Appendix V6-3A

Back River Project: 2010 Lake Water and Sediment Quality Baseline Report

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Sabina Gold and Silver Corporation

BACK RIVER PROJECT
2010 Lake Water and Sediment Quality Baseline Report

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BACK RIVER PROJECT

2010 LAKE WATER AND SEDIMENT QUALITY BASELINE REPORT

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Executive Summary

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Engineers and Scientists

Executive Summary

The Back River Project (the Project) is an exploration gold project owned by Sabina Gold and Silver Corporation (Sabina) located in the West Kitikmeot region of Nunavut. The Project consists of several different properties, one of which is the Back River property. An exploration camp is located near Back River (Back River Camp), and Sabina conducted a drilling program out of this camp during 2010.

Several exploration targets exist in the Back River area, including the Goose deposit, and the Llama deposit. For 2010, select baseline studies were conducted in the areas that could be influenced by the future development of the Llama deposit (Goose Lake Property). This report presents the results from the Lake Bathymetry, Limnology, Water and Sediment Quality Baseline Program that was carried out in 2010.

Baseline data on bathymetry, limnology, water and sediment quality was collected from five lakes in the Llama deposit area during August 2010. The five lakes included one lake that could be directly impacted by the Project (Llama Lake), a second lake from the same watershed (Umwelt), two lakes from a neighbouring watershed (Mam and Chair), and a reference lake (Reference Lake B). The reference lake was selected based on its size and drainage basin area, as well as having a greater than 10 km buffer from the potential Project to negate any effects of dustfall from Project activities.

Bathymetric and limnological measurements showed that Umwelt and Mam lakes were relatively shallow, clear, cold, and had the highest dissolved oxygen levels of the five lakes. Llama and Chair lakes were deeper lakes, with slightly warmer water than Umwelt and Mam lakes, and lower levels of dissolved oxygen. Reference Lake B had intermediate depth, temperature, dissolved oxygen, and water clarity. Sufficient light for photosynthesis reached the entire benthic region in all five lakes.

Where possible, water quality was sampled at two depths (1 m and mid-depth). Overall, the water quality concentrations were similar between depths, likely due to the lack of stratification or weak stratification found at lake sites during the sampling period. All five lakes were oligotrophic, with low nutrient concentrations, as is typical in Arctic and subarctic lakes. Umwelt and Llama lakes, located within the Llama Watershed where two known deposits are located, had the highest concentrations for most total metals, pH, conductivity, and hardness. Chair and Mam Lakes had intermediate concentration of most metals, turbidity, and total phosphorus, but had the highest levels iron. Reference Lake B was generally metal-poor, with low levels of conductivity and total dissolved solids, although it did have had the highest levels of turbidity and total phosphorus.

A comparison of baseline water quality with CCME guidelines indicated that Llama and Umwelt lakes had total copper concentrations higher than guideline values.

Sediment quality samples were collected from the five Project lakes at the same time as the limnology and water quality samples. Where possible, sediment samples were collected from shallow, mid-, and deep depth zones. Overall, the chemistry of the sediments was largely determined by its particle composition. Mam, Chair, and Llama lakes all contained high proportions of silt and were naturally enriched with several metals. Reference Lake B and Umwelt Lake sediments were largely composed of sand-sized particles, with much lower metal concentrations. Umwelt Lake sediments were largely nutrient-poor, with little organic material.

Llama and Mam lakes had baseline sediment quality higher than the CCME Interim Sediment Quality Guideline (ISQG) for arsenic, chromium and copper. Umwelt Lake had baseline sediment quality higher than the CCME ISQG for arsenic and copper, while Chair Lake had baseline sediment quality higher than the CCME ISQG for arsenic, cadmium, chromium, copper and zinc. Reference Lake B had baseline sediment quality higher than the CCME ISQG for arsenic and copper. All lakes, except the reference lake, had baseline sediment quality that exceeded the CCME Probable Effects Level (PEL) for arsenic.

Acknowledgements

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Acknowledgements

This report was prepared for Sabina Gold and Silver Corporation by Rescan Environmental Services Ltd. This report was written by Pamela Reece (M.Sc., R.P. Bio), and was reviewed by Michael Henry (Ph.D.) and Deborah Muggli (Ph.D., M.Sc., R.P.Bio.). Field work was conducted by Tonia Robb (Ph.D.), Ryan Kaiyogana, Michael Soloducha (B.Sc.), and Gary Kelloguk. Dan Russel assisted with logistics and Doug Caters managed the Goose Lake camp. Deborah Muggli (Ph.D., M.Sc., R.P.Bio.) was the Rescan Project Manager for this project.

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1. Introduction

1. Introduction

The Back River Project (the Project) is an exploration gold project owned by Sabina Gold and Silver Corporation (Sabina) located in the West Kitikmeot region of Nunavut. The Project consists of several different properties, one of which is the Back River property (Figure 1-1). An exploration camp is located near Back River (Back River Camp), and Sabina conducted a drilling program out of this camp during 2010.

Several exploration targets exist in the Back River area, including the Goose deposit, and the Llama deposit. For 2010, select baseline studies were conducted in the areas that could be influenced by the future development of the Llama deposit (Goose Lake Property). Rescan Environmental Services (Rescan) was contracted by Sabina, to conduct the following baseline studies in 2010:

- Hydrology Baseline Program;
- Lake Bathymetry, Water & Sediment Baseline Program;
- Fish & Fish Habitat Baseline Program;
- Archaeological Survey Program; and
- Regional Wildlife Program.

In addition, Sabina continued to operate a meteorological station on site as well as collect data on permafrost temperatures.

This report presents the results from the Lake Bathymetry, Limnology, Water and Sediment Quality Baseline Program that was carried out in 2010. The report describes the methods used to collect the data, and the results. Analytical results from all samples collected as part of the 2010 aquatic baseline program are provided as appendices to this report.

General Back River Project Location Map

Figure 1-1

2. Methods

2. Methods

2.1 STUDY AREA

The Back River Project is located in the Southern Arctic Ecozone. It is characterized by short, cool summers (mean temperature: 5°C) and long cold winters (mean temperature: -28°C). Vegetation in the Southern Arctic Ecozone and around the study lakes consists of predominantly dwarf shrub vegetation, including *Betula* spp. (birch), *Salix* spp. (willow), and grasses. There is a continuous permafrost layer under the landscape, which prevents water from penetrating deep into the soils. This creates surface run-off from precipitation, and waterlogged soils that freeze regularly. There are numerous depressions, kettle lakes, ponds, and deposits in the study area that were left by retreating glaciers.

Baseline data on bathymetry, limnology, water and sediment quality was collected from five of the lakes in the Project area. The five lakes included one lake that would be directly impacted by the Project (Llama Lake), a second lake immediately downstream and from the same watershed (Umwelt), two lakes from a neighbouring watershed (Mam and Chair), and a reference lake (Reference Lake B). The reference lake was selected based on its size and drainage basin area, and was placed more than 10 km from the potential Project to avoid potential dustfall issues. Figure 2.1-1 shows the relative locations of the study lakes. Plate 2.1-1 presents photographs of four of the project study lakes, surface run-off, and surrounding landscape. Table 2.1-1 summarizes the lake locations and rationale for including the lakes in the baseline study.

Table 2.1-1. Sample Location, Samples Collected, and Rationale for Lakes Sampled as Part of the Back River Project Baseline Study, August 2010

Lake	UTM Zone	Easting	Northing	Data Collected	Rationale for Inclusion
Umwelt	13W	428927	7270960	SQ, WQ, Ba, Lim	Immediately downstream of potential impact site within the same watershed
Llama	13W	428572	7272571	SQ, WQ, Ba, Lim	Potential impact site
Mam	13W	427976	7272192	SQ, WQ, Ba, Lim	Potential impact site and/or close proximity to potential impact site.
Chair	13W	427604	7273392	SQ, WQ, Ba, Lim	Potential impact site and/or close proximity to potential impact site.
Reference Lake B	13W	442019	7258465	SQ, WQ, Ba, Lim	Reference lake. Similar in size, and size of watershed to other lakes. Over 10 km away.

SQ = Sediment Quality, WQ = Water Quality, Ba = Bathymetry, Lim = Limnology

2.2 PHYSICAL LIMNOLOGY

All sampling was done with the use of a 12-foot aluminum boat that was slung from lake to lake by a Northern Air Support helicopter. For safety, all field work was conducted by two-person crews.

a) b)

c) d)

Plate 2.1-1. Back River Project study area lakes: a) Llama Lake, b) Mam Lake, c) Umwelt Lake, and d) Reference Lake B.

2.2.1 Bathymetry Methods

Each lake was surveyed in late August, 2010 using a Garmin 526s Depth Sounder/GPS attached to the stern of an aluminum boat. Depth readings were taken every two seconds at an approximate cruising speed of 5 km/h. Initial bathymetric readings were taken along the perimeter of the lakes to establish an electronic outline of the lake on the view screen of the depth sounder. An Exploratory-line (E-line) was then completed along the (estimated) deepest section of the lake. If depths were fairly uniform, the E-line should run along the middle of the water body. Once the perimeter and the E-line were completed, transects were run back and forth across the lake from one end to the other, perpendicular to the E-line and parallel to each other. The distance between transects was determined by the size of the lake and the uniformity of the bottom. Water bodies with irregular or complex bottoms required that transects were run closer together to accurately capture the bathymetry. At Mam Lake, the shallow depth over the southwest part of the lake required that manual depth readings be taken using a handheld GPS and a stadia rod.

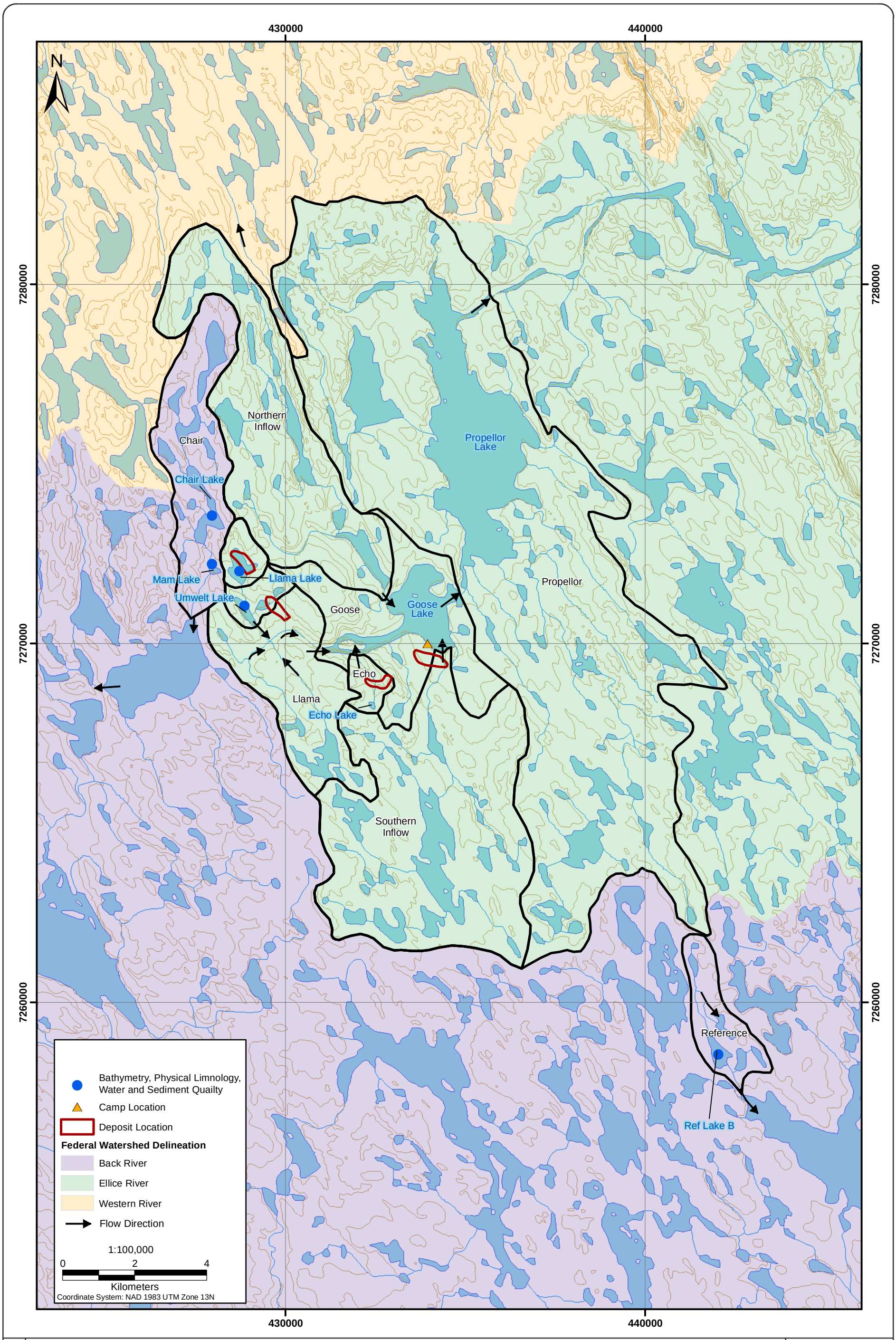

Figure 2.1-1

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Back River Project Sampling Locations, August 2010

Figure 2.1-1

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2.2.2 Physical Limnology

Physical limnology measurements were collected from the lakes in late August, 2010, during the open water season. At the deepest area of the lake, vertical profiles of temperature and dissolved oxygen were recorded using a YSI probe and meter. The YSI probe was lowered on a metred cable to approximately 1 m above the lake bottom. The probe was allowed to equilibrate for a few minutes then brought to the surface at half-metre intervals, and measurements were recorded. As the probe consumes oxygen while taking a reading, it was gently agitated to ensure a continual flushing of 'new' water.

Water transparency was measured using a Secchi disk at the deepest point of each lake. The 30 cm-diameter Secchi disk was lowered over the shaded side of the boat using a metred line. The Secchi disk was weighted to keep it as vertical as possible, and lowered until it disappeared. The disk was then raised slowly until it could just be seen, and the depth of the disk was recorded. This is known as the Secchi depth (Ds). A Light attenuation coefficient (or extinction coefficient) (k) was calculated by dividing 1.7 by the Secchi depth (Ds, m), where 1.7 is a widely accepted value for non-turbid waters (Parsons et al. 1984). From this, the 1% euphotic zone depth (EZD) was calculated. The 1% EZD ($Z_{1\%}$, m), calculated as 4.6/k, is the depth of the water column where 1% of the surface irradiance reaches. It represents the depth where the integrated gross water column photosynthetic production is the equivalent of the integrated gross water column respiration; thus, there is net production of carbon above this depth. It is often known as the compensation depth.

2.3 WATER QUALITY

Water quality samples were collected along with the physical limnology and sediment samples in late August 2010. The samples were collected from the deepest area at each of the five lakes. For the deeper lakes, (Chair, Reference Lake B, and Llama) samples were collected at two depths: 1 m below the surface and at mid-depth. In the shallow lakes (Umwelt and Mam), samples were collected at a depth of 1 m which was close to mid-depth for those lakes. Samples were collected with a 5 L Teflon-lined GO-FLO bottle using metal-clean techniques. All water samples were collected in acid-washed, triple-rinsed sample bottles with the scientist wearing nitrile gloves. Samples were preserved as required, kept cold, and sent to ALS Environmental Services in Yellowknife on the first available flight out of camp. Samples were then transferred to ALS's Burnaby, BC laboratory.

Lake water samples were analyzed for general physical parameters, nutrients, total organic carbon (TOC), and total and dissolved metals at the lowest possible detection limit. Preservatives were added at the time of sample collection to total metals (ultra-pure nitric acid), TOC (hydrochloric acid), and total kjeldahl nitrogen (TKN) (sulphuric acid) sample containers. Dissolved metal samples were filtered under trace-metal clean conditions at the laboratory to avoid contamination associated with field filtration and to achieve the lowest possible detection limits.

Table 2.3-1 presents the water quality parameters analyzed and their analytical detection limits. Detection limits were the lowest achievable by the lab, and lower than, or equal to, the CCME guidelines for the protection of aquatic life (CCME 1999). Detection limits were occasionally higher than the theoretical minimum presented in Table 2.3-1 for some samples. This occurred when dilution of a sample was required to compensate for high concentrations of other, interfering parameters. All realized detection limit ranges are indicated on graphs.

Values of pH differed between the measurements taken in the field (at the sampling site) (see Table 3.1-1), and values determined in the lab by ALS (Appendix 2a). In the field, the pH meter was calibrated and held in the water until the meter had equilibrated. Lab values for pH were determined after sample collection and transport to the lab. British Columbia Environmental Laboratory Methods Manual (BCMOE 2009) recommends immediate analysis for pH and a maximum holding time of 15 minutes.

Transportation to the lab exceeded the recommended holding time. During the transportation from the field to the lab, organisms in the water would have respired generating hydrogen ions and lowering the pH. The water samples had low alkalinity and therefore a low ability to buffer the pH against the production of hydrogen ions, potentially resulting in a pH lower than that determined in the field. This is consistent with previous studies that found lakes within the Shield area of the Northwest Territories to be sensitive to acidification and to have low buffering abilities (Padgham and Fyson 1992). Values of pH based on field measurements were used for water quality analysis and graphing purposes.

Table 2.3-1. Water Quality Parameters and Method Detection Limits, Back River Project, August 2010

Parameter	Detection Limit	Parameter	Detection Limit
Physical Tests		**Metals (Total and Dissolved)** *(continued)*	
Conductivity	2 µS/cm	Barium (Ba)	0.00005
Hardness (as $CaCO_3$)	0.5	Beryllium (Be)	0.0002
pH	0.1 pH	Bismuth (Bi)	0.0005
Total Suspended Solids	3	Boron (B)	0.001
Total Dissolved Solids	10	Cadmium (Cd)	0.00001
Turbidity	0.1 NTU	Calcium (Ca)	0.02
		Chromium (Cr)	0.0001
Anions and Nutrients		Cobalt (Co)	0.0001
Alkalinity, Bicarbonate (as $CaCO_3$)	2	Copper (Cu)	0.0001
Alkalinity, Carbonate (as $CaCO_3$)	2	Iron (Fe)	0.01
Alkalinity, Hydroxide (as $CaCO_3$)	2	Lead (Pb)	0.00005
Alkalinity, Total (as $CaCO_3$)	2	Lithium (Li)	0.005
Bromide (Br)	0.05	Magnesium (Mg)	0.005
Chloride (Cl)	0.5	Manganese (Mn)	0.00005
Fluoride (F)	0.02	Mercury (Hg)	0.00001
Sulphate (SO_4)	0.5	Molybdenum (Mo)	0.00005
Ammonia (as N)	0.005	Nickel (Ni)	0.0001
Nitrate (as N)	0.005	Phosphorus (P)	0.05
Nitrite (as N)	0.001	Potassium (K)	0.0001
Total Kjeldahl Nitrogen	0.05	Selenium (Se)	0.05
Ortho Phosphate (as P)	0.001	Silicon (Si)	0.00001
Total Phosphorus	0.002	Silver (Ag)	0.01
		Sodium (Na)	0.0001
Organic / Inorganic Carbon		Strontium (Sr)	0.0001
Total Organic Carbon	0.5	Thallium (Tl)	0.0001
		Tin (Sn)	0.01
Metals (Total and Dissolved)		Titanium (Ti)	0.00001
Aluminum (Al)	0.001	Uranium (U)	0.00005
Antimony (Sb)	0.0001	Vanadium (V)	0.001
Arsenic (As)	0.00003	Zinc (Zn)	0.001

Detection limits are mg/L unless otherwise indicated.

2.3.1 Quality Assurance and Quality Control (QA/QC)

To determine sources of potential contamination during water quality sampling, a separate set of bottles for travel, field, and equipment blanks were included as part of the field QA/QC program. The travel blank bottles were filled with distilled deionized water in the lab and remained closed throughout the field trip. This allowed assessment of contamination associated with sample transit and lab procedures. The field blank bottles were also filled with distilled deionized water, but were opened in the field for 30 seconds, and preserved as required for respective analyses. This allowed assessment of contamination associated with field sampling (airborne contamination, contamination of the lid/bottle, etc.) and preservation procedures.

Equipment blanks were collected in the field by first rinsing an acid-washed GO-FLO with double de-ionized water (DDI water; provided by ALS), filling the GO-FLO bottle with DDI water, allowing the water to sit for a few minutes (as would occur with a real sample), and then drawing sub-samples from the bottle. Equipment blanks were preserved and handled the same as regular samples.

All QA/QC data for field, travel, and equipment blanks are reported in Appendix 2. The frequency of detection of a concentration for a water quality variable greater than the analytical detection limit was noted for travel, field, and equipment blanks, indicating possible contamination.

Also as part of the QA/QC program, 25% of the water samples were collected in duplicate to assess the magnitude and potential causes of variability between samples. Duplicate water samples were randomly taken at 25% of the stations.

2.3.2 Principal Components Analysis

Principal Components Analysis (PCA) was used to objectively summarize the water quality data, facilitating easy interpretation of the spatial pattern of the data. PCA reduces the number of variables to a small number of indices (the principal components) that are linear combinations of the original variables. Each principal component accounts for a percentage of the variation in the data set. The first principal component accounts for the majority of the variation in the data set, and subsequent principal components account for successively less. Eigenvectors or loadings represent the direction and magnitude of correlation of between the variables and the principal components.

PCA was conducted using STATISTICA software. The PCA was run on physical parameters, dissolved anions, nutrients, and total metals. Variables were excluded from the PCA if more than 80% of their values for samples were below the method detection limit (MDL). For the remaining variables, any values below MDL were replaced with one half of the MDL value. All variables except pH (already in log units) were then log-transformed to normalize their distribution.

2.3.3 Water Quality Parameters in Relation to Guidelines

All water quality parameters that have CCME water quality guidelines for the protection of freshwater aquatic life, as well as other parameters of interest, were graphed for all study lakes, unless values were consistently below analytical detection limits. For analysis and graphing purposes, any values below analytical detection limits were replaced with half of the realized sample detection limit. The water quality data was presented to allow comparisons of samples collected from shallow and deep depths.

2.4 SEDIMENT QUALITY

Sediment quality samples were collected at each of the five Project lakes and were analyzed for moisture, particle size, nutrients, organic carbon, and total metal concentrations. A list of the analyzed sediment quality variables and their respective detection limits are presented in Table 2.4-1.

The lowest analytical detection limit possible was used for all analysis. These were always below CCME guideline concentrations.

Table 2.4-1. Sediment Quality Parameters and Method Detection Limits, Back River Project, August 2010

Parameter	Detection Limit	Parameter	Detection Limit
% Moisture	0.1	**Metals** *(continued)*	
pH	0.1	Cadmium (Cd)	0.1
		Cadmium (Cd)	0.1
Particle Size		Calcium (Ca)	50
% Gravel (> 2 mm)	0.1	Chromium (Cr)	0.5
% Sand (2.0 mm - 0.063 mm)	0.1	Cobalt (Co)	0.1
% Silt (0.063 mm – 4 µm)	0.1	Copper (Cu)	0.5
% Clay (<4 µm)	0.1	Iron (Fe)	50
		Lead (Pb)	0.5
Nutrients		Lithium (Li)	1
Available Ammonium-N	1	Magnesium (Mg)	20
Available Nitrate-N	2.5	Manganese (Mn)	1
Available Nitrite-N	0.5	Mercury (Hg)	0.005
Available Phosphate (as P)	2	Molybdenum (Mo)	0.5
		Nickel (Ni)	0.5
Organic / Inorganic Carbon		Phosphorus (P)	50
$CaCO_3$ Equivalent (%)	0.8	Potassium (K)	100
Inorganic Carbon (%)	0.1	Selenium (Se)	0.2
Total Carbon (%)	0.1	Silver (Ag)	0.1
Total Organic Carbon (%)	0.1	Sodium (Na)	100
		Strontium (Sr)	0.5
Metals		Sulphur (S)	100
Aluminum (Al)	50	Thallium (Tl)	0.05
Antimony (Sb)	0.1	Tin (Sn)	2
Arsenic (As)	0.05	Titanium (Ti)	1
Barium (Ba)	0.5	Uranium	0.05
Beryllium (Be)	0.2	Vanadium (V)	2
Bismuth (Bi)	0.2	Zinc (Zn)	1

**All units are in mg/kg dry weight unless otherwise noted.*

Sediment samples were collected using an Ekman grab sampler and were collected from the following depth zones in each lake: shallow (0–5 m), mid-depth (5–10 m), and deep (>10 m). At each sampling site, three replicate Ekman grab samples were collected a minimum of 5 to 25 m apart (depending on the size of the site). Each sediment sample was carefully transferred onto a white tray, photographed (Plate 2.4-1), and described for colour, texture, and organic content. The sample was then divided into two equal parts. From each part, the top 2 cm of sediment was collected and placed into a clean, pre-labelled Whirl-Pak bag, sealed (no air bubbles), and kept cold and dark until the samples were sent to ALS, Yellowknife, NWT, before being forwarded to ALS, Burnanby, BC for analysis. One part of the sample was analyzed for particle size, and the second was analyzed for sediment chemistry.

Plate 2.4-1. Sediment sample from the shallow depth zone of Chair Lake, August 2010.

For data interpretation and graphing purposes, values below the detection limit ("non-detects") were considered to be half of the detection limit. Data were summarized by site and depth and compared to CCME sediment quality guidelines (CCME 2002).

2.4.1 Principal Components Analysis

Principal Components Analysis (PCA) was used to objectively summarize the sediment quality data, facilitating easy interpretation of the spatial pattern of the data (see Section 2.3.2 for explanation). The PCA was run on physical parameters, nutrients, and metals. Variables were excluded from the PCA if more than 20% of their values for samples were below the method detection limit (MDL). A cut-off level of 20% was selected, because most metals were detected in the sediments. For the remaining variables, any values below MDL were replaced with one half of the MDL value. All variables were log-transformed to normalize their distribution.

3. Results

3. Results

3.1 BATHYMETRY, LIMNOLOGY, AND LIGHT PENETRATION

Results of the lake bathymetry measurements and the locations of the sampling stations are presented in Figures 3.1-1 to 3.1-5. Temperature and dissolved oxygen profiles were taken at the deepest point in each lake (Figures 3.1-1 to 3.1-5). Appendix 1 contains the temperature and dissolved oxygen profile data and Figure 3.1-6 graphically illustrates the data. Table 3.1-1 summarizes Secchi depth, the calculated light attenuation coefficient, euphotic zone depth, and pH measurements taken at the site where the profile data and water quality samples were collected.

Table 3.1-1. Lake Characteristics and Euphotic Zone Depth, Back River Project, 2010

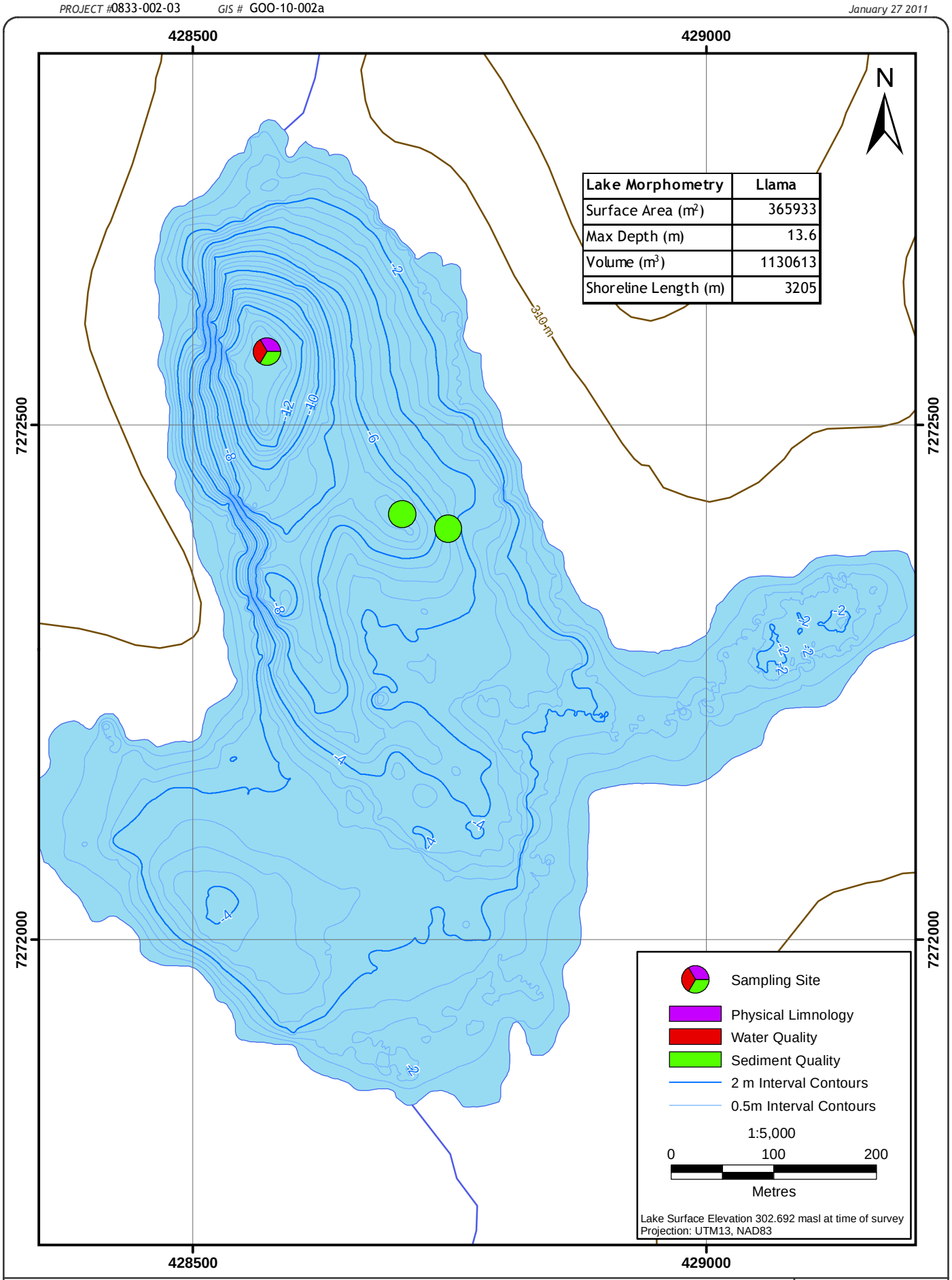
Watershed	Lake	Surface Area (m^2)	Maximum Depth (m)	Secchi Depth (m)	Euphotic Zone Depth ($Z_{1\%}$) (m)
Llama Watershed	Umwelt	193,603	2.7	2.7 (bottom)	bottom (11)
	Llama	365,933	13.6	5.5	bottom (22.3)
Chair Watershed	Mam	76,928	3.8	3.8 (bottom)	bottom (15.3)
	Chair	706,275	10.3	4.9	bottom (19.3)
Reference Watershed	Reference Lake B	322,402	5.1	4.3	bottom (17.3)

In general, Umwelt and Mam lakes were relatively shallow, clear, cold, and had the highest dissolved oxygen levels (Table 3.1-1, Figure 3.1-6). Llama and Chair lakes were deeper lakes, with slightly warmer water than Umwelt and Mam lakes, and had lower levels of dissolved oxygen. Reference Lake B had intermediate depth, temperature, dissolved oxygen, and light penetration. In all lakes, dissolved oxygen concentrations and saturation levels were greatest at the surface and decreased towards the sediment layer (Figure 3.1-6 Appendix 1), likely due to elevated photosynthesis near the surface and enhanced microbial activity in the sediments. Dissolved oxygen levels were nearly saturated in all five lakes (~95% in the surface; Appendix 1).

The calculated 1% euphotic zone depth was greater than the actual lake depth for all lakes. As a result, more than 1% of the surface irradiance reaches the bottom of the lakes, and there is sufficient light penetration for net primary production (photosynthesis exceeds respiration) throughout the lakes. This includes benthic primary producers such as macrophytes and microscopic periphyton.

3.2 WATER QUALITY

All raw water quality data can be found in Appendix 2a. Water quality parameters that have CCME water quality guidelines for the protection of aquatic life (CCME 2007), as well as other parameters of interest, were graphed for all study lakes unless values were consistently below analytical detection limits (Figures 3.2-2 to 3.2-17). Any values below analytical detection limits were replaced with half of the realized sample detection limit. The average determined for duplicate samples is presented where applicable. For water quality parameters with CCME guidelines, the guideline levels were included in the figures.



Sabina GOLD & SILVER CORP.

Llama Lake
Bathymetry and Sampling Locations, August, 2010

Figure 3.1-1

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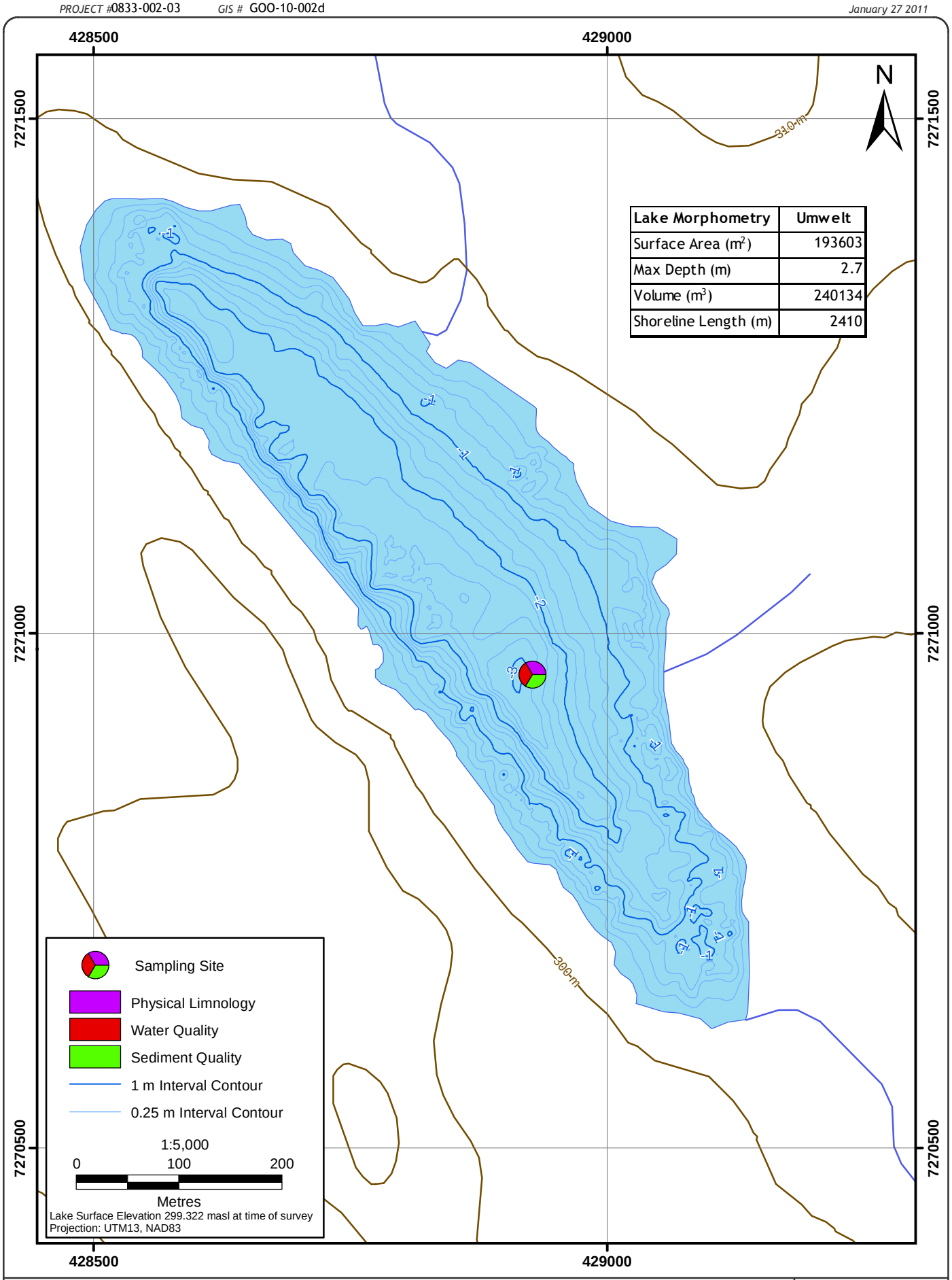
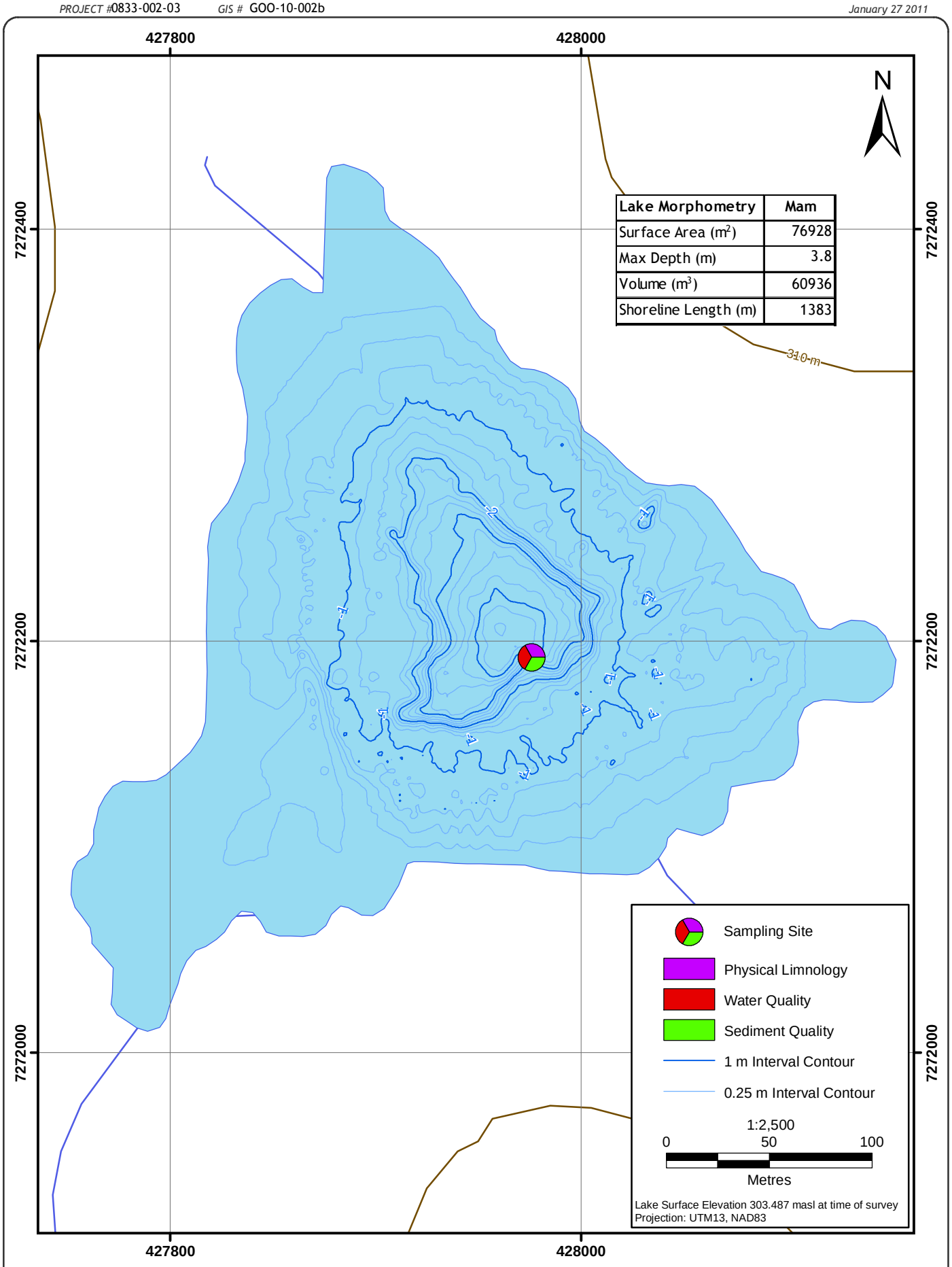


Sabina GOLD & SILVER CORP.

Umwelt Lake
Bathymetry and Sampling Locations, August, 2010

Figure 3.1-2

Rescan™ Engineers & Scientists

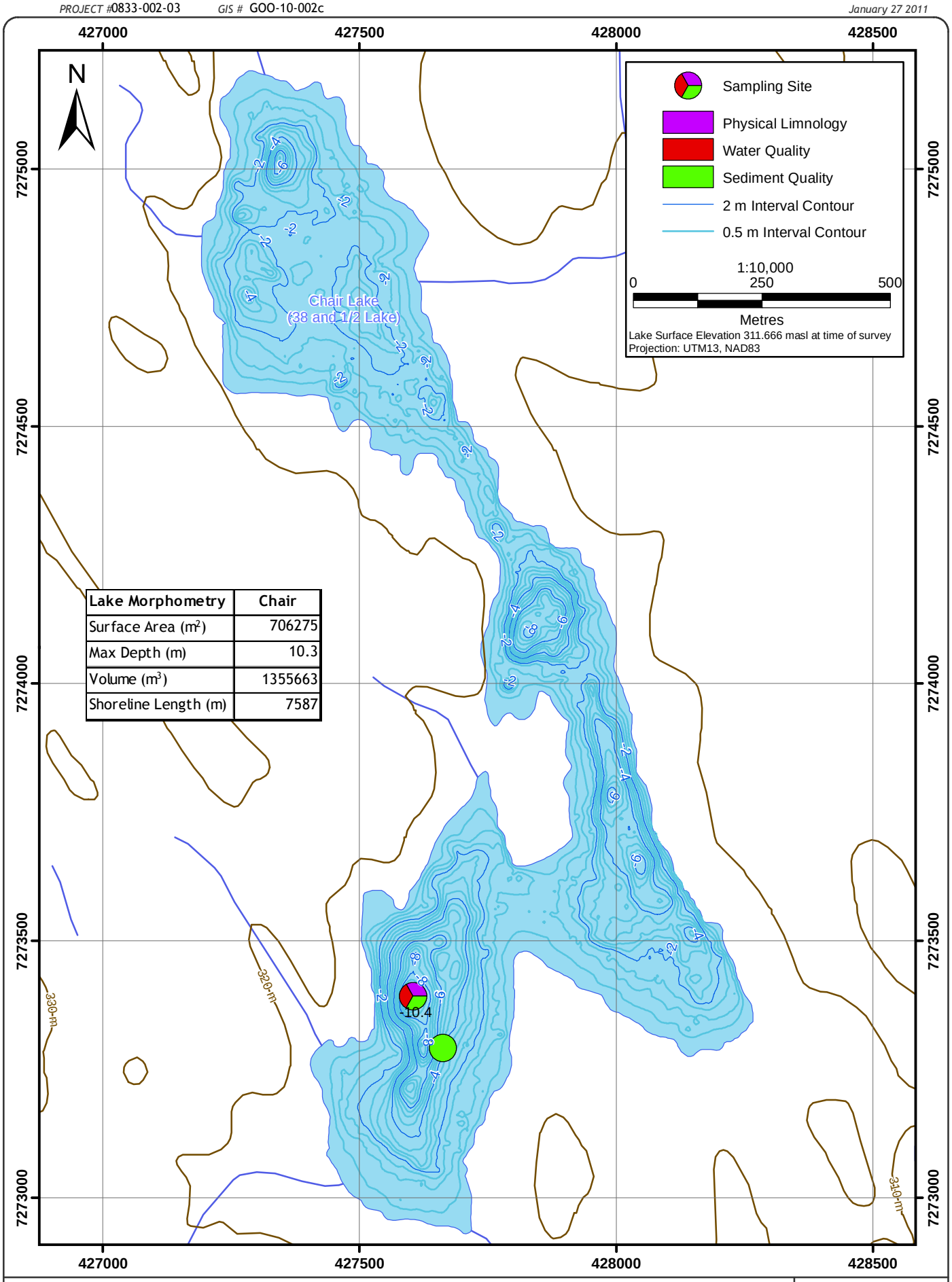


Sabina GOLD & SILVER CORP.

Mam Lake
Bathymetry and Sampling Locations, August, 2010

Figure 3.1-3

Rescan™ Engineers & Scientists



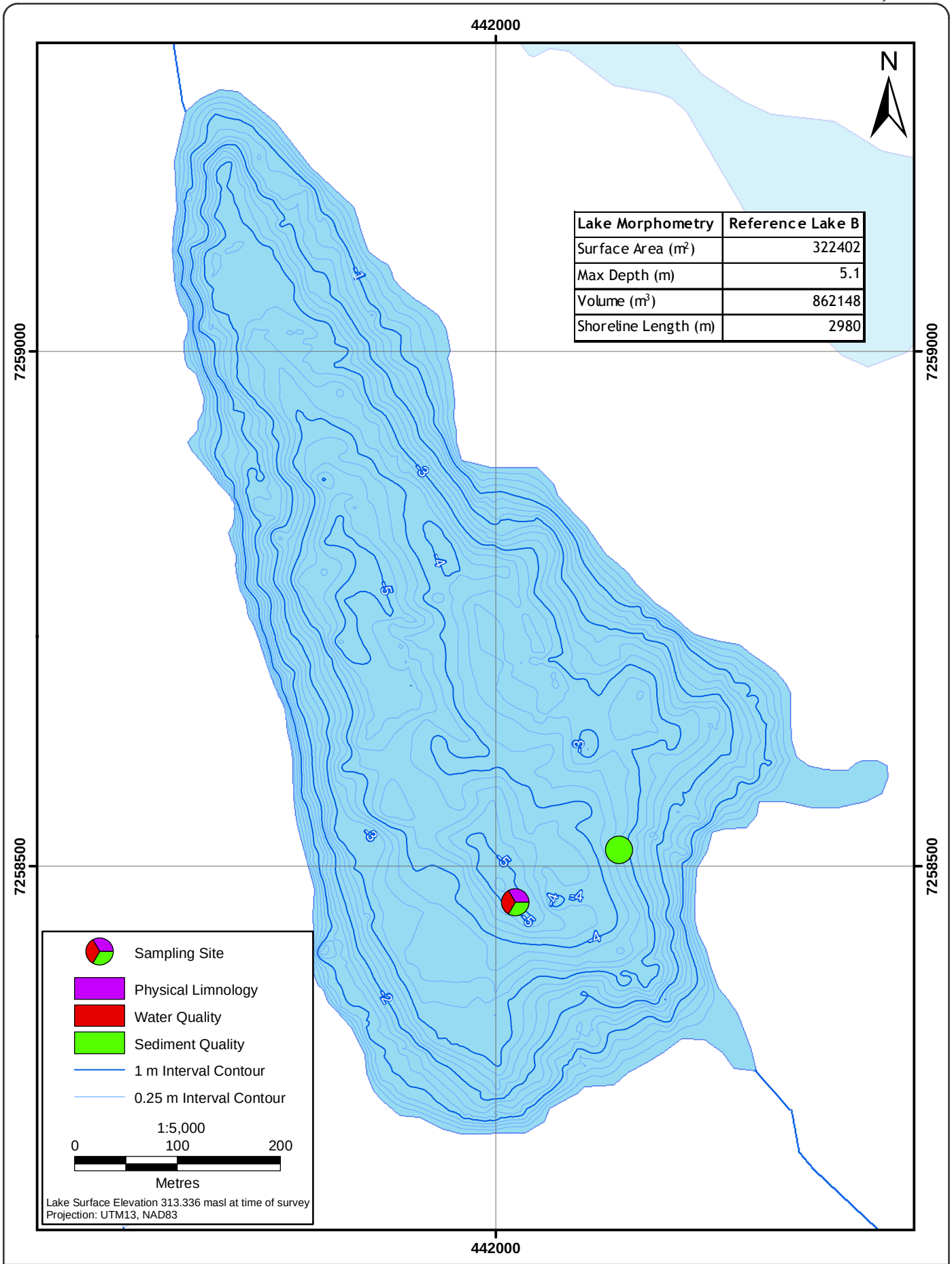
Lake Morphometry	Chair
Surface Area (m^2)	706275
Max Depth (m)	10.3
Volume (m^3)	1355663
Shoreline Length (m)	7587

Sabina GOLD & SILVER CORP.

Chair Lake
Bathymetry and Sampling Locations, August, 2010

Figure 3.1-4

Rescan™ Engineers & Scientists



Sabina GOLD & SILVER CORP.

Reference Lake B
Bathymetry and Sampling Locations, August, 2010

Figure 3.1-5

Rescan™ Engineers & Scientists

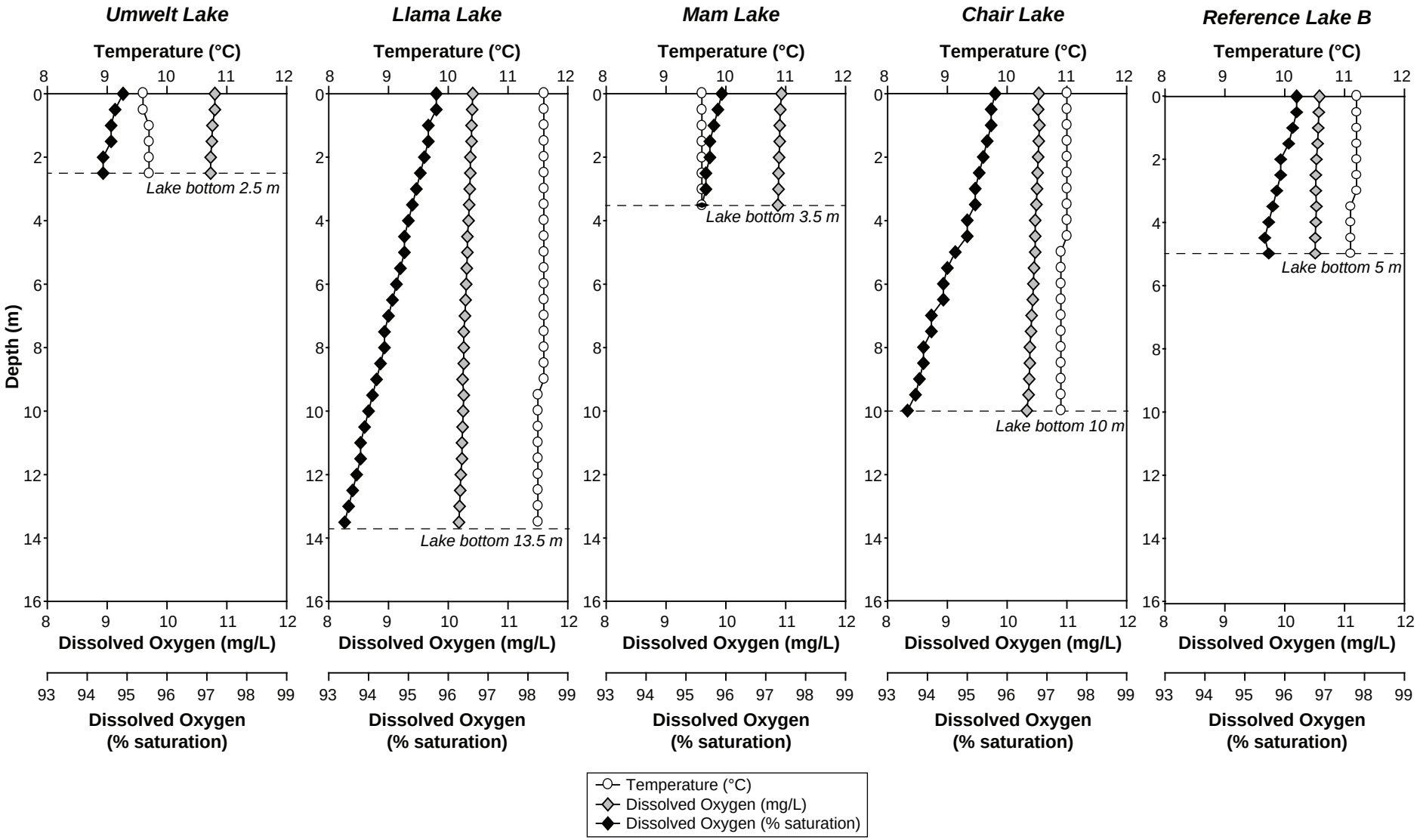


Figure 3.1-6

Lake Temperature and Dissolved Oxygen Profiles, Back River Project, August 2010

Figure 3.1-6

3.2.1 Principal Components Analysis Results

Results of the water quality PCA are presented in Figure 3.2-1 and Appendix 2b. The plots were created to illustrate the relative location of the sites in ordination space, the loadings of the water quality parameters, and the variation in the data explained by the principal components. The sites were separated in ordination space based on the water quality parameters used in the analysis. Thus, the site locations in Figure 3.2-1b can be superimposed over the environmental variables in Figure 3.2-1a indicating the dominant environmental features in each lake.

Overall, principal components 1 (x-axis) and 2 (y-axis) explained 74.2% of the variation in the data set (Appendix 2b). Umwelt and Llama lakes, located on top of and near the ore zone, had the highest levels of most total metals, pH, conductivity, and hardness. Notably, Llama Lake was situated in ordinal space near several ions and metals that suggest a marine influence (e.g., sodium, chloride, magnesium, calcium, sulphate, etc.), potentially through groundwater inputs. This is possible since ancient seabed does underlay this region. Umwelt Lake showed some marine influence, but with higher concentrations of several metals than Llama Lake (e.g., copper, chromium, nickel, and zinc). Chair and Mam lakes had intermediate levels of most metals, turbidity, and total phosphorus compared to the other lakes, but did have the highest iron concentrations. Reference Lake B was generally metal-poor, with the highest turbidity and total phosphorus levels of the five lakes.

3.2.2 General Parameters and Anions

Arctic lakes are often soft water, poorly buffered systems (0–30 mg $CaCO_3$), with relatively low levels of hardness, alkalinity, total dissolved solids, and conductivity (Pienitz et al. 1997; Ruhland and Smol 1998). Water quality samples collected from the five lakes in the Back River area confirm these characteristics, as the hardness and total alkalinity ranged from 6.2 to 14.7 mg/L and 4.1 to 5.1 mg $CaCO_3$/L, respectively. The highest levels of each were found in Llama Lake (Figure 3.2-2).

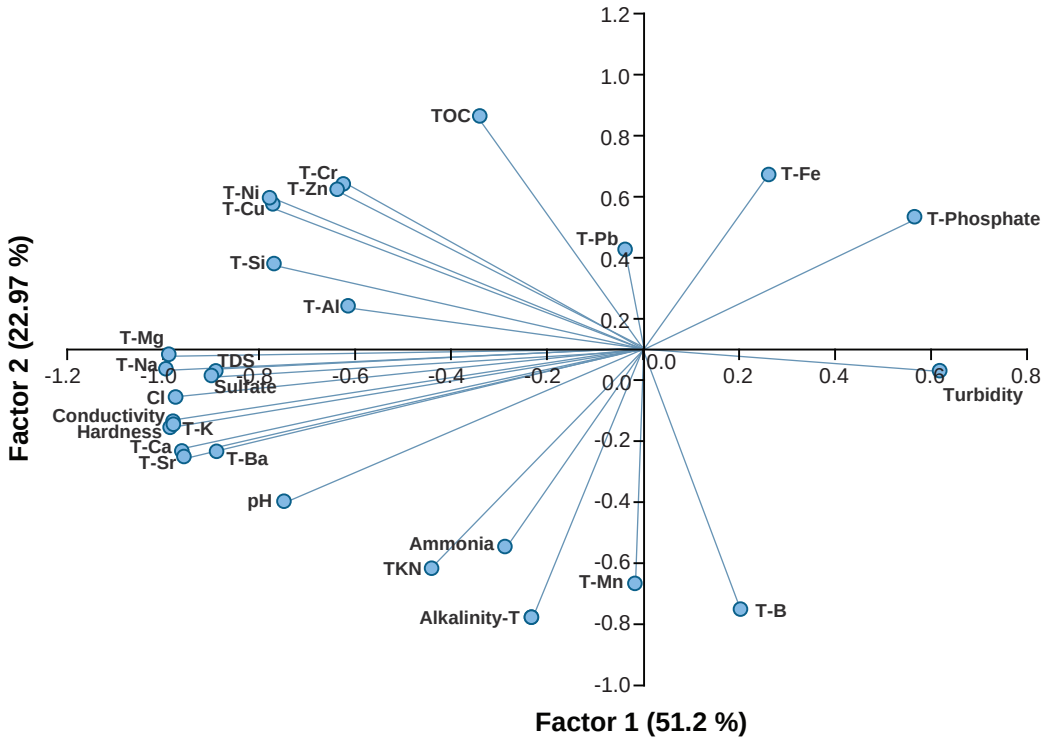
Despite the poor buffering capacity, each of the lakes was slightly basic, ranging from 7.4 in Chair Lake to 8.4 in Umwelt Lake, and changed little with depth (Figure 3.2-3). These were within the limits recommended by the CCME guidelines (pH: 6.5–9.0). The sampled lakes had limited conductivity, ranging from 15.6 (Reference Lake B) to 37.9 µS/cm (Llama Lake; Figure 3.2-3), and low levels of total dissolved solids (TDS) and sulphate concentrations (Figure 3.2-4). Concentrations of TDS ranged from below detection limits (10 mg/L; Reference Lake B) to 31 mg/L (Llama Lake), while sulphate ranged between 1.6 mg/L (Reference Lake B) and 3.7 mg/L (Llama Lake).

The general trend of these physical parameters was the highest levels were found in Llama and Umwelt lakes, intermediate levels in Chair and Mam lakes, with the lowest levels furthest away at Reference Lake B.

3.2.3 Suspended Material and Nutrients

Suspended material, whether dissolved or particulate, absorbs or reflects incoming irradiation, thereby affecting the light quantity and quality available to aquatic primary producers. The lakes in this sampling program were relatively free of suspended material, with no detectable levels of total suspended solids (TSS), and very low levels of turbidity in each lake (Figure 3.2-5). The absence of TSS suggests that particulate and dissolved organic material, as well as dissolved inorganic material, largely influence the light regime. The low levels of light attenuating substances give the high water clarity observed in the lakes, as seen by the deep Secchi depths and 1% light levels that reach the sediment surface (Table 3.1-1). This indicates that benthic primary production is possible over the entire portion of each lake. Reference Lake B had the highest turbidity of the sampled lakes (0.67 NTU), which corresponded to the shallowest Secchi depth measured (Table 3.1-1).

a) PCA biplot showing loadings for water quality parameters included in analysis



b) PCA of Back River sites based on August 2010 water quality data

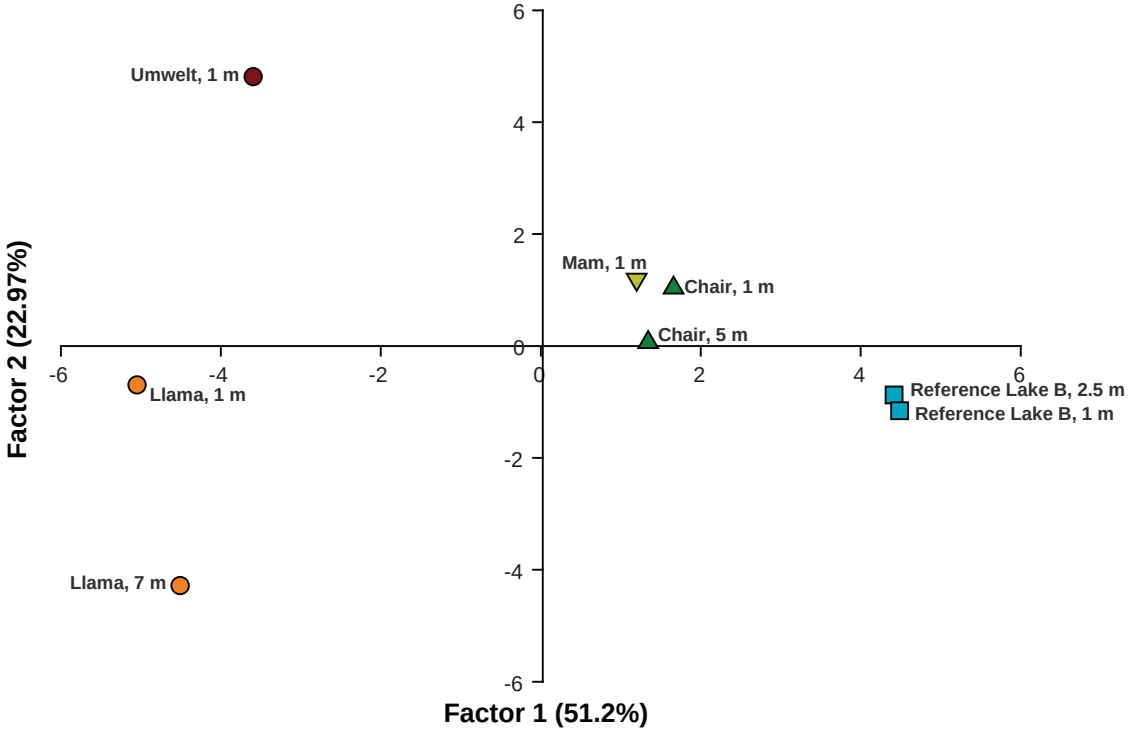
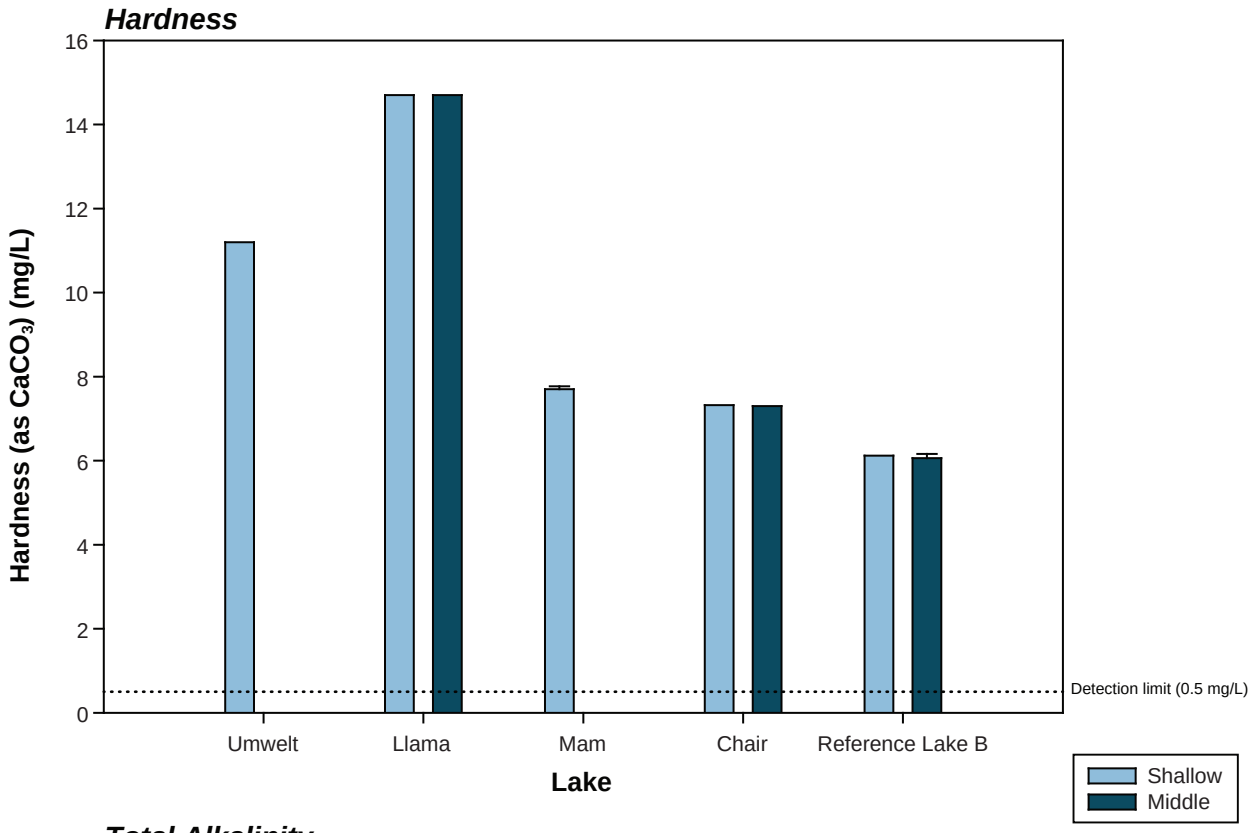
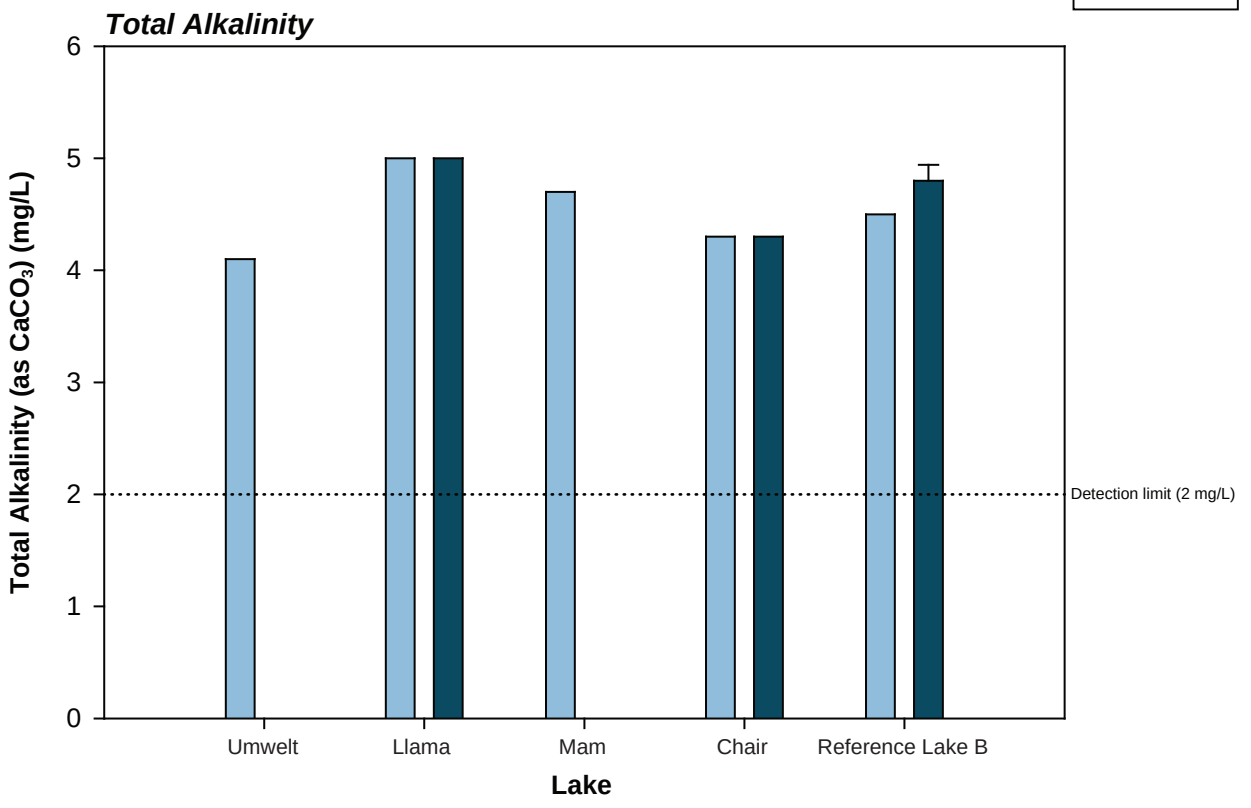


Figure 3.2-1

Principal Component Analysis of Back River Project Water Quality Sites





Note: Error bars represent standard error of the mean.

Sabina GOLD & SILVER CORP.

Hardness and Total Alkalinity Concentrations in the Lakes of the Back River Project Area, August 2010

Figure 3.2-2

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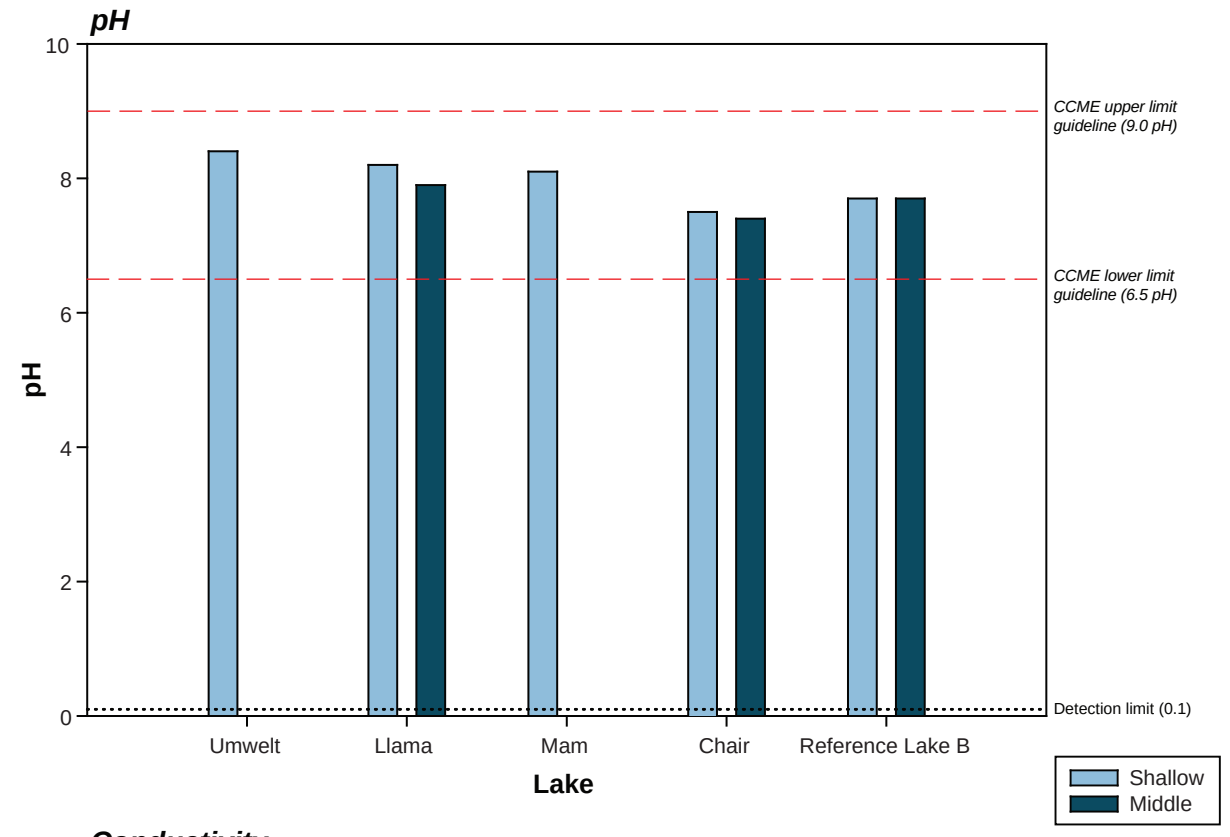

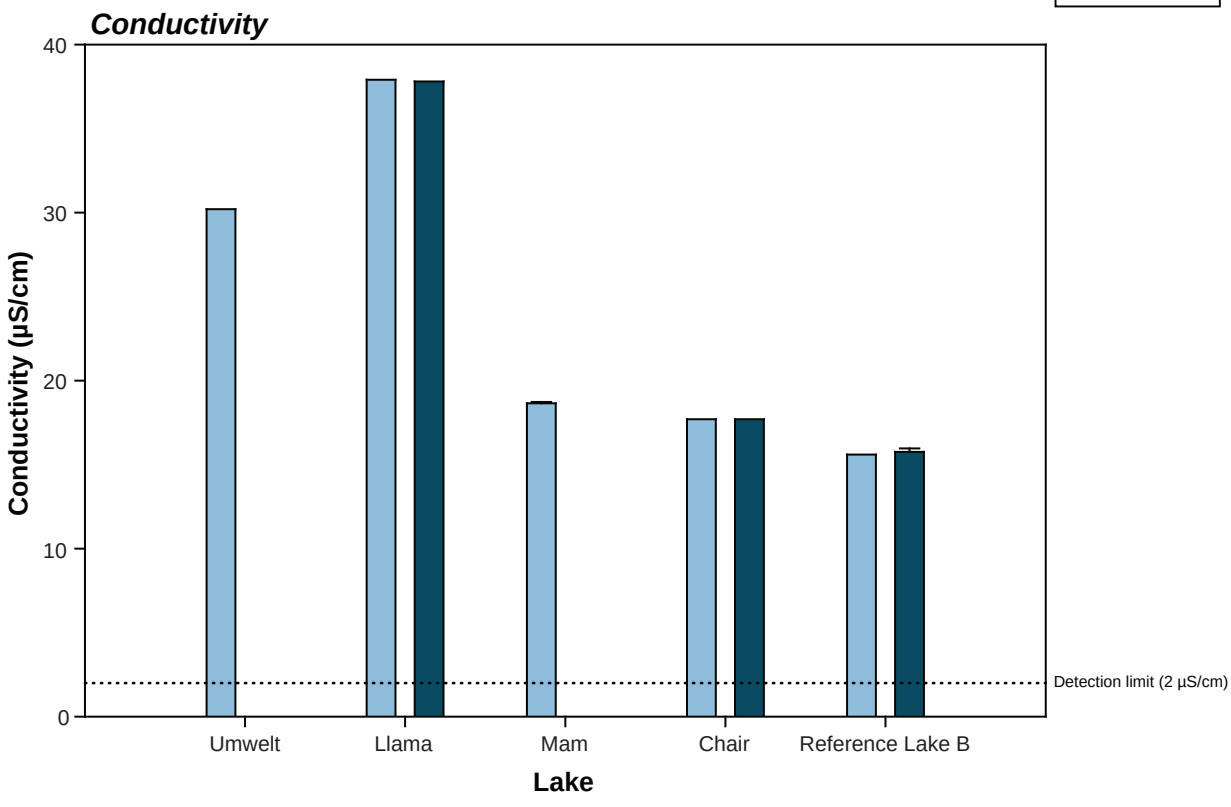

Note: Error bars represent standard error of the mean.

Sabina GOLD & SILVER CORP.

pH and Conductivity in the Lakes of the Back River Project Area, August 2010

Figure 3.2-3

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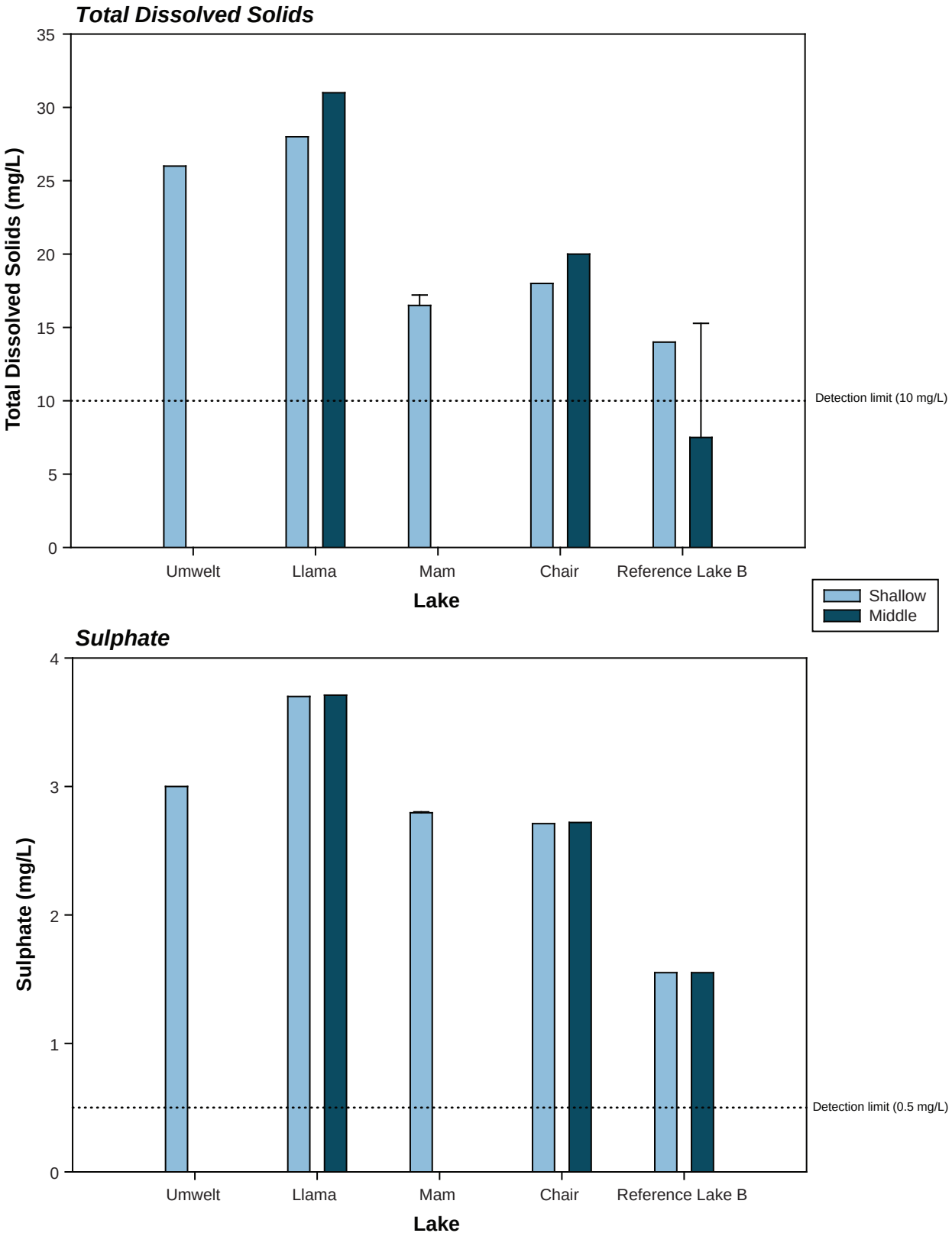

Note: Error bars represent standard error of the mean.

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Total Dissolved Solids and Sulphate Concentrations in the Lakes of the Back River Project Area, August 2010

Figure 3.2-4

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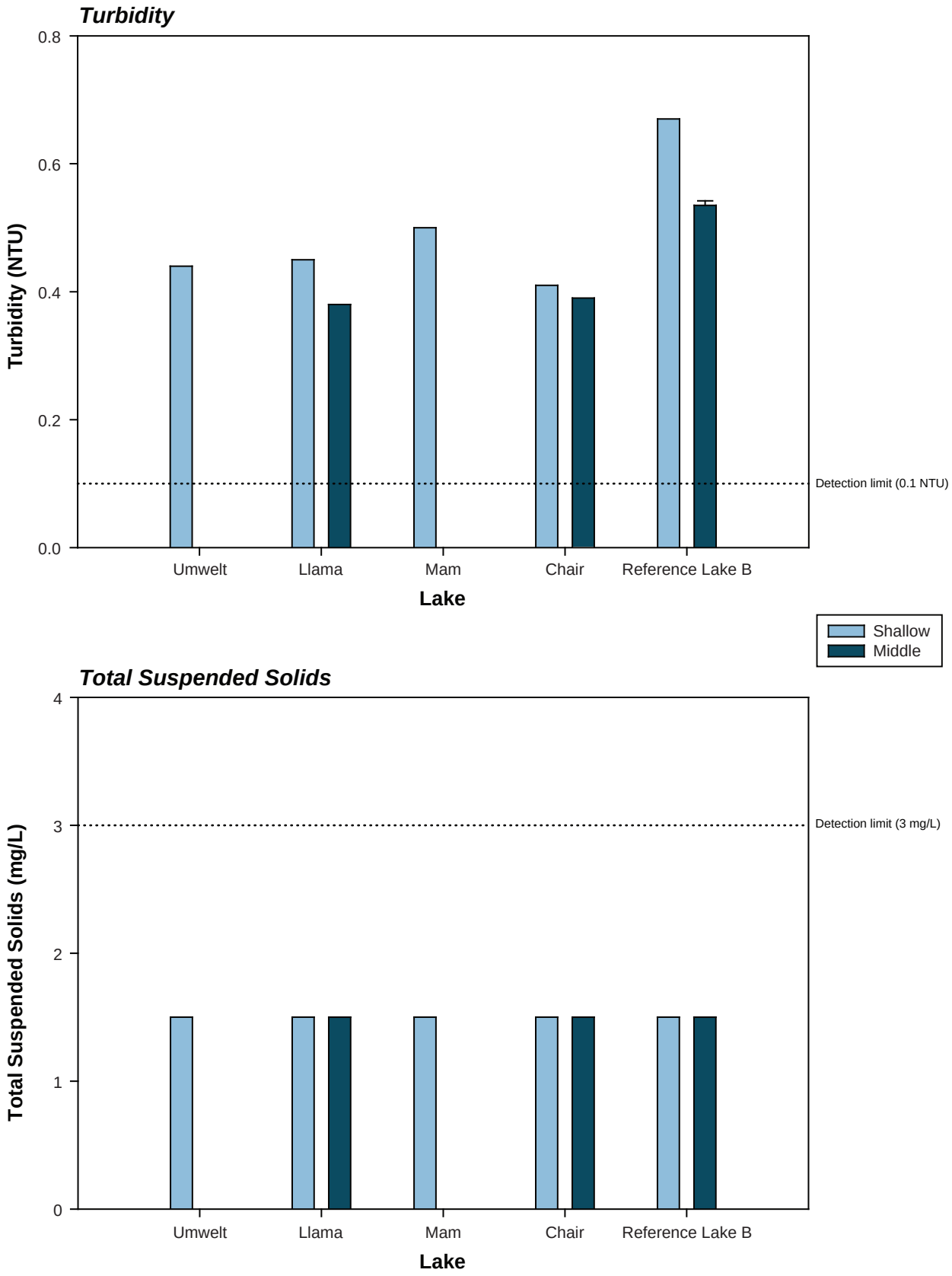

Note: Error bars represent standard error of the mean.

Sabina GOLD & SILVER CORP.

Turbidity and Total Suspended Solids in the Lakes of the Back River Project Area, August 2010

Figure 3.2-5

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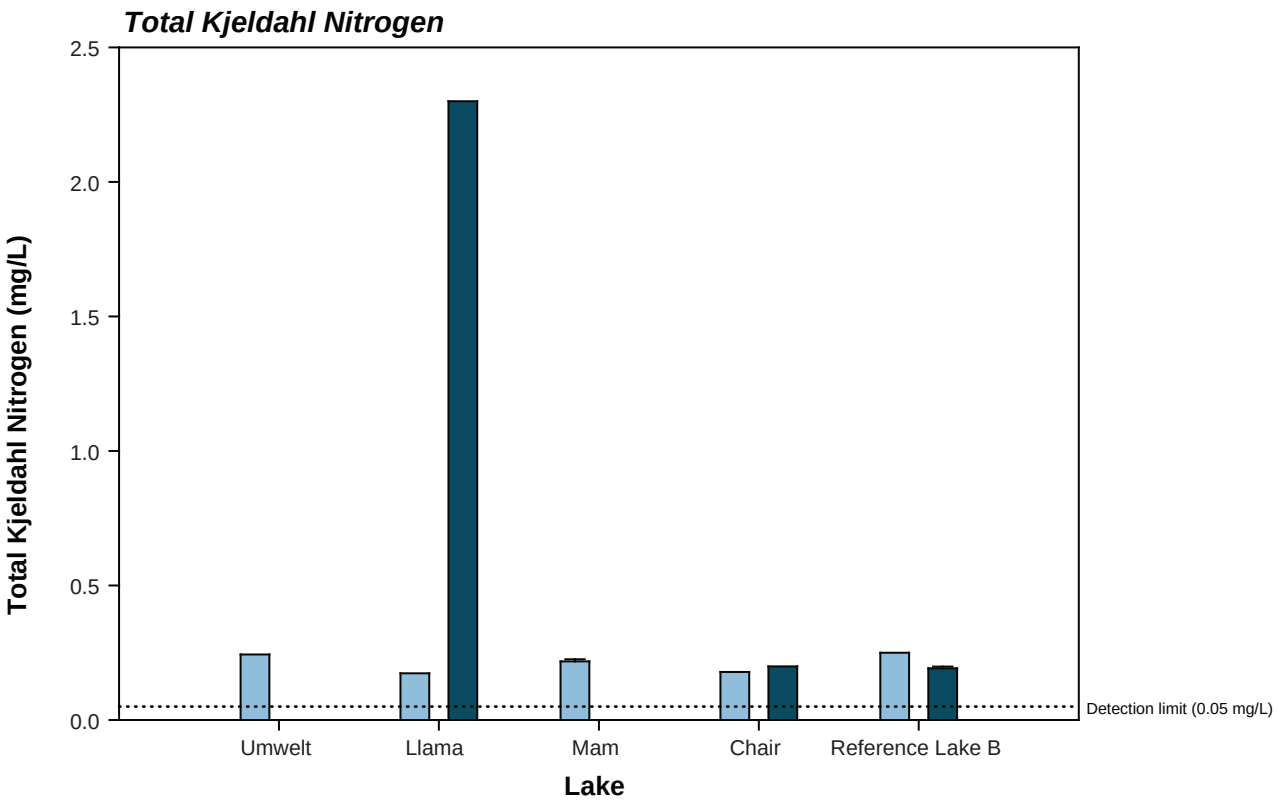

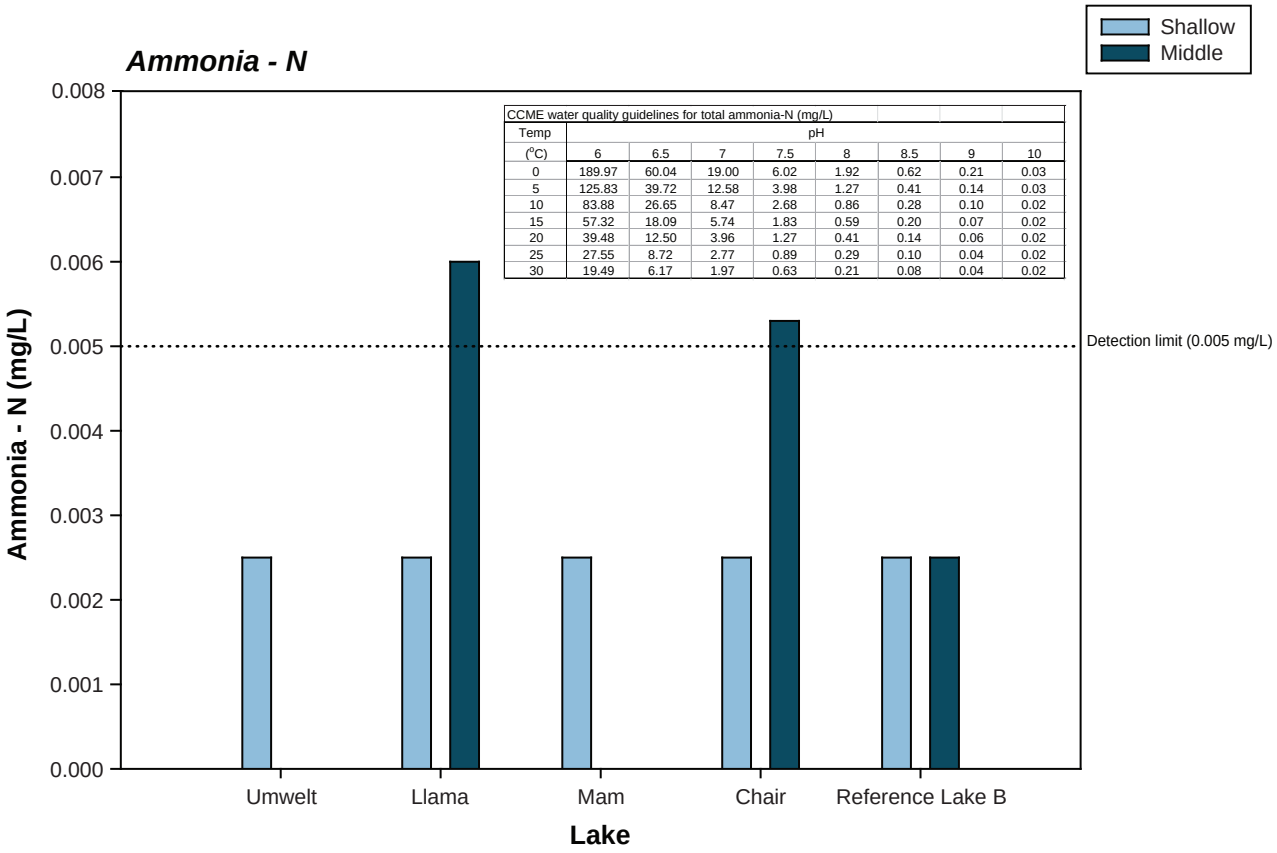

CCME water quality guidelines for total ammonia-N (mg/L)

Temp	pH							
(°C)	6	6.5	7	7.5	8	8.5	9	10
0	189.97	60.04	19.00	6.02	1.92	0.62	0.21	0.03
5	125.83	39.72	12.58	3.98	1.27	0.41	0.14	0.03
10	83.88	26.65	8.47	2.68	0.86	0.28	0.10	0.02
15	57.32	18.09	5.74	1.83	0.59	0.20	0.07	0.02
20	39.48	12.50	3.96	1.27	0.41	0.14	0.06	0.02
25	27.55	8.72	2.77	0.89	0.29	0.10	0.04	0.02
30	19.49	6.17	1.97	0.63	0.21	0.08	0.04	0.02

Note: Error bars represent standard error of the mean.
CCME guidelines are for the protection of freshwater aquatic life.
No CCME guideline listed for Total Kjeldahl Nitrogen.

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Total Kjeldahl Nitrogen and Ammonia Nitrogen Concentrations in the Lakes of the Back River Project Area, August 2010

Figure 3.2-6

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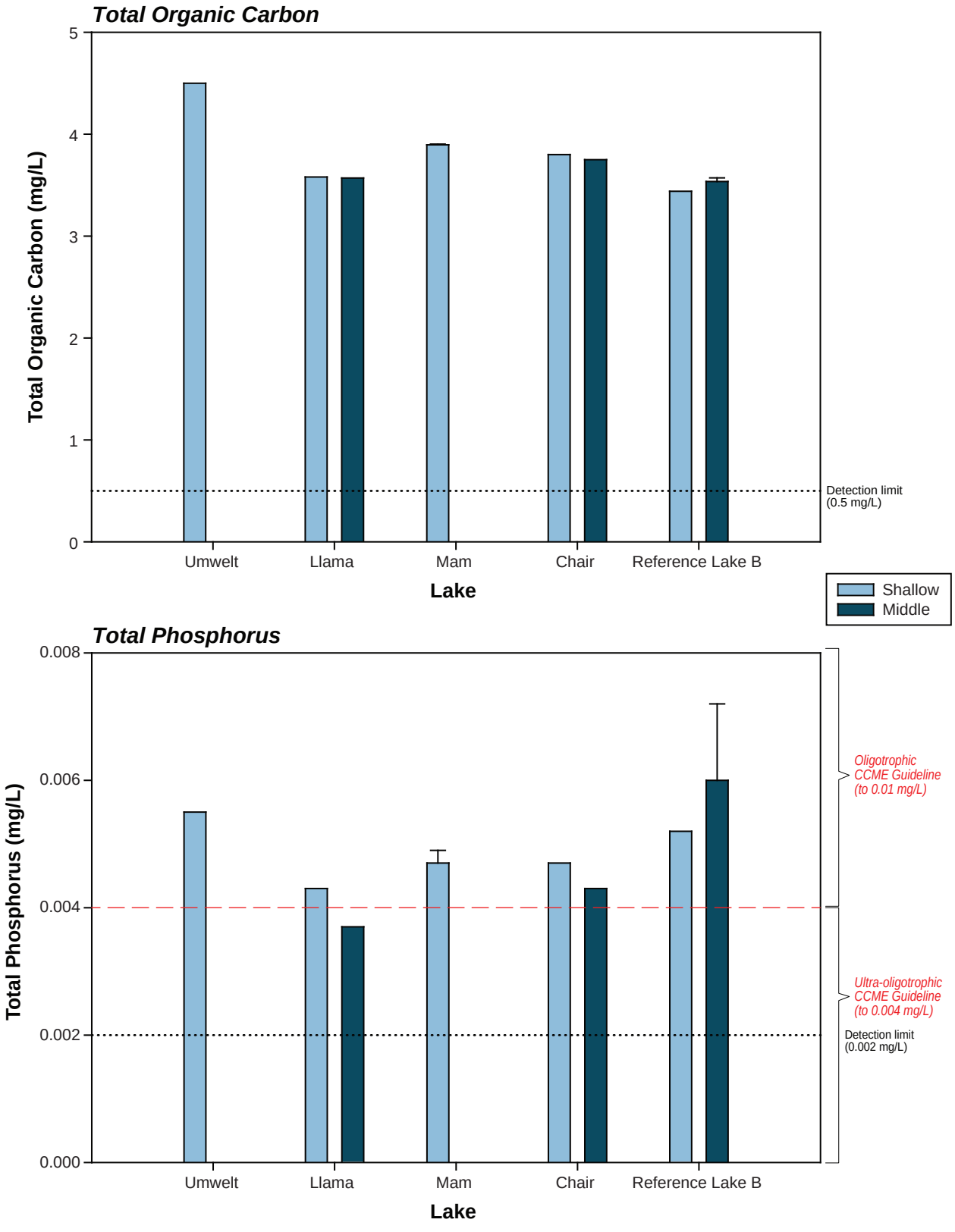

Note: Error bars represent standard error of the mean.
No CCME guideline exists for Total Organic Carbon.

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Total Organic Carbon and Total Phosphorus Concentrations in the Lakes of the Back River Project Area, August 2010

Figure 3.2-7

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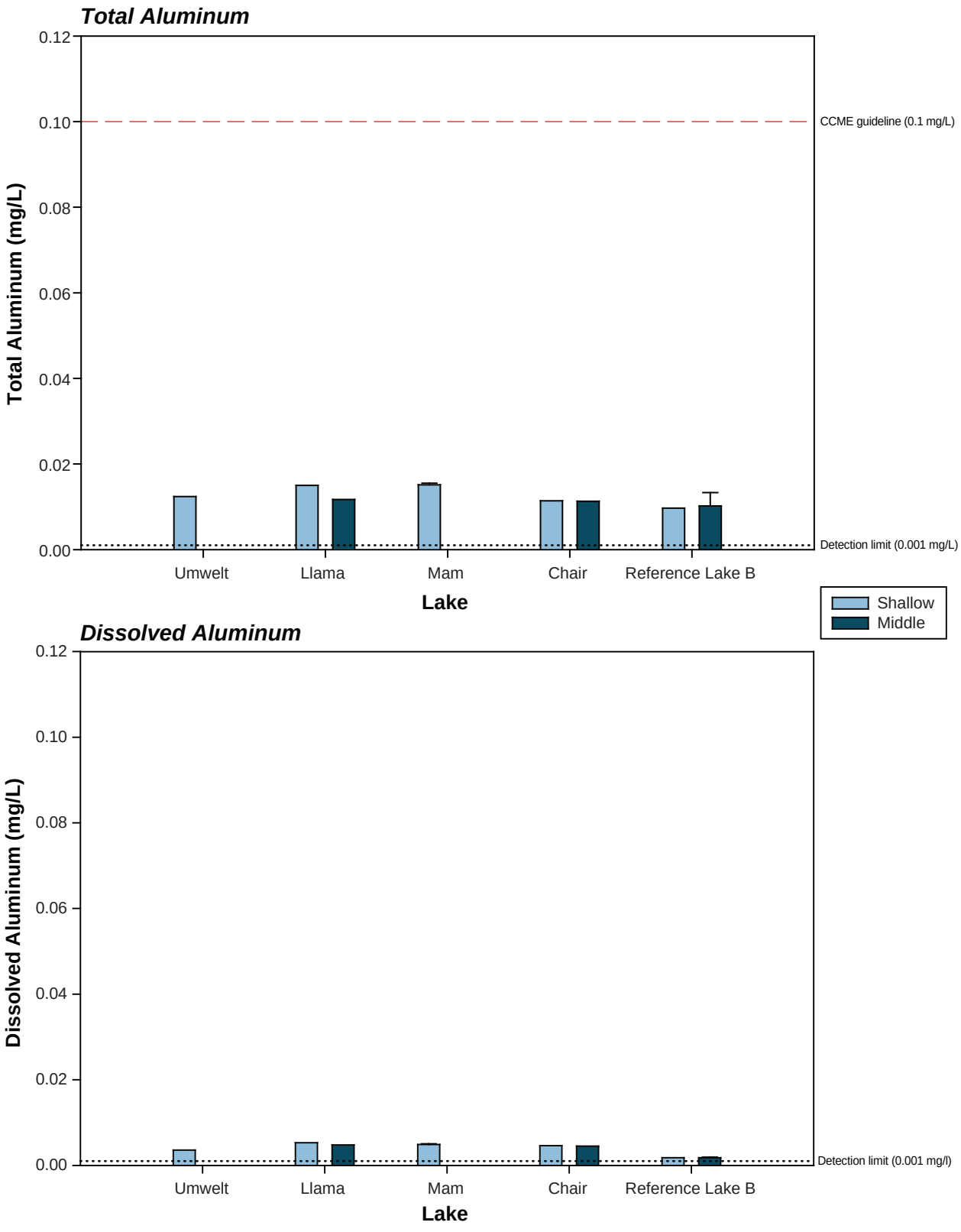

Notes: Error bars represent standard error of the mean.
Red dashed line represents CCME guideline and is pH-dependent: 0.005 mg/L, at pH less than 6.5 or 0.1 mg/L, at pH greater than or equal to 6.5.
pH values were greater than 6.5 for all samples and sites (based on field measurements).
** Indicates values that are higher than their sample guideline.*
CCME guidelines are for Total Metal concentrations.

Sabina GOLD & SILVER CORP.

Total and Dissolved Aluminum Concentrations in the Lakes of the Back River Project Area, August 2010

Figure 3.2-8

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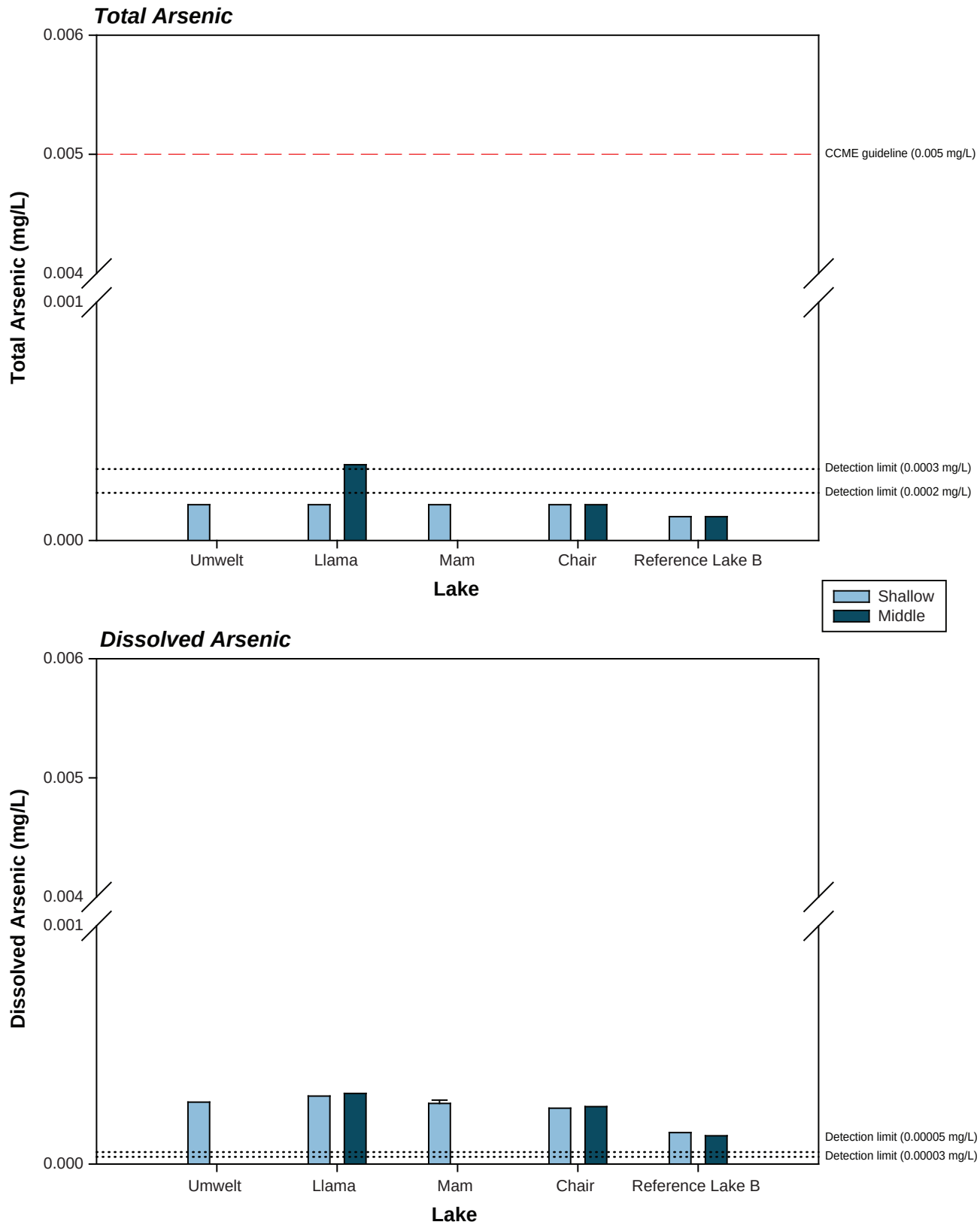

Notes: Error bars represent standard error of the mean.
Red dashed line represents CCME guideline.
CCME guidelines are for Total Metal concentrations.
Detection limits within and between analysis for total and dissolved arsenic concentration.

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Total and Dissolved Arsenic Concentrations in the Lakes of the Back River Project Area, August 2010

Figure 3.2-9

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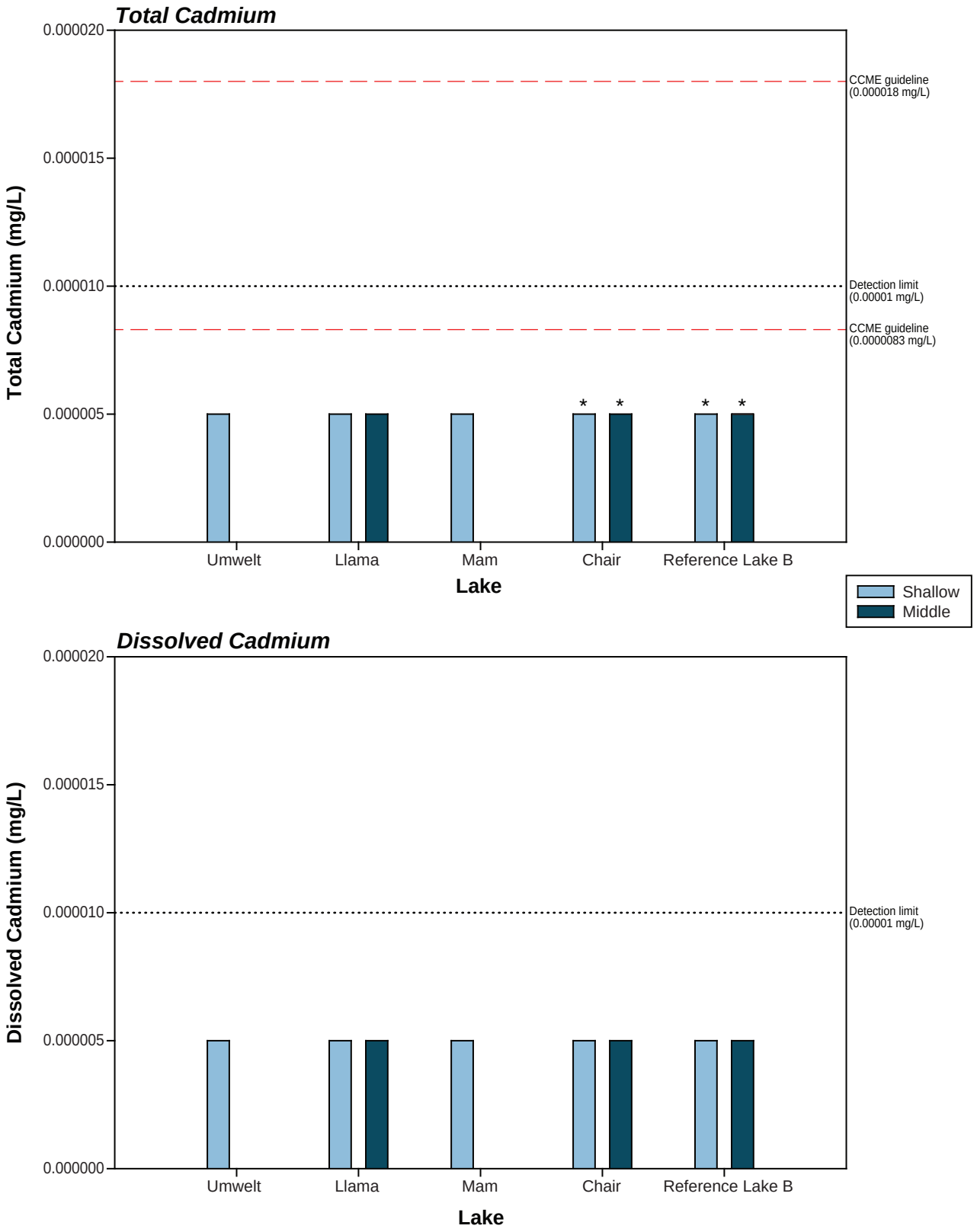

Notes: Error bars represent standard error of the mean.
CCME guideline for Total Metal concentrations is hardness-dependent
(CCME guideline = $0.001*10^{(0.86[\log(\text{hardness})]-3.2)}$ mg/L) and ranged from 0.0000083 to 0.000018.
The range is indicated in the figures.
**indicates total cadmium detection limit that is higher than hardness-corrected CCME guideline.*

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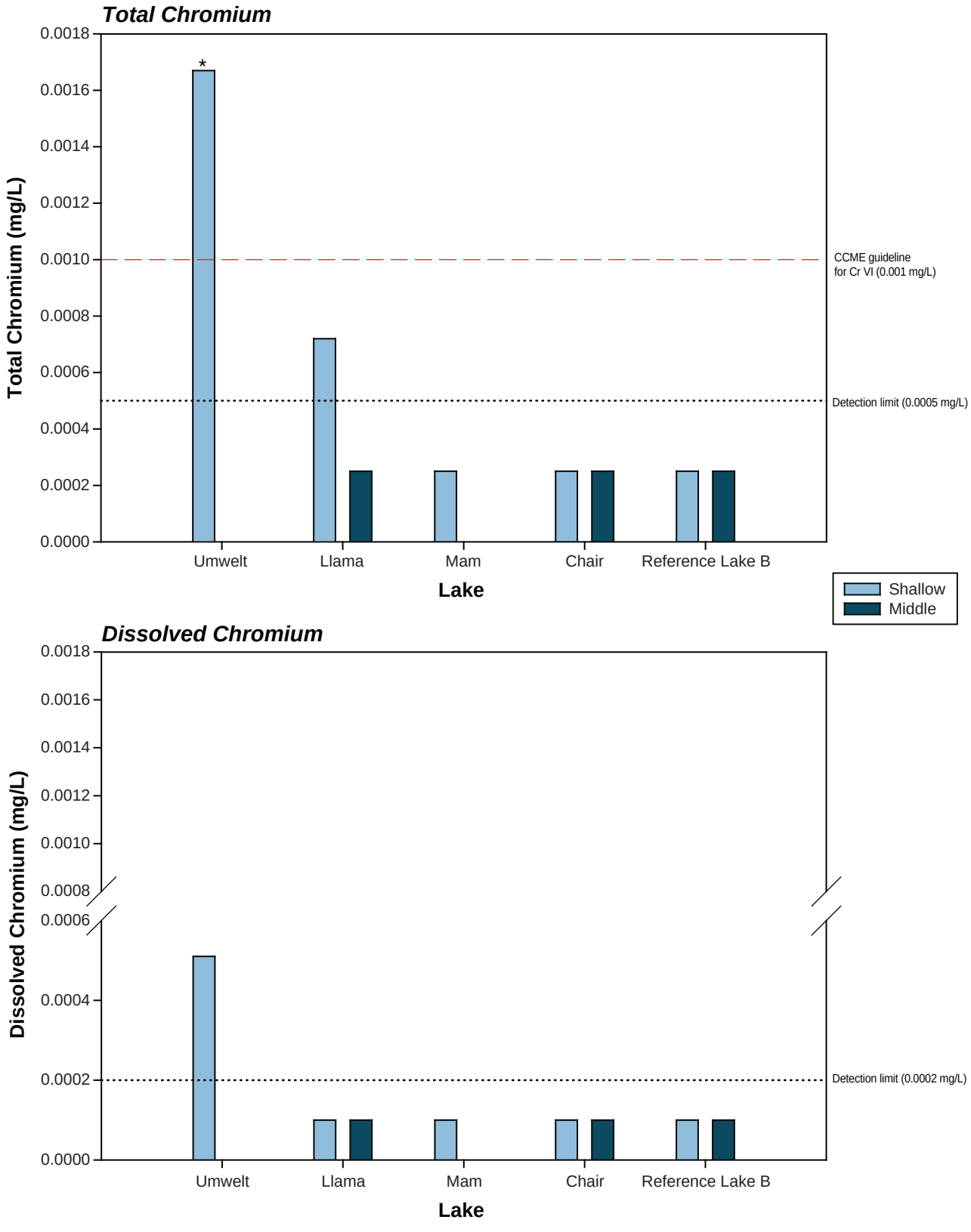
Total and Dissolved Cadmium Concentrations in the Lakes of the Back River Project Area, August 2010

Figure 3.2-10

Rescan™ Engineers & Scientists



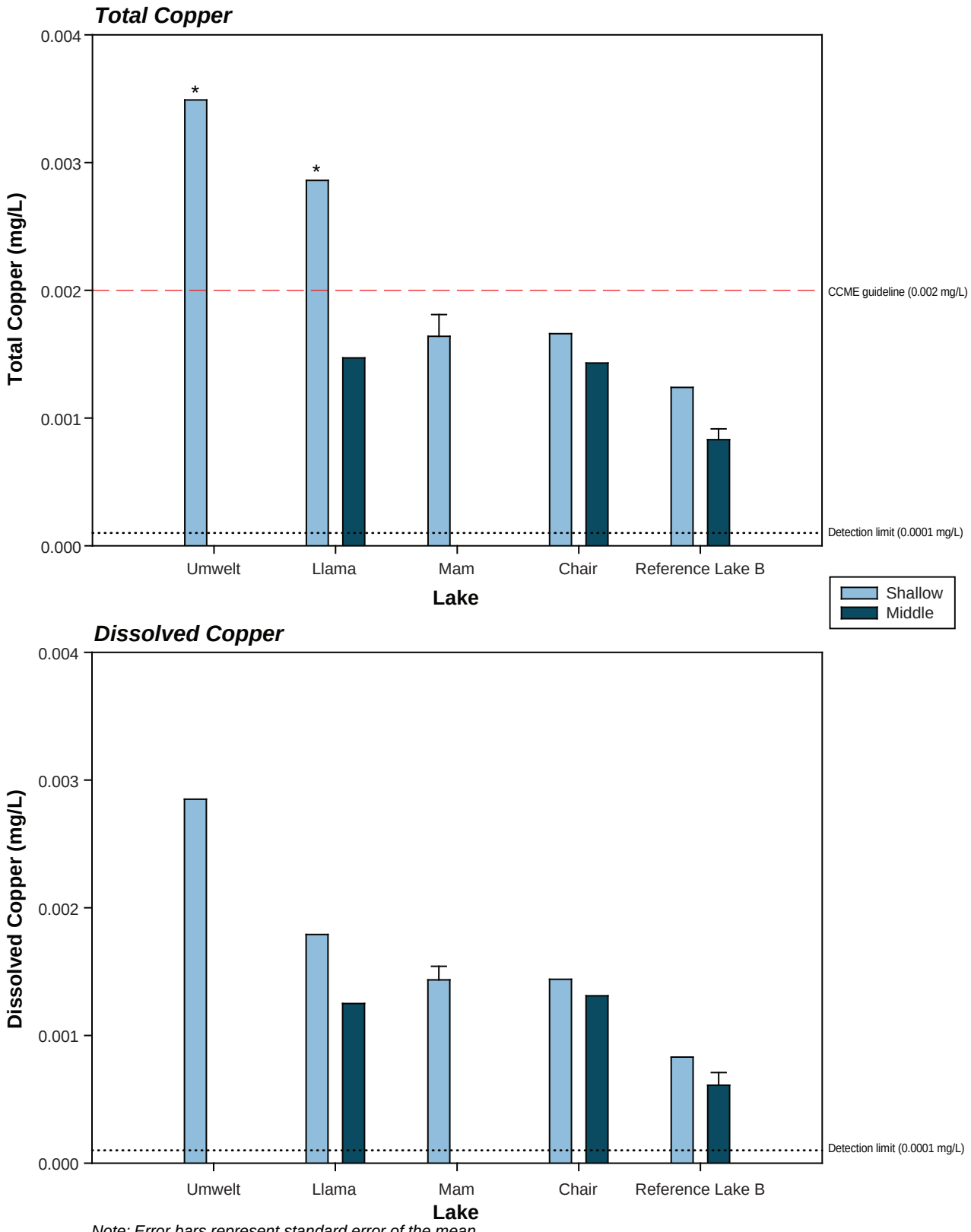
Note: Error bars represent standard error of the mean.
** Indicates values that are higher than their sample guideline.*
CCME guidelines are for Total Metal concentrations.

Sabina GOLD & SILVER CORP.

Total and Dissolved Chromium Concentrations in the Lakes of the Back River Project Area, August 2010

Figure 3.2-11

Rescan™ Engineers & Scientists



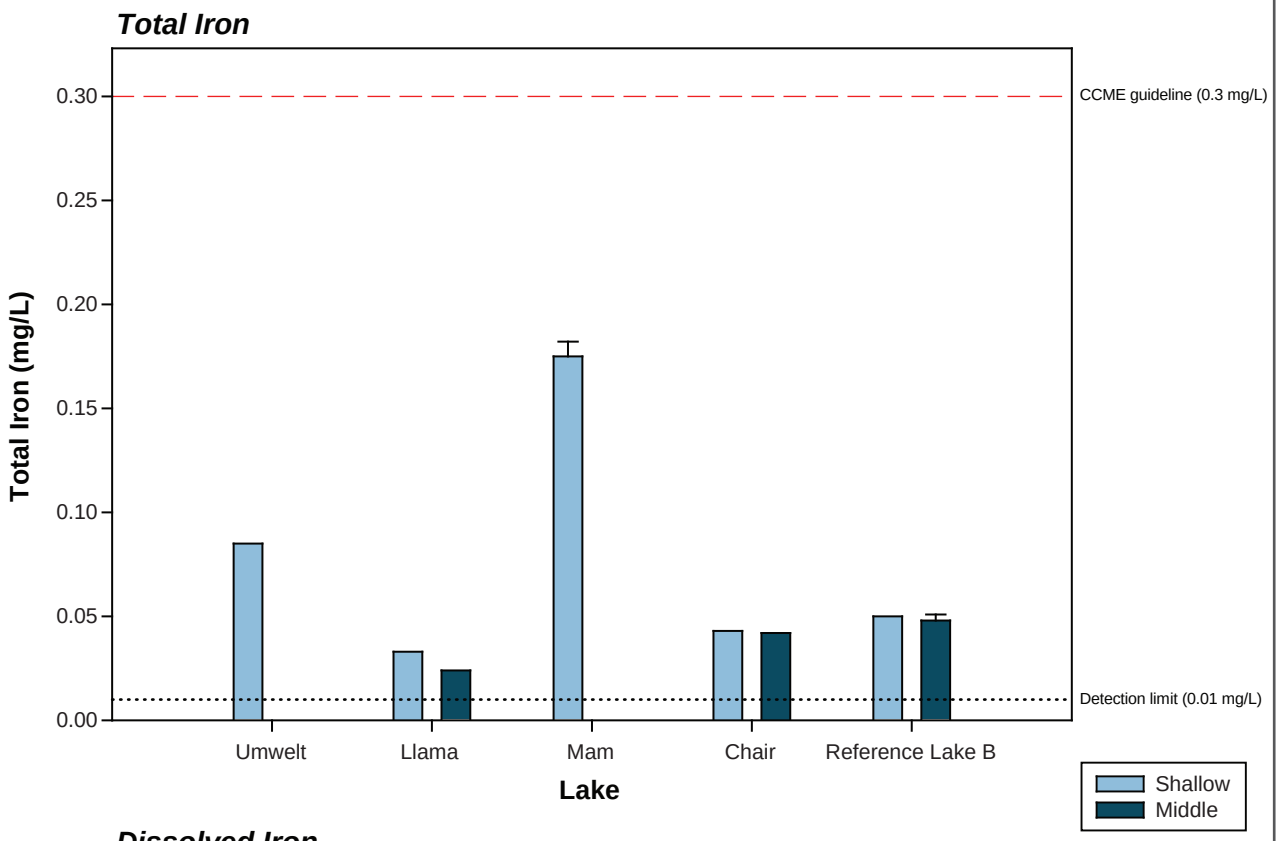
Note: Error bars represent standard error of the mean.
Red dashed line represents CCME guideline for total metals (0.002 mg/L at [$CaCO_3$] = 0-120 mg/L; 0.003 mg/L at [$CaCO_3$] = 120-180 mg/L; 0.004 mg/L at [$CaCO_3$] = >180 mg/L).
** Indicates values that are higher than their sample guideline.*
CCME guidelines are for Total Metal concentrations.

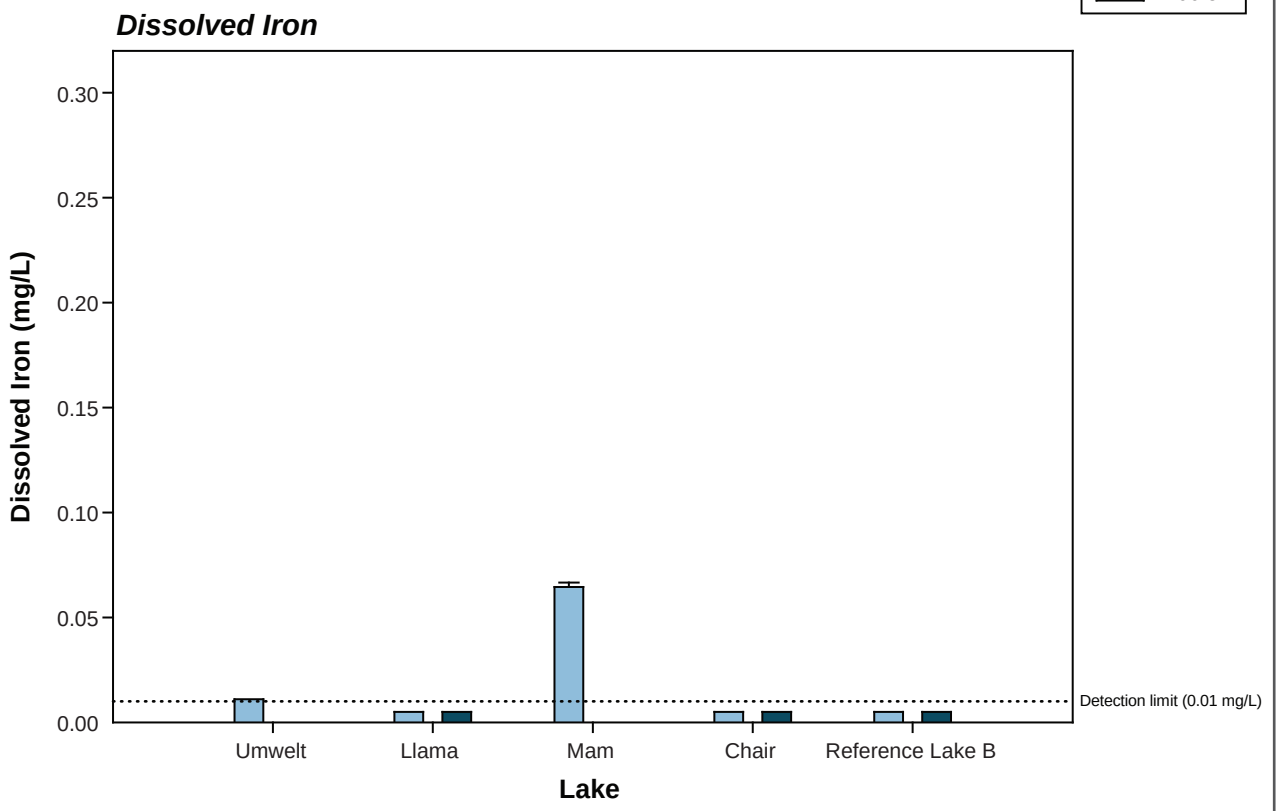
Sabina GOLD & SILVER CORP.

Total and Dissolved Copper Concentrations in the Lakes of the Back River Project Area, August 2010

Figure 3.2-12

Rescan™ Engineers & Scientists





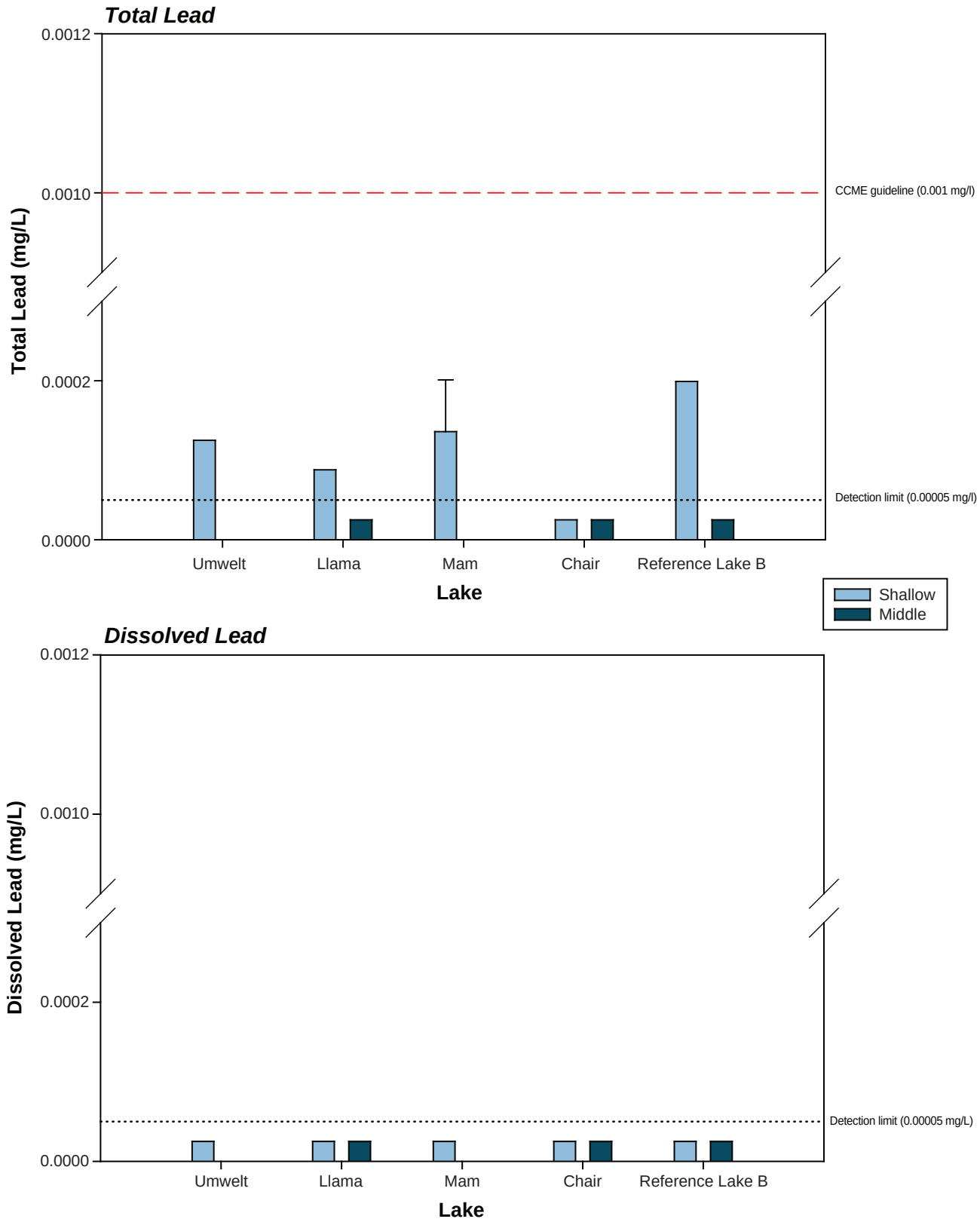
Note: Error bars represent standard error of the mean.
CCME guidelines are for Total Metal concentrations.

Sabina GOLD & SILVER CORP.

Total and Dissolved Iron Concentrations in the Lakes of the Back River Project Area, August 2010

Figure 3.2-13

Rescan™ Engineers & Scientists



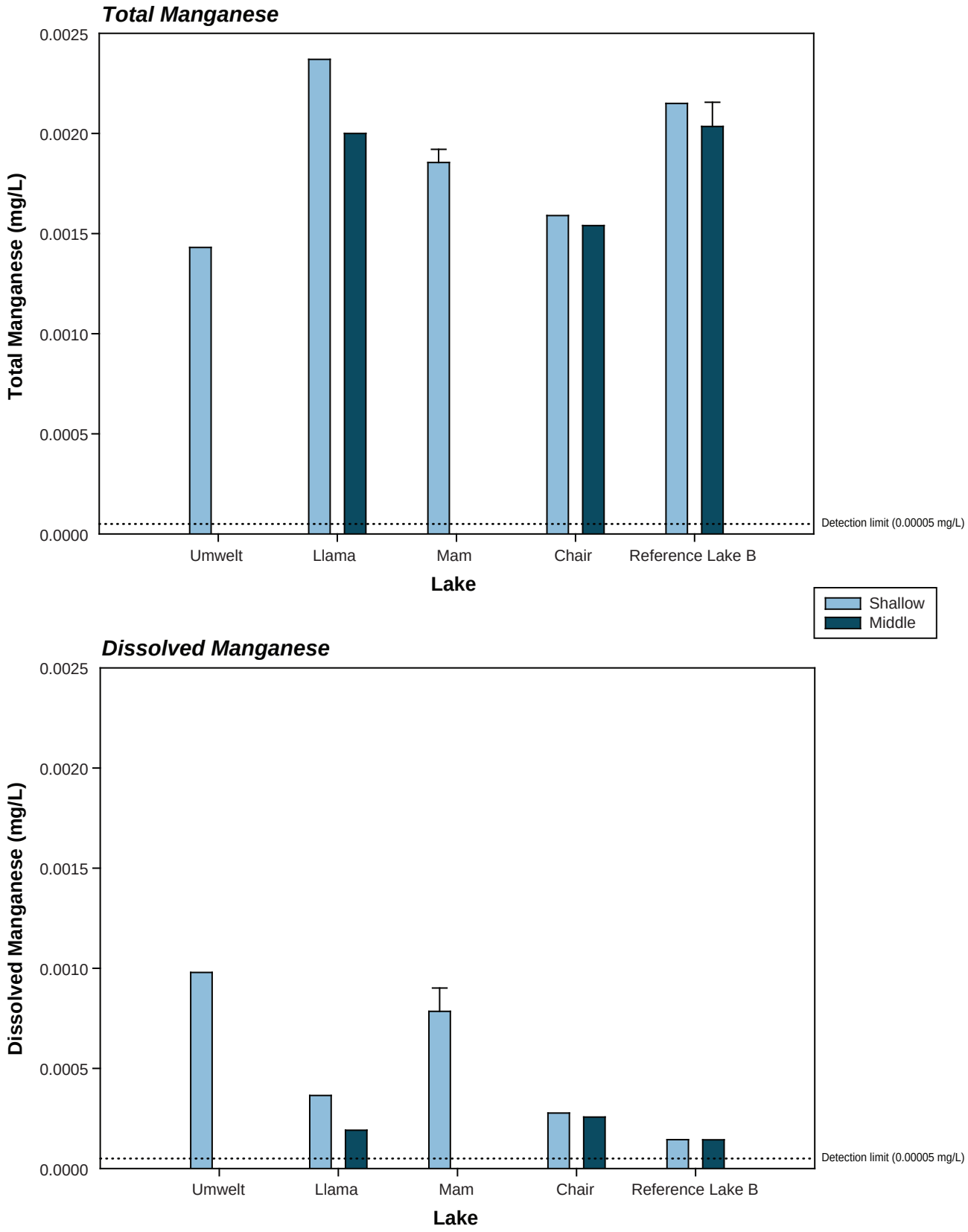
Notes: Error bars represent standard error of the mean.
Red dashed line represents CCME guideline and are for Total Metal concentrations (0.001 mg/L at [$CaCO_3$] = 0-60 mg/L; 0.002 mg/L at [$CaCO_3$] = 60-120 mg/L; 0.004 mg/L at [$CaCO_3$] = 120-180 mg/L; 0.007 mg/L at [$CaCO_3$] = > 180 mg/L).
** Indicates values that are higher than their sample guideline.*

Sabina GOLD & SILVER CORP.

Total and Dissolved Lead Concentrations in the Lakes of the Back River Project Area, August 2010

Figure 3.2-14

Rescan™ Engineers & Scientists



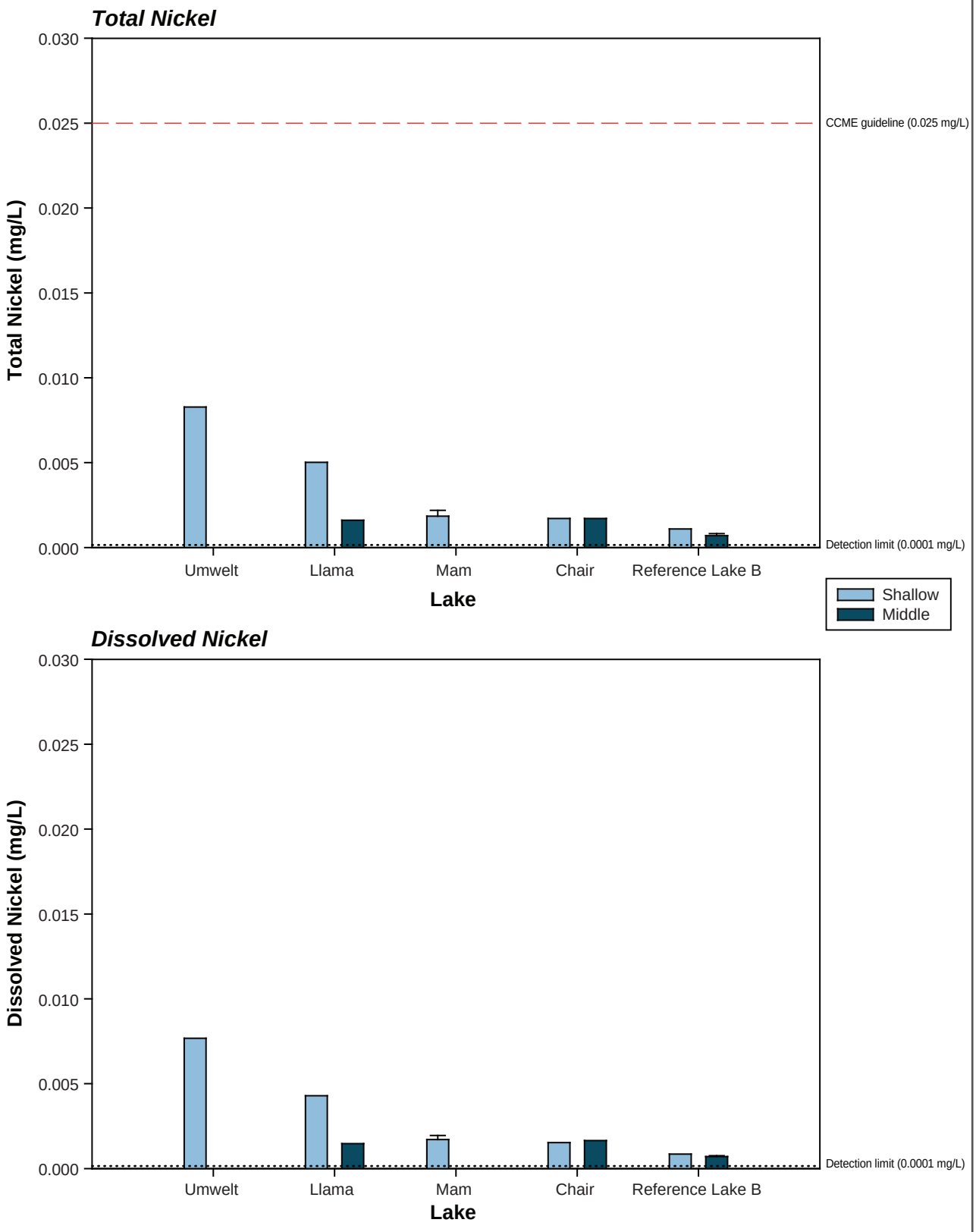
Note: Error bars represent standard error of the mean.
No CCME guideline exists for manganese.

Sabina GOLD & SILVER CORP.

Total and Dissolved Manganese Concentrations in the Lakes of the Back River Project Area, August 2010

Figure 3.2-15

Rescan™ Engineers & Scientists



Notes: Error bars represent standard error of the mean.
CCME guideline is hardness-dependent (0.025 mg/L at [$CaCO_3$ = 0-60 mg/L; 0.065 mg/L at [$CaCO_3$] = 60-120 mg/L; 0.110 mg/L at [$CaCO_3$] = > 180 mg/L).
CCME guidelines are for Total Metal concentrations

Sabina GOLD & SILVER CORP.

Total and Dissolved Nickel Concentrations in the Lakes of the Back River Project Area, August 2010

Figure 3.2-16

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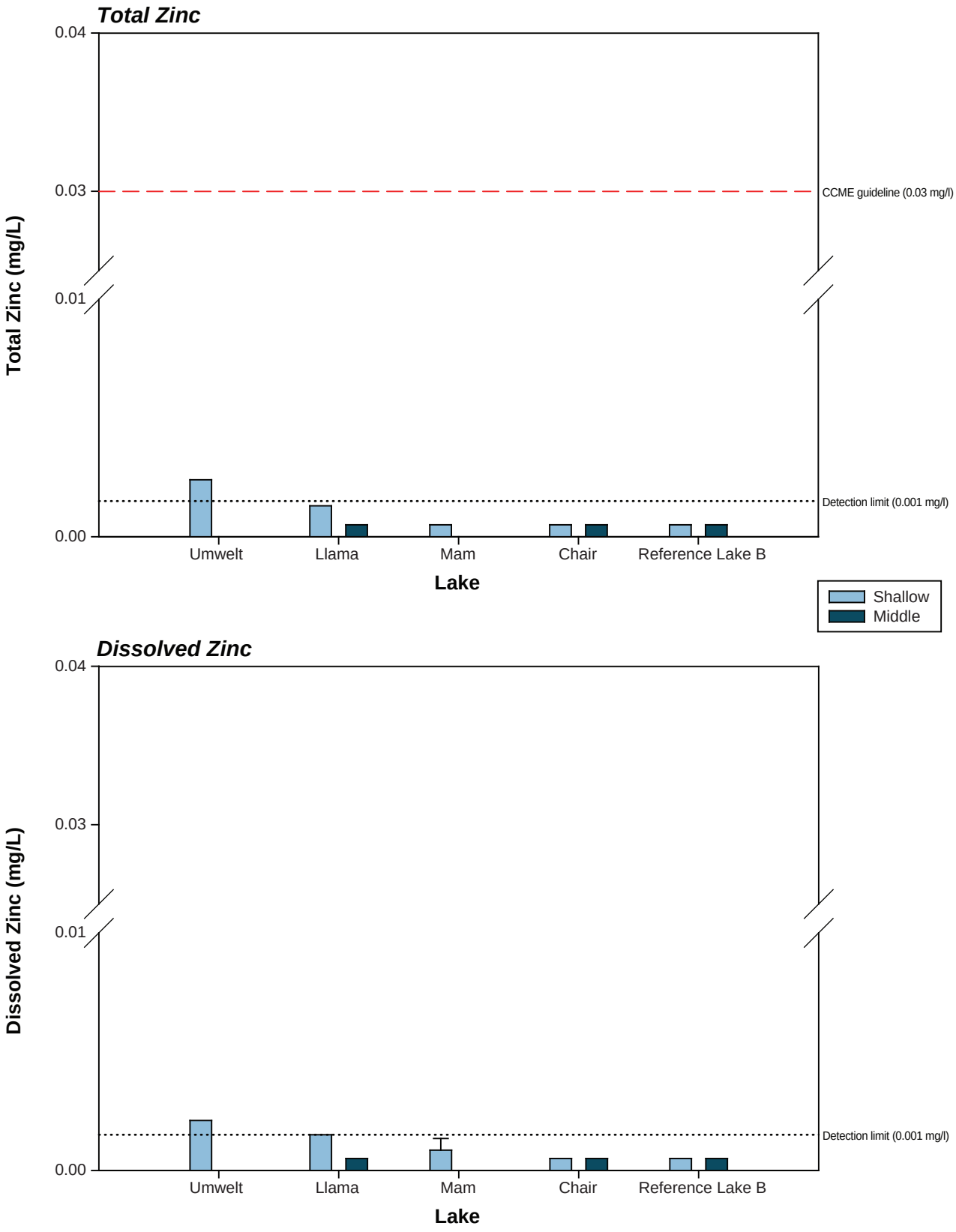

Notes: Error bars represent standard error of the mean.
CCME guidelines are for Total Metal concentrations.

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Total and Dissolved Zinc Concentrations in the Lakes of the Back River Project Area, August 2010

Figure 3.2-17

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Nitrogen and phosphorus are always present in aquatic ecosystems, and the availability of various forms of these nutrients can limit aquatic plant growth. In general, the five Back River Project lakes can be considered nutrient-poor, particularly in nitrogen. Nitrate and nitrite levels were below detection limits in all five lakes, while ammonia was only detectable in the deeper depths of Llama (0.006 mg/L) and Chair lakes (0.0053 mg/L) and not elsewhere. Total Kjeldahl Nitrogen (TKN), which represents the sum of organic nitrogen and ammonia, ranged from 0.17 mg/L (Llama Lake - surface) to 0.25 mg/L (Reference Lake B - surface), except in the deep water of Llama Lake (7 m), where it jumped to 2.3 mg/L (Figure 3.2-6). Thus, the vast majority of nitrogen in the five lakes is tied up in the dissolved and particulate organic fraction, which is not as easily accessed by growing plants (as ammonia or nitrate are).

Like nitrogen, phosphorus is a critical macronutrient for plant growth in Arctic lakes. Ortho-phosphate levels were undetectable in all five lakes (Appendix 2a), while total phosphorus (TP) concentrations were low and largely similar between the five lakes, ranging from 0.0037 mg/L in the deep waters of Llama Lake to 0.0068 mg/L in the mid-water column of Reference Lake B (Figure 3.2-7). Thus, these lakes can be considered ultra-oligotrophic to oligotrophic based on the CCME trigger ranges for phosphorous levels in freshwater systems (CCME 2007).

Total Organic Carbon (TOC) is made of dissolved and particulate components, with dissolved organic carbon generally related to surrounding vegetation in Arctic lakes (e.g., Pienitz et al. 1997). Overall, the TOC in August varied little between the five lakes, ranging from 3.4 mg/L in Reference Lake B to 4.5 mg/L in Umwelt Lake (Figure 3.2-7).

3.2.4 Total and Dissolved Metals

The Back River lakes had low levels of several metals in their water as many of the metals had more than 75% percent of their samples below analytic detection limits. This included several biologically important metals that were always below detection, such as: cadmium, cobalt, mercury, molybdenum, and selenium. The others were antimony, beryllium, bismuth, lithium, silver, thallium, tin, titanium, uranium, and vanadium. Except for cadmium, no graphs were prepared for the aforementioned metals; however, they were created for aluminum, arsenic, chromium, copper, iron, lead, manganese, nickel, and zinc, which were often or occasionally above analytic detection limits (Figures 3.2-8 to 3.2-17).

Based on their metal concentrations, the five lakes generally fell into three categories: those with the highest metal concentrations near the ore zone (Llama and Umwelt lakes), those with intermediate concentrations (Chair and Mam lakes), and that with the lowest concentrations (Reference Lake B). Both Llama and Umwelt lakes appeared to have some deep groundwater influence due to the higher levels of the seawater constituents: sodium, calcium, magnesium, chloride, and sulphate. In addition to any groundwater influence, Umwelt Lake also had elevated dissolved and total concentrations of chromium (Figure 3.2-11), copper (Figure 3.2-12), nickel (Figure 3.2-16), and zinc (Figure 3.2-17) relative to the other lakes. This is not unusual due to its proximity to the ore zone. Llama Lake, also near the ore zone, was the only other lake with detectable levels of chromium (total) and zinc (total). It also had the highest total manganese concentrations (0.0024 mg/L; Figure 3.2-15) and the only detectable levels of arsenic of the five sampled lakes (0.00032 mg/L - surface; Figure 3.2-9).

In the other lakes, Mam Lake was unique regarding its iron content (Figure 3.2-13), with the highest levels of dissolved (0.066 mg/L) and total iron (0.18 mg/L). Although Reference Lake B generally had the lowest metal concentrations, it did have the highest lead level of the five lakes, with a concentration of 0.0002 mg/L in its surface waters (Figure 3.2-14).

3.2.5 CCME Guidelines

All water quality data collected in Back River lakes were compared to the CCME water quality guidelines for the protection of freshwater aquatic life (CCME 2007). In general, the water column metal concentrations in the five sampled lakes were quite low, as there were very few exceedances of CCME guidelines. Umwelt Lake had naturally elevated concentrations of total copper and chromium with concentrations being higher than CCME guidelines. Llama Lake also had naturally elevated concentrations of total copper. All other water quality paramaters in the 5 lakes sampled were below CCME guidelines for the protection for freshwater aquatic life.

Table 3.2-1 shows the percentage of water quality samples in which parameter concentrations were higher than water quality guidelines, and the factor by which concentrations were higher than guidelines. For the Back River Project lakes, total and dissolved copper concentrations were greatest near the ore zone and decreased with increasing distance from the deposit zone. In Umwelt and Llama lakes, total copper concentrations exceeded the CCME guideline of 0.002 mg/L (for 0–120 mg/L $CaCO_3$) (Figure 3.2-12; Table 3.2-1). Total copper exceeded the guideline by less than twice the recommended concentration (Table 3.2-1). In Umwelt Lake, the dissolved copper concentration (0.00285 mg/L) was also higher than the CCME guideline for total copper concentration.

In Umwelt Lake, the total chromium concentration (0.0017 mg/L) exceeded the CCME guideline of 0.001 mg/L for hexavalent chromium (Cr^{6+}), but was below the trivalent chromium (Cr^{3+}) guideline of 0.0089 mg/L (Figure 3.2-11). Total chromium concentrations were below detection levels for Mam Lake, Chair Lake, and Reference Lake B. Dissolved chromium levels were below the CCME guideline for chromium in all Project lakes, as all concentrations, with the exception of Umwelt Lake (0.0051 mg/L), were below detection limits.

3.2.6 Quality Assurance and Quality Control (QA/QC)

Results for the travel, field and equipment blanks are presented in Appendix 2c. Possible sources of contamination could be revealed if specific water quality parameters in the respective blanks have concentrations greater than the analytical detection limit. There were no concentrations greater than the realized detection limit for the travel or field blanks, and therefore no contamination from the shipping or handling of the samples. For the equipment blank, conductivity, nitrate, TOC, total barium, boron, chromium, lead, magnesium, zinc, and dissolved boron, chromium, lead, magnesium, and zinc were slightly above the analytical detection limit, and well within five times the detection limit (the range of analytical error), or the realized detection limit for field and travel blanks. The equipment blank for total and dissolved nickel was more than five times the detection limit; however, this does not appear to be an issue as total and dissolved nickel concentrations in the lake water quality samples typically fell below the equipment blank concentration and are well below CCME guidelines. Total and dissolved manganese and dissolved copper in the equipment blank samples were more than five times the analytical and realized detection limits. All three occurred in detectable concentrations in the field samples. There is no CCME guideline for total or dissolved manganese or dissolved copper.

3.3 SEDIMENT QUALITY

In August, 2010, sediment quality samples were collected from five lakes in the Back River Project area. Sediment samples were collected from the same lakes as the bathymetry and water quality samples. Umwelt and Mam lakes have a maximum depth of 2.7 and 3.8 m, respectively, so sediment samples were collected from only the shallow zone in these lakes. Chair Lake and Reference Lake B have maximum depths of 10.3 and 5.1 m, respectively, so sediment samples were collected from the shallow (0–5 m) and mid-depth (5–10 m) zones. Llama Lake has a maximum depth of 13.6 m, and sediment samples were collected from each of the shallow (0–5 m), mid-depth (5–10 m), and deep zones (>10 m).

Table 3.2-1. Lake Water Quality, Samples Which Exceed CCME Guidelines, Back River Project, August 2010

		Percent of Samples in which Concentrations Exceed CCME Guidelines					Factor by Which Concentrations Exceed CCME Guidelines				
Lake		**Umwelt Lake**	**Llama Lake**	**Mam Lake**	**Chair Lake**	**Reference Lake B shallow**	**Umwelt Lake**	**Llama Lake**	**Mam Lake**	**Chair Lake**	**Reference Lake B shallow**
Total Number of Samples Collected		1	2	2	2	3	1	2	2	2	3
CCME Guideline Value[a]:											
pH	6.5-9.0	0	0	0	0	0	-	-	-	-	-
Ammonia (as N)	pH- and temperature-dependent	0	0	0	0	0	-	-	-	-	-
Nitrate (as N)	2.93 mg/L	0	0	0	0	0	-	-	-	-	-
Nitrite (as N)	0.06 mg/L	0	0	0	0	0	-	-	-	-	-
Total Phosphorus	Trophic Status[b]	Oligotrophic	Ultra-oligotrophic	Ultra-oligotrophic	Ultra-oligotrophic	Oligotrophic	-	-	-	-	-
Aluminum (Al)-Total	0.005 or 0.1[c] mg/L	0	0	0	0	0	-	-	-	-	-
Arsenic (As)-Total	0.005 mg/L	0	0	0	0	0	-	-	-	-	-
Cadmium(Cd)-Total	0.000017 mg/L	0	0	0	0	0	-	-	-	-	-
Chromium (Cr)-Total	0.001 or 0.0089[d] mg/L	100[i]	0	0	0	0	1.67[i]	-	-	-	-
Copper (Cu)-Total	0.002-0.004[e] mg/L	100	50	0	0	0	1.75	1.08	-	-	-
Iron (Fe)-Total	0.3 mg/L	0	0	0	0	0	-	-	-	-	-
Lead (Pb)-Total	0.001-0.007[f] mg/L	0	0	0	0	0	-	-	-	-	-
Mercury	0.000026[g] mg/L	0	0	0	0	0	-	-	-	-	-
Molybdenum (Mo)-Total	0.073 mg/L	0	0	0	0	0	-	-	-	-	-
Nickel (Ni)-Total	0.025-0.110[h] mg/L	0	0	0	0	0	-	-	-	-	-
Selenium (Se)-Total	0.001 mg/L	0	0	0	0	0	-	-	-	-	-
Silver (Ag)-Total	0.0001 mg/L	0	0	0	0	0	-	-	-	-	-
Thallium (Ag)-Total	0.0008 mg/L	0	0	0	0	0	-	-	-	-	-
Zinc (Zn)-Total	0.03 mg/L	0	0	0	0	0	-	-	-	-	-

a) Canadian water quality guidelines for the protection of aquatic life (CCME 2007)

b) Trophic categories from CCME 2007): <0.004 mg/L = ultra-oligotrophic; 0.004-0.010 mg/L = oligotrophic; 0.01-0.02 mg/L = mesotrophic; 0.02-0.035 mg/L = meso-eutrophic; 0.35-0.1 mg/L = eutrophic; >0.1 mg/L = hyper-eutrophic

c) 0.005 mg/L at pH <6.5; 0.1 mg/L a pH ≥6.5

d) 0.001 mg/L for hexavalent chromium (Cr(VI)); 0.0089 mg/L for trivalent chromium (Cr(III))

e) 0.002 mg/L at [$CaCO_3$] = 0-120 mg/L; 0.003 mg/L at [$CaCO_3$] = 120-180 mg/L; 0.004 mg/L at [$CaCO_3$] = >180 mg/L

f) 0.001 mg/L at [$CaCO_3$] = 0-60 mg/L; 0.002 mg/L at [$CaCO_3$] = 60-120 mg/L; 0.004 mg/L at [$CaCO_3$] = 120-180 mg/L; 0.007 mg/L at [$CaCO_3$] = >180 mg/L

g) Guideline refers to inorganic mercury.

h) 0.025 mg/L at [$CaCO_3$] = 0-60 mg/L; 0.065 mg/L at [$CaCO_3$] = 60-120 mg/L; 0.110 mg/L at [$CaCO_3$] = 120-180 mg/L; 0.150 mg/L at [$CaCO_3$] = >180 mg/L

i) Assumes that all chromium in sample is in the form of hexavalent chromium.

Sediment samples were evaluated for particle size, nutrients, total organic carbon, and metals. Results, detection limits, and sediment quality guidelines are provided in Appendix 3a.

3.3.1 Particle Size

In general, lake sediments were dominated by silt (Figure 3.3-1), with Mam, Chair, and Llama lakes composed of over 75% silt at all depths. Umwelt Lake had the coarsest sediments as it was dominated by sand (68%), with the largest proportion of gravel of the lakes (7.8%), and had almost no clay (average of 0.5% clay). Reference Lake B also had coarser sediments, with approximately 50–60% sand and 40–50% silt and clay.

3.3.2 Principal Components Analysis

Results of the sediment quality PCA data are presented in Figure 3.3-2 and in Appendix 3b. Plots were created to illustrate the relative location of the lakes and sampling depths in ordination space, the loadings of the sediment quality parameters, and the variation in the data explained by the principal components. Principle components 1 and 2 explained 86.3% of the variation.

In general, Umwelt and Reference Lake B separated from the other lakes in ordination space because they had more sand, less silt and clay, and lower concentrations of nutrients, organic carbon, and metals than the other lakes (Figures 3.3-2 to 3.3-8). Reference Lake B and Umwelt Lake separated from each other based on the higher concentrations of TOC, total nitrogen (TN), and ammonium in Reference Lake B. Chair Lake, Mam Lake, and Llama Lake had predominantly silt and clay sediments at mid-depth, and had the higher concentrations for most nutrients and metals (TOC, TN, total sulphur, strontium, and calcium). Chair Lake had the largest percentage of clay in its sediments, and had the highest concentrations of metals. This included cadmium, chromium, copper, lead, iron, magnesium, manganese, nickel, potassium, selenium, uranium, and zinc among others (Appendix 3).

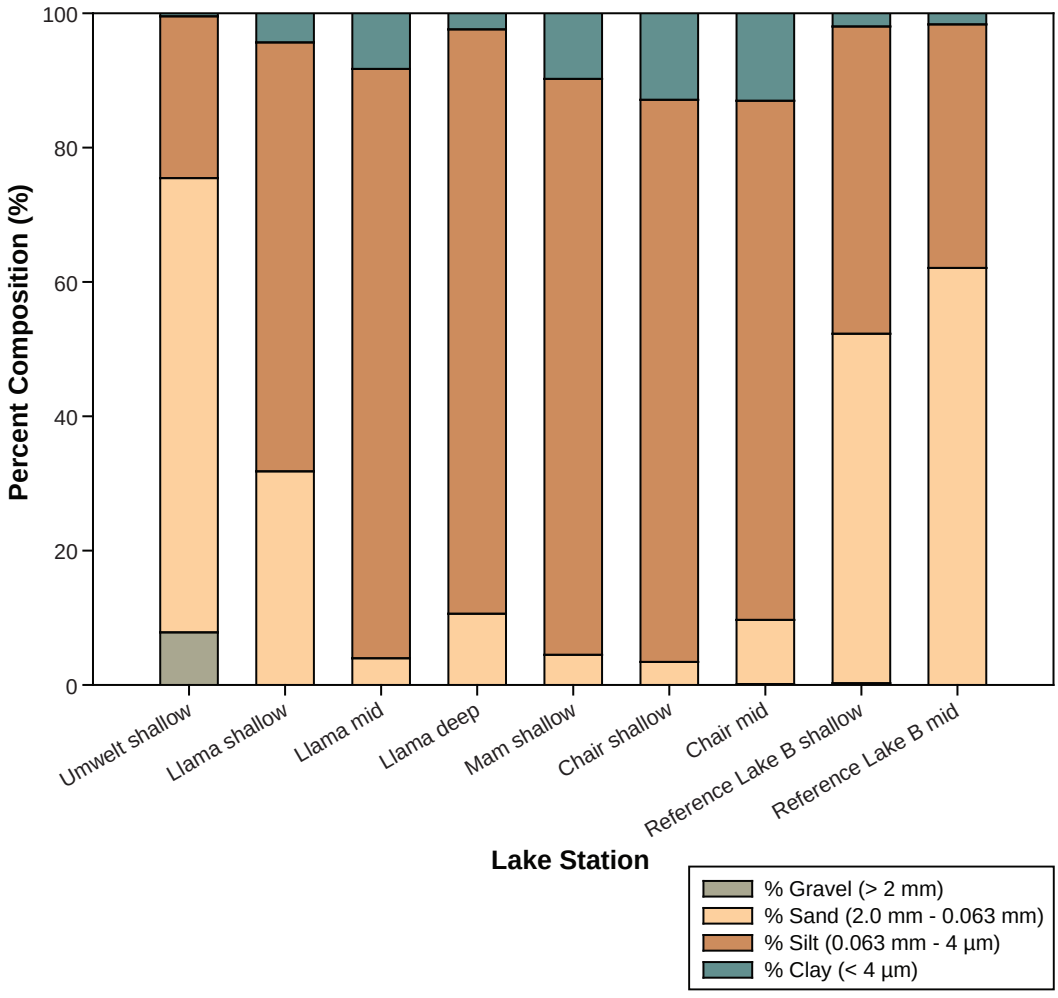
3.3.3 Nutrients and Total Organic Carbon

Total organic carbon and total nitrogen content followed similar patterns in the lake sediments, with the highest concentrations in the shallow areas of Reference Lake B, Mam Lake, and Chair Lake, and in the mid-depth zone of Llama Lake (Figure 3.3-3). The lowest levels were found in the deep sections of Llama and Chair lakes, and in Umwelt Lake. Overall, organic carbon made up the majority of the carbon content in the lakes, since the inorganic carbon content was below the method detection limit (Appendix 3). Nitrogen was predominantly in the form of ammonium. Nitrite and nitrate were below their detection limit, which suggests the lake sediments may have been mildly reducing in the upper few centimetres (Appendix 3).

Unlike TN and TOC, available phosphate concentrations were greatest in the deep and mid-depth samples from Llama and Chair lakes, and decreased in the shallower samples (Figure 3.3-4). The deep Llama Lake sediment samples had the highest available phosphate concentrations (7 mg/kg) of all lakes and depths. Available phosphate concentrations were below method detection limits in the mid-depth sediments of both Llama Lake and Reference Lake B.

3.3.4 Total Metals

Thirty-two metals were analyzed from each of the lake sediment samples collected in 2010. Seven of those have CCME working sediment quality guidelines. Figures were created to show the mean metal concentration and standard error of the mean for metals with guidelines, and concentrations in relation to the interim sediment quality guideline (ISQG) and the probable effect level (PEL) (Figures 3.3-5 to 3.3-8). Only metals with guidelines are presented and discussed. All other metal concentrations are listed in Appendix 3a.



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Sediment Particle Size Distribution for Lakes of the Back River Project Area, August 2010

Figure 3.3-1

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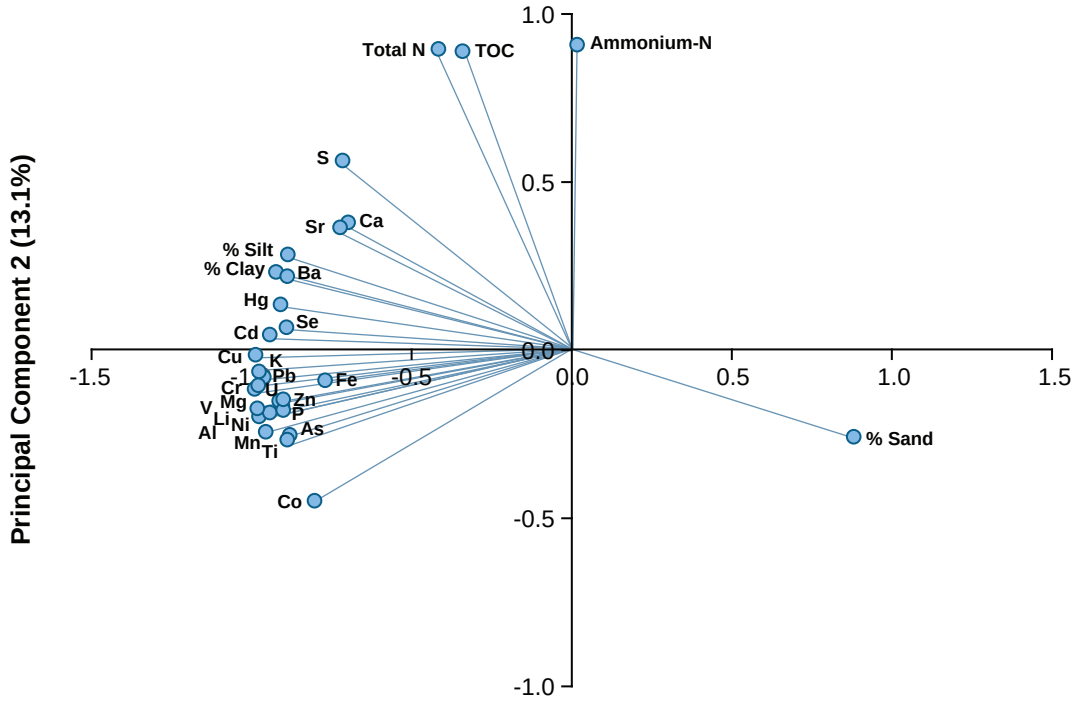
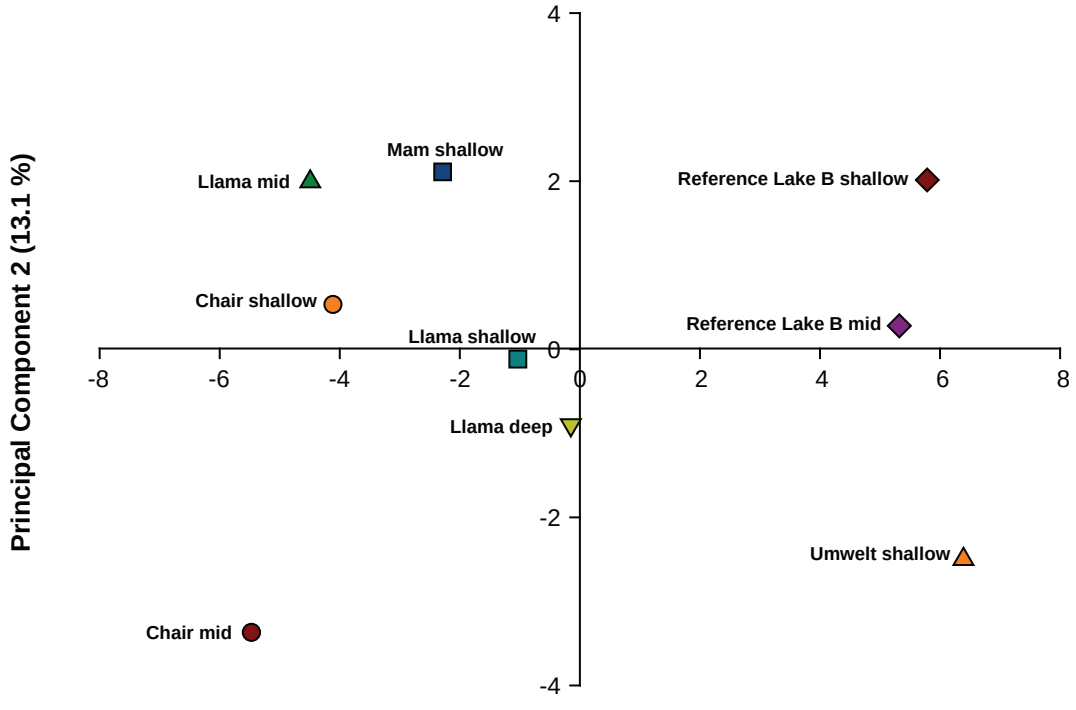
a) PCA biplot of loadings for sediment quality parameters used in analysis



b) PCA of Goose Lake sites and sample depth for August 2010 sediment quality data



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Principal Component Analysis of Sediment Quality Data for Lakes of the Back River Project Area, August 2010

Figure 3.3-2

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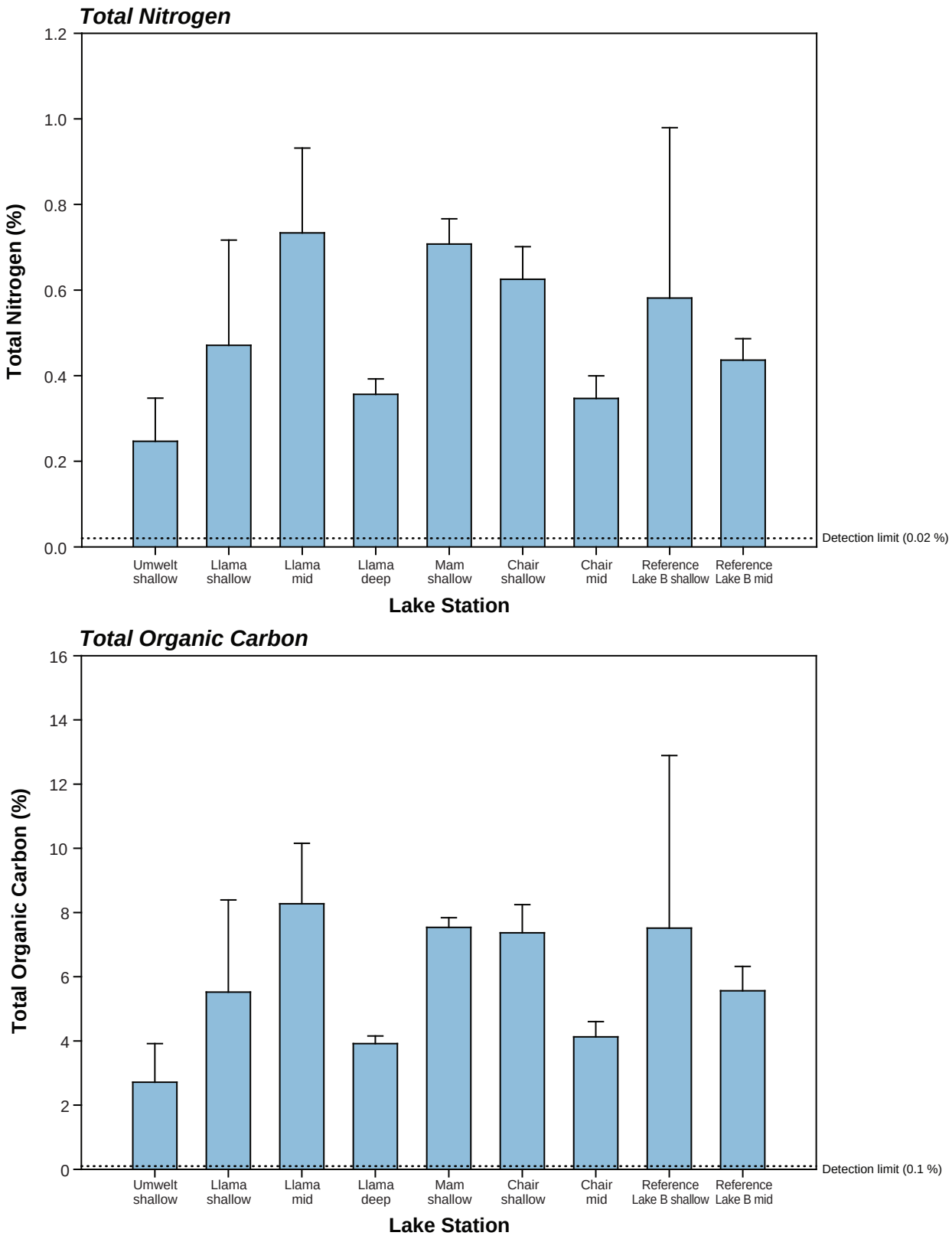

Note: Dotted line represents analytical detection limit
Error bars represent standard error of the mean.

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Percent Total Organic Carbon and Total Nitrogen (by LECO) in Lake Sediments from Lakes in the Back River Project Area, August 2010

Figure 3.3-3

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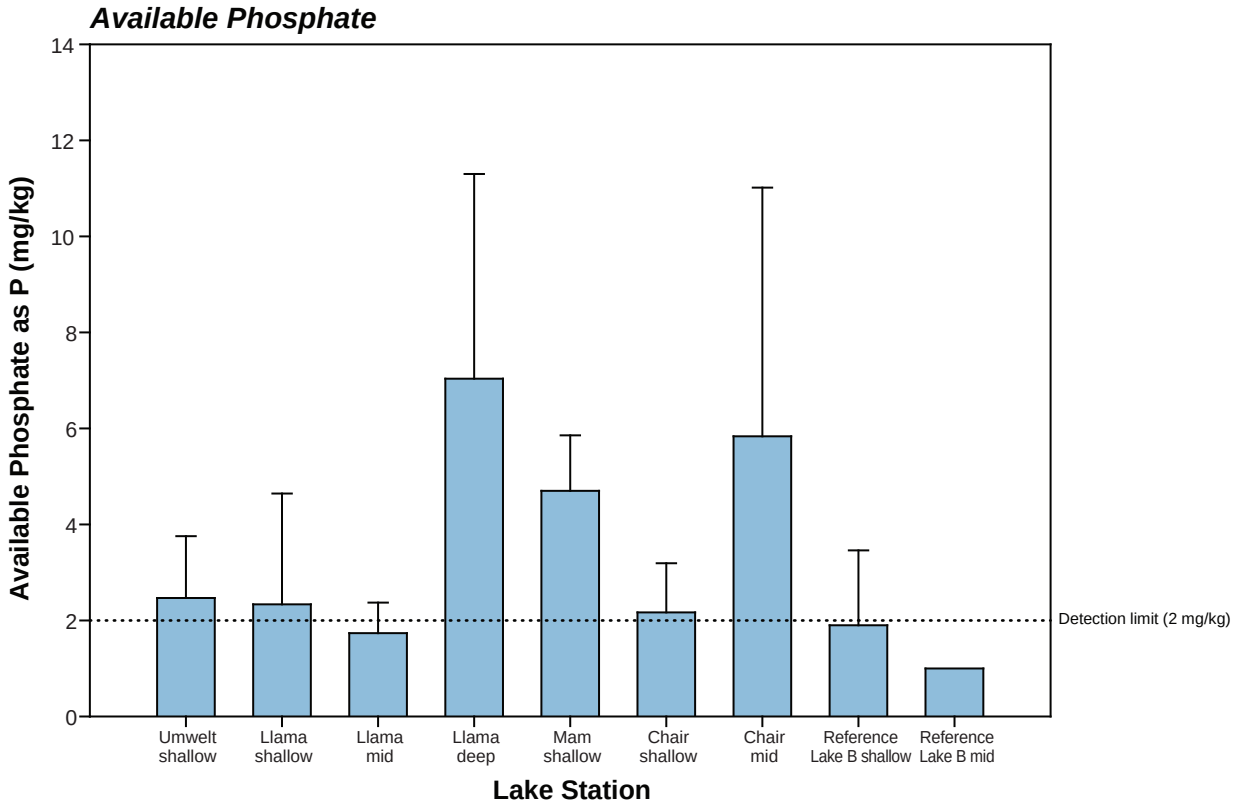

Note: Dotted line represents analytical detection limit
Error bars represent standard error of the mean.

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Available Phosphate Concentrations in Lake Sediments in the Back River Project Area, August 2010

Figure 3.3-4

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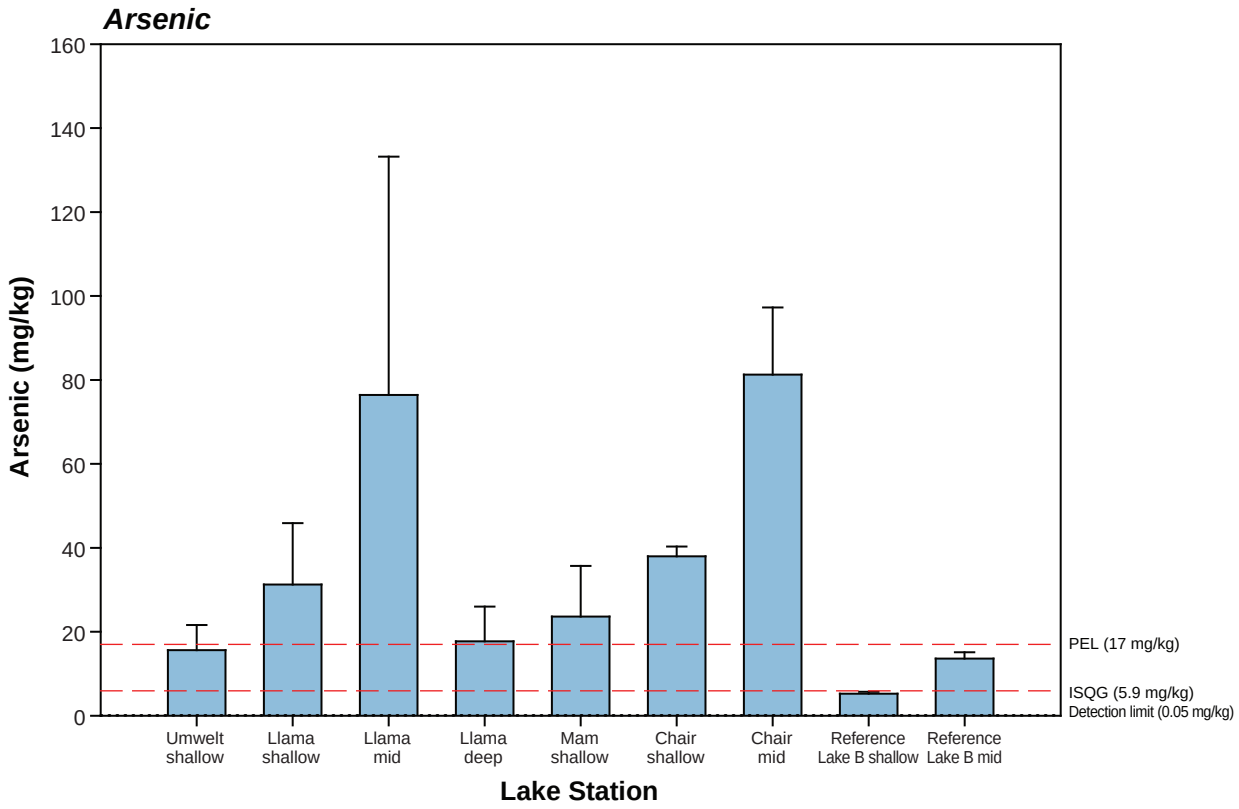

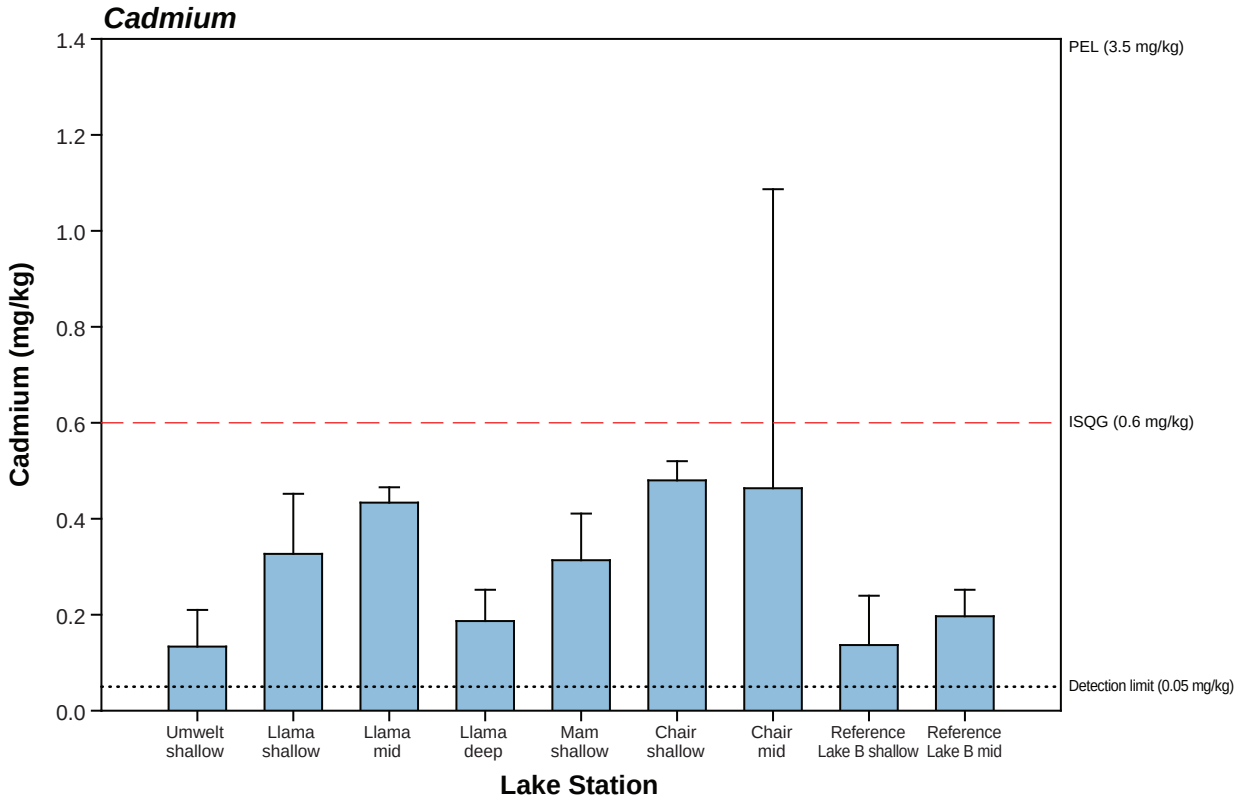

Note: Dotted line represents analytical detection limit
Dashed lines represent CCME Sediment Quality Guidelines
Error bars represent standard error of the mean.

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Arsenic and Cadmium Concentrations in Lake Sediments in the Back River Project Area, August 2010

Figure 3.3-5

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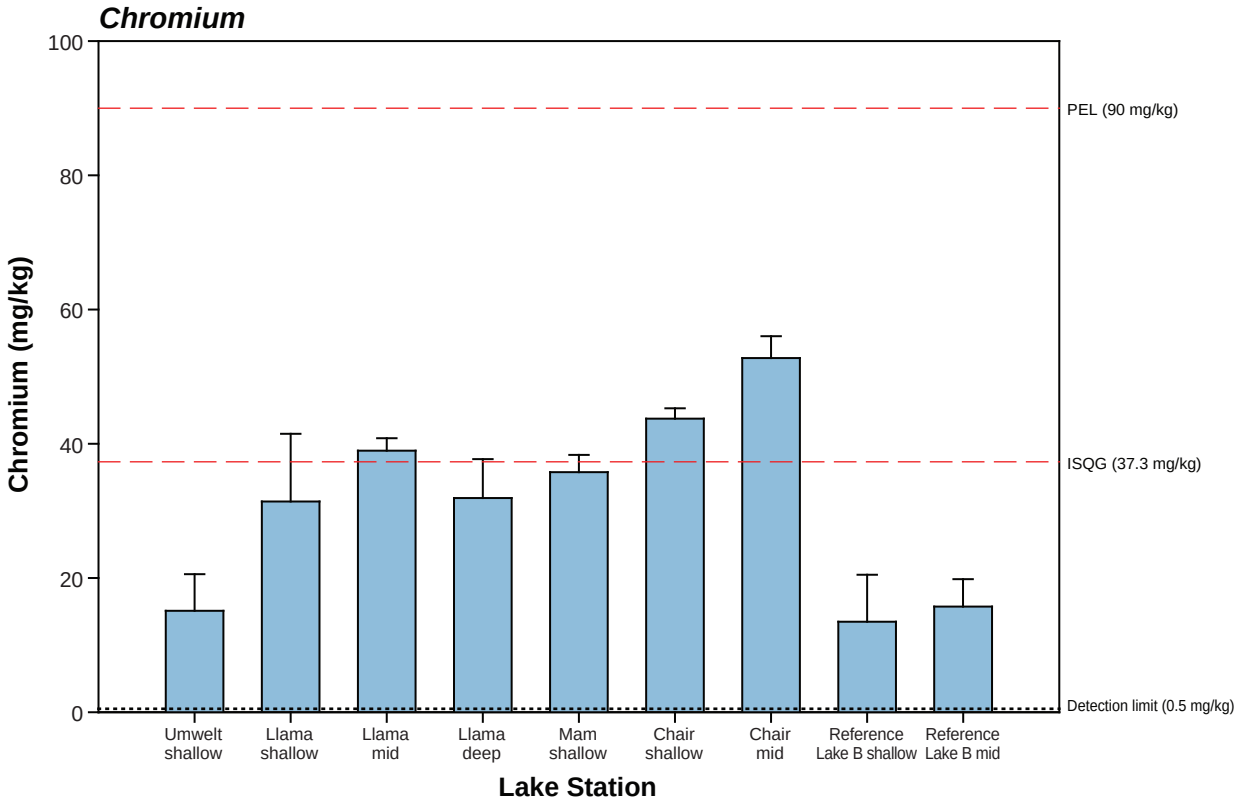

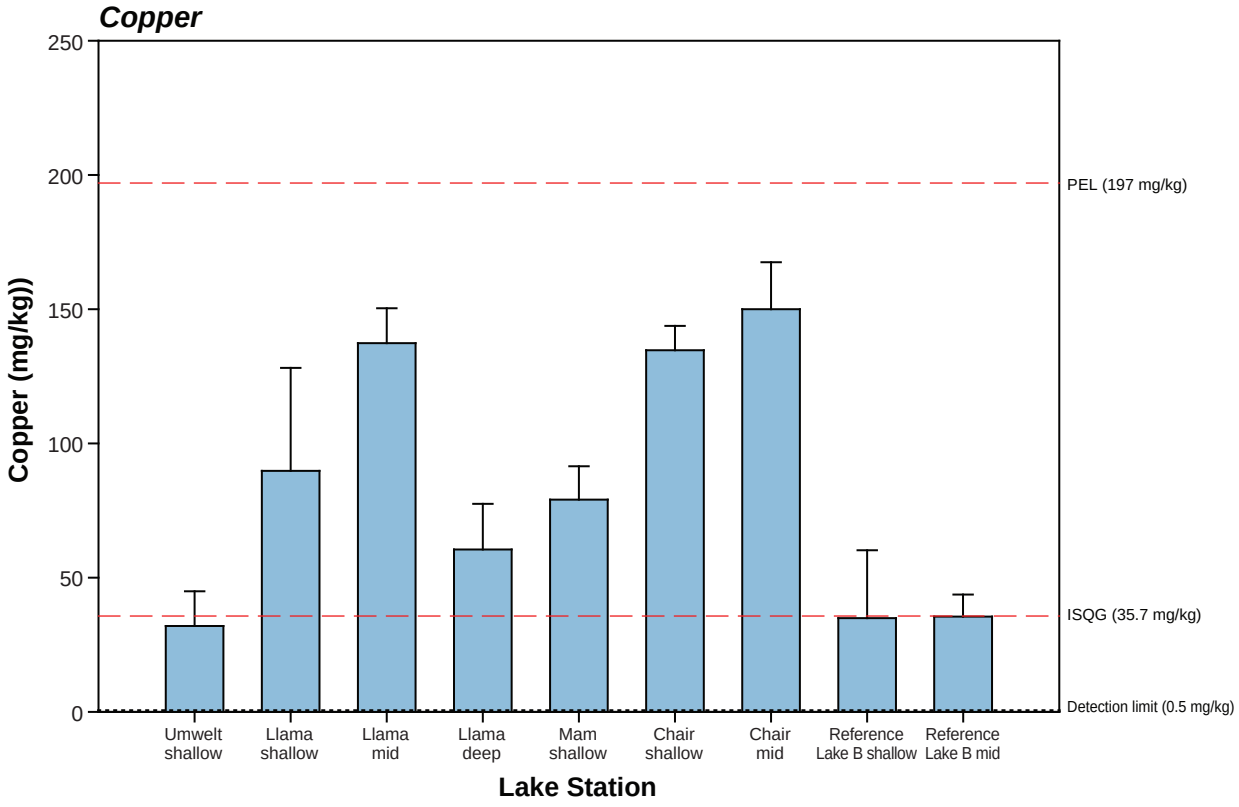

Note: Dotted line represents analytical detection limit
Dashed lines represent CCME Sediment Quality Guidelines
Error bars represent standard error of the mean.

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Chromium and Copper Concentrations in Lake Sediments in the Back River Project Area, August 2010

Figure 3.3-6

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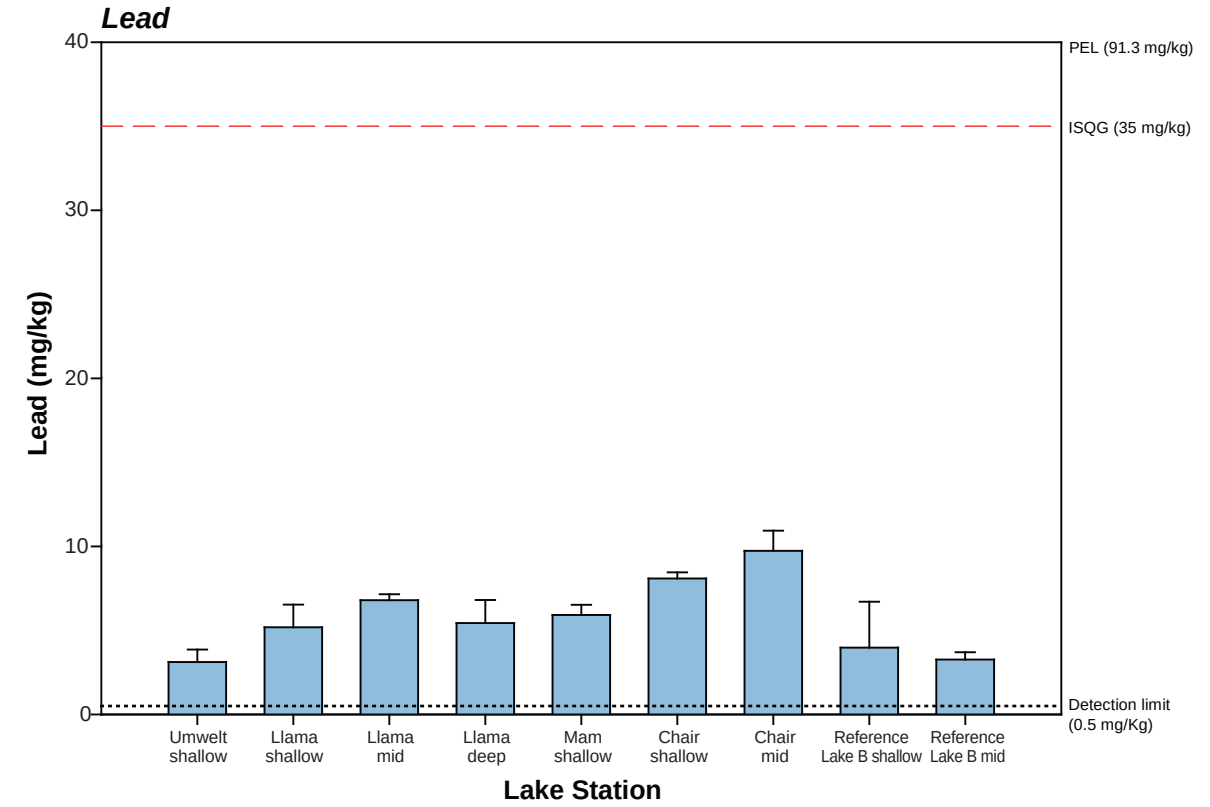

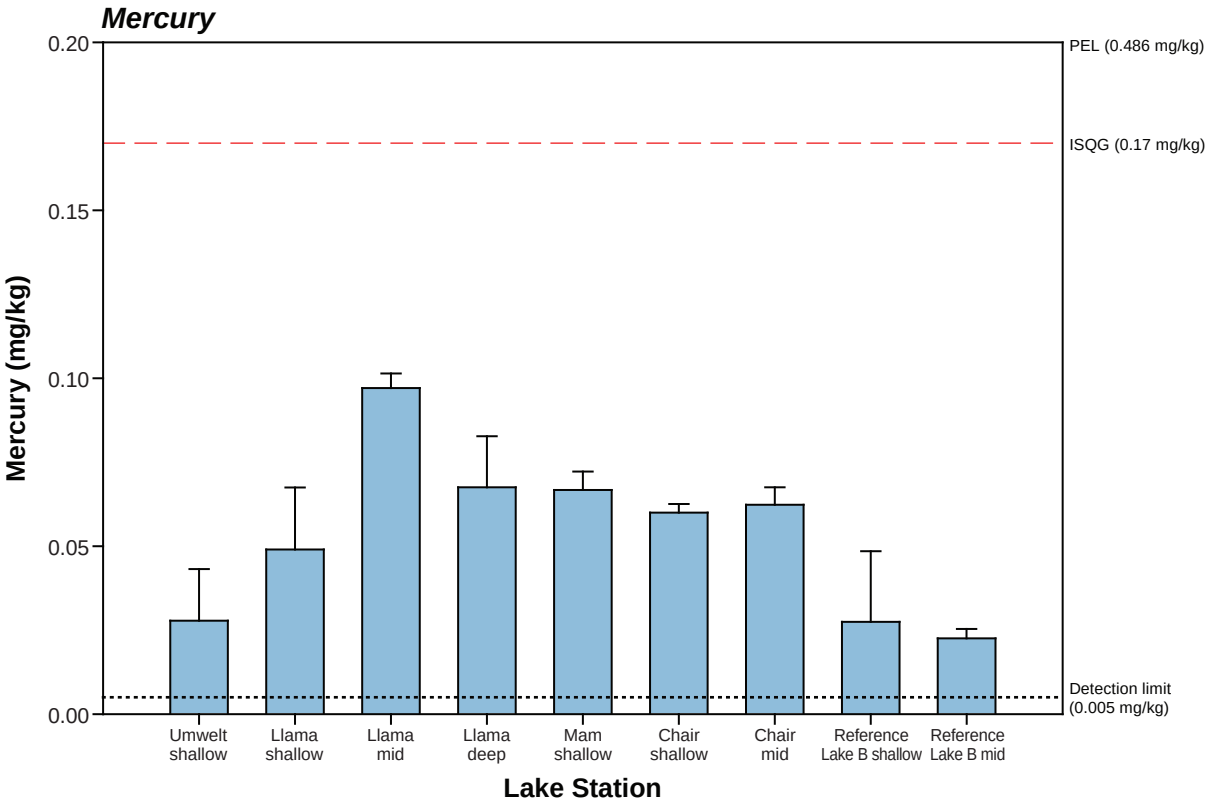

Note: Dotted line represents analytical detection limit
Dashed lines represent CCME Sediment Quality Guidelines
Error bars represent standard error of the mean.

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Lead and Mercury Concentrations in Lake Sediments in the Back River Project Area, August 2010

Figure 3.3-7

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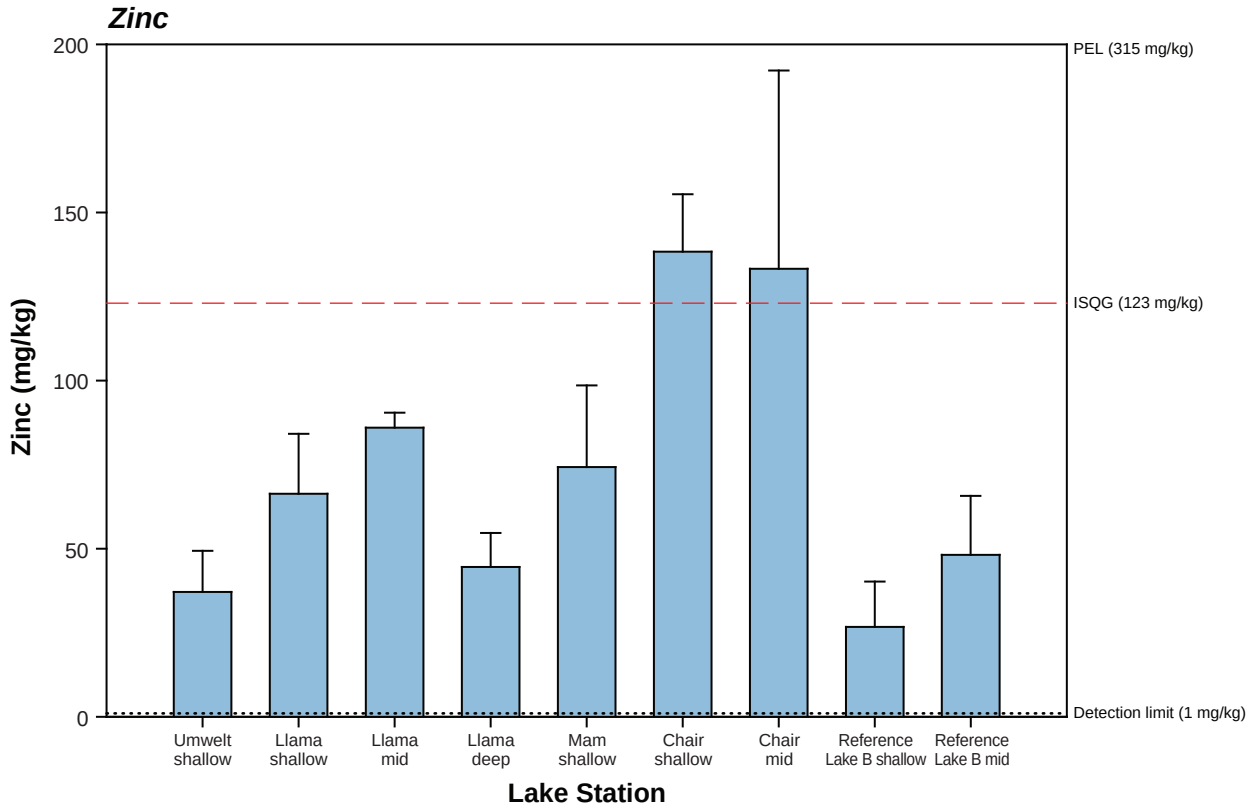

Note: Dotted line represents analytical detection limit
Dashed lines represent CCME Sediment Quality Guidelines
Error bars represent standard error of the mean.

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Zinc Concentrations in Lake Sediments in the Back River Project Area, August 2010

Figure 3.3-8

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Overall, the metal concentrations in the sampled lake sediments co-varied with their fine particle composition. Sites with finer sediments consisting of mostly silts and clays (e.g., Chair, Llama, and Mam lakes) tended to contain the highest concentrations of arsenic (Figure 3.3-5), cadmium (Figure 3.3-5), chromium (Figure 3.3-6), copper (Figure 3.3-6), lead (Figure 3.3-7), mercury (Figure 3.3-7), and zinc (Figure 3.3-8), among others (Appendix 3a) The Chair Lake sediments generally had the highest concentrations of most metals compared to the other sites, while Umwelt Lake and Reference Lake B typically had the lowest metal concentrations, largely due to the high sand content in these lakes.

3.3.5 CCME Guidelines

All sediment samples collected were compared to CCME guidelines for the protection of aquatic life. These include the interim sediment quality guidelines (ISQGs) and the probable effects levels (PELs; CCME 2002). The more conservative ISQGs are levels below which adverse biological effects are rarely observed. The higher PELs correspond to concentrations above which negative effects frequently occur.

Lakes in the Back River Project area contained naturally elevated sediment metal concentrations, as every lake had metal concentrations that exceeded ISQG levels. The lakes were particularly enriched with arsenic as all lakes, except the reference lake, had arsenic concentrations that surpassed the PEL guideline limit (Table 3.3-1), and all surpassed the ISQ guideline of 5.9 mg/kg by more than 2- to 13-fold. (Table 3.3-2). In Chair, Llama, and Mam lakes, arsenic concentrations exceeded the PEL guideline (17 mg/kg) with a maximum exceedance factor approaching 5-fold. In all lakes, copper concentrations were higher than their ISQ guideline levels in at least one sample replicate, but their magnitude of exceedance was much less than that observed for arsenic. No PEL guidelines for copper were exceeded. Llama, Mam, and Chair lakes had chromium concentrations that exceeded ISQ guidelines by a factor of 1 to 1.4. Chair Lake was the only lake that exceeded cadmium and zinc ISQ guidelines.

Metal concentrations in Chair Lake sediments exceeded the CCME guidelines the most frequently (Table 3.3-1). Metals that exceeded ISQG in Chair Lake sediments include arsenic, cadmium, chromium, copper, and zinc. The mid-depth section of Chair Lake had the most guideline exceedances and surpassed the guidelines by the greatest factor.

Lead and mercury concentrations were not exceeded in any of the sediment samples from the Back River Project Lakes.

Table 3.3-1. Lake Sediment Quality, Percent of Samples in which Concentrations are Higher than CCME Guidelines, Back River Project, August 2010

Lake and Sample Depth:		Percent of samples exceeding ISQG[b] guidelines									Total Sites where Guideline Naturally Exceeded
		Umwelt shallow	Llama shallow	Llama mid	Llama deep	Mam shallow	Chair shallow	Chair mid	Reference Lake B shallow	Reference Lake B mid	
Total Number of Samples Collected:		3	3	3	3	3	3	3	3	3	
CCME Guideline Value[a]	(mg/kg):										
Arsenic (As)	5.9	100	100	100	100	100	100	100	0	100	**8**
Cadmium (Cd)	0.6	0	0	0	0	0	0	33	0	0	**1**
Chromium (Cr)	37.3	0	33	67	0	33	100	100	0	0	**5**
Copper (Cu)	35.7	33	100	100	100	100	100	100	33	67	**9**
Lead (Pb)	35	0	0	0	0	0	0	0	0	0	**0**
Mercury (Hg)	0.17	0	0	0	0	0	0	0	0	0	**0**
Zinc (Zn)	123	0	0	0	0	0	67	33	0	0	**2**
		Percent of samples exceeding PEL[c] guidelines									
Arsenic (As)	17	33	67	100	33	67	100	100	0	0	**7**
Cadmium (Cd)	3.5	0	0	0	0	0	0	0	0	0	**0**
Chromium (Cr)	90	0	0	0	0	0	0	0	0	0	**0**
Copper (Cu)	197	0	0	0	0	0	0	0	0	0	**0**
Lead (Pb)	91.3	0	0	0	0	0	0	0	0	0	**0**
Mercury (Hg)	0.486	0	0	0	0	0	0	0	0	0	**0**
Zinc (Zn)	315	0	0	0	0	0	0	0	0	0	**0**

Values represent precentages of samples collected at each site that are higher than CCME guidelines.

a) Canadian sediment quality guidelines for the protection of aquatic life (CCME 2002)

b) ISQG = Interim Sediment Quality Guidelines

c) PEL = Probable Effects Level

Table 3.3-2. Lake Sediment Quality, Factor by which Average Concentrations are Higher than CCME Guidelines, Back River Project, August 2010

Lake and Sample Depth:		Umwelt shallow	Llama shallow	Llama mid	Llama deep	Mam shallow	Chair shallow	Chair mid	Reference Lake B shallow	Reference Lake B mid	Total Sites where Guideline Naturally Exceeded
		Factor by which replicate averages exceed ISQG[b] guidelines									
Total Number of Samples Collected:		3	3	3	3	3	3	3	3	3	
CCME Guideline Value[a]	(mg/kg):										
Arsenic (As)	**5.9**	2.6	5.3	12.9	3.0	4.0	6.4	13.8	-	2.3	**8**
Cadmium (Cd)	**0.6**	-	-	-	-	-	-	-	-	-	**0**
Chromium (Cr)	**37.3**	-	-	1.0	-	-	1.2	1.4	-	-	**3**
Copper (Cu)	**35.7**	-	2.5	3.9	1.7	2.2	3.8	4.2	-	-	**6**
Lead (Pb)	**35**	-	-	-	-	-	-	-	-	-	**0**
Mercury (Hg)	**0.17**	-	-	-	-	-	-	-	-	-	**0**
Zinc (Zn)	**123**	-	-	-	-	-	1.1	1.1	-	-	**2**
		Factor by which replicate averages exceed PEL[c] guidelines									
Arsenic (As)	**17**	-	1.8	4.5	1.0	1.4	2.2	4.8	-	-	**6**
Cadmium (Cd)	**3.5**	-	-	-	-	-	-	-	-	-	**0**
Chromium (Cr)	**90**	-	-	-	-	-	-	-	-	-	**0**
Copper (Cu)	**197**	-	-	-	-	-	-	-	-	-	**0**
Lead (Pb)	**91.3**	-	-	-	-	-	-	-	-	-	**0**
Mercury (Hg)	**0.486**	-	-	-	-	-	-	-	-	-	**0**
Zinc (Zn)	**315**	-	-	-	-	-	-	-	-	-	**0**

Values represent the factor by which replicate averages are higher than CCME guidelines.

Even though a percentage of replicates may be higher than a guideline amount, the calculate average of replicates may not be higher that a guideline amount.

a) Canadian sediment quality guidelines for the protection of aquatic life (CCME 2002)

b) ISQG = Interim Sediment Quality Guidelines

c) PEL = Probable Effects Level

4. Summary

4. Summary

Five lakes were sampled in late August 2010 for the Back River Project. Bathymetry surveys were conducted, and maps illustrating the lake profiles were created. Limnological measurements determined that Umwelt and Mam lakes were relatively shallow, clear, cold, and had the highest levels of dissolved oxygen. Llama and Chair lakes were deeper lakes, and were slightly warmer than Umwelt and Mam lakes, with lower levels of dissolved oxygen. Reference Lake B had intermediate depth, temperature, dissolved oxygen, and water clarity (Secchi depth). There is sufficient light penetration for primary production to exceed respiration throughout the lakes.

Where lakes were sufficiently deep, water quality was sampled at two depths (1 m and mid-depth). General variables, nutrients, organics, and metals were analyzed. Concentrations of water quality variables were similar between depths. This was probably due to the lack of stratification or weak stratification found at lake sites during the sampling period. All five lakes had low nutrient concentrations, which is typical in Arctic and subartic regions (Pienitz 1997; Ruhland and Smol 1998). Umwelt and Llama lakes, which are located in the Llama Watershed where two known deposits are located, had highest concentrations of most total metals, pH, conductivity, and hardness. Chair and Mam lakes had intermediate concentrations of most metals, turbidity, and total phosphate, and had the highest levels of iron. Reference Lake B had the highest turbidity and total phosphate, and was generally low in nitrogen and metals.

All water quality parameters were below the CCME guidelines for the protection of freshwater aquatic life with the following exceptions: Umwelt Lake had naturally elevated total copper and chromium concentrations, and Llama Lake had naturally elevated total chromium concentrations.

Sediment quality samples were collected from the five lakes at the same time as the limnology and water quality samples. Sediment samples were collected from shallow, mid-, and deep depth zones as permitted by the lake depth. The sediment samples were analyzed for particle size distribution, nutrients, and metals. Overall, lakes with higher clay and silt content (Llama, Chair, and Mam lakes) had higher organic content, nutrients, and metal concentrations than that measured in sediments with higher sand content (Umwelt Lake and Reference Lake B).

Each lake had sediment metal concentrations that naturally exceeded CCME ISQ guideline levels (Table 4-1). Llama and Mam lakes had baseline sediment quality higher than the CCME Interim Sediment Quality Guideline (ISQG) for arsenic, chromium and copper. Umwelt Lake had baseline sediment quality higher than the CCME ISQG for arsenic and copper, while Chair Lake had baseline sediment quality higher than the CCME ISQG for arsenic, cadmium, chromium, copper and zinc. Reference Lake B had baseline sediment quality higher than the CCME ISQG for arsenic and copper. All lakes, except the reference lake, had baseline sediment quality that exceeded the CCME Probable Effects Level (PEL) for arsenic.

Table 4-1 provides a summary of the general characteristics of each lake sampled in 2010.

Table 4-1. Summary of Back River Project Lake Characteristics

Watershed	Lake	Maximum Depth (m)	Euphotic Zone Depth ($Z_{1\%}$)	pH	Conductivity and TSS	Nutrient Status	Water Quality Parameters that Exceed CCME WQ Guidelines[1]	Sediment Quality Parameters that Exceed CCME ISQ Guidelines[1]
Llama	Umwelt	2.7	to sediments	slightly alkaline	low	oligotrophic	Cr[2], Cu	As, Cu
	Llama	13.6	to sediments	slightly alkaline	low	ultra-oligotrophic	Cu	As, Cr, Cu
Chair	Mam	3.8	to sediments	slightly alkaline	low	ultra-oligotrophic	-	As, Cu
	Chair	10.3	to sediments	slightly alkaline	low	ultra-oligotrophic	-	As, Cd, Cr, Cu, Zn
Reference Lake	Reference Lake B	5.1	to sediments	slightly alkaline	low	oligotrophic	-	As, Cu

As = arsenic, Cd = cadmium, Cr = chromium, Cu = copper, Zn = zinc.

[1] *CCME guidelines for the protection of aquatic life.*

[2] *when compared to the CCME water quality guideline for Cr VI.*

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Appendix 1

Temperature and Dissolved Oxygen Profiles from the Back River Project Study Lakes, August 2010

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Appendix 1. Temperature and Dissolved Oxygen Profiles from the Back River Project Study Lakes, August 2010

Site	Site Depth (m)	Depth (m)	Temperature (˚C)	DO (mg/l)	DO (% sat)
Llama Lake	13.6	0	11.6	10.41	95.7
20-Aug		0.5	11.6	10.4	95.7
		1	11.6	10.39	95.5
		1.5	11.6	10.39	95.5
		2	11.6	10.37	95.4
		2.5	11.6	10.37	95.3
		3	11.6	10.36	95.2
		3.5	11.6	10.35	95.1
		4	11.6	10.34	95
		4.5	11.6	10.32	94.9
		5	11.6	10.32	94.9
		5.5	11.6	10.31	94.8
		6	11.6	10.3	94.7
		6.5	11.6	10.29	94.6
		7	11.6	10.28	94.5
		7.5	11.6	10.26	94.4
		8	11.6	10.26	94.4
		8.5	11.6	10.26	94.3
		9	11.6	10.24	94.2
		9.5	11.5	10.26	94.1
		10	11.5	10.25	94
		10.5	11.5	10.24	93.9
		11	11.5	10.23	93.8
		11.5	11.5	10.23	93.8
		12	11.5	10.21	93.7
		12.5	11.5	10.2	93.6
		13	11.5	10.19	93.5
		13.5	11.5	10.18	93.4
Umwelt Lake	2.7	0	9.6	10.8	94.9
20-Aug		0.5	9.6	10.8	94.7
		1	9.7	10.76	94.6
		1.5	9.7	10.75	94.6
		2	9.7	10.73	94.4
		2.5	9.7	10.73	94.4

Site	Site Depth (m)	Depth (m)	Temperature (˚C)	DO (mg/l)	DO (% sat)
Mam Lake	3.8	0	9.6	10.93	95.9
21-Aug		0.5	9.6	10.91	95.8
		1	9.6	10.9	95.7
		1.5	9.6	10.9	95.6
		2	9.6	10.89	95.6
		2.5	9.6	10.88	95.5
		3	9.6	10.88	95.5
		3.5	9.6	10.87	95.4
Chair Lake	10.3	0	11	10.53	95.7
21-Aug		0.5	11	10.52	95.6
		1	11	10.54	95.6
		1.5	11	10.53	95.5
		2	11	10.52	95.4
		2.5	11	10.51	95.3
		3	11	10.5	95.2
		3.5	11	10.49	95.2
		4	11	10.47	95
		4.5	11	10.47	95
		5	10.9	10.47	94.7
		5.5	10.9	10.45	94.5
		6	10.9	10.44	94.4
		6.5	10.9	10.43	94.4
		7	10.9	10.41	94.1
		7.5	10.9	10.4	94.1
		8	10.9	10.38	93.9
		8.5	10.9	10.38	93.9
		9	10.9	10.37	93.8
		9.5	10.9	10.36	93.7
		10	10.9	10.33	93.5
Reference Lake B	5.1	0	11.2	10.58	96.3
22-Aug		0.5	11.2	10.57	96.3
		1	11.2	10.56	96.2
		1.5	11.2	10.55	96.1
		2	11.2	10.53	95.9
		2.5	11.2	10.52	95.9
		3	11.2	10.52	95.8
		3.5	11.1	10.53	95.7
		4	11.1	10.52	95.6
		4.5	11.1	10.51	95.5
		5	11.1	10.51	95.6

Appendix 2

Water Quality Data from the Back River Project Study Lakes, August 2010

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Appendix 2a. Water Quality Data from the Back River Project Study Lakes, August 2010

Sample ID			UMWELT, 1M	LLAMA, 1M	LLAMA, MID, 7M	MAM, 1M	CHAIR, 1M	CHAIR, MID, 5M	REFERENCE B, 1M	REFERENCE B, MID, 2.5 M	DUPLICATE 1 MAM 1M	DUPLICATE 2 Ref Lk B, 2.5M
Date Sampled			20-AUG-10	20-AUG-10	20-AUG-10	21-AUG-10	21-AUG-10	21-AUG-10	22-AUG-10	22-AUG-10	21-AUG-10	22-AUG-10
ALS Sample ID	Units	Realized detection limit	L923641-2	L923641-3	L923641-4	L923641-5	L923641-7	L923641-8	L923641-10	L923641-11	L923641-6	L923641-12
Physical Tests												
Conductivity	µS/cm	2.0	30.2	37.9	37.8	18.7	17.7	17.7	15.6	15.6	18.6	15.9
Hardness (as $CaCO_3$)	mg/L	0.50	11.2	14.7	14.7	7.65	7.32	7.30	6.12	6.13	7.75	5.99
pH	pH	0.10	6.60	6.69	6.74	6.33	6.42	6.45	6.47	6.53	6.38	6.55
Total Suspended Solids	mg/L	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L	10	26	28	31	16	18	20	14	<10	17	13
Turbidity	NTU	0.10	0.44	0.45	0.38	0.50	0.41	0.39	0.67	0.54	0.50	0.53
Leachable Anions & Nutrients												
Anion Sum	meq/L	-	0.25	0.33	0.32	0.17	0.14	0.16	0.12	0.13	0.17	0.13
Cation Sum	meq/L	-	0.27	0.34	0.34	0.19	0.18	0.18	0.15	0.15	0.19	0.15
Cation - Anion Balance	%	-	4.2	2.7	2.8	6.5	11.9	6.7	11.1	7.4	7.5	8.2
Anions and Nutrients												
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L	2.0	4.1	5.0	5.0	4.7	4.3	4.3	4.5	4.9	4.7	4.7
Alkalinity, Carbonate (as $CaCO_3$)	mg/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L	2.0	4.1	5.0	5.0	4.7	4.3	4.3	4.5	4.9	4.7	4.7
Bromide (Br)	mg/L	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	0.50	3.70	5.27	5.26	0.55	<0.5	0.52	<0.5	<0.5	0.53	<0.5
Fluoride (F)	mg/L	0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Sulphate (SO_4)	mg/L	0.50	3.00	3.70	3.71	2.79	2.71	2.72	1.55	1.55	2.80	1.55
Ammonia as N	mg/L	0.0050	<0.0050	<0.0050	0.0060	<0.0050	<0.0050	0.0053	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate (as N)	mg/L	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L	0.050	0.243	0.173	2.30	0.223	0.178	0.199	0.250	0.187	0.212	0.196
Ortho Phosphate (as P)	mg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus	mg/L	0.0020	0.0055	0.0043	0.0037	0.0045	0.0047	0.0043	0.0052	0.0051	0.0048	0.0068
Organic / Inorganic Carbon												
Total Organic Carbon	mg/L	0.50	4.50	3.58	3.57	3.90	3.80	3.75	3.44	3.56	3.89	3.51
Total Metals												
Aluminum (Al)-Total	mg/L	0.0010	0.0124	0.0150	0.0117	0.0154	0.0114	0.0113	0.0097	0.0080	0.0149	0.0124
Antimony (Sb)-Total	mg/L	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)-Total	mg/L	0.0002 to 0.0003	<0.00030	<0.00030	0.000318	<0.00030	<0.00030	<0.00030	<0.00020	<0.00020	<0.00030	<0.00020
Barium (Ba)-Total	mg/L	0.000050	0.00462	0.00669	0.00650	0.00248	0.00218	0.00203	0.00256	0.00254	0.00236	0.00250
Beryllium (Be)-Total	mg/L	0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)-Total	mg/L	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)-Total	mg/L	0.0010	0.0085	0.0095	0.0108	0.0091	0.0095	0.0103	0.0111	0.0099	0.0097	0.0086
Cadmium (Cd)-Total	mg/L	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)-Total	mg/L	0.020	2.37	3.69	3.69	1.49	1.35	1.37	1.21	1.21	1.45	1.20
Chromium (Cr)-Total	mg/L	0.0001 to 0.0005	0.00167	0.00072	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)-Total	mg/L	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)-Total	mg/L	0.00010	0.00349	0.00286	0.00147	0.00176	0.00166	0.00143	0.00124	0.00089	0.00152	0.00077
Iron (Fe)-Total	mg/L	0.010	0.085	0.033	0.024	0.180	0.043	0.042	0.050	0.050	0.170	0.046
Lead (Pb)-Total	mg/L	0.000050	0.000125	0.000088	<0.000050	0.000090	<0.000050	<0.000050	0.000199	<0.000050	0.000182	<0.000050
Lithium (Li)-Total	mg/L	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)-Total	mg/L	0.0050	1.34	1.41	1.36	1.08	1.03	1.02	0.807	0.856	1.06	0.841
Manganese (Mn)-Total	mg/L	0.000050	0.00143	0.00237	0.00200	0.00193	0.00159	0.00154	0.00215	0.00212	0.00178	0.00195
Mercury (Hg)-Total	mg/L	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Total	mg/L	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)-Total	mg/L	0.00010	0.00828	0.00502	0.00161	0.00209	0.00171	0.00171	0.00109	0.00074	0.00161	0.00066

Note: shaded cells exceed CCME water quality guidelines for the protection of aquatic life.

Appendix 2a. Water Quality Data from the Back River Project Study Lakes, August 2010

Sample ID			UMWELT, 1M	LLAMA, 1M	LLAMA, MID, 7M	MAM, 1M	CHAIR, 1M	CHAIR, MID, 5M	REFERENCE B, 1M	REFERENCE B, MID, 2.5 M	DUPLICATE 1 MAM 1M	DUPLICATE 2 Ref Lk B, 2.5M
Date Sampled			20-AUG-10	20-AUG-10	20-AUG-10	21-AUG-10	21-AUG-10	21-AUG-10	22-AUG-10	22-AUG-10	21-AUG-10	22-AUG-10
ALS Sample ID	Units	Realized detection limit	L923641-2	L923641-3	L923641-4	L923641-5	L923641-7	L923641-8	L923641-10	L923641-11	L923641-6	L923641-12
Total Metals (continued)		0.30										
Phosphorus (P)-Total	mg/L	0.050	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Total	mg/L	0.00010	0.500	0.580	0.589	0.364	0.356	0.352	0.315	0.335	0.360	0.326
Selenium (Se)-Total	mg/L	0.050	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Silicon (Si)-Total	mg/L	0.000010	0.306	0.258	0.250	0.237	0.254	0.251	0.134	0.132	0.231	0.131
Silver (Ag)-Total	mg/L	0.010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)-Total	mg/L	0.00010	0.771	0.816	0.805	0.636	0.608	0.603	0.500	0.521	0.626	0.511
Strontium (Sr)-Total	mg/L	0.00010	0.0129	0.0281	0.0281	0.00574	0.00548	0.00543	0.00435	0.00448	0.00562	0.00440
Thallium (Tl)-Total	mg/L	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)-Total	mg/L	0.010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Total	mg/L	0.000010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Total	mg/L	0.000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)-Total	mg/L	0.0010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc (Zn)-Total	mg/L	0.0010	0.0024	0.0013	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Dissolved Metals												
Aluminum (Al)-Dissolved	mg/L	0.0010	0.0036	0.0053	0.0048	0.0050	0.0046	0.0045	0.0018	0.0019	0.0048	0.0017
Antimony (Sb)-Dissolved	mg/L	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)-Dissolved	mg/L	0.00003 to 0.00005	0.000260	0.000285	0.000296	0.000245	0.000234	0.000241	0.000132	0.000128	0.000264	0.000109
Barium (Ba)-Dissolved	mg/L	0.000050	0.00458	0.00662	0.00658	0.00235	0.00203	0.00202	0.00248	0.00243	0.00234	0.00238
Beryllium (Be)-Dissolved	mg/L	0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)-Dissolved	mg/L	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)-Dissolved	mg/L	0.001 to 0.005	0.0092	0.0096	0.0086	0.0098	0.0067	0.0077	0.0085	0.0076	0.0077	0.0074
Cadmium (Cd)-Dissolved	mg/L	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)-Dissolved	mg/L	0.020	2.33	3.61	3.61	1.38	1.31	1.33	1.14	1.15	1.42	1.10
Chromium (Cr)-Dissolved	mg/L	0.0001 to 0.0002	0.00051	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Cobalt (Co)-Dissolved	mg/L	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)-Dissolved	mg/L	0.00010	0.00285	0.00179	0.00125	0.00151	0.00144	0.00131	0.00083	0.00068	0.00136	0.00054
Iron (Fe)-Dissolved	mg/L	0.010	0.011	<0.010	<0.010	0.066	<0.010	<0.010	<0.010	<0.010	0.063	<0.010
Lead (Pb)-Dissolved	mg/L	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000066	<0.000050
Lithium (Li)-Dissolved	mg/L	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)-Dissolved	mg/L	0.0050	1.31	1.38	1.37	1.02	0.984	0.968	0.797	0.789	1.02	0.787
Manganese (Mn)-Dissolved	mg/L	0.000050	0.000979	0.000365	0.000191	0.000867	0.000277	0.000257	0.000144	0.000134	0.000702	0.000153
Mercury (Hg)-Dissolved	mg/L	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	mg/L	0.000050	<0.000050	0.000057	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)-Dissolved	mg/L	0.00010	0.00768	0.00429	0.00147	0.00188	0.00153	0.00165	0.00085	0.00067	0.00154	0.00074
Phosphorus (P)-Dissolved	mg/L	0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	mg/L	0.050	0.493	0.578	0.593	0.357	0.349	0.347	0.314	0.318	0.359	0.310
Selenium (Se)-Dissolved	mg/L	0.0001 to 0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Silicon (Si)-Dissolved	mg/L	0.050	0.288	0.239	0.238	0.218	0.229	0.230	0.115	0.110	0.216	0.112
Silver (Ag)-Dissolved	mg/L	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)-Dissolved	mg/L	0.010	0.739	0.781	0.792	0.609	0.567	0.572	0.475	0.469	0.606	0.471
Strontium (Sr)-Dissolved	mg/L	0.00010	0.0124	0.0274	0.0279	0.00554	0.00531	0.00532	0.00428	0.00424	0.00543	0.00416
Thallium (Tl)-Dissolved	mg/L	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)-Dissolved	mg/L	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Dissolved	mg/L	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Dissolved	mg/L	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)-Dissolved	mg/L	0.000050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc (Zn)-Dissolved	mg/L	0.0010	0.0021	0.0015	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010

Note: shaded cells exceed CCME water quality guidelines for the protection of aquatic life.

Appendix 2b. Results from the Principal Components Analysis (PCA) of the Back River Water Quality Data, August 2010

i) Principal Component Scores for the Sample Sites

Lake and Sample Depth	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7
Umwelt, 1 m	-3.58	4.79	0.19	1.47	0.21	0.66	-0.02
Llama, 1 m	-5.03	-0.72	2.35	-0.61	-0.43	-1.31	-0.17
Llama, 7 m	-4.49	-4.31	-1.22	0.45	0.30	0.93	0.21
Mam, 1 m	1.20	1.21	0.50	-2.87	0.13	0.93	-0.03
Chair, 1 m	1.66	1.02	-1.86	-0.19	-0.61	-0.85	0.86
Chair, 5 m	1.34	0.05	-2.98	-0.03	0.25	-0.60	-0.78
Reference Lake B, 1 m	4.42	-0.87	1.68	0.75	2.07	-0.25	0.11
Reference Lake B, 2.5 m	4.49	-1.16	1.35	1.04	-1.93	0.49	-0.18

PC = principal component

ii) Eigenvectors or Loadings for Water Quality Parameters Included in the PCA

	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7
pH	-0.75	-0.40	0.23	0.47	-0.10	0.04	-0.04
Conductivity	-0.98	-0.14	0.12	0.08	0.00	0.04	0.02
Hardness	-0.98	-0.16	0.07	0.01	0.00	0.01	0.03
TDS	-0.89	0.03	-0.25	-0.08	0.35	-0.12	0.06
Turbidity	0.62	0.03	0.71	0.05	0.32	0.07	0.01
TOC	-0.34	0.86	-0.22	0.04	-0.04	0.30	0.02
Alkalinity-bicarbonate	-0.23	-0.78	0.44	-0.29	-0.23	0.08	-0.04
Alkalinity-total	-0.23	-0.78	0.44	-0.29	-0.23	0.08	-0.04
Chloride	-0.97	-0.06	0.12	0.09	0.04	0.11	-0.12
Sulphate	-0.90	0.01	-0.30	-0.31	-0.03	-0.07	0.04
Ammonia	-0.29	-0.55	-0.67	0.10	0.15	0.16	-0.33
TKN	-0.44	-0.62	-0.24	0.17	0.22	0.51	0.17
TP	0.57	0.53	0.43	0.37	-0.23	0.14	0.00
T-Al	-0.61	0.24	0.18	-0.71	-0.14	-0.02	-0.08
T-Ba	-0.89	-0.24	0.34	0.19	0.02	0.07	0.04
T-B	0.20	-0.75	-0.17	0.01	0.59	-0.12	-0.04
T-Ca	-0.96	-0.23	0.14	0.05	0.00	0.01	0.02
T-Cr	-0.62	0.64	0.30	0.32	-0.01	-0.03	-0.10
T-Cu	-0.77	0.57	0.10	-0.05	0.16	-0.19	0.05
T-Fe	0.26	0.67	0.17	-0.51	0.07	0.43	-0.06
T-Pb	-0.04	0.43	0.64	-0.20	0.60	0.09	-0.02
T-Mg	-0.99	0.08	-0.06	-0.09	-0.07	0.02	0.02
T-Mn	-0.02	-0.67	0.71	-0.15	0.03	-0.16	-0.01
T-Ni	-0.78	0.60	0.09	0.02	0.11	-0.14	-0.05
T-K	-0.98	-0.15	0.10	0.09	-0.05	0.05	0.03
T-Si	-0.77	0.38	-0.45	-0.23	-0.02	-0.07	0.05
T-Na	-0.99	0.03	-0.05	-0.07	-0.05	0.04	0.03
T-Sr	-0.96	-0.25	0.13	0.07	-0.01	-0.01	0.03
T-Zn	-0.64	0.62	0.32	0.30	-0.02	-0.06	-0.10

PC = principal component

iii) Percent Variation of the Data Explained by Principal Components (Factors)

Principal Component	Eigenvalue	% Variation Explained	Cumulative % Variation
1	14.8	51.2	51.2
2	6.7	23.0	74.2
3	3.5	12.0	86.1
4	1.8	6.2	92.4
5	1.2	4.3	96.7
6	0.8	2.6	99.3
7	0.2	0.7	100.0

Appendix 2c. Travel, Field, and Equipment Blank Data for Back River Project Water Quality Samples, August 2010

Sample ID			TRAVEL BLANK	FIELD BLANK AT CHAIR	EQUIPMENT BLANK AT UMWELT
Date Sampled			22-AUG-10	21-AUG-10	20-AUG-10
ALS Sample ID	Units	Detection Limit	L923641-13	L923641-9	L923641-1
Physical Tests					
Conductivity	µS/cm	2.0	<2.0	<2.0	2.2
Hardness (as $CaCO_3$)	mg/L	0.50	<0.5	<0.5	<0.5
pH	pH	0.10	5.74	6.08	5.87
Total Suspended Solids	mg/L	3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L	10	<10	<10	<10
Turbidity	NTU	0.10	<0.1	<0.1	<0.1
Leachable Anions & Nutrients					
Anion Sum	meq/L	-	<0.1	<0.1	<0.1
Cation Sum	meq/L	-	<0.1	<0.1	<0.1
Cation - Anion Balance	%	-	0.0	0.0	71.2
Anions and Nutrients					
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L	2.0	<2.0	<2.0	<2.0
Alkalinity, Carbonate (as $CaCO_3$)	mg/L	2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L	2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L	2.0	<2.0	<2.0	<2.0
Bromide (Br)	mg/L	0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	0.50	<0.5	<0.5	<0.5
Fluoride (F)	mg/L	0.020	<0.020	<0.020	<0.020
Sulphate (SO_4)	mg/L	0.50	<0.5	<0.5	<0.5
Ammonia (as N)	mg/L	0.0050	<0.0050	<0.0050	<0.0050
Nitrate (as N)	mg/L	0.0050	<0.0050	<0.0050	0.0053
Nitrite (as N)	mg/L	0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L	0.050	<0.050	<0.050	<0.050
Ortho Phosphate (as P)	mg/L	0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus	mg/L	0.0020	<0.0020	<0.0020	<0.0020
Organic / Inorganic Carbon					
Total Organic Carbon	mg/L	0.50	<0.5	<0.5	0.55
Total Metals					
Aluminum (Al)-Total	mg/L	0.0010	<0.0010	<0.0010	<0.0010
Antimony (Sb)-Total	mg/L	0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)-Total	mg/L	0.000030	<0.000030	<0.000030	<0.000030
Barium (Ba)-Total	mg/L	0.000050	<0.000050	<0.000050	0.000092
Beryllium (Be)-Total	mg/L	0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)-Total	mg/L	0.00050	<0.00050	<0.00050	<0.00050
Boron (B)-Total	mg/L	0.0010	<0.0050	<0.0050	0.0013
Cadmium (Cd)-Total	mg/L	0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)-Total	mg/L	0.020	<0.020	<0.020	<0.020
Chromium (Cr)-Total	mg/L	0.00010	<0.00010	<0.00010	0.00043
Cobalt (Co)-Total	mg/L	0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)-Total	mg/L	0.00010	<0.00010	<0.00010	0.00034
Iron (Fe)-Total	mg/L	0.010	<0.010	<0.010	<0.010
Lead (Pb)-Total	mg/L	0.000050	<0.000050	<0.000050	0.000088
Lithium (Li)-Total	mg/L	0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)-Total	mg/L	0.0050	<0.0050	<0.0050	0.0099
Manganese (Mn)-Total	mg/L	0.000050	<0.000050	<0.000050	0.000104
Mercury (Hg)-Total	mg/L	0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Total	mg/L	0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)-Total	mg/L	0.00010	<0.00010	<0.00010	0.00253
Phosphorus (P)-Total	mg/L	0.30	<0.30	<0.30	<0.30
Potassium (K)-Total	mg/L	0.050	<0.050	<0.050	<0.050
Selenium (Se)-Total	mg/L	0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)-Total	mg/L	0.050	<0.050	<0.050	<0.050
Silver (Ag)-Total	mg/L	0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)-Total	mg/L	0.010	<0.010	<0.010	<0.010
Strontium (Sr)-Total	mg/L	0.00010	<0.00010	<0.00010	<0.00010

Note: shaded cell indicates values greater than detection limits.

Appendix 2c. Travel, Field, and Equipment Blank Data for Back River Project Water Quality Samples, August 2010

Sample ID			TRAVEL BLANK	FIELD BLANK AT CHAIR	EQUIPMENT BLANK AT UMWELT
Date Sampled			22-AUG-10	21-AUG-10	20-AUG-10
ALS Sample ID	Units	Detection Limit	L923641-13	L923641-9	L923641-1
Total Metals (continued)					
Thallium (Tl)-Total	mg/L	0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)-Total	mg/L	0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Total	mg/L	0.010	<0.010	<0.010	<0.010
Uranium (U)-Total	mg/L	0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)-Total	mg/L	0.000050	<0.000050	<0.000050	<0.000050
Zinc (Zn)-Total	mg/L	0.0010	<0.0010	<0.0010	0.0034
Dissolved Metals					
Aluminum (Al)-Dissolved	mg/L	0.0010	<0.0010	<0.0010	<0.0010
Antimony (Sb)-Dissolved	mg/L	0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)-Dissolved	mg/L	0.000030	<0.000030	<0.000030	<0.000030
Barium (Ba)-Dissolved	mg/L	0.000050	<0.000050	<0.000050	0.000150
Beryllium (Be)-Dissolved	mg/L	0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)-Dissolved	mg/L	0.00050	<0.00050	<0.00050	<0.00050
Boron (B)-Dissolved	mg/L	0.0010	<0.0050	<0.0050	0.0095
Cadmium (Cd)-Dissolved	mg/L	0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)-Dissolved	mg/L	0.020	<0.020	<0.020	<0.020
Chromium (Cr)-Dissolved	mg/L	0.00010	<0.00010	<0.00010	0.00046
Cobalt (Co)-Dissolved	mg/L	0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)-Dissolved	mg/L	0.00010	<0.00010	<0.00010	0.00065
Iron (Fe)-Dissolved	mg/L	0.010	<0.010	<0.010	<0.010
Lead (Pb)-Dissolved	mg/L	0.000050	<0.000050	<0.000050	0.000071
Lithium (Li)-Dissolved	mg/L	0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)-Dissolved	mg/L	0.0050	<0.0050	<0.0050	0.0092
Manganese (Mn)-Dissolved	mg/L	0.000050	<0.000050	<0.000050	0.000257
Mercury (Hg)-Dissolved	mg/L	0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	mg/L	0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)-Dissolved	mg/L	0.00010	<0.00010	<0.00010	0.00770
Phosphorus (P)-Dissolved	mg/L	0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	mg/L	0.050	<0.050	<0.050	<0.050
Selenium (Se)-Dissolved	mg/L	0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)-Dissolved	mg/L	0.050	<0.050	<0.050	<0.050
Silver (Ag)-Dissolved	mg/L	0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)-Dissolved	mg/L	0.010	<0.010	<0.010	<0.010
Strontium (Sr)-Dissolved	mg/L	0.00010	<0.00010	<0.00010	<0.00010
Thallium (Tl)-Dissolved	mg/L	0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)-Dissolved	mg/L	0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Dissolved	mg/L	0.010	<0.010	<0.010	<0.010
Uranium (U)-Dissolved	mg/L	0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)-Dissolved	mg/L	0.000050	<0.000050	<0.000050	<0.000050
Zinc (Zn)-Dissolved	mg/L	0.0010	<0.0010	<0.0010	0.0032

Note: shaded cell indicates values greater than detection limits.

Appendix 3

Sediment Quality Data from the Back River Project Study Lakes, August 2010

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Appendix 3a. Sediment Quality Data from the Back River Project Study Lakes, August 2010

Sample ID					UMWELT, SHALLOW REP1	UMWELT, SHALLOW REP2	UMWELT, SHALLOW REP3	LLAMA, SHALLOW REP1	LLAMA, SHALLOW REP2	LLAMA, SHALLOW REP3	LLAMA, MID REP1	LLAMA, MID REP2	LLAMA, MID REP3	LLAMA, DEEP REP1
Date Sampled					20-AUG-10	20-AUG-10	20-AUG-10	20-AUG-10	20-AUG-10	20-AUG-10	20-AUG-10	20-AUG-10	20-AUG-10	20-AUG-10
ALS Sample ID					L924211-1	L924211-2	L924211-3	L924211-4	L924211-5	L924211-6	L924211-7	L924211-8	L924211-9	L924211-10
Matrix					Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
	Units	Realized Detection Limits	CCME ISQG[1]	CCME PEL[2]										
Physical Tests														
Moisture	%	0.10			48.7	49.2	76.8	63.3	87.1	85.3	90.3	86.5	87.1	69.0
pH	pH	0.10			6.27	6.63	5.55	6.60	6.22	6.31	5.86	6.27	5.72	5.31
Particle Size														
% Gravel (>2 mm)	%	0.10			<0.10	23.4	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
% Sand (2.0 mm - 0.063 mm)	%	0.10			79.1	63.9	59.9	74.1	7.35	13.8	3.28	4.36	4.05	13.4
% Silt (0.063 mm - 4 µm)	%	0.10			20.8	12.6	38.9	24.8	87.4	79.3	85.6	86.9	90.8	85.0
% Clay (<4 µm)	%	0.10			0.14	0.11	1.22	1.10	5.25	6.87	11.2	8.79	5.14	1.59
Leachable Anions & Nutrients														
Total Nitrogen by LECO	%	0.020			0.208	0.171	0.361	0.213	0.702	0.498	0.945	0.704	0.552	0.316
Organic / Inorganic Carbon														
$CaCO_3$ Equivalent	%	0.80			<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	0.87	0.85	<0.80	<0.80
Inorganic Carbon	%	0.10			<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Carbon by Combustion	%	0.1			2.3	1.8	4.1	2.5	8.2	5.9	10.2	8.2	6.4	3.6
Total Organic Carbon	%	0.10			2.28	1.79	4.07	2.48	8.19	5.89	10.2	8.18	6.44	3.65
Plant Available Nutrients														
Available Ammonium-N	mg/kg	1 to 3			8.6	4.8	15.8	4.7	32.2	16.7	27.8	24.0	23.6	15.4
Available Nitrate-N	mg/kg	2.5 to 7.5			<2.6	<2.5	<3.0	<3.0	<5.0	<5.0	<7.5	<6.7	<6.7	<4.6
Available Nitrite-N	mg/kg	0.5 to 1.5			<0.52	<0.50	<0.60	<0.60	<1.0	<1.0	<1.5	<1.3	<1.3	<0.92
Available Phosphate-P	mg/kg	2.0			3.4	3.0	<2.0	5.0	<2.0	<2.0	2.1	2.1	<2.0	3.0
Metals														
Aluminum (Al)	mg/kg	50			5580	4590	7630	7300	13700	12200	13500	13900	12300	10200
Antimony (Sb)	mg/kg	0.10			<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Arsenic (As)	mg/kg	0.050	5.9	17	12.9	11.4	22.5	15.6	33.5	44.6	34.3	53.9	141	15.1
Barium (Ba)	mg/kg	0.50			28.9	23.7	46.2	57.4	115	105	95.1	111	104	58.4
Beryllium (Be)	mg/kg	0.20			<0.20	<0.20	0.28	0.28	0.52	0.45	0.47	0.53	0.50	0.28
Bismuth (Bi)	mg/kg	0.20			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg	0.10	0.6	3.5	0.15	<0.10	0.20	0.20	0.45	0.33	0.42	0.47	0.41	0.19
Calcium (Ca)	mg/kg	50			1240	1080	1740	1860	3280	2790	3550	3490	2910	2450
Chromium (Cr)	mg/kg	0.50	37.3	90	13.8	10.4	21.1	19.9	38.6	35.7	39.6	40.4	36.9	32.8
Cobalt (Co)	mg/kg	0.10			6.15	3.83	9.19	8.00	17.6	15.7	17.4	14.9	20.6	19.5
Copper (Cu)	mg/kg	0.50	35.7	197	27.6	21.9	46.5	47.4	122	99.9	124	150	138	60.8
Iron (Fe)	mg/kg	50			11300	9310	22900	14000	31700	31400	31000	43600	82100	19100
Lead (Pb)	mg/kg	0.50	35	91.3	3.15	2.35	3.84	3.66	6.22	5.66	6.80	7.15	6.43	5.22
Lithium (Li)	mg/kg	1.0			7.5	6.5	10.6	11.6	16.4	17.1	16.9	15.6	13.3	15.1
Magnesium (Mg)	mg/kg	20			2640	2200	3210	3330	5490	5470	5620	5370	4810	5090
Manganese (Mn)	mg/kg	1.0			53.5	45.9	75.0	90.7	238	304	187	183	337	178
Mercury (Hg)	mg/kg	0.0050	0.17	0.486	0.0211	0.0169	0.0454	0.0280	0.0627	0.0563	0.101	0.0978	0.0924	0.0705
Molybdenum (Mo)	mg/kg	0.50			<0.50	<0.50	0.72	0.54	1.25	1.38	1.23	1.63	1.73	0.62
Nickel (Ni)	mg/kg	0.50			23.6	17.8	41.4	40.0	78.8	65.8	71.9	70.8	74.8	42.3
Phosphorus (P)	mg/kg	50			332	247	492	358	715	655	876	844	954	738
Potassium (K)	mg/kg	100			420	360	520	620	1070	1100	1140	1030	800	760
Selenium (Se)	mg/kg	0.20			<0.20	<0.20	0.29	0.20	0.55	0.44	0.70	0.74	0.80	0.38
Silver (Ag)	mg/kg	0.10			<0.10	<0.10	<0.10	<0.10	0.24	1.35	0.37	0.30	0.31	0.18
Sodium (Na)	mg/kg	100			220	<100	130	130	200	170	180	170	140	180
Strontium (Sr)	mg/kg	0.50			7.74	5.49	10.5	12.4	20.9	21.3	29.1	26.8	20.0	14.2
Sulphur (S)-Total	mg/kg	100			820	580	1560	480	1820	1660	2860	1940	2170	1350
Thallium (Tl)	mg/kg	0.050			<0.050	<0.050	0.055	0.055	0.110	0.092	0.133	0.124	0.106	0.088
Tin (Sn)	mg/kg	2.0			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg	1.0			184	171	262	267	390	349	369	355	304	411
Uranium (U)	mg/kg	0.050			0.337	0.292	0.579	0.651	1.38	1.14	1.38	1.51	1.34	0.875
Vanadium (V)	mg/kg	0.20			19.5	17.4	27.6	22.2	40.9	35.3	39.9	41.7	38.0	32.9
Zinc (Zn)	mg/kg	1.0	123	315	32.9	27.5	50.9	47.2	82.4	69.4	81.5	90.4	86.1	46.3

Shaded cells indicated metal concentrations exceed CCME interim sediment quality guideline (ISQG) levels.

1) CCME interim sediment quality guideline

2) CCME probable effects level

Appendix 3a. Sediment Quality Data from the Back River Project Study Lakes, August 2010

Sample ID					LLAMA, DEEP REP2	LLAMA, DEEP REP3	MAM, SHALLOW REP1	MAM, SHALLOW REP2	MAM, SHALLOW REP3	CHAIR, SHALLOW REP1	CHAIR, SHALLOW REP2	CHAIR, SHALLOW REP3	CHAIR, MID REP1	CHAIR, MID REP2
Date Sampled					20-AUG-10	20-AUG-10	21-AUG-10	21-AUG-10	21-AUG-10	21-AUG-10	21-AUG-10	21-AUG-10	21-AUG-10	21-AUG-10
ALS Sample ID					L924211-11	L924211-12	L924211-13	L924211-14	L924211-15	L924211-16	L924211-17	L924211-18	L924211-19	L924211-20
Matrix					Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
	Units	Realized Detection Limits	CCME ISQG[1]	CCME PEL[2]										
Physical Tests														
Moisture	%	0.10			72.3	72.4	77.6	81.9	77.4	85.2	87.7	82.9	75.3	76.2
pH	pH	0.10			5.62	5.49	6.37	6.20	5.73	6.23	6.42	6.59	5.14	5.79
Particle Size														
% Gravel (>2 mm)	%	0.10			<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.25
% Sand (2.0 mm - 0.063 mm)	%	0.10			11.1	7.07	3.91	5.16	4.21	3.97	2.84	3.25	9.30	11.8
% Silt (0.063 mm - 4 µm)	%	0.10			86.0	90.0	89.8	89.9	77.5	82.8	83.9	84.4	77.6	72.8
% Clay (<4 µm)	%	0.10			2.89	2.91	6.28	4.97	18.3	13.2	13.3	12.4	13.2	15.1
Leachable Anions & Nutrients														
Total Nitrogen by LECO	%	0.020			0.368	0.385	0.726	0.755	0.641	0.548	0.700	0.628	0.400	0.294
Organic / Inorganic Carbon														
$CaCO_3$ Equivalent	%	0.80			<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	1.07	1.53	<0.80
Inorganic Carbon	%	0.10			<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.16	<0.10
Total Carbon by Combustion	%	0.1			4.0	4.1	7.7	7.7	7.2	6.5	8.2	7.4	4.8	3.6
Total Organic Carbon	%	0.10			3.97	4.12	7.73	7.69	7.19	6.47	8.22	7.41	4.59	3.64
Plant Available Nutrients														
Available Ammonium-N	mg/kg	1 to 3			12.0	14.6	49.9	74.9	37.0	14.1	21.8	23.9	11.4	4.7
Available Nitrate-N	mg/kg	2.5 to 7.5			<6.0	<6.0	<6.0	<6.0	<6.0	<7.5	<7.5	<6.7	<4.0	<4.6
Available Nitrite-N	mg/kg	0.5 to 1.5			<1.2	<1.2	<1.2	<1.2	<1.2	<1.5	<1.5	<1.3	<0.80	<0.92
Available Phosphate-P	mg/kg	2.0			11.5	6.6	5.8	4.8	3.5	2.9	<2.0	2.6	11.3	<2.0
Metals														
Aluminum (Al)	mg/kg	50			7830	10900	11100	9950	11400	15100	16200	15000	17400	19500
Antimony (Sb)	mg/kg	0.10			<0.10	0.11	<0.10	<0.10	<0.10	0.16	0.11	0.11	0.11	<0.10
Arsenic (As)	mg/kg	0.050	5.9	17	11.0	27.0	16.1	17.3	37.5	38.3	40.1	35.5	82.9	64.5
Barium (Ba)	mg/kg	0.50			49.7	61.9	73.4	66.2	72.9	79.3	84.0	75.9	75.3	59.2
Beryllium (Be)	mg/kg	0.20			0.22	0.32	0.32	0.28	0.41	0.57	0.64	0.61	0.59	0.74
Bismuth (Bi)	mg/kg	0.20			<0.20	<0.20	<0.20	<0.20	<0.20	0.22	0.23	0.22	0.24	0.29
Cadmium (Cd)	mg/kg	0.10	0.6	3.5	0.12	0.25	0.29	0.23	0.42	0.52	0.48	0.44	1.18	<0.10
Calcium (Ca)	mg/kg	50			2230	2680	2860	2690	2620	2280	2380	2370	2370	1510
Chromium (Cr)	mg/kg	0.50	37.3	90	25.7	37.2	36.6	32.9	37.8	43.0	45.5	42.7	49.6	56.1
Cobalt (Co)	mg/kg	0.10			13.6	22.1	13.9	12.5	16.3	22.9	24.5	22.6	167	43.2
Copper (Cu)	mg/kg	0.50	35.7	197	43.3	77.3	77.6	67.4	92.1	136	143	125	142	138
Iron (Fe)	mg/kg	50			14700	27400	25400	25100	35100	43000	46200	42000	48700	85800
Lead (Pb)	mg/kg	0.50	35	91.3	4.19	6.90	6.20	5.22	6.33	8.46	8.07	7.72	8.38	10.7
Lithium (Li)	mg/kg	1.0			12.5	15.8	16.0	14.7	15.2	15.9	15.8	15.8	16.8	23.4
Magnesium (Mg)	mg/kg	20			4160	5530	5720	5200	5570	5540	5920	5630	6560	6470
Manganese (Mn)	mg/kg	1.0			136	195	155	137	149	257	244	208	257	586
Mercury (Hg)	mg/kg	0.0050	0.17	0.486	0.0511	0.0810	0.0729	0.0625	0.0648	0.0574	0.0601	0.0625	0.0614	0.0679
Molybdenum (Mo)	mg/kg	0.50			<0.50	0.84	0.67	0.62	1.10	2.04	2.22	1.94	4.21	2.04
Nickel (Ni)	mg/kg	0.50			30.7	53.9	62.1	56.7	75.5	89.9	95.5	92.9	242	84.7
Phosphorus (P)	mg/kg	50			783	963	1110	1030	891	705	792	709	1670	1990
Potassium (K)	mg/kg	100			620	940	1010	870	890	1020	1080	1040	1370	1130
Selenium (Se)	mg/kg	0.20			0.27	0.43	0.43	0.37	0.46	0.59	0.62	0.52	1.10	0.68
Silver (Ag)	mg/kg	0.10			0.12	0.21	0.14	0.11	0.13	0.25	0.24	0.22	0.42	0.49
Sodium (Na)	mg/kg	100			110	200	210	150	160	260	150	150	170	100
Strontium (Sr)	mg/kg	0.50			12.3	17.3	14.6	12.2	13.1	12.9	14.0	13.3	15.6	10.1
Sulphur (S)-Total	mg/kg	100			1320	1690	1750	1870	2160	1680	1920	1850	2720	680
Thallium (Tl)	mg/kg	0.050			0.067	0.122	0.108	0.094	0.132	0.131	0.148	0.129	0.599	0.122
Tin (Sn)	mg/kg	2.0			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg	1.0			323	428	360	331	367	320	327	310	513	427
Uranium (U)	mg/kg	0.050			0.692	1.22	1.26	1.09	1.41	2.04	2.19	2.05	2.57	2.81
Vanadium (V)	mg/kg	0.20			27.0	37.4	37.7	34.4	41.2	43.0	45.1	42.6	55.2	53.7
Zinc (Zn)	mg/kg	1.0	123	315	33.7	53.7	63.8	57.0	102	122	156	137	201	93.7

Shaded cells indicated metal concentrations exceed CCME interim sediment quality guideline (ISQG) levels.

1) CCME interim sediment quality guideline

2) CCME probable effects level

Appendix 3a. Sediment Quality Data from the Back River Project Study Lakes, August 2010

Sample ID					CHAIR, MID REP3	REFERENCE LAKE B SHALLOW REP1	REFERENCE LAKE B SHALLOW REP2	REFERENCE LAKE B SHALLOW REP3	REFERENCE LAKE B MID REP1	REFERENCE LAKE B MID REP2	REFERENCE LAKE B MID REP3
Date Sampled					21-AUG-10	22-AUG-10	22-AUG-10	22-AUG-10	22-AUG-10	22-AUG-10	22-AUG-10
ALS Sample ID					L924211-21	L924211-25	L924211-26	L924211-27	L924211-22	L924211-23	L924211-24
Matrix	Units	Realized Detection Limits	CCME ISQG[1]	CCME PEL[2]	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Physical Tests											
Moisture	%	0.10			80.9	68.5	64.0	89.2	77.5	77.2	82.3
pH	pH	0.10			5.83	6.32	6.36	6.09	5.48	5.02	5.42
Particle Size											
% Gravel (>2 mm)	%	0.10			<0.10	<0.10	0.65	<0.10	<0.10	<0.10	<0.10
% Sand (2.0 mm - 0.063 mm)	%	0.10			7.60	69.1	77.3	9.69	62.5	56.4	67.2
% Silt (0.063 mm - 4 µm)	%	0.10			81.4	29.5	21.3	86.4	36.0	41.3	31.4
% Clay (<4 µm)	%	0.10			11.0	1.40	0.78	3.88	1.53	2.31	1.42
Leachable Anions & Nutrients											
Total Nitrogen by LECO	%	0.020			0.346	0.443	0.271	1.03	0.418	0.493	0.398
Organic / Inorganic Carbon											
$CaCO_3$ Equivalent	%	0.80			1.00	<0.80	<0.80	<0.80	0.90	<0.80	<0.80
Inorganic Carbon	%	0.10			<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Carbon by Combustion	%	0.1			4.1	5.5	3.4	13.6	5.2	6.4	5.0
Total Organic Carbon	%	0.10			4.15	5.52	3.42	13.6	5.21	6.43	5.04
Plant Available Nutrients											
Available Ammonium-N	mg/kg	1 to 3			5.9	23.9	12.1	34.4	29.0	32.2	22.5
Available Nitrate-N	mg/kg	2.5 to 7.5			<5.5	<3.0	<2.5	<3.8	<3.8	<3.8	<2.7
Available Nitrite-N	mg/kg	0.5 to 1.5			<1.1	<0.60	<0.50	<0.75	<0.75	<0.75	<0.55
Available Phosphate-P	mg/kg	2.0			5.2	<2.0	<2.0	3.7	<2.0	<2.0	<2.0
Metals											
Aluminum (Al)	mg/kg	50			18400	4030	2780	6770	4220	6520	4980
Antimony (Sb)	mg/kg	0.10			<0.10	<0.10	<0.10	0.18	<0.10	<0.10	<0.10
Arsenic (As)	mg/kg	0.050	5.9	17	96.4	5.25	5.71	4.80	14.1	14.8	11.9
Barium (Ba)	mg/kg	0.50			60.4	30.9	20.4	59.0	22.0	34.1	27.0
Beryllium (Be)	mg/kg	0.20			0.68	<0.20	<0.20	0.26	<0.20	0.26	0.23
Bismuth (Bi)	mg/kg	0.20			0.27	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg	0.10	0.6	3.5	0.16	0.11	<0.10	0.25	0.14	0.25	0.20
Calcium (Ca)	mg/kg	50			1400	1320	767	3310	519	1230	822
Chromium (Cr)	mg/kg	0.50	37.3	90	52.6	11.3	7.85	21.3	11.9	20.0	15.3
Cobalt (Co)	mg/kg	0.10			37.6	3.87	2.87	6.01	10.6	17.9	12.9
Copper (Cu)	mg/kg	0.50	35.7	197	170	27.9	13.8	62.9	27.0	43.5	35.8
Iron (Fe)	mg/kg	50			70900	14200	11400	17900	36400	40300	37300
Lead (Pb)	mg/kg	0.50	35	91.3	10.1	3.00	1.84	7.06	2.81	3.67	3.32
Lithium (Li)	mg/kg	1.0			18.3	5.7	5.1	7.5	2.9	5.8	4.2
Magnesium (Mg)	mg/kg	20			6010	1490	1120	2500	1010	1920	1350
Manganese (Mn)	mg/kg	1.0			690	57.1	47.9	74.2	57.5	79.5	62.3
Mercury (Hg)	mg/kg	0.0050	0.17	0.486	0.0576	0.0216	0.0100	0.0508	0.0193	0.0245	0.0238
Molybdenum (Mo)	mg/kg	0.50			2.26	<0.50	<0.50	0.56	<0.50	0.74	<0.50
Nickel (Ni)	mg/kg	0.50			74.3	19.6	13.4	37.6	28.9	48.1	36.2
Phosphorus (P)	mg/kg	50			1590	357	190	664	256	379	345
Potassium (K)	mg/kg	100			1110	390	280	590	270	460	340
Selenium (Se)	mg/kg	0.20			0.85	0.22	<0.20	0.54	0.24	0.47	0.37
Silver (Ag)	mg/kg	0.10			0.30	<0.10	<0.10	0.12	<0.10	<0.10	<0.10
Sodium (Na)	mg/kg	100			110	<100	<100	240	<100	<100	<100
Strontium (Sr)	mg/kg	0.50			9.34	8.18	5.34	17.8	5.35	8.92	7.10
Sulphur (S)-Total	mg/kg	100			1060	810	630	2300	1510	1940	1140
Thallium (Tl)	mg/kg	0.050			0.112	<0.050	<0.050	0.056	<0.050	0.106	0.070
Tin (Sn)	mg/kg	2.0			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg	1.0			407	144	96.0	163	120	201	143
Uranium (U)	mg/kg	0.050			2.43	0.382	0.260	0.717	0.375	0.619	0.521
Vanadium (V)	mg/kg	0.20			53.5	18.6	12.5	26.1	18.6	25.5	20.7
Zinc (Zn)	mg/kg	1.0	123	315	105	22.0	16.3	41.9	32.2	66.9	45.4

Shaded cells indicated metal concentrations exceed CCME interim sediment quality guideline (ISQG) levels.

1) CCME interim sediment quality guideline

2) CCME probable effects level

Appendix 3b. Results from the Principal Components Analysis (PCA) of the Back River Sediment Quality Data, August 2010

i) Principal Component Scores for the Sample Sites

Lake and sample depth	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8
Umwelt shallow	6.39	-2.50	-1.13	0.39	-0.64	0.57	0.42	0.23
Llama shallow	-1.03	-0.12	-1.21	1.14	0.49	0.46	-0.83	-0.13
Llama mid	-4.49	1.99	-0.18	1.12	-0.65	-0.80	0.36	0.19
Llama deep	-0.15	-0.90	-1.97	-0.93	-0.25	-0.87	-0.06	-0.48
Mam shallow	-2.29	2.11	-0.37	-1.21	-0.55	0.65	-0.34	0.39
Chair shallow	-4.09	0.51	0.81	-0.04	0.27	0.95	0.60	-0.49
Chair mid	-5.45	-3.39	1.31	-0.30	0.58	-0.35	-0.04	0.33
Reference Lake B shallow	5.79	2.01	-0.19	-0.21	1.33	-0.34	0.27	0.18
Reference Lake B mid	5.32	0.28	2.93	0.05	-0.57	-0.27	-0.37	-0.22

PC = principal component

ii) Eigenvectors or Loadings for Sediment Quality Parameters Included in the PCA

Parameters	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8
% Sand	0.88	-0.26	0.06	0.22	0.18	-0.04	-0.25	0.05
% Silt	-0.88	0.28	-0.14	-0.23	0.09	-0.17	-0.08	-0.16
% Clay	-0.92	0.23	0.22	-0.11	0.18	0.07	-0.04	0.03
Total Nitrogen	-0.41	0.89	0.14	0.02	0.09	0.06	0.03	0.04
Ammonium-N	0.02	0.90	0.12	-0.19	-0.23	0.16	-0.22	0.04
TOC	-0.34	0.88	0.24	0.05	0.20	0.02	0.02	0.01
Al	-0.97	-0.20	-0.02	0.03	-0.02	0.10	0.02	-0.03
As	-0.88	-0.26	0.11	0.29	-0.23	-0.03	0.02	0.11
Ba	-0.88	0.22	-0.31	0.25	0.03	0.08	-0.08	-0.02
Cd	-0.94	0.04	0.25	0.18	0.00	0.15	-0.03	-0.01
Ca	-0.69	0.38	-0.60	0.07	0.06	-0.01	0.04	0.04
Cr	-0.99	-0.12	-0.03	-0.07	-0.03	0.03	-0.03	-0.05
Co	-0.80	-0.45	0.33	-0.12	-0.03	-0.13	-0.11	-0.06
Cu	-0.98	-0.02	0.05	0.15	0.07	0.03	0.05	-0.01
Fe	-0.77	-0.09	0.60	0.14	-0.12	-0.13	-0.01	0.02
Pb	-0.96	-0.08	0.06	-0.11	0.21	-0.02	0.13	0.01
Li	-0.90	-0.17	-0.38	-0.04	0.02	0.11	0.00	0.05
Mg	-0.91	-0.16	-0.34	-0.07	-0.08	0.13	0.01	0.01
Mn	-0.95	-0.25	0.01	0.04	0.13	-0.08	-0.09	-0.02
Hg	-0.91	0.13	-0.32	-0.04	-0.16	-0.16	0.07	0.01
Ni	-0.94	-0.19	0.25	0.03	0.01	0.12	-0.06	0.02
P	-0.90	-0.18	-0.06	-0.29	0.06	-0.15	-0.02	0.22
K	-0.97	-0.07	-0.18	0.00	0.07	0.09	-0.04	0.01
Se	-0.89	0.06	0.36	0.06	0.12	-0.25	-0.01	0.02
Sr	-0.72	0.36	-0.44	0.34	0.00	-0.21	-0.05	-0.03
S	-0.71	0.56	0.25	-0.04	-0.29	-0.16	0.07	-0.03
Ti	-0.88	-0.27	-0.30	-0.10	-0.16	-0.01	-0.14	-0.03
U	-0.98	-0.11	0.12	-0.07	0.10	0.08	0.03	-0.04
V	-0.98	-0.18	0.04	-0.07	-0.02	0.05	0.01	0.02
Zn	-0.90	-0.15	0.31	0.07	-0.06	0.24	0.06	-0.05

PC = principal component

iii) Percent Variation of the Data Explained by Principal Components

Principal component	Eigenvalue	% Variation Explained	Cumulative % Variation
1	22.0	73.2	73.2
2	3.9	13.1	86.2
3	2.2	7.4	93.6
4	0.6	2.2	95.8
5	0.5	1.6	97.4
6	0.4	1.5	98.9
7	0.2	0.7	99.6
8	0.1	0.4	100.0

Appendix V6-3B

Back River Project: 2011 Freshwater Baseline Report

Sabina
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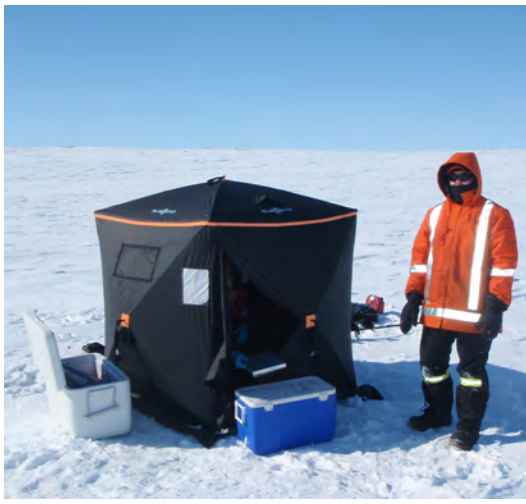
BACK RIVER PROJECT
2011 Freshwater Baseline Report



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June 2012

BACK RIVER PROJECT
2011 FRESHWATER BASELINE REPORT

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Executive Summary

Rescan™
Engineers and Scientists

Executive Summary

The Back River Project (the Project) is an exploration gold project owned by Sabina Gold and Silver Corporation (Sabina) located in the West Kitikmeot region on Nunavut. The Project consists of several properties, one of which is the Back River property. Environmental baseline studies were conducted by Rescan Environmental Services Ltd. (Rescan) in 2011 on behalf of Sabina in the Goose property area. This report presents the results from the freshwater baseline program that was conducted in 2011.

The 2011 freshwater baseline program involved collecting information for the following: lake water quality (winter and summer), physical limnology (winter and summer), lake sediment quality, lake phytoplankton, lake zooplankton, lake benthos, stream water quality, stream sediment quality, stream periphyton, and stream benthos. The program included collecting samples from lakes and streams in areas that could potentially be influenced by the development of known deposits. A reference lake and stream, located well away from known deposits, were also sampled. A total of 6 lakes and 8 streams were sampled in 2011. Lakes sampled were Llama Lake, Umwelt Lake, Giraffe Lake, Goose Lake (sampled at neck, central and tail), Propellor Lake and Reference B Lake. Streams sampled were Chair Outflow, Llama Outflow, Echo Outflow, Giraffe Outflow, Wolf Outflow, Goose Outflow, Propellor Outflow (upstream and downstream) and Reference B Outflow.

Lake Physical Limnology

Dissolved oxygen concentrations in the lakes ranged from 3.3 mg/L to 16.2 mg/L during winter, with the highest concentrations near the water-ice interface. During summer, shallow lakes were generally well-mixed and deeper lakes weakly stratified, with dissolved oxygen levels ranging from 7.7 mg/L to 10.0 mg/L. Water clarity was high in the lakes sampled as the euphotic zone depths extended throughout the entire water column in all lakes.

Lake Water Quality

Lakes in the study area had slightly acidic to neutral pH, with Goose Lake Tail (pH of 6.46) being slightly below the CCME guideline of 6.5. Lakes in the area had low hardness and conductivity, with Umwelt Lake having considerably higher under-ice levels of hardness and conductivity than other lakes. The lakes contained variable concentrations of metals and nutrients, which were usually greater in winter than in summer. Free cyanide concentrations were below detection limits in most lake samples (93%), and always below the CCME guideline (0.005 mg/L).

Overall, turbidity and total suspended solids were low in the sampled lakes, contributing to the high water clarity in the area. Nutrients were also generally low at all lake sampling sites. Ammonia and nitrate concentrations showed similar patterns, and ranged from below detection to 0.082 mg/L. Nitrite concentrations were below detection at all lake sites. Based on CCME categorizations of total phosphorus, lakes sampled were generally ultra-oligotrophic to oligotrophic, with only Umwelt Lake in winter being outside this range (mesotrophic).

CCME guidelines for aluminum, cadmium and copper were exceeded in at least one replicate from every lake except Llama and Reference lakes. Average concentrations exceeded CCME guidelines at Umwelt (copper), Giraffe (cadmium, copper), Goose Neck (cadmium), Goose Central (cadmium), Goose Tail (aluminum) and Propellor (cadmium) lakes. The soft waters meant lower hardness-dependent CCME guideline concentrations, which were in some cases lower than achievable analytical detection limits (e.g., cadmium at Goose Lake Tail and Propellor Lake).

Stream Water Quality

Streams had relatively high water levels and flow during freshet (June), but lower discharge in August. Echo Outflow was dry during August sampling, and many of the other streams had dry or underground sections. All streams had dissolved oxygen concentrations below CCME guidelines for early life stages (less than 9.5 mg/L) during summer, with Llama Outflow being below CCME guidelines for all life stages (less than 6.5 mg/L). Fall dissolved oxygen concentrations were all above CCME guidelines (9.5 mg/L to 10.9 mg/L).

Streams and rivers in the study area had slightly acidic to neutral pH. Llama Outflow, Goose Outflow and Giraffe Outflow had pH levels below the CCME guideline range (6.5 to 9 pH units) during summer sampling, and Echo Outflow had pH levels below CCME guidelines during the freshet and fall periods. Hardness, conductivity and total dissolved solids were low in most streams, although considerably higher in Llama OF over summer and freshet than at any other stream. Turbidity and total suspended solids were highest at Chair OF and Reference B OF. Free cyanide concentrations were below detection for most streams, and always below the CCME guideline (0.005 mg/L).

Nitrate, nitrite and ammonia concentrations were generally low, often near or below detection limits. Total phosphorus levels were more variable and sites were categorized as ultra-oligotrophic to meso-eutrophic, based on the CCME trigger ranges for total phosphorus.

Over half of the streams had water that exceeded at least one CCME guideline for total aluminum, cadmium, copper and iron concentrations. Mean metal concentrations exceeded CCME guidelines at Chair Outflow (cadmium, copper), Llama Outflow (aluminum, cadmium, and copper), Echo Outflow (aluminum, cadmium, and copper), Giraffe Outflow (copper), and Reference B Outflow (iron).

Lake Sediment Quality

Lake sediments were largely composed of silt, with lesser amounts of clay and sand. Goose Lake Tail and Reference B Lake both had distinctive sediments, being composed of more than two thirds sand. The higher proportion of fine sediments (clay and silt) within a lake was generally associated with an increase in all evaluated parameters.

Lake sediments were naturally elevated in arsenic, cadmium and copper, and concentrations of these metals were often higher than CCME Interim Sediment Quality Guidelines (ISQGs). Mean sediment concentrations exceeded CCME ISQG guidelines at Llama (arsenic, copper), Umwelt (arsenic, copper), Giraffe (arsenic, copper), Goose Neck (arsenic, cadmium and copper), Goose Central (arsenic, copper), and Propellor (copper) lake sampling sites. Llama had particularly high arsenic concentrations, exceeding the CCME Probable Effects Level (PEL) by a factor of 1.37. Two replicate samples from Goose Lake Central exceeded the PEL for arsenic, but the mean concentration for Goose Lake Central was below the PEL.

Stream Sediment Quality

Stream sediments were composed mainly of silt and sand, and tended to have similar or lower metal concentrations than lake sediments. Stream sediments at many sites had naturally elevated levels of arsenic and copper, with some exceeding CCME guidelines. ISQGs were exceeded for mean arsenic and copper concentrations at Chair Outflow (arsenic), Giraffe Outflow (arsenic), Goose Outflow (arsenic, copper) and Reference B Outflow (copper). Individual replicates also exceeded ISQGs at Chair OF (copper), Giraffe Outflow (copper) and Goose Outflow (cadmium). Stream sediment metal concentrations were always below the CCME PELs, except one replicate at Chair Outflow and Goose Outflow for arsenic. Depositional sediments were not present at Llama OF or Propellor Outflow.

Lake Aquatic Life

Lake phytoplankton biomass (as chlorophyll *a*) was low in all lakes, ranging from 0.14 to 0.61 µg chl *a*/L. Densities showed similar patterns to biomass, and ranged from 630 cells/mL to 1,040 cells/mL, with chrysophytes, diatoms, green algae and cyanobacteria being the most prevalent taxa. Phytoplankton richness and diversity was high and very similar across lakes, ranging from 20 to 25 genera/sample and from 0.82 to 0.88 (Simpson's index), respectively.

Mean zooplankton densities ranged from 6,400 organisms/m^3 to 23,000 organisms/m^3 for most lake sites. Llama Lake, the deepest lake, had zooplankton densities more than twice as high as other sites (40,200 organisms/m^3). The zooplankton assemblages typically consisted of rotifers and calanoid and cyclopoid copepods. Calanoid copepods were the dominant group in all lakes, except Reference B, where rotifers dominated. Zooplankton genera richness (4.0 to 10.7 genera/sample) and diversity varied between lakes (0.22 to 0.73).

Lake benthos densities varied between lakes, ranging from 1,140 to 6,650 organisms/m^2. Lake benthic communities were generally dominated by dipterans. The most abundant genera tended to be chironomids (non-biting midges) and at some lake sites, bivalves (pea clams). Lakes had similar richness and diversity, with a mean of 5.7 families/sample, and a mean diversity of 0.84 (Simpson's index).

Stream Aquatic Life

Periphyton biomass ranged from approximately 0.96 to 2.51 µg chl *a*/cm^2, while density ranged from 1.1×10^6 cells/cm^2 to 7.1×10^6 cells/cm^2 among stream sites. Diatoms and cyanobacteria were the dominant periphyton taxa in all streams surveyed, with cyanobacteria being more prevalent in Chair OF, Giraffe OF and Reference B OF. Genera richness ranged from 18 to 35 genera/sample, and diversity from 0.72 to 0.84 (Simpson's index). Llama OF had the lowest richness and diversity of all stream sites.

Overall, stream benthos density ranged from 970 to 2,070 organisms/m^2, except in Llama OF (4,370 organisms/m^2) and Propellor OF (3,230 organisms/m^2) where higher densities were present. Stream benthos assemblages were dominated by dipterans, with oligochaetes and ostracods present in smaller numbers. Mean benthic community richness ranged from 6.4 to 14.6 families/sample, with a mean of 9.9 families/sample. Diversity was lower in stream benthic communities than in lake benthic communities, with a mean diversity of 0.50 (Simpson's index).

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Rescan™
Engineers and Scientists

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BACK RIVER PROJECT
2011 FRESHWATER BASELINE REPORT

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Glossary and Abbreviations

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Glossary and Abbreviations

Terminology used in this document is defined where it is first used. The following list will assist readers who may choose to review only portions of the document.

°C	Degrees Celsius
Allochthonous	External inputs of carbon and nutrients into aquatic systems, for example plant debris or soils from riparian systems
ALS	ALS Environmental Services
Autotrophic	Organisms which manufacture their food, usually via photosynthesis.
$CaCO_3$	Calcium carbonate
Chl *a*	Chlorophyll *a*
CCME	Canadian Council of Ministers of the Environment
D/S	Downstream
DDI	Double de-ionized water
DGPS	Differential Global Positioning System
Heterotrophic	Organisms unable to synthesize their own food, e.g., animals and fungi
ISQG	Interim Sediment Quality Guideline
m	Metres
m^3	Cubic metres
mm	Millimetres
OF	Outflow
PEL	Probable Effects Level
QA/QC	Quality Assurance and Quality Control
RDL	Realized Detection Limit
Rescan	Rescan Environmental Services Ltd.
Sabina	Sabina Gold & Silver Corp.
sp.	Refers to a single species in a genus
spp.	Refers to multiple species within a genus
TKN	Total Kjeldahl Nitrogen
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
TOC	Total Organic Carbon
TP	Total Phosphorus
WAD	Weak Acid Dissociable

1. Introduction

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1. Introduction

The Back River Project (the Project) is an exploration gold project owned by Sabina Gold and Silver Corporation (Sabina) located in the West Kitikmeot region on Nunavut. The Project consists of several properties, one of which is the Goose property (Figure 1-1). An exploration camp is located beside Goose Lake (Goose Camp), and Sabina conducted a drilling program from this camp during 2011.

Several exploration targets exist in the Goose property area, including the Llama, Umwelt, Echo and Goose deposits. For 2011, select baseline studies were conducted in the areas that could be influenced by the future development of these deposits. Rescan Environmental Services (Rescan) was contracted by Sabina to conduct the following baseline studies in 2011:

- Dustfall and Air Quality;
- Surface Hydrology;
- ML/ARD;
- Lake and Pond Bathymetry;
- Freshwater Water Quality, Sediment Quality and Aquatic Biology;
- Freshwater Fish and Fish Habitat;
- Wildlife; and
- Archaeology.

In addition, Sabina continued the on-site meteorology and hydrogeology monitoring programs. Data from these programs will also be included in 2011 baseline reports to be prepared by Rescan.

This report presents the results from the freshwater baseline program (water quality, sediment quality and aquatic biology) that was carried out in 2011. Results from the lake and pond bathymetric surveys are also included. The freshwater baseline program included sampling lakes and streams within the watersheds that could be influenced by the development of known deposits, as well as in a reference watershed located well away from known deposits.

For lakes, the following environmental components were sampled:

- bathymetry;
- physical limnology;
- water quality;
- sediment quality;
- phytoplankton assemblages;
- zooplankton assemblages; and
- benthic macroinvertebrate communities.

Sabina GOLD & SILVER CORP.

Back River Project Location

Figure 1-1

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For streams, the following components were sampled:

- water quality;
- sediment quality;
- periphyton assemblages; and
- benthic macroinvertebrate communities.

Chapter 2 of this report presents the overall sampling design and the methods used for all sample collection. Chapter 3 of this report provides the results. All raw data are provided as appendices to this report.

2. Methods

2. Methods

2.1 SAMPLING DESIGN

In 2011, baseline data were collected from lakes and streams in watersheds containing known deposits as well as a reference lake and stream well away from any known deposits.

The following components were sampled as part of the 2011 freshwater baseline program:

Lakes:

- bathymetry;
- physical limnology;
- water quality;
- sediment quality;
- phytoplankton assemblages;
- zooplankton assemblages; and
- benthic macroinvertebrate communities.

Streams:

- water quality;
- sediment quality;
- periphyton assemblages; and
- benthic macroinvertebrate communities.

The sampling locations and the dates for each component in lakes and streams are shown in Tables 2.1-1 and 2.1-2, and sampling details can be seen in Table 2.1-3.

Within each lake, sampling locations were selected either where historical data existed, or in the deepest section in the lake, or in a spatially significant location (i.e., a central location where water from multiple inflows mix; Table 2.1-4). Winter sampling occurred near the middle of the lake, or in the middle of any obvious basins as estimated by the topography if no bathymetric information or prior sampling history was available. In such cases, at least three holes were drilled and samples were collected from the deepest point. Summer sampling locations were moved when new bathymetric information found more suitable sites.

Sampling locations in streams were selected to be on the outflows of the major watersheds in the area. The exception to this was Propellor D/S (downstream), which was selected the furtherest downstream sampling site immediately before a major confluence with another drainage area within the Regional Western River Watershed. During freshet, water quality samples were taken slightly upstream or downstream as required to avoid large blocks of unmelted ice influencing water quality samples.

Bathymetric surveys were conducted on Goose Lake and the two ponds north east of Umwelt Lake during summer 2012.

Table 2.1-1. Water, Sediment, and Aquatic Biology Sampling Dates and Locations in Lakes, Back River Project, 2011

Watershed	Lake Site Name	Abbreviated Name	Water Quality and Limnology		Sediment Quality	Phytoplankton	Zooplankton	Benthos
			Winter	Summer				
Llama Watershed	Llama Lake	Llama	12-Apr	06-Aug	06-Aug	06-Aug	09-Aug	09-Aug
	Umwelt Lake	Umwelt	13-Apr	05-Aug	05-Aug	05-Aug	05-Aug	10-Aug
Giraffe Watershed	Giraffe Lake	Giraffe	16-Apr	10-Aug	11-Aug	10-Aug	10-Aug	11-Aug
Goose Watershed	Goose Lake Neck	Goose Neck	17-Apr	07-Aug	07-Aug	07-Aug	14-Aug	7-Aug-11 and 14-Aug-11
	Goose Lake Central	Goose Central	14-Apr	07-Aug	07-Aug	07-Aug	07-Aug	07-Aug
	Goose Lake Tail	Goose Tail	*nc*	17-Aug	17-Aug	*nc*	*nc*	*nc*
Propellor Watershed	Propellor Lake	Propellor	16-Apr	11-Aug	11-Aug	*nc*	*nc*	*nc*
Reference B Watershed	Reference B Lake	Reference B	12-Apr	08-Aug	08-Aug	08-Aug	08-Aug	08-Aug

nc = data not collected at these sites by sampling design.

Table 2.1-2. Water, Sediment, and Aquatic Biology Sampling Dates and Locations in Streams, Back River Project, 2011

Watershed	Stream Site Name	Stream Site Name	Water Quality and Limnology			Sediment Quality	Periphyton	Benthos
			Freshet	Summer	Fall			
Chair Watershed	Chair Watershed Outflow	Chair OF	18-Jun	13-Aug	08-Sep	13-Aug	13-Aug	13-Aug
Llama Watershed	Llama Watershed Outflow	Llama OF	18-Jun	17-Aug	08-Sep	*nc*	17-Aug	17-Aug
Echo Watershed	Echo Watershed Outflow	Echo OF	18-Jun	*nc*	08-Sep	*nc*	*nc*	*nc*
Giraffe Watershed	Giraffe Watershed Outflow	Giraffe OF	18-Jun	12-Aug	08-Sep	12-Aug	12-Aug	12-Aug
Wolf Watershed	Wolf Watershed Outflow	Wolf OF	18-Jun	13-Aug	09-Sep	13-Aug	13-Aug	13-Aug
Goose Watershed	Goose Watershed Outflow	Goose OF	18-Jun	16-Aug	08-Sep	16-Aug	16-Aug	16-Aug
Propellor Watershed	Propellor Watershed Outflow	Propellor OF	18-Jun	15-Aug	09-Sep	*nc*	15- & 16-Aug	16-Aug
	Propellor Downstream	Propellor D/S	18-Jun	15-Aug	09-Sep	15-Aug	15-Aug	15-Aug
Reference B Watershed	Reference B Outflow	Ref. B OF	18-Jun	14-Aug	09-Sep	14-Aug	14-Aug	17-Aug

nc = data could not be collected at these sites due to either low water levels, lack of fine sediments, or unsuitable sediment at the site.

Note: Echo Watershed Outflow was completely dry during August sampling.

Table 2.1-3. Sampling Details for Physical Limnology, Water Quality, Sediment Quality, and Aquatic Biology, Back River Project, 2011

Monitoring Parameter	Sampling Frequency	Sampling Replication	Sampling Equipment	Sampling Dates/Timing
Lakes				
Winter Physical Limnology				
Dissolved oxygen/temperature profile	1 x	n=1	YSI DO Probe	April (winter)
Summer Physical Limnology				
Dissolved oxygen/temperature profile; Secchi depth	1 x	n=1	YSI DO Probe	August (summer)
Winter Lake Water Quality				
Physical, nutrients, total & dissolved metals	1 x	n=1 at 1 m below the ice and at 1.5 m to 2 m above the water-sediment interface in lakes deeper than approximately 5 m + 20% replication	Modified 5 L Skinny Niskin Bottle; preservatives	April (winter)
Summer Lake Water Quality				
Physical, nutrients, cyanides, total & dissolved metals	1 x	n=1 at 1 m depth and at mid depth in lakes deeper than approximately 5 m + 20% replication	5 L Go-Flo Bottle; preservatives	August (summer)
Lake Sediment Quality				
Physical, nutrients, cyanide, metals	1 x	n=3, each sample is a composite of two grabs. Sampled at deep and shallow depths in lakes deeper than approximately 5 m	Ekman Grab	August (summer)
Phytoplankton				
Biomass (as chlorophyll *a*)	1 x	n=3 at 1 m below surface	5 L Go-Flo Bottle; filtration with 45µm filters	August (summer)
Abundance and taxonomy	1 x	n=3 at 1 m below surface	5 L Go-Flo Bottle; Lugols solution to preserve	August (summer)
Zooplankton				
Abundance and taxonomy	1 x	n=3 horizontal tows of ~10 m at 0.5 m depth or vertical hauls from 1.5 m above bottom in lakes deeper than approximately 5 m	120 µm mesh with a 30 cm mouth diameter; with General Oceanics Flow Meter attached to calculate volume filtered	August (summer)
Lake Benthos				
Density and taxonomy	1 x	n=5, each sample is a composite samples of three grabs. Sampled at deep and shallow depths in lakes deeper than approximately 5 m	Ekman grab and 500 µm seive bucket; formalin to preserve	August (summer)
Streams				
Stream Water Quality				
Dissolved oxygen and temperature	1 x	n=1	YSI DO Probe	August (summer), September (fall)
Physical, nutrients, cyanide, total & dissolved metals	3x	n=2	grab samples; preservatives	June (freshet), August (summer), September (fall)
Stream Sediment Quality				
Physical, nutrients, cyanide, metals	1 x	n=3	Ekman sampler where possible, alternatively bowl and spoon	August (summer)
Periphyton				
Biomass (as chlorophyll *a*)	1 x	n=3	instantaneous samples; peiphyton collected from 4.5 cm diameter circle templates; periphyton from six circles from two different rocks were pooled and then split in half for biomass and density/taxonomy samples; Lugols solution to preserve	August (summer)
Density and taxonomy	1 x	n=3		August (summer)
Stream Benthos				
Density and taxonomy	1 x	n=5; each a composite of three	500µm Hess sampler; formalin to preserve	August (summer)

Table 2.1-4. Rationale for Water, Sediment, and Aquatic Biology Sampling Location Selection in Lakes, Back River Project, 2011

Site Name	Sampling Locations*	Reason for Site Selection
Llama Lake	Shallow and Deep	Near deposits and future potential Project activities
		Historical sampling locations (2010 water quality, sediment quality and physical limnology data).
	Deep	Deepest point on lake.
Umwelt Lake	Shallow	Near deposits and future potential Project activities.
		Historical sampling location (2010 water quality, sediment quality and physical limnology data).
		Deepest point on lake.
Giraffe Lake	Shallow and Deep	Near future potential Project activities.
	Winter and Summer Shallow	Aimed for deepest point in central part of lake in winter. Used same site in summer for consistency.
	Summer Deep	Added deep sampling site in summer after discovering deeper basin in south eastern end of lake.
Goose Lake Neck	Shallow	Downstream of deposits and future potential Project activities.
		Aimed for deepest area in neck area of the lake.
Goose Lake Central	Shallow and Deep	Downstream of deposits and future potential Project activities.
	Winter Deep	Central part of lake.
	Summer Shallow	Moved sampling site 350 m southeast in summer to a more central location to ensure flow out of Goose Lake was captured.
		Historical sampling location (2007 water quality, sediment quality and physical limnology data).
Goose Lake Tail	Shallow	Downstream of deposits and near future potential Project activities.
		Close to the only drainage of Goose Lake.
Propellor Lake	Deep	Lake which receives flow from watersheds near deposits and future potential Project activities.
		Central part of southern end of lake (near the Goose Lake Outflow), away from the influence of the central island.
Reference B Lake	Shallow	Reference site away from any future potential Project activities.
		Historical sampling location (2010 water quality, sediment quality and physical limnology data).
		Deepest point on lake

**Note: In deep lakes, benthos and sediment quality samples were collected from both a shallow and deep location in summer.*
When not specified winter and summer locations were identical.

Figure 2.1-1 presents an overview of the 2011 sampling locations along with the major drainage basins in the area. Arrows show the direction of water flow. For the Ellice River watershed, Llama OF, Echo OF, and Giraffe OF drain the eastern watersheds and their lakes (Llama, Echo and Giraffe) into Goose Lake. Wolf OF drains the southern Wolf Watershed into Goose Lake. Water flows out of Goose Lake via the Goose OF into Propellor Lake, which then drains out of Propellor Stream. Figures 2.1-2 through to 2.1-5 show sampling locations on lakes with known bathymetry.

PROJECT #0833-002-03 GIS # BAC-01-005 July 16 2012

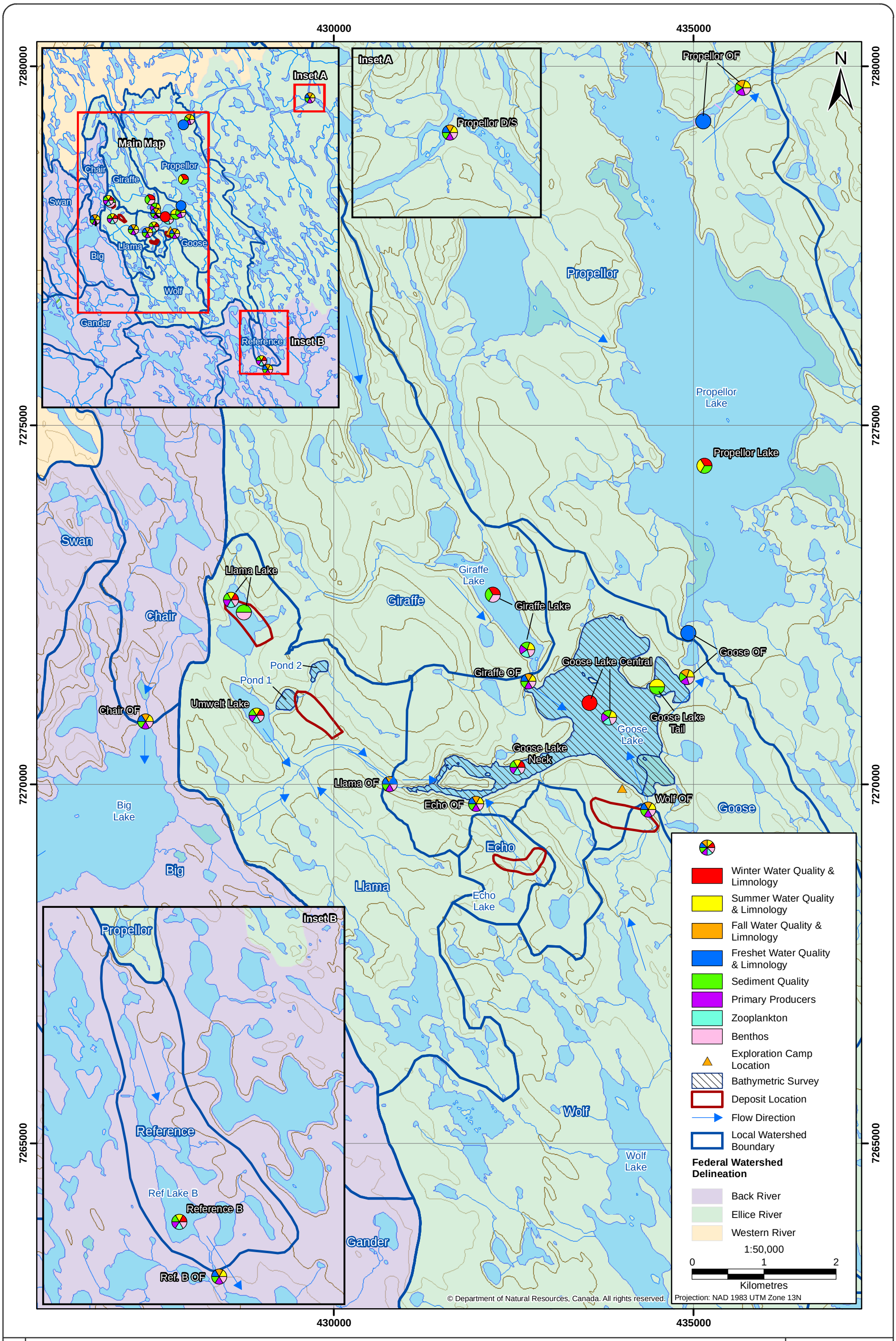

Figure 2.1-1

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Water Quality, Sediment Quality, Aquatic Biology and Bathymetric Survey Sampling Locations in Lakes and Streams, Back River Project, 2011

Figure 2.1-1

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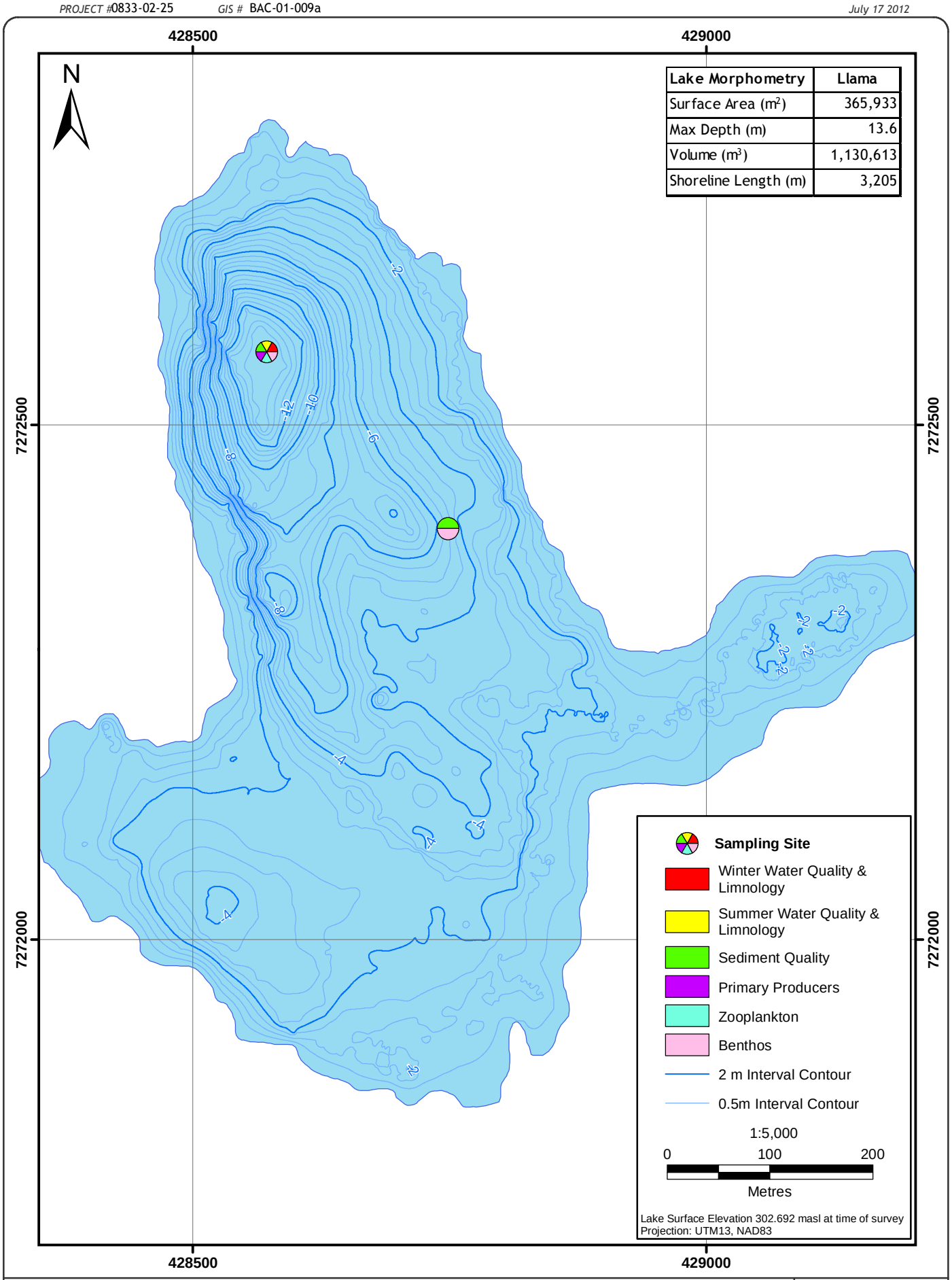

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Bathymetry and Sampling Locations in Llama Lake, Back River Project, 2011

Figure 2.1-2

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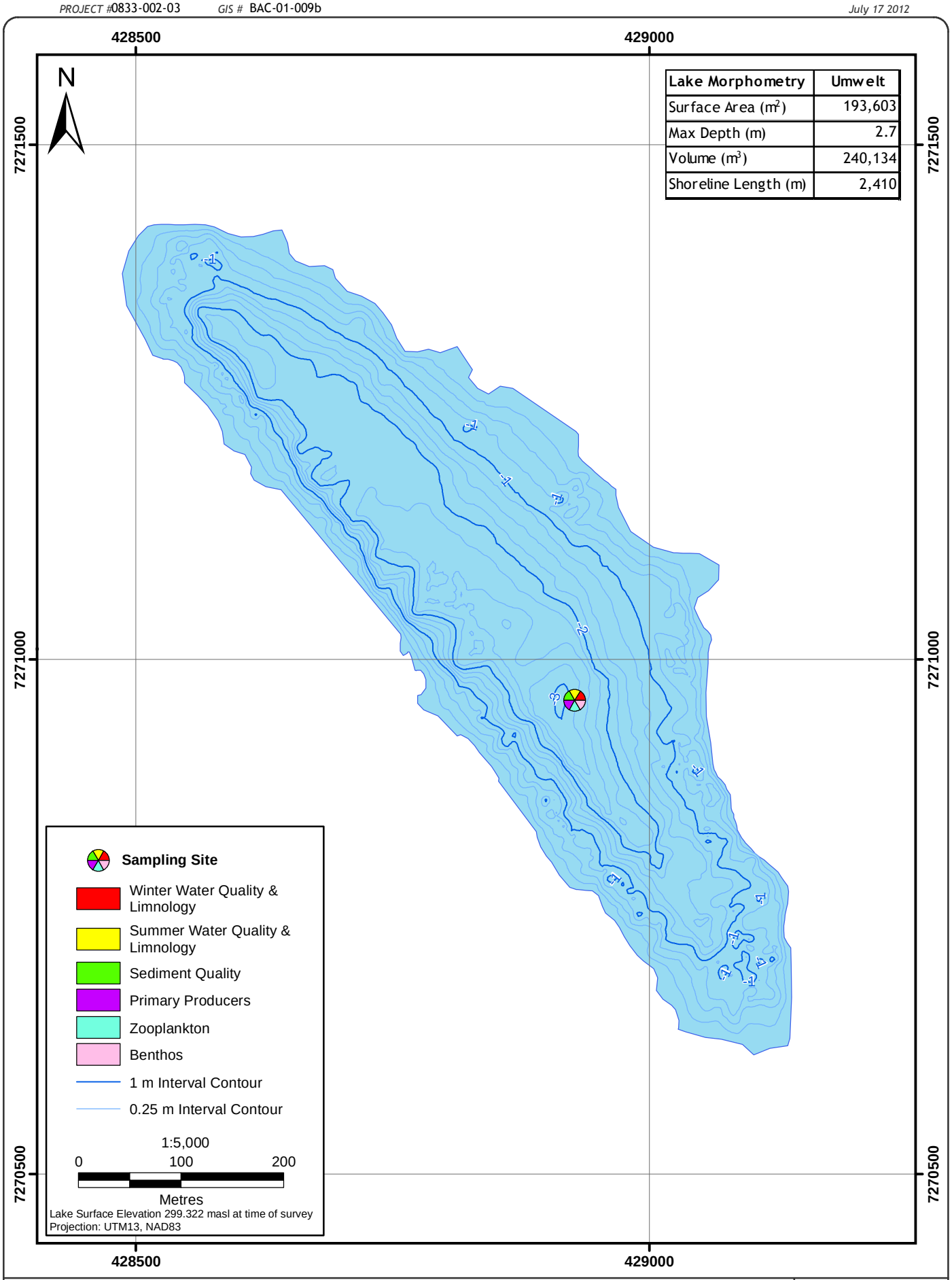

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Bathymetry and Sampling Locations in Umwelt Lake, Back River Project, 2011

Figure 2.1-3

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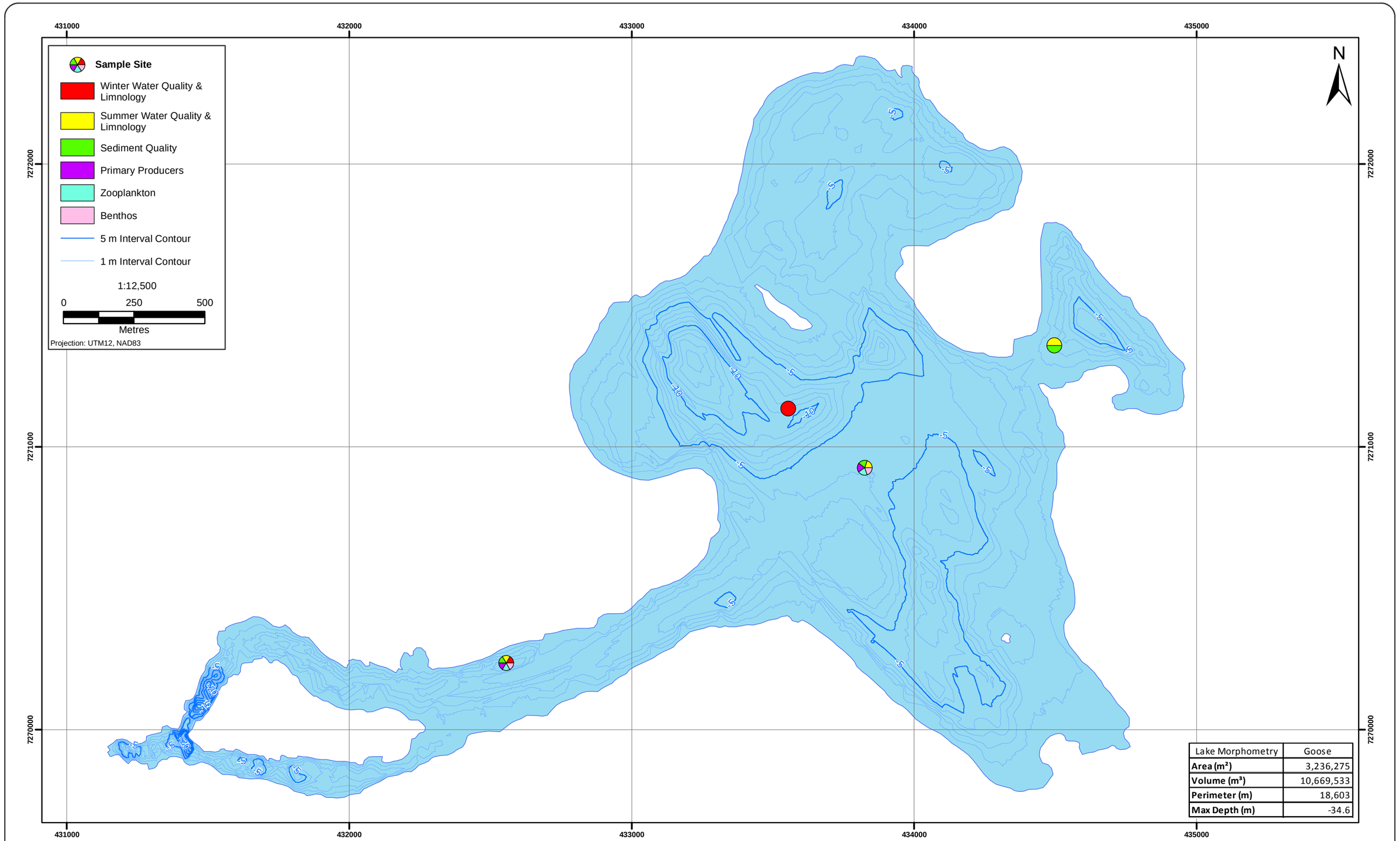

Lake Morphometry	Goose
Area (m^2)	3,236,275
Volume (m^3)	10,669,533
Perimeter (m)	18,603
Max Depth (m)	-34.6

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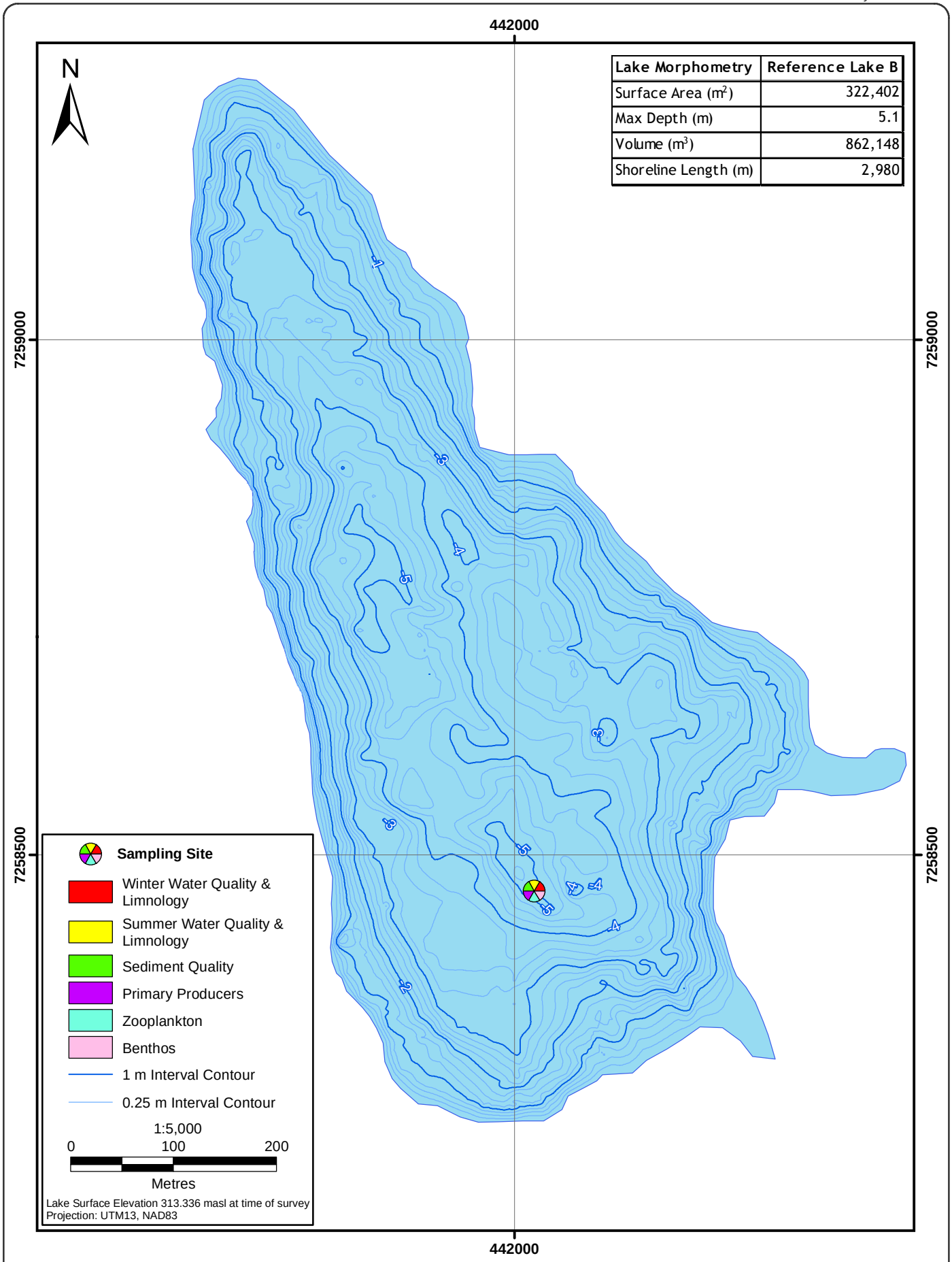
Figure 2.1-4

Bathymetry and Sampling Locations in Goose Lake, Back River Project, 2011



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Bathymetry and Sampling Locations in Reference B Lake, Back River Project, 2011

Figure 2.1-5

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2.2 PHYSICAL LIMNOLOGY

During 2011, dissolved oxygen and temperature profiles were collected in April and August in six lakes. Secchi depth measurements were also recorded in August.

2.2.1 Winter Lake Physical Limnology

Lake sampling sites were accessed by helicopter during April. Before collecting the physical profiles (and later water samples), an ice auger was used to drill a 25-cm hole through the ice (Plate 2.2-1). Water column profiling and water quality sampling depths were calculated based on bottom depth.

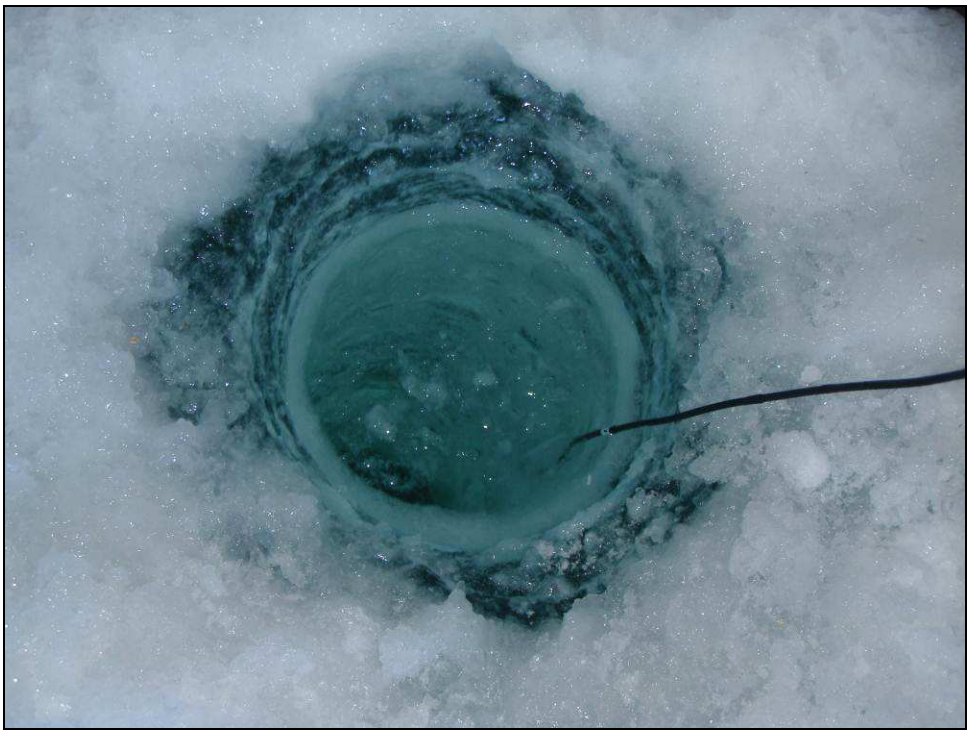


Plate 2.2-1. Measuring dissolved oxygen and temperature through an augered hole in the ice.

Temperature and dissolved oxygen profiles were recorded at 0.5 m intervals down the water column using a YSI Pro-ODO optical dissolved oxygen meter. The profiles ended at approximately 0.5 m above the sediment surface to reduce suspension of bottom sediments.

2.2.2 Summer Lake Physical Limnology

Summer temperature and dissolved oxygen profiles were measured from an aluminum boat at the same locations that winter samples were collected, unless new information prompted relocation to a more suitable location (e.g., Giraffe Lake and Goose Lake Central).

Light attenuation was estimated in each lake using a 20-cm, black and white Secchi disk. Measurements were collected at each site by lowering the disk on a metred line through the water column on the shaded side of the boat until it disappeared from sight. The depth of disappearance was identified as the Secchi depth, which was then used to calculate the depth of the euphotic zone. Euphotic zone depth (EZD) is defined in this report as the depth at which 1% of surface radiation occurs, and generally represents the zone in a waterbody where integrated photosynthesis equals the integrated respiration

(i.e., compensation depth). Above this depth net primary production is possible given sufficient nutrients. The EZD was calculated as follows:

$$k' = 1.7/D_s ;$$

where k' = light extinction coefficient, D_s is the Secchi depth, and 1.7 is a constant derived from experimental data (Parsons, Maita, and Lalli 1984).

$$EZD = 4.6/k'$$

2.3 LAKE WATER QUALITY

The 2011 lake water quality sampling focused on characterizing the natural variation in water quality with water column depth, season (winter vs. summer), and geographical location. A total of eight sites in six lakes within several different watersheds were sampled, including one reference lake located approximately 15 km away from camp and known deposits.

Parameters of interest, including parameters with Canadian Council for Ministers of the Environment (CCME) water quality guidelines for the protection of aquatic life, were graphed for all study lakes and streams unless values were consistently below detection limits (CCME 2011b). Values below analytical detection limits were replaced with half the realized sample detection limit (RDL) for graphing and analysis.

2.3.1 Winter Lake Water Quality

Winter water quality samples were collected from the ice hole augered for the physical limnology measurements. Where lake sites were sufficiently deep, shallow (1 m below the ice) and deep (1.5 m to 2 m from the bottom) samples were collected. One sample was collected at each depth with 20% replication for QA/QC.

A modifed 2.5 L 'skinny' Niskin bottle was used for winter sampling as GO-FLO sampling bottles (generally preferred for sampling waters with low metal concentrations) are prone to freezing in cold waters.

The Niskin bottles were acid-cleaned at ALS Environmental Services (ALS), Burnaby, BC, and contained acid-cleaned clear silicone tubing in the interior of the bottle to avoid metal contamination. A dual rope system was used for bottle closure.

The water collected in the Niskin was used to rinse and fill the appropriate sample bottles. All water samples were analyzed for general physical parameters, nutrients, major anions, total organic carbon (TOC), and total and dissolved metals at the lowest feasible detection limits by ALS (Table 2.3-1). Preservatives were added in the field to the nutrient (sulphuric acid), TOC (hydrochloric acid), and total metals (ultra-pure nitric acid) sample containers.

All water samples were kept cold, but above freezing, and sent to ALS in Yellowknife, NT on the first available flight from camp. Samples were then sent to ALS's Burnaby laboratory where the lowest metal detection limits are available. Due to logistical constraints, hold times for some parameters and some samples were exceeded. Dissolved metals samples were filtered by ALS in their Burnaby laboratory to avoid contamination issues related to field filtration.

Detection limits were the lowest achievable by the lab. Detection limits were occasionally higher than the theoretical minimum presented in Table 2.3-1. This occurred when dilution of a sample was required to compensate for other interfering parameters (e.g., turbidity). Realized detection limit ranges are indicated on all relevant figures in this report.

Table 2.3-1. Water Quality Parameters and Method Detection Limits, Back River Project, 2011

Parameter	Detection Limit	Parameter	Detection Limit
Physical Tests		***Metals (Total and Dissolved continued)***	
Conductivity	2 µS/cm	Barium (Ba)	0.00005
Hardness (as $CaCO_3$)	0.5	Beryllium (Be)	0.0002
pH	0.1 pH	Bismuth (Bi)	0.0005
Alkalinity, Bicarbonate (as $CaCO_3$)	2	Boron (B)	0.001
Alkalinity, Carbonate (as $CaCO_3$)	2	Cadmium (Cd)	0.00001
Alkalinity, Hydroxide (as $CaCO_3$)	2	Calcium (Ca)	0.02
Alkalinity, Total (as $CaCO_3$)	2	Chromium (Cr)	0.0001
Total Suspended Solids	3	Cobalt (Co)	0.0001
Total Dissolved Solids	10	Copper (Cu)	0.0005
Turbidity	0.1 NTU	Iron (Fe)	0.01
Nutrients		Lead (Pb)	0.00005
Ammonia (as N)	0.005	Lithium (Li)	0.005
Nitrate (as N)	0.005	Magnesium (Mg)	0.005
Nitrite (as N)	0.001	Manganese (Mn)	0.00005
Total Kjeldahl Nitrogen	0.05	Mercury (Hg)	0.00001
Ortho Phosphate (as P)	0.001	Molybdenum (Mo)	0.00005
Total Phosphorus	0.002	Nickel (Ni)	0.0001
Major Anions		Phosphorus (P)	0.3
Bromide (Br)	0.05	Potassium (K)	0.05
Chloride (Cl)	0.5	Selenium (Se)	0.0001
Fluoride (F)	0.02	Silicon (Si)	0.05
Sulphate (SO_4)	0.5	Silver (Ag)	0.00001
Organic Carbon		Sodium (Na)	0.01
Total Organic Carbon	0.5	Strontium (Sr)	0.0001
Cyanides*		Thallium (Tl)	0.0001
Free Cyanide	0.005	Tin (Sn)	0.0001
Total Cyanide	0.001	Titanium (Ti)	0.01
Metals (Total and Dissolved)		Uranium (U)	0.00001
Aluminum (Al)	0.003	Vanadium (V)	0.00005
Antimony (Sb)	0.0001	Zinc (Zn)	0.003
Arsenic (As)	0.00003		

Detection limits are mg/L unless otherwise indicated.

** Collected in August from lakes, and in June, August and September for streams.*

2.3.2 Summer Lake Water Quality

Summer lake sampling locations were the same as those sampled in the winter. Exceptions were Giraffe Lake, where a deeper basin was found in the southern part of the lake in summer, and Goose Lake, where the central sampling station was moved 350 m in summer to align with a historical station and to better capture the water flow out of Goose Lake.

Where lake sites were deep enough (greater than 5 m), two depths were sampled: shallow-depth (1 m below the surface) and mid-depth. One sample was collected at each depth with 20% replication for QA/QC.

A 5 L Teflon-lined GO-FLO bottle was used for water collection. The GO-FLO was lowered on a metred line to a depth 0.5 m lower than the desired sampling depth, before being raised to the sampling depth and closed using a weighted messenger. The water collected was used to triple-rinse and fill the laboratory-provided sample containers.

In August, free and total cyanides were measured in addition to the parameters measured in winter. Cyanide samples were field preserved with sodium hydroxide. Preservatives were added to the other samples as outlined in the winter water quality section.

Summer water quality samples were handled, transported, and analyzed as described in the winter water quality section.

2.3.3 Quality Assurance/Quality Control (QA/QC)

A quality assurance and quality control program (QA/QC) was incorporated into the design of the freshwater baseline program to account for within site variability and any contamination that originated from sampling equipment, field sampling, or sample transportation. This included the use of replicates, blanks, and chain of custody forms.

Replicate samples accounted for approximately 20% of lake water samples collected during each sampling period.

Equipment blanks, field blanks, and travel blanks comprised approximately 5% of the total number of lake water quality samples collected. Equipment blanks were designed to detect contamination from the sampling equipment, including the sampling bottle (GO-FLO or Niskin). Field blanks measured any contamination from sample exposure to air, while travel blanks were designed to detect any contamination from travel and storage during sampling.

Equipment blanks were collected in the field by first rinsing an acid-washed GO-FLO with double de-ionized water (DDI water; provided by ALS) then filling the GO-FLO bottle with DDI water, allowing the water to sit for one minute (as would occur with a real sample), and then drawing sub-samples from the bottle. Equipment blanks were preserved and handled the same as real samples.

Field blanks were processed in the field by opening the bottles provided by ALS (containing DDI water) and exposing the sample to air for one minute. The bottles were preserved and handled the same as the regular samples.

Travel blanks were provided by ALS and were never opened, but were otherwise handled in the same way as the regular samples.

All samples, including blanks, were recorded on a chain of custody form and sent to ALS Burnaby via ALS Yellowknife. Blanks were tested for general parameters, nutrients, anions, cyanides and metals.

2.4 STREAM WATER QUALITY

The 2011 stream water quality sampling focused on characterizing the potential natural variation by season (during freshet, the low flow summer period, and the higher flow fall period) and geographical location. Nine sites within eight streams were sampled, including one reference stream approximately 15 km from camp and known deposits.

Surface temperature and dissolved oxygen concentrations were measured during August and September at nine stream sites using a YSI meter.

Duplicate stream water samples were collected from each site using clean techniques. Where reduced flow was present, samples were collected from banks or rocks to prevent contamination from sediments. Where flow was high, the scientist stood facing upstream being careful not to disturb sediments, and plunged the sample bottle 30 cm into the water. For every sample the bottle and cap were triple-rinsed with stream water before filling the bottle.

All water samples were analyzed for general physical parameters, nutrients, anions, TOC, cyanide, and total and dissolved metals, at the lowest feasible detection limits by ALS (Table 2.3.1). Preservatives were added in the field as described in the lake water quality section above.

All water samples were transported and analyzed as described for lake water quality samples.

2.4.1 Quality Assurance/Quality Control (QA/QC)

As with lake water quality, a quality assurance and quality control program (QA/QC) was included in the study design. The program included the use of replicates, blanks, and chain of custody forms.

Replicate samples were collected at all sites to allow identification of natural variability, which tends to be higher in streams compared to lakes due to heterogeneously suspended matter (such as organic debris, small insects, etc.).

Field blanks and travel blanks comprised about 5% of the total number of water quality samples, and were collected in addition to any collected for lake QA/QC purposes. Field blanks and travel blanks were collected as described in the lake water quality section above.

2.5 LAKE SEDIMENT QUALITY

The 2011 sediment quality sampling focused on characterizing the natural variation in lake sediments with depth and by lake. Samples were collected in August at eight sites from six different lakes, and included one reference lake located approximately 15 km away from the camp and known deposits.

Triplicate sediment quality samples were collected from one depth for lakes shallower than 5 m. For deeper lakes, triplicate sediment quality samples were collected from shallow and deep (greater than 5 m) depth strata.

An Ekman grab sampler (surface area: 0.0225 m^2) was used to collect two grabs per replicate, which were composited to ensure enough sediment was obtained for all of the required analyses.

Sediment was carefully transferred onto a white plastic tray, photographed, and described for colour, texture, and other characteristics (measured parameters are listed in Table 2.5-1) (Plate 2.5-1). The top 2–3 cm of sediment was collected and analyzed for grain size, moisture, nutrients, cyanide and solid-phase metals. Of the two grabs making up a replicate, half of the top layer from each was used for sediment chemistry and half for grain size to ensure that the grain size data corresponded to the chemistry data. The sample was then homogenized before being sent to ALS.

Table 2.5-1. Sediment Quality Parameters and Detection Limits, Back River Project, 2011

Parameter	Units	Detection Limit	Parameter	Units	Detection Limit
Physical Tests			***Metals (continued)***		
% Moisture	%	0.25	Cadmium (Cd)	mg/kg	0.1
pH	pH	0.1	Calcium (Ca)	mg/kg	50
Particle Size			Chromium (Cr)	mg/kg	0.5
% Gravel (>2 mm)	%	0.1	Cobalt (Co)	mg/kg	0.1
% Sand (2.0 mm - 0.063 mm)	%	0.1	Copper (Cu)	mg/kg	0.5
% Silt (0.063 mm – 4 µm)	%	0.1	Iron (Fe)	mg/kg	50
% Clay (<4 µm)	%	0.1	Lead (Pb)	mg/kg	0.5
Organic Carbon			Lithium (Li)	mg/kg	1
Total Organic Carbon	%	0.1	Magnesium (Mg)	mg/kg	20
Leachable Nutrients			Manganese (Mn)	mg/kg	1
Total Nitrogen	%	0.02	Mercury (Hg)	mg/kg	0.005
Plant Available Nutrients			Molybdenum (Mo)	mg/kg	0.5
Available Ammonium (as N)	mg/kg	1	Nickel (Ni)	mg/kg	0.5
Available Nitrate (as N)	mg/kg	2	Phosphorus (P)	mg/kg	50
Nitrite (as N)	mg/kg	0.4	Potassium (K)	mg/kg	100
Available Phosphate (as P)	mg/kg	2	Selenium (Se)	mg/kg	0.2
Cyanides			Silver (Ag)	mg/kg	0.1
Total Cyanide	mg/kg	3	Sodium (Na)	mg/kg	100
Weak-acid dissociable Cyanide	mg/kg	3	Strontium (Sr)	mg/kg	0.5
Metals			Sulphur (S)	mg/kg	100
Aluminum (Al)	mg/kg	50	Thallium (Tl)	mg/kg	0.05
Antimony (Sb)	mg/kg	0.1	Tin (Sn)	mg/kg	2
Arsenic (As)	mg/kg	0.05	Titanium (Ti)	mg/kg	1
Barium (Ba)	mg/kg	0.05	Uranium (U)	mg/kg	0.05
Beryllium (Be)	mg/kg	0.5	Vanadium (V)	mg/kg	0.2
Bismuth (Bi)	mg/kg	0.2	Zinc (Zn)	mg/kg	1

Table 2.5-1 presents the sediment quality parameters that were analyzed and their detection limits. Note that realized detection limits may differ from these theoretical values. The realized detection limit ranges are indicated on all relevant figures.

All sediment quality samples were recorded on a chain of custody form and sent to ALS in Yellowknife. Samples were then sent to ALS's Burnaby laboratory for analysis, as lower detection limits could be obtained there.

All parameters for which CCME sediment quality guidelines for the protection of aquatic life exist, as well as other parameters of interest, were graphed. Values below analytical detection limits were replaced with half the realized detection limit for graphing and analysis.

All sediment samples collected were compared to the following CCME guidelines for the protection of aquatic life: the interim sediment quality guidelines (ISQGs) and the probable effects levels (PELs; CCME 2011a). The more conservative ISQGs are levels below which adverse biological effects are rarely observed, whereas the higher PELs correspond to concentrations above which negative effects frequently occur.

Plate 2.5-1. A sediment quality sample collected at Umwelt Lake, August 2011.

2.6 STREAM SEDIMENT QUALITY

Nine stream sites were sampled for sediment quality in August 2011, including a reference stream (Table 2.1-2). Three replicate samples were collected per stream site.

Sediments were collected with an Ekman grab where possible, or a spoon in streams with only small patches of sediment. Depositional zones (where finer sediments accumulate) were preferentially sampled. All sediment quality samples were transported and analyzed as described in the lake sediment section above.

2.7 PRIMARY PRODUCERS

2.7.1 Phytoplankton

Phytoplankton are free-floating autotrophic algae that play an important role in many aquatic systems as primary producers and prey for higher trophic levels. Phytoplankton have short generation times and can respond rapidly to environmental change. These characteristics make them useful indicators of water quality and ecosystem health.

Phytoplankton biomass, densities and taxonomy samples were collected from seven sites in six lakes during August 2011. Triplicate samples were collected from 1 m below the surface using a 5 L Go-Flo bottle. Samples were collected 5 to 20 m apart, and each sample was split for phytoplankton biomass (as chlorophyll *a*), and density/taxonomy.

Phytoplankton biomass samples were filtered onto 0.45 µm pore size filters back in camp and kept dark and frozen until analysis by ALS in Burnaby. Density/taxonomic samples were preserved with Lugol's iodine solution and were sent to Bio-limno Research and Consulting Inc, Halifax, Nova Scotia for enumeration and identification.

2.7.2 Periphyton

Periphyton are algae that grow on the surfaces of rocks or larger plants and are an important food item for many benthic invertebrates, which are in turn the main food source for fish in streams and rivers. Because of their short life cycles, periphyton are among the first organisms to respond to environmental stressors or nutrients, and can exhibit taxon-specific changes, making them good indicators of current environmental conditions.

Three stream periphyton samples were collected at each stream site in August. A circular template with a foam base was used to seal a known area of rock from the rest of the rock. Periphyton in this area were collected using tweezers, a modified toothbrush, a syringe and distilled water. For each replicate, two rocks were selected with flat upper surfaces suitable for periphyton sampling. The periphyton were sampled from three circles on each of the two rocks for each replicate (i.e., a total of six circles) (Plate 2.7-1).

Plate 2.7-1. Collection of periphyton for one replicate at Wolf Outflow, August 2011.

Periphyton samples were diluted to 500 mL back in camp, homogenized, and then split into two 250 mL samples for biomass (as chlorophyll *a*), and density/taxonomy. In order to avoid clogging of the filter, periphyton biomass samples were diluted to 1 L and homogenized before a subsample was filtered, as described above for lake phytoplankton. Periphyton density/taxonomy samples were preserved and analyzed as outlined above for lake phytoplankton.

2.7.3 Data Management and Analysis

The number of organisms per sample was converted to density, either cells/L for phytoplankton and cells/cm^2 for periphyton, by dividing each sample by the volume/area sampled.

Density, genus richness, and diversity were calculated from the taxonomic analysis. Richness is the simplest measure of biodiversity and is simply a count of the number of taxa (in this case genera) in a given area or volume. Diversity indices are used as a measure to define overall ecosystem health, defining how equal the community is numerically, taking into account both richness and density.

For the calculation of richness and diversity, taxa were grouped by genera. Organisms were occasionally not identifiable to the genus level, and were identified only to higher taxonomic levels (e.g., family or order). In cases where an unidentified group made up more than 15% of total individuals collected, unidentified groups were treated as a single genus for the diversity and richness calculations. In cases where the unidentified group made up less than 15% of the total individuals collected, unidentifiable individuals were excluded from the calculations if the higher taxonomic group contained identified genera, or treated as a single genus if the higher taxonomic group contained no other identified genera. The proportion of individuals excluded from the diversity analysis is reported with the diversity results.

Simpson's Diversity Index was used as the measure of diversity, and takes into account dominance, the number of species present, and relative abundance of each species (evenness).

This was calculated by:

$$\textit{Simpson's Diversity Index (D)} = 1 - \sum_{i=1}^{G} p_i^2$$

where G is the number of genera present, and p_i is the relative density of each genus calculated as n_i/N, where n_i is the number of individuals in genus i, and N is the total number of all individuals.

Note that this formula for the Simpson's diversity index produces values that range from 0 (lowest diversity) to 1 (maximum diversity).

2.8 AQUATIC INVERTEBRATES

2.8.1 Zooplankton

Zooplankton, the heterotrophic component of aquatic plankton, are an important link in the aquatic food web, acting as consumers of phytoplankton and prey to many fish species. Zooplankton samples were collected from seven sites in six lakes during August 2011, including one reference lake (Table 2.1-1).

Three samples were collected using a 30 cm diameter, 118 µm mesh size zooplankton net fitted with an internally mounted flowmeter (General Oceanics, model 2030R; Plate 2.8-1). At locations deeper than 5 m, vertical hauls were used. At these sites, the net was lowered to within 1.5 m to 2 m of the lake bottom and brought to the surface at a speed of 0.5 m/s. Horizontal tows were conducted at the shallower sites by pulling the zooplankton net through the surface water (0.5 m depth) for approximately 10 seconds at a rate of 0.5 m/s. The volumes sieved in horizontal tows were similar to that sieved in the vertical tows. The samples were preserved with 5% buffered formalin and sent to Applied Technical Services in Victoria, BC, for enumeration and identification.

The internally mounted flowmeter was used to allow the calculation of the volume of water passing through the net during all hauls. The volume sampled for zooplankton was calculated, as outlined in the General Oceanics instruction manual (General Oceanics Inc.), and shown by the following equation:

$$\textit{Volume in } m^3 = (\textit{number of flowmeter counts} \times 26{,}873/999{,}999) \times (\textit{diameter of net opening}^2/4) \times \pi$$

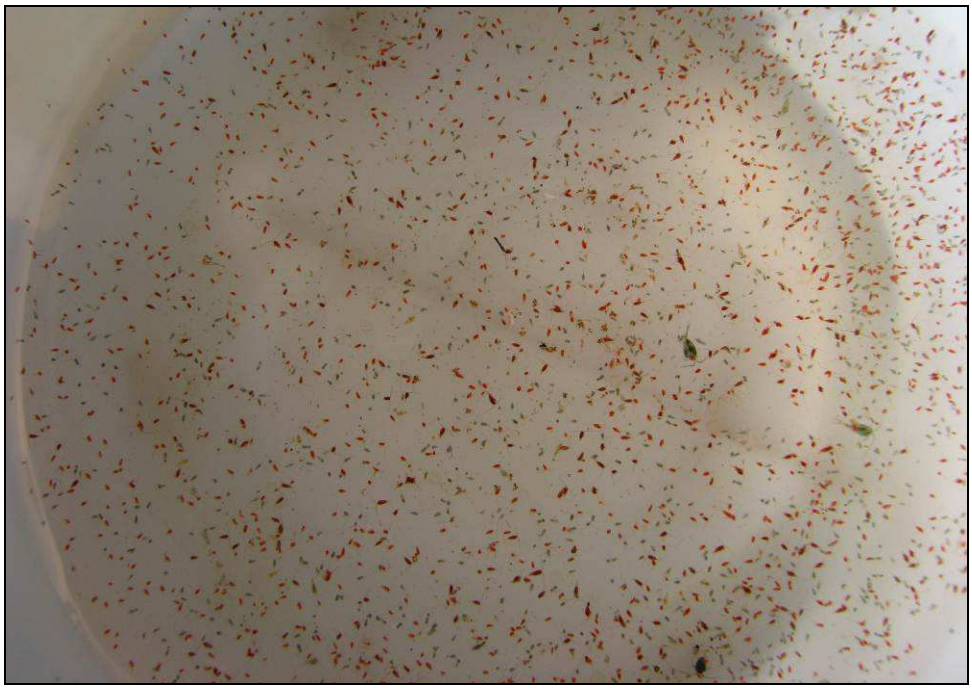


Plate 2.8-1. Zooplankton collected at Goose Lake Neck, August 2011.

Zooplankton densities were calculated by dividing the number of individuals per sample by the volume of water filtered (in cubic metres). Genus richness and diversity were calculated as outlined in the primary production section. Different life stages of the same genus, for example nauplii and copepodites, were pooled together.

2.8.2 Benthic Macroinvertebrates

Benthic macroinvertebrates (benthos) are organisms greater than 0.5 mm in size that inhabit lake and stream bottoms. Benthos are important indicators of environmental change as these organisms are in close contact with the sediments and feed on algae, bacteria, and detritus. Benthos also tend to be less mobile than fish, making them good indicators of local conditions. Benthic organisms are also important food sources for fish, particularly in streams.

2.8.2.1 Lake Benthos

Lake benthos samples were collected from six lake sites in August 2011, including one reference lake located approximately 15 km away from the camp and known deposits. Benthos samples were collected from the same depth zones and locations as the sediment samples: shallow (less than 5 m) and deep (over 5 m).

Five replicate samples, each a composite of three Ekman grab samples, were collected at each sampling location. Samples were gently sieved in the field using a 500 μm sieve bucket and were preserved in 10% buffered formalin. Samples were sent to Dr. Jack Zloty in Summerland, BC, for enumeration and identification.

2.8.2.2 Stream Benthos

Benthos samples were collected from nine stream sites in eight streams during August 2011, including one reference stream. Streams sampled for benthos were the same as those sampled for other parameters such as water quality, sediment quality, and periphyton.

A 500 μm mesh size Hess sampler, with a sampling surface area of 0.096 m^2, was used to collect stream benthos samples. Five replicate samples, each a composite of three Hess samples were collected from each stream station. Most streams had limited flow during August. Consequently, replicate samples were collected where depth and substrate allowed. Notes were taken on depth and flow in the area. When required, flow was created by the sampler to ensure all benthic invertebrates were swept into the Hess sampler's cod end.

Samples were preserved in 10% buffered formalin and sent to Dr. Jack Zloty in Summerland, BC, for enumeration and identification.

2.8.2.3 Data Management and Analysis

Benthos samples were converted to density by dividing the number of organisms in a sample by the surface area sampled.

Richness and diversity samples were calculated to the family taxonomic level, which is the recommended level for freshwater systems (Environment Canada 2011). Individuals were occasionally not able to be identified to the family level. Where an unidentified group made up greater than 15% of total individuals collected, it was treated as a single family for richness and diversity analyses. Where the higher taxonomic contained no identified families, as in the case of Ostracoda and Hydracarina, the unidentifiable individuals were treated as a single family for the richness and diversity analyses. Where the unidentified group was less than 15% and in cases where the higher taxonomic group contained identified families, the unidentifiable individuals were excluded from the richness and diversity analyses.

2.8.3 Quality Assurance/Quality Control (QA/QC)

Chain of custody forms were used for all aquatic biology samples as part of the QA/QC program. All samples had replication, as triplicate samples were taken for phytoplankton, periphyton, and zooplankton, and five replicates of three composite samples were collected for lake and stream benthos.

To ensure consistent and accurate sorting of benthos samples, the re-sorting of benthic sample residues was conducted on a randomly selected 10% of the benthos samples. The criterion for an acceptable sorting was that more than 90% of the total number of organisms found in both the initial and QA/QC sort were recovered during the initial sort, as required by Environment Canada for invertebrate community surveys (Environment Canada 2002). This was calculated by the following equation:

$$\% \text{ Sorting Efficiency} = [1 - (\#\text{ in QA/QC re-sort} / (\#\text{ sorted originally} + \#\text{ QA/QC resort}))] \times 100$$

Any sample not meeting the 90% removal criterion was re-sorted a third time. The 90% minimum sorting efficiency was attained for all benthos samples in this study.

2.9 BATHYMETRY

Bathymetric surveys of Goose Lake and two ponds east of Umwelt Lake were undertaken in July 2011. The surveys consisted of two parts:

1. The collection of continuous depth records along perpendicular and perimeter transects along the lake and pond surfaces using Differential Global Positioning System (DGPS) ; and
2. Establishing proper on-land benchmarks via DGPS surveys of the lake shorelines.

A Trimble PF power DGPS was used for positioning during the depth survey, and a depth sounder and a Trimble TSC1 datalogger were used to collect and store the data in electronic files. The DGPS and sounder were mounted on the boat for surveys along the lake surfaces.

Depth surveys were carried out by navigating a course of regular spaced transects across the width of each lake. Several transects along the long-axis of the lake and in prominent bay areas were also navigated to improve the accuracy of the bathymetric measurements. The transect spacing was determined from a number of factors, including the lake area and the level of bathymetric detail required. Manual survey methods were used along pond shorelines and in areas too shallow for reliable depth readings.

3. Results and Discussion

3. Results and Discussion

3.1 LAKE PHYSICAL LIMNOLOGY

3.1.1 Winter Lake Physical Limnology

Ice thickness and dissolved oxygen concentrations were measured in April 2011. Ice thickness on the lakes in April ranged from 1.3 m to 1.85 m. Maximum lake depths ranged from 1.1 m to 12.2 m (not including ice), so some lakes had very little open water under ice in winter.

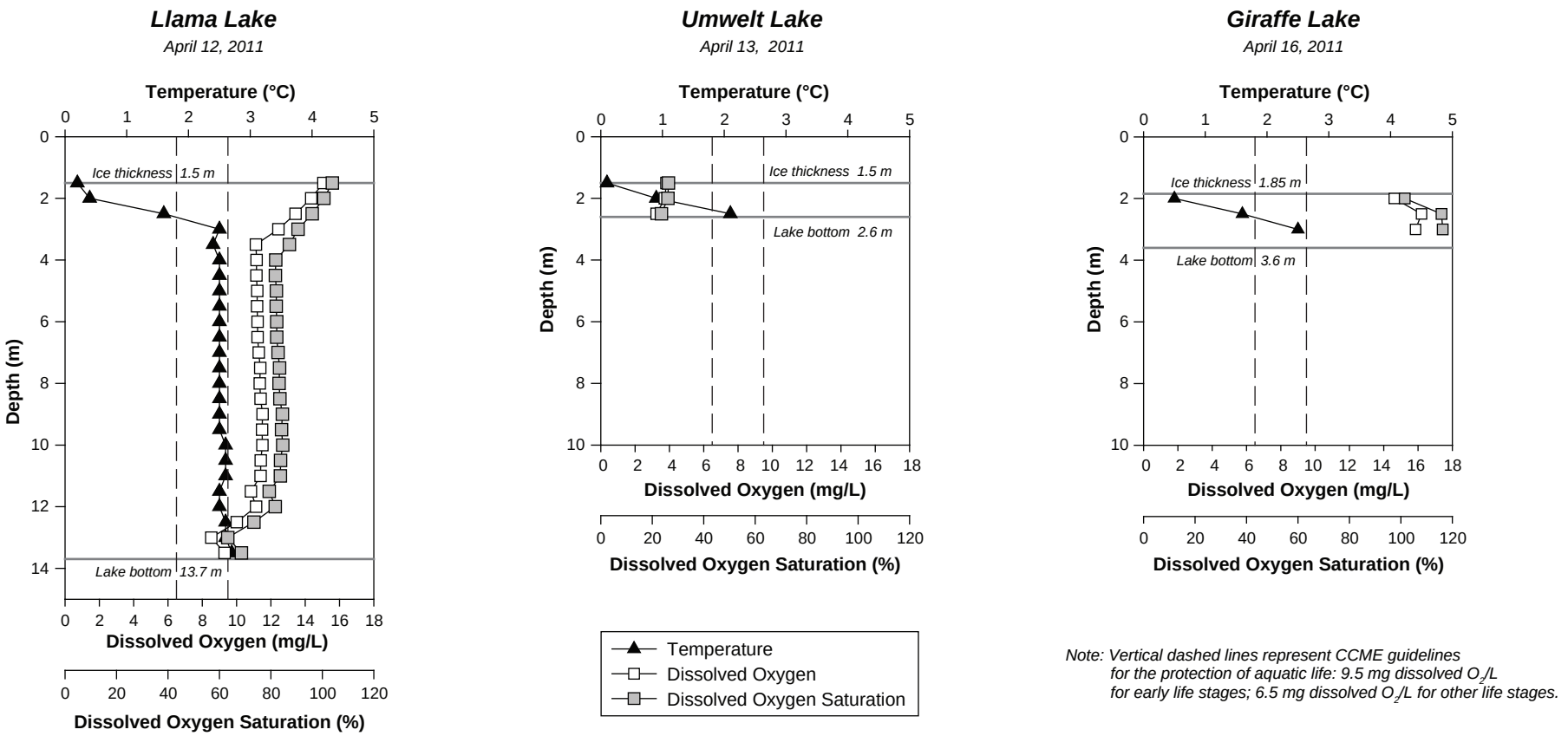
Winter dissolved oxygen and temperature profiles showed an increase in temperature and a decrease in dissolved oxygen with depth (Figures 3.1-1a and 3.1-1b; Appendix 3.1-1). Four lake sites contained more than 3 m of water below the ice: Llama, Goose Central, Propellor, and Reference B. Of these lakes, Llama Lake and Goose Lake Central were stratified, with uniform temperatures and dissolved oxygen concentrations below 4 m, while Propellor Lake and Reference B showed gradual vertical gradients of temperature and dissolved oxygen.

Temperatures near the ice-water interface were close to 0°C, and warmed to approximately 2.5°C in the top 2 m. Temperatures in the two deepest lake sites, Llama Lake (13.7 m) and Goose Lake Central (9.2 m), were stratified and were largely isothermal (2.5°C) below 3 m. There was a gradual warming with depth in the deeper waters of the two moderately deep lakes, Propellor (7.9 m) and Reference B (5.1 m). Temperatures in all deeper lakes tended to warm slightly at the water-sediment interface.

Dissolved oxygen concentrations tended to be highest near the water-ice interface: between 13.4 and 15.7 mg/L in all lakes. This suggests primary productivity was high during this time' since any algae would be actively photosynthesizing during this period. The surface waters tended to be near 100% oxygen saturation, except at the shallow Umwelt Lake, which had much lower dissolved oxygen levels than the other lakes. Umwelt Lake had between 3.3 mg/L and 3.8 mg/L of dissolved oxygen in the 1.1 m of open water under ice, which translated into the low oxygen saturation levels of 23.6 to 26.3%.

Dissolved oxygen stabilized below the surface 4 m in the deepest lakes at approximately 11.3 mg/L or 82% saturation in Llama Lake, and 8 mg/L or 60% saturation in Goose Lake Central. In the moderately deep lakes, Propellor and Reference B, dissolved oxygen concentrations declined gradually throughout the water column to minimum concentrations at the water-sediment interface. Dissolved oxygen was lowest near the water-sediment interface for all deeper lakes, ranging from 1.4 mg/L or 10.4% saturation at Reference B to 8.5 mg/L or 63.3% saturation at Llama Lake.

Established CCME guideline oxygen concentrations for the protection of (cold-water) aquatic life are 9.5 mg/L for early life stages and 6.5 mg/L for other life stages (CCME 2011b). During winter, most lakes had dissolved oxygen concentrations above these guidelines in the upper portions of the water column. Bottom oxygen concentrations were below guideline levels in the deeper lakes (Llama, Goose Lake Central, Propellor, and Reference B). In the shallow Umwelt Lake, oxygen levels were below 6.5 mg/L throughout the water column. Low levels of dissolved oxygen near the water-sediment interface are common in Arctic lakes over winter, and are a result of oxygen depletion from decomposition and respiration in the water-sediment interface and a lack of mixing or aeration due to ice cover (CCME 2011b).



Note: Vertical dashed lines represent CCME guidelines for the protection of aquatic life: 9.5 mg dissolved O_2/L for early life stages; 6.5 mg dissolved O_2/L for other life stages.

Figure 3.1-1a

Sabina GOLD & SILVER CORP.

Winter Under-ice Dissolved Oxygen and Temperature Profiles in Lakes, Back River Project, April 2011

Figure 3.1-1a

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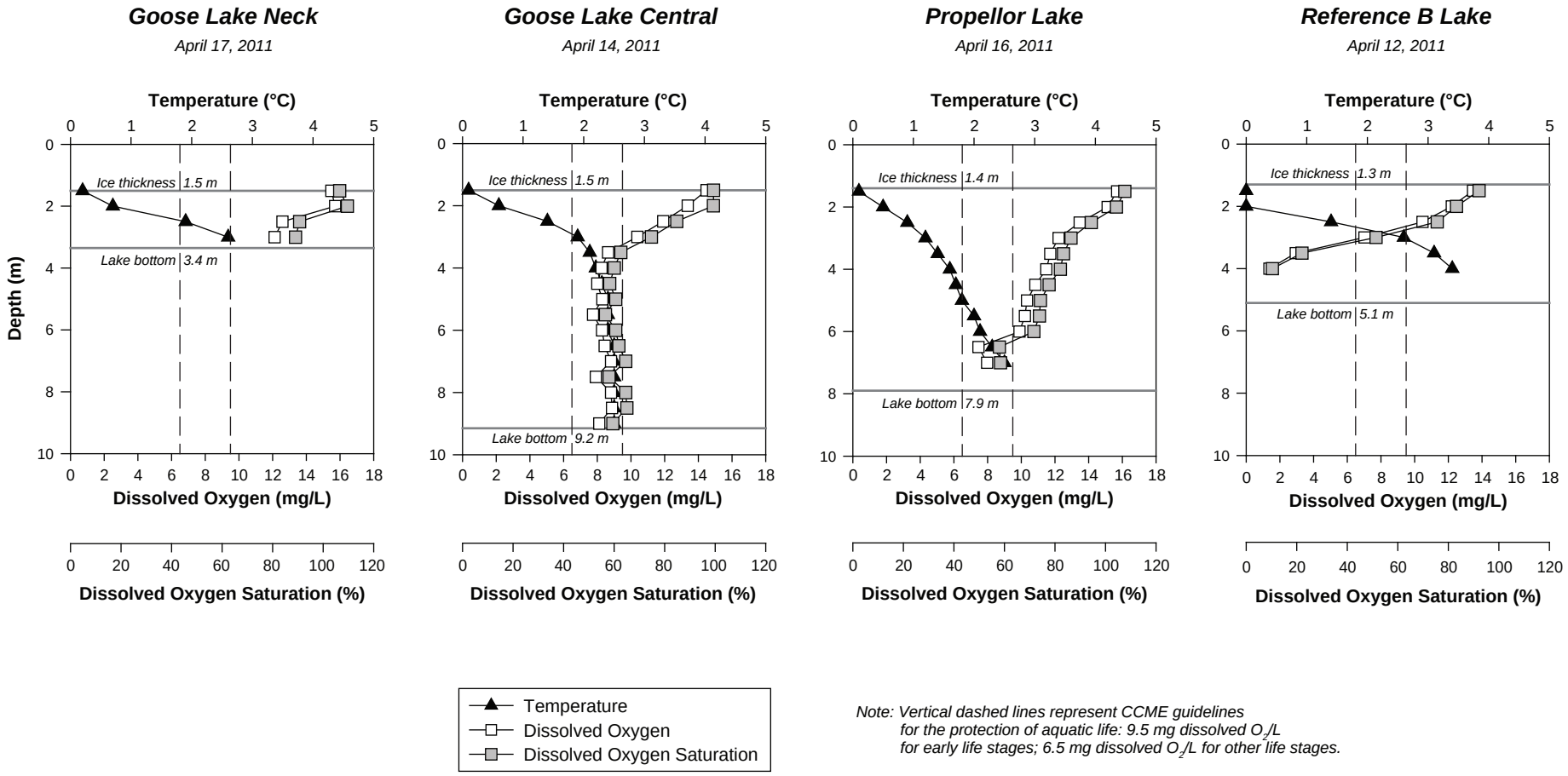

Note: Vertical dashed lines represent CCME guidelines for the protection of aquatic life: 9.5 mg dissolved O_2/L for early life stages; 6.5 mg dissolved O_2/L for other life stages.

Figure 3.1-1b

Sabina GOLD & SILVER CORP.

Winter Under-ice Dissolved Oxygen and Temperature Profiles in Lakes, Back River Project, April 2011

Figure 3.1-1b

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3.1.2 Summer Lake Physical Limnology

Limnological characteristics were measured during the open-water season in August 2011, and included dissolved oxygen and temperature profiles (Figures 3.1-2a and 3.1-2b) and Secchi depths. Unlike in the ice-covered season (April), profiles showed lakes to be well mixed in the summer, with temperatures that ranged from 12.6°C to 16.8°C. The deepest lake, Llama Lake, was weakly stratified with a poorly developed thermocline between 3 and 7 m.

Summer dissolved oxygen concentrations generally remained stable throughout the water column of all lakes, mirroring patterns observed in water temperature. Some oxygen depletion was present near the lake bottom of Goose Lake Tail and Propellor Lake, indicating oxygen consumption due to decomposition.

Overall, lakes had lower dissolved oxygen concentrations in August than in April, with concentrations ranging from 7.70 mg/L to 9.96 mg/L. Lakes were generally between 80% and 90% oxygen saturation throughout the water column, although Goose Lake Tail had surface saturations of over 90%.

Dissolved oxygen concentrations were below CCME guidelines for the protection of aquatic life for early life stages (9.5 mg/L) at all lake sites, at all depths, except the shallow depths at Goose Lake Tail (CCME 2011b). Dissolved oxygen concentrations measured in August were consistently above the CCME guidelines for early life stages (6.5 mg/L).

Secchi depth, a measure of water clarity, was deeper than the bottom in shallow lakes and Propellor Lake (Table 3.1-1). The Secchi depth ranged from 4 m to 9.2 m at the deeper lakes, Llama, Giraffe and Reference B. The euphotic depth extended throughout the water column in all lakes (Table 3.1-1). Consequently, both benthic and pelagic primary production can occur throughout the sampled lakes.

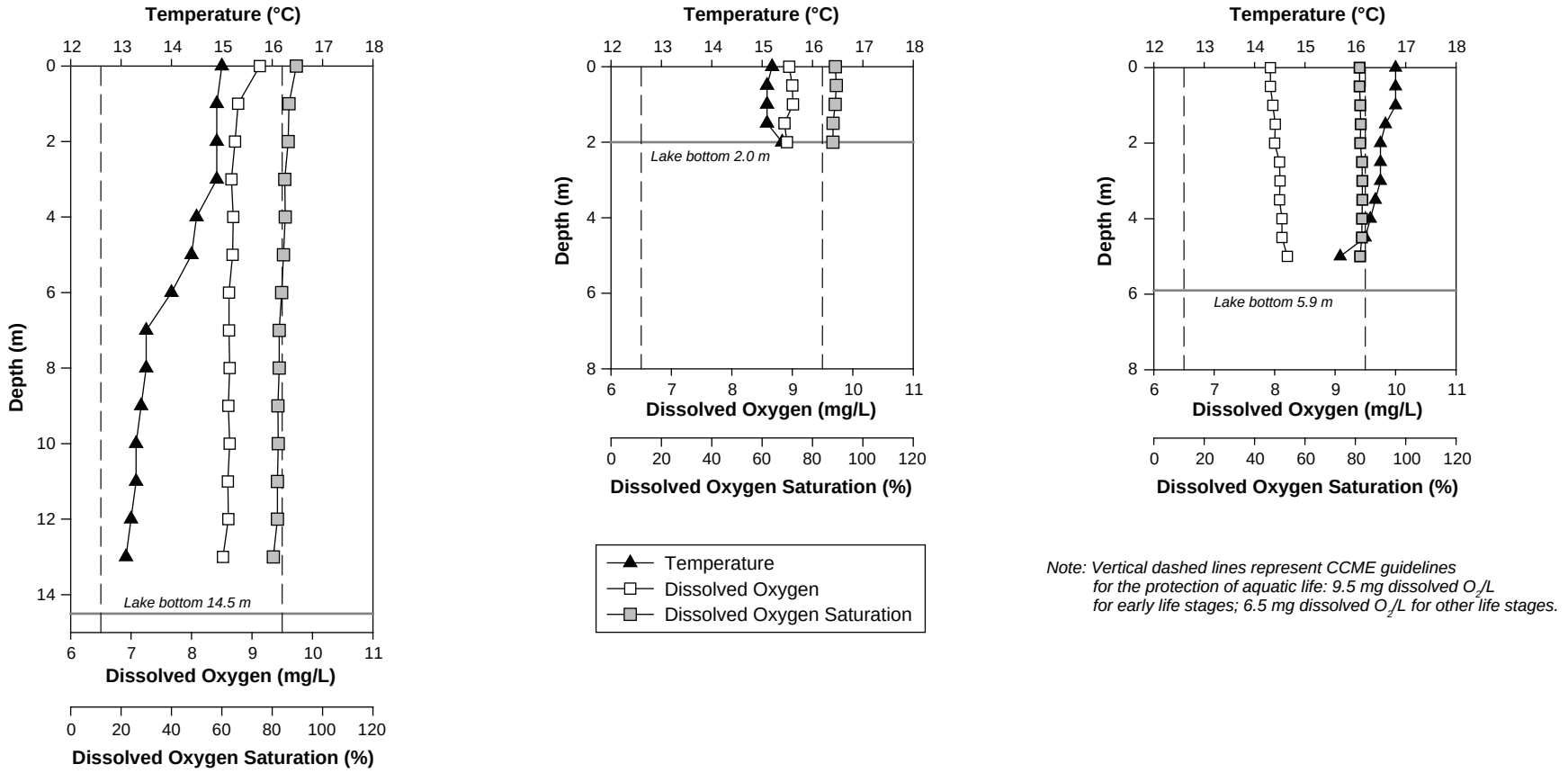
Table 3.1-1. Secchi and Euphotic Zone Depths for the Back River Lakes, August 2011

Lake	Lake Depth (m)	Secchi Depth D_s (m)	Euphotic Zone Depth EZD (m)
Llama	14.5	9.2	bottom (24.9 m)
Umwelt	2.0	bottom	
Giraffe	5.9	4	bottom (10.8 m)
Goose Neck	3.5	bottom	
Goose Central	5.2	bottom	
Goose Tail	2.5	bottom	
Propellor	7.8	bottom	
Reference B	5.3	4.5	bottom (12.2 m)

Note: Euphotic Zone Depth is the depth at which light penetration is 1% of the surface irradiance.

3.1.3 Stream Temperature and Dissolved Oxygen

Surface temperature and dissolved oxygen were measured at all streams in August and September 2011 (Table 3.1-2). Streams had higher water levels and flow in June, and lower levels and flow in August. Echo OF was completely dry in August, and sections of most streams were either dry or flowed underground or through boulder fields. By September, water levels and flow were higher, and no dry or underground sections were observed. Plate 3.1-1 shows photos of stream sites during summer sampling.



Note: Vertical dashed lines represent CCME guidelines for the protection of aquatic life: 9.5 mg dissolved O_2/L for early life stages; 6.5 mg dissolved O_2/L for other life stages.

Figure 3.1-2a

Sabina GOLD & SILVER CORP.

Summer Dissolved Oxygen and Temperature Profiles in Lakes, Back River Project, August 2011

Figure 3.1-2a

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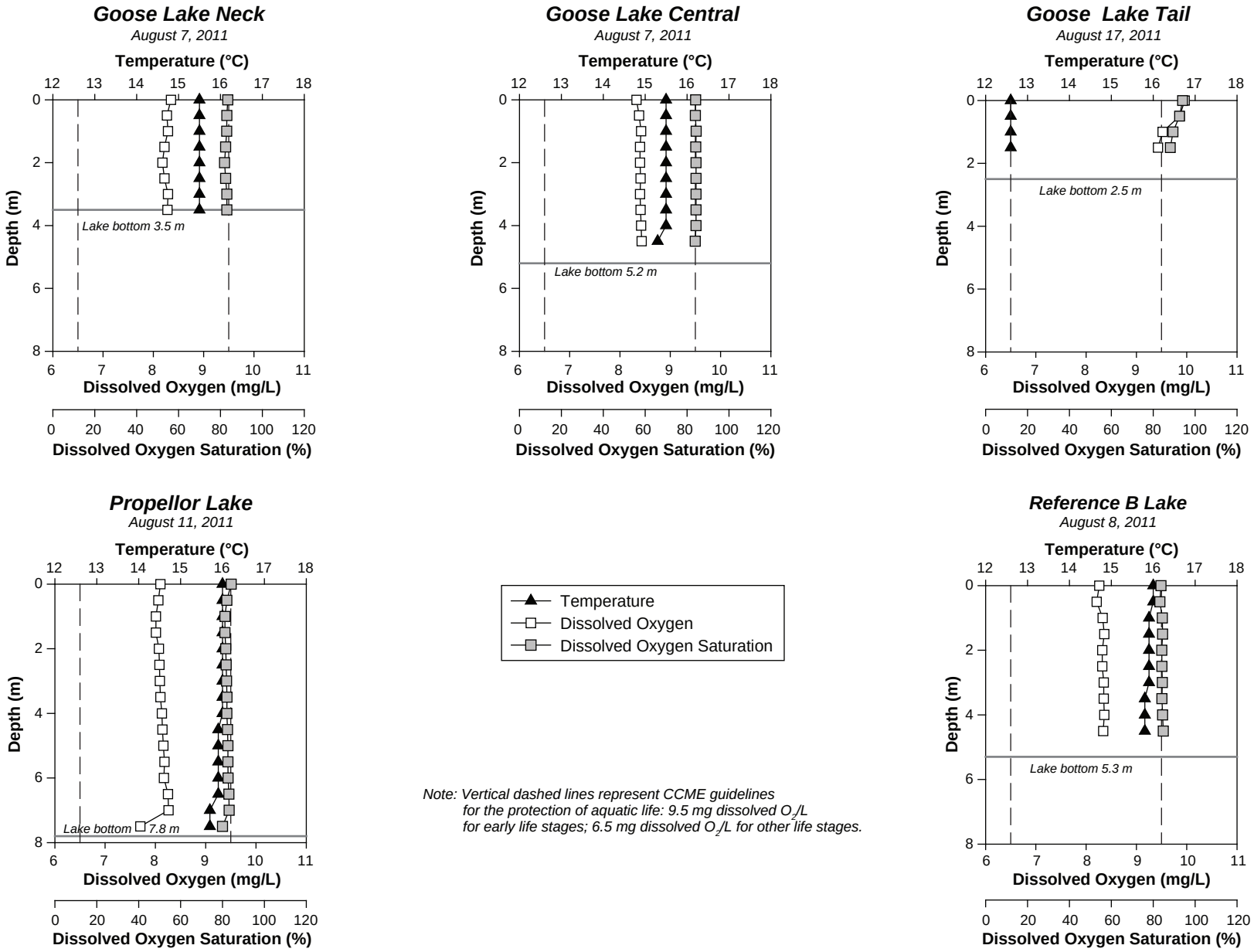


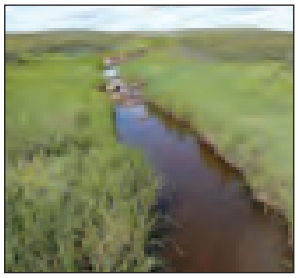
Figure 3.1-2b

Sabina GOLD & SILVER CORP.

Summer Dissolved Oxygen and Temperature Profiles in Lakes, Back River Project, August 2011

Figure 3.1-2b

Rescan™ Engineers & Scientists



Chair Outflow

Small stream through floodplain.

Goose Outflow

Short medium sized stream linking to close by lakes, cobbles.

Llama Outflow

Medium stream through large boulder field.

Propellor Outflow

Large stream draining largest lake in the area. Runs through boulder field.

Echo Outflow

Very small stream through flood plain, dry during summer sampling.

Propellor Downstream

Large stream down-stream from the source lake, cobbles and boulders.

Giraffe Outflow

Short medium sized stream linking to close by lakes, cobbles.

Reference B Outflow

Small stream through floodplain.

Wolf Outflow

Small stream running through flood plain.

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Streams during August Sampling, Back River Project, 2011

Plate 3.1-1

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Table 3.1-2. Temperature and Dissolved Oxygen in Streams, Back River Project, 2011

Stream	August			September		
	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen Saturation (%)	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen Saturation (%)
Chair OF	17.7	8.35	87.7	8.3	10.72	91.0
Llama OF	9.4	3.73	31.5	7.4	9.60	79.7
Echo OF	*nc*	*nc*	*nc*	8.3	9.61	82.1
Giraffe OF	12.9	9.11	85.1	8.1	10.15	84.9
Wolf OF	10.6	9.30	84.1	5.3	10.90	85.9
Goose OF	12.7	9.37	87.3	8.7	10.00	85.2
Propellor OF	14.2	7.88	76.6	8.1	9.51	80.9
Propellor D/S	13.4	8.82	84.5	7.6	10.10	84.0
Ref. B OF	17.6	6.81	71.3	5.1	10.38	81.5

Note: nc = not collected; Echo OF was dry in August.

3.2 LAKE WATER QUALITY

Lake water quality samples were collected in April (ice-covered) and August (open-water) 2011. Lake water quality data collected in 2011 are presented graphically in Figures 3.2-1a to 3.2-6. Raw water quality data for lakes are presented in Appendices 3.2-1 and 3.2-2 (QA/QC data).

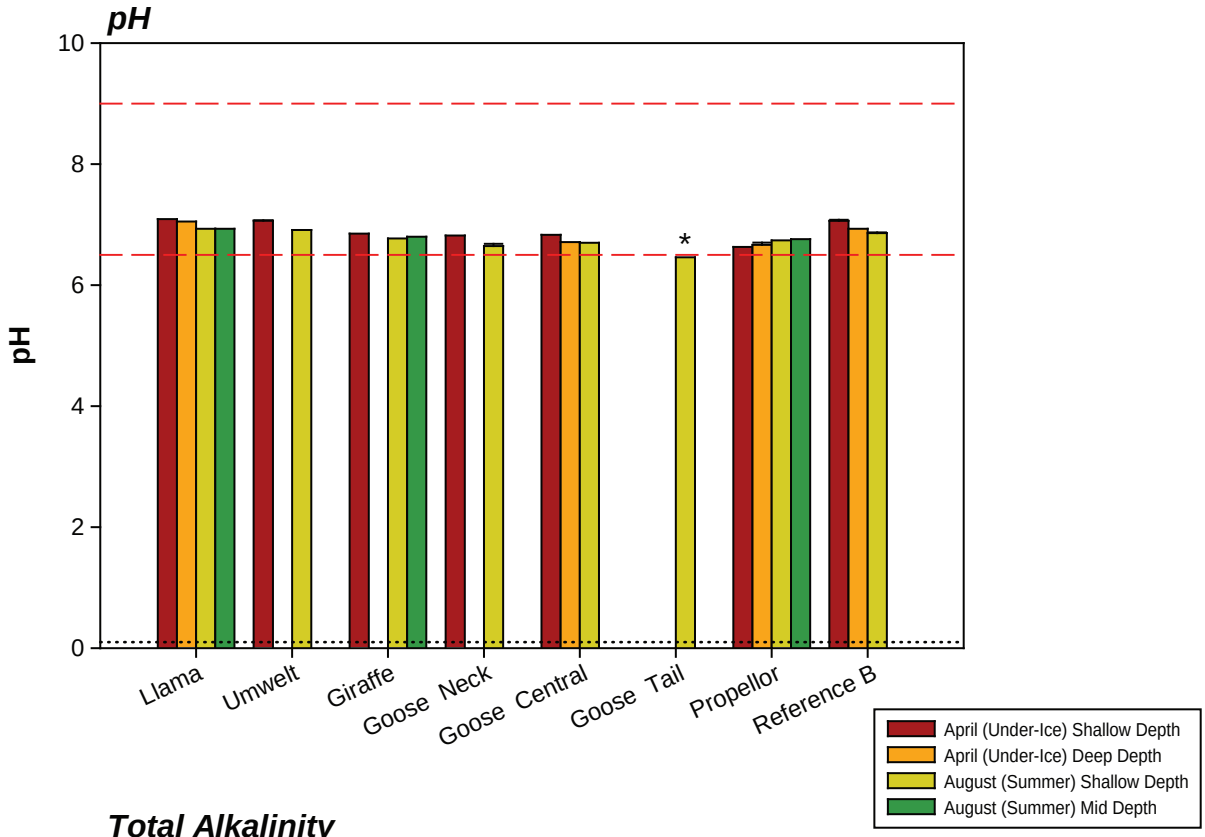
3.2.1 Physical Parameters

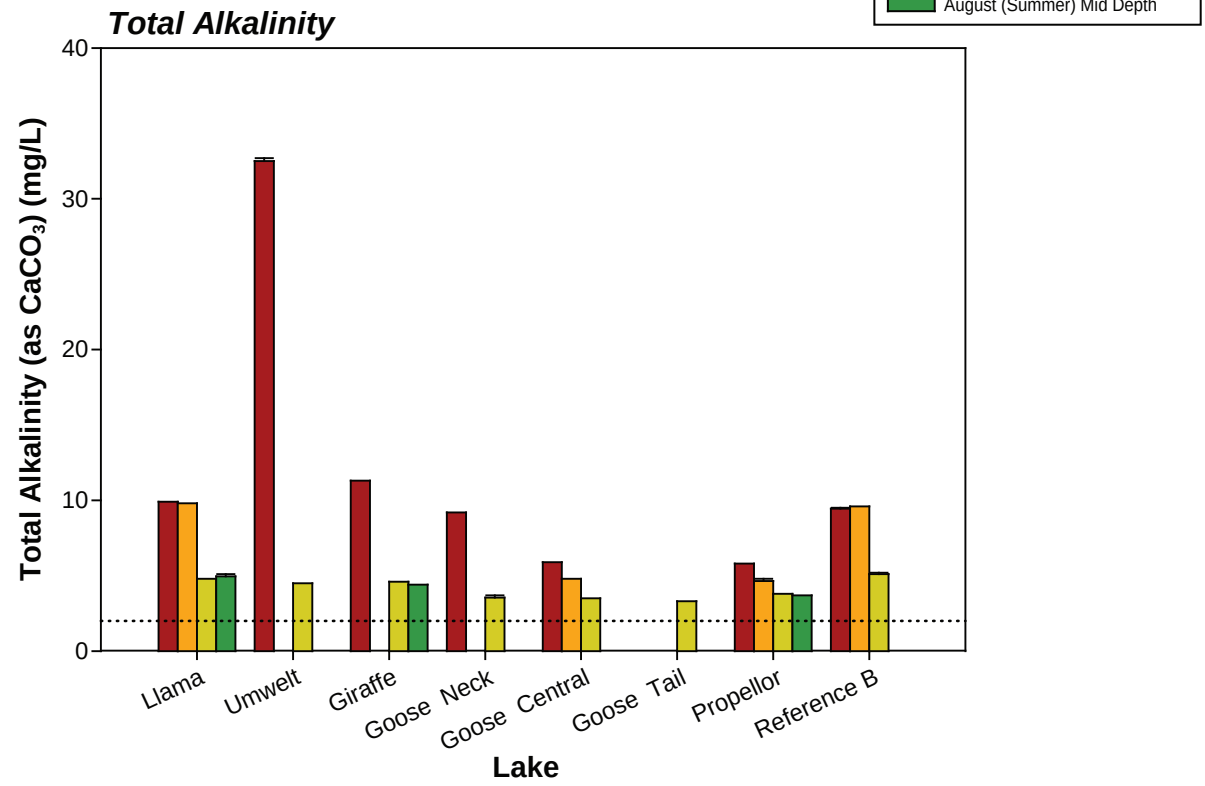
The lakes had slightly acidic to neutral pH values ranging from 6.46 at Goose Lake Tail to 7.08 at Reference B Lake (shallow depth) (Figure 3.2-1a). Only Goose Lake Tail during August was outside the CCME pH guideline of 6.5 to 9.0 (CCME 2011b) with a pH of 6.46. The Project lakes were poorly buffered (total alkalinity below 40 mg $CaCO_3$/L), with total alkalinity ranging from 3.3 mg/L $CaCO_3$ at Goose Lake Tail (summer) to 11.3 mg/L $CaCO_3$ at Giraffe Lake (winter), with increased alkalinity in Umwelt Lake in the winter (averaging 32.5 mg/L $CaCO_3$) (Figure 3.2-1a).

Hardness, conductivity and total dissolved solids followed similar patterns to alkalinity, with Umwelt Lake having elevated levels of each parameter during winter sampling, over twice as high as other lake samples (Figure 3.2-1b). This reflected the increased calcium and magnesium concentrations at Umwelt Lake, and may have resulted from the extrusion of salts from the lake ice into a small volume of water. The sampled lakes generally had soft water (hardness less than 60 mg CaCO3/L) and low conductivity. Llama and Umwelt lakes had the highest total dissolved solids (TDS) concentrations generally ranging from 49 mg/L to 55 mg/L, with the exception of Umwelt Lake over winter which had 128 mg/L. Mean TDS concentrations at other lakes ranged from 11 mg/L to 55 mg/L and tended to be highest in winter.

3.2.2 Major Anions

Sulphate concentrations in lakes were highest over winter (Figure 3.2-2). The highest concentrations occurred at Umwelt (13.5 mg/L) and Giraffe lakes (14.9 mg/L), while all other lakes had concentrations below 8 mg/L. Propellor Lake and Reference B Lake had the lowest concentrations of sulphate between 1.8 mg/L and 3.4 mg/L.





Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (pH 0.1; alkalinity 2 mg/L).
Dashed lines represent CCME guideline for pH 6.5–9.

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pH and Alkalinity in Lakes, Back River Project, 2011

Figure 3.2-1a

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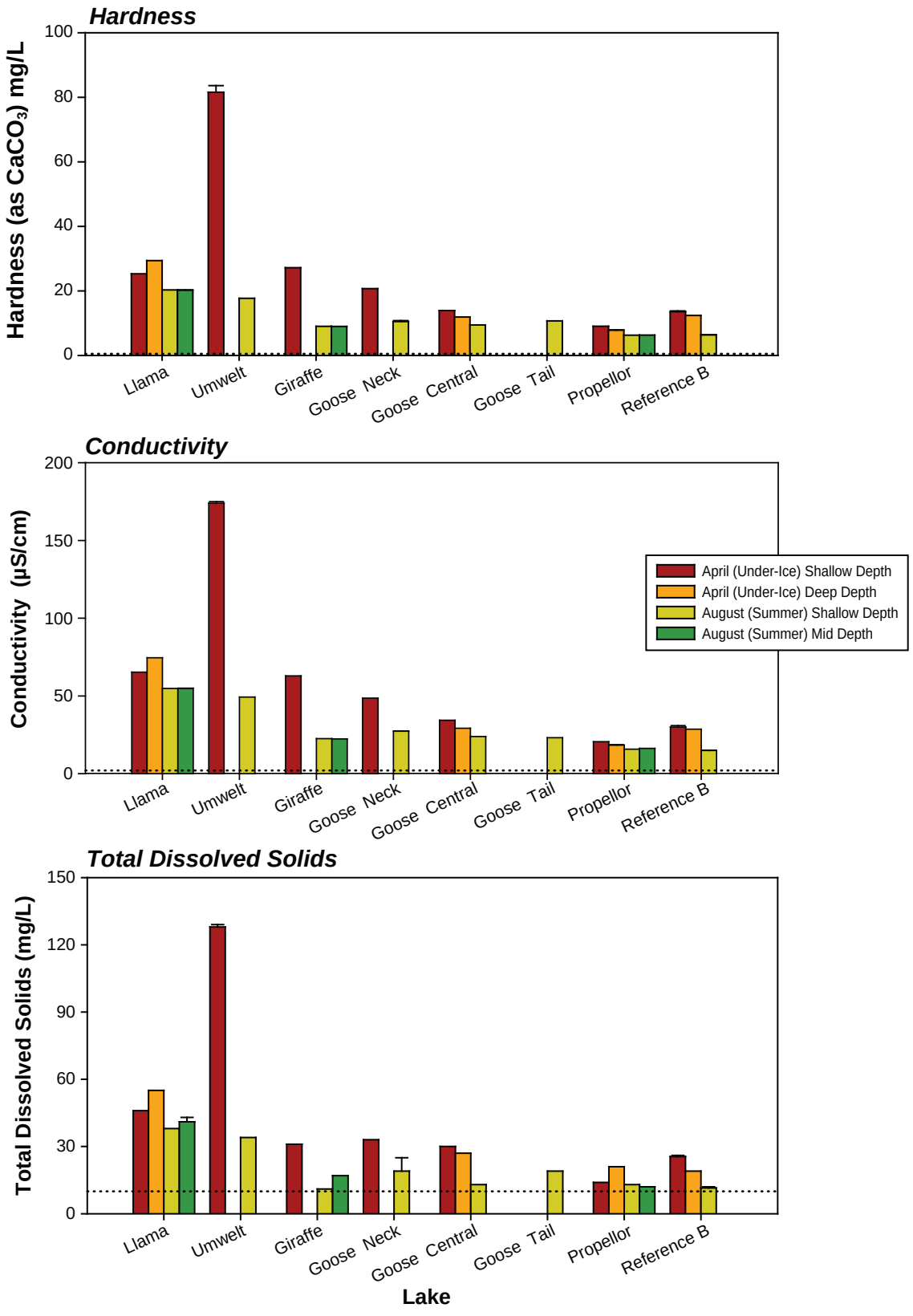

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (hardness 0.5 mg/L; conductivity 2.0 mS/cm; total disolved solids 10 mg/L).

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Hardness, Conductivity and Total Dissolved Solid Concentrations in Lakes, Back River Project, 2011

Figure 3.2-1b

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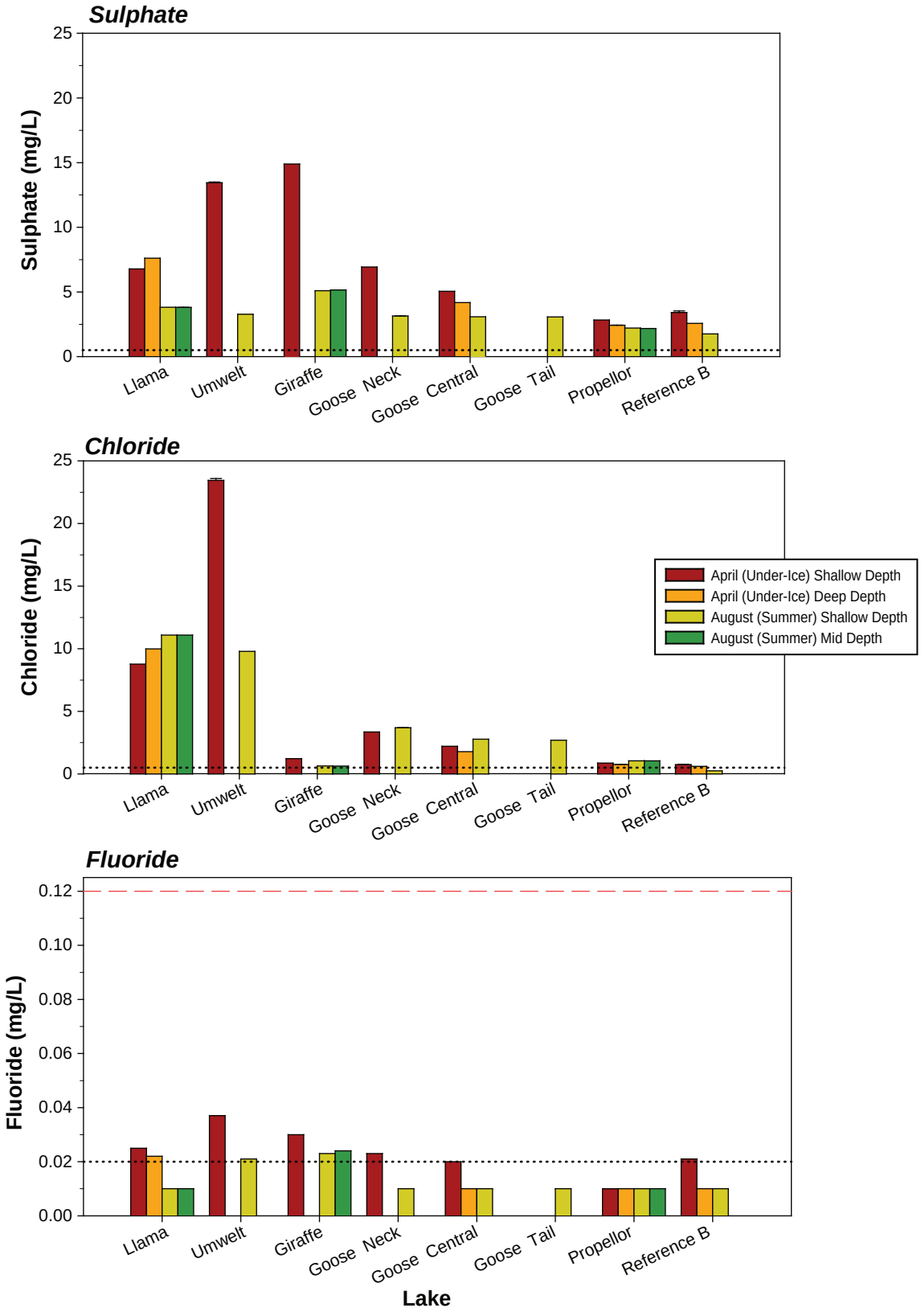

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (sulphate 0.5 mg/L; chloride 0.5 mg/L; fluoride 0.02 mg/L).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent the CCME guideline for fluoride (0.12 mg/L).
The CCME guideline for chloride is 640 mg/L (not shown).

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Sulphate, Chloride and Fluoride Concentrations in Lakes, Back River Project, 2011

Figure 3.2-2

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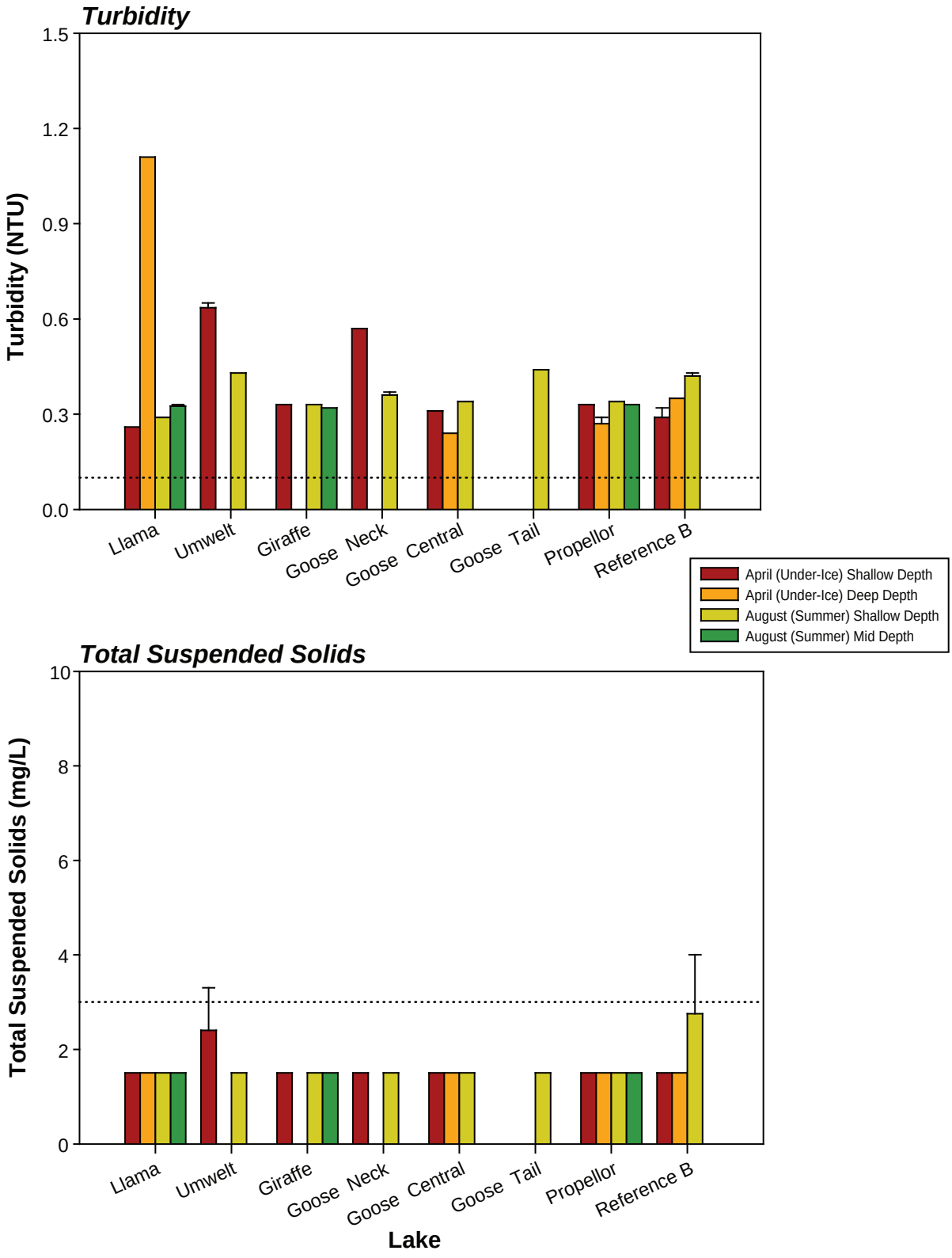

Note: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (turbidity 0.1 NTU; total suspended solids 3 mg/L).
Values below the detection limit are plotted at half the detection limit.
CCME guidelines for turbidity and total suspended solids are dependent upon background levels.

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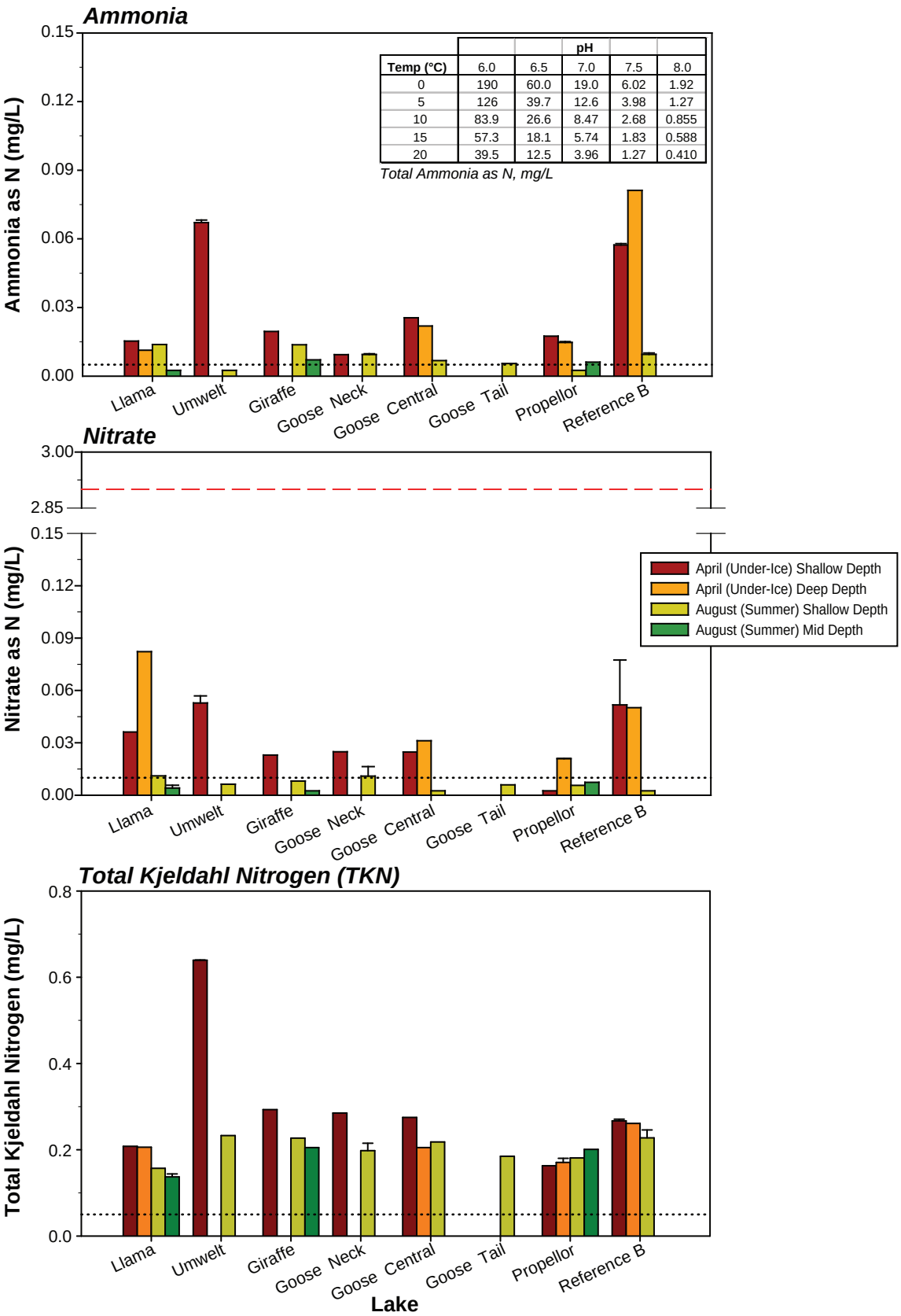
Turbidity and Total Suspended Solid Concentrations in Lakes, Back River Project, 2011

Figure 3.2-3

Rescan™ Engineers & Scientists



Temp (°C)	pH 6.0	6.5	7.0	7.5	8.0
0	190	60.0	19.0	6.02	1.92
5	126	39.7	12.6	3.98	1.27
10	83.9	26.6	8.47	2.68	0.855
15	57.3	18.1	5.74	1.83	0.588
20	39.5	12.5	3.96	1.27	0.410

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (ammonia 0.005 mg/L; nitrate 0.05 mg/L; TKN 0.05 mg/L).
Values below the detection limit are plotted at half the detection limit.
Inset table shows temperature- and pH-dependent CCME guideline for ammonia.
Dashed lines represent CCME guidelines for nitrate (2.9 mg/L).
Nitrite concentrations were always below detection limits (0.001 mg/L) so were not plotted.

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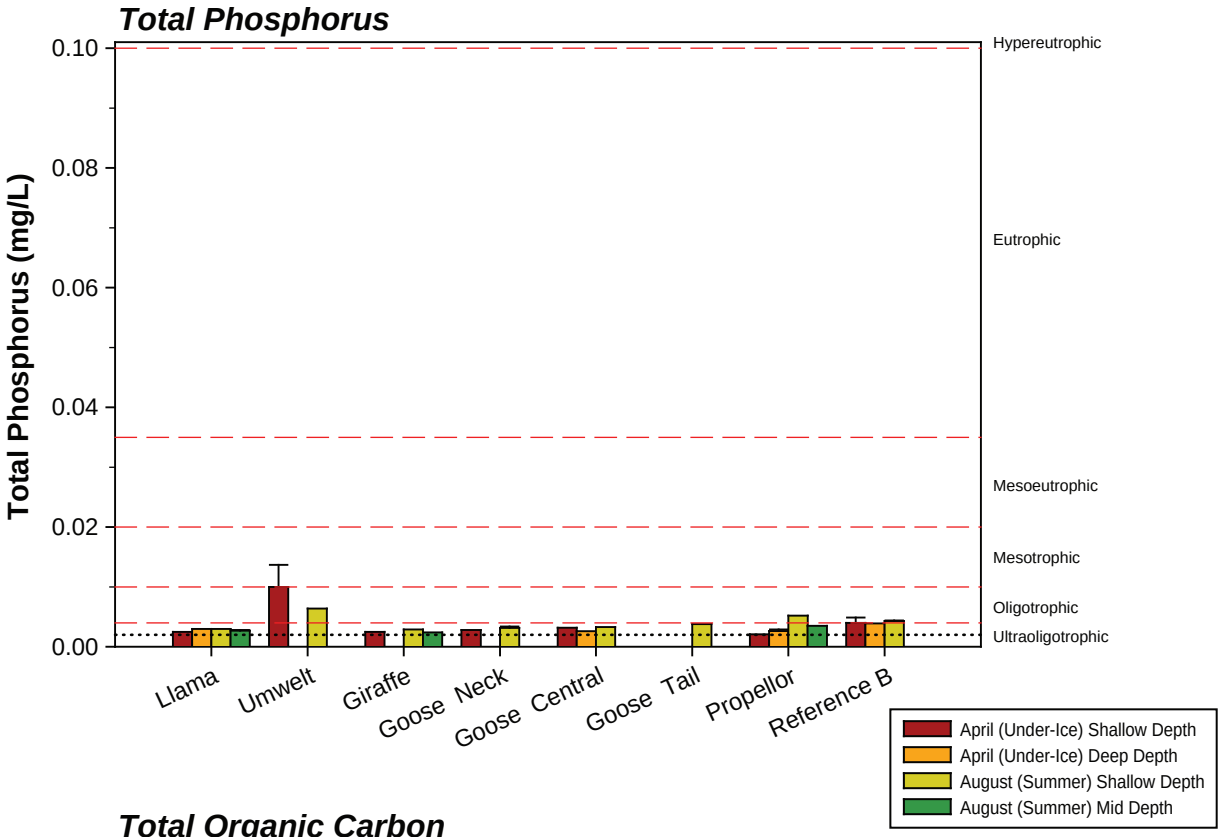
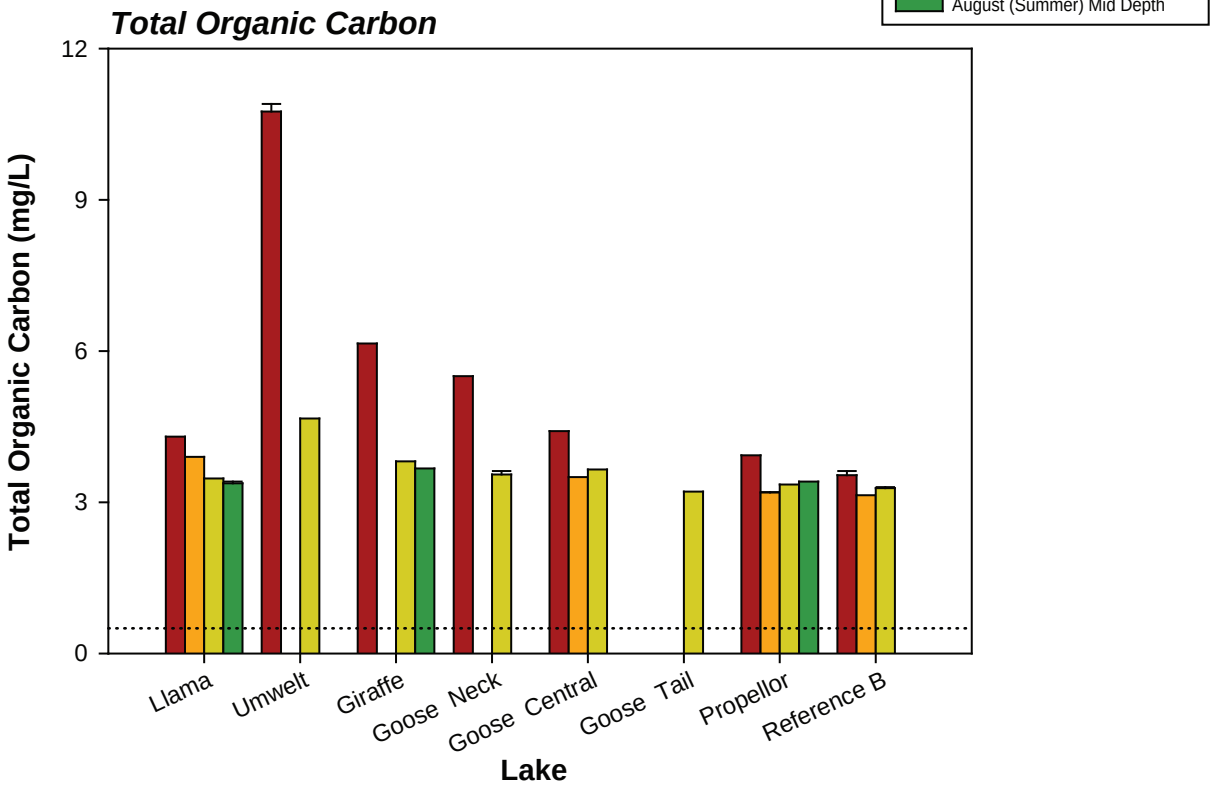
Ammonia, Nitrate and Total Kjeldahl Nitrogen Concentrations in Lakes, Back River Project, 2011

Figure 3.2-4a

Rescan™ Engineers & Scientists





Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (total phosphorus 0.002 mg/L; TOC 0.5 mg/L).
Dashed lines represents CCME trigger ranges (<0.004 mg/L = ultraoligotrophic; 0.004–0.010 mg/L = oligotrophic; 0.01–0.02 mg/L = mesotrophic; 0.02–0.035 mg/L = mesoeutrophic; 0.035–0.1 mg/L = eutrophic; >0.1 mg/L = hypereutrophic).

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Total Phosphorus and Total Organic Carbon Concentrations in Lakes, Back River Project, 2011

Figure 3.2-4b

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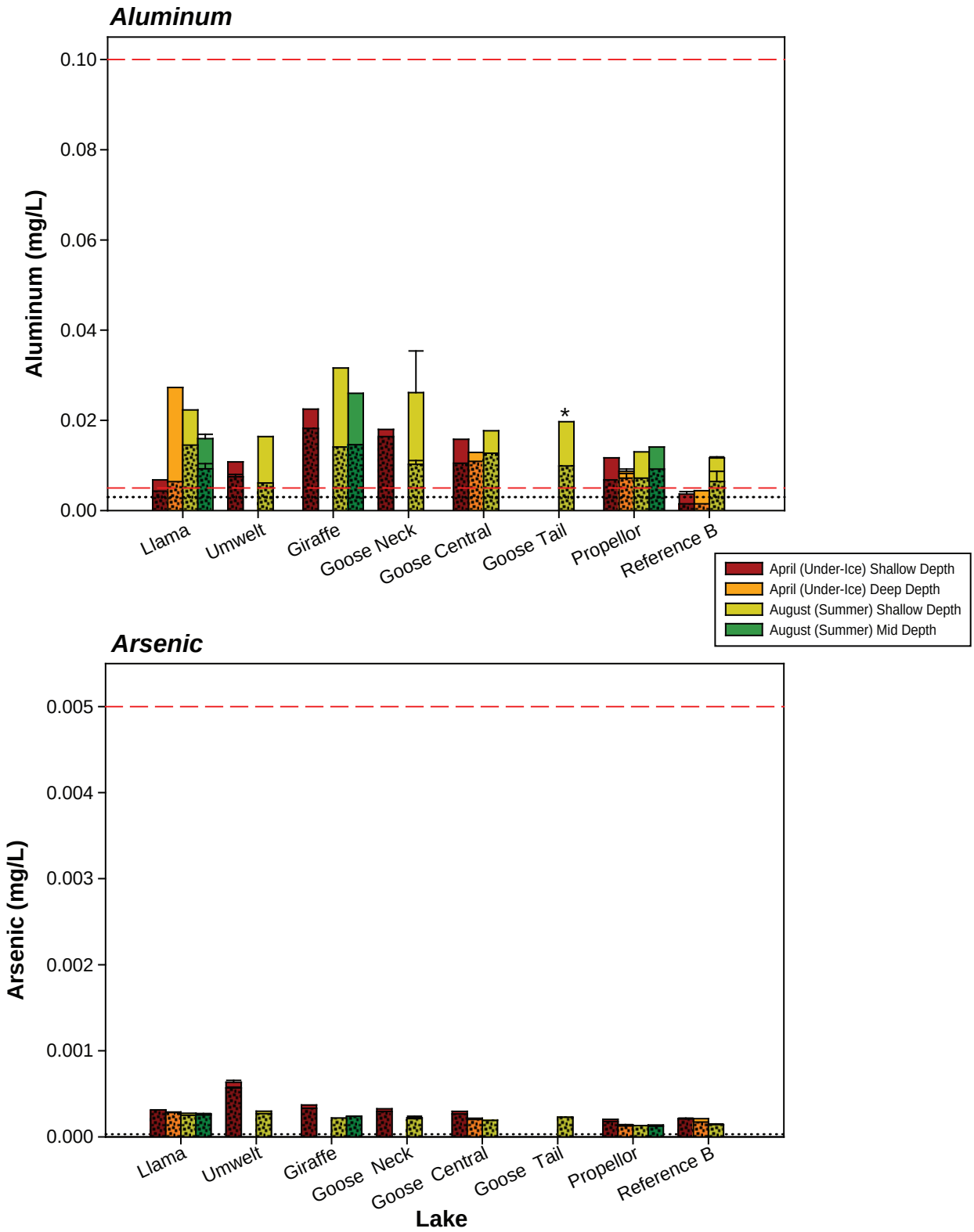

Notes: Error bars represent standard error of the mean of replicates.
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dotted lines represent analytical detection limits (aluminum 0.003 mg/L; arsenic 0.00003 mg/L).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guidelines.
CCME guidelines for aluminum are pH-dependent (0.005 mg/L at pH less than 6.5; 0.1 mg/L at pH greater than or equal to 6.5).
pH was above 6.5 at all sites except Goose Lake Tail (6.46).
CCME guidelines for arsenic are 0.005 mg/L.
** Indicates mean total metal values that are higher than CCME guidelines.*

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Aluminum and Arsenic Concentrations in Lakes, Back River Project, 2011

Figure 3.2-5a

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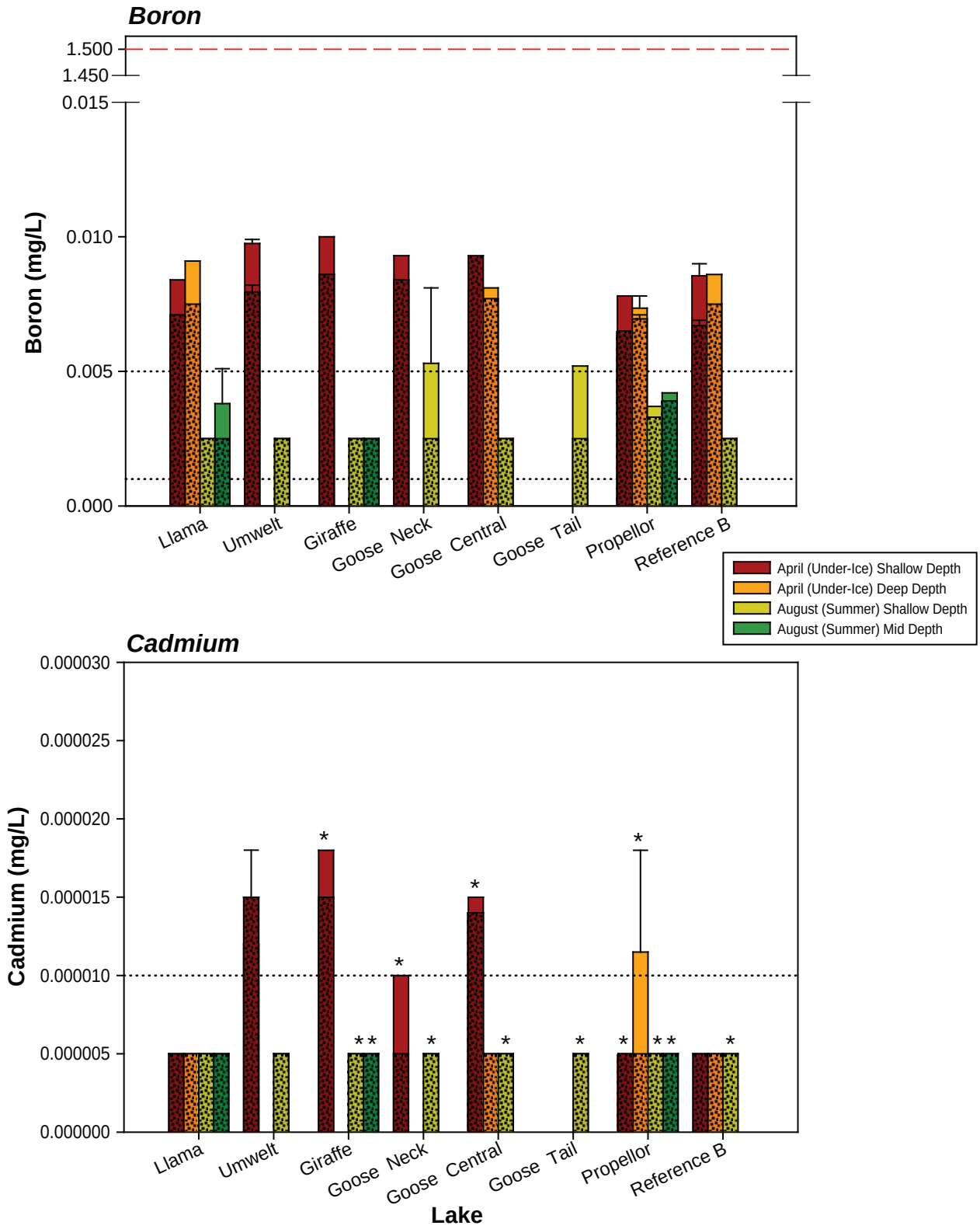

Notes: Error bars represent standard error of the mean of replicates.
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dotted lines represent analytical detection limits (boron 0.001 or 0.005 mg/L; cadmium 0.00001 mg/L).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guidelines (boron 1.5 mg/L long term and 29 mg/L short term [not shown]).
The interim CCME guideline for cadmium (in mg/L) is calculated using the equation $10^{(0.86[\log(\text{hardness})]-3.2)}/1000$.
The CCME guideline for hexavalent chromium (0.001 mg/L) and interim guideline for trivalent chromium (0.0089 mg/L) [not shown].
** Indicates mean total metal values that are higher than CCME guidelines (hardness corrected in the case of cadmium).*

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Boron and Cadmium Concentrations in Lakes, Back River Project, 2011

Figure 3.2-5b

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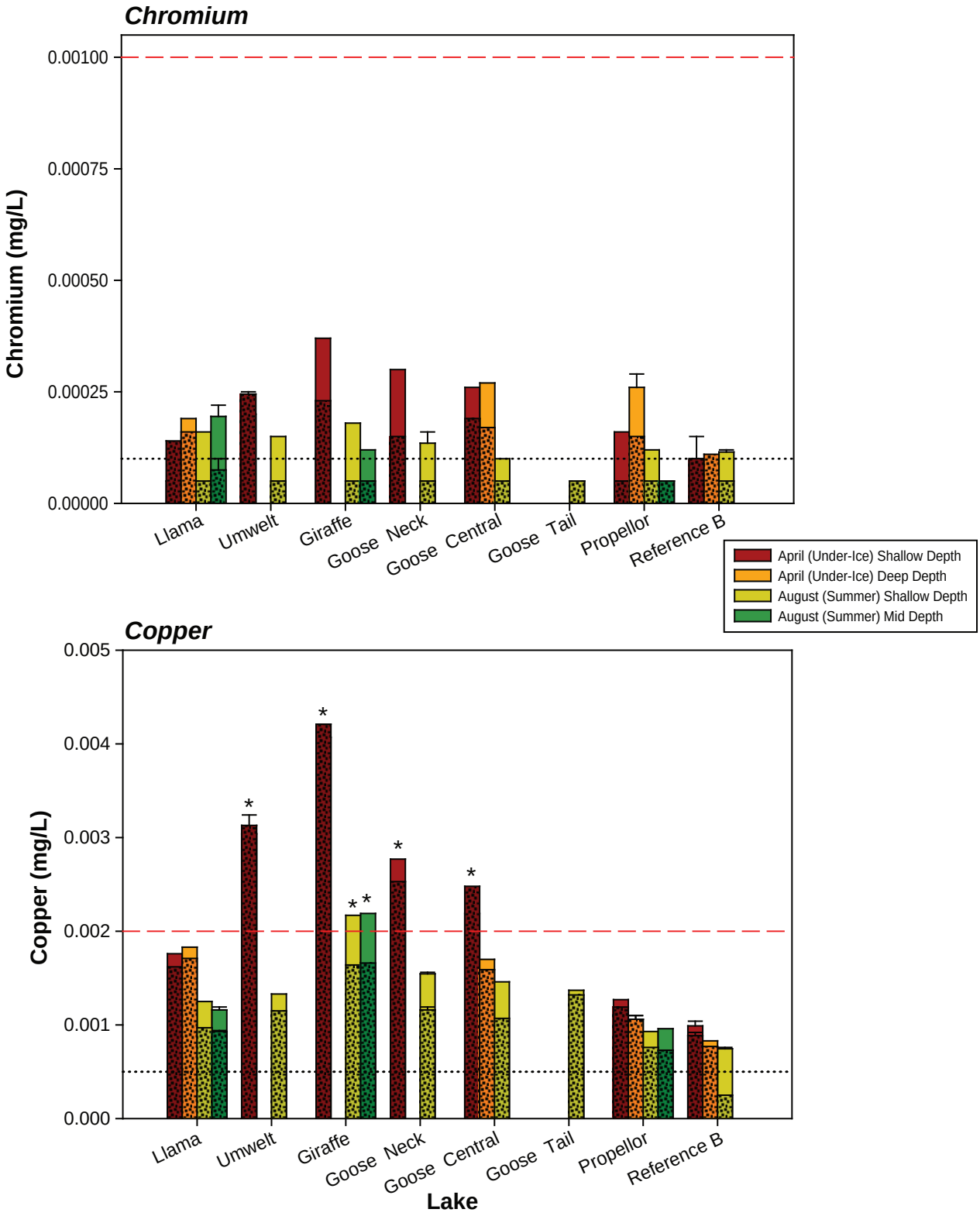

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (copper 0.0005 mg/L; chromium 0.0001 mg/L).
Values below the detection limit are plotted at half the detection limit.
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dashed lines represent CCME guidelines.
The CCME guideline for hexavalent chromium (0.001 mg/L) and interim guideline for trivalent chromium (0.0089 mg/L) [not shown].
The CCME guideline for copper (in mg/L) is calculated using the equation: $e^{(0.8545[\ln(\text{hardness})]-1.465)} * 0.0002$.
Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.
** Indicates mean total metal values that are higher than CCME guidelines (hardness corrected in the case of cadmium).*

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Chromium and Copper Concentrations in Lakes, Back River Project, 2011

Figure 3.2-5c

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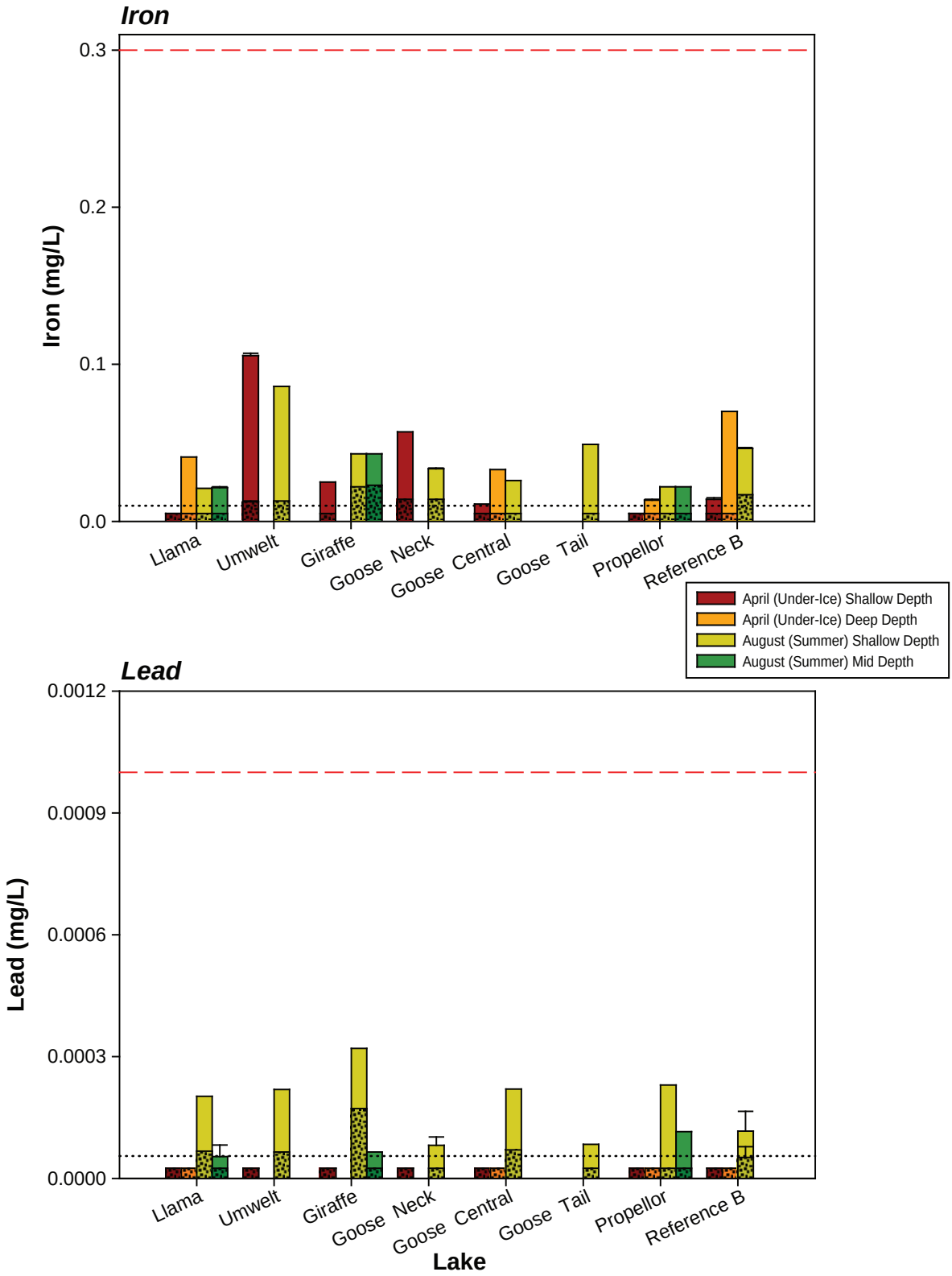

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (iron 0.01 mg/L; lead 0.00005 mg/L).
Values below the detection limit are plotted at half the detection limit.
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dashed lines represent CCME guidelines.
The CCME guideline for iron is 0.3 mg/L.
The CCME guideline for lead (in mg/L) is calculated using the equatione $e^{(1.273[\ln(\text{hardness})]-4.705)}/1000$, and is a minumum of 0.001 mg/L regardless of hardness.

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Iron and Lead Concentrations in Lakes, Back River Project, 2011

Figure 3.2-5d

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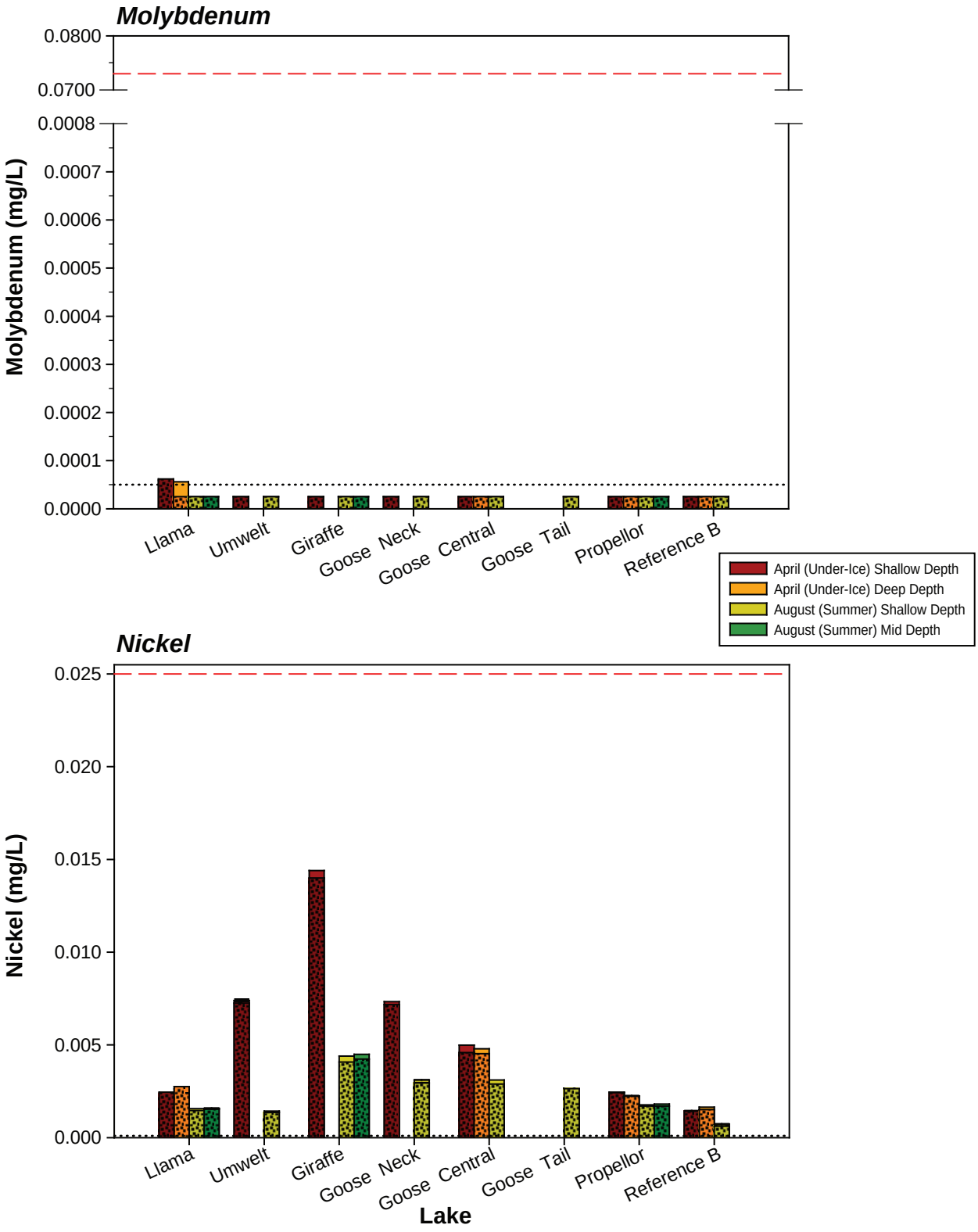

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (molybdenum 0.00005 mg/L; nickel 0.0001 mg/L).
Values below the detection limit are plotted at half the detection limit.
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Red dashed lines represent CCME guidelines.
The interim CCME guideline for molybdenum is 0.073 mg/L.
The CCME guideline for nickel (in mg/L) can be calculated using the equation $e^{(1.273[\ln(\text{hardness})]-4.705)}/1000$.
Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

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Molybdenum and Nickel Concentrations in Lakes, Back River Project, 2011

Figure 3.2-5e

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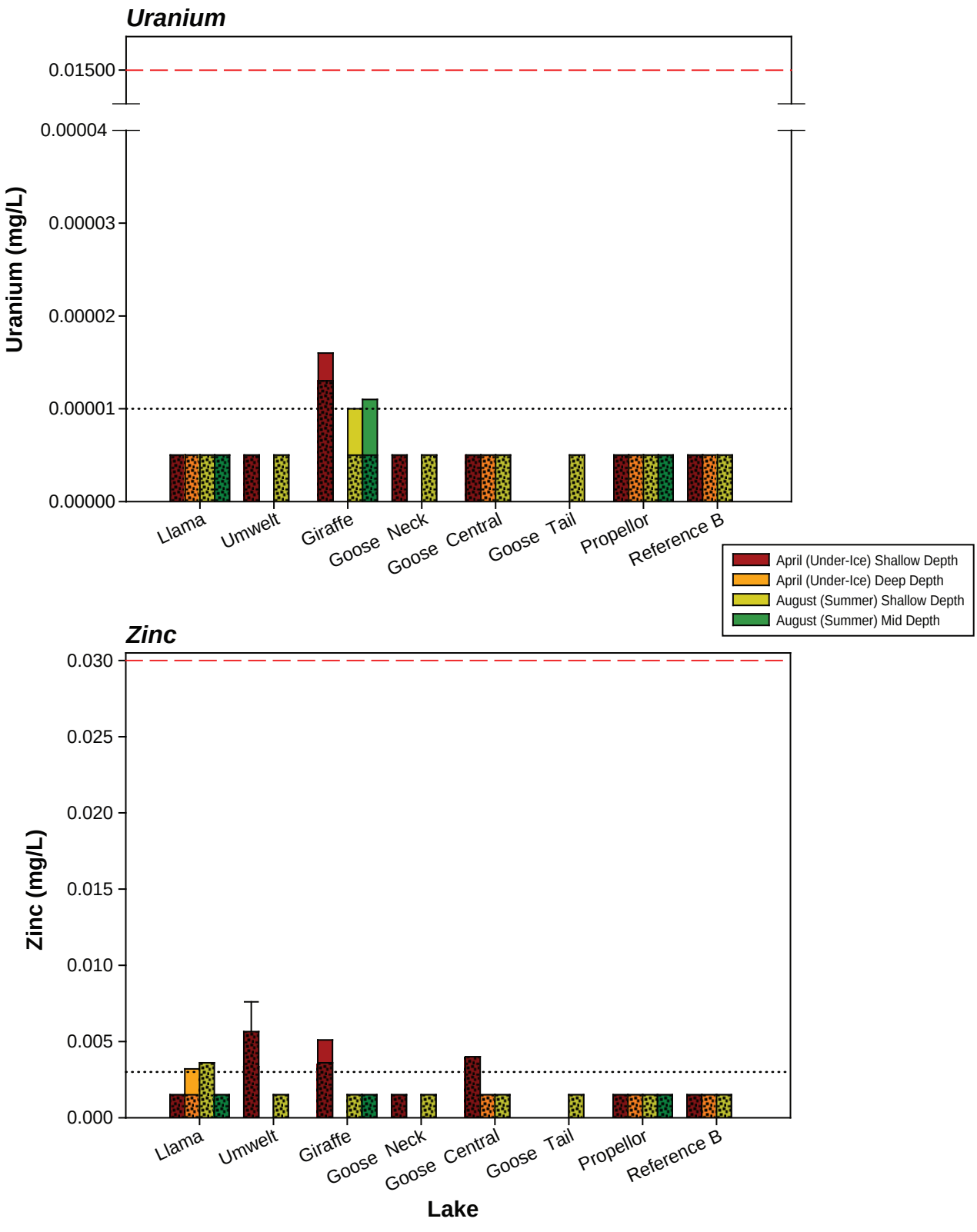

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (uranium 0.00001 mg/L; zinc 0.003 mg/L).
Values below the detection limit are plotted at half the detection limit.
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dashed lines represent CCME guidelines (uranium long term 0.015 mg/L and short term 0.033 mg/L; zinc 0.03 mg/L).

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Uranium and Zinc Concentrations in Lakes, Back River Project, 2011

Figure 3.2-5f

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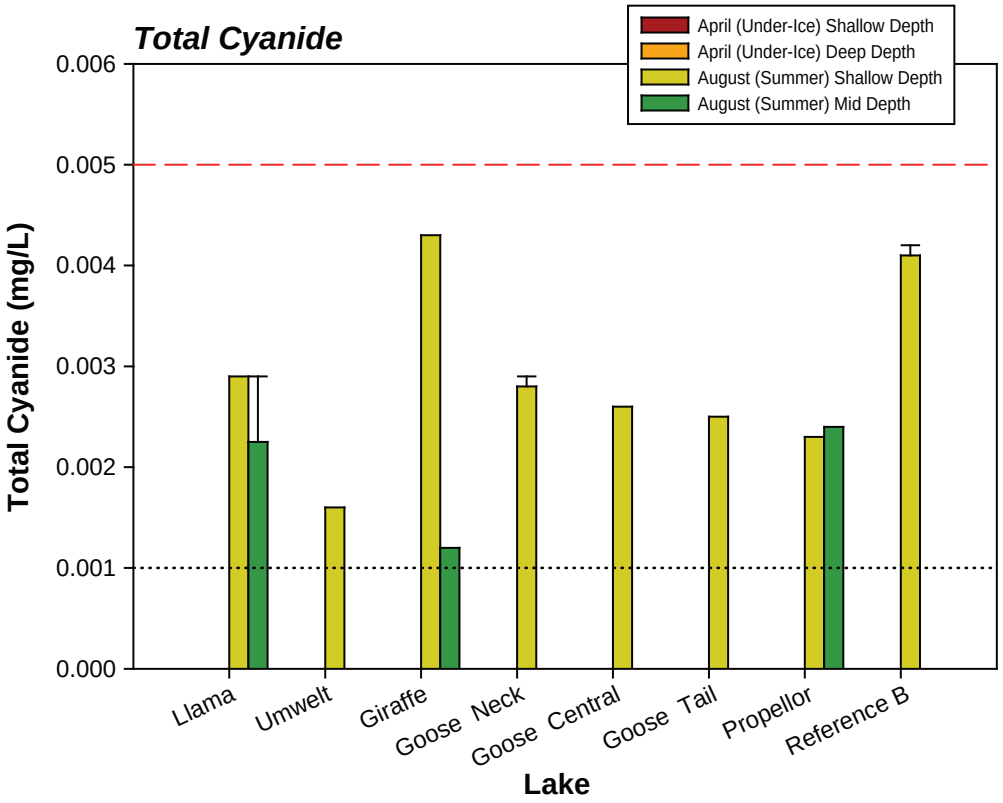

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (total cyanide 0.001 mg/L).
Dashed line represents CCME guideline for cyanide as free CN (0.005 mg/L).
Free CN was not plotted as 93 % of samples were below detection limits, and all were below the CCME guideline.

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Total Cyanide Concentrations in Lakes, Back River Project, 2011

Figure 3.2-6

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Highest chloride concentrations occurred at Umwelt Lake over winter, with a mean of 23.5 mg/L, whilst all other lake sampling sessions had concentrations less than 12 mg/L (Figure 3.2-2). Lake fluoride concentrations were generally higher in the winter, and often below detection limits in summer (Figure 3.2-2). The highest fluoride concentrations were in Umwelt Lake over winter at 0.037 mg/L, well below the CCME interim guideline of 0.12 mg/L (CCME 2011b).

Higher sulphate and chloride concentrations in Umwelt and Llama have previously been inferred as a result of deep groundwater influence (Rescan 2010).

3.2.3 Suspended Material

Turbidity levels were low in all lakes, generally below 0.64 NTU. The exception was Llama Lake where turbidity was 1.1 NTU near the bottom over winter. The lakes sampled had low levels of total suspended solids (TSS), with concentrations generally below detection limits (Figure 3.2-3). The low turbidity and TSS allowed greater light penetration in the water column, creating the high water clarity observed with the Secchi depths.

3.2.4 Nutrients

Nutrient concentrations across the eight lakes were frequently below detection and the lakes can be considered nutrient-poor (Figure 3.2-4a). Nutrient concentrations varied seasonally, with nutrients highest over winter due to reduced biological uptake and increased remineralization.

Overall, ammonia and nitrate concentrations showed similar patterns across lakes, while nitrite concentrations were consistently below detection limits. The highest ammonia concentrations were at Reference B Lake and Umwelt Lake over winter, ranging from 0.057 mg/L to 0.081 mg/L. All other lakes and seasons had concentrations less than 0.026 mg/L. Nitrate concentrations were highest in winter at Llama, Umwelt and Reference B lakes (0.036 mg/L to 0.082 mg/L), and lowest in summer in all lakes (below 0.011 mg/L).

Ortho-phosphate concentrations were below detection for all lakes and total phosphorus concentrations were generally low (Figure 3.2-4b). The lakes sampled can be classified as ultra-oligotrophic (<0.004 mg/L) to oligotrophic (0.004 to 0.01 mg/L) based on the CCME trigger ranges for phosphorus in freshwater systems (CCME 2011b).

Much of the nutrients in the lakes were in forms not as readily available to plant life. The vast majority of both nitrogen and phosphorus were tied up in the organic fraction, with total total Kjeldahl nitrogen (TKN) generally a magnitude greater than nitrate and ammonia concentrations, and phosphate was only detectable in the total phase.

Total organic carbon (TOC) concentrations in lakes were highest in shallow winter waters (Figure 3.2-4b). Lake TOC concentrations ranged between 3.2 mg/L and 6.2 mg/L, except in Umwelt Lake where levels reached 10.8 mg/L in April.

3.2.5 Metals

Lakes generally had low metal concentrations, with higher concentrations occurring in the winter for most lakes. Metals concentrations can be higher during the winter due to natural processes, including solute exclusion during ice formation, changes in redox chemistry, increased remineralization, and decreased biological uptake.

Overall, the lakes tended to have similar metal concentrations, although some patterns appeared as Giraffe Lake often had the highest concentrations and Reference B often had the lowest. Graphs for all metals with CCME guidelines are presented in Figures 3.2-5a to 3.2-5f.

Total aluminum concentrations in lakes ranged from 0.0037 mg/L to 0.032 mg/L and was lowest in Reference B Lake (Figure 3.2-5a). Total arsenic concentrations ranged from 0.00013 mg/L to 0.00037 mg/L and were highest in winter, particularly in Umwelt Lake (0.00063 mg/L) (Figure 3.2-5a).

Lake total boron and cadmium concentrations were higher in winter than in summer, with most samples over the detection limits in winter and below in summer (boron 0.001 mg/L or 0.005 mg/L; cadmium 0.00001 mg/L) (Figure 3.2-5b).

Generally, total chromium and copper concentrations in lakes were highest over winter at Umwelt, Giraffe, Goose Neck and Goose Central, and lowest at Reference B (Figure 3.2-5c). This pattern was most pronounced in copper.

Lakes had similar total iron concentrations, with highest concentrations at Umwelt Lake (Figure 3.2-5d). Iron was one of the only metals where Reference B Lake had relatively high concentrations compared to the other lake sites.

Total lead concentrations were highest in summer, opposite to the trends seen in other metals (Figure 3.2-5d). During winter, most lakes had lead concentrations below detection limits (0.00005 mg/L). Total lead concentrations were similar across lakes in summer, with Giraffe Lake having the highest concentrations (0.00032 mg/L in summer).

Total nickel concentrations followed a similar pattern to chromium and copper, with highest concentrations tending to occur in winter in the western lakes (Llama, Umwelt, Giraffe and Goose) (Figure 3.2-5e).

The majority of lakes had total molybdenum, uranium and zinc concentrations below detection limits (Figures 3.2-5e and 3.2-5f). Exceptions were Llama (molybdenum, zinc), Umwelt (zinc), Giraffe (uranium and zinc), and Goose Lake Central (zinc).

Total mercury, selenium, silver and thallium concentrations were consistently below analytical detection limits in all study lakes and were not graphed.

3.2.6 Cyanides

Total cyanide concentrations in lakes ranged from 0.0012 mg/L to 0.0043 mg/L over summer (Figure 3.2-6), with the lowest and highest concentrations occurring in Giraffe Lake (mid depth and shallow depth). The vast majority (93%) of lakes had free cyanide concentrations below detection limits and all were below the CCME guideline for free cyanide (0.005 mg/L; CCME 2011b).

3.2.7 Comparison with CCME Guidelines

Table 3.2-1 gives the percentage of lake water quality samples that were above their respective parameter CCME guideline level, and Table 3.2-2 provides the factor by which the mean concentrations were higher than CCME guidelines.

All lakes had water quality within the CCME guidelines for pH, (6.5 to 9), except Goose Tail (pH: 6.46). All lakes had water quality below CCME guidelines for nitrate, nitrite, ammonia, fluoride, chloride and free cyanide. All lakes except Llama and Reference B exceeded CCME guidelines for at least one of the following metals: total aluminum, total cadmium and total copper.

Table 3.2-1. Lake Water Quality, Percent of Samples in which Concentrations are Higher than CCME Guidelines, Back River Project, 2011

Lake	Total Number of Samples Collected	CCME Guideline Value[a]:	pH	Ammonia (as N)	Fluoride (F)	Chloride (Cl)	Nitrate (as N)	Nitrite (as N)	Total Phosphorus	Free Cyanide
			6.5-9.0	temperature - and pH-dependent	0.12[b] mg/L	640 mg/L	2.935[b] mg/L	0.06 mg/L	Trophic Status[c]	0.005 mg/L
Llama	5		0	0	0	0	0	0	Ultraoligotrophic	0
Umwelt	3		0	0	0	0	0	0	Oligotrophic - Mesotrophic	0
Giraffe	3		0	0	0	0	0	0	Ultraoligotrophic	0
Goose Neck	3		0	0	0	0	0	0	Ultraoligotrophic	0
Goose Central	3		0	0	0	0	0	0	Ultraoligotrophic	0
Goose Tail	1		100	0	0	0	0	0	Ultraoligotrophic	0
Propellor	5		0	0	0	0	0	0	Ultraoligotrophic - Oligotrophic	0
Reference B	5		0	0	0	0	0	0	Ultraoligotrophic - Oligotrophic	0
Total	**28**									

Lake	Total Number of Samples Collected	CCME Guideline Value[a]:	Aluminum (Al) - Total	Arsenic (As) -Total	Boron (B) - Total	Cadmium (Cd) - Total	Chromium (Cr) - Total	Copper (Cu) - Total	Iron (Fe) - Total	Lead (Pb) - Total
			0.005-0.1[d] mg/L	0.005 mg/L	Short term 29 mg/L; Long term 1.5 mg/L	hardness-based equation[be]	Cr (VI) 0.001[bf] mg/L	hardness dependent ≥0.002[g] mg/L	0.3 mg/L	hardness dependent ≥0.001[h] mg/L
Llama	5		0	0	0	0	0	0	0	0
Umwelt	3		0	0	0	0	0	66.6	0	0
Giraffe	3		0	0	0	100	0	100	0	0
Goose Neck	3		0	0	0	100	0	33.3	0	0
Goose Central	3		0	0	0	66.6	0	33.3	0	0
Goose Tail	1		100	0	0	0	0	0	0	0
Propellor	5		0	0	0	20	0	0	0	0
Reference B	5		0	0	0	0	0	0	0	0
Total	**28**									

Lake	Total Number of Samples Collected	CCME Guideline Value[a]:	Mercury (Hg) - Total	Molybdenum (Mo) - Total	Nickel (Ni) - Total	Selenium (Se) - Total	Silver (Ag) - Total	Thallium (Tl) - Total	Uranium (U) - Total	Zinc (Zn) - Total
			0.000026[i] mg/L	0.073[b] mg/L	hardness dependent ≥0.025[j] mg/L	0.001 mg/L	0.0001 mg/L	0.0008 mg/L	Short term 0.033 mg/L; Long term 0.015 mg/L	0.03 mg/L
Llama	5		0	0	0	0	0	0	0	0
Umwelt	3		0	0	0	0	0	0	0	0
Giraffe	3		0	0	0	0	0	0	0	0
Goose Neck	3		0	0	0	0	0	0	0	0
Goose Central	3		0	0	0	0	0	0	0	0
Goose Tail	1		0	0	0	0	0	0	0	0
Propellor	5		0	0	0	0	0	0	0	0
Reference B	5		0	0	0	0	0	0	0	0
Total	**28**									

All values represent percentages of 2011 samples that are both higher than the CCME guidelines and above detection limits.

a) Canadian water quality guidelines for the protection of aquatic life (CCME 2011)

b) Intermin guideline

c) <0.004 mg/L = ultraoligotrophic; 0.004 - 0.010 mg/L = oligotrophic; 0.01 - 0.02 mg/L = mesotrophic; 0.02 - 0.035 mg/L = mesoeutrophic; 0.035 - 0.1 mg/L = eutrophic; >0.1 mg/L = hypereutrophic

d) 0.005 mg/L at pH <6.5; 0.1 mg/L at pH ≥6.5

e) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000

f) Guideline concentration for hexavalent chromium. No concentrations were higher than the CCME guideline for trivalent chromium (0.0089 mg/L)

*g) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness*

h) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness

i) Guideline concentration for inorganic mercury

j) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness

Table 3.2-2. Lake Water Quality, Factor by which Average Concentrations are Higher than CCME Guidelines, Back River Project, 2011

Lake	Total Number of Samples Collected	CCME Guideline Value[a]:	pH*	Ammonia (as N)	Fluoride (F)	Chloride (Cl)	Nitrate (as N)	Nitrite (as N)	Total Phosphorus	Free Cyanide
			6.5-9.0	temperature- and pH-dependent	0.120[b] mg/L	640 mg/L	2.935[b] mg/L	0.06 mg/L	Trophic Status[c]	0.005 as free CN
Llama	5		-	-	-	-	-	-	Ultraoligotrophic	-
Umwelt	3		-	-	-	-	-	-	Oligotrophic - Mesotrophic	-
Giraffe	3		-	-	-	-	-	-	Ultraoligotrophic	-
Goose Neck	3		-	-	-	-	-	-	Ultraoligotrophic	-
Goose Central	3		-	-	-	-	-	-	Ultraoligotrophic	-
Goose Tail	1		exceed	-	-	-	-	-	Ultraoligotrophic	-
Propellor	5		-	-	-	-	-	-	Ultraoligotrophic - Oligotrophic	-
Reference B	5		-	-	-	-	-	-	Ultraoligotrophic - Oligotrophic	-
Total	**28**									

Lake	Total Number of Samples Collected	CCME Guideline Value[a]:	Aluminum (Al) - Total	Arsenic (As) -Total	Boron (B) - Total	Cadmium (Cd) - Total	Chromium (Cr) - Total	Copper (Cu) - Total	Iron (Fe) - Total	Lead (Pb) - Total
			0.005-0.1[d] mg/L	0.005 mg/L	Short term 29 mg/L; Long term 1.5 mg/L	hardness based equation[be]	Cr (VI) 0.001[bf] mg/L	hardness dependent ≥0.002[g] mg/L	0.3 mg/L	hardness dependent ≥0.001[h] mg/L
Llama	5		-	-	-	-	-	-	-	-
Umwelt	3		-	-	-	-	-	1.24	-	-
Giraffe	3		-	-	-	1.43	-	1.41	-	-
Goose Neck	3		-	-	-	1.10	-	-	-	-
Goose Central	3		-	-	-	1.59	-	-	-	-
Goose Tail	1		3.94	-	-	-	-	-	-	-
Propellor	5		-	-	-	2.14	-	-	-	-
Reference B	5		-	-	-	-	-	-	-	-
Total	**28**									

Lake	Total Number of Samples Collected	CCME Guideline Value[a]:	Mercury (Hg) - Total	Molybdenum (Mo) - Total	Nickel (Ni) - Total	Selenium (Se) - Total	Silver (Ag) - Total	Thallium (Tl) - Total	Uranium (U) - Total	Zinc (Zn) - Total
			0.000026[i] mg/L	0.073[b] mg/L	hardness dependent ≥0.025[j] mg/L	0.001 mg/L	0.0001 mg/L	0.0008 mg/L	Short term 0.033 mg/L; Long term 0.015 mg/L	0.03 mg/L
Llama	5		-	-	-	-	-	-	-	-
Umwelt	3		-	-	-	-	-	-	-	-
Giraffe	3		-	-	-	-	-	-	-	-
Goose Neck	3		-	-	-	-	-	-	-	-
Goose Central	3		-	-	-	-	-	-	-	-
Goose Tail	1		-	-	-	-	-	-	-	-
Propellor	5		-	-	-	-	-	-	-	-
Reference B	5		-	-	-	-	-	-	-	-
Total	**28**									

Values represent the factor by which average 2011 concentrations are higher than CCME guidelines.

Half the detection limit was substituted for values that were below the detection limit for the calculation of parameter averages.

Factors were not calculated in cases where all replicates were below detection limits.

The average 2011 concentration of a particular parameter may be below the CCME guideline concentration even if a percentage of samples is higher than this guideline concentration.

For hardness-dependent guidelines, the average hardness over all sampling periods was used to determine the site-specific CCME guideline.

a) Canadian water quality guidelines for the protection of aquatic life (CCME 2011)

b) Intermin guideline

c) <0.004 mg/L = ultraoligotrophic; 0.004 - 0.010 mg/L = oligotrophic; 0.01 - 0.02 mg/L = mesotrophic; 0.02 - 0.035 mg/L = mesoeutrophic; 0.035 - 0.1 mg/L = eutrophic; >0.1 mg/L = hypereutrophic

d) 0.005 mg/L at pH <6.5; 0.1 mg/L at pH ≥6.5

e) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000

f) Guideline concentration for hexavalent chromium. No concentrations were higher than the CCME guideline for trivalent chromium (0.0089 mg/L)

*g) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness*

h) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness

i) Guideline concentration for inorganic mercury

j) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness

**Note factor by which average concentrations exceeded pH guidelines was not calculated as pH guidelines are a range. Exceendences are shown for reference only.*

Llama and Umwelt Lake had higher hardness levels than other lakes, which resulted in higher site specific CCME guideline concentrations for parameters that are hardness dependent (total cadmium, copper, lead, and nickel). Despite this, Umwelt Lake had total copper concentrations on average 1.24 times the hardness-dependent CCME guideline levels. All other lakes had much lower hardness levels (i.e., were softer), meaning the hardness-dependent CCME guidelines were lower—sometimes below detection limits.

Giraffe Lake exceeded the hardness-dependent CCME guidelines for total cadmium and copper, on average by a factor of 1.43 and 1.41, respectively. Goose Lake Neck, Goose Lake Central, and Propellor Lake exceeded hardness-dependent CCME total cadmium guidelines on average by a factor of 1.10, 1.59, and 2.14.

3.2.8 Lake Water Quality Assurance/Quality Control

In total, two equipment blanks, two field blanks, and two travel blanks (accounting for 21% of lake samples collected) were processed as part of the 2011 lake water quality program.

The winter equipment and field blanks showed detectable levels of nitrogen (Appendix 3.2-2). Nitrate concentrations were 0.0165 mg/L in the winter equipment blank and TKN concentrations were 0.161 mg/L in the winter field blank. Both of these concentrations were amongst the lowest concentrations observed in lake samples so no modifications were made to the data.

The summer equipment and field blanks showed detectable levels of nitrate, some metals and cyanide. The summer equipment blank had nitrate concentrations of 0.012 mg/L, total aluminum concentrations of 0.0125 mg/L and dissolved aluminum concentrations of 0.0062 mg/L, and total lead concentrations of 0.000194 mg/L. The summer field blank had total cyanide concentrations of 0.002 mg/L, although free cyanide was below detection limits. These residual levels would likely have been removed during field sampling as the GO-FLOs remained in the water for one minute to equilibrate with the surrounding water before being triggered. Given that the QA/QC concentrations were near or below the lower concentrations observed in lake samples, this suggests the water quality data is reliable.

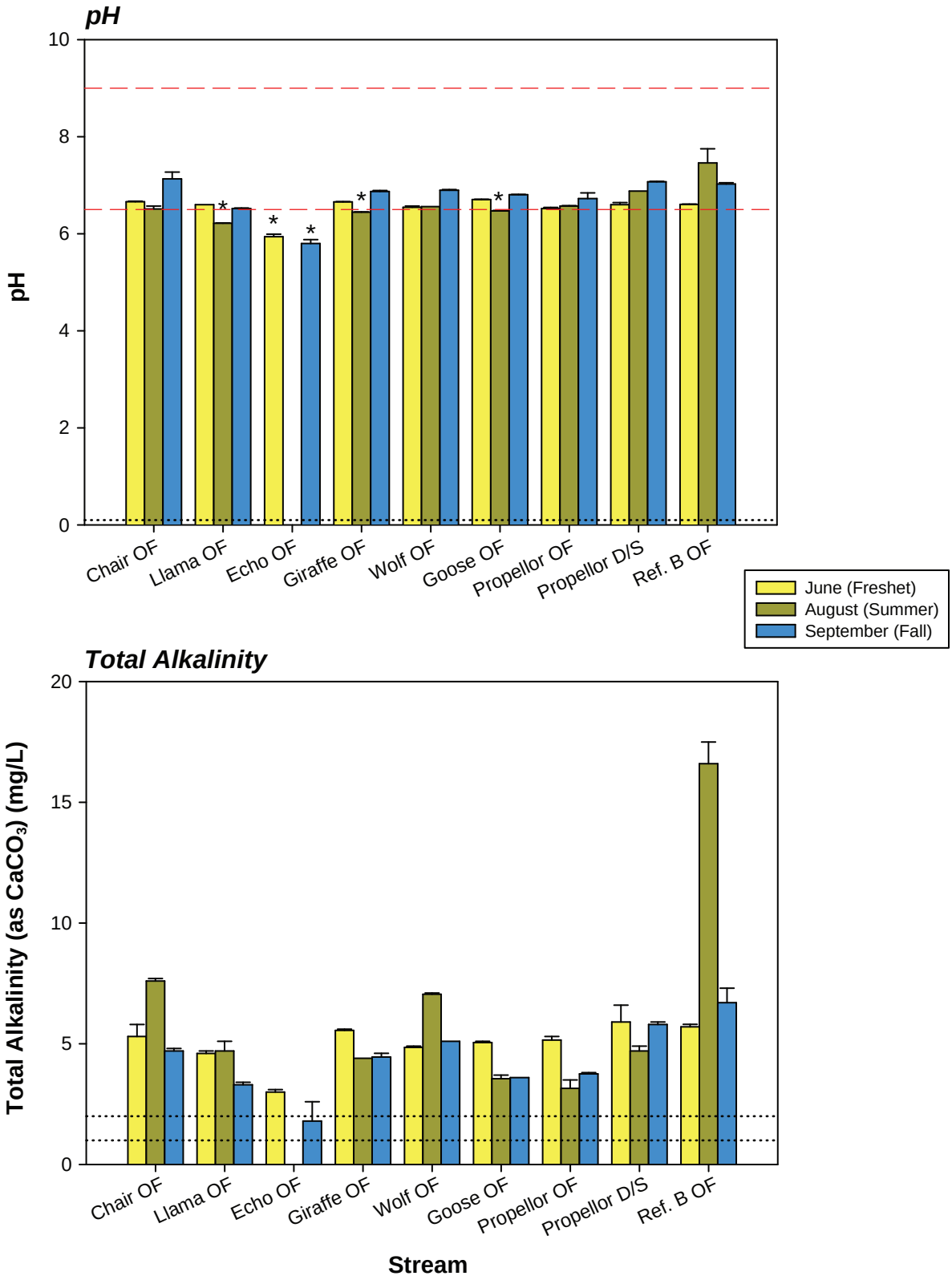
3.3 STREAM WATER QUALITY

Stream water quality samples were collected in June (freshet), August (summer), and September (fall) (Figures 3.3-1a to 3.3-6; Appendix 3.3-1 and 3.3-2).

3.3.1 Physical Parameters

The surveyed streams were slightly acidic to neutral, with the lowest pH levels at Echo OF (mean: 5.87) and highest at Ref. B OF (mean: 7.03; Figure 3.3-1a). Streams were poorly buffered, with low alkalinity levels. Total alkalinities were less than 8 mg/L at all streams, except at Reference B OF during summer which had 16.6 mg/L (Figure 3.3-1a).

All streams had low levels of hardness (Figure 3.3-1b) and would be classified as soft, except for Llama OF which would be classified as hard (121 mg/L – 180 mg/L) and moderately hard (61 mg/L – 120 mg/L) over summer and fall (Briggs et al. 1977). Patterns in conductivity and TDS followed those of hardness, with low conductivity (less than 85 µs/cm) and TDS (less than 100 mg/L) in all streams, except Llama OF where conductivity was elevated in summer (conductivity 325 µs/cm; TDS 403 mg/L) and fall (264 µs/cm; TDS 300 mg/L) (Figure 3.3-1b).



Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (pH 0.1; total alkalinity 1 mg/L or 2 mg/L).
Dashed lines represent CCME guideline for pH 6.5–9.
** Indicates mean values that are outside of CCME guidelines.*

Sabina GOLD & SILVER CORP.

pH and Alkalinity in Streams, Back River Project, 2011

Figure 3.3-1a

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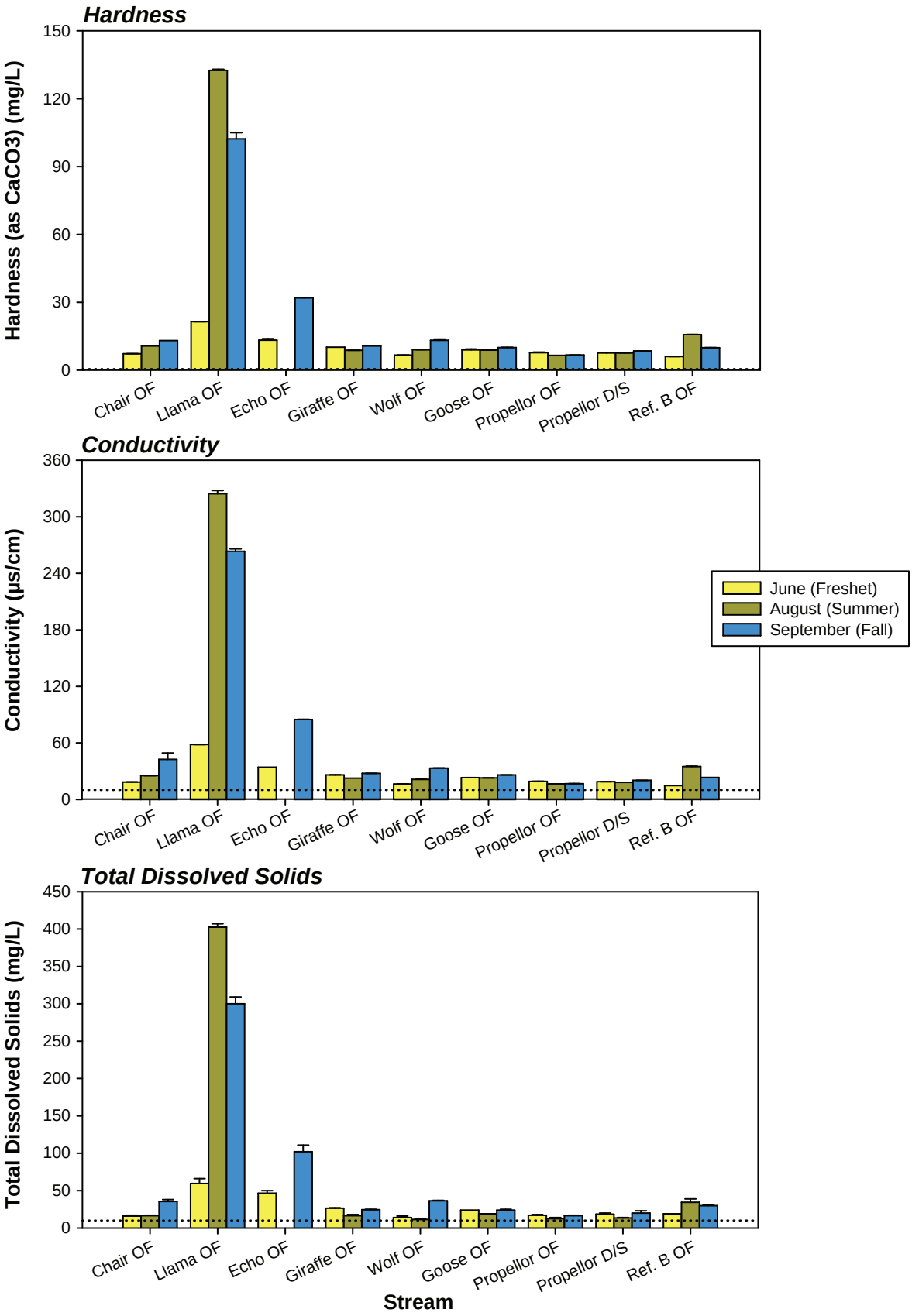

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (hardness 0.5 mg/L; conductivity 2 mg/L; total dissolved solids 10 mg/L).
Dashed lines represent CCME guideline for pH 6.5–9. There is no CCME guideline for hardness.
** Indicates average values that are outside of CCME guidelines.*

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Hardness, Conductivity and Total Dissolved Solids in Streams, Back River Project, 2011

Figure 3.3-1b

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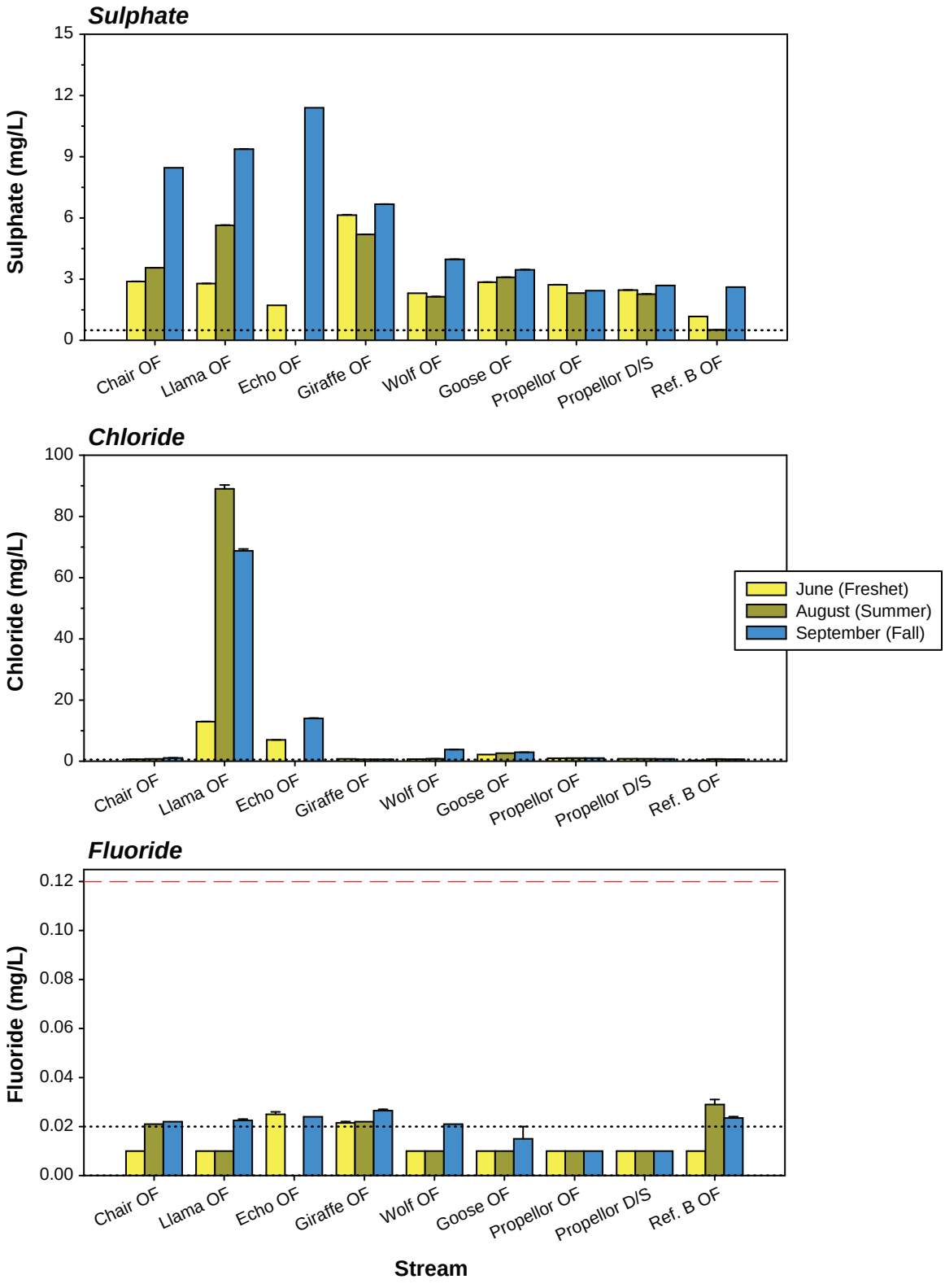

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (sulphate 0.5 mg/L; chloride 0.5 mg/L; fluoride 0.02 mg/L).
The dashed line represents the CCME guideline for fluoride (0.12 mg/L).

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Sulphate, Chloride and Fluoride Concentrations in Streams, Back River Project, 2011

Figure 3.3-2

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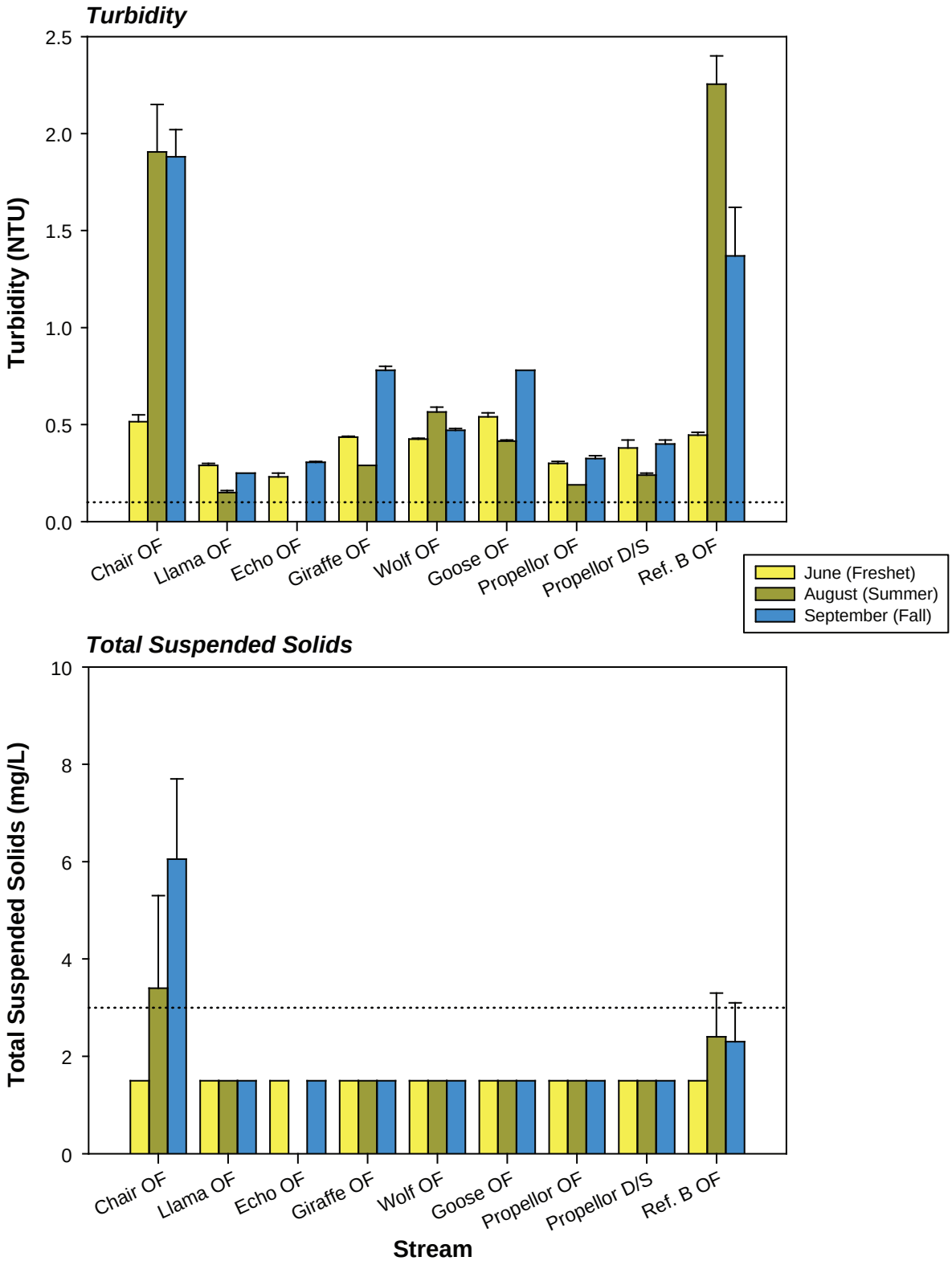

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (turbidity 0.1 NTU; total suspended solids 3 mg/L).
Values below the detection limit are plotted at half the detection limit.
CCME guidelines for turbidity and total suspended solids are dependent on background levels.

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Turbidity and Total Suspended Solids in Streams, Back River Project, 2011

Figure 3.3-3

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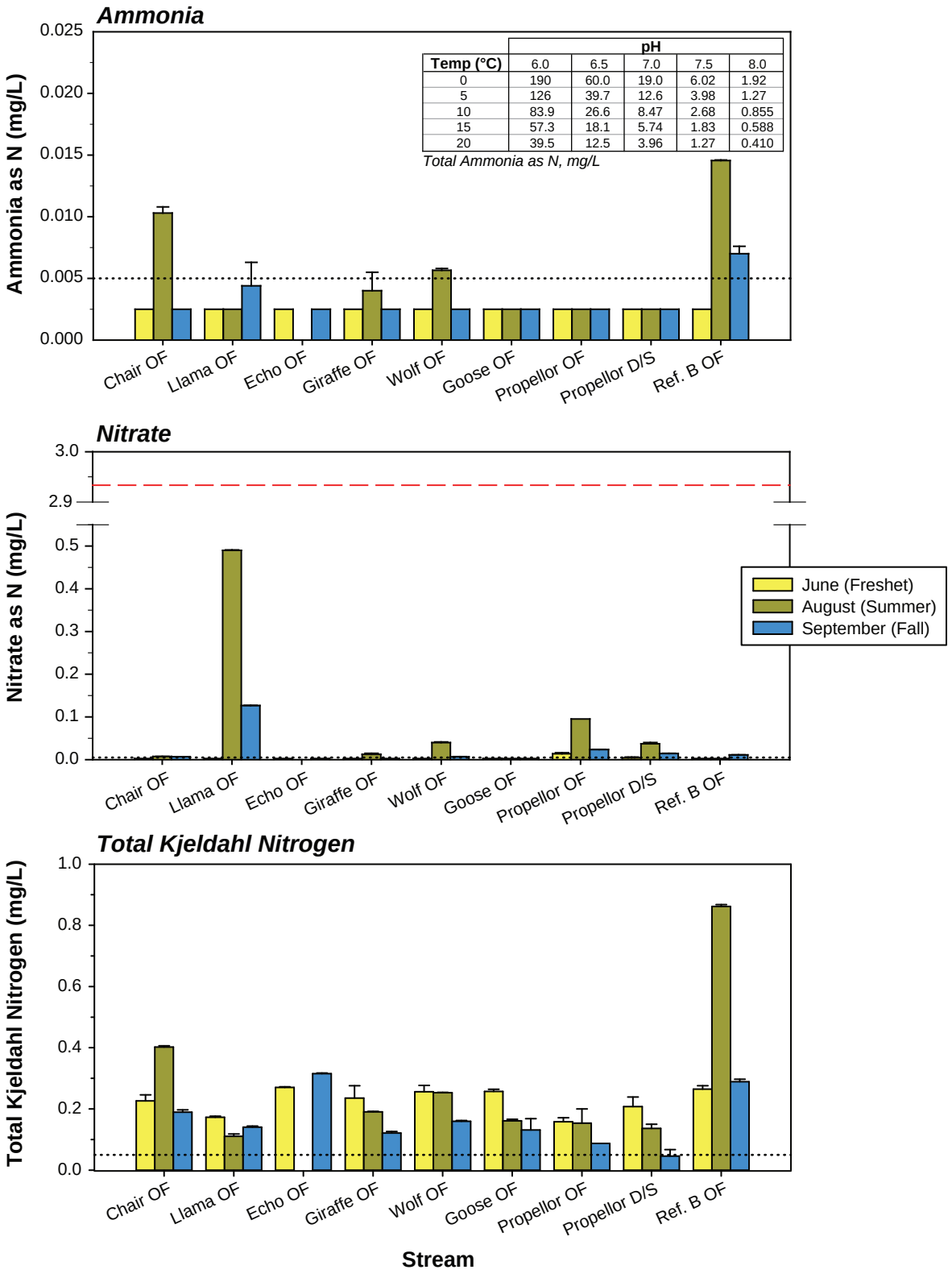

Temp (°C)	pH 6.0	6.5	7.0	7.5	8.0
0	190	60.0	19.0	6.02	1.92
5	126	39.7	12.6	3.98	1.27
10	83.9	26.6	8.47	2.68	0.855
15	57.3	18.1	5.74	1.83	0.588
20	39.5	12.5	3.96	1.27	0.410

Total Ammonia as N, mg/L

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (ammonia 0.005 mg/L; nitrate 0.005 mg/L; TKN 0.05 mg/L).
Values below the detection limit are plotted at half the detection limit.
Inset table shows temperature- and pH-dependent CCME guidelines for ammonia.
Dashed lines represent CCME guidelines (nitrate 2.935 mg/L; nitrite 0.06 mg/L).

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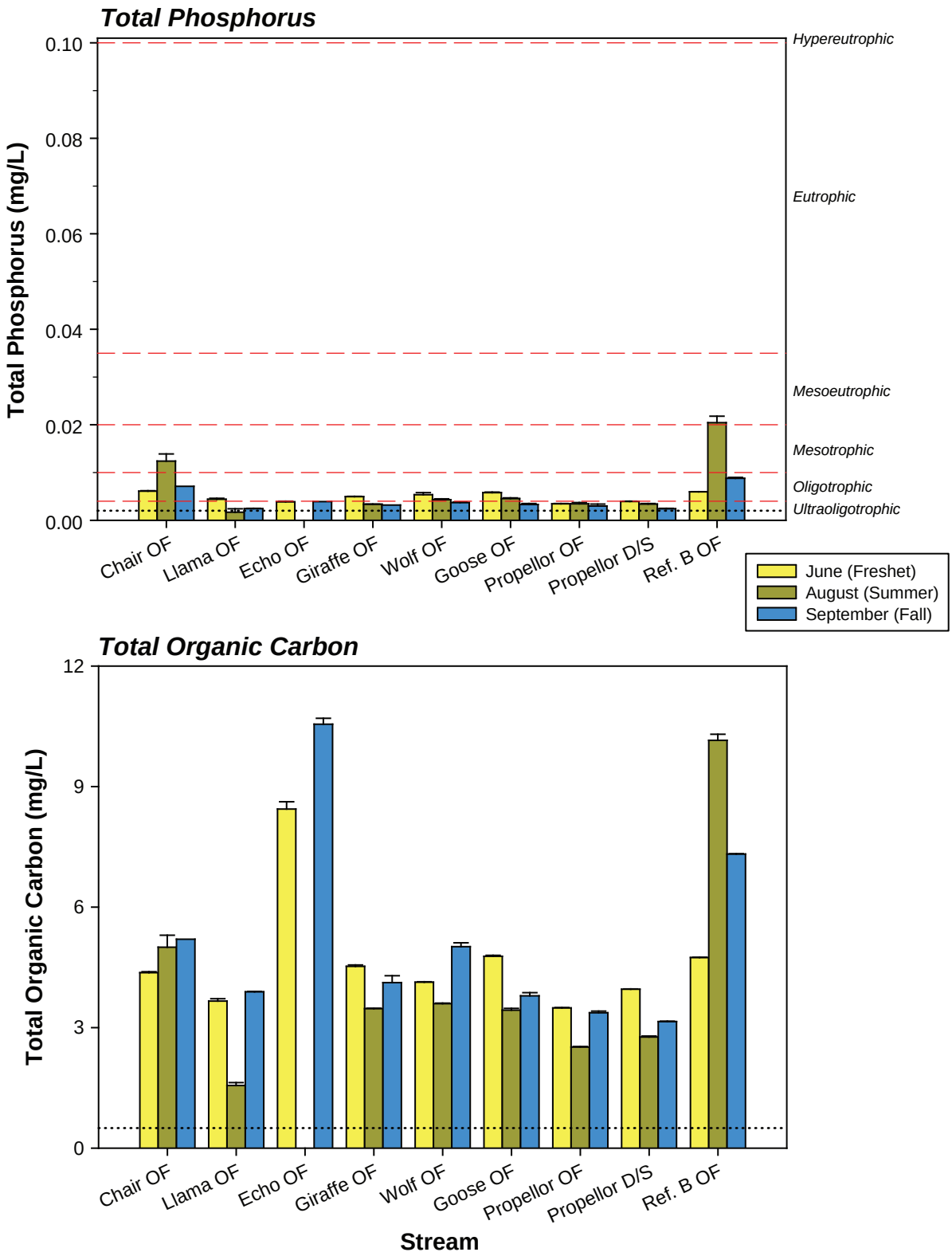
Ammonia, Nitrate and Total Kjeldahl Nitrogen Concentrations in Streams, Back River Project, 2011

Figure 3.3-4a

Rescan™ Engineers & Scientists



Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (total phosphorus 0.002 mg/L; total organic carbon 0.5 mg/L).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represents CCME trigger ranges for total phosphorus (<0.004 mg/L = ultraoligotrophic; 0.004–0.010 mg/L = oligotrophic; 0.01–0.02 mg/L = mesotrophic; 0.02–0.035 mg/L = mesoeutrophic; 0.035–0.1 mg/L = eutrophic; >0.1 mg/L = hypereutrophic).
There is no CCME guideline for total organic carbon.

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Total Phosphorus and Total Organic Carbon Concentrations in Streams, Back River Project, 2011

Figure 3.3-4b

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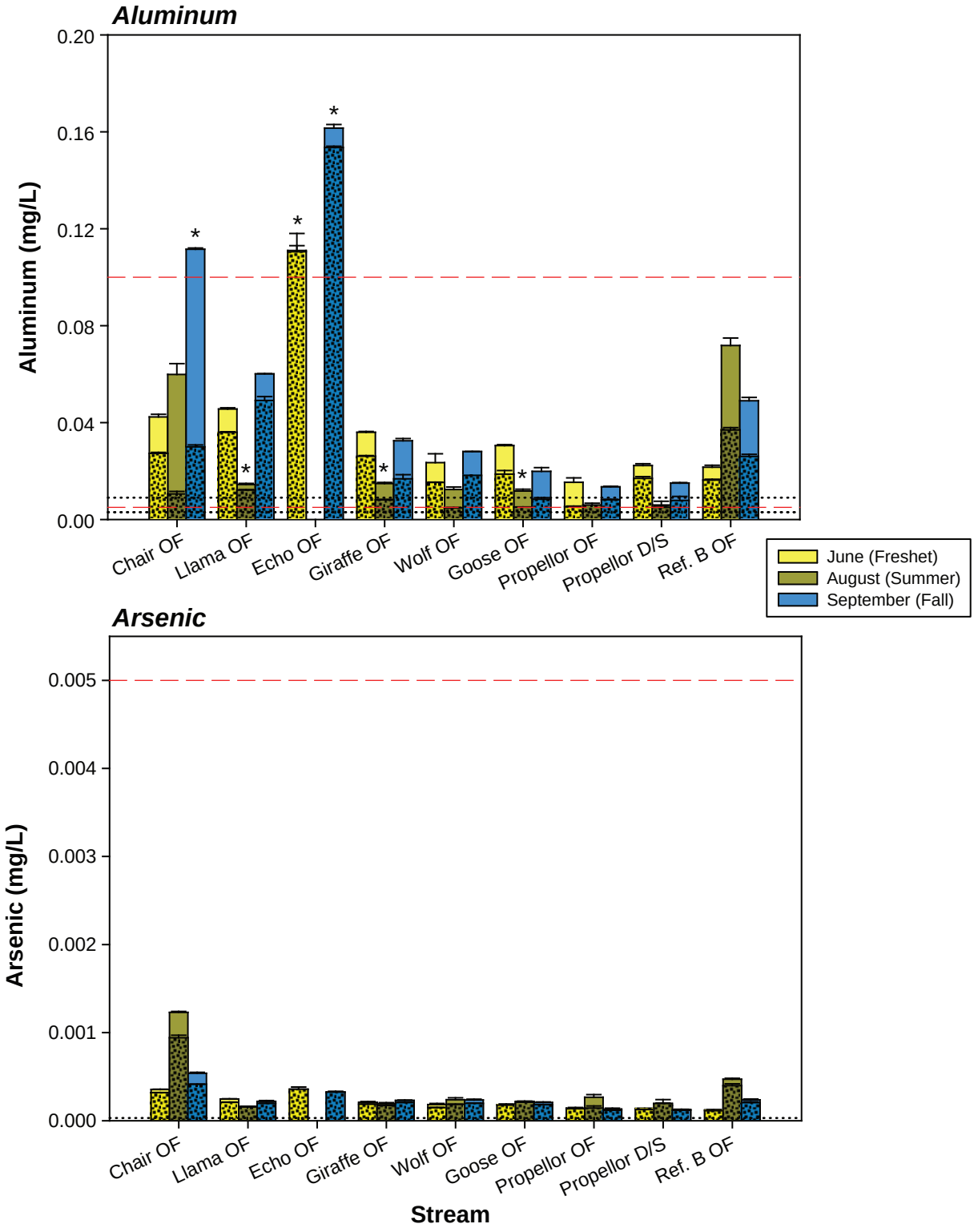

Notes: Error bars represent standard error of the mean of replicates.
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dotted lines represent analytical detection limits (aluminum 0.003 mg/L or 0.009 mg/L; arsenic 0.00003 mg/L).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guidelines. The CCME interim guideline for arsenic is 0.005 mg/L.
CCME guidelines for aluminum are pH-dependendent (0.005 mg/L at pH less than 6.5; 0.1 mg/L at pH greater than or equal to 6.5).
pH was above 6.5 at all sites except Llama OF, Giraffe OF and Goose OF in summer, and Echo OF in freshet and fall.
** Indicates mean total metal values that are higher than CCME guidelines.*

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Aluminum and Arsenic Concentrations in Streams, Back River Project, 2011

Figure 3.3-5a

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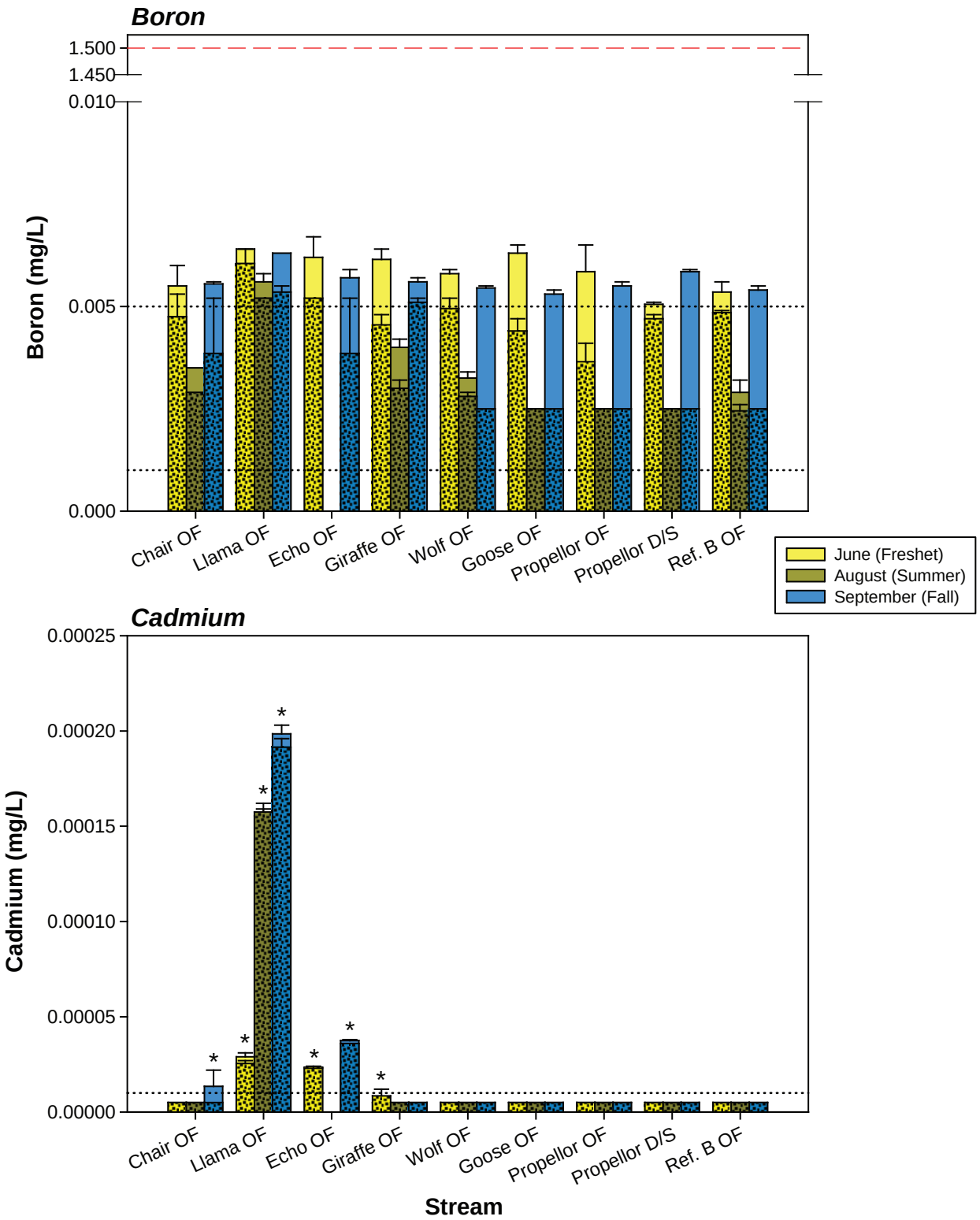

Notes: Error bars represent standard error of the mean of replicates.
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dotted lines represent analytical detection limits (boron 0.001 or 0.005 mg/L; cadmium 0.00001 mg/L).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guidelines.
The CCME guideline for cadmium (in mg/L) can be calculated using the equation: $10^{[0.86[\log(\text{hardness})]-3.2]}/1000$.
The CCME guidelines for boron are 1.5 mg/L long term and 29 mg/L short term [not shown]).
** Indicates mean total metal values that are higher than CCME guidelines.*

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Boron and Cadmium Concentrations in Streams, Back River Project, 2011

Figure 3.3-5b

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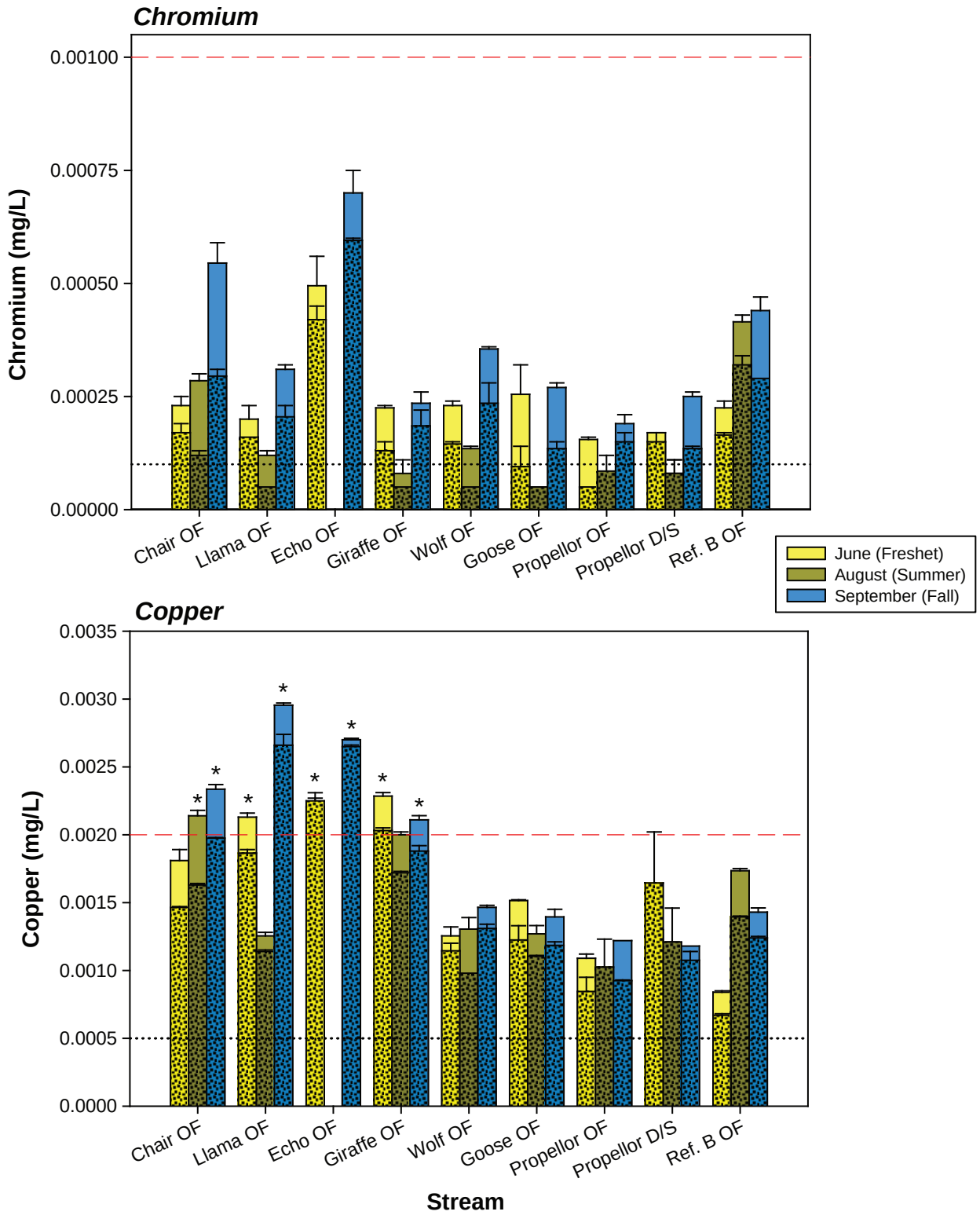

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (chromium 0.0001 mg/L; copper 0.0005 mg/L).
Values below the detection limit are plotted at half the detection limit.
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dashed lines represent CCME guidelines.
The CCME guideline for copper (in mg/L) can be calculated using the equation: $C^{\{0.8545[\ln(\text{hardness})]-1.465\}} * 0.0002$.
Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.
The CCME guideline for hexavalent chromium (0.001 mg/L) and interim guideline for trivalent chromium (0.0089 mg/L) [not shown].
** Indicates mean total metal values that are higher than CCME guidelines.*

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Chromium and Copper Concentrations in Streams, Back River Project, 2011

Figure 3.3-5c

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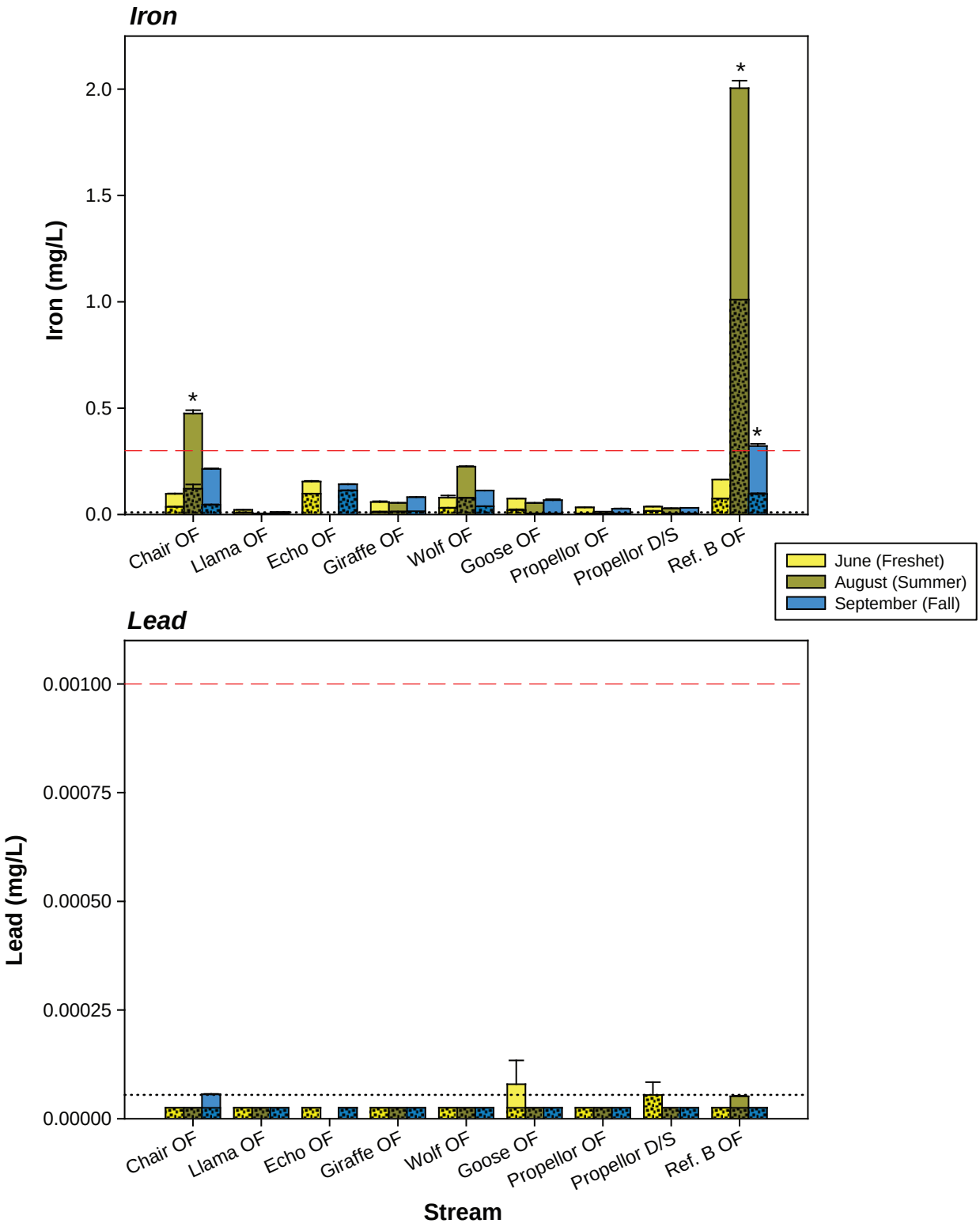

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (iron 0.01 mg/L; lead 0.00005 mg/L).
Values below the detection limit are plotted at half the detection limit.
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dashed lines represent CCME guidelines.
The CCME guideline for iron is 0.3 mg/L.
The CCME guideline for lead (in mg/L) can be calculated using the equation: $e^{\{1.273[\ln(\text{hardness})]-4.705\}}/1000$.
Lead guideline is a minumum of 0.001 mg/L regardless of hardness.
** Indicates mean total metal values that are higher than CCME guideline.*

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Iron and Lead Concentrations in Streams, Back River Project, 2011

Figure 3.3-5d

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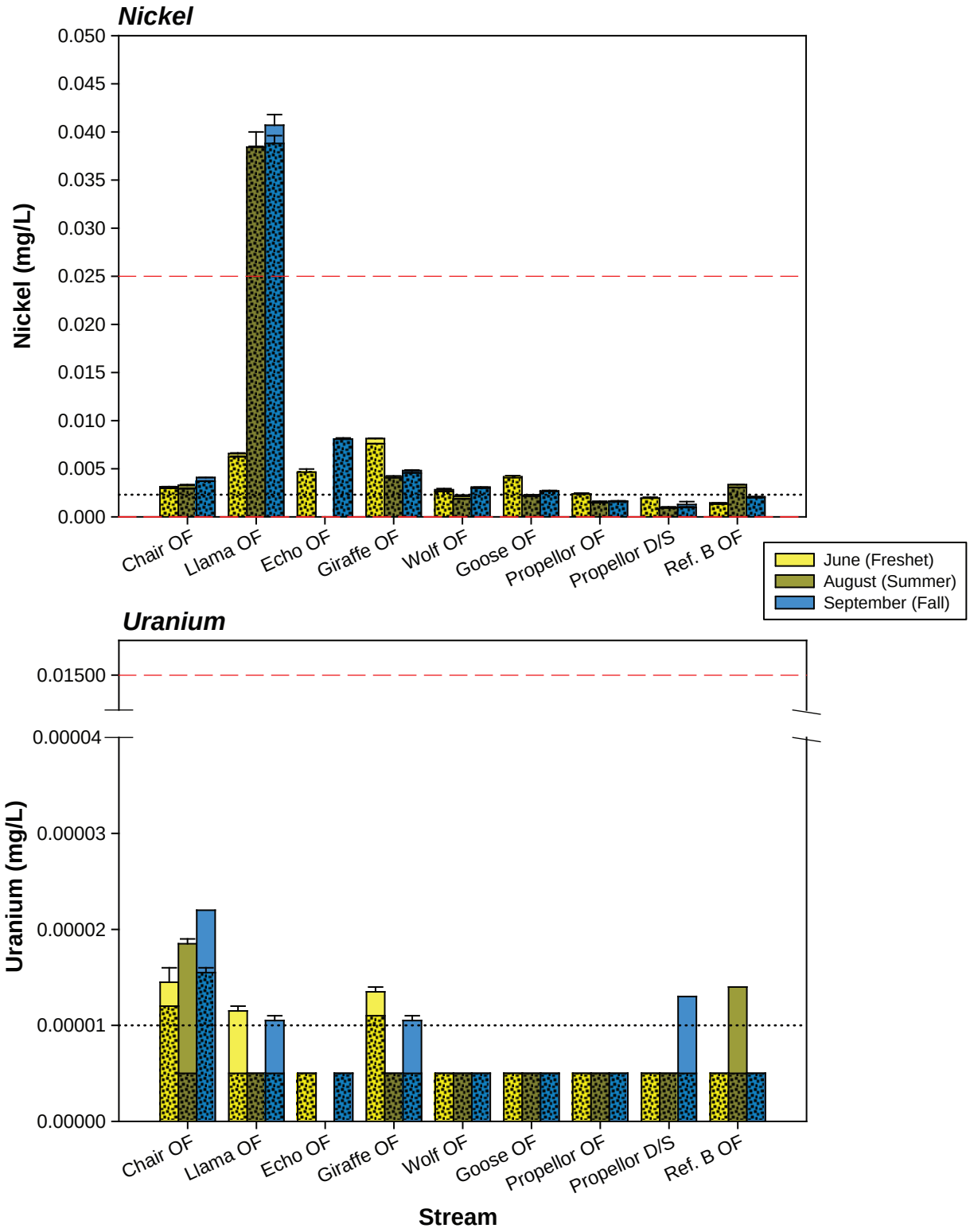

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (nickel 0.0001 mg/L; uranium 0.00001 mg/L).
Values below the detection limit are plotted at half the detection limit.
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dashed lines represent CCME guidelines.
The CCME guideline for nickel (in mg/L) can be calculated using the equation $e^{\{0.76[\ln(\text{hardness})]+1.06\}}/1000$.
Nickel guideline is a minumum of 0.025 mg/L regardless of hardness.
The CCME guidelines for uranium are 0.015 mg/L long term and 0.033 mg/L short term(not shown).

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Nickel and Uranium Concentrations in Streams, Back River Project, 2011

Figure 3.3-5e

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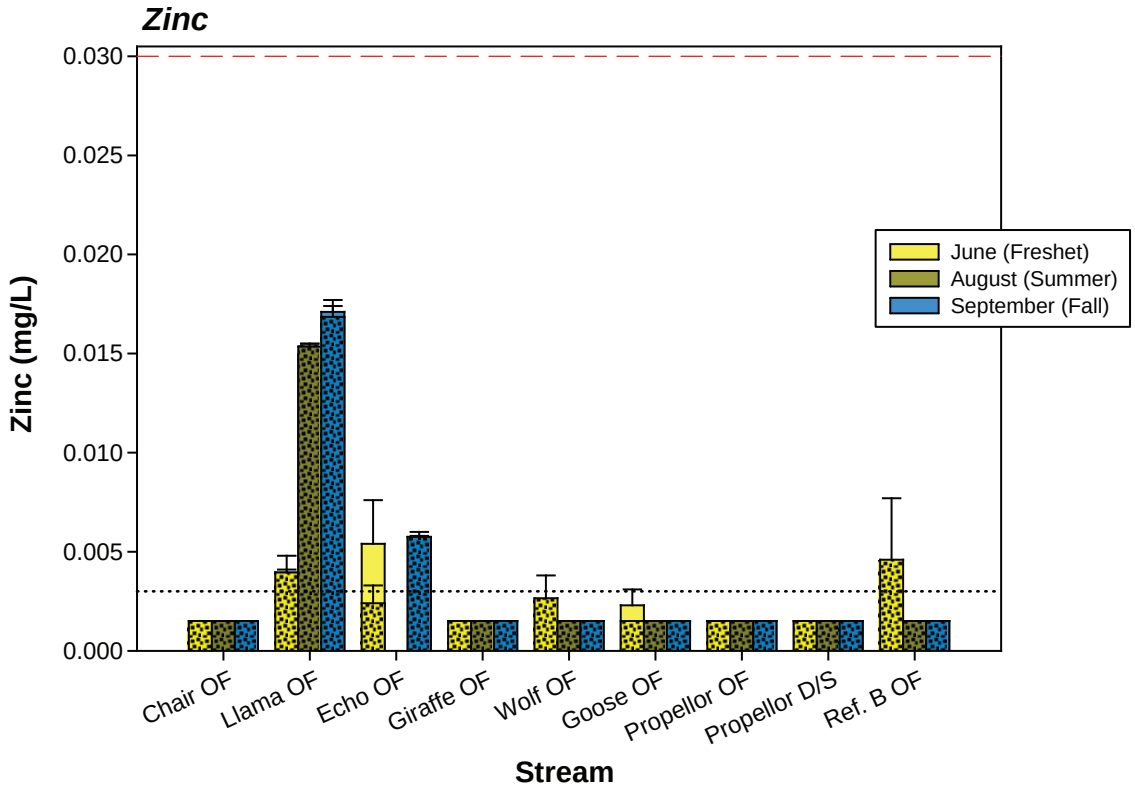

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (zinc 0.003 mg/L).
Values below the detection limit are plotted at half the detection limit.
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dashed lines represent CCME guidelines (zinc 0.03 mg/L).

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Zinc Concentrations in Streams, Back River Project, 2011

Figure 3.3-5f

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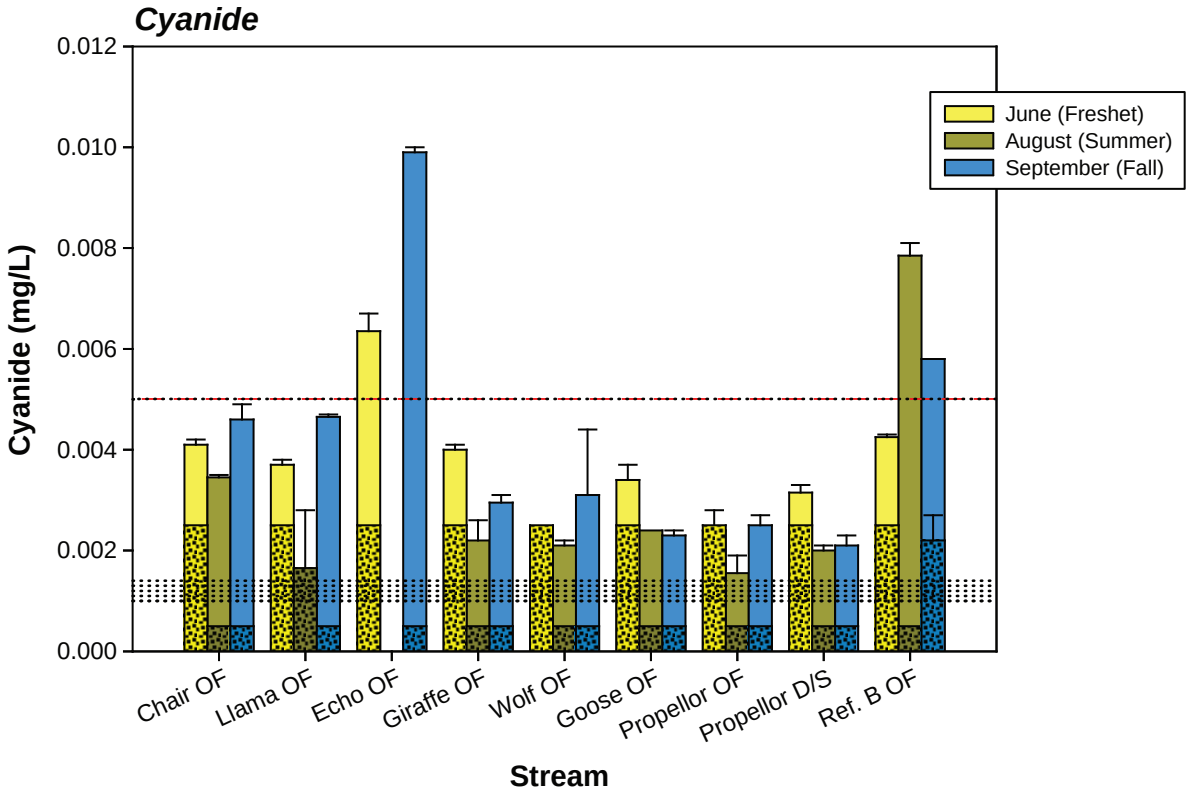

Notes: Error bars represent standard error of the mean of replicates.
Solid columns represent total cyanide and superimposed dotted columns represent free cyanide.
Dotted lines represent analytical detection limits (total cyanide 0.001 mg/L to 0.0014 mg/L; free cyanide 0.001 mg/L or 0.005 mg/L).
Values below the detection limit are plotted at half the detection limit.
Dashed line represents CCME guideline for free cyanide (0.005 mg/L).
** Indicates average values that are higher than the CCME guideline.*

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Cyanide Concentrations in Streams, Back River Project, 2011

Figure 3.3-6

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3.3.2 Major Anions

Sulphate concentrations varied seasonally, tending to be highest in fall (Figure 3.3-2). Sulphate concentrations also varied geographically, with the greatest concentrations in the western streams (Chair OF, Llama OF, Echo OF and Giraffe OF).

Patterns in chloride concentrations followed those of conductivity, with low concentrations (< 14 mg/L) at all streams except Llama OF during summer (89 mg/L) and fall (69 mg/L) (Figure 3.3-2). Fluoride concentrations were also low in streams, often below detection limits (0.02 mg/L) (Figure 3.3-2). Giraffe OF and Echo OF were the only sites with concentrations above detection limits in all seasons, while both Propellor OF and Propellor D/S were always below detection limits.

3.3.3 Suspended Material

In general, project streams had clear water. Turbidity levels were low at most streams, ranging from 0.15 to 0.78 NTU (Figure 3.3-3). The exceptions were Chair OF and Ref. B OF, which had higher turbidity levels than other streams during summer and fall and ranged from 1.37 to 2.55 NTU. TSS followed a similar pattern to turbidity, with all streams being under detection limits (3 mg/L) except in Chair OF and Ref. B OF (Figure 3.3-3).

3.3.4 Nutrients

Like the surveyed lakes, streams in the study area tended to have low concentrations of inorganic nitrogen (ammonia, nitrate, and nitrite) (Figure 3.3-4a). Most stream sites had ammonia concentrations below detection limits (0.005 mg/L) in all seasons. Chair OF (summer), Wolf OF (summer), and Ref. B OF (summer and fall) were the only stream sites to be above detection limits in both replicates. Nitrate levels were low in streams in all seasons, generally below 0.13 mg/L. The exception to this was Llama OF in summer, which had nitrate concentrations more than three times higher than other sites (0.49 mg/L). Nitrite levels were below detection limits (0.001 mg/L) at all stream sites in all seasons.

All streams sampled had total phosphorus concentrations below 0.02 mg/L (Figure 3.3-4b), which would be considered either ultraoligotrophic (0.004 to 0.01 mg/L) or oligotrophic (0.01 to 0.02 mg/L) based on the CCME trigger ranges for total phosphorus (CCME 2011b). The exceptions to this were Ref. B OF and Chair OF, which during the low flow summer period had total phosphorus peaks high enough to be considered meso-eutrophic and mesotrophic, respectively.

TOC was similar across all streams, between 1.6 and 5.2 mg/L (Figure 3.3-4b). Exceptions to this were Echo OF in freshet and fall and Ref. B OF in summer and fall, which were between 7.32 and 10.6 mg/L. These two streams had the lowest water levels.

3.3.5 Metals

Overall, metal concentrations tended to be slightly higher in the western streams (Chair OF, Llama OF, Echo OF, and Giraffe OF) than the eastern streams draining out of Goose Lake (Goose OF, Propellor OF, Propellor D/S) (Figures 3.3-5a to 3.3-5f). The western streams run through the Llama, Umwelt and Echo ore deposit areas, and are likely influenced by local geochemistry. This influence appears to be diluted by Goose Lake, leaving downstream eastern stream sites with lower metal concentrations.

The highest total aluminum concentrations were found in Echo OF, with a mean of 0.14 mg/L, which was more than twice as high as most other streams (Figure 3.3-5a). Chair OF, Llama OF, and Ref. B OF had the next highest aluminum concentrations, whilst the two Propellor Stream sites had the lowest (averaging 0.011 and 0.014 mg/L, respectively).

Overall, streams had low total arsenic concentrations (Figure 3.3-5a). Mean concentrations were highest during the summer low flow period at Chair OF (0.0012 mg/L) and Ref. B OF (0.0015 mg/L). Boron concentrations were similar across sites, and tended to be highest during the freshet and lowest in summer (Figure 3.3-5b).

Total cadmium concentrations varied geographically (Figure 3.3-5b). Eastern streams and the reference stream (Wolf OF, Goose OF, Propellor OF, Propellor D/S and Ref. B OF) had cadmium concentrations consistently below detection limits (0.00001 mg/L). Llama OF had particularly high cadmium concentrations during summer (0.00016 mg/L) and fall (0.0002 mg/L), at an order of magnitude greater than the analytical detection limit (0.00001 mg/L) and that observed at other stream sites (less than 0.000038 mg/L).

Total chromium concentrations ranged from below detection limits (0.0001 mg/L) to 0.0007 mg/L, and tended to be highest in fall and in Chair OF, Echo OF, and Ref. B OF (Figure 3.3-5c).

Western streams (Chair, Llama, Echo and Giraffe) had naturally high levels of total copper (Figure 3.3-5c), with most seasons above the minimum CCME guideline level (0.002 mg/L; CCME 2011b)). Eastern streams, including Wolf OF, Goose OF, Propellor OF, Propellor D/S, and Ref. B OF, had lower concentrations of total copper ranging from 0.0008 mg/L to 0.0017 mg/L.

Patterns in total iron concentrations were similar to arsenic, with summer samples from Chair OF and Ref. B OF having the highest concentrations (Figure 3.3-5d). Total iron concentrations at Ref. B OF over summer averaged 2.01 mg/L, more than four times higher than summer concentrations at Chair OF and over eight times higher than any other stream site in any season. Chair OF and Ref B OF had the lowest summer water levels and flows out of all streams sampled.

Total nickel concentrations were low at most sites (Figure 3.3-5e), except in Llama OF, showing similar patterns to cadmium. Summer and fall nickel concentrations at Llama OF were over four times higher than at any other site in any other season, and at 0.0383 mg/L and 0.0407 mg/L, exceeded the CCME guideline of 0.025 mg/L (CCME 2011b).

Total uranium concentrations were low in the streams sampled (Figure 3.3-5e), frequently below the analytical detection limit (0.00001 mg/L). Concentrations were above detection limits in Chair OF in all seasons, Llama OF and Giraffe OF in freshet and fall, Propellor D/S in freshet, and Ref. B OF in summer.

Total zinc concentrations followed a similar pattern to nickel, with summer and fall concentrations at Llama OF being particularly high (0.015 mg/L and 0.017 mg/L compared to less than 0.006 mg/L at all other sites) (Figure 3.3-5f).

Total lead and molybdenum concentrations were below detection limits in all streams in all seasons, with a few exceptions. All streams in all seasons had total mercury, selenium, silver and thallium concentrations below detection limits.

3.3.6 Cyanides

Total cyanide concentrations followed a similar pattern to TOC. Concentrations tended to be below 0.005 mg/L, except in Echo OF (June 0.006 mg/L; September 0.01 mg/L) and Ref. B OF (June 0.008 mg/L; September 0.006 mg/L). Free cyanide concentrations were below detection limits for almost all samples (0.001 mg/L or 0.005 mg/L).

3.3.7 Comparison with CCME Guidelines

The percentage of stream water quality samples where parameter concentrations were above CCME guidelines is presented in Table 3.3-1. Table 3.3-2 shows the factor that mean concentrations, pooled across depth and season for each site, were higher than CCME guidelines.

Over half of the streams had mean concentrations that exceeded CCME guidelines for at least one of the following parameters: pH, total aluminum, cadmium, copper and iron (Table 3.3-2). Cyanide and nutrient concentrations were within CCME guidelines at all streams in all seasons. Generally, there were larger and more numerous exceedances in the western streams that drain into Goose Lake (Llama OF, Echo OF, Giraffe OF) than the eastern streams down flow from Goose Lake (Goose OF, Propellor OF, Propellor D/S). Ref. B OF had similar exceedances to the eastern streams, except its iron exceedance.

Llama OF, Goose OF and Giraffe OF had pH levels below the CCME guideline range (6.5 to 9 pH units) during summer sampling, and Echo OF had pH levels below CCME guidelines during all sampling (freshet and fall). Mean pH levels at Llama OF (pH: 6.4) and Echo OF (pH: 5.9) were outside of the CCME guideline range of 6.5 to 9 pH units.

CCME guidelines for total aluminum are pH dependent, with a lower total aluminum guideline for waters with a pH of less than 6.5. Only the two streams with mean pH values below 6.5, Llama OF and Echo OF, had average aluminum concentrations that exceeded the guideline concentration (by a factor of 8.01 and 27.3). Seasonal exceedances for total aluminum were also found in Chair OF (fall), Giraffe OF (summer) and Goose OF (summer).

Chair OF, Llama OF, and Echo OF exceeded the CCME guideline for total cadmium, which is hardness dependent. These three streams had total cadmium concentrations between 1.7 and 4.4 times higher than their site specific guidelines.

The western streams, Chair OF, Llama OF, Echo OF and Giraffe OF, had mean total copper concentrations between 1.02 and 1.23 times higher than the CCME guidelines.

Ref. B OF had mean total iron concentrations 2.8 times higher than the CCME guidelines for iron. Iron concentrations were particularly high at Ref. B OF during summer (6.7 times the CCME guideline). Chair OF exceeded CCME guidelines during summer, but annually averaged data was below CCME guidelines.

3.3.8 Stream Water Quality Assurance/Quality Control

Six field and travel blanks were collected during stream sampling, representing 12% of stream samples collected (Appendix 3.3-2). Detectable levels of key parameters were found in some of the blanks.

Summer field and travel blanks showed detectable TOC (0.75 mg/L and 0.73 mg/L). This was below the minimum concentrations found in summer samples (1.56 mg/L). The consistency between field and travel blanks suggests this is either due to the lab supplied water, or the handling and transporting of samples.

The fall field blank showed sodium present (0.171 mg/L), below the levels found in samples. The fall travel blank showed ammonia (as N) at a level higher than found in any of the samples (0.0197 mg/L), and TOC at a level below all samples.

The presence of detectable parameters in travel blanks, which were never opened in the field, suggests they come from the lab water lab-supplied bottles, or are an artefact of handling and transporting of samples.

Table 3.3-1. Stream Water Quality, Percent of Samples in which Concentrations are Higher than CCME Guidelines, Back River Project, 2011

Stream	Total Number of Samples Collected	CCME Guideline Value[a]:	pH	Ammonia (as N)	Fluoride (F)	Chloride (Cl)	Nitrate (as N)	Nitrite (as N)	Total Phosphorus	Free Cyanide	Aluminum (Al)
			6.5 - 9.0	temperature- and pH-dependent	0.12[b] mg/L	640 mg/L	2.935[b] mg/L	0.06 mg/L	Trophic Status[c]	0.005 as free CN	0.005-0.1[d] mg/L
Chair OF	6		16.7	-	-	-	-	-	Oligotrophic - Mesotrophic	-	50
Llama OF	6		33.3	-	-	-	-	-	Ultraoligotrophic - Oligotrophic	-	33.3
Echo OF	4		100	-	-	-	-	-	Ultraoligotrophic - Oligotrophic	-	100
Giraffe OF	6		33.3	-	-	-	-	-	Ultraoligotrophic - Oligotrophic	-	33.3
Wolf OF	6		-	-	-	-	-	-	Ultraoligotrophic - Oligotrophic	-	-
Goose OF	6		33.3	-	-	-	-	-	Ultraoligotrophic - Oligotrophic	-	33.3
Propellor OF	6		-	-	-	-	-	-	Ultraoligotrophic	-	-
Propellor D/S	6		-	-	-	-	-	-	Ultraoligotrophic - Oligotrophic	-	-
Ref. B OF	6		-	-	-	-	-	-	Oligotrophic - Mesoeutrophic	-	-
Total	**52**										

Stream	Total Number of Samples Collected	CCME Guideline Value[a]:	Arsenic (As)	Boron (B)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Iron (Fe)	Lead (Pb)	Mercury (Hg)	Molybdenum (Mo)
			0.005 mg/L	Short term 29 mg/L; Long term 1.5 mg/L	hardness based equation[be]	Cr (VI) 0.001[bf] mg/L	hardness dependent ≥0.002[g] mg/L	0.3 mg/L	hardness dependent ≥0.001[h] mg/L	0.000026[i] mg/L	0.073[b] mg/L
Chair OF	6		-	-	16.7	-	66.6	33.3	-	-	-
Llama OF	6		-	-	100	-	66.6	-	-	-	-
Echo OF	4		-	-	100	-	100	-	-	-	-
Giraffe OF	6		-	-	-	-	83.3	-	-	-	-
Wolf OF	6		-	-	-	-	-	-	-	-	-
Goose OF	6		-	-	-	-	-	-	-	-	-
Propellor OF	6		-	-	-	-	-	-	-	-	-
Propellor D/S	6		-	-	-	-	-	-	-	-	-
Ref. B OF	6		-	-	-	-	-	66.6	-	-	-
Total	**52**										

Stream	Total Number of Samples Collected	CCME Guideline Value[a]:	Nickel (Ni)	Selenium (Se)	Silver (Ag)	Thallium (Tl)	Uranium (U)	Zinc (Zn)
			≥0.025[j] mg/L	0.001 mg/L	0.0001 mg/L	0.0008 mg/L	Short term 0.033 mg/L; Long term 0.015 mg/L	0.03 mg/L
Chair OF	6		-	-	-	-	-	-
Llama OF	6		-	-	-	-	-	-
Echo OF	4		-	-	-	-	-	-
Giraffe OF	6		-	-	-	-	-	-
Wolf OF	6		-	-	-	-	-	-
Goose OF	6		-	-	-	-	-	-
Propellor OF	6		-	-	-	-	-	-
Propellor D/S	6		-	-	-	-	-	-
Ref. B OF	6		-	-	-	-	-	-
Total	**52**							

All values represent percentages of 2011 samples that are both higher than the CCME guidelines and above detection limits.

a) Canadian water quality guidelines for the protection of aquatic life (CCME 2011)

b) Intermin guideline

c) <0.004 mg/L = ultraoligotrophic; 0.004 - 0.010 mg/L = oligotrophic; 0.01 - 0.02 mg/L = mesotrophic; 0.02 - 0.035 mg/L = mesoeutrophic; 0.035 - 0.1 mg/L = eutrophic; >0.1 mg/L = hypereutrophic

d) 0.005 mg/L at pH <6.5; 0.1 mg/L at pH ≥6.5

e) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}} / 1000$

f) Guideline concentration for hexavalent chromium. No concentrations were higher than the CCME guideline for trivalent chromium (0.0089 mg/L)

g) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}} * 0.0002$. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness

h) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}} / 1000$. Lead guideline is a minumum of 0.001 mg/L regardless of hardness

i) Guideline concentration for inorganic mercury

j) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}} / 1000$. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness

Table 3.3-2. Stream Water Quality, Factor by which Average Concentrations are Higher than CCME Guidelines, Back River Project, 2011

Stream	Total Number of Samples Collected	CCME Guideline Value[a]:	pH*	Ammonia (as N)	Fluoride (F)	Chloride (Cl)	Nitrate (as N)	Nitrite (as N)	Total Phosphorus	Free Cyanide	Aluminum (Al) - Total
			6.5-9.0	temperature- and pH-dependent	0.120[b] mg/L	640 mg/L	2.935[b] mg/L	0.06 mg/L	Trophic Status[c]	0.005 as free CN	0.005-0.1[d] mg/L
Chair OF	6		-	-	-	-	-	-	Oligotrophic - Mesotrophic	-	-
Llama OF	6		exceed	-	-	-	-	-	Ultraoligotrophic - Oligotrophic	-	8.01
Echo OF	4		exceed	-	-	-	-	-	Ultraoligotrophic - Oligotrophic	-	27.25
Giraffe OF	6		-	-	-	-	-	-	Ultraoligotrophic - Oligotrophic	-	-
Wolf OF	6		-	-	-	-	-	-	Ultraoligotrophic - Oligotrophic	-	-
Goose OF	6		-	-	-	-	-	-	Ultraoligotrophic - Oligotrophic	-	-
Propellor OF	6		-	-	-	-	-	-	Ultraoligotrophic	-	-
Propellor D/S	6		-	-	-	-	-	-	Ultraoligotrophic - Oligotrophic	-	-
Ref. B OF	6		-	-	-	-	-	-	Oligotrophic - Mesoeutrophic	-	-
Total	**52**										

Stream	Total Number of Samples Collected	CCME Guideline Value[a]:	Arsenic (As) -Total	Boron (B) - Total	Cadmium (Cd) - Total	Chromium (Cr) - Total	Copper (Cu) - Total	Iron (Fe) - Total	Lead (Pb) - Total	Mercury (Hg) - Total	Molybdenum (Mo) - Total
			0.005 mg/L	Short term 29 mg/L; Long term 1.5 mg/L	hardness based equation[be]	Cr (VI) 0.001[bf] mg/L	hardness dependent ≥0.002[g] mg/L	0.3 mg/L	hardness dependent ≥0.001[h] mg/L	0.000026[i] mg/L	0.073[b] mg/L
Chair OF	6		-	-	1.66	-	1.05	-	-	-	-
Llama OF	6		-	-	4.42	-	1.02	-	-	-	-
Echo OF	4		-	-	3.30	-	1.23	-	-	-	-
Giraffe OF	6		-	-	-	-	1.07	-	-	-	-
Wolf OF	6		-	-	-	-	-	-	-	-	-
Goose OF	6		-	-	-	-	-	-	-	-	-
Propellor OF	6		-	-	-	-	-	-	-	-	-
Propellor D/S	6		-	-	-	-	-	-	-	-	-
Ref. B OF	6		-	-	-	-	-	2.77	-	-	-
Total	**52**										

Stream	Total Number of Samples Collected	CCME Guideline Value[a]:	Nickel (Ni) - Total	Selenium (Se) - Total	Silver (Ag) - Total	Thallium (Tl) - Total	Uranium (U) - Total	Zinc (Zn) - Total
			hardness dependent ≥0.025[j] mg/L	0.001 mg/L	0.0001 mg/L	0.0008 mg/L	Short term 0.033 mg/L; Long term 0.015 mg/L	0.03 mg/L
Chair OF	6		-	-	-	-	-	-
Llama OF	6		-	-	-	-	-	-
Echo OF	4		-	-	-	-	-	-
Giraffe OF	6		-	-	-	-	-	-
Wolf OF	6		-	-	-	-	-	-
Goose OF	6		-	-	-	-	-	-
Propellor OF	6		-	-	-	-	-	-
Propellor D/S	6		-	-	-	-	-	-
Ref. B OF	6		-	-	-	-	-	-
Total	**52**							

All values represent percentages of 2011 samples that are both higher than the CCME guidelines and above detection limits.

a) Canadian water quality guidelines for the protection of aquatic life (CCME 2011)

b) Intermin guideline

c) <0.004 mg/L = ultraoligotrophic; 0.004 - 0.010 mg/L = oligotrophic; 0.01 - 0.02 mg/L = mesotrophic; 0.02 - 0.035 mg/L = mesoeutrophic; 0.035 - 0.1 mg/L = eutrophic; >0.1 mg/L = hypereutrophic

d) 0.005 mg/L at pH <6.5; 0.1 mg/L at pH ≥6.5

e) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000

f) Guideline concentration for hexavalent chromium. No concentrations were higher than the CCME guideline for trivalent chromium (0.0089 mg/L)

g) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}} * 0.0002$. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness

h) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness

i) Guideline concentration for inorganic mercury

j) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness

**Note factor by which average concentrations exceeded pH guidelines was not calculated as pH guidelines are a range. Exceendences are shown for reference only.*

The majority of parameters in the blanks were below detection limits. Analytical results from the stream samples were unmodified for parameters which were detected in the blanks.

3.4 LAKE SEDIMENT QUALITY

Lake sediment quality samples were collected in the summer of 2011. Lake sediment quality data are presented graphically in Figures 3.4-1 to 3.4-2b. Appendices 3.4-1 and 3.4-2 provide sediment descriptions and raw analytical data.

3.4.1 Particle Size

Lake sediments were largely composed of silt, with lesser amounts of clay and sand (Figure 3.4-1). Two exceptions to this were Goose Lake Tail and Reference B Lake which were mainly composed of sand (67% and 74%).

3.4.2 Nutrients

Overall, nutrient concentrations tended to be higher in sediments from the western lake sites (Llama, Umwelt, Giraffe, Goose Neck and Goose Central) compared to sediments from the eastern Goose Tail, Propellor, and Reference B lake sampling sites (Figure 3.4-2a).

Available ammonium and total nitrogen showed similar patterns, with the highest concentrations at Goose Lake Neck and lowest concentrations at Goose Lake Tail. Propellor Lake and Reference B Lake also tended to have low available ammonium and total nitrogen concentrations. Nitrate and nitrite concentrations were below detection limits for all sediment replicates at all lakes.

Available phosphate (as P) was less than 24 mg/kg for all lakes, except Propellor Lake which had more than 2.5 times as much as all other sites (61.3 mg/kg) (Figure 3.4-2b). Deeper sediments tended to have higher concentrations of available phosphate compared to shallow sediments within the deeper lakes (Llama and Giraffe).

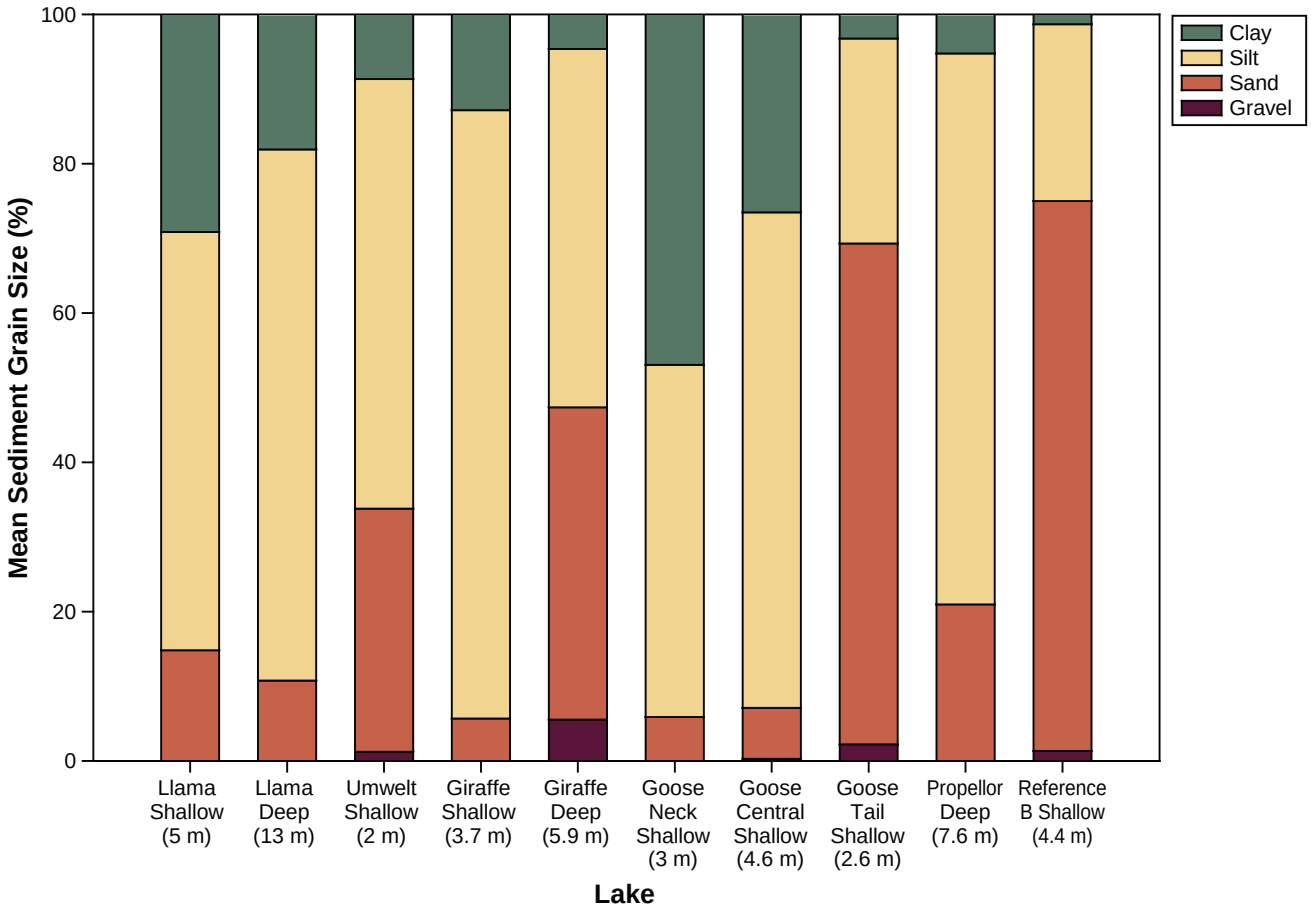
Lake sediments contained between 1.5% and 14.3% TOC, with greater proportions of TOC in the shallow western lake sampling sites (Llama Lake, Umwelt Lake, Giraffe Lake, Goose Lake Neck, Goose Lake Central) (Figure 3.4-2b). TOC levels were roughly 2 to 3 times higher in the shallow sites of Llama and Giraffe lakes compared to their deep sampling sites.

3.4.3 Metals

Overall, the highest metal concentrations tended to occur in shallow samples and in western lake sampling sites (Llama, Umwelt, Giraffe, Goose Neck and Goose Central). The lowest concentrations tended to occur in Goose Lake Tail and Reference B Lake, which had the lowest proportions of silt in their sediments.

Mean arsenic concentrations varied between lakes, with particularly high concentrations at Llama Lake in both the shallow (29 mg/kg) and deep sediments (17 mg/kg) (Figure 3.4-3a). High arsenic levels at Llama Lake were also observed in 2010 (Rescan 2011), and are likely a result of geological influence from the ore deposit directly below the lake. Other lakes in the general area of the ore deposits also tended to have naturally elevated levels of arsenic in their sediments, as Llama, Umwelt, Giraffe, Goose Neck and Goose Central all had mean concentrations above the CCME ISQG level of 5.9 mg/kg.

Lake sediments showed similar patterns for cadmium, copper, mercury and zinc, with the highest concentrations at Goose Lake Neck and Giraffe Lake, and lowest concentrations at Goose Lake Tail and Reference B Lake (Figures 3.4-3a to 3.4-3d). Cadmium levels were high in sediments at Goose Lake Neck (Figure 3.4-3a), and copper levels were high in all sediments except Goose Lake Tail and Reference B Lake (Figure 3.4-3b). Mercury levels were generally low, and zinc levels were always below CCME guidelines (Figures 3.4-3c and 3.4-3d).



Note: Stacked bars are means of triplicate samples.

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Sediment Grain Size Composition in Lakes, Back River Project, 2011

Figure 3.4-1

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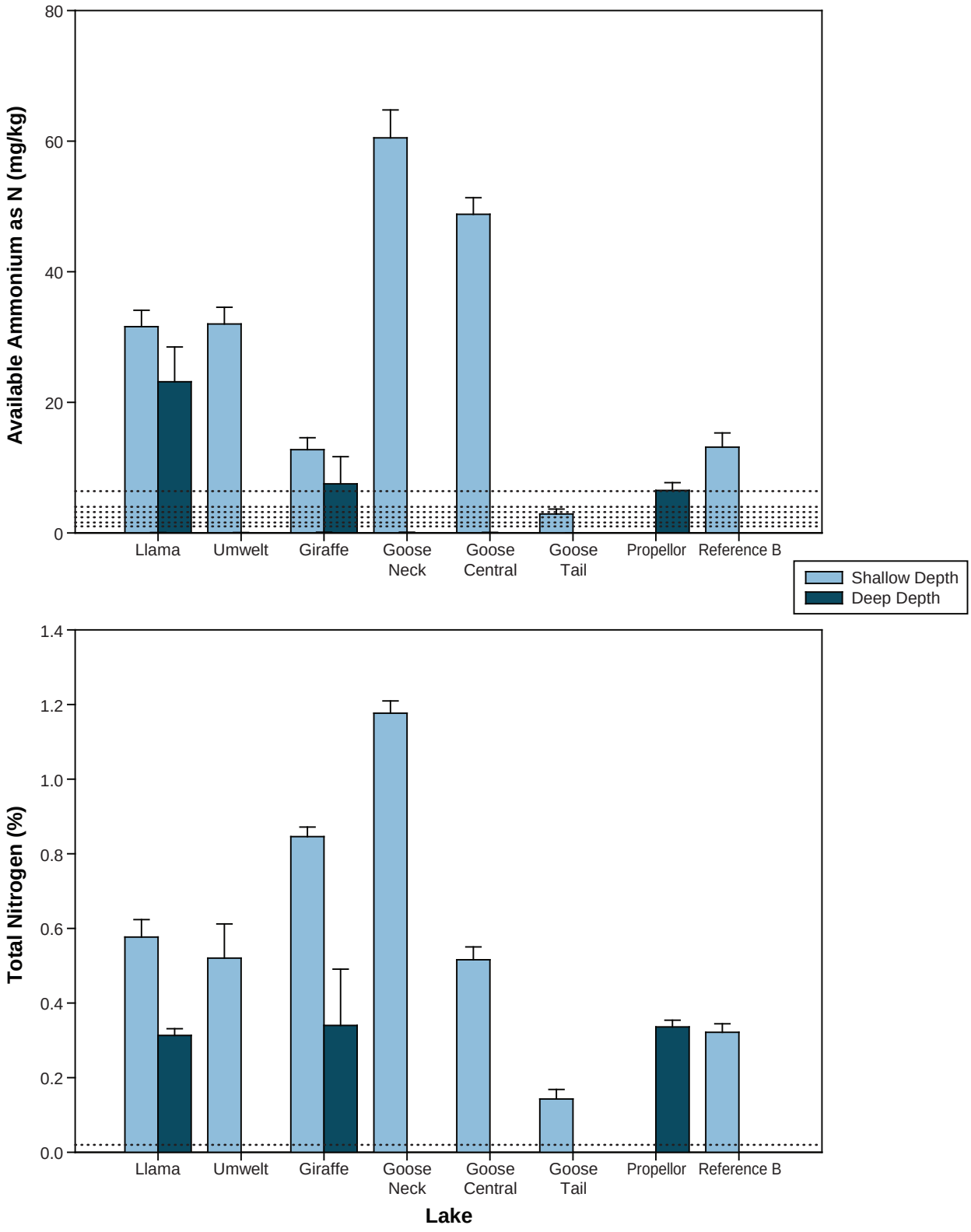

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (available ammonia 1 - 6.4 mgkg; total nitrogen 0.02%).
Values below the detection limit are plotted at half the detection limit.

Figure 3.4-2a

Available Ammonium and Total Nitrogen Concentrations in Lake Sediments, Back River Project, 2011

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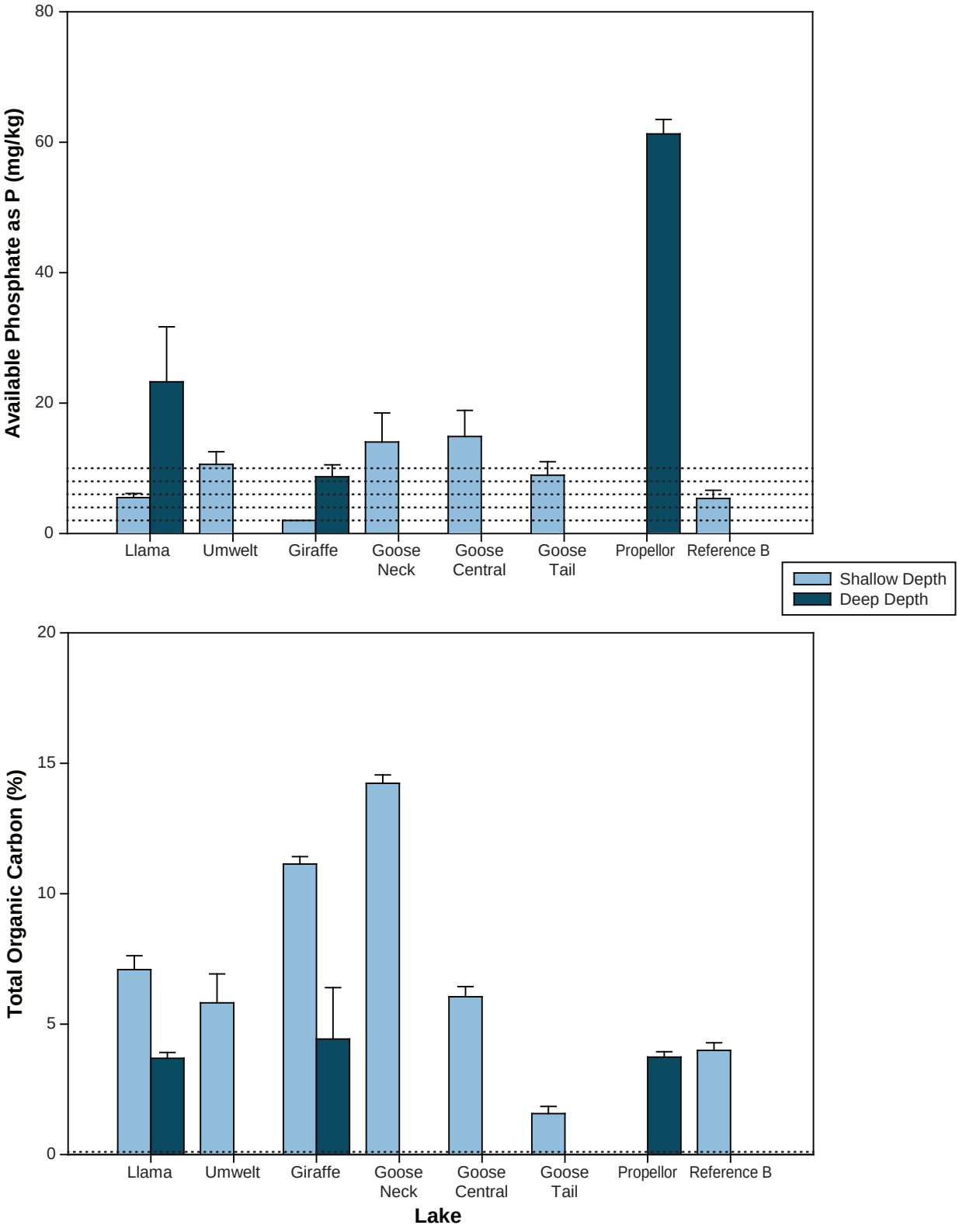

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (available phosphate 2.0 - 10.0 mg/kg; total organic carbon 0.1%).
Values below the detection limit are plotted at half the detection limit.

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Available Phosphate and Total Organic Carbon Concentrations in Lake Sediments, Back River Project, 2011

Figure 3.4-2b

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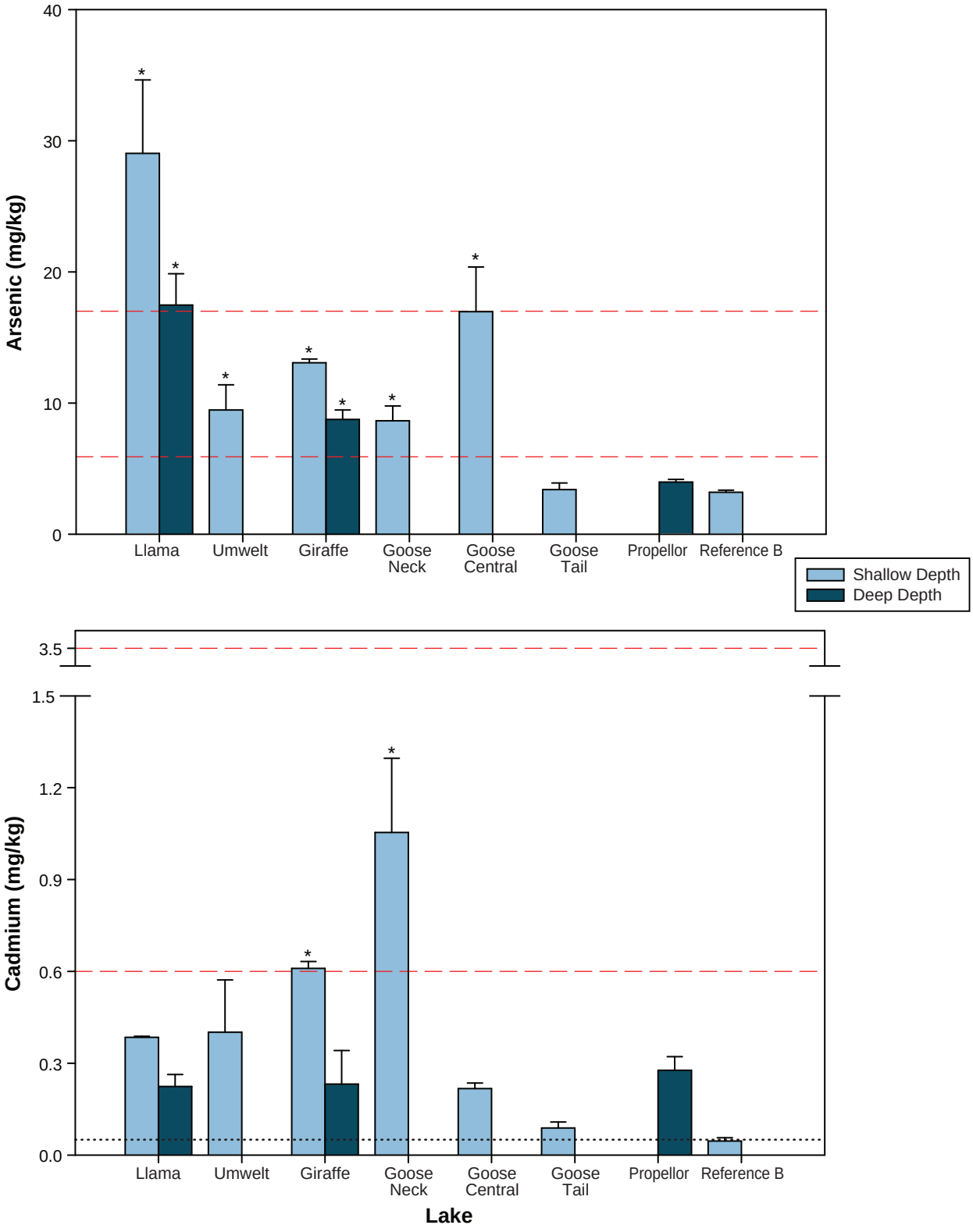

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (arsenic 0.05 mg/kg; cadmium 0.05 mg/kg).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guidelines.
For arsenic, the interim sediment quality guideline is 5.9 mg/kg and the probable effects level is 17 mg/kg.
For cadmium, the interim sediment quality guideline is 0.6 mg/kg and the probable effects level is 3.5 mg/kg.
** Indicates mean total metal values that are higher than CCME guidelines.*

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Arsenic and Cadmium Concentrations in Lake Sediments, Back River Project, 2011

Figure 3.4-3a

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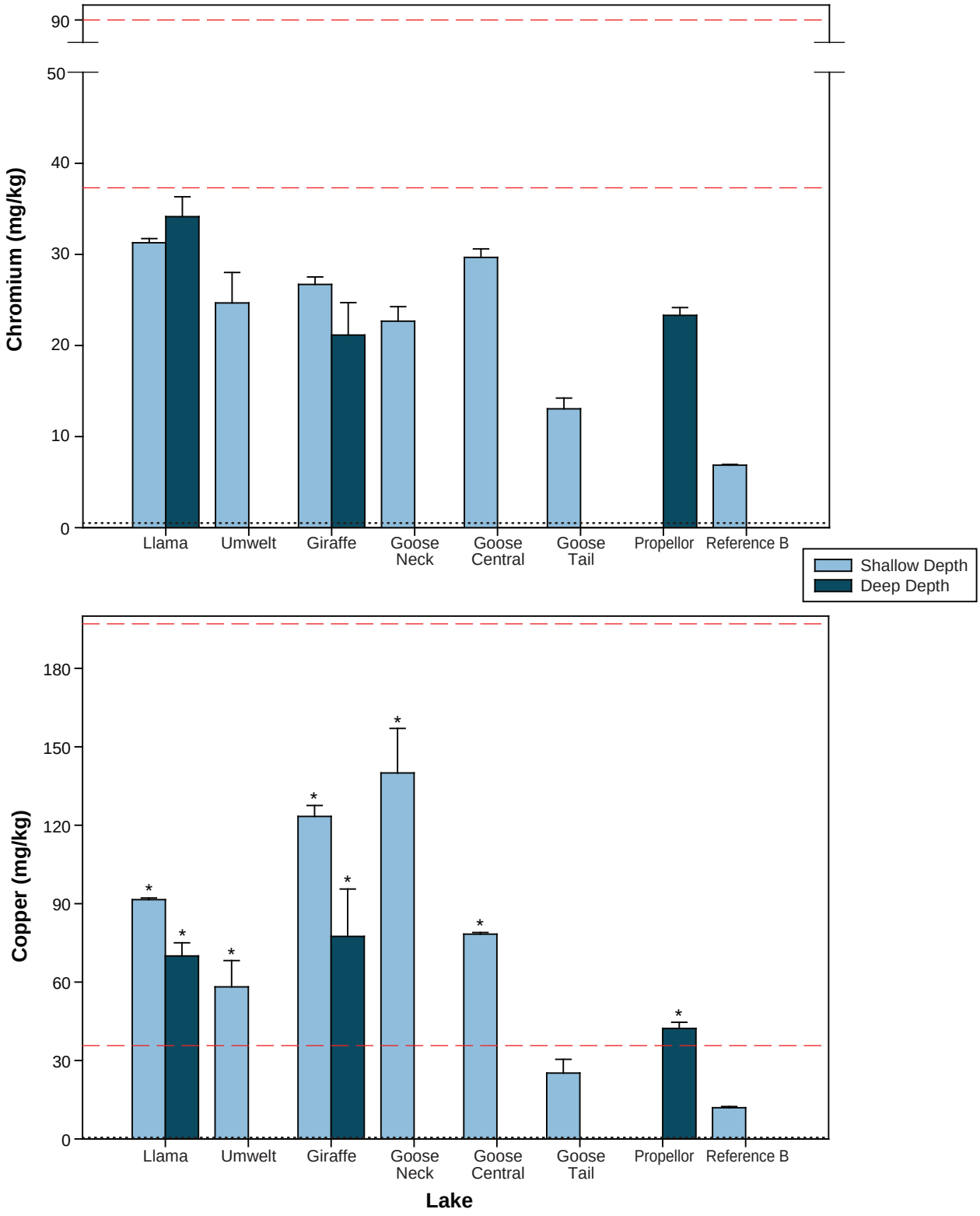

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (cadmium 0.05 mg/kg; chromium 0.5 mg/kg).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guidelines.
For chromium, the interim sediment quality guideline is 37.3 mg/kg and the probable effects level is 90 mg/kg.
For copper, the interim sediment quality guideline is 35.7 mg/kg and the probable effects level is 197 mg/kg.
** Indicates mean total metal values that are higher than CCME guidelines.*

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Chromium and Copper Concentrations in Lake Sediments, Back River Project, 2011

Figure 3.4-3b

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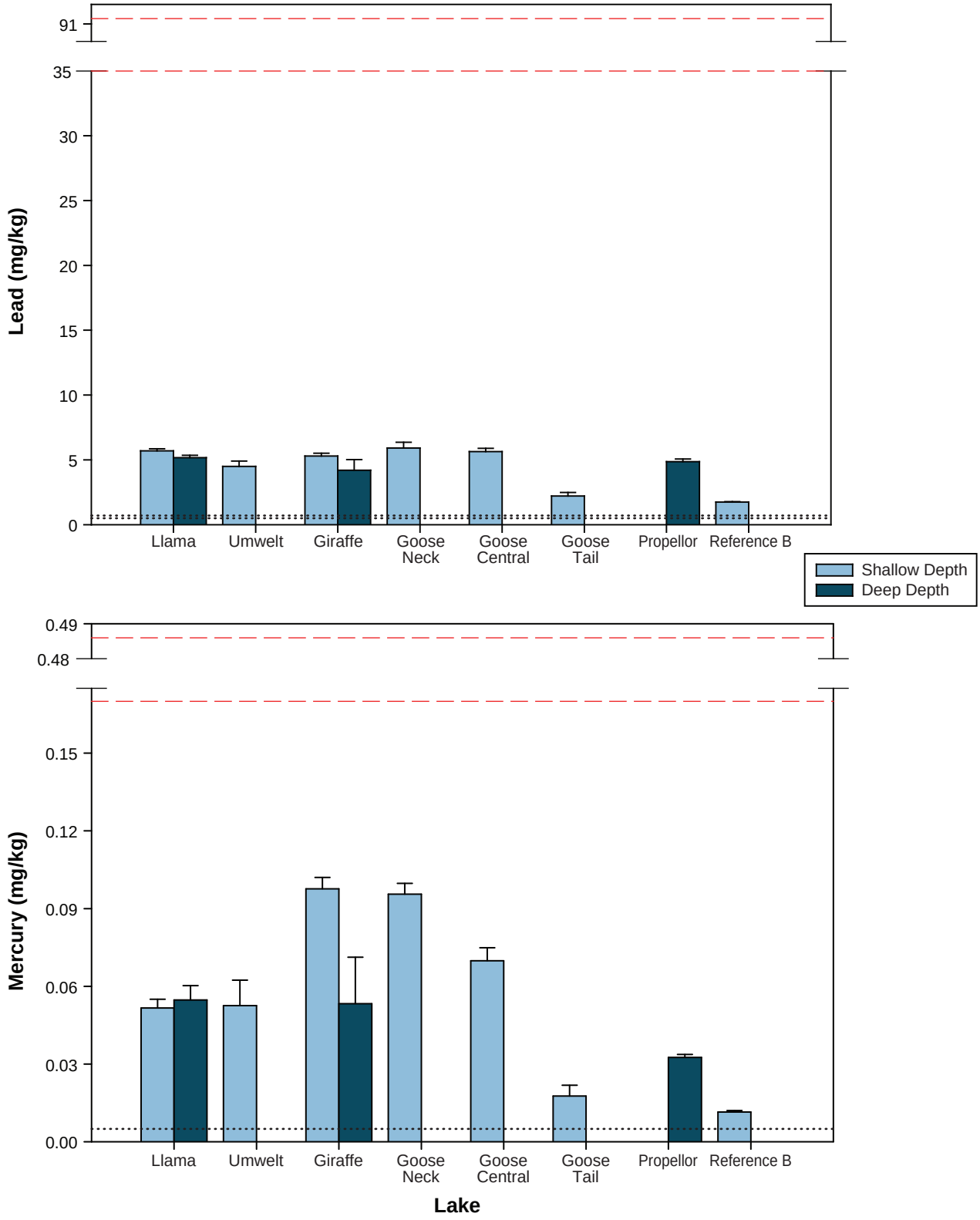

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (mercury 0.005 mg/kg; lead 0.5 or 0.7 mg/kg).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent the CCME guidelines.
For lead, the interim sediment quality guideline is 35 mg/kg and the probable effects level is 91.3 mg/kg.
For mercury, the interim sediment quality guideline is 0.17 mg/kg and the probable effects level is 0.486 mg/kg.

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Lead and Mercury Concentrations in Lake Sediments, Back River Project, 2011

Figure 3.4-3c

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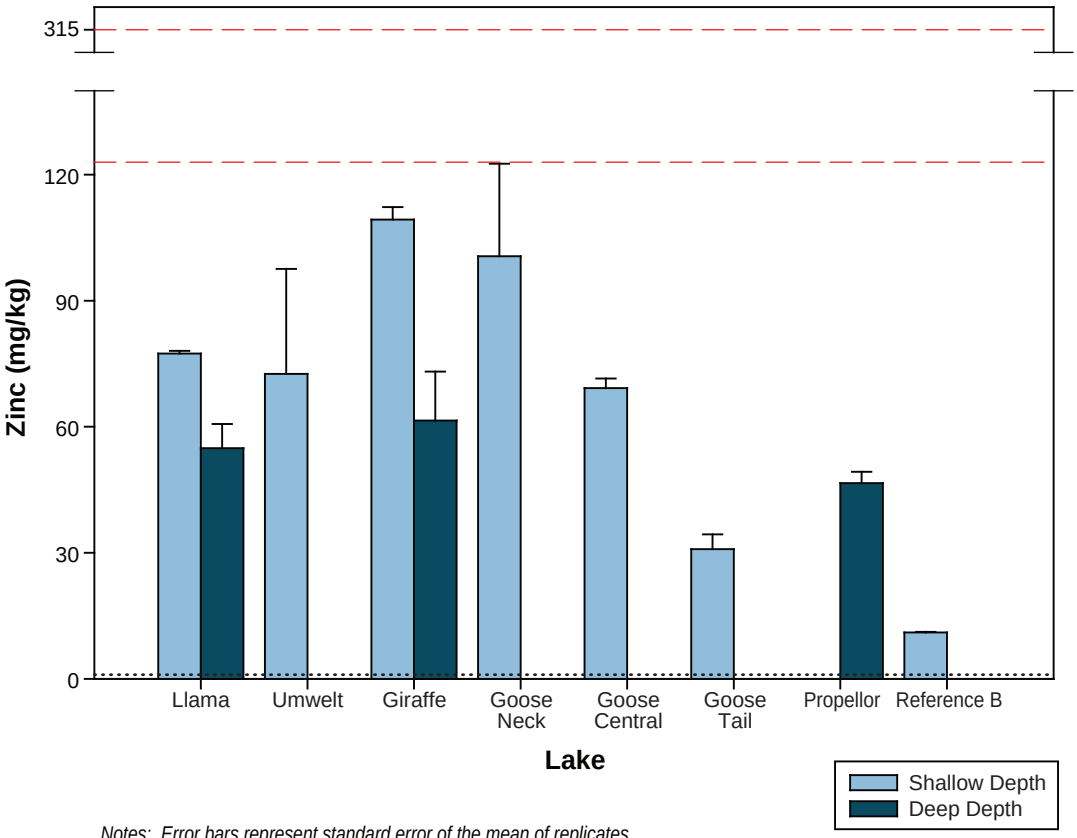

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (zinc 1.0 mg/kg).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guidelines.
For zinc, the interim sediment quality guideline is 123 mg/kg and the probable effects level is 315 mg/kg.

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Zinc Concentrations in Lake Sediments, Back River Project, 2011

Figure 3.4-3d

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Lake sediments also showed similar patterns for chromium and lead concentrations, as Llama Lake, Umwelt Lake, Giraffe Lake, Goose Lake Neck, Goose Lake Central and Propellor Lake had similar concentrations, with the lowest concentrations at Goose Lake Tail and Reference B Lake.

3.4.4 Cyanides

Cyanide levels were very low in all lake sediment samples as the total and weak acid dissociable (WAD) concentrations were below their analytical detection limit of 3 mg/kg, except one shallow replicate at Giraffe Lake that had 3.1 mg/kg.

3.4.5 Comparison with CCME Guidelines

Table 3.4-1 summarizes the percentage of sediment sample in which metal concentrations were higher than CCME guidelines, and Table 3.4-2 presents the factor by which sediment metal concentrations were higher than CCME guidelines.

Overall, the surveyed lakes sediments had concentrations of arsenic, cadmium and copper that were often higher than CCME ISQGs. Most lakes exceeded at ISQGs for at least one parameter, with the two exceptions being Goose Lake Tail and Reference B Lake.

The western lake sampling sites, Llama, Umwelt, Giraffe and Goose Neck and Goose Central, had mean arsenic and copper concentrations between 1.4 and 4.0 times the ISQGs. Goose Lake Neck also had mean cadmium concentrations 1.8 times higher than the ISQG. Although their means were below guideline levels, a few lakes had individual replicates above ISQGs: Llama (chromium), Umwelt (cadmium), Giraffe (cadmium) and Goose Neck (cadmium). Propellor Lake was the only other lake to exceed any ISQG, with a mean copper concentration 1.2 times the ISQG.

All lake sediments were below CCME PELs, except the arsenic levels in the Llama Lake sediments that were on average 1.37 times higher than the arsenic PEL (17 mg/kg). Llama Lake sediments also exceeded the arsenic PEL in 2010 (Rescan 2011). Llama Lake appears to have naturally elevated levels of arsenic; probably due to its location directly above a gold deposit (arsenic and gold are often found in conjunction). Two of the three Goose Central replicates exceeded the arsenic PEL (17 mg/kg), although the mean was still below the PEL (16.97 mg/kg).

3.5 STREAM SEDIMENT QUALITY

Stream sediment samples were collected in August 2011. Due to the absence of fine depositional sediments, no data could be collected at Llama OF or Propellor OF. Also, no sediments could be collected at Echo OF because it was dry during the August sampling period. Figure 3.5-1 to 3.5-3d present 2011 stream sediment quality results. All raw sediment quality data are presented in Appendix 3.5-1.

3.5.1 Particle Size

Stream sediments were a mixture of gravel, sand, silt and clay, with a combination of sand/silt dominant across all sites (Figure 3.5-1). The exception to this was Giraffe OF, which was over half gravel.

3.5.2 Nutrients

Mean available ammonium ranged between 12.4 mg/kg and 21.6 mg/kg in most stream sediments, except in Ref. B OF sediments where higher concentrations were present (36.9 mg/kg) (Figure 3.5-2a). Total nitrogen tended to be higher in sediments at Goose OF, Propellor D/S and Ref. B OF (averaging between 0.85% and 1.0%) than at Chair OF, Giraffe OF and Wolf OF (averaging between 0.13% and 0.42%).

Table 3.4-1. Lake Sediment Quality, Percent of Samples in which Concentrations are Higher than CCME Guidelines, Back River Project, 2011

Lake	Total Number of Samples Collected	CCME Guideline value[a] (mg/kg):	Percent of samples that exceed the ISQG[b] guidelines						
			Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Zinc (Zn)
			5.9	0.6	37.3	35.7	35	0.17	123
Llama	6		100	-	16.6	100	-	-	-
Umwelt	3		66.6	33.3	-	100	-	-	-
Giraffe	6		100	33.3	-	100	-	-	-
Goose Neck	3		100	100	-	100	-	-	33.3
Goose Central	3		100	-	-	100	-	-	-
Goose Tail	3		-	-	-	-	-	-	-
Propellor	3		-	-	-	100	-	-	-
Reference B	3		-	-	-	-	-	-	-
Total Sites	**30**		**5**	**3**	**1**	**6**	**0**	**0**	**1**

Lake	Total Number of Samples Collected	CCME Guideline value[a] (mg/kg):	Percent of samples that exceed the PEL[c] guidelines						
			Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Zinc (Zn)
			17	3.5	90	197	91.3	0.486	315
Llama	6		66.6	-	-	-	-	-	-
Umwelt	3		-	-	-	-	-	-	-
Giraffe	6		-	-	-	-	-	-	-
Goose Neck	3		-	-	-	-	-	-	-
Goose Central	3		66.6	-	-	-	-	-	-
Goose Tail	3		-	-	-	-	-	-	-
Propellor	3		-	-	-	-	-	-	-
Reference B	3		-	-	-	-	-	-	-
Total Sites	**30**		**2**	**0**	**0**	**0**	**0**	**0**	**0**

All values represent the percent of samples which are higher than CCME guidelines.

Even though a percentage of samples may be higher than a guideline amount, the calculated lake average may not be higher than a guideline amount.

a) Canadian sediment quality guidelines for the protection of aquatic life (CCME 2011)

b) ISQG = Interim sediment quality guideline

c) PEL = Probable Effects Level

Table 3.4-2. Lake Sediment Quality, Factor by which Average Concentrations are Higher than CCME Guidelines, Back River Project, 2011

Lake	Total Number of Samples Collected	CCME Guideline value[a] (mg/kg):	Factor by which samples are higher than ISQG[b] guidelines						
			Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Zinc (Zn)
			5.9	0.6	37.3	35.7	35	0.17	123
Llama	6		3.94	-	-	2.26	-	-	-
Umwelt	3		1.61	-	-	1.63	-	-	-
Giraffe	6		1.85	-	-	2.81	-	-	-
Goose Neck	3		1.46	1.76	-	3.92	-	-	-
Goose Central	3		2.88	-	-	2.19	-	-	-
Goose Tail	3		-	-	-	-	-	-	-
Propellor	3		-	-	-	1.18	-	-	-
Reference B	3		-	-	-	-	-	-	-
Total	**30**								

Lake	Total Number of Samples Collected	CCME Guideline value[a] (mg/kg):	Factor by which samples are higher than PEL[c] guidelines						
			Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Zinc (Zn)
			17	3.5	90	197	91.3	0.486	315
Llama	6		1.37	-	-	-	-	-	-
Umwelt	3		-	-	-	-	-	-	-
Giraffe	6		-	-	-	-	-	-	-
Goose Neck	3		-	-	-	-	-	-	-
Goose Central	3		-	-	-	-	-	-	-
Goose Tail	3		-	-	-	-	-	-	-
Propellor	3		-	-	-	-	-	-	-
Reference B	3		-	-	-	-	-	-	-
Total	**30**								

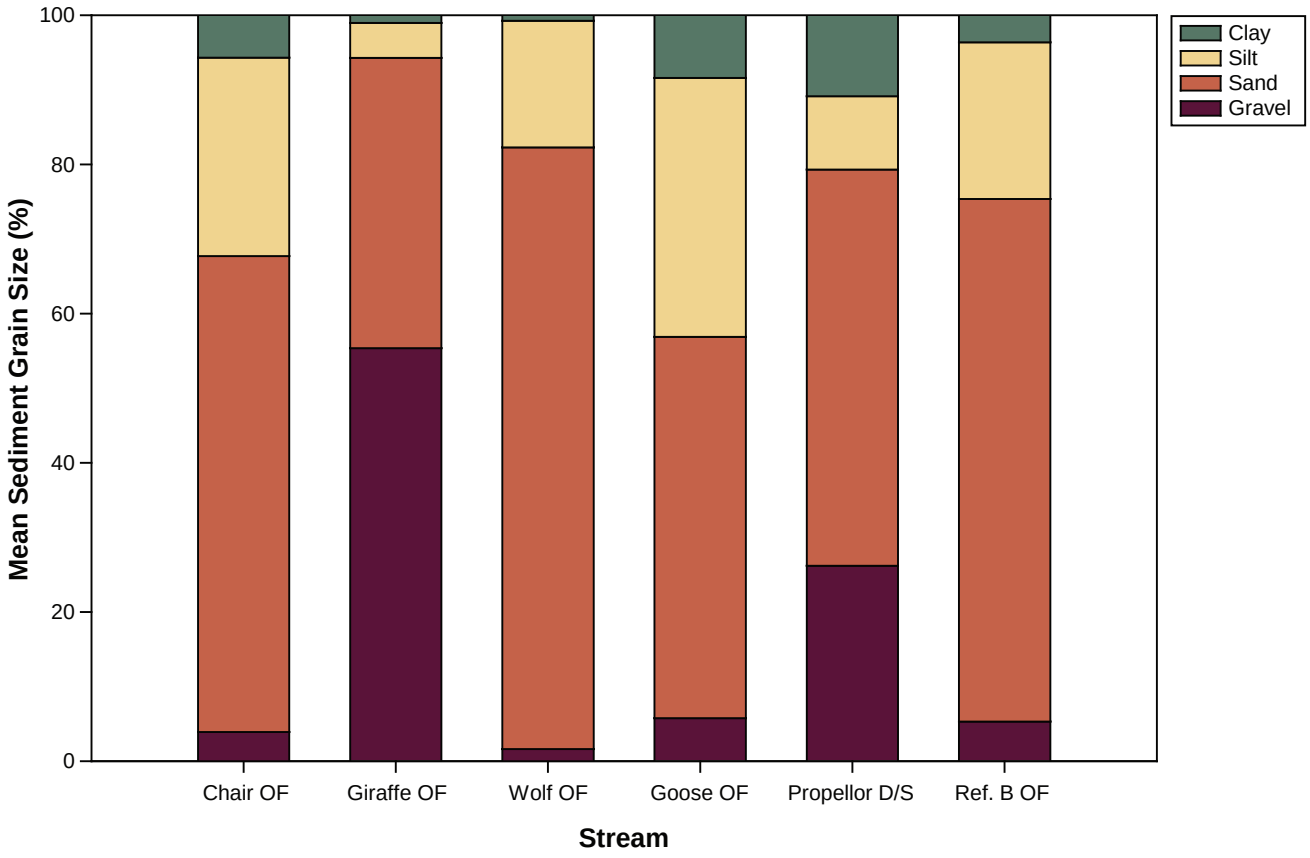
All values represent the percent of samples which are higher than CCME guidelines.

Even though a percentage of samples may be higher than a guideline amount, the calculated lake average may not be higher than a guideline amount.

a) Canadian sediment quality guidelines for the protection of aquatic life (CCME 2011)

b) ISQG = Interim sediment quality guideline

c) PEL = Probable Effects Level



Note: Stacked bars are means of triplicate samples.

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Sediment Grain Size Composition in Streams, Back River Project, 2011

Figure 3.5-1

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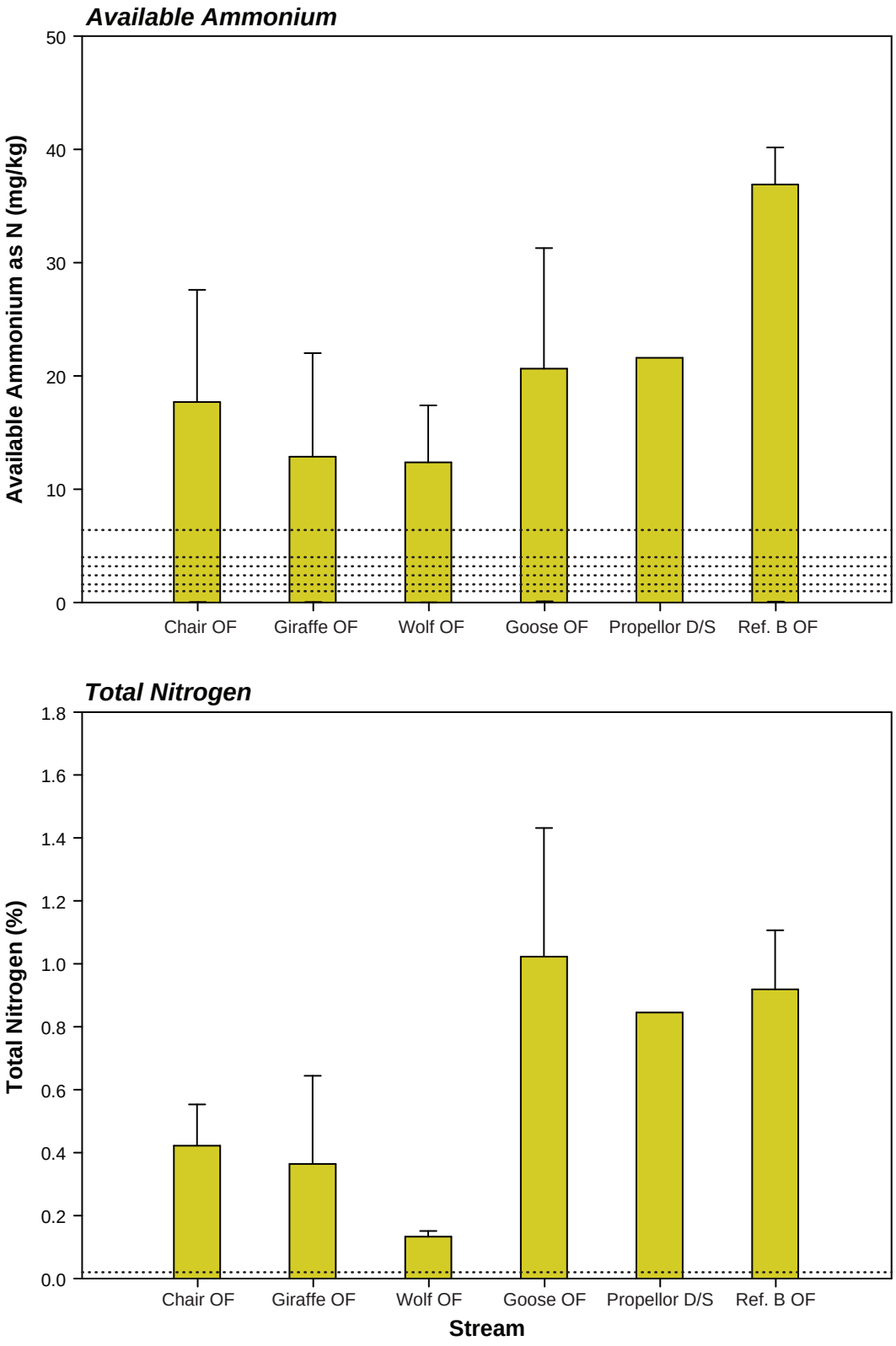

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (available ammonia 1 - 6.4 mg/kg; total nitrogen 0.02%).
Values below the detection limit are plotted at half the detection limit.

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Available Ammonium and Total Nitrogen Concentrations in Stream Sediments, Back River Project, 2011

Figure 3.5-2a

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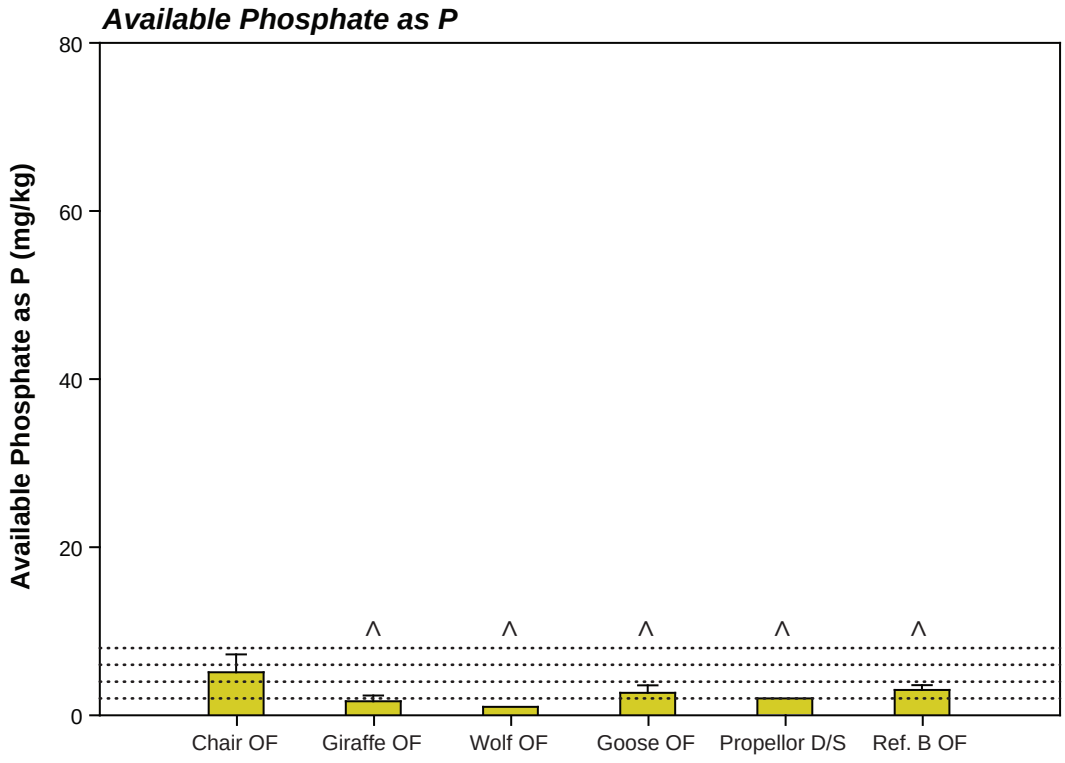

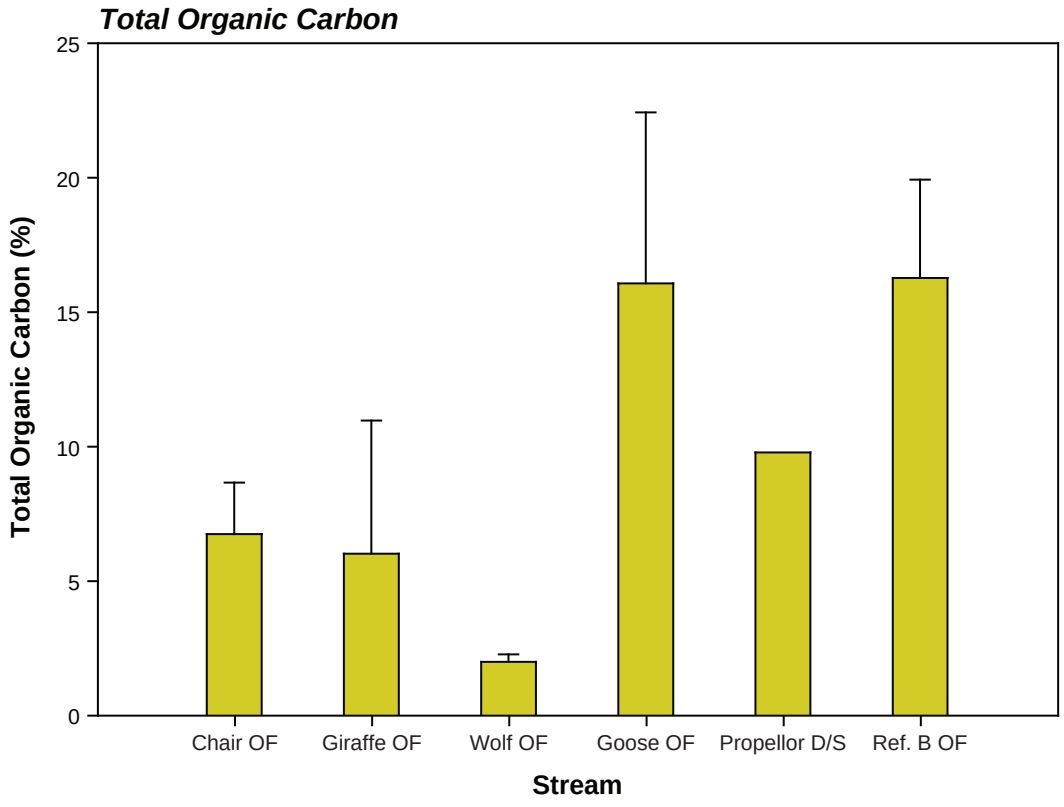

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (available phosphate 2.0 - 8.0 mg/kg; total organic carbon 0.1%).
Values below the detection limit are plotted at half the detection limit.
^ Indicates all replicates were below detection limits.

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Available Phosphate and Total Organic Carbon Concentrations in Stream Sediments, Back River Project, 2011

Figure 3.5-2b

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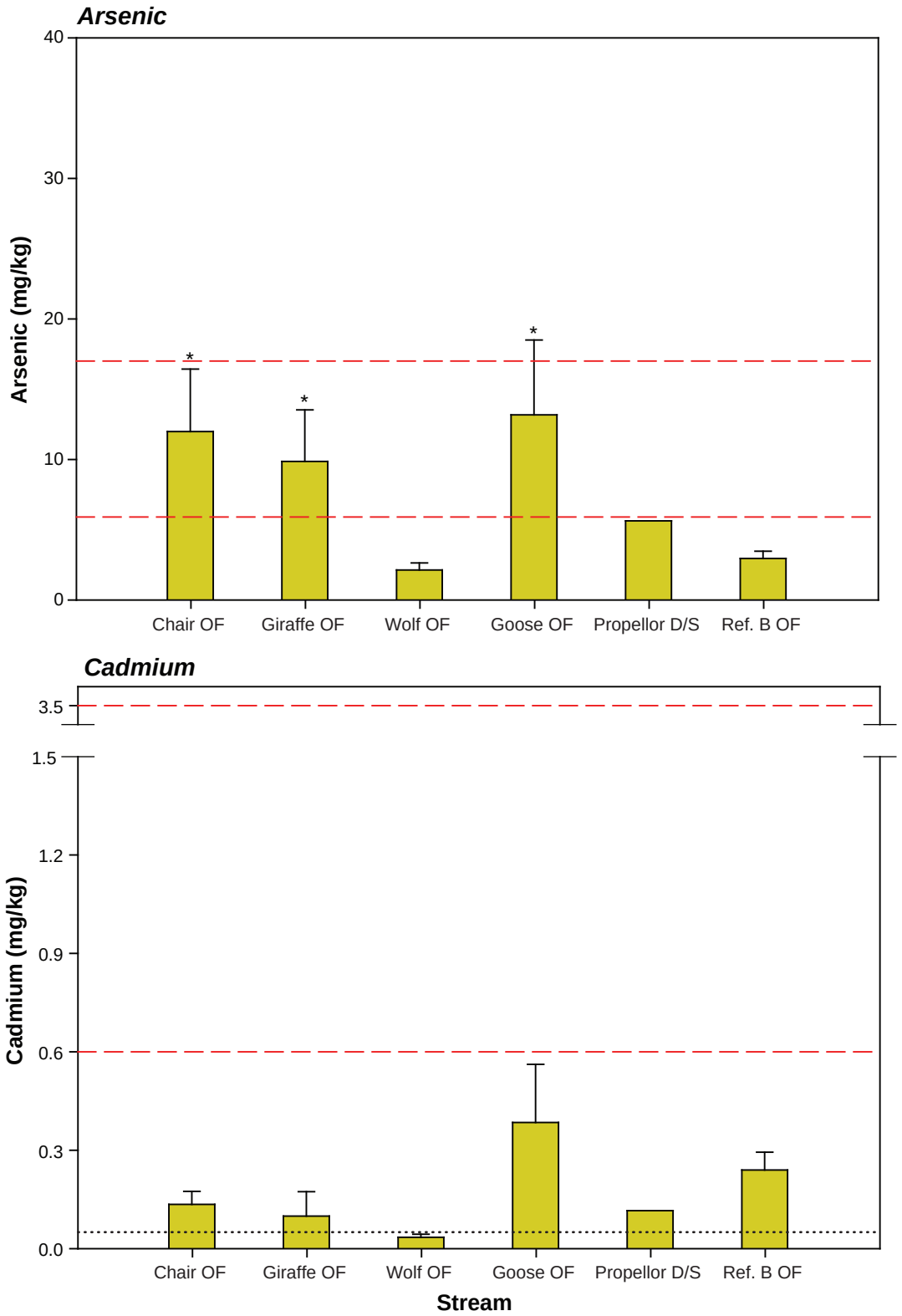

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (arsenic 0.05 mg/kg; cadminum 0.05 mg/kg).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guidelines.
For arsenic, the interim sediment quality guideline is 5.9 mg/kg and the probable effects level is 17 mg/kg.
For cadmium, the interim sediment quality guideline is 0.6 mg/kg and the probable effects level is 3.5 mg/kg.
** Indicates mean total metal values that are higher than CCME guidelines.*

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Arsenic and Cadmium Concentrations in Stream Sediments, Back River Project, 2011

Figure 3.5-3a

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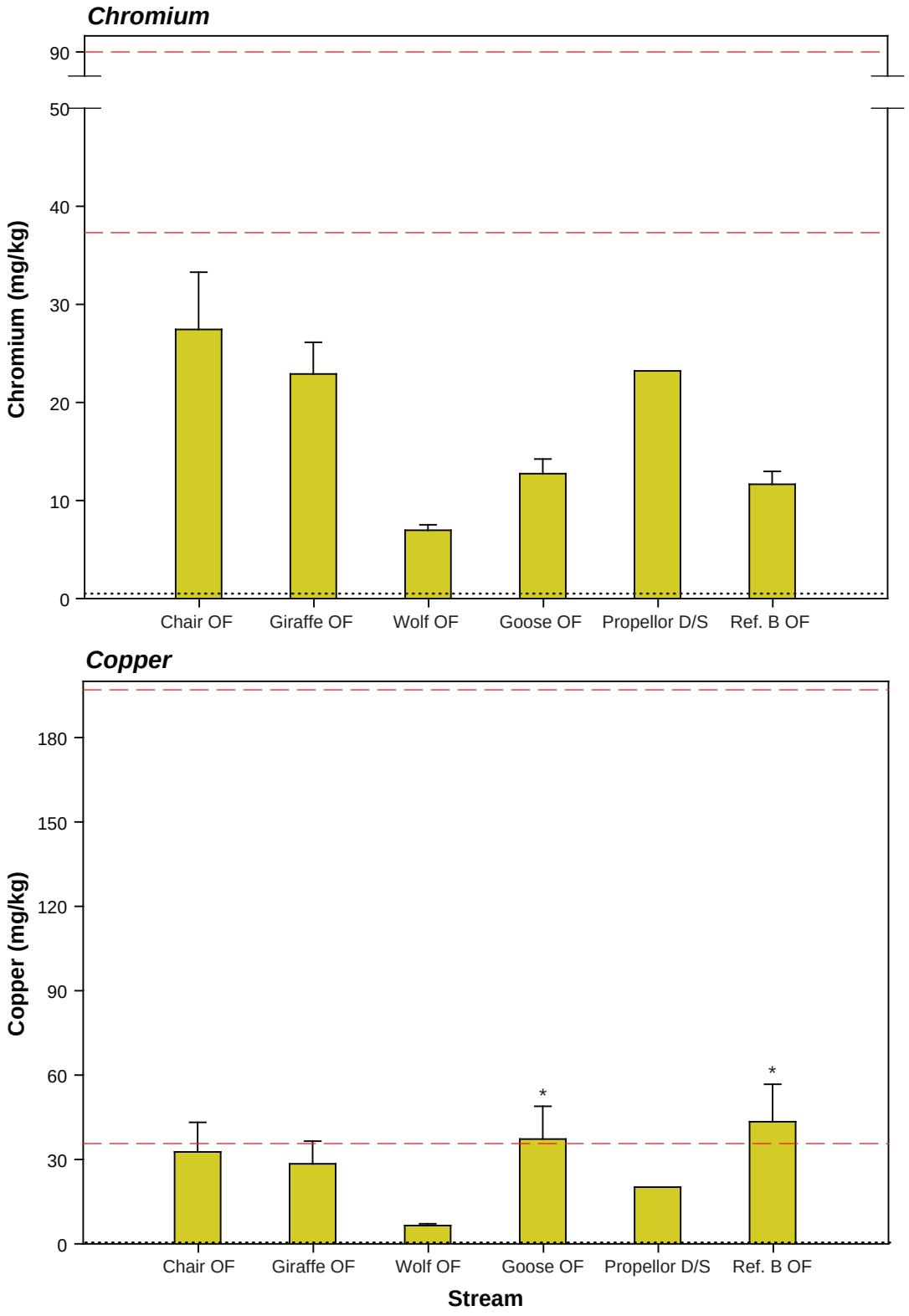

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (chromium 0.5 mg/kg; copper 0.5 mg/L).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guidelines.
For chromium, the interim sediment quality guideline is 37.3 mg/kg and the probable effects level is 90 mg/kg.
For copper the interim sediment quality guideline is 35.7 mg/kg and the probable effects level 197 mg/kg.
** Indicates mean total metal values that are higher than CCME guidelines.*

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Chromium and Copper Concentrations in Stream Sediments, Back River Project, 2011

Figure 3.5-3b

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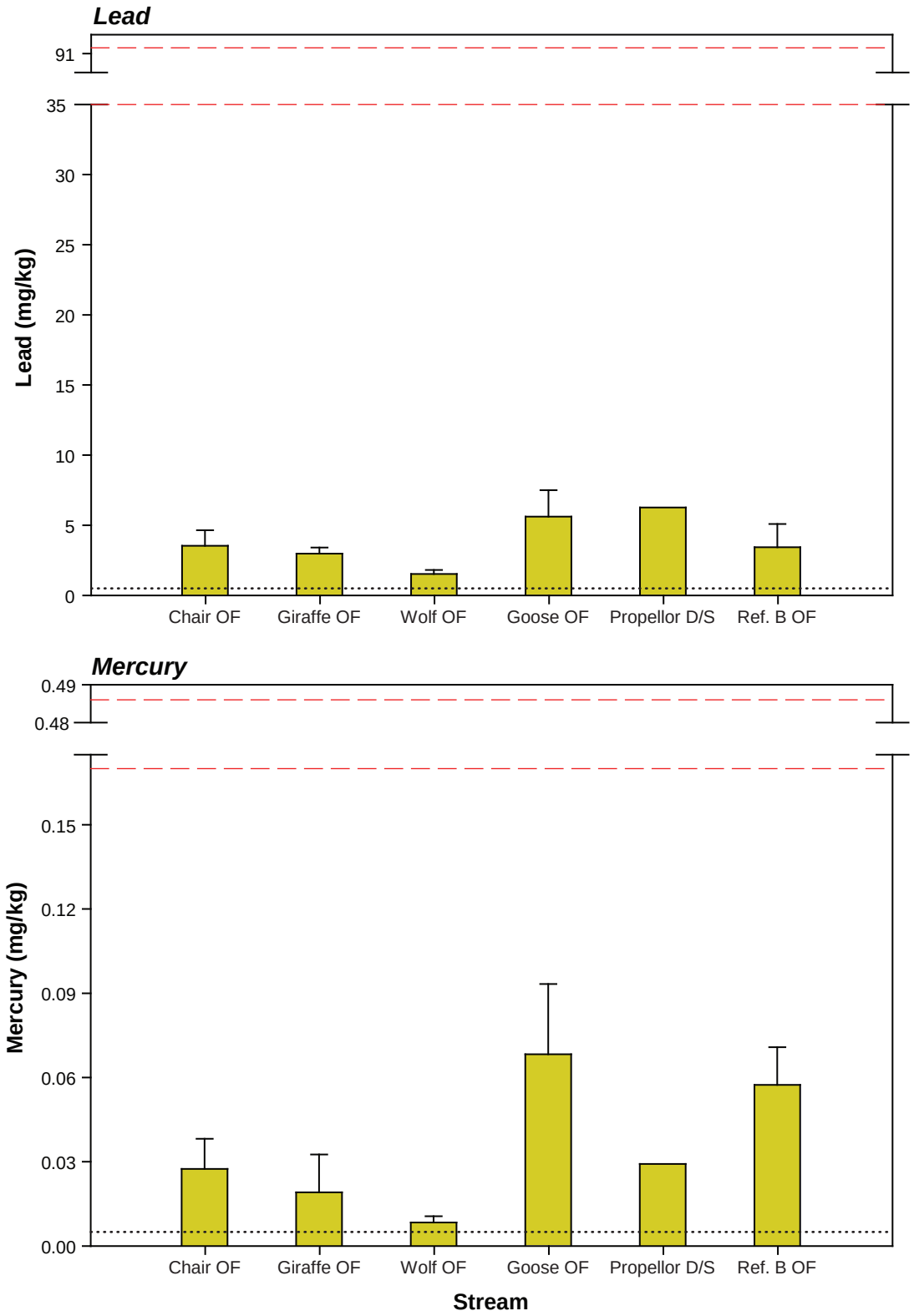

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (lead 0.5 mg/kg; mercury 0.005 mg/kg).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent the CCME guidelines.
For lead the interim sediment quality guideline is 35 mg/kg and the probable effects level is 91.3 mg/kg.
For mercury the interim sediment quality guideline is 0.17 mg/kg and the probable effects level is 0.486 mg/kg.

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Lead and Mercury Concentrations in Stream Sediments, Back River Project, 2011

Figure 3.5-3c

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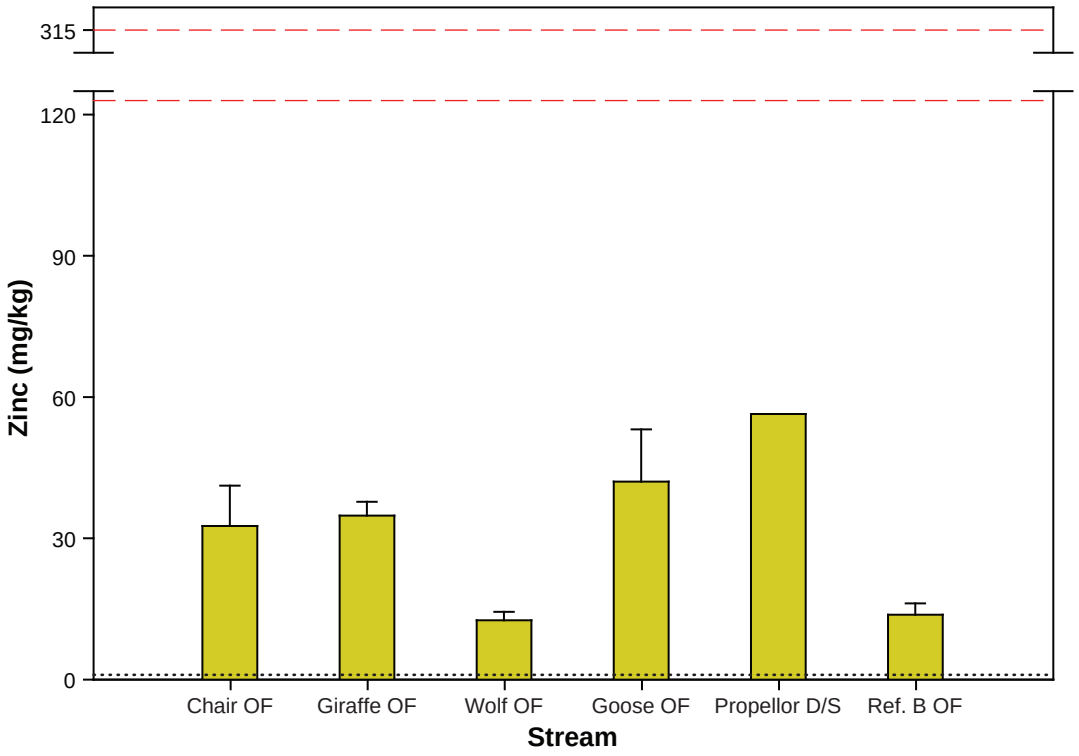

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (zinc 1.0 mg/kg).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guidelines.
For zinc, the interim sediment quality guideline is 123 mg/kg and the probable effects level is 315 mg/kg.

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Zinc Concentrations in Stream Sediments, Back River Project, 2011

Figure 3.5-3d

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Available phosphate levels were below detection limits in all stream sediments (2.0 mg/kg to 8.0 mg/kg), except in two Chair OF replicates (6.1 mg/kg and 8.2 mg/kg) (Figure 3.5-2b).

Total organic carbon (TOC) content was highest in Goose OF and Ref. B OF sediments, averaging 16% (Figure 3.5-2b). Chair OF, Giraffe OF and Propellor D/S sediments had intermediate TOC content, averaging between 6.0% and 9.8%, while Wolf OF had the lowest content at 2.0%.

3.5.3 Metals

Metal concentrations in stream sediments were similar or lower than in lake sediments (Figures 3.5-3a to 3.5-3b). Metal concentrations varied considerably between stream sediments, and were consistently lowest in the sediments at Wolf OF. Concentrations of arsenic and copper were naturally elevated in the sediments of some streams.

Arsenic concentrations were highest in sediments at Chair OF, Giraffe OF and Goose OF, averaging between 9.9 mg/kg and 13.2 mg/kg (Figure 3.5-3a). This was higher than the ISQG levels of 5.9 mg/kg. The other streams sampled had less than 5.6 mg/kg in their sediments. Copper concentrations were high in the stream sediments, averaging between 20.2 mg/kg and 43.4 mg/kg (Figure 3.5-3c). The exception to this was Wolf OF sediments, which had an average of 6.6 mg/kg copper.

Similar spatial patterns were seen in the concentrations of some metals in the stream sediments. The highest concentrations of cadmium, copper and mercury were found in the Goose OF and Ref. B OF sediments, and the lowest concentrations in Wolf OF. For chromium and zinc, the highest concentrations were at Chair OF, Giraffe OF, Goose OF and Propellor D/S, and lowest concentrations at Wolf OF and Ref. B OF.

3.5.4 Cyanides

Both total and WAD cyanides were below their respective analytical detection limit in all replicates at all streams (3.0 mg/kg).

3.5.5 Comparison with CCME Guidelines

The percentage of sediment samples in which metal concentrations were higher than CCME guidelines is summarized in Table 3.5-1. Table 3.5-2 presents the factor by which mean sediment concentrations were higher than CCME guidelines.

At most stream sites, sediments from at least one replicate exceeded the CCME ISQG for arsenic, chromium, and copper. Goose Lake had the most parameters that at least one replicate exceeded an ISQG (arsenic, cadmium, and copper), followed by Chair OF (arsenic and copper), and Giraffe OF (arsenic and copper). Chair OF and Giraffe OF had mean arsenic concentrations 2.0 and 1.7 times higher than the ISQG, and while they had replicates that exceeded copper ISQGs, their mean concentrations did not. Mean arsenic and copper concentrations at Goose OF exceeded ISQGs (by factors of 2.23 and 1.04), and one replicate exceeded cadmium ISQGs. Ref. B OF exceeded the ISQG for copper by a factor of 1.22.

No stream sites had average concentrations above the CCME PELs, although both Chair OF and Giraffe OF had replicates that were higher than the PEL for arsenic (17 mg/kg).

Table 3.5-1. Stream Sediment Quality, Percent of Samples in which Concentrations are Higher than CCME Guidelines, Back River Project, 2011

Stream	Total Number of Samples Collected	CCME Guideline value[a] (mg/kg):	Percent of samples that exceed the ISQG[b] guidelines						
			Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Zinc (Zn)
			5.9	0.6	37.3	35.7	35	0.17	123
Chair OF	3		66.7	-	-	66.7	-	-	-
Giraffe OF	3		66.7	-	-	33.3	-	-	-
Wolf OF	3		-	-	-	-	-	-	-
Goose OF	3		66.7	33.3	-	66.7	-	-	-
Propellor D/S	1		-	-	-	-	-	-	-
Ref. B OF	3		-	-	-	66.7	-	-	-
Total	**16**								

Stream	Total Number of Samples Collected	CCME Guideline value[a] (mg/kg):	Percent of samples that exceed the PEL[c] guidelines						
			Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Zinc (Zn)
			17	3.5	90	197	91.3	0.486	315
Chair OF	3		33.3	-	-	-	-	-	-
Giraffe OF	3		-	-	-	-	-	-	-
Wolf OF	3		-	-	-	-	-	-	-
Goose OF	3		33.3	-	-	-	-	-	-
Propellor D/S	1		-	-	-	-	-	-	-
Ref. B OF	3		-	-	-	-	-	-	-
Total Sites	**16**								

All values represent the percent of samples which are higher than CCME guidelines.

Note: sediment sampleswere not collected from Echo OF, Llama OF and Propellor OF. Only one sample was collected from Propellor D/S.

Even though a percentage of samples may be higher than a guideline amount, the calculated stream mean may not be higher than a guideline amount.

a) Canadian sediment quality guidelines for the protection of aquatic life (CCME 2011)

b) ISQG = Interim sediment quality guideline

c) PEL = Probable Effects Level

Table 3.5-2. Stream Sediment Quality, Factor by which Average Concentrations are Higher than CCME Guidelines, Back River Project, 2011

Stream	Total Number of Samples Collected	CCME Guideline value[a] (mg/kg):	Factor by which samples are higher than ISQG[b] guidelines						
			Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Zinc (Zn)
			5.9	0.6	37.3	35.7	35	0.17	123
Chair OF	3		2.03	-	-	-	-	-	-
Giraffe OF	3		1.67	-	-	-	-	-	-
Wolf OF	3		-	-	-	-	-	-	-
Goose OF	3		2.23	-	-	1.04	-	-	-
Propellor D/S	1		-	-	-	-	-	-	-
Ref. B OF	3		-	-	-	1.22	-	-	-
Total	**16**								

Stream	Total Number of Samples Collected	CCME Guideline value[a] (mg/kg):	Factor by which samples are higher than PEL[c] guidelines						
			Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Zinc (Zn)
			17	3.5	90	197	91.3	0.486	315
Chair OF	3		-	-	-	-	-	-	-
Giraffe OF	3		-	-	-	-	-	-	-
Wolf OF	3		-	-	-	-	-	-	-
Goose OF	3		-	-	-	-	-	-	-
Propellor D/S	1		-	-	-	-	-	-	-
Ref. B OF	3		-	-	-	-	-	-	-
Total	**16**								

All values represent the percent of samples which are higher than CCME guidelines.

Note: sediment samples were not collected from Echo OF, Llama OF and Propellor OF. Only one sample was collected from Propellor D/S.

Even though a percentage of samples may be higher than a guideline amount, the calculated stream mean may not be higher than a guideline amount.

a) Canadian sediment quality guidelines for the protection of aquatic life (CCME 2011)

b) ISQG = Interim sediment quality guideline

c) PEL = Probable Effects Level

3.6 PRIMARY PRODUCERS

3.6.1 Phytoplankton

Lake phytoplankton samples were collected in August 2011. Figures 3.6-1 and 3.6-2 present 2011 phytoplankton results, and all raw phytoplankton data are presented in Appendix 3.6-1 to 3.6-3.

3.6.1.1 Biomass, Density and Community Composition

Summer phytoplankton biomass (as chlorophyll *a*) was very low in all lakes, consistently below 1 µg chl *a*/L, and can be considered ultra-oligotrophic (Vollenweider and Kerekes 1982; Figure 3.6-1). Chlorophyll *a* levels were highest at Umwelt Lake, Goose Lake Central, and Reference B Lake, averaging 0.6 µg chl *a*/L, and was lowest at Giraffe Lake, averaging just 0.14 µg chl *a*/L.

Summer phytoplankton biomass calculated as biovolume followed a similar trend to biomass based on chlorophyll *a*. Differences may reflect varying levels of intracellular chlorophyll *a* in different phytoplankton cells, or the presence of mixotrophic or heterotrophic algae.

There was no clear spatial pattern in phytoplankton densities. Phytoplankton densities averaged 1,036 cells/mL, and ranged from 630 cells/mL at Goose Lake Neck to 1,300 cells/mL at Umwelt and Reference B lakes.

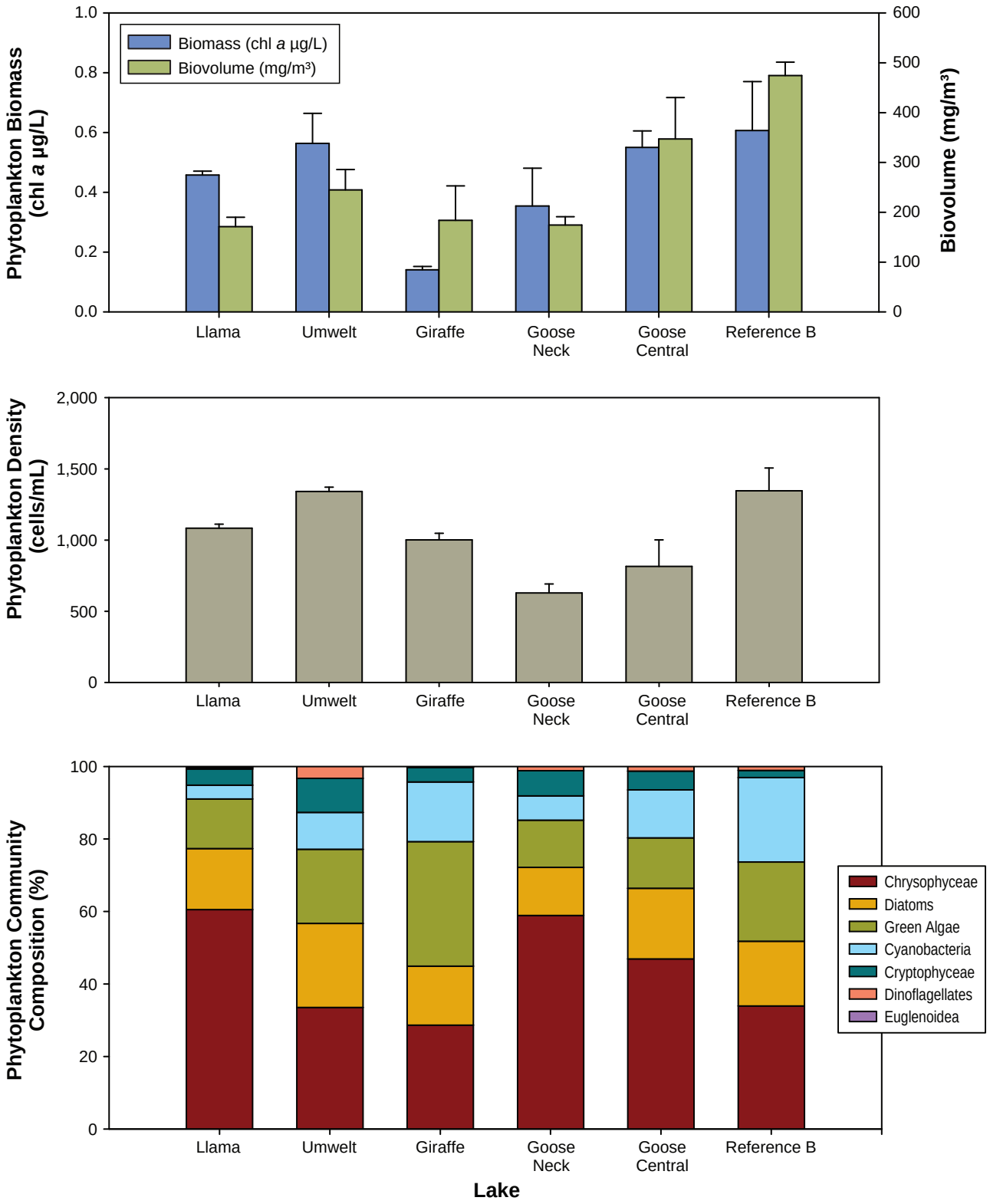
Lakes in the study area contained a diverse assemblage of phytoplankton taxa (Figure 3.6-1). The major phytoplankton group observed was chrysophytes (including diatoms shown separately in Figure 3.6-1 from other chrysophytes), representing between 45% and 77% of phytoplankton communities. The composition of the rest of the phytoplankton community, mainly green algae, cyanobacteria and cryptophytes, varied between lakes. Umwelt Lake also had dinoflagellates that comprised 3% of the community, whilst at all other lakes dinoflagellates made up 1% or lower of the total community.

Phytoplankton unidentified to the genus level made up a significant portion of the communities at all lakes, on average 39% to 68% of the total individuals collected. Two groups of unidentified naked chrysophytes, and one group of unidentified centric diatoms were considered as a single genus for the purpose of diversity and richness analyses as each group averaged greater than 15% of the total individuals collected. Unidentified individuals excluded from diversity and richness analysis made up less than 0.02%.

Of the genera that were identified, the three most abundant made up between 12% and 38% percent of the total community (Table 3.6-1). The three most abundant genera tended to be green algae or cyanobacteria, with the green alga *Elakatothrix* and the cyanobacteria *Aphanocapsa* present for all lakes. The exception to this was Reference B Lake, where the chrysophyte, *Dinobryon*, was the third most abundant genera and the dominant genera did not include *Elakatothrix* or *Aphanocapsa*. The green algal genus *Monoraphidium* was the most abundant genus at Giraffe Lake, composing nearly 20% of the total individuals collected.

3.6.1.2 Richness and Diversity

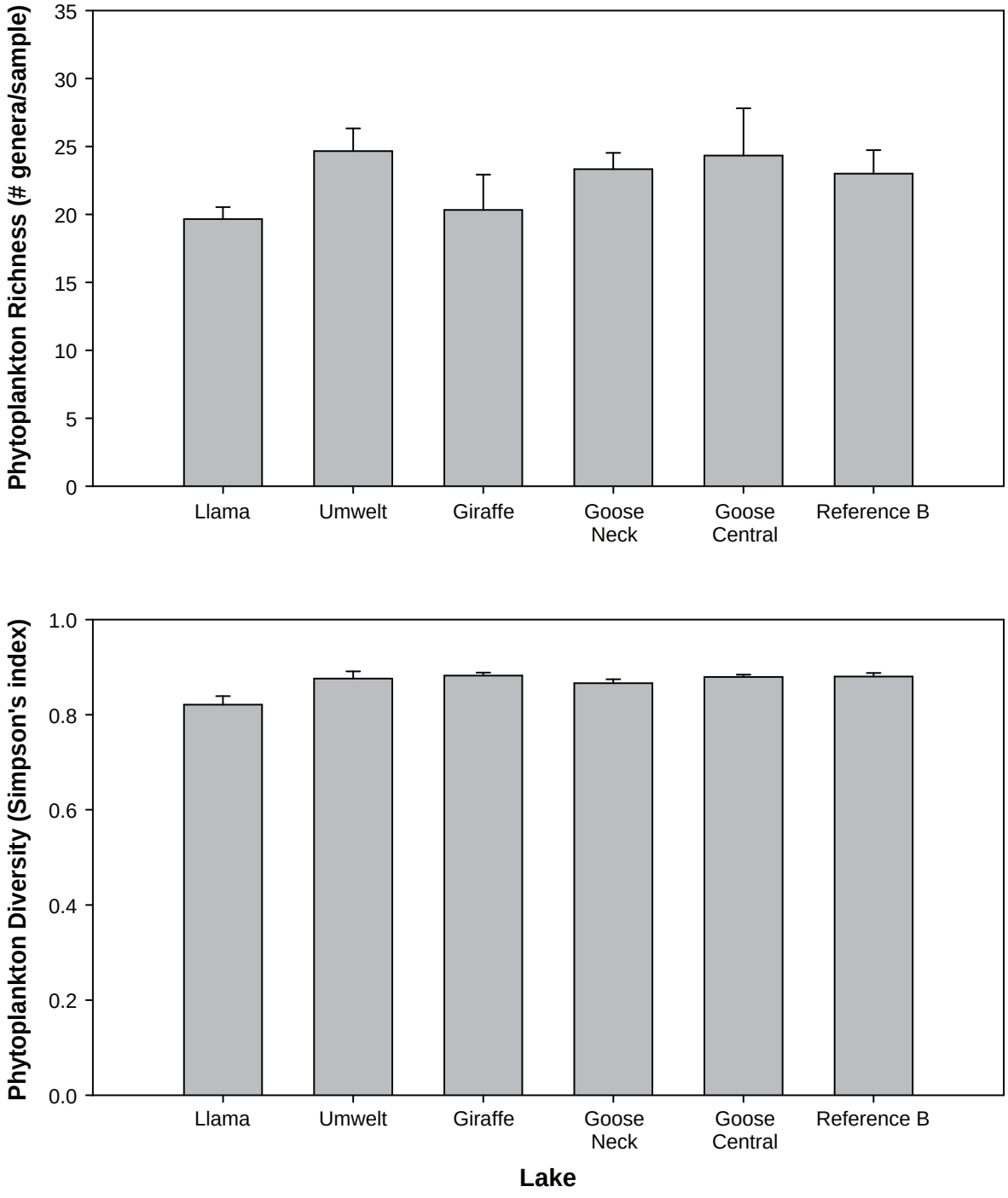
Genera richness averaged 23 genera per sample in the study lakes during August 2011 (Figure 3.6-2). Richness was similar at all lakes, ranging from 20 genera/sample at Llama and Giraffe lakes to 25 genera/sample at Umwelt Lake.



Note: Error bars represent standard error of the mean.
Community composition values represent the mean of replicates.

Figure 3.6-1

Phytoplankton Biomass, Density and Community Composition in Lakes, Back River Project, August 2011



Note: Error bars represent standard error of the mean.
Diversity was analyzed at the genus level.

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Phytoplankton Richness and Diversity in Lakes, Back River Project, 2011

Figure 3.6-2

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Table 3.6-1. Most Abundant Phytoplankton Genera in Lakes, Back River Project, August 2011

Lake	Most Abundant Phytoplankton Genera		
	Major Taxonomic Group	Genus Species	% Relative Abundance
Llama	Green Algae - Chlorophyceae	*Oocystis* spp.	4.7
	Green Algae - Chlorophyceae	*Elakatothrix genevensis*	4.3
	Cyanobacteria	*Aphanocapsa* spp.	3.4
Umwelt	Green Algae - Chlorophyceae	*Elakatothrix genevensis*	9.2
	Cyanobacteria	*Aphanocapsa* spp.	8.2
	Cryptophyceae	*Cryptomonas* spp.	6.9
Giraffe	Green Algae - Chlorophyceae	*Monoraphidium* spp.	19.8
	Cyanobacteria	*Aphanocapsa* spp.	9.5
	Green Algae - Chlorophyceae	*Elakatothrix* spp.	8.3
Goose Neck	Cyanobacteria	*Aphanocapsa* spp.	4.6
	Cryptophyceae	*Rhodomonas minuta*	4.4
	Green Algae - Chlorophyceae	*Elakatothrix genevensis*	4.1
Goose Central	Cyanobacteria	*Aphanocapsa* spp.	6.3
	Green Algae – Chlorophyceae	*Elakatothrix genvensis*	4.6
	Cyanobacteria	*Limnothrix* sp.	3.3
Reference B	Cyanobacteria	*Limnothrix* sp.	17.9
	Green Algae – Chlorophyceae	*Ankistrodesmus* spp.	11.4
	Chrysophyceae	*Dinobryon* spp.	4.2

Note: Species names are only included where all individuals in the genus were identified as from a single species. Individuals not identified to the genus level were not included in this table.

Simpson's diversity index is a combined measure of genera richness and the evenness with which abundances are distributed among these genera. Diversity was high and similar across lakes, averaging between 0.82 and 0.88 (Simpson's index; Figure 3.6-2).

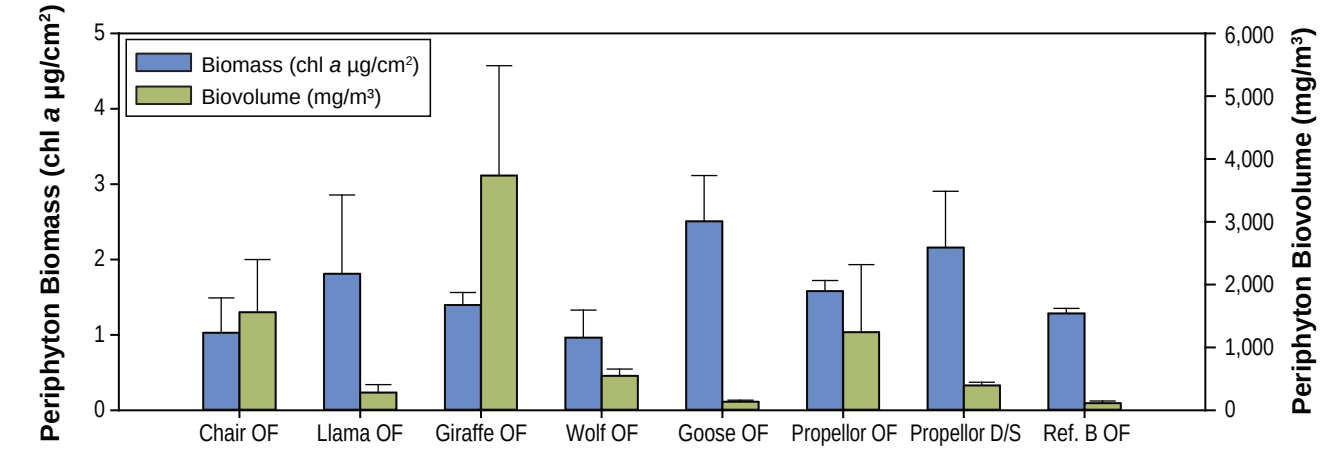
3.6.2 Periphyton

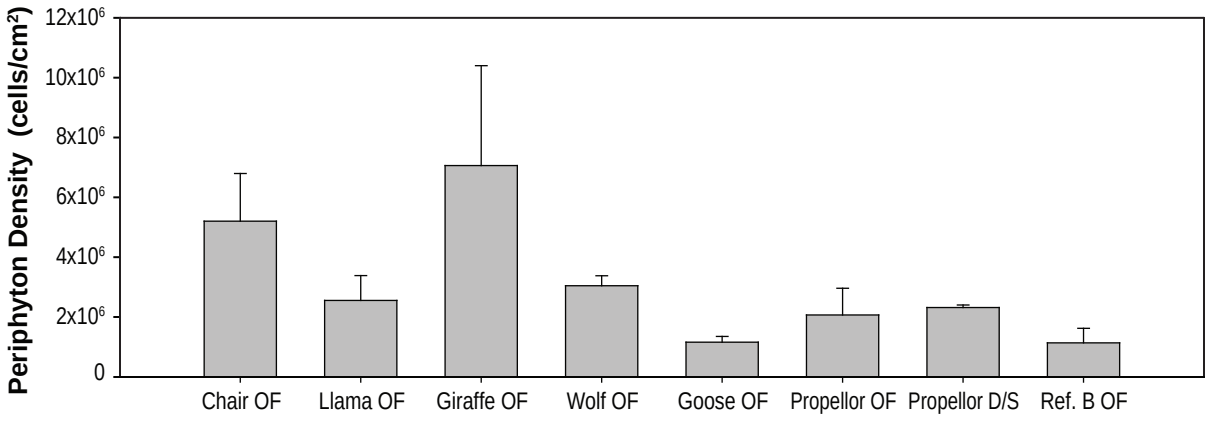
Stream periphyton samples were collected in August 2011. No periphyton samples could be collected at Echo OF as it was dry during summer sampling. Figures 3.6-3 and 3.6-4 present 2011 periphyton results, and all raw periphyton data are presented in Appendix 3.6-4 to 3.6-6.

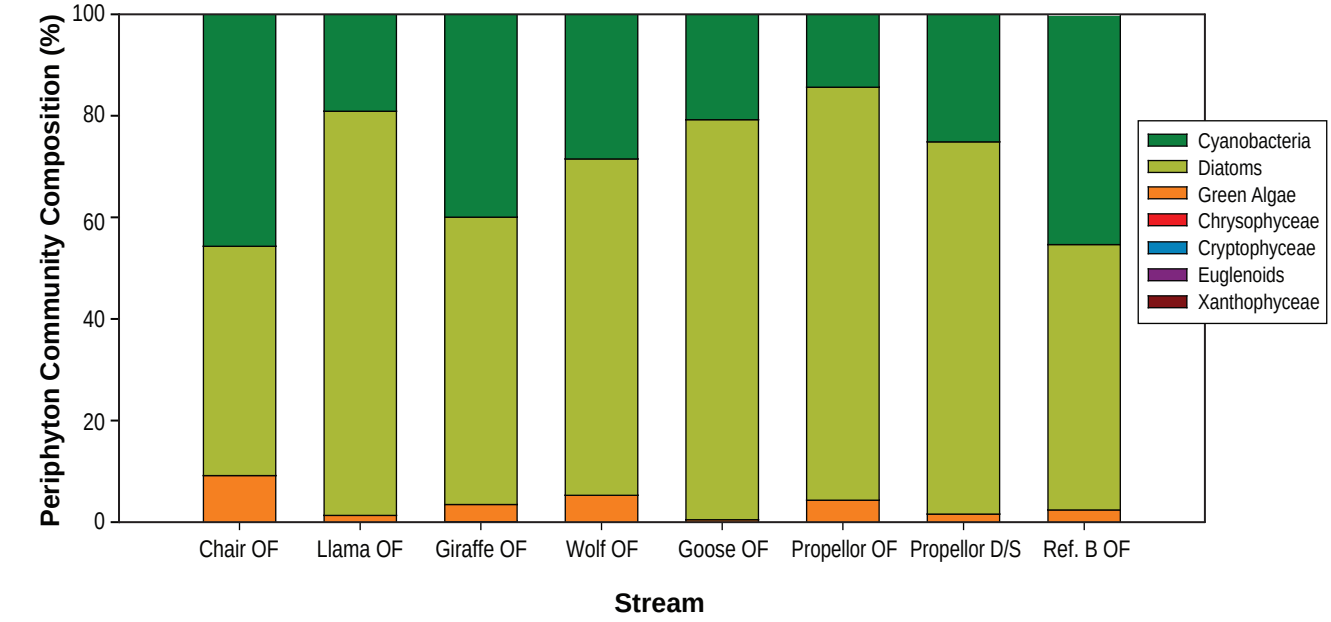
3.6.2.1 Biomass, Density and Community Composition

Mean periphyton biomass (as chlorophyll *a*) ranged from 0.96 µg chl *a*/cm^2 at Wolf OF to 2.51 µg chl *a*/cm^2 at Goose OF (Figure 3.6-3), and averaged 1.59 µg chl *a*/cm^2 over all streams. Biomass as chlorophyll *a* tended to be highest in the larger streams, which had higher discharge during the summer sampling (e.g., Goose OF and both Propellor sites). Biomass as calculated by biovolume was variable across sites, with Giraffe OF having higher total biovolume levels than the other streams.

Periphyton density ranged from a mean of 1.1×10^6 to 7.1×10^6 cells/cm^2 and differed slightly from patterns seen in biomass (Figure 3.6-3). Differences between density and biomass patterns are likely a reflection of size variation between taxa. Densities at Giraffe OF (7.1×10^6 cells/cm^2) and Chair OF (5.2×10^6 cells/cm^2) were higher than at other sites, which were less than 3.0×10^6 cells/cm^2.







Note: Error bars represent standard error of the mean
Community composition values represent the mean of replicates

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Periphyton Biomass, Density and Community Composition in Streams, Back River Project, August 2011

Figure 3.6-3

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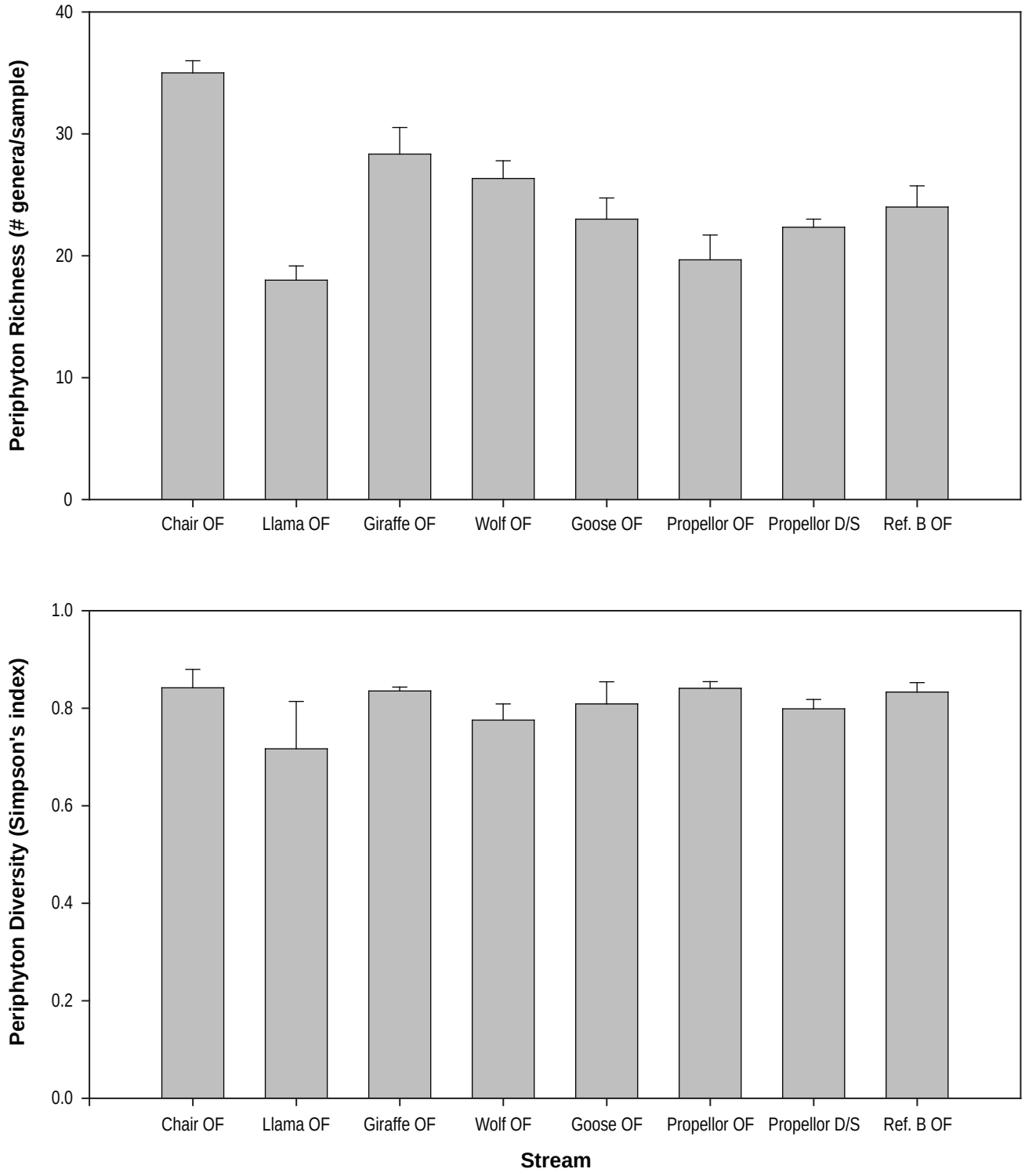

Note: Error bars represent standard error of the mean
Diversity was analyzed at the genus level.

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Periphyton Richness and Diversity in Streams, Back River Project, August 2011

Figure 3.6-4

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Stream periphyton were dominated by diatoms (by density), which made up between 45% and 81% of the community (see Figure 3.7-2). Common species were *Achnanthidium minutissimum, Tabellaria flocculosa, Nitzschia* spp. *and Anomoeoneis* spp. (Table 3.6-2). The second most common periphyton group was cyanobacteria, including *Phormidium formosum, Snowella lacustris, Limnothrix* sp., *Leibleinia* sp., *and Aphanocapsa delicatissima.* Cyanobacteria averaged between 14% and 47% of the stream community, and made up 40% or more of the communities at the small stream sites with low summer flow (e.g., Chair OF, Giraffe OF and Ref. B OF). Green algae were the third other significant component, averaging 9% or less of stream communities depending on the stream. Although other taxa were present (e.g., chyrsophytes, cryptophytes, euglenoids, and xanthophytes), these averaged under 1% at all stream sites.

Table 3.6-2. Most Abundant Periphyton Genera in Streams, Back River Project, August 2011

Stream	Most Abundant Periphyton Genera		
	Major Taxonomic Group	Genus species	% Relative Abundance
Chair OF	Diatom	*Achnanthidium minutissimum*	20.1
	Cyanobacteria	*Phormidium formosum*	20.1
	Cyanobacteria	*Snowella lacustris*	10.9
Llama OF	Diatom	*Achnanthidium minutissimum*	41.3
	Diatom	*Tabellaria flocculosa*	17.4
	Cyanobacteria	*Limnothrix* sp.	11.1
Giraffe OF	Diatom	*Nitzschia* spp.	20.8
	Cyanobacteria	*Limnothrix* sp.	18.2
	Cyanobacteria	*Leibleinia* sp.	16.5
Wolf OF	Diatom	*Achnanthidium minutissimum*	35.9
	Cyanobacteria	*Limnothrix* sp.	17.5
	Cyanobacteria	*Leibleinia* sp.	8.3
Goose OF	Diatom	*Achnanthidium* spp.	37.5
	Diatom	*Tabellaria flocculosa*	13.0
	Cyanobacteria	*Limnothrix* sp.	8.1
Propellor OF	Diatom	*Achnanthidium* spp.	20.4
	Diatom	*Anomoeoneis* spp.	19.4
	Diatom	*Tabellaria flocculosa*	19.3
Propellor D/S	Diatom	*Achnanthidium minutissimum*	31.9
	Diatom	*Nitzschia* spp.	11.7
	Diatom	*Anomoeoneis* spp.	10.8
Ref. B OF	Diatom	*Achnanthidium minutissimum*	23.9
	Cyanobacteria	*Aphanocapsa delicatissima*	18.4
	Cyanobacteria	*Leibleinia* sp.	8.3

Note: Species names are only included where all individuals in the genus were identified as from a single species. Individuals not identified to the genus level were not included in this table.

3.6.2.2 Richness and Diversity

Periphyton genera richness ranged from a mean of 18 genera/sample at Llama OF to 35 genera/sample at Chair OF (see Figure 3.7-3). Periphyton diversity was high at all stream sites, averaging 0.81.

3.7 AQUATIC INVERTEBRATES

3.7.1 Zooplankton

Lake zooplankton samples were collected in August 2011. Figures 3.7-1 and 3.7-2 present 2011 zooplankton results, and all raw data are presented in Appendix 3.7-1 and 3.7-3.

3.7.1.1 Density and Community Composition

Zooplankton densities averaged between 6,360 organisms/m^3 and 22,900 organisms/m^3 at most lakes (Figure 3.7-1). The exception was Llama Lake, the deepest lake, where mean densities were almost twice those found in other lakes (40,200 organisms/m^3).

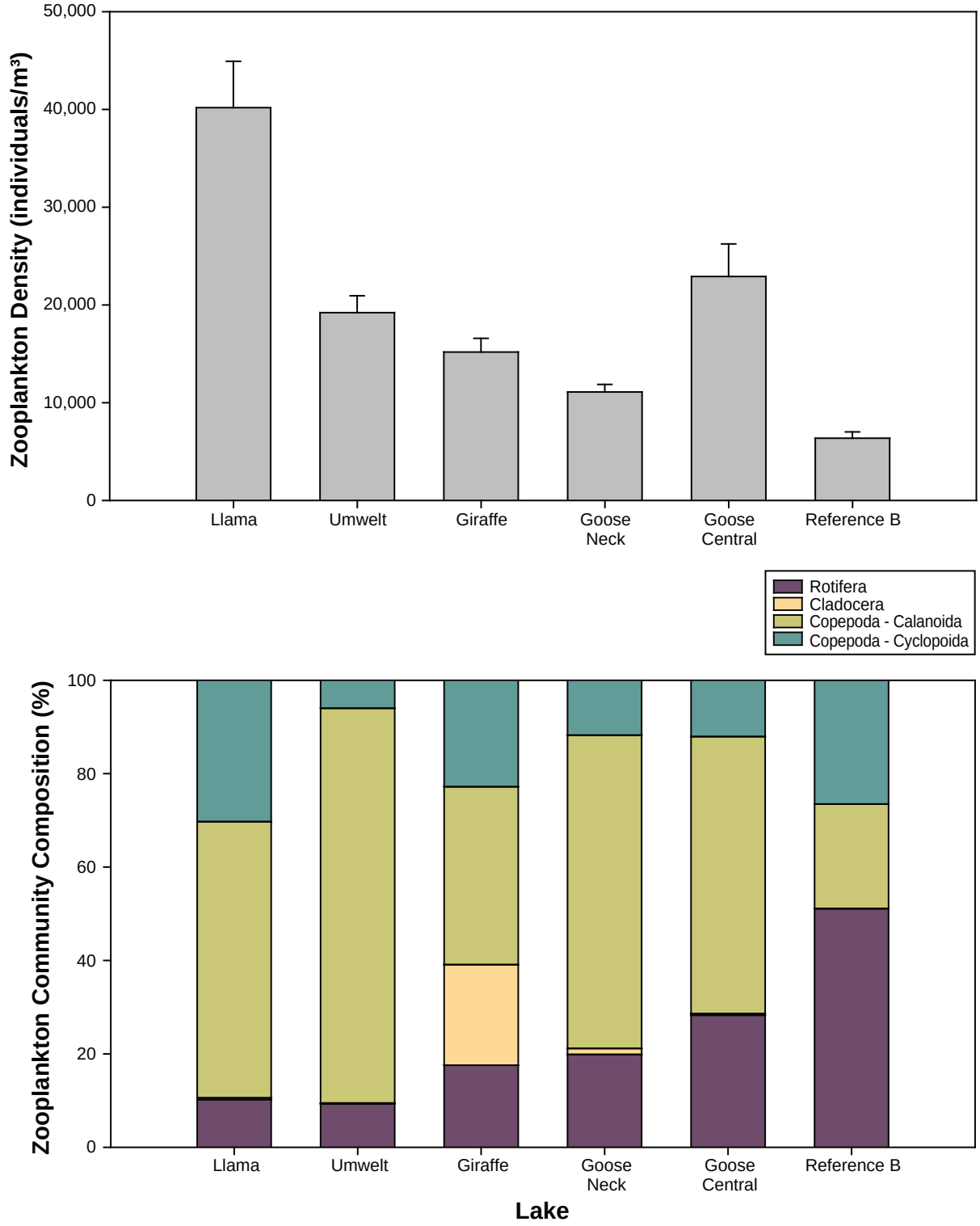
In general, lake zooplankton communities were dominated by rotifers, and calanoid and cyclopoid copepods, with smaller proportions of cladocerans also present (Figure 3.7-1). Llama, Umwelt, Goose Neck and Goose Central had similar zooplankton community composition, with calanoid copepods making up more than half of their community (59% to 85%) and the remainder of the community split between rotifers and cyclopoid copepods. Giraffe Lake (38%) and Reference B Lake (22%) both had smaller proportions of calanoid copepods, but differed in the composition of the rest of community. Giraffe Lake was the only site with a significant proportion of cladocerans (22%), whilst Reference B Lake was dominated by rotifers (51%).

Lakes were dominated by a few highly abundant genera, with the three most abundant genera comprising over 70% of communities (Table 3.7-1). Common zooplankton genera encountered in the area included *Leptodiaptomus*, a calanoid copepod, *Cyclop,* a cyclopoid copepod, and *Kellicottia longispina,* a rotifer. The cladoceran *Holopedium gibberum* was common at Giraffe Lake (making up 16.2% of the community).

Table 3.7-1. Most Abundant Zooplankton Genera in Lakes, Back River Project, August 2011

Lake	Most Abundant Zooplankton Genera		
	Major Taxonomic Group	Genus species	% Relative Abundance
Llama	Copepoda – Calanoida	*Leptodiaptomus* spp.	58.2
	Copepoda – Cyclopoida	*Cyclops* spp.	15.3
	Rotifera	*Kellicottia longispina*	9.4
Umwelt	Copepoda – Calanoida	*Leptodiaptomus* spp.	83.8
	Rotifera	*Kellicottia longispina*	8.9
	Copepoda - Cyclopoida	*Cyclops* spp.	1.6
Giraffe	Copepoda – Calanoida	*Leptodiaptomus* spp.	37.2
	Rotifera	*Kellicottia longispina*	17.3
	Cladocera	*Holopedium gibberum*	16.2
Goose Neck	Copepoda – Calanoida	*Leptodiaptomus* spp.	66.0
	Rotifera	*Kellicottia longispina*	19.3
	Copepoda - Cyclopoida	*Cyclops* spp.	9.7
Goose Central	Copepoda – Calanoida	*Leptodiaptomus* spp.	58.5
	Rotifera	*Kellicottia longispina*	28.1
	Copepoda - Cyclopoida	*Cyclops* spp.	9.5
Reference B	Rotifera	*Kellicottia longispina*	51.1
	Copepoda – Calanoida	*Leptodiaptomus* spp.	22.3
	Copepoda - Cyclopoida	*Cyclops* spp.	13.8

Note: Species names are only included where all individuals in the genus were identified as from a single species. Individuals not identified to the genus level were not included in this table.



Note: Error bars represent the standard error of the mean of the total density.
Community composition values represent the mean of replicates.
Zooplankton were collected with vertical tows at Llama and Giraffe lakes (the deeper lakes), and horizontal tows at the shallow lakes.

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Zooplankton Density and Taxonomic Composition in Lakes, Back River Project, August 2011

Figure 3.7-1

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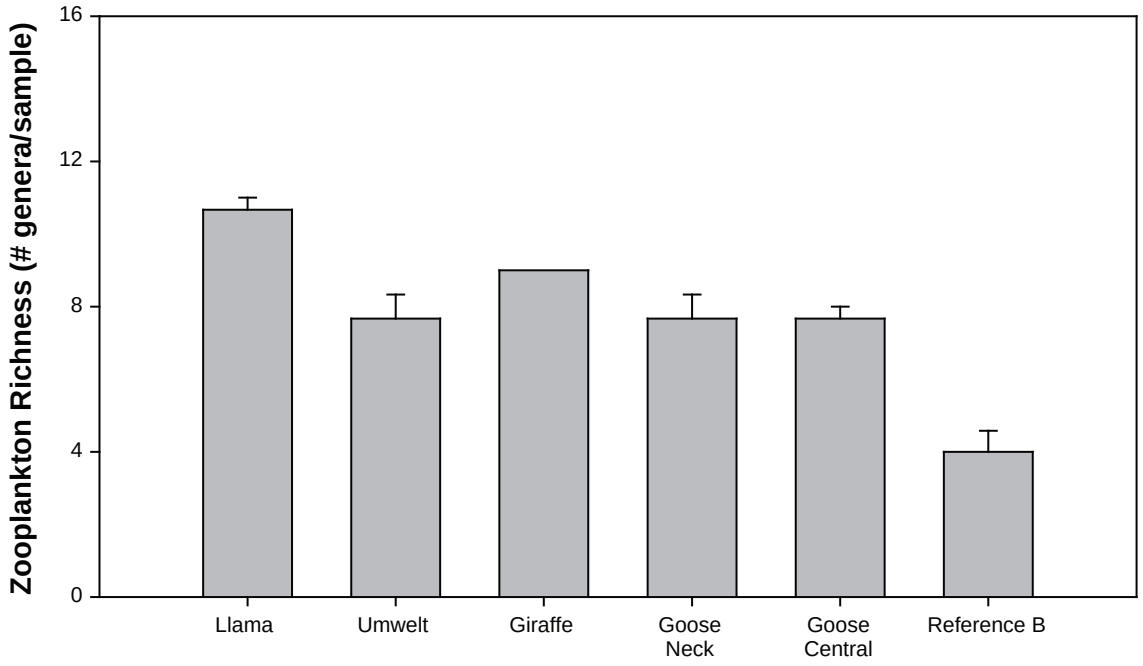

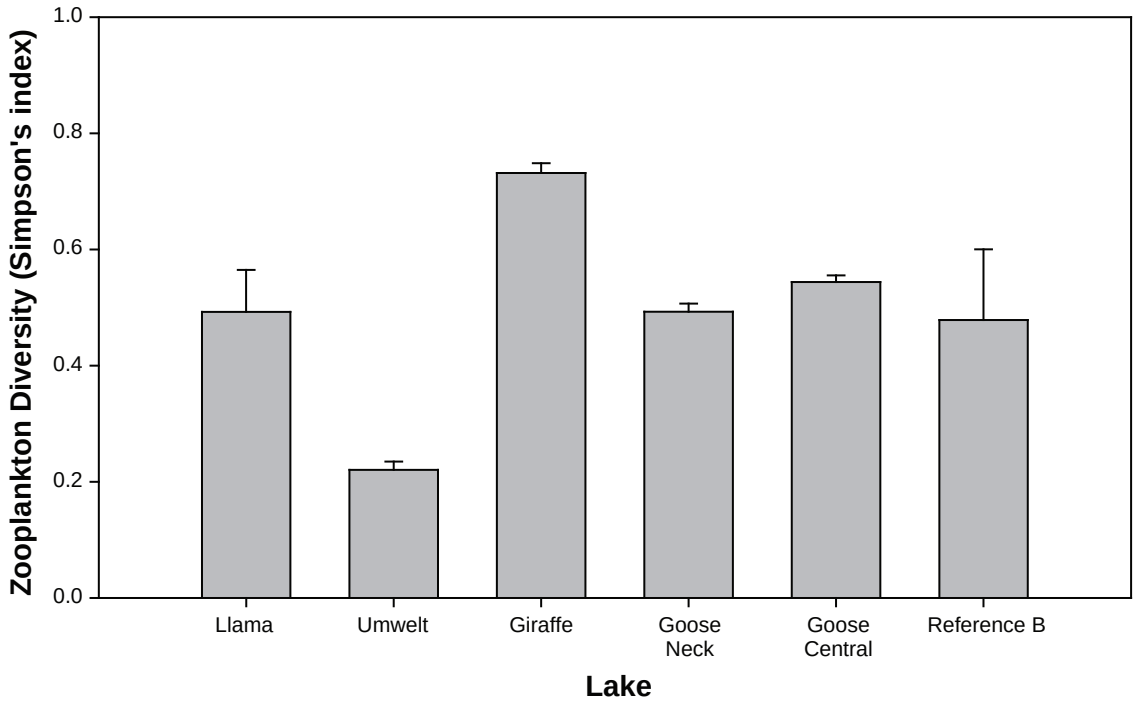

Note: Error bars represent standard error of the mean.
Diversity was analyzed at the genus level.

Sabina GOLD & SILVER CORP.

Zooplankton Richness and Diversity in Lakes, Back River Project, 2011

Figure 3.7-2

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3.7.1.2 Richness and Diversity

Mean zooplankton genera richness varied between lakes, with a low of 4.0 genera at Reference B Lake to a high of 10.7 at Llama Lake (see Figure 3.7-2). The mean genera richness of the other sites ranged from 7.7 to 9.0.

Zooplankton diversity also varied between lakes, with highest diversity at Giraffe Lake (0.73) and lowest at Umwelt Lake (0.22). Other lakes had similar diversity, with Simpson's index values between 0.48 and 0.54. The differences in diversity mirrors the evenness in the lakes; Giraffe Lake had a more even spread of taxa, while at Umwelt Lake more than 80% of individuals were from a single genus (*Leptodiaptomus*).

Unidentified cyclopoid and calanoid copepod nauplii, composing 8% of total individuals, were excluded from the richness and diversity analyses.

3.7.2 Lake Benthic Macroinvertebrates

Lake benthos samples were collected in August 2011. Figures 3.7-3 and 3.7-4 present 2011 benthos results, and all raw data are presented in Appendix 3.7-3 and 3.7-4. Sorting efficiencies for both lake and stream benthic invertebrates are presented in Appendix 3.7-7.

3.7.2.1 Density and Community Composition

Mean benthos densities varied between lakes, ranging from 1,140 organisms/m^2 in Llama Lake (deep depth) to 6,650 organisms/m^2 in the shallow Umwelt Lake (see Figure 3.7-3). Benthos densities at Umwelt, Goose Central and Reference B lake sampling sites were higher than in Llama, Giraffe or Goose Neck lake sampling sites.

Benthic communities were similar across the different lake sampling sites. Lake benthic communities were dominated by dipterans (true flies), which made up between 66% and 82% of individuals found (see Figure 3.7-3). The rest of the community was mainly bivalves (small to tiny clams from the family Sphaeriidae), smaller numbers of oligochaetes (a subclass of worms), and ostracods (seed shrimp).

The most abundant three genera at each site made up between 35% and 72% of all individuals. These genera were mainly chironomid dipterans (non-biting midges), with the bivalve *Psidium* (pill or pea clams) also present at Llama Lake and Reference B Lake (Table 3.7-2).

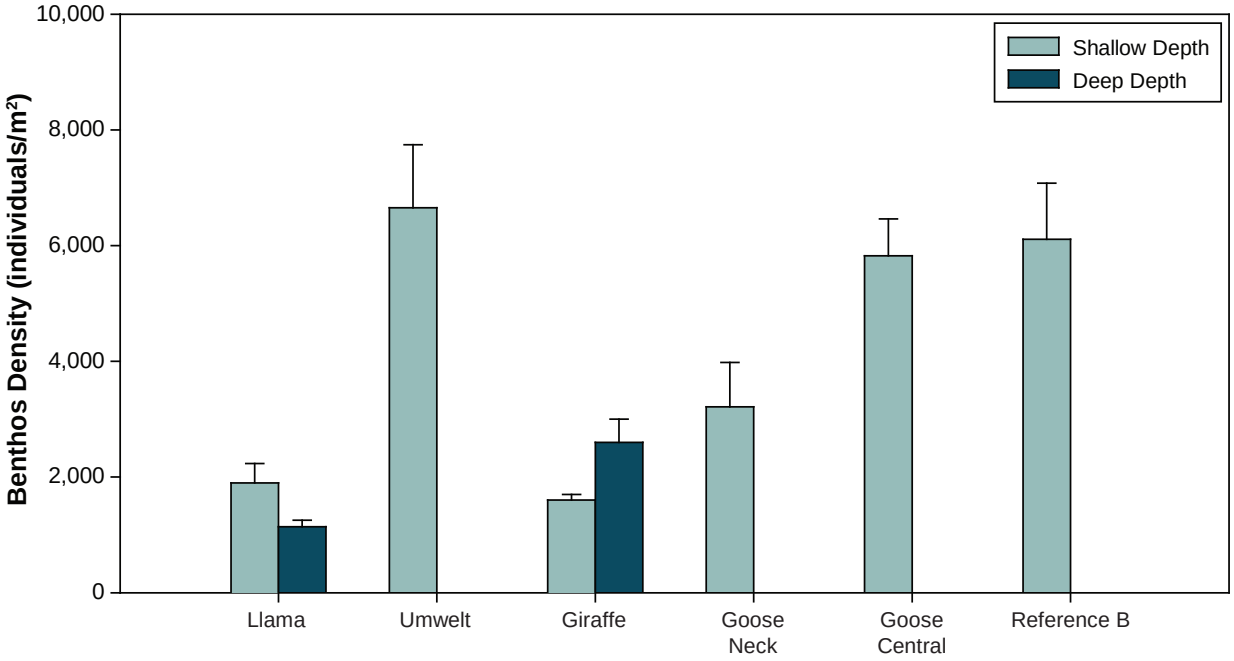
3.7.2.2 Richness and Diversity

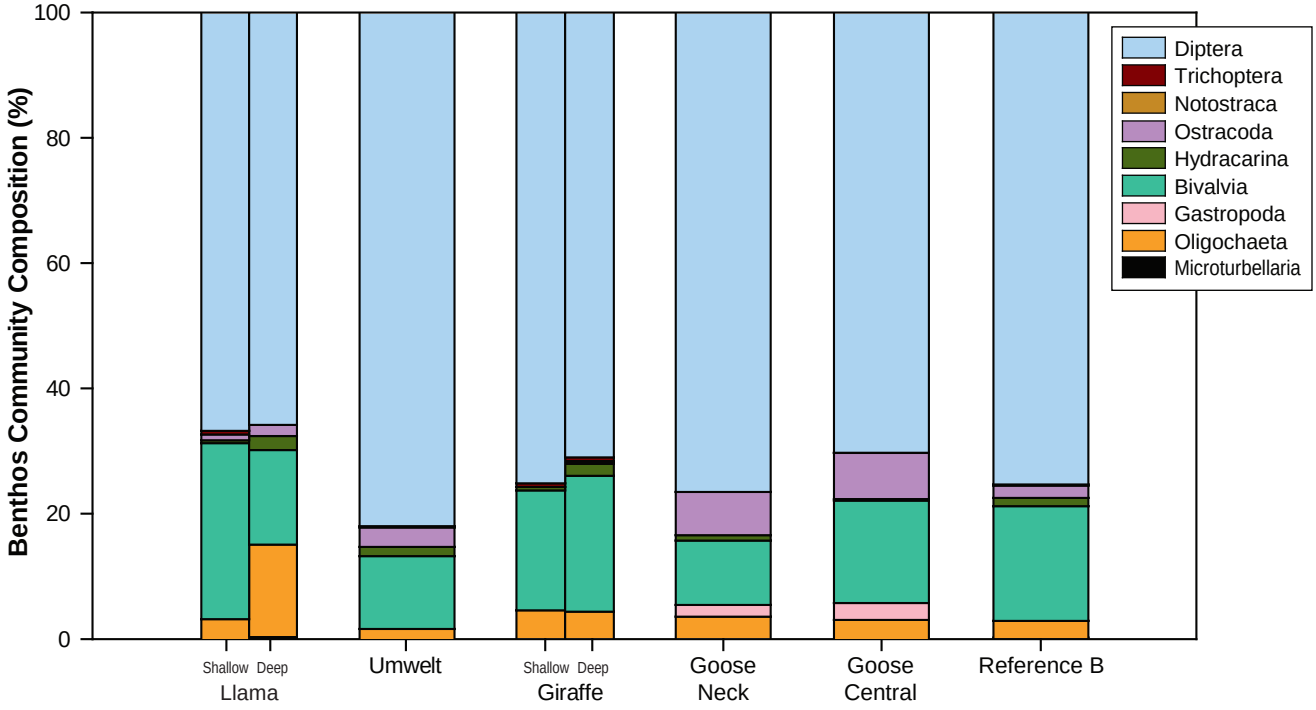
Benthos family richness ranged from 4.4 to 7.2 families/sample (see Figure 3.7-4). Goose Lake Neck, Goose Lake Central and Reference B Lake had slightly higher richness levels than the other lake sampling sites, ranging from 6.0 to 7.2 families/sample compared to between 4.4 and 5.8 families/sample. Benthos diversities were high across all lakes, with mean Simpson's index values ranging from 0.77 at Goose Lake Neck to 0.90 at Giraffe Lake (shallow). Richness and diversities showed no clear patterns with depth.

No individuals were excluded from the lake benthos richness and diversity analyses. Individuals in the clade Hydracarina and class Ostracoda (4% of total individuals) could not be resolved to family level, and so were each considered a single family for the richness and diversity analysis.

3.7.3 Stream Benthic Macroinvertebrates

Stream benthos samples were collected in August 2011. No benthos samples could be collected at Echo OF as it was dry during summer sampling. Figures 3.7-5 and 3.7-6 present 2011 results, and all raw data are presented in Appendix 3.7-5 and 3.7-6.





Note: Error bars represent standard error of the mean.
Community composition values represent the mean of replicates.

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Benthos Density and Community Composition in Lakes, Back River Project, August 2011

Figure 3.7-3

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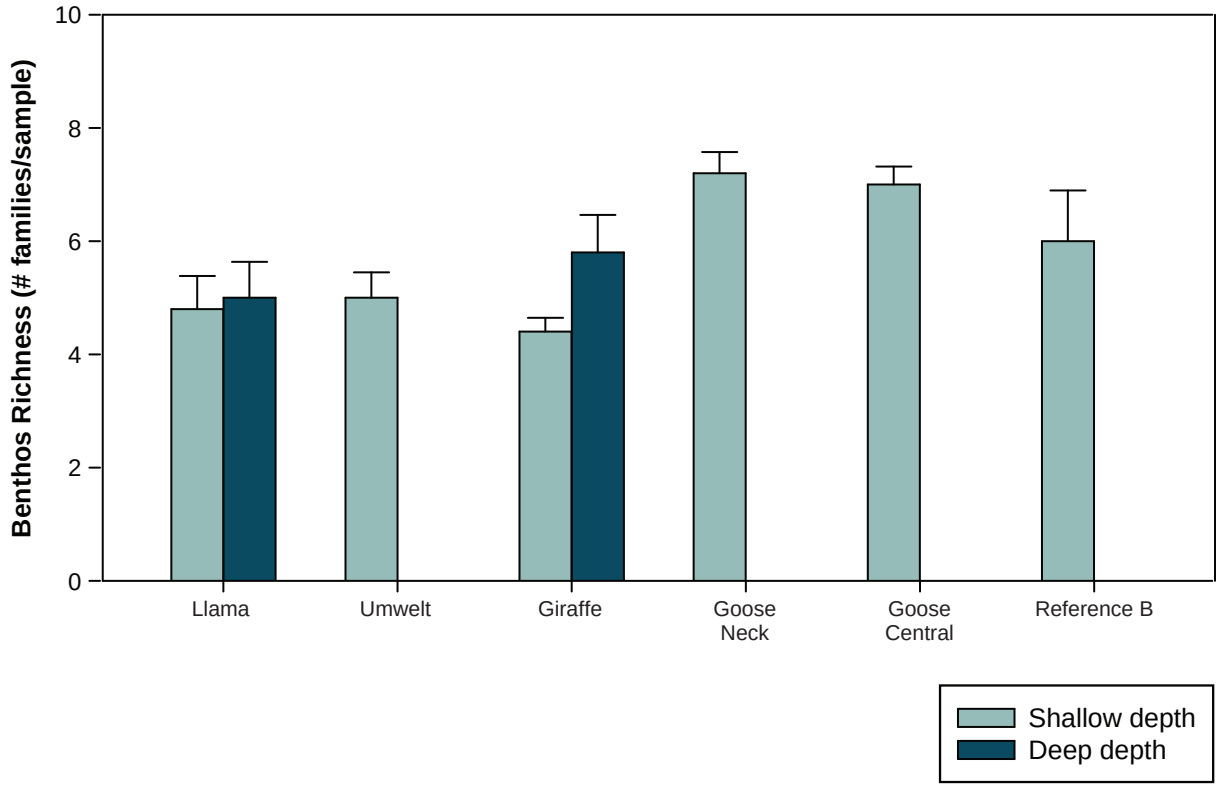
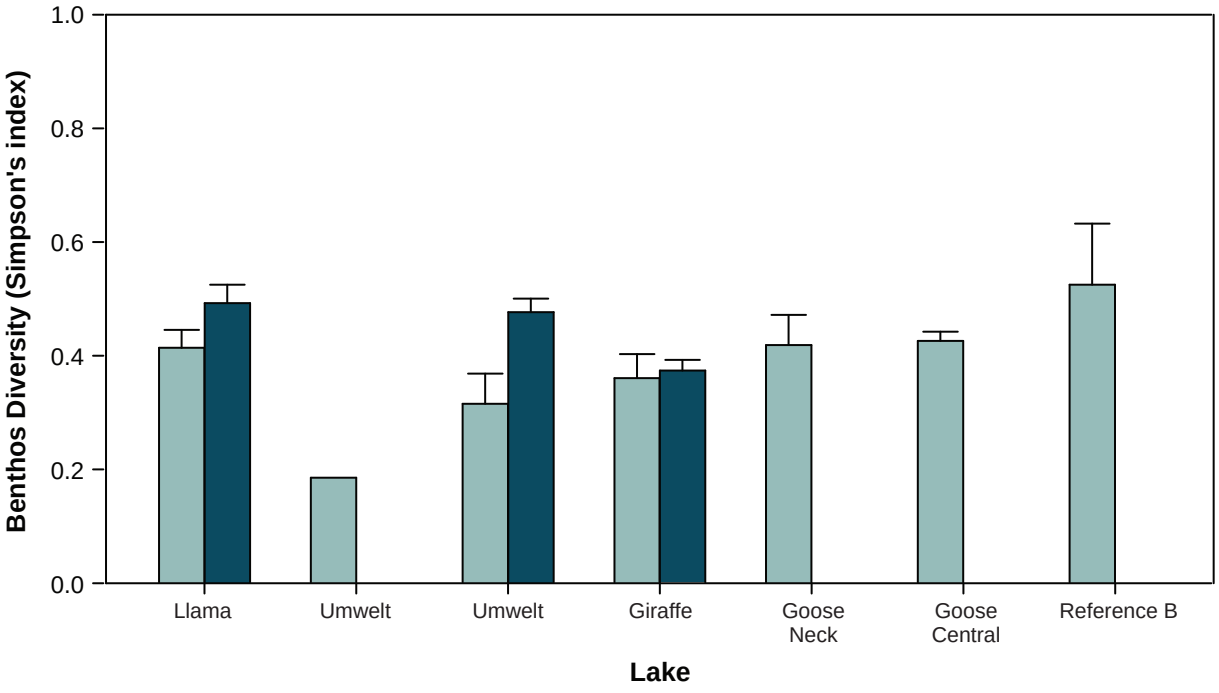
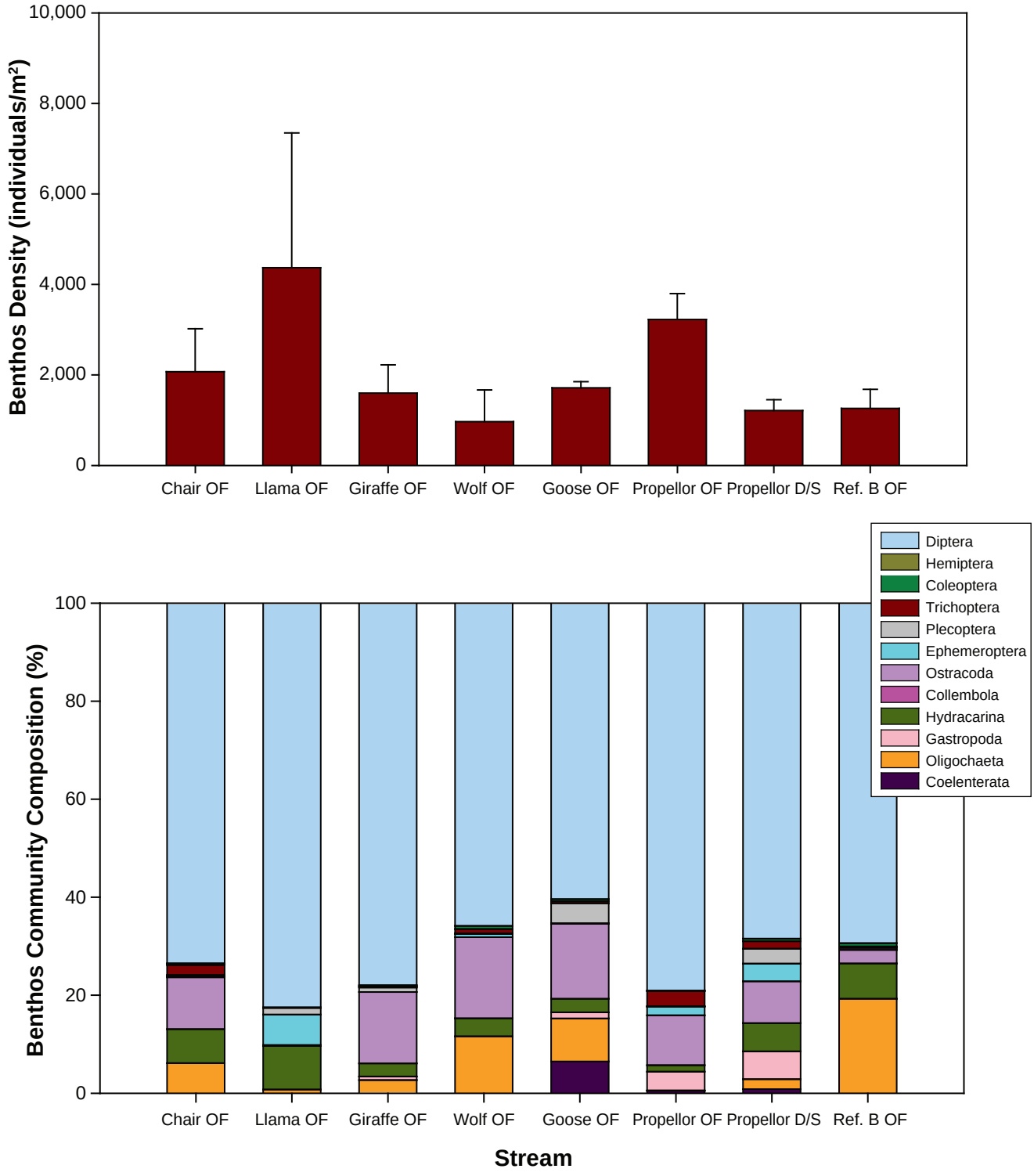




Note: Error bars represent standard error of the mean.
Diversity was analyzed at the family level.

Figure 3.7-4

Benthos Richness and Diversity in Lakes, Back River Project, August 2011



Note: Error bars represent standard error of the mean.
Community composition values represent mean of triplicate samples.

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Benthos Density and Community Composition in Streams, Back River Project, August 2011

Figure 3.7-5

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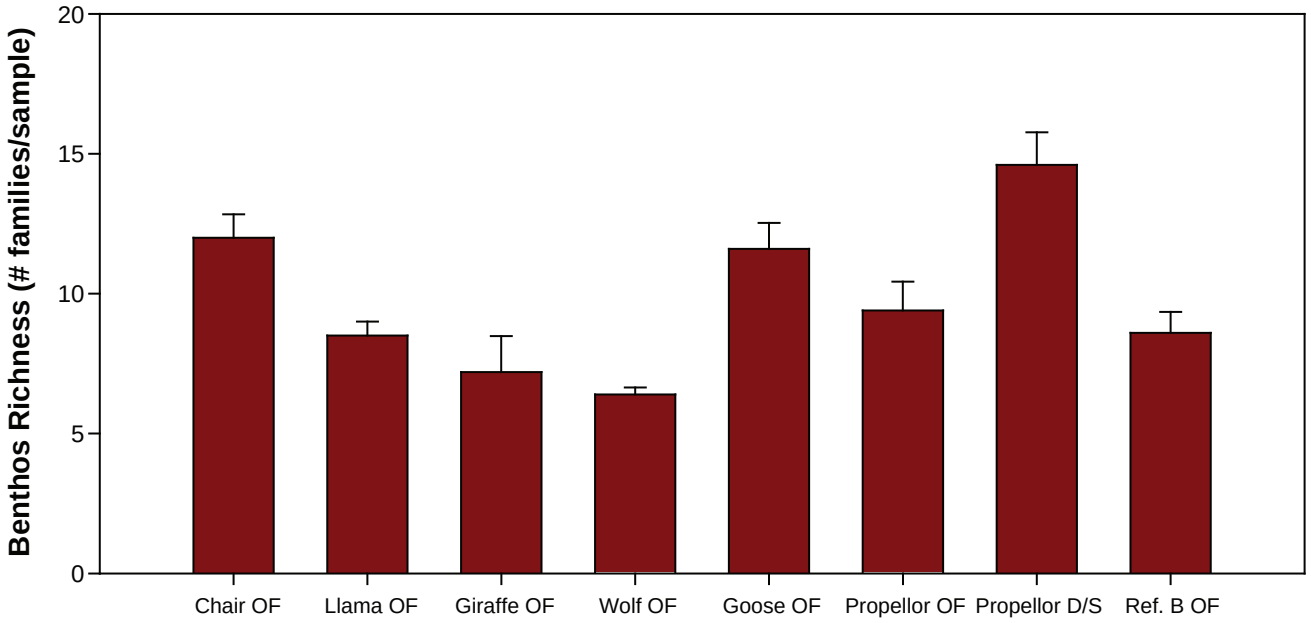

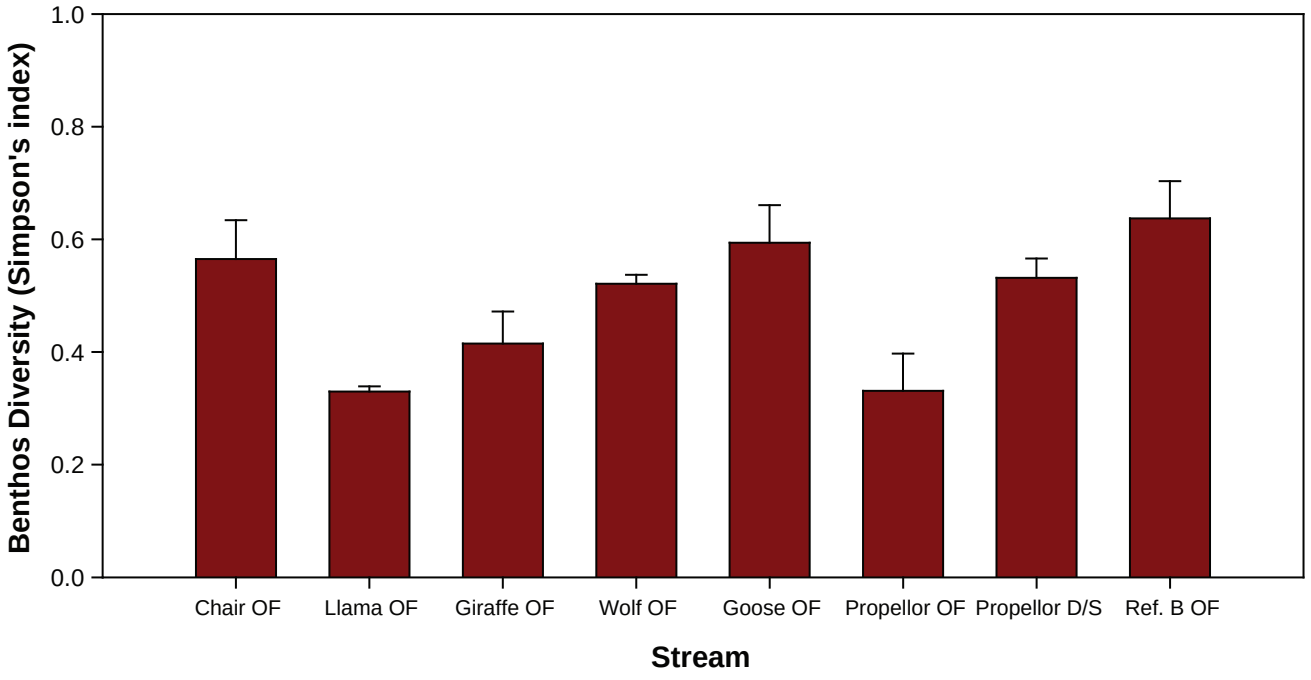

Note: Error bars represent standard error of the mean.
Diversity was analyzed at the family level.

Sabina GOLD & SILVER CORP.

Benthos Richness and Diversity in Streams, Back River Project, August 2011

Figure 3.7-6

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Table 3.7-2. Most Abundant Benthic Macroinvertebrate Genera in Lakes, Back River Project, August 2011

Lake	Major Group	Family	Genus	% of Total Individuals
Llama Shallow	Diptera	Chironomidae	*Stictochironomus*	30.2
	Diptera	Chironomidae	*Psectrocladius*	12.4
	Bivalvia	Sphaeriidae	*Pisidium*	10.3
Llama Deep	Diptera	Chironomidae	*Heterotrissocladius*	21.1
	Bivalvia	Sphaeriidae	*Pisidium*	12.8
	Diptera	Chironomidae	*Procladius*	9.5
Umwelt	Diptera	Chironomidae	*Corynocera*	23.1
	Diptera	Chironomidae	*Cladopelma*	13.9
	Diptera	Chironomidae	*Polypedilum*	13.1
Giraffe Shallow	Diptera	Chironomidae	*Procladius*	14.5
	Diptera	Chironomidae	*Stictochironomus*	10.9
	Diptera	Chironomidae	*Psectrocladius*	10.1
Giraffe Deep	Diptera	Chironomidae	*Stictochironomus*	30.1
	Diptera	Chironomidae	*Pagastiella*	11.1
	Diptera	Chironomidae	*Psectrocladius*	10.8
Goose Neck	Diptera	Chironomidae	*Paratanytarsus*	42.6
	Diptera	Chironomidae	*Psectrocladius*	13.4
	Diptera	Chironomidae	*Stictochironomus*	4.6
Goose Central	Diptera	Chironomidae	*Stictochironomus*	24.1
	Diptera	Chironomidae	*Paratanytarsus*	12.4
	Diptera	Chironomidae	*Psectrocladius*	8.3
Reference B	Diptera	Chironomidae	*Corynocera*	35.9
	Diptera	Chironomidae	*Procladius*	23.3
	Bivalvia	Sphaeriidae	*Pisidium*	12.2

Note: None of the genera listed in this table were identified below genus level. Individuals not identified to genus level, which includes immature and damaged individuals, were not included in this table

3.7.3.1 Density and Community Composition

Mean benthos density in most streams ranged from 968 organisms/m^2 (Wolf OF) to 2,070 organisms/m^2 (Chair OF; Figure 3.7-5). The exceptions were Llama OF and Propellor OF, which tended to have higher densities, 4,370 organisms/m^2 and 3,230 organisms/m2, respectively. These two stream sites had the largest substrate size, with rocks tending to be larger than 50 cm at both sites, with no depositional material present.

Stream benthos communities were dominated by dipterans, which averaged between 61% and 83% of the stream benthic organisms sampled (Figure 3.7-6). Ostracods (seed shrimp), oligochaete worms, and hydracarina (water mites) were also present, averaging between 5% and 10% of the benthos community. The remainder of the community was made up of Coelenterata (*Hydra*), Gastrapoda (snails and slugs), Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies).

Ephemeroptera, Plecoptera, and Trichoptera (together termed EPT) are pollution sensitive taxa, often used as indicators of ecosystem health. On average, EPT made up between 0.2% (Ref. B OF) and 8.2%

(Propellor D/S) of the benthos. EPT tended to make up a larger proportion of benthos in stream sites with larger stone or rock substrate (Llama OF, Propellor OF, Propellor D/S), rather than sediments made up of fines (e.g., Chair OF, Wolf OF, Ref. B OF).

The most abundant three genera at each site made up between 31% and 75% of all individuals (Table 3.7-3). These genera were mainly dipterans, with the Coelenterata *Hydra* also present at Goose OF. The dipterans were from the family Chironomidae (non-biting midges) at all stream sites, except in Ref. B OF where the two dominant genera were from the dipteran family Ceratopogonidae (biting midges). Ref. B OF had the lowest water levels of all stream sites sampled, with sections completely dried up, and was only able to be sampled for benthos after a week of rain.

Table 3.7-3. Most Abundant Benthic Macroinvertebrate Genera in Streams, Back River Project, August 2011

Stream	Major Group	Family	Genera	%
Chair OF	Diptera	Chironomidae	*Polypedilum*	27.4
	Diptera	Chironomidae	*Tanytarsus*	11.7
	Diptera	Chironomidae	*Thienemannimyia* group	11.5
Llama OF	Diptera	Chironomidae	*Diamesa*	35.8
	Diptera	Chironomidae	*Cricotopus/Orthocladius*	29.6
	Diptera	Chironomidae	*Eukiefferiella*	9.2
Giraffe OF	Diptera	Chironomidae	*Paratanytarsus*	51.2
	Diptera	Chironomidae	*Psectrocladius*	7.1
	Diptera	Chironomidae	*Zalutschia*	4.3
Wolf OF	Diptera	Chironomidae	*Dicrotendipes*	23.0
	Diptera	Chironomidae	*Thienemannimyia* group	12.1
	Diptera	Chironomidae	*Polypedilum*	7.5
Goose OF	Diptera	Chironomidae	*Paratanytarsus*	16.4
	Diptera	Chironomidae	*Cricotopus/Orthocladius*	8.4
	Coelenterata	Hydridae	*Hydra*	6.5
Propellor OF	Diptera	Chironomidae	*Cricotopus/Orthocladius*	26.7
	Diptera	Chironomidae	*Psectrocladius*	17.2
	Diptera	Chironomidae	*Paratanytarsus*	17.1
Propellor D/S	Diptera	Chironomidae	*Thienemannimyia* group	20.5
	Diptera	Chironomidae	*Euryhapsis*	16.3
	Diptera	Chironomidae	*Dicrotendipes*	10.8
Ref. B OF	Diptera	Ceratopogonidae	*Cladotanytarsus*	27.2
	Diptera	Ceratopogonidae	*Bezzia*	12.3
	Diptera	Chironomidae	*Tanytarsus*	10.2

Note: None of the genera listed in this table were identified below genus level. Individuals not identified to genus level, which includes immature and damaged individuals, were not included in this table.

3.7.3.2 Richness and Diversity

Stream benthic richness was higher than lake richness, ranging from 6.4 to 14.6 families/sample and averaging 9.9 families/sample (Figure 3.7-6). The greatest family richness was recorded at Propellor D/S (15 families/sample), followed by Chair OF and Goose OF (both 12 families/sample). All other stream sampling sites had an average of less than 9.4 families/sample.

The mean diversity index ranged between 0.33 at Llama OF and Propellor OF, and 0.64 at Ref. B OF. The greatest diversity was seen at Ref. B OF, Goose OF, and Chair OF which had diversities of 0.64, 0.59 and 0.56, respectively. Diversity did not always correspond with richness, indicating that some family-rich sites were dominated numerically by a few families (or a single family) or, alternatively, that some family-poor sites contained a relatively even distribution of individuals amongst families.

3.8 BATHYMETRY

Figures 3.8-1 to 3.8-3 provide the bathymetric maps generated for: Goose Lake, Round Pond and the pond north east of Round Pond (see Figure 2.1-1 for location).

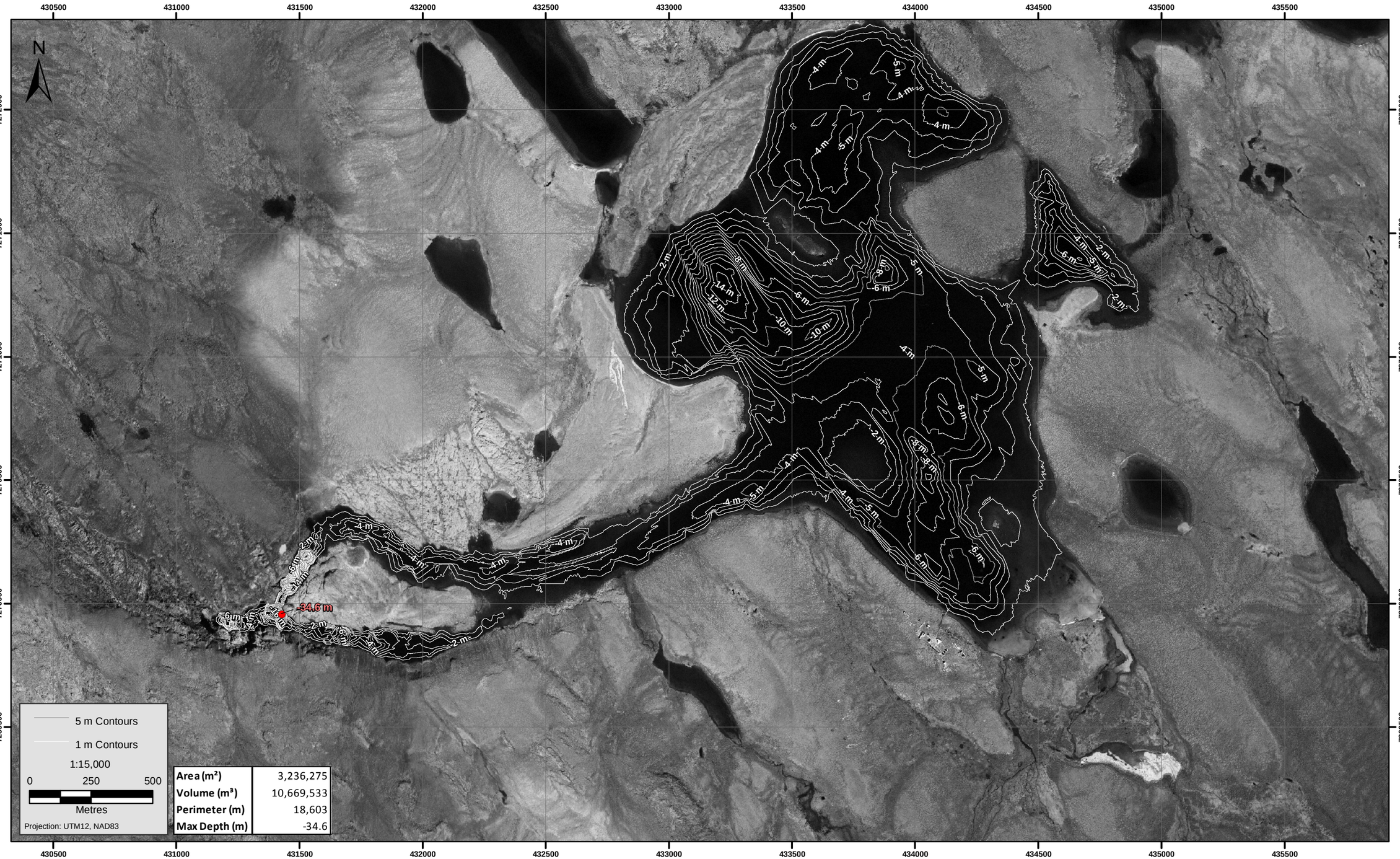

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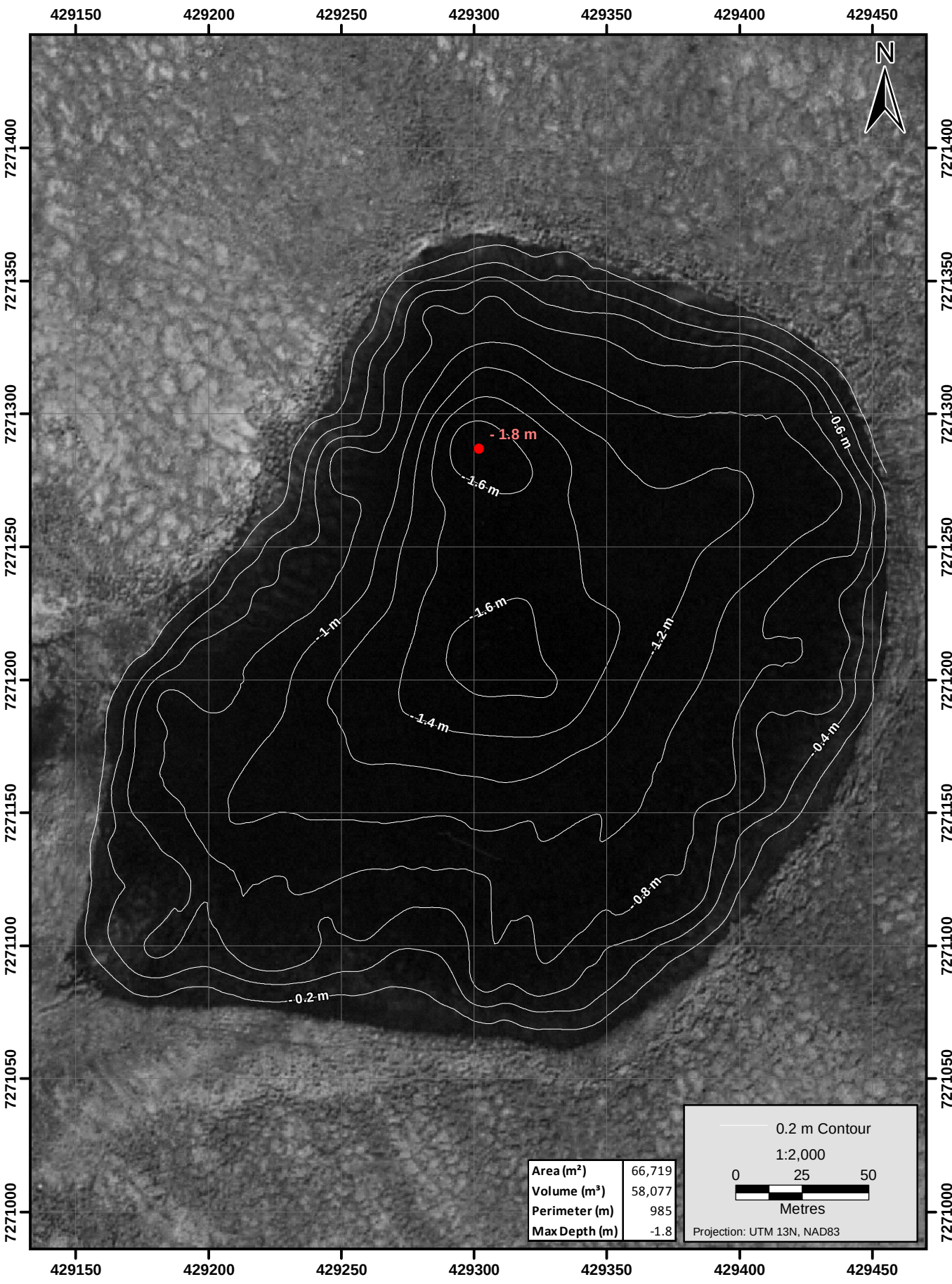
Figure 3.8-1

Bathymetry of Goose Lake, Back River Project, 2011



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Bathymetry of Round Pond, Back River Project, 2011

Figure 3.8-2

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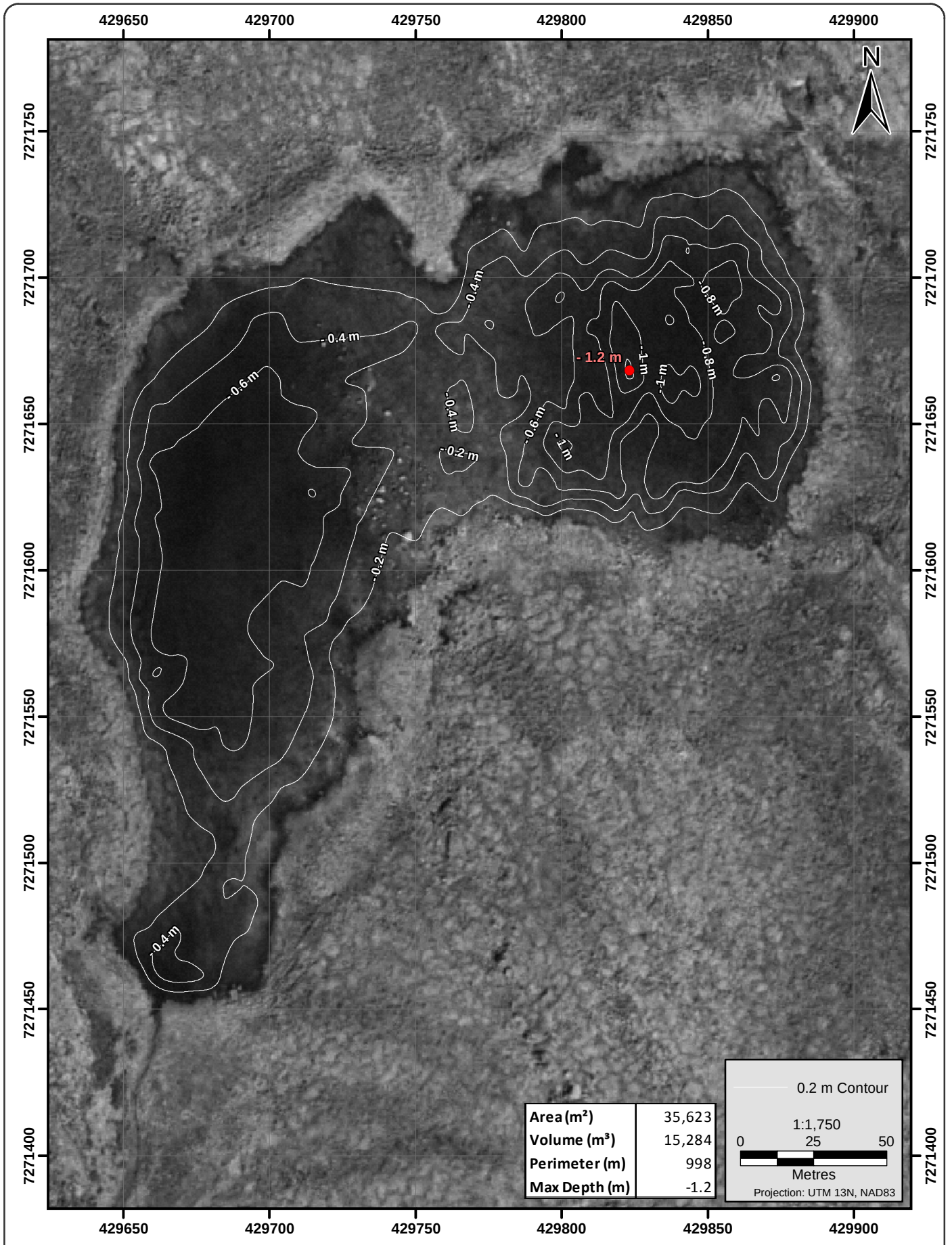

Figure 3.8-3

Bathymetry of Pond North East of Round Pond, Back River Project, 2011

4. Summary

4. Summary

Of the eight lake sites sampled, seven were less than 10 m deep. Dissolved oxygen concentrations at either bottom depths or all depths exceeded CCME guidelines at all lakes sampled. Lakes tended to have low nutrient levels, with the exception of Umwelt Lake. Umwelt Lake was a shallow lake with hard water, and high total dissolved sediments. Most lake sites exceeded CCME water quality guidelines for at least one parameter, commonly cadmium, with Llama Lake and Reference B Lake as exceptions. Most sites exceeded CCME guidelines for sediment quality, with exceptions being Goose Lake Tail and Reference B. Average sediment arsenic concentrations at Llama Lake exceeded PELs.

Lakes had similar phytoplankton biomasses and densities, with most of the community being made up of chrysophytes, green algae, diatoms and cyanobacteria. Zooplankton concentrations were greatest in Llama Lake, the deepest lake, and similar in all other lakes. Zooplankton communities were mainly composed of copepods and rotifers, with cladocerans being a significant component in Giraffe Lake. Benthos densities were highest in Umwelt, Goose Central and Reference B lakes, and mainly composed of dipterans at all lakes. A summary of the findings for lake sites sampled in the 2011 Freshwater Baseline Report is presented in Table 4.1-1.

Streams sampled varied from small streams with silt substrate, such as Chair OF, Echo OF, Wolf OF, and Ref. B OF, to larger cobble or boulder substrate streams, such as Llama OF, Giraffe OF, Goose OF, Propellor OF, and Propellor D/S. In August, dissolved oxygen concentrations exceeded CCME guidelines at all sites, with the lowest concentrations at Llama OF. Streams tended to have low nutrients, with exceptions being the smaller streams Chair OF and Ref. B OF. Water quality at Chair OF, Llama OF, Echo OF, Giraffe OF and Ref. B OF exceeded CCME guidelines for at least one parameter, often copper and cadmium. Sediment quality at Chair OF, Giraffe OF, Goose OF and Ref. B OF exceeded guidelines for arsenic or copper or both.

Periphyton biomass and density was similar across stream sites, with communities being dominated largely by diatoms and then cyanobacteria. Benthos densities were similar across streams, communities were mainly composed of dipterans, with smaller ammounts of ostracoda, hydracarina and oligochaeta. A summary of the findings for stream sites sampled in the 2011 Freshwater Baseline Report is presented in Table 4.1-2.

Table 4.1-1. Summary of 2011 Freshwater Baseline Results for Lakes

		Dissolved Oxygen	Water Quality			Sediment Quality	Primary production	Aquatic Macroinvertebrates	
Lake	Max Depth (m)	Seasons and Depths that Exceed CCME Guidelines*	General Description	Nutrient Status	Parameters that Exceed CCME Guidelines*	Parameters that Exceed CCME Guidelines	Phytoplankton	Zooplankton	Benthos
Llama	14.5	Early life stages: winter, bottom depths; summer, all depths	Slightly acidic, soft, low TDS	Ultra-oligotrophic	-	ISQGs: As, Cu; PELs: As	Low chl *a* biomass, 61% chrysophyte, lowest richness and diversity	Highest densities, dominated by copepods	Lowest densities, lowest proportion of dipterans (66%)
Umwelt	2.6	All life stages: winter, all depths; early life stages: summer, all depths	Neutral, soft to moderately hard, highest TDS	Oligotrophic to Mesotrophic	Cu	ISQGs: As, Cu	Highest chl *a* biomass and density, high richness and diversity	Intermediate densities, dominated by calanoid copepods, lowest diversity	Highest densities, highest proportion of dipterans (82%)
Giraffe	5.9	Early life stages: summer, all depths	Slightly acidic, soft, low TDS	Ultra-oligotrophic	Cd, Cu	ISQGs: As, Cu	Lowest chl *a* biomass, high richness and diversity	Intermediate densities, community most evenly split	Relatively low densities, dominated by dipterans
Goose Neck	3.5	Early life stages: summer, all depths	Slightly acidic, soft, low TDS	Ultra-oligotrophic	Cd	ISQGs: As, Cd, Cu	Low chl *a* biomass and lowest densities, 59% chrysophyte, high richness and diversity	Intermediate densities, dominated by calanoid copepods	Relatively low densities, dominated by dipterans
Goose Central	9.2 (winter location) or 5.2 (summer location)	Early life stages: winter, below 2 m; summer, all depths	Slightly acidic, soft, low TDS	Ultra-oligotrophic	Cd	ISQGs: As, Cu	Higher chl *a* biomass, 47% chrysophytes, high richness and diversity	Intermediate densities, dominated by calanoid copepods	Relatively high densities, dominated by dipterans
Goose Tail	2.5	Early life stages: summer, bottom depths	Slightly acidic, low TDS	Ultra-oligotrophic	pH, Al	-	nc	nc	nc
Propellor	7.9	Early life stages: winter, bottom depths; summer, all depths	Slightly acidic, soft, low TDS	Ultra-oligotrophic to Oligotrophic	Cd	ISQGs: Cu	nc	nc	nc
Reference B	5.3	Early life stages: winter, bottom depths; summer, all depths	Neutral, soft, low TDS	Ultra-oligotrophic to Oligotrophic	-	-	Higher chl *a* biomass and density, high richness and diversity	Lowest densities and richness, dominated by rotifers, smallest proportion of calanoid copepods	Relatively high densities, dominated by dipterans, biting midges abundant

nc = not collected

** CCME guidelines for the protection of aquatic life can be found on all graphs and appendices.*

Samples were only considered exceedences if they were above detection limits.

Table 4.1-2. Summary of 2011 Freshwater Baseline Results from Streams

			Dissolved Oxygen	Water Quality			Sediment Quality	Primary Production	Aquatic Macroinvertebrates
Stream	General Description	Substrate	Seasons that Exceed CCME Guidelines	General Description	Nutrient Status	Parameters that Exceed CCME Guidelines	Parameters that Exceed CCME Guidelines	Periphyton	Benthos
Chair OF	Small stream through floodplain.	Mainly silt, few small stones	Early life stages: summer	Slightly acidic, soft, low TDS	Oligotrophic to Mesotrophic	Cd, Cu	ISQGs: As	Low chl *a* biomass, higher densities, cyanobacteria (45%) and diatoms (46%) dominate, highest richness, high diversity	Lower densities, dominated by dipterans (74%), high diversity
Llama OF	Medium stream through large boulder field.	Cobbles, large stones, boulders	All life stages: summer	Slightly acidic, soft to hard depending on season, high TDS	Ultra-oligotrophic to Oligotrophic	pH, Al, Cd, Cu	nc	Intermediate chl *a* biomass, diatoms dominate (80%), lowest richness, lowest diversity	Highest densities, highest proportion of diptera (82%), lowest diversity
Echo OF	Very small stream through flood plain, dry during summer sampling.	Mainly silt, few small stones	Early life stages: summer	The most acidic of all streams sampled, soft, low TDS	Ultra-oligotrophic to Oligotrophic	pH, Al, Cd, Cu	nc	nc	nc
Giraffe OF	Short, medium-sized stream linking to close by lakes, cobbles.	Cobbles, large stones, boulders	Early life stages: summer	Slightly acidic, soft, low TDS	Ultra-oligotrophic to Oligotrophic	Cu	ISQGs: As	Intermediate chl *a* biomass, highest densities; cyanobacteria (40%) and diatoms (57%) dominate, high richness and diversity	Lower densities, dominated by dipterans (78%)
Wolf OF	Small stream running through flood plain	Mainly silt, few small stones	Early life stages: summer	Slightly acidic, soft, low TDS	Ultra-oligotrophic to Oligotrophic	-	nc	Lowest chl *a* biomass, diatoms dominate (66%), lowest richness, high richness and diversity	Lower densities, dominated by dipterans (66%), lowest family richness
Goose OF	Short, medium-sized stream linking to close by lakes, cobbles.	Cobbles, large stones, boulders	Early life stages: summer	Slightly acidic, soft, low TDS	Ultra-oligotrophic to Oligotrophic	-	ISQGs: As, Cu	Highest chl *a* biomass, diatoms dominate (79%), high richness and diversity	Lower densities, lowest proportion of diptera (60%), high diversity
Propellor OF	Large stream draining largest lake in the area. Runs through boulder field.	Large stones, boulders	Early life stages: summer	Slightly acidic, soft, low TDS	Ultra-oligotrophic to Oligotrophic	-	-	Intermediate chl *a* biomass, diatoms dominate (81%), high richness and diversity	Relatively high densities, dominated by dipterans (79%)
Propellor D/S	Large stream downstream from the source lake, cobbles and boulders.	Cobbles, large stones, boulders	Early life stages: summer	Slightly acidic, soft, low TDS	Ultra-oligotrophic to Oligotrophic	-	-	Highest chl *a* biomass, diatoms dominate (73%), high richness and diversity	Lower densities, dominated by dipterans (68%), highest richness, lowest diversity
Ref. B OF	Small stream through floodplain.	Mainly silt, few small stones	Early life stages: summer	Neutral, soft, low TDS	Oligotrophic to Mesoeutrophic	Fe	ISQGs: Cu	Intermediate chl *a* biomass, cyanobacteria (45%) and diatoms (52%) dominate, high richness and diversity	Lower densities, dominated by dipterans (69%), high diversity

nc = not collected

** CCME guidelines for the protection of aquatic life can be found on all graphs and appendices.*

Samples were only considered exceedences if they were above detection limits.

References

References

Definitions of the acronyms and abbreviations used in this reference list can be found in the Glossary and Abbreviations section.

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Appendix 3.1-1

Lakes Dissolved Oxygen/Temperature Profiles, Back River Project, 2011

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Appendix 3.1-1. Lakes Dissolved Oxygen/Temperature Profiles, Back River Project, 2011

Lake	Llama Lake					
Date	12-Apr-11			06-Aug-11		
Depth	Temp	Dissolved Oxygen	Dissolved Oxygen	Temp	Dissolved Oxygen	Dissolved Oxygen
(m)	(°C)	(mg/L)	(% Saturation)	(°C)	(mg/L)	(% Saturation)
0	ice thickness = 1.5 m			15	9.13	89.6
0.5						
1				14.9	8.77	86.7
1.5	0.2	15.06	103.9			
2	0.4	14.35	100.6	14.9	8.72	86.4
2.5	1.6	13.44	96.1			
3	2.5	12.44	90.6	14.9	8.66	85.0
3.5	2.4	11.13	87.2			
4	2.5	11.17	81.9	14.5	8.69	85.2
4.5	2.5	11.16	81.8			
5	2.5	11.21	82.2	14.4	8.68	84.5
5.5	2.5	11.20	82.1			
6	2.5	11.23	82.3	14	8.62	83.8
6.5	2.5	11.23	82.3			
7	2.5	11.30	82.8	13.5	8.62	82.8
7.5	2.5	11.38	83.4			
8	2.5	11.35	83.2	13.5	8.63	82.8
8.5	2.5	11.40	83.5			
9	2.5	11.52	84.5	13.4	8.61	82.3
9.5	2.5	11.49	84.2			
10	2.6	11.51	84.6	13.3	8.63	82.4
10.5	2.6	11.41	83.8			
11	2.6	11.40	83.7	13.3	8.60	82.1
11.5	2.5	10.84	79.4			
12	2.5	11.14	81.7	13.2	8.61	82.1
12.5	2.6	10.01	73.4			
13	2.6	8.53	63.3	13.1	8.52	80.5
13.5	2.7	9.31	68.6			
	bottom depth = 13.7 m			bottom depth = 14.5 m		

Lake	Umwelt Lake					
Date	13-Apr-11			05-Aug-11		
Depth	Temp	Dissolved Oxygen	Dissolved Oxygen	Temp	Dissolved Oxygen	Dissolved Oxygen
(m)	(°C)	(mg/L)	(% Saturation)	(°C)	(mg/L)	(% Saturation)
0	ice thickness = 1.5 m			15.2	8.95	89.1
0.5				15.1	9.00	89.5
1				15.1	9.01	89.0
1.5	0.1	3.83	26.3	15.1	8.87	88.2
2	0.9	3.73	26.1	15.4	8.91	88.1
2.5	2.1	3.26	23.6			
	bottom depth = 2.6 m			bottom depth = 2.0 m		

Appendix 3.1-1. Lakes Dissolved Oxygen/Temperature Profiles, Back River Project, 2011

Lake	Giraffe Lake					
Date	16-Apr-11			10-Aug-11		
Depth	Temp	Dissolved Oxygen	Dissolved Oxygen	Temp	Dissolved Oxygen	Dissolved Oxygen
(m)	(˚C)	(mg/L)	(% Saturation)	(˚C)	(mg/L)	(% Saturation)
0	ice thickness = 1.85 m			16.8	7.93	81.7
0.5				16.8	7.93	81.7
1				16.8	7.97	82.0
1.5				16.6	8.01	82.2
2	0.5	14.62	101.5	16.5	8.00	82.0
2.5	1.6	16.21	115.8	16.5	8.08	82.7
3	2.5	15.86	116.3	16.5	8.09	82.8
3.5				16.4	8.08	82.8
4				16.3	8.12	82.7
4.5				16.2	8.12	82.6
5				15.7	8.21	81.9
	bottom depth = 3.6 m			bottom depth = 5.9 m		

Lake	Goose Lake Neck					
Date	17-Apr-11			07-Aug-11		
Depth	Temp	Dissolved Oxygen	Dissolved Oxygen	Temp	Dissolved Oxygen	Dissolved Oxygen
(m)	(˚C)	(mg/L)	(% Saturation)	(˚C)	(mg/L)	(% Saturation)
0	ice thickness = 1.5			15.5	8.35	83.5
0.5				15.5	8.27	83.1
1				15.5	8.29	83.0
1.5	0.2	15.49	106.6	15.5	8.22	82.5
2	0.7	15.71	109.6	15.5	8.18	82.0
2.5	1.9	12.59	90.7	15.5	8.22	82.5
3	2.6	12.12	89.1	15.5	8.29	83.1
3.5				15.5	8.28	83.1
	bottom depth = 3.35 m			bottom depth = 3.5 m		

Lake	Goose Lake Central					
Date	14-Apr-11			07-Aug-11		
Depth	Temp	Dissolved Oxygen	Dissolved Oxygen	Temp	Dissolved Oxygen	Dissolved Oxygen
(m)	(˚C)	(mg/L)	(% Saturation)	(˚C)	(mg/L)	(% Saturation)
0	ice thickness = 1.5 m			15.5	8.33	84.1
0.5				15.5	8.38	84.0
1				15.5	8.42	84.4
1.5	0.1	14.49	99.4	15.5	8.40	84.2
2	0.6	13.37	99.3	15.5	8.40	84.3
2.5	1.4	11.92	84.8	15.5	8.41	84.3
3	1.9	10.38	74.8	15.5	8.40	84.3
3.5	2.1	8.65	62.7	15.5	8.41	84.3
4	2.2	8.26	60.1	15.5	8.42	84.3
4.5	2.3	8.00	58.3	15.3	8.43	83.9
5	2.4	8.31	60.7			
5.5	2.4	7.75	56.6			
6	2.4	8.29	60.7			
6.5	2.5	8.44	61.9			
7	2.5	8.82	64.6			
7.5	2.5	7.92	58.0			
8	2.5	8.82	64.6			
8.5	2.5	8.88	65.1			
9	2.5	8.12	59.5			
	bottom depth = 9.15 m			bottom depth = 5.2 m		

Appendix 3.1-1. Lakes Dissolved Oxygen/Temperature Profiles, Back River Project, 2011

Lake	Goose Lake Tail			Goose Lake Tail		
Date				17-Aug-11		
Depth				Temp	Dissolved Oxygen	Dissolved Oxygen
(m)				(°C)	(mg/L)	(% Saturation)
0	winter data not collected at this site			12.6	9.96	94.0
0.5				12.6	9.86	92.6
1				12.6	9.52	89.5
1.5				12.6	9.43	88.2
				bottom depth = 2.5 m		

Lake	Propellor Lake					
Date	16-Apr-11			11-Aug-11		
Depth	Temp	Dissolved Oxygen	Dissolved Oxygen	Temp	Dissolved Oxygen	Dissolved Oxygen
(m)	(°C)	(mg/L)	(% Saturation)	(°C)	(mg/L)	(% Saturation)
0	ice thickness = 1.4 m			16.0	8.10	84.2
0.5				16.0	8.06	82.1
1				16.0	8.01	81.2
1.5	0.1	15.69	107.7	16.0	8.01	81.2
2	0.5	15.13	104.4	16.0	8.07	81.6
2.5	0.9	13.47	94.4	16.0	8.08	81.8
3	1.2	12.22	86.4	16.0	8.09	82.0
3.5	1.4	11.72	83.4	16.0	8.10	82.2
4	1.6	11.49	82.2	16.0	8.13	82.1
4.5	1.7	10.84	77.7	15.9	8.14	82.4
5	1.8	10.34	74.3	15.9	8.16	82.6
5.5	2.0	10.22	73.9	15.9	8.18	82.6
6	2.1	9.90	71.7	15.9	8.17	82.7
6.5	2.3	7.46	58.0	15.9	8.25	83.1
7	2.5	7.98	58.5	15.7	8.26	83.2
7.5				15.7	7.70	80.0
	bottom depth = 7.9 m			bottom depth = 7.8 m		

Lake	Reference B Lake					
Date	12-Apr-11			08-Aug-11		
Depth	Temp	Dissolved Oxygen	Dissolved Oxygen	Temp	Dissolved Oxygen	Dissolved Oxygen
(m)	(°C)	(mg/L)	(% Saturation)	(°C)	(mg/L)	(% Saturation)
0	ice thickness = 1.3 m			16.0	8.26	83.7
0.5				16.0	8.21	83.2
1				15.9	8.33	84.4
1.5	0.0	13.47	92.2	15.9	8.36	84.5
2	0.0	12.21	83.3	15.9	8.32	84.1
2.5	1.4	10.47	75.6	15.9	8.32	84.2
3	2.6	7.02	51.4	15.9	8.35	84.4
3.5	3.1	2.95	22.1	15.8	8.35	84.2
4	3.4	1.38	10.4	15.8	8.36	84.5
4.5				15.8	8.34	84.8
	bottom depth 5.1 m			bottom depth = 5.3 m		

Appendix 3.2-1

Lake Water Quality Analytical Results, Back River Project, 2011

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Appendix 3.2-1. Lake Water Quality Analytical Results, Back River Project, 2011

Site Abbreviation:				Llama Lake	Llama Lake	Umwelt Lake	Umwelt Lake	Giraffe Lake	Goose Lake Neck	Goose Lake Central	Goose Lake Central	Propellor Lake	Propellor Lake	Propellor Lake	Reference B Lake	Reference B Lake	Reference B Lake
Depth Zone:				Shallow	Bottom	Ice-water interface	Ice-water interface	Ice-water interface	Ice-water interface	Shallow	Bottom	Shallow	Bottom	Bottom	Shallow	Shallow	Bottom
Depth (m):				1	12	0	0	0.2	0	1	7.5	1	6	6	1	1	3.5
Replicate:				1	1	1	2	1	1	1	1	1	1	2	1	2	1
Date Sampled:		CCME Guideline for the Protection		12-Apr-11	12-Apr-11	13-Apr-11	13-Apr-11	16-Apr-11	17-Apr-11	14-Apr-11	14-Apr-11	16-Apr-11	16-Apr-11	16-Apr-11	13-Apr-11	13-Apr-11	13-Apr-11
ALS Sample ID:	Units	of Freshwater Aquatic Life[a]	RDL[h]	L995193-1	L995193-2	L995193-7	L995193-8	L996086-4	L996086-7	L996086-5	L996086-6	L996086-1	L996086-2	L996086-3	L995193-4	L995193-6	L995193-5
Physical Tests																	
Conductivity	µS/cm		2.0	65.3	74.6	173	175	62.9	48.6	34.4	29.2	20.5	18.0	18.6	31.0	29.1	28.6
Hardness (as $CaCO_3$)	mg/L		0.50	25.3	29.4	83.6	79.5	27.2	20.7	13.9	11.9	9.04	7.91	7.77	13.8	13.3	12.4
pH	pH	6.5-9.0	0.10	7.09	7.05	7.07	7.06	6.85	6.82	6.83	6.71	6.63	6.63	6.70	7.08	7.04	6.93
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	9.9	9.8	32.3	32.7	11.3	9.2	5.9	4.8	5.8	4.5	4.8	9.4	9.5	9.6
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	9.9	9.8	32.3	32.7	11.3	9.2	5.9	4.8	5.8	4.5	4.8	9.4	9.5	9.6
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	3.3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	46	55	127	129	31	33	30	27	14	21	21	26	25	19
Turbidity	NTU	dependent on background levels	0.10	0.26	1.11	0.65	0.62	0.33	0.57	0.31	0.24	0.33	0.25	0.29	0.26	0.32	0.35
Nutrients																	
Ammonia (as N)	mg/L	pH- and temperature-dependent	0.0050	0.0153	0.0113	0.0660	0.0682	0.0195	0.0094	0.0255	0.0219	0.0175	0.0143	0.0151	0.0567	0.0579	0.0812
Nitrate (as N)	mg/L	2.935[b]	0.01	0.0362	0.0822	0.0569	0.0487	0.0230	0.0249	0.0247	0.0312	<0.0050	0.0209	0.0210	0.0774	0.0260	0.0501
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.208	0.206	0.639	0.640	0.293	0.285	0.275	0.205	0.163	0.180	0.161	0.271	0.263	0.261
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus	mg/L	Trigger ranges from guidance framework	0.002	0.0025	0.0030	0.0137	0.0063	0.0025	0.0028	0.0032	0.0026	0.0021	0.0024	0.0029	0.0049	0.0031	0.0039
Anions																	
Bromide (Br)	mg/L		0.050	<0.050	<0.050	0.078	0.081	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L		0.50	8.78	9.99	23.3	23.6	1.22	3.35	2.21	1.78	0.87	0.74	0.76	0.77	0.71	0.60
Fluoride (F)	mg/L	0.12[b]	0.02	0.025	0.022	0.037	0.037	0.030	0.023	0.020	<0.020	<0.020	<0.020	<0.020	0.021	0.021	<0.020
Sulphate (SO_4)	mg/L		0.5	6.79	7.62	13.4	13.5	14.9	6.94	5.05	4.18	2.84	2.42	2.44	3.54	3.28	2.58
Cyanides																	
Cyanide, Total	mg/L		0.0010	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide, Free	mg/L	0.005	0.0010 - 0.0050	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Organic / Inorganic Carbon																	
Total Organic Carbon	mg/L		0.50	4.30	3.90	10.6	10.9	6.15	5.50	4.41	3.50	3.93	3.20	3.19	3.62	3.45	3.14
Total Metals																	
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0068	0.0273	0.0108	0.0108	0.0225	0.0180	0.0158	0.0129	0.0117	0.0092	0.0082	0.0031	0.0042	0.0044
Antimony (Sb)	mg/L		0.00005 - 0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)	mg/L	0.005	0.000030	0.000305	0.000288	0.000612	0.000656	0.000370	0.000326	0.000296	0.000216	0.000203	0.000142	0.000133	0.000212	0.000213	0.000211
Barium (Ba)	mg/L		0.000050	0.0119	0.0145	0.0420	0.0429	0.00915	0.0109	0.00647	0.00606	0.00405	0.00393	0.00395	0.00604	0.00587	0.00648
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.001 - 0.005	0.0084	0.0091	0.0099	0.0096	0.0100	0.0093	0.0080	0.0081	0.0078	0.0078	0.0069	0.0081	0.0090	0.0086
Cadmium (Cd)	mg/L	equation[b,d]	0.000010	<0.000010	<0.000010	0.000010	0.000014	0.000018	0.000010	0.000015	<0.000010	<0.000010	<0.000010	0.000018	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	6.12	6.78	17.8	17.2	4.84	4.41	3.01	2.58	1.56	1.34	1.50	2.27	2.44	2.39
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	<0.00010	0.00019	0.00019	0.00021	0.00037	0.00030	0.00026	0.00027	0.00016	0.00029	0.00023	0.00010	<0.00010	<0.00010
Cobalt (Co)	mg/L		0.00010	<0.00010	<0.00010	0.00027	0.00028	0.00040	0.00028	<0.00010	0.00026	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00023
Copper (Cu)	mg/L	≥0.002[e]	0.00050	0.00176	0.00183	0.00298	0.00310	0.00407	0.00277	0.00219	0.00170	0.00127	0.00110	0.00102	0.00104	0.00094	0.00083
Iron (Fe)	mg/L	0.3	0.010	<0.010	0.041	0.104	0.107	0.025	0.057	0.011	0.033	<0.010	0.013	0.014	0.015	0.013	0.070
Lead (Pb)	mg/L	≥0.001[f]	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	2.78	3.06	9.42	9.39	3.77	2.46	1.79	1.48	1.17	0.990	1.00	1.79	1.78	1.65
Manganese (Mn)	mg/L		0.000050	0.00148	0.00611	0.0175	0.0172	0.00445	0.00631	0.00247	0.00981	0.00121	0.00373	0.00368	0.00383	0.00358	0.0190
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073[d]	0.000050	0.000059	0.000056	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050

Winter surface water quality samples were collected from 1 m below the ice water interface, unless lakes were particularly shallow.

Winter bottom water quality samples were collected from 1.5 to 2 m above the sediments to avoid contamination.

Shaded cells indicate values that are both above analytical detection limits and exceed CCME guidelines for the protection of freshwater aquatic life.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, Updated January 2011.

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realized detection limit

Appendix 3.2-1. Lake Water Quality Analytical Results, Back River Project, 2011

Site Abbreviation:				Llama Lake	Llama Lake	Umwelt Lake	Umwelt Lake	Giraffe Lake	Goose Lake Neck	Goose Lake Central	Goose Lake Central	Propellor Lake	Propellor Lake	Propellor Lake	Reference B Lake	Reference B Lake	Reference B Lake
Depth Zone:				Shallow	Bottom	Ice-water interface	Ice-water interface	Ice-water interface	Ice-water interface	Shallow	Bottom	Shallow	Bottom	Bottom	Shallow	Shallow	Bottom
Depth (m):				1	12	0	0	0.2	0	1	7.5	1	6	6	1	1	3.5
Replicate:				1	1	1	2	1	1	1	1	1	1	2	1	2	1
Date Sampled:		CCME Guideline for the Protection		12-Apr-11	12-Apr-11	13-Apr-11	13-Apr-11	16-Apr-11	17-Apr-11	14-Apr-11	14-Apr-11	16-Apr-11	16-Apr-11	16-Apr-11	13-Apr-11	13-Apr-11	13-Apr-11
ALS Sample ID:	Units	of Freshwater Aquatic Life[a]	RDL[h]	L995193-1	L995193-2	L995193-7	L995193-8	L996086-4	L996086-7	L996086-5	L996086-6	L996086-1	L996086-2	L996086-3	L995193-4	L995193-6	L995193-5
Total Metals (continued)																	
Nickel (Ni)	mg/L	≥0.025[g]	0.00010	0.00240	0.00263	0.00732	0.00747	0.0144	0.00733	0.00499	0.00479	0.00245	0.00221	0.00227	0.00135	0.00146	0.00164
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.929	0.982	2.29	2.27	0.775	0.690	0.493	0.405	0.381	0.319	0.311	0.552	0.507	0.488
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.577	0.693	1.52	1.56	1.10	0.520	0.398	0.434	0.134	0.136	0.145	0.218	0.209	0.261
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	1.28	1.39	3.86	3.86	1.61	1.23	0.883	0.709	0.627	0.525	0.526	0.852	0.848	0.746
Strontium (Sr)	mg/L		0.00010	0.0462	0.0495	0.0843	0.0843	0.0205	0.0192	0.0130	0.0113	0.00785	0.00688	0.00686	0.00866	0.00871	0.00839
Thallium (Tl)	mg/L	0.0008	0.00005 - 0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000016	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	<0.000050	0.000077	0.000067	0.000081	0.000051	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Zinc (Zn)	mg/L	0.03	0.0030	<0.0030	0.0032	0.0033	0.0034	0.0051	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals																	
Aluminum (Al)	mg/L		0.0030	0.0043	0.0064	0.0080	0.0070	0.0182	0.0164	0.0105	0.0109	0.0068	0.0062	0.0082	<0.0030	<0.0030	<0.0030
Antimony (Sb)	mg/L		0.00005 - 0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)	mg/L		0.000030	0.000313	0.000282	0.000578	0.000559	0.000332	0.000296	0.000266	0.000202	0.000179	0.000120	0.000133	0.000217	0.000199	0.000172
Barium (Ba)	mg/L		0.000050	0.0114	0.0143	0.0430	0.0415	0.00873	0.0107	0.00632	0.00586	0.00416	0.00382	0.00375	0.00593	0.00577	0.00635
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.001 - 0.005	0.0071	0.0075	0.0077	0.0082	0.0086	0.0084	0.0093	0.0077	0.0065	0.0071	0.0068	0.0065	0.0069	0.0075
Cadmium (Cd)	mg/L		0.000010	<0.000010	<0.000010	0.000012	0.000018	0.000015	<0.000010	0.000014	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	5.62	6.71	18.0	17.0	4.88	4.36	2.72	2.36	1.67	1.56	1.51	2.56	2.44	2.26
Chromium (Cr)	mg/L		0.00010	0.00014	0.00016	0.00024	0.00025	0.00023	0.00015	0.00019	0.00017	<0.00010	0.00015	0.00015	0.00015	<0.00010	0.00011
Cobalt (Co)	mg/L		0.00010	<0.00010	<0.00010	0.00020	0.00019	0.00032	0.00020	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L		0.00050	0.00162	0.00171	0.00324	0.00302	0.00421	0.00253	0.00248	0.00159	0.00119	0.00102	0.00110	0.00092	0.00085	0.00077
Iron (Fe)	mg/L		0.010	<0.010	<0.010	0.013	0.012	<0.010	0.014	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	2.74	3.07	9.37	8.98	3.65	2.37	1.73	1.46	1.18	0.974	0.973	1.81	1.75	1.64
Manganese (Mn)	mg/L		0.000050	0.00119	0.00306	0.0152	0.0145	0.00355	0.00509	0.000673	0.00403	0.000639	0.00191	0.00225	0.00155	0.00157	0.00783
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	0.000062	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.00245	0.00275	0.00735	0.00716	0.0140	0.00717	0.00459	0.00453	0.00242	0.00225	0.00222	0.00144	0.00141	0.00151
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.947	0.995	2.28	2.21	0.757	0.670	0.472	0.388	0.386	0.309	0.316	0.552	0.517	0.473
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.561	0.655	1.54	1.54	1.09	0.504	0.388	0.421	0.135	0.135	0.142	0.210	0.211	0.241
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	1.27	1.39	3.85	3.74	1.56	1.20	0.855	0.695	0.641	0.510	0.523	0.864	0.824	0.759
Strontium (Sr)	mg/L		0.00010	0.0448	0.0482	0.0823	0.0825	0.0195	0.0186	0.0126	0.0107	0.00775	0.00649	0.00655	0.00846	0.00854	0.00836
Thallium (Tl)	mg/L		0.00005 - 0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000013	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	<0.000050	<0.000050	0.000056	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Zinc (Zn)	mg/L		0.0030	<0.0030	<0.0030	0.0076	0.0037	0.0036	<0.0030	0.0040	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Winter surface water quality samples were collected from 1 m below the ice water interface, unless lakes were particularly shallow.

Winter bottom water quality samples were collected from 1.5 to 2 m above the sediments to avoid contamination.

Shaded cells indicate values that are both above analytical detection limits and exceed CCME guidelines for the protection of freshwater aquatic life.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, Updated January 2011.

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realized detection limit

Appendix 3.2-1. Lake Water Quality Analytical Results, Back River Project, 2011

Site Abbreviation:				Llama Lake	Llama Lake	Llama Lake	Umwelt Lake	Giraffe Lake	Giraffe Lake	Goose Lake Neck	Goose Lake Neck	Goose Lake Central	Goose Lake Tail	Propellor Lake	Propellor Lake	Reference B Lake	Reference B Lake
Depth Zone:				Shallow	Mid	Mid	Shallow	Shallow	Mid	Shallow	Shallow	Shallow	Shallow	Shallow	Mid	Shallow	Shallow
Depth (m):				1	7	7	1	1	2.9	1	1	1	1	1	3.5	1	1
Replicate:		CCME Guideline		1	1	2	1	1	1	1	2	1	1	1	1	1	2
Date Sampled:		for the Protection		6-Aug-11	6-Aug-11	6-Aug-11	5-Aug-11	10-Aug-11	10-Aug-11	7-Aug-11	7-Aug-11	7-Aug-11	17-Aug-11	11-Aug-11	11-Aug-11	8-Aug-11	8-Aug-11
ALS Sample ID:	Units	of Freshwater Aquatic Life[a]	RDL[h]	L1041632-3	L1041632-4	L1041632-5	L1041632-2	L1043888-8	L1043888-9	L1043888-1	L1043888-2	L1043888-3	L1047401-8	L1047634-2	L1047634-1	L1043888-6	L1043888-7
Physical Tests																	
Conductivity	µS/cm		2.0	54.9	54.9	55.0	49.3	22.5	22.3	27.4	27.1	23.9	23.1	15.7	16.2	15.0	14.8
Hardness (as $CaCO_3$)	mg/L		0.50	20.3	20.3	20.2	17.7	9.02	8.99	10.8	10.2	9.45	10.7	6.27	6.29	6.39	6.38
pH	pH	6.5-9.0	0.10	6.93	6.93	6.93	6.91	6.77	6.80	6.61	6.68	6.70	6.46	6.74	6.76	6.85	6.87
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	4.8	4.8	5.1	4.5	4.6	4.4	3.7	3.4	3.5	3.3	3.8	3.7	5.0	5.2
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	4.8	4.8	5.1	4.5	4.6	4.4	3.7	3.4	3.5	3.3	3.8	3.7	5.0	5.2
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	4.0	<3.0
Total Dissolved Solids	mg/L		10	38	39	43	34	11	17	25	13	13	19	13	12	11	12
Turbidity	NTU	dependent on background levels	0.10	0.29	0.32	0.33	0.43	0.33	0.32	0.35	0.37	0.34	0.44	0.34	0.33	0.41	0.43
Nutrients																	
Ammonia (as N)	mg/L	pH- and temperature-dependent	0.0050	0.0138	<0.0050	<0.0050	<0.0050	0.0137	0.0071	0.0091	0.0098	0.0068	0.0055	<0.0050	0.0061	0.0089	0.0101
Nitrate (as N)	mg/L	2.935[b]	0.01	0.0111	0.0057	<0.0050	0.0063	0.0081	<0.0050	0.0055	0.0164	<0.0050	0.0059	0.0056	0.0074	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.157	0.130	0.144	0.233	0.227	0.205	0.181	0.215	0.218	0.185	0.181	0.201	0.209	0.246
Ortho Phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus	mg/L	Trigger ranges from guidance framework	0.002	0.0030	0.0026	0.0028	0.0064	0.0029	0.0024	0.0034	0.0029	0.0033	0.0038	0.0052	0.0035	0.0042	0.0044
Anions																	
Bromide (Br)	mg/L		0.050	0.055	0.074	0.072	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L		0.50	11.1	11.1	11.1	9.80	0.63	0.62		3.66	2.77	2.69	1.04	1.04	<0.50	<0.50
Fluoride (F)	mg/L	0.12[b]	0.02	<0.020	<0.020	<0.020	0.021	0.023	0.024	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Sulphate (SO_4)	mg/L		0.5	3.82	3.82	3.81	3.28	5.10	5.16	3.15	3.14	3.09	3.07	2.21	2.18	1.76	1.76
Cyanides																	
Cyanide, Total	mg/L		0.0010	0.0029	0.0029	0.0016	0.0016	0.0043	0.0012	0.0029	0.0027	0.0026	0.0025	0.0023	0.0024	0.0042	0.0040
Cyanide, Free	mg/L	0.005	0.0010 - 0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0029	<0.0010	<0.0010	<0.0050	<0.0050
Organic / Inorganic Carbon																	
Total Organic Carbon	mg/L		0.50	3.47	3.41	3.34	4.66	3.81	3.67	3.48	3.62	3.65	3.21	3.35	3.41	3.26	3.30
Total Metals																	
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0223	0.0150	0.0169	0.0164	0.0316	0.0260	0.0354	0.0169	0.0177	0.0197	0.0130	0.0141	0.0114	0.0119
Antimony (Sb)	mg/L		0.00005 - 0.0001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000095	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000275	0.000270	0.000265	0.000298	0.000191	0.000230	0.000240	0.000204	0.000195	0.000221	0.000125	0.000138	0.000138	0.000136
Barium (Ba)	mg/L		0.000050	0.00995	0.0101	0.0101	0.00895	0.00314	0.00313	0.00553	0.00506	0.00467	0.00405	0.00303	0.00309	0.00271	0.00269
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.001 - 0.005	<0.0050	<0.0050	0.0051	<0.0050	<0.0050	<0.0050	0.0081	<0.0050	<0.0050	0.0052	0.0037	0.0042	<0.0050	<0.0050
Cadmium (Cd)	mg/L	equation[b,d]	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	5.59	5.60	5.62	4.27	1.64	1.67	2.63	2.33	2.13	1.98	1.34	1.60	1.22	1.20
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00016	0.00017	0.00022	0.00015	0.00018	0.00012	0.00016	0.00011	0.00010	<0.00010	0.00012	<0.00010	0.00012	0.00011
Cobalt (Co)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	0.00010	0.00012	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	≥0.002[e]	0.00050	0.00125	0.00119	0.00113	0.00133	0.00217	0.00219	0.00153	0.00156	0.00146	0.00137	0.00093	0.00096	0.00076	0.00073
Iron (Fe)	mg/L	0.3	0.010	0.021	0.021	0.022	0.086	0.043	0.043	0.033	0.034	0.026	0.049	0.022	0.022	0.047	0.046
Lead (Pb)	mg/L	≥0.001[f]	0.000050	0.000202	0.000082	<0.000050	0.000219	0.000320	0.000065	0.000102	0.000061	0.000220	0.000084	0.000230	0.000115	0.000165	0.000068
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	1.71	1.73	1.71	1.85	1.22	1.27	1.22	1.15	1.09	1.07	0.770	0.773	0.894	0.884
Manganese (Mn)	mg/L		0.000050	0.00230	0.00237	0.00230	0.00133	0.00179	0.00176	0.00297	0.00273	0.00252	0.00286	0.00265	0.00276	0.00181	0.00182
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073[d]	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050

Winter surface water quality samples were collected from 1 m below the ice water interface, unless lakes were particularly shallow.

Winter bottom water quality samples were collected from 1.5 to 2 m above the sediments to avoid contamination.

Shaded cells indicate values that are both above analytical detection limits and exceed CCME guidelines for the protection of freshwater aquatic life.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, Updated January 2011.

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c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

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f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realized detection limit

Appendix 3.2-1. Lake Water Quality Analytical Results, Back River Project, 2011

Site Abbreviation:				Llama Lake	Llama Lake	Llama Lake	Umwelt Lake	Giraffe Lake	Giraffe Lake	Goose Lake Neck	Goose Lake Neck	Goose Lake Central	Goose Lake Tail	Propellor Lake	Propellor Lake	Reference B Lake	Reference B Lake
Depth Zone:				Shallow	Mid	Mid	Shallow	Shallow	Mid	Shallow	Shallow	Shallow	Shallow	Shallow	Mid	Shallow	Shallow
Depth (m):				1	7	7	1	1	2.9	1	1	1	1	1	3.5	1	1
Replicate:		CCME Guideline		1	1	2	1	1	1	1	2	1	1	1	1	1	2
Date Sampled:		for the Protection		6-Aug-11	6-Aug-11	6-Aug-11	5-Aug-11	10-Aug-11	10-Aug-11	7-Aug-11	7-Aug-11	7-Aug-11	17-Aug-11	11-Aug-11	11-Aug-11	8-Aug-11	8-Aug-11
ALS Sample ID:	Units	of Freshwater Aquatic Life[a]	RDL[h]	L1041632-3	L1041632-4	L1041632-5	L1041632-2	L1043888-8	L1043888-9	L1043888-1	L1043888-2	L1043888-3	L1047401-8	L1047634-2	L1047634-1	L1043888-6	L1043888-7
Total Metals (continued)																	
Nickel (Ni)	mg/L	≥0.025[g]	0.00010	0.00156	0.00160	0.00155	0.00143	0.00440	0.00449	0.00312	0.00310	0.00311	0.00229	0.00177	0.00181	0.00075	0.00072
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.598	0.609	0.601	0.579	0.324	0.337	0.383	0.344	0.333	0.305	0.285	0.290	0.303	0.296
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.290	0.287	0.292	0.314	0.239	0.240	0.217	0.197	0.178	0.180	0.092	0.099	0.109	0.111
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.791	0.797	0.791	0.850	0.654	0.669	0.661	0.609	0.589	0.565	0.474	0.482	0.496	0.499
Strontium (Sr)	mg/L		0.00010	0.0395	0.0399	0.0397	0.0263	0.00715	0.00736	0.0135	0.0120	0.0109	0.0101	0.00611	0.00728	0.00456	0.00454
Thallium (Tl)	mg/L	0.0008	0.00005 - 0.0001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	0.000011	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Zinc (Zn)	mg/L	0.03	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals																	
Aluminum (Al)	mg/L		0.0030	0.0145	0.0104	0.0081	0.0061	0.0141	0.0146	0.0111	0.0094	0.0127	0.0099	0.0072	0.0092	0.0087	0.0042
Antimony (Sb)	mg/L		0.00005 - 0.0001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000250	0.000239	0.000270	0.000269	0.000219	0.000239	0.000223	0.000200	0.000191	0.000228	0.000131	0.000123	0.000133	0.000150
Barium (Ba)	mg/L		0.000050	0.00979	0.00970	0.00971	0.00853	0.00307	0.00306	0.00520	0.00500	0.00461	0.00464	0.00297	0.00300	0.00268	0.00261
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.001 - 0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0033	0.0039	<0.0050	<0.0050
Cadmium (Cd)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	5.40	5.41	5.38	4.22	1.60	1.59	2.39	2.24	2.05	2.22	1.29	1.30	1.14	1.14
Chromium (Cr)	mg/L		0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt (Co)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L		0.00050	0.00097	0.00092	0.00094	0.00115	0.00164	0.00166	0.00113	0.00119	0.00107	0.00132	0.00076	0.00073	<0.00050	<0.00050
Iron (Fe)	mg/L		0.010	<0.010	<0.010	<0.010	0.013	0.022	0.023	0.014	0.014	<0.010	<0.010	<0.010	<0.010	0.017	0.017
Lead (Pb)	mg/L		0.000050	0.000067	<0.000050	<0.000050	0.000065	0.000172	<0.000050	<0.000050	<0.000050	0.000070	<0.000050	<0.000050	<0.000050	0.000078	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	1.66	1.64	1.65	1.75	1.22	1.22	1.17	1.13	1.05	1.25	0.740	0.740	0.859	0.856
Manganese (Mn)	mg/L		0.000050	0.00120	0.00108	0.000913	0.000937	0.00139	0.00139	0.00123	0.000782	0.000444	0.00127	0.000150	0.000212	0.000278	0.000143
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.00146	0.00153	0.00155	0.00136	0.00408	0.00424	0.00293	0.00297	0.00289	0.00264	0.00170	0.00170	0.00062	0.00063
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.586	0.581	0.589	0.555	0.323	0.323	0.351	0.337	0.328	0.357	0.286	0.279	0.287	0.279
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.285	0.279	0.274	0.295	0.235	0.233	0.210	0.191	0.168	0.168	0.086	0.097	0.106	0.100
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.766	0.763	0.767	0.813	0.641	0.640	0.613	0.592	0.574	0.653	0.469	0.458	0.481	0.476
Strontium (Sr)	mg/L		0.00010	0.0380	0.0378	0.0379	0.0259	0.00694	0.00691	0.0122	0.0114	0.0103	0.0113	0.00584	0.00592	0.00427	0.00426
Thallium (Tl)	mg/L		0.00005 - 0.0001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Zinc (Zn)	mg/L		0.0030	0.0036	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Winter surface water quality samples were collected from 1 m below the ice water interface, unless lakes were particularly shallow.

Winter bottom water quality samples were collected from 1.5 to 2 m above the sediments to avoid contamination.

Shaded cells indicate values that are both above analytical detection limits and exceed CCME guidelines for the protection of freshwater aquatic life.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, Updated January 2011.

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realized detection limit

Appendix 3.2-2

Lake Water Quality QA/QC Results, Back River Project, 2011

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Appendix 3.2-2. Lake Water Quality QA/QC Results, Back River Project, 2011

Site Abbreviation:				Winter Equipment Blank	Winter Field Blank	Winter Travel Blank	Summer Equipment Blank	Summer Field Blank*	Summer Travel Blank
Depth Zone:		CCME Guideline for the Protection		12-Apr-11	17-Apr-11	17-Apr-11	5-Aug-11	07-Aug-11 and 11-Aug-11	07-Aug-11 and 11-Aug-11
Depth (m):		of Freshwater Aquatic Life[a]	RDL[h]	L995193-3	L996086-8	L996086-9	L1041632-1	L1043888-4 and L1047634-4	L1043888-5 and L1047634-3
Physical Tests									
Conductivity	µS/cm		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Hardness (as $CaCO_3$)	mg/L		0.50	<0.50	-	-	<0.50	<0.50	<0.50
pH	pH	6.5-9.0	0.10	5.86	5.46	5.57	5.85	5.55	5.54
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10 - 13	<10	<13	<10	<10	<10	<10
Turbidity	NTU	dependent on background levels	0.10	<0.10	0.18	0.17	<0.10	<0.10	<0.10
Nutrients									
Ammonia (as N)	mg/L	pH- and temperature-dependent	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0058
Nitrate (as N)	mg/L	2.935[b]	0.0050	0.0165	<0.0050	<0.0050	0.0123	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.050	<0.050	0.161	<0.050	<0.050	<0.050	<0.050
Ortho-phosphate (as P)	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus	mg/L	Trigger ranges from guidance framework	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Anions									
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L		0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride (F)	mg/L	0.12[b]	0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Sulphate (SO_4)	mg/L		0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Cyanides									
Cyanide, Total	mg/L		0.0010	-	-	-	<0.0010	0.0020	<0.0010
Cyanide, Free	mg/L	0.005	0.0050	-	-	-	<0.0050	<0.0050	<0.0050
Organic / Inorganic Carbon									
Total Organic Carbon	mg/L		0.50	<0.50	<0.50	<0.50	0.72	<0.50	<0.50
Total Metals									
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	<0.0030	<0.0030	<0.0030	0.0125	-	-
Antimony (Sb)	mg/L		0.000050 - 0.00010	<0.00010	<0.00010	<0.00010	<0.000050	-	-
Arsenic (As)	mg/L	0.005	0.000030	<0.000030	<0.000030	<0.000030	<0.000030	-	-
Barium (Ba)	mg/L		0.000050	0.00227	<0.000050	<0.000050	0.000236	-	-

Winter surface water quality samples were collected from 1 m below the ice water interface, unless lakes were particularly shallow.

Winter bottom water quality samples were collected from 1.5 to 2 m above the sediments to avoid contamination.

Shaded cells indicate values that are both above analytical detection limits and exceed CCME guidelines for the protection of freshwater aquatic life.

Total metal blanks were not collected in summer as ALS did not send these blanks to site.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, Updated January 2011.

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realized detection limit

Appendix 3.2-2. Lake Water Quality QA/QC Results, Back River Project, 2011

Site Abbreviation:				Winter Equipment Blank	Winter Field Blank	Winter Travel Blank	Summer Equipment Blank	Summer Field Blank*	Summer Travel Blank
Depth Zone:		CCME Guideline for the Protection of Freshwater Aquatic Life[a]	RDL[h]	12-Apr-11	17-Apr-11	17-Apr-11	5-Aug-11	07-Aug-11 and 11-Aug-11	07-Aug-11 and 11-Aug-11
Depth (m):				L995193-3	L996086-8	L996086-9	L1041632-1	L1043888-4 and L1047634-4	L1043888-5 and L1047634-3
Total Metals *(continued)*									
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	-	-
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	-	-
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.0010 - 0.0050	0.0018	<0.0010	0.0024	<0.0050	-	-
Cadmium (Cd)	mg/L	equation[b,d]	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	-	-
Calcium (Ca)	mg/L		0.020	<0.020	<0.020	<0.020	<0.020	-	-
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	-	-
Cobalt (Co)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	-	-
Copper (Cu)	mg/L	≥0.002[e]	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	-	-
Iron (Fe)	mg/L	0.3	0.010	<0.010	<0.010	<0.010	<0.010	-	-
Lead (Pb)	mg/L	≥0.001[f]	0.000050	<0.000050	<0.000050	<0.000050	0.000194	-	-
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	-	-
Magnesium (Mg)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	-	-
Manganese (Mn)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	0.000163	-	-
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	-	-
Molybdenum (Mo)	mg/L	0.073[d]	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-
Nickel (Ni)	mg/L	≥0.025[g]	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	-	-
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	-	-
Potassium (K)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	-	-
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	-	-
Silicon (Si)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	-	-
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	-	-
Sodium (Na)	mg/L		0.010	<0.010	<0.010	<0.010	0.014	-	-
Strontium (Sr)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	-	-
Thallium (Tl)	mg/L	0.0008	0.000050 - 0.00010	<0.00010	<0.00010	<0.00010	<0.000050	-	-
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	-	-
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	-	-
Uranium (U)	mg/L	short-term: 0.033; long-term:	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	-	-
Vanadium (V)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-
Zinc (Zn)	mg/L	0.03	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	-	-
Dissolved Metals									
Aluminum (Al)	mg/L		0.0030	<0.0030	-	-	0.0062	<0.0030	<0.0030
Antimony (Sb)	mg/L		0.000050 - 0.00010	<0.00010	-	-	<0.000050	<0.000050	<0.000050

Winter surface water quality samples were collected from 1 m below the ice water interface, unless lakes were particularly shallow.

Winter bottom water quality samples were collected from 1.5 to 2 m above the sediments to avoid contamination.

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d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

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g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

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Appendix 3.2-2. Lake Water Quality QA/QC Results, Back River Project, 2011

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Depth (m):			L995193-3	L996086-8	L996086-9	L1041632-1	L1043888-4 and L1047634-4	L1043888-5 and L1047634-3
Dissolved Metals *(cont'd)*								
Arsenic (As)	mg/L	0.000030	<0.000030	-	-	<0.000030	<0.000030	<0.000030
Barium (Ba)	mg/L	0.000050	0.00292	-	-	0.000147	<0.000050	<0.000050
Beryllium (Be)	mg/L	0.00020	<0.00020	-	-	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L	0.00050	<0.00050	-	-	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	0.0010 - 0.0050	<0.0010	-	-	<0.0050	<0.0010	<0.0010
Cadmium (Cd)	mg/L	0.000010	<0.000010	-	-	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L	0.020	<0.020	-	-	<0.020	<0.020	<0.020
Chromium (Cr)	mg/L	0.00010	<0.00010	-	-	<0.00010	<0.00010	<0.00010
Cobalt (Co)	mg/L	0.00010	<0.00010	-	-	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	0.00050	<0.00050	-	-	<0.00050	<0.00050	<0.00050
Iron (Fe)	mg/L	0.010	<0.010	-	-	<0.010	<0.010	<0.010
Lead (Pb)	mg/L	0.000050	<0.000050	-	-	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L	0.0050	<0.0050	-	-	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L	0.0050	<0.0050	-	-	<0.0050	<0.0050	<0.0050
Manganese (Mn)	mg/L	0.000050	<0.000050	-	-	0.000088	<0.000050	<0.000050
Mercury (Hg)	mg/L	0.000010	<0.000010	-	-	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.000050	<0.000050	-	-	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.00010	<0.00010	-	-	<0.00010	<0.00010	<0.00010
Phosphorus (P)	mg/L	0.30	<0.30	-	-	<0.30	<0.30	<0.30
Potassium (K)	mg/L	0.050	<0.050	-	-	<0.050	<0.050	<0.050
Selenium (Se)	mg/L	0.00010	<0.00010	-	-	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L	0.050	<0.050	-	-	<0.050	<0.050	<0.050
Silver (Ag)	mg/L	0.000010	<0.000010	-	-	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L	0.010	<0.010	-	-	0.012	<0.010	<0.010
Strontium (Sr)	mg/L	0.00010	<0.00010	-	-	<0.00010	<0.00010	<0.00010
Thallium (Tl)	mg/L	0.000050 - 0.00010	<0.00010	-	-	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L	0.00010	<0.00010	-	-	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L	0.010	<0.010	-	-	<0.010	<0.010	<0.010
Uranium (U)	mg/L	0.000010	<0.000010	-	-	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L	0.000050	<0.000050	-	-	<0.000050	<0.000050	<0.000050
Zinc (Zn)	mg/L	0.0030	<0.0030	-	-	<0.0030	<0.0030	<0.0030

Winter surface water quality samples were collected from 1 m below the ice water interface, unless lakes were particularly shallow.

Winter bottom water quality samples were collected from 1.5 to 2 m above the sediments to avoid contamination.

Shaded cells indicate values that are both above analytical detection limits and exceed CCME guidelines for the protection of freshwater aquatic life.

Total metal blanks were not collected in summer as ALS did not send these blanks to site.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, Updated January 2011.

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realized detection limit

Appendix 3.3-1

Stream Water Quality Analytical Results, Back River Project, 2011

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Appendix 3.3-1. Stream Water Quality Analytical Results, Back River Project, 2011

Site Abbreviation:				Chair OF	Chair OF	Llama OF	Llama OF	Echo OF	Echo OF	Giraffe OF	Giraffe OF	Wolf OF	Wolf OF	Goose OF	Goose OF	Propellor OF	Propellor OF	Propellor Downstream	Propellor Downstream	Ref. B OF	Ref. B OF
Replicate:		CCME Guideline		1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Date Sampled:		for the Protection		18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11
ALS Sample ID:	Units	of Freshwater Aquatic Life[a]	RDL[h]	L1020118-3	L1020118-4	L1020118-5	L1020118-6	L1020118-7	L1020118-8	L1020118-9	10	11	12	13	14	15	16	17	18	19	20
Physical Tests																					
Conductivity	µS/cm		2	18.6	18.3	58.3	58.2	34.2	34.2	26.1	26.0	16.4	16.5	23.2	23.1	19.0	19.3	18.9	18.8	14.7	14.7
Hardness (as $CaCO_3$)	mg/L		0.5	7.31	7.20	21.5	21.4	13.6	13.0	10.2	10.2	6.70	6.63	8.67	9.35	7.95	7.57	7.86	7.43	6.03	6.05
pH	pH	6.5-9.0	0.1	6.67	6.65	6.60	6.60	5.99	5.89	6.66	6.65	6.52	6.57	6.71	6.70	6.54	6.50	6.56	6.64	6.61	6.60
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		1.0 - 2.0	5.8	4.8	4.5	4.7	2.9	3.1	5.6	5.5	4.8	4.9	5.1	5.0	5.0	5.3	6.6	5.2	5.6	5.8
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		1.0 - 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		1.0 - 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		1.0 - 2.0	5.8	4.8	4.5	4.7	2.9	3.1	5.6	5.5	4.8	4.9	5.1	5.0	5.0	5.3	6.6	5.2	5.6	5.8
Total Suspended Solids	mg/L	dependent on background levels	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	17	15	53	66	43	50	26	27	16	12	24	24	18	16	20	17	19	19
Turbidity	NTU	dependent on background levels	0.1	0.48	0.55	0.28	0.30	0.21	0.25	0.44	0.43	0.43	0.42	0.56	0.52	0.29	0.31	0.42	0.34	0.43	0.46
Nutrients																					
Ammonia (as N)	mg/L	pH- and temperature-dependent	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate (as N)	mg/L	2.935[b]	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0116	0.0160	0.0059	<0.0050	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.246	0.206	0.169	0.176	0.268	0.272	0.195	0.276	0.235	0.277	0.264	0.250	0.145	0.171	0.239	0.176	0.253	0.276
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus	mg/L	Trigger ranges from guidance framework	0.002	0.0062	0.0060	0.0046	0.0042	0.0037	0.0040	0.0050	0.0049	0.0058	0.0049	0.0059	0.0057	0.0034	0.0035	0.0039	0.0040	0.0059	0.0060
Anions																					
Bromide (Br)	mg/L		0.05	<0.050	<0.050	0.051	0.051	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L		0.5	0.59	0.58	12.9	13.0	7.01	6.98	0.74	0.74	0.63	0.62	2.22	2.22	0.95	0.95	0.79	0.79	<0.50	<0.50
Fluoride (F)	mg/L	0.12[b]	0.02	<0.020	<0.020	<0.020	<0.020	0.026	0.024	0.022	0.021	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Sulphate (SO_4)	mg/L		0.5	2.88	2.89	2.78	2.79	1.72	1.72	6.16	6.12	2.31	2.31	2.86	2.84	2.73	2.72	2.47	2.46	1.17	1.17
Cyanides																					
Cyanide, Weak Acid Dissociable	mg/L		0.001 - 0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide, Total	mg/L		0.001 - 0.0014084	0.0042	0.0040	0.0036	0.0038	0.0067	0.0060	0.0041	0.0039	<0.0010	0.0019	0.0031	0.0037	0.0028	0.0020	0.0030	0.0033	0.0042	0.0043
Cyanide, Free	mg/L	0.005	0.001 - 0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Organic / Inorganic Carbon																					
Total Organic Carbon	mg/L		0.5	4.39	4.34	3.72	3.60	8.26	8.62	4.49	4.56	4.12	4.14	4.75	4.80	3.48	3.50	3.95	3.96	4.75	4.74
Total Metals																					
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.003 - 0.009	0.0412	0.0434	0.0461	0.0451	0.113	0.109	0.0363	0.0356	0.0271	0.0198	0.0301	0.0309	0.0135	0.0172	0.0215	0.0230	0.0208	0.0224
Antimony (Sb)	mg/L		0.00005 - 0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)	mg/L	0.005	0.00003	0.000351	0.000358	0.000249	0.000243	0.000356	0.000357	0.000217	0.000201	0.000195	0.000171	0.000175	0.000189	0.000133	0.000150	0.000141	0.000138	0.000117	0.000127
Barium (Ba)	mg/L		0.00005	0.00366	0.00371	0.0146	0.0144	0.0161	0.0157	0.00437	0.00414	0.00428	0.00386	0.00541	0.00579	0.00419	0.00437	0.00384	0.00394	0.00532	0.00524
Beryllium (Be)	mg/L		0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.001 - 0.005	0.0050	0.0060	0.0064	0.0064	0.0057	0.0067	0.0064	0.0059	0.0059	0.0057	0.0061	0.0065	0.0065	0.0052	0.0051	0.0050	0.0056	0.0051
Cadmium (Cd)	mg/L	equation[b,d]	0.00001	<0.000010	<0.000010	0.000031	0.000027	0.000023	0.000024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.02	1.38	1.47	6.40	6.32	3.47	3.39	1.95	1.98	1.43	1.44	2.01	2.04	1.54	1.60	1.57	1.58	1.32	1.27
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.0001	0.00021	0.00025	0.00017	0.00023	0.00043	0.00056	0.00023	0.00022	0.00024	0.00022	0.00019	0.00032	0.00016	0.00015	0.00017	0.00017	0.00024	0.00021
Cobalt (Co)	mg/L		0.0001	0.00020	0.00021	0.00107	0.00105	0.00137	0.00130	0.00085	0.00060	<0.00010	<0.00010	0.00024	0.00025	0.00013	0.00013	<0.00010	<0.00010	0.00014	0.00013
Copper (Cu)	mg/L	≥0.002[e]	0.0005	0.00173	0.00189	0.00216	0.00210	0.00227	0.00214	0.00231	0.00226	0.00132	0.00119	0.00151	0.00152	0.00106	0.00112	0.00130	0.00130	0.00085	0.00083
Iron (Fe)	mg/L	0.3	0.01	0.094	0.099	0.022	0.021	0.151	0.158	0.062	0.055	0.089	0.069	0.074	0.075	0.034	0.032	0.038	0.035	0.162	0.165
Lead (Pb)	mg/L	≥0.001[f]	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000134	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.005	1.01	1.02	1.75	1.71	1.29	1.23	1.40	1.39	0.881	0.842	0.998	1.04	0.889	0.945	0.963	0.983	0.819	0.802
Manganese (Mn)	mg/L		0.00005	0.00262	0.00273	0.0103	0.00992	0.00787	0.00764	0.0106	0.00727	0.00100	0.000653	0.00578	0.00598	0.00790	0.00824	0.00180	0.00176	0.00340	0.00340
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073[d]	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000081	<0.000050	<0.000050

Shaded cells indicate values that are both above analytical detection limits and exceed CCME guidelines for the protection of freshwater aquatic life.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, Updated January 2011.

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ /1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ /1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ /1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realized detection limit

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River Project, 2011

Site Abbreviation:				Chair OF 1	Chair OF 2	Llama OF 1	Llama OF 2	Echo OF 1	Echo OF 2	Giraffe OF 1	Giraffe OF 2	Wolf OF 1	Wolf OF 2	Goose OF 1	Goose OF 2	Propellor OF 1	Propellor OF 2	Propellor Downstream 1	Propellor Downstream 2	Ref. B OF 1	Ref. B OF 2
Replicate:				1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Date Sampled:		CCME Guideline for the Protection		18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11	18-Jun-11
ALS Sample ID:	Units	of Freshwater Aquatic Life[a]	RDL[h]	L1020118-3	L1020118-4	L1020118-5	L1020118-6	L1020118-7	L1020118-8	L1020118-9	10	11	12	13	14	15	16	17	18	19	20
Total Metals *(continued)*																					
Nickel (Ni)	mg/L	≥0.025[g]	0.0001	0.00309	0.00314	0.00663	0.00650	0.00458	0.00445	0.00816	0.00808	0.00293	0.00268	0.00403	0.00426	0.00230	0.00244	0.00190	0.00189	0.00145	0.00143
Phosphorus (P)	mg/L		0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.05	0.342	0.340	0.571	0.546	0.231	0.223	0.395	0.390	0.317	0.295	0.397	0.418	0.323	0.342	0.339	0.344	0.321	0.309
Selenium (Se)	mg/L	0.001	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.05	0.294	0.302	0.460	0.453	0.837	0.804	0.405	0.413	0.202	0.194	0.307	0.312	0.171	0.175	0.292	0.297	0.200	0.205
Silver (Ag)	mg/L	0.0001	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.01	0.548	0.555	0.781	0.763	0.758	0.725	0.718	0.712	0.568	0.541	0.635	0.665	0.529	0.563	0.557	0.559	0.476	0.463
Strontium (Sr)	mg/L		0.0001	0.00577	0.00612	0.0394	0.0390	0.0163	0.0157	0.00842	0.00847	0.00618	0.00616	0.0108	0.0110	0.00690	0.00718	0.00599	0.00615	0.00483	0.00474
Thallium (Tl)	mg/L	0.0008	0.00005 - 0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)	mg/L		0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.00001	0.000013	0.000016	0.000012	0.000011	<0.000010	<0.000010	0.000014	0.000013	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.00005	0.000113	0.000112	<0.000050	<0.000050	0.000109	0.000108	<0.000050	<0.000050	0.000064	<0.000050	<0.000050	0.000057	<0.000050	<0.000050	<0.000050	<0.000050	0.000064	0.000068
Zinc (Zn)	mg/L	0.03	0.003	<0.0030	<0.0030	0.0041	0.0038	0.0032	0.0076	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0031	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals																					
Aluminum (Al)	mg/L		0.003	0.0269	0.0277	0.0362	0.0357	0.118	0.103	0.0264	0.0258	0.0154	0.0152	0.0202	0.0172	0.0051	0.0055	0.0177	0.0162	0.0159	0.0166
Antimony (Sb)	mg/L		0.00005 - 0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)	mg/L		0.00003	0.000320	0.000315	0.000212	0.000204	0.000382	0.000333	0.000190	0.000187	0.000146	0.000151	0.000185	0.000169	0.000130	0.000141	0.000131	0.000121	0.000111	0.000117
Barium (Ba)	mg/L		0.00005	0.00348	0.00341	0.0139	0.0139	0.0173	0.0153	0.00400	0.00397	0.00374	0.00377	0.00523	0.00609	0.00447	0.00391	0.00405	0.00356	0.00476	0.00492
Beryllium (Be)	mg/L		0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.001 - 0.005	0.0042	0.0053	0.0064	0.0057	0.0052	0.0052	0.0048	0.0043	0.0047	0.0052	0.0047	0.0041	0.0041	0.0032	0.0046	0.0048	0.0048	0.0049
Cadmium (Cd)	mg/L		0.00001	<0.000010	<0.000010	0.000027	0.000024	0.000024	0.000022	<0.000010	0.000012	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.02	1.32	1.30	5.94	5.90	3.19	3.24	1.89	1.89	1.36	1.35	1.91	1.92	1.52	1.50	1.48	1.47	1.19	1.18
Chromium (Cr)	mg/L		0.0001	0.00015	0.00019	0.00016	0.00016	0.00045	0.00039	0.00015	0.00011	0.00014	0.00015	0.00014	<0.00010	<0.00010	<0.00010	0.00017	0.00013	0.00016	0.00017
Cobalt (Co)	mg/L		0.0001	0.00014	0.00014	0.00099	0.00097	0.00144	0.00125	0.00052	0.00052	<0.00010	<0.00010	0.00015	0.00017	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L		0.0005	0.00146	0.00147	0.00189	0.00184	0.00231	0.00219	0.00205	0.00201	0.00120	0.00109	0.00133	0.00112	0.00095	0.00074	0.00127	0.00202	0.00066	0.00068
Iron (Fe)	mg/L		0.01	0.034	0.037	<0.010	0.010	0.098	0.097	0.014	<0.010	0.032	0.029	0.024	0.017	<0.010	<0.010	0.017	0.014	0.075	0.074
Lead (Pb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000084	<0.000050	<0.000050
Lithium (Li)	mg/L		0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.005	0.973	0.961	1.63	1.62	1.36	1.20	1.34	1.33	0.801	0.791	0.948	1.11	1.01	0.930	1.01	0.915	0.742	0.757
Manganese (Mn)	mg/L		0.00005	0.00179	0.00187	0.00926	0.00914	0.00839	0.00730	0.00610	0.00601	0.000381	0.000360	0.00393	0.00457	0.00423	0.00369	0.000915	0.000798	0.00143	0.00153
Mercury (Hg)	mg/L		0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.0001	0.00298	0.00296	0.00629	0.00616	0.00496	0.00430	0.00761	0.00759	0.00269	0.00254	0.00385	0.00427	0.00246	0.00228	0.00204	0.00183	0.00131	0.00133
Phosphorus (P)	mg/L		0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.05	0.330	0.328	0.531	0.516	0.256	0.221	0.379	0.375	0.287	0.284	0.382	0.445	0.381	0.343	0.363	0.324	0.288	0.295
Selenium (Se)	mg/L		0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.05	0.259	0.265	0.433	0.421	0.762	0.779	0.376	0.374	0.186	0.183	0.278	0.286	0.158	0.165	0.269	0.268	0.180	0.187
Silver (Ag)	mg/L		0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.01	0.525	0.524	0.730	0.721	0.802	0.703	0.682	0.689	0.517	0.511	0.606	0.693	0.597	0.561	0.580	0.530	0.432	0.439
Strontium (Sr)	mg/L		0.0001	0.00553	0.00542	0.0368	0.0363	0.0150	0.0150	0.00891	0.00816	0.00587	0.00580	0.0103	0.0103	0.00681	0.00666	0.00571	0.00566	0.00446	0.00441
Thallium (Tl)	mg/L		0.00005 - 0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)	mg/L		0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.00001	0.000012	0.000012	<0.000010	<0.000010	<0.000010	<0.000010	0.000011	0.000011	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.00005	0.000094	0.000082	<0.000050	<0.000050	0.000111	0.000102	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Zinc (Zn)	mg/L		0.003	<0.0030	<0.0030	0.0048	0.0031	<0.0030	0.0033	<0.0030	<0.0030	<0.0030	0.0038	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0077

Shaded cells indicate values that are both above analytical detection limits and exceed CCME guidelines for the protection of freshwater aquatic life.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, Updated January 2011.

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realized detection limit

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River Project, 2011

Site Abbreviation:				Chair OF	Chair OF	Llama OF	Llama OF	Giraffe OF	Giraffe OF	Wolf OF	Wolf OF	Goose OF	Goose OF	Propellor OF	Propellor OF	Propellor Downstream	Propellor Downstream	Ref. B OF	Ref. B OF	Chair OF	Chair OF
Replicate:		CCME Guideline		1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Date Sampled:		for the Protection		13-Aug-11	13-Aug-11	17-Aug-11	17-Aug-11	12-Aug-11	12-Aug-11	13-Aug-11	13-Aug-11	16-Aug-11	16-Aug-11	15-Aug-11	15-Aug-11	15-Aug-11	15-Aug-11	14-Aug-11	14-Aug-11	8-Sep-11	8-Sep-11
ALS Sample ID:	Units	of Freshwater Aquatic Life[a]	RDL[h]	L1047634-5	L1047634-6	L1047401-9	10	L1047634-9	10	L1047634-7	L1047634-8	11	12	15	16	13	14	11	12	L1056717-1	L1056717-2
Physical Tests																					
Conductivity	µS/cm		2	25.2	25.3	321	328	22.6	22.6	21.1	21.4	22.9	22.7	16.6	16.6	18.2	18.2	34.6	35.3	49.3	35.8
Hardness (as $CaCO_3$)	mg/L		0.5	10.7	10.7	133	132	8.76	8.82	9.10	9.05	8.91	8.83	6.55	6.55	7.65	7.59	15.8	15.7	13.1	13.1
pH	pH	6.5-9.0	0.1	6.45	6.57	6.21	6.22	6.44	6.45	6.56	6.56	6.48	6.46	6.58	6.56	6.88	6.88	7.17	7.75	7.27	6.99
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		1.0 - 2.0	7.7	7.5	5.1	4.3	4.4	4.4	7.0	7.1	3.7	3.4	3.5	2.8	4.9	4.5	17.5	15.7	4.8	4.6
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		1.0 - 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		1.0 - 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		1.0 - 2.0	7.7	7.5	5.1	4.3	4.4	4.4	7.0	7.1	3.7	3.4	3.5	2.8	4.9	4.5	17.5	15.7	4.8	4.6
Total Suspended Solids	mg/L	dependent on background levels	3	5.3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	3.3	4.4	7.7
Total Dissolved Solids	mg/L		10	17	16	398	407	18	15	12	11	19	19	11	14	14	13	30	39	38	33
Turbidity	NTU	dependent on background levels	0.1	2.15	1.66	0.16	0.14	0.29	0.29	0.59	0.54	0.42	0.41	0.19	0.19	0.25	0.23	2.40	2.11	2.02	1.74
Nutrients																					
Ammonia (as N)	mg/L	pH- and temperature-dependent	0.005	0.0108	0.0098	<0.0050	<0.0050	0.0055	<0.0050	0.0058	0.0055	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0146	0.0145	<0.0050	<0.0050
Nitrate (as N)	mg/L	2.935[b]	0.005	0.0072	0.0076	0.491	0.489	0.0148	0.0101	0.0383	0.0415	<0.0050	<0.0050	0.0952	0.0952	0.0342	0.0400	<0.0050	<0.0050	0.0069	0.0069
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.406	0.398	0.118	0.103	0.189	0.192	0.252	0.254	0.166	0.156	0.107	0.200	0.150	0.122	0.855	0.868	0.197	0.182
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus	mg/L	Trigger ranges from guidance framework	0.002	0.0139	0.0109	<0.0020	0.0024	0.0034	0.0033	0.0045	0.0041	0.0047	0.0044	0.0037	0.0032	0.0035	0.0033	0.0218	0.0191	0.0071	0.0071
Anions																					
Bromide (Br)	mg/L		0.05	<0.050	<0.050	0.479	0.531	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L		0.5	0.75	0.75	87.8	90.3	0.59	0.59	0.77	0.76	2.65	2.65	1.01	1.01	0.77	0.77	0.70	0.68	1.11	1.02
Fluoride (F)	mg/L	0.12[b]	0.02	0.021	0.021	<0.020	<0.020	0.022	0.022	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.027	0.031	0.022	0.022
Sulphate (SO_4)	mg/L		0.5	3.56	3.55	5.65	5.63	5.19	5.20	2.15	2.13	3.08	3.10	2.32	2.32	2.25	2.28	0.52	0.51	8.46	8.46
Cyanides																					
Cyanide, Weak Acid Dissociable	mg/L		0.001 - 0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.0010	<0.0010
Cyanide, Total	mg/L		0.001 - 0.0014084	0.0034	0.0035	0.0016	0.0011	0.0018	0.0026	0.0022	0.0020	0.0024	0.0024	0.0019	0.0012	0.0019	0.0021	0.0081	0.0076	0.0043	0.0049
Cyanide, Free	mg/L	0.005	0.001 - 0.005	<0.0010	<0.0010	<0.0010	0.0028	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon																					
Total Organic Carbon	mg/L		0.5	4.70	5.30	1.49	1.63	3.48	3.46	3.58	3.61	3.39	3.48	2.50	2.53	2.79	2.74	10.0	10.3	5.20	5.20
Total Metals																					
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.003 - 0.009	0.0643	0.0554	0.0149	0.0140	0.0144	0.0153	0.0114	0.0134	0.0125	0.0110	<0.0090	<0.0090	0.0075	<0.0090	0.0749	0.0687	0.112	0.111
Antimony (Sb)	mg/L		0.00005 - 0.0001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.00003	0.00124	0.00122	0.000161	0.000163	0.000205	0.000180	0.000216	0.000260	0.000223	0.000217	0.000237	0.000296	0.000150	0.000201	0.000482	0.000459	0.000526	0.000549
Barium (Ba)	mg/L		0.00005	0.00408	0.00397	0.0609	0.0634	0.00309	0.00298	0.00437	0.00469	0.00417	0.00377	0.00353	0.00327	0.00303	0.00332	0.0102	0.0101	0.00580	0.00577
Beryllium (Be)	mg/L		0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.001 - 0.005	0.0035	0.0035	0.0058	0.0054	0.0038	0.0042	0.0031	0.0034	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0032	0.0026	0.0056	0.0055
Cadmium (Cd)	mg/L	equation[b,d]	0.00001	<0.000010	<0.000010	0.000149	0.000162	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000022	<0.000010
Calcium (Ca)	mg/L		0.02	1.99	1.95	31.3	32.6	1.69	1.60	1.94	1.94	1.99	1.87	1.43	1.34	1.55	1.64	3.19	3.18	2.34	2.38
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.0001	0.00030	0.00027	0.00013	0.00011	0.00011	<0.00010	0.00013	0.00014	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	0.00043	0.00040	0.00059	0.00050
Cobalt (Co)	mg/L		0.0001	0.00049	0.00047	0.00492	0.00563	0.00013	0.00013	0.00010	0.00011	0.00013	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	0.00042	0.00042	0.00045	0.00045
Copper (Cu)	mg/L	≥0.002[e]	0.0005	0.00218	0.00210	0.00123	0.00128	0.00202	0.00198	0.00122	0.00139	0.00133	0.00121	0.00102	0.00098	0.00121	0.00120	0.00175	0.00172	0.00230	0.00237
Iron (Fe)	mg/L	0.3	0.01	0.490	0.460	<0.010	<0.010	0.055	0.054	0.227	0.223	0.055	0.053	0.013	0.013	0.030	0.026	2.04	1.97	0.217	0.211
Lead (Pb)	mg/L	≥0.001[f]	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000053	0.000050	0.000057	0.000055
Lithium (Li)	mg/L		0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.005	1.54	1.49	12.4	13.1	1.25	1.21	1.13	1.26	1.08	1.01	0.859	0.782	0.943	1.03	2.05	2.02	1.89	1.91
Manganese (Mn)	mg/L		0.00005	0.00963	0.00936	0.0148	0.0175	0.00309	0.00286	0.00188	0.00196	0.00427	0.00391	0.00140	0.00134	0.00134	0.00150	0.00935	0.00922	0.00472	0.00457
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073[d]	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050

Shaded cells indicate values that are both above analytical detection limits and exceed CCME guidelines for the protection of freshwater aquatic life.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, Updated January 2011.

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ /1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ /1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ /1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realized detection limit

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River Project, 2011

Site Abbreviation:				Chair OF	Chair OF	Llama OF	Llama OF	Giraffe OF	Giraffe OF	Wolf OF	Wolf OF	Goose OF	Goose OF	Propellor OF	Propellor OF	Propellor Downstream	Propellor Downstream	Ref. B OF	Ref. B OF	Chair OF	Chair OF
Replicate:				1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Date Sampled:		CCME Guideline for the Protection		13-Aug-11	13-Aug-11	17-Aug-11	17-Aug-11	12-Aug-11	12-Aug-11	13-Aug-11	13-Aug-11	16-Aug-11	16-Aug-11	15-Aug-11	15-Aug-11	15-Aug-11	15-Aug-11	14-Aug-11	14-Aug-11	8-Sep-11	8-Sep-11
ALS Sample ID:	Units	of Freshwater Aquatic Life[a]	RDL[h]	L1047634-5	L1047634-6	L1047401-9	10	L1047634-9	10	L1047634-7	L1047634-8	11	12	15	16	13	14	11	12	L1056717-1	L1056717-2
Total Metals *(continued)*																					
Nickel (Ni)	mg/L	≥0.025[g]	0.0001	0.00335	0.00317	0.0366	0.0400	0.00425	0.00413	0.00200	0.00227	0.00230	0.00215	0.00162	0.00143	0.00093	0.00103	0.00337	0.00329	0.00408	0.00409
Phosphorus (P)	mg/L		0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.05	0.426	0.410	0.992	1.02	0.327	0.313	0.321	0.361	0.317	0.299	0.303	0.278	0.298	0.328	0.456	0.458	0.380	0.386
Selenium (Se)	mg/L	0.001	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.05	0.272	0.259	1.45	1.45	0.259	0.250	0.426	0.429	0.166	0.159	0.147	0.149	0.215	0.221	0.223	0.212	1.49	1.48
Silver (Ag)	mg/L	0.0001	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.01	0.777	0.758	2.04	2.15	0.658	0.641	0.628	0.701	0.576	0.537	0.481	0.444	0.470	0.512	0.902	0.889	0.847	0.861
Strontium (Sr)	mg/L		0.0001	0.00859	0.00841	0.155	0.166	0.00732	0.00696	0.00855	0.00855	0.0101	0.00945	0.00654	0.00621	0.00582	0.00614	0.0121	0.0121	0.00962	0.00963
Thallium (Tl)	mg/L	0.0008	0.00005 - 0.0001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.00001	0.000019	0.000018	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000014	0.000014	0.000022	0.000022
Vanadium (V)	mg/L		0.00005	0.000369	0.000322	<0.000050	<0.000050	<0.000050	<0.000050	0.000065	0.000069	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000706	0.000663	0.000339	0.000342
Zinc (Zn)	mg/L	0.03	0.003	<0.0030	<0.0030	0.0144	0.0155	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals																					
Aluminum (Al)	mg/L		0.003	0.0116	0.0095	0.0120	0.0123	0.0083	0.0079	0.0050	0.0046	0.0050	0.0052	0.0053	0.0067	0.0043	0.0057	0.0360	0.0379	0.0308	0.0291
Antimony (Sb)	mg/L		0.00005 - 0.0001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.00003	0.000970	0.000913	0.000155	0.000157	0.000173	0.000174	0.000186	0.000187	0.000210	0.000209	0.000168	0.000121	0.000150	0.000240	0.000419	0.000379	0.000415	0.000413
Barium (Ba)	mg/L		0.00005	0.00355	0.00357	0.0631	0.0628	0.00293	0.00292	0.00409	0.00404	0.00369	0.00360	0.00329	0.00324	0.00305	0.00286	0.00896	0.00905	0.00521	0.00505
Beryllium (Be)	mg/L		0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.001 - 0.005	0.0029	0.0029	0.0052	0.0052	0.0028	0.0032	0.0027	0.0029	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0023	0.0026	<0.0050	0.0052
Cadmium (Cd)	mg/L		0.00001	<0.000010	<0.000010	0.000156	0.000159	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.02	1.87	1.88	32.5	32.1	1.56	1.56	1.85	1.84	1.87	1.86	1.33	1.35	1.50	1.54	3.06	3.06	2.28	2.24
Chromium (Cr)	mg/L		0.0001	0.00011	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00012	<0.00010	0.00011	0.00030	0.00034	0.00031	0.00028
Cobalt (Co)	mg/L		0.0001	0.00021	0.00021	0.00544	0.00530	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00018	0.00016	0.00035	0.00033
Copper (Cu)	mg/L		0.0005	0.00164	0.00162	0.00113	0.00115	0.00171	0.00173	0.00098	0.00098	0.00111	0.00110	0.00082	0.00123	0.00096	0.00146	0.00139	0.00140	0.00198	0.00197
Iron (Fe)	mg/L		0.01	0.141	0.102	<0.010	<0.010	0.014	0.013	0.076	0.079	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	1.01	1.01	0.047	0.044
Lead (Pb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.005	1.46	1.46	12.6	12.7	1.18	1.20	1.09	1.08	1.03	1.01	0.784	0.772	0.946	0.909	1.98	1.95	1.80	1.82
Manganese (Mn)	mg/L		0.00005	0.00511	0.00506	0.0167	0.0162	0.00217	0.00180	0.000684	0.000685	0.00111	0.00122	0.000558	0.000508	0.000711	0.00115	0.00454	0.00377	0.00309	0.00286
Mercury (Hg)	mg/L		0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.0001	0.00285	0.00296	0.0385	0.0383	0.00408	0.00405	0.00181	0.00188	0.00214	0.00216	0.00147	0.00144	0.00093	0.00088	0.00304	0.00305	0.00372	0.00367
Phosphorus (P)	mg/L		0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.05	0.404	0.399	0.996	1.01	0.312	0.309	0.310	0.312	0.309	0.304	0.287	0.291	0.304	0.296	0.451	0.442	0.358	0.364
Selenium (Se)	mg/L		0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.05	0.181	0.179	1.44	1.44	0.242	0.248	0.409	0.412	0.153	0.155	0.140	0.142	0.207	0.209	0.185	0.181	1.20	1.20
Silver (Ag)	mg/L		0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.01	0.749	0.744	2.06	2.06	0.631	0.637	0.600	0.603	0.550	0.545	0.451	0.438	0.471	0.455	0.880	0.870	0.826	0.826
Strontium (Sr)	mg/L		0.0001	0.00807	0.00799	0.161	0.158	0.00676	0.00680	0.00807	0.00802	0.00950	0.00943	0.00612	0.00751	0.00568	0.00584	0.0116	0.0116	0.00911	0.00903
Thallium (Tl)	mg/L		0.00005 - 0.0001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000015	0.000016
Vanadium (V)	mg/L		0.00005	0.000108	0.000097	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000335	0.000353	0.000128	0.000115
Zinc (Zn)	mg/L		0.003	<0.0030	<0.0030	0.0155	0.0152	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Shaded cells indicate values that are both above analytical detection limits and exceed CCME guidelines for the protection of freshwater aquatic life.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, Updated January 2011.

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realized detection limit

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River Project, 2011

Site Abbreviation:				Llama OF	Llama OF	Echo OF	Echo OF	Giraffe OF	Giraffe OF	Wolf OF	Wolf OF	Goose OF	Goose OF	Propellor OF	Propellor OF	Propellor Downstream	Propellor Downstream	Ref. B OF	Ref. B OF
Replicate:				1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Date Sampled:		CCME Guideline for the Protection		8-Sep-11	8-Sep-11	8-Sep-11	8-Sep-11	8-Sep-11	8-Sep-11	9-Sep-11	9-Sep-11	8-Sep-11	8-Sep-11	9-Sep-11	9-Sep-11	9-Sep-11	9-Sep-11	9-Sep-11	9-Sep-11
ALS Sample ID:	Units	of Freshwater Aquatic Life[a]	RDL[h]	L1056717-3	L1056717-4	L1056717-5	L1056717-6	L1056717-7	L1056717-8	11	12	L1056717-9	10	13	14	15	16	17	18
Physical Tests																			
Conductivity	µS/cm		2	266	261	85.1	84.8	27.8	27.6	33.3	33.1	26.0	25.9	16.7	16.8	20.2	20.3	23.3	23.3
Hardness (as $CaCO_3$)	mg/L		0.5	99.5	105	31.9	32.1	10.7	10.7	13.4	13.1	9.89	10.1	6.73	6.66	8.53	8.54	10.0	9.92
pH	pH	6.5-9.0	0.1	6.53	6.51	5.88	5.72	6.85	6.89	6.88	6.91	6.80	6.81	6.84	6.61	7.06	7.08	7.05	7.00
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		1.0 - 2.0	3.4	3.2	<2.0	2.6	4.6	4.3	5.1	5.1	3.6	3.6	3.8	3.7	5.9	5.7	7.3	6.1
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		1.0 - 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<1.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		1.0 - 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<1.0
Alkalinity, Total (as $CaCO_3$)	mg/L		1.0 - 2.0	3.4	3.2	<2.0	2.6	4.6	4.3	5.1	5.1	3.6	3.6	3.8	3.7	5.9	5.7	7.3	6.1
Total Suspended Solids	mg/L	dependent on background levels	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	3.1	<3.0
Total Dissolved Solids	mg/L		10	291	309	93	111	24	25	36	37	23	25	16	17	17	23	31	29
Turbidity	NTU	dependent on background levels	0.1	0.25	0.25	0.31	0.30	0.80	0.76	0.48	0.46	0.78	0.78	0.31	0.34	0.42	0.38	1.12	1.62
Nutrients																			
Ammonia (as N)	mg/L	pH- and temperature-dependent	0.005	<0.0050	0.0063	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0076	0.0064
Nitrate (as N)	mg/L	2.935[b]	0.005	0.126	0.127	<0.0050	<0.0050	<0.0050	<0.0050	0.0063	0.0070	<0.0050	<0.0050	0.0239	0.0232	0.0147	0.0140	0.0106	0.0114
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.144	0.137	0.313	0.317	0.126	0.116	0.162	0.157	0.094	0.168	0.087	0.087	<0.050	0.067	0.297	0.281
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011
Total Phosphorus	mg/L	Trigger ranges from guidance framework	0.002	0.0024	0.0025	0.0039	0.0039	0.0032	0.0032	0.0038	0.0036	0.0031	0.0035	0.0034	0.0026	0.0025	0.0023	0.0086	0.0090
Anions																			
Bromide (Br)	mg/L		0.05	0.101	0.109	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L		0.5	69.4	68.1	14.0	14.1	0.62	0.62	3.85	3.83	2.94	2.95	0.99	0.99	0.75	0.75	0.55	0.62
Fluoride (F)	mg/L	0.12[b]	0.02	0.023	0.022	0.024	0.024	0.026	0.027	0.021	0.021	<0.020	0.020	<0.020	<0.020	<0.020	<0.020	0.023	0.024
Sulphate (SO_4)	mg/L		0.5	9.37	9.38	11.4	11.4	6.68	6.67	3.98	3.96	3.45	3.47	2.44	2.44	2.69	2.69	2.61	2.61
Cyanides																			
Cyanide, Weak Acid Dissociable	mg/L		0.001 - 0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0040	<0.0010
Cyanide, Total	mg/L		0.001 - 0.0014084	0.0046	0.0047	0.0100	0.0098	0.0028	0.0031	0.0044	0.0018	0.0022	0.0024	0.0027	0.0023	0.0023	0.0019	0.0058	0.0058
Cyanide, Free	mg/L	0.005	0.001 - 0.005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0027	0.0017
Organic / Inorganic Carbon																			
Total Organic Carbon	mg/L		0.5	3.88	3.90	10.4	10.7	4.29	3.95	5.11	4.92	3.71	3.87	3.41	3.33	3.14	3.16	7.31	7.33
Total Metals																			
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.003 - 0.009	0.0602	0.0600	0.163	0.160	0.0316	0.0334	0.0281	0.0280	0.0214	0.0183	0.0132	0.0137	0.0148	0.0152	0.0504	0.0476
Antimony (Sb)	mg/L		0.00005 - 0.0001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.00003	0.000228	0.000210	0.000331	0.000316	0.000225	0.000235	0.000227	0.000244	0.000213	0.000199	0.000142	0.000121	0.000130	0.000123	0.000227	0.000246
Barium (Ba)	mg/L		0.00005	0.0563	0.0540	0.0360	0.0347	0.00366	0.00364	0.00714	0.00713	0.00462	0.00439	0.00279	0.00276	0.00286	0.00291	0.00658	0.00674
Beryllium (Be)	mg/L		0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.001 - 0.005	0.0063	0.0063	0.0055	0.0059	0.0055	0.0057	0.0055	0.0054	0.0054	0.0052	0.0054	0.0056	0.0058	0.0059	0.0053	0.0055
Cadmium (Cd)	mg/L	equation[b,d]	0.00001	0.000203	0.000194	0.000038	0.000037	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.02	31.4	30.0	8.55	8.14	1.98	2.00	3.26	3.30	2.24	2.20	1.39	1.35	1.76	1.77	1.91	1.96
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.0001	0.00032	0.00030	0.00065	0.00075	0.00021	0.00026	0.00036	0.00035	0.00026	0.00028	0.00017	0.00021	0.00024	0.00026	0.00041	0.00047
Cobalt (Co)	mg/L		0.0001	0.00968	0.00904	0.00555	0.00531	0.00020	0.00020	0.00027	0.00029	0.00018	0.00016	<0.00010	<0.00010	<0.00010	<0.00010	0.00023	0.00023
Copper (Cu)	mg/L	≥0.002[e]	0.0005	0.00297	0.00294	0.00271	0.00269	0.00208	0.00214	0.00145	0.00148	0.00145	0.00134	0.00122	0.00122	0.00118	0.00118	0.00146	0.00140
Iron (Fe)	mg/L	0.3	0.01	0.012	0.012	0.143	0.140	0.082	0.081	0.113	0.111	0.072	0.062	0.026	0.028	0.031	0.031	0.332	0.312
Lead (Pb)	mg/L	≥0.001[f]	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.005	7.52	7.26	2.85	2.73	1.44	1.47	1.32	1.34	1.17	1.16	0.840	0.818	1.10	1.10	1.24	1.26
Manganese (Mn)	mg/L		0.00005	0.0716	0.0672	0.0518	0.0497	0.00225	0.00221	0.00390	0.00396	0.00439	0.00378	0.00243	0.00232	0.00152	0.00138	0.00345	0.00336
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073[d]	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050

Shaded cells indicate values that are both above analytical detection limits and exceed CCME guidelines for the protection of freshwater aquatic life.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, Updated January 2011.

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ /1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ /1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ /1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realized detection limit

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River Project, 2011

Site Abbreviation:				Llama OF 1	Llama OF 2	Echo OF 1	Echo OF 2	Giraffe OF 1	Giraffe OF 2	Wolf OF 1	Wolf OF 2	Goose OF 1	Goose OF 2	Propellor OF 1	Propellor OF 2	Propellor Downstream 1	Propellor Downstream 2	Ref. B OF 1	Ref. B OF 2
Replicate:		CCME Guideline		1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Date Sampled:		for the Protection		8-Sep-11	8-Sep-11	8-Sep-11	8-Sep-11	8-Sep-11	8-Sep-11	9-Sep-11	9-Sep-11	8-Sep-11	8-Sep-11	9-Sep-11	9-Sep-11	9-Sep-11	9-Sep-11	9-Sep-11	9-Sep-11
ALS Sample ID:	Units	of Freshwater Aquatic Life[a]	RDL[h]	L1056717-3	L1056717-4	L1056717-5	L1056717-6	L1056717-7	L1056717-8	11	12	L1056717-9	10	13	14	15	16	17	18
Total Metals *(continued)*																			
Nickel (Ni)	mg/L	≥0.025[g]	0.0001	0.0418	0.0396	0.00819	0.00785	0.00473	0.00486	0.00310	0.00307	0.00273	0.00263	0.00166	0.00157	0.00098	0.00158	0.00211	0.00204
Phosphorus (P)	mg/L		0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.05	0.837	0.802	0.319	0.305	0.345	0.354	0.288	0.289	0.330	0.327	0.277	0.268	0.325	0.325	0.346	0.347
Selenium (Se)	mg/L	0.001	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.05	1.87	1.84	3.37	3.26	0.514	0.510	0.870	0.887	0.295	0.281	0.194	0.188	0.362	0.361	0.756	0.757
Silver (Ag)	mg/L	0.0001	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.01	2.23	2.13	1.41	1.35	0.717	0.822	0.777	0.801	0.635	0.615	0.494	0.510	0.529	0.571	0.749	0.772
Strontium (Sr)	mg/L		0.0001	0.110	0.106	0.0341	0.0328	0.00828	0.00831	0.0195	0.0197	0.0110	0.0109	0.00585	0.00558	0.00591	0.00593	0.00652	0.00669
Thallium (Tl)	mg/L	0.0008	0.00005 - 0.0001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.00001	0.000011	0.000010	<0.000010	<0.000010	0.000011	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000013	0.000013	<0.000010	<0.000010
Vanadium (V)	mg/L		0.00005	<0.000050	0.000051	0.000157	0.000173	0.000088	0.000084	0.000070	0.000061	0.000063	0.000073	<0.000050	<0.000050	<0.000050	0.000051	0.000210	0.000192
Zinc (Zn)	mg/L	0.03	0.003	0.0177	0.0165	0.0060	0.0055	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals																			
Aluminum (Al)	mg/L		0.003	0.0475	0.0507	0.153	0.154	0.0151	0.0185	0.0182	0.0182	0.0077	0.0090	0.0083	0.0080	0.0095	0.0062	0.0269	0.0252
Antimony (Sb)	mg/L		0.00005 - 0.0001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.00003	0.000197	0.000198	0.000332	0.000317	0.000203	0.000209	0.000195	0.000200	0.000182	0.000182	0.000116	0.000122	0.000114	0.000124	0.000195	0.000215
Barium (Ba)	mg/L		0.00005	0.0518	0.0547	0.0356	0.0356	0.00332	0.00362	0.00689	0.00679	0.00425	0.00438	0.00271	0.00282	0.00272	0.00273	0.00642	0.00641
Beryllium (Be)	mg/L		0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.001 - 0.005	0.0052	0.0055	<0.0050	0.0052	0.0052	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cadmium (Cd)	mg/L		0.00001	0.000187	0.000196	0.000036	0.000036	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.02	28.3	30.1	8.19	8.29	1.94	1.94	3.22	3.14	2.13	2.15	1.36	1.33	1.69	1.70	1.95	1.92
Chromium (Cr)	mg/L		0.0001	0.00018	0.00023	0.00059	0.00060	0.00022	0.00015	0.00028	0.00019	0.00012	0.00015	0.00017	0.00013	0.00013	0.00014	0.00029	0.00029
Cobalt (Co)	mg/L		0.0001	0.00846	0.00900	0.00538	0.00536	0.00015	0.00015	0.00025	0.00023	<0.00010	<0.00010	0.00013	<0.00010	<0.00010	<0.00010	0.00019	0.00018
Copper (Cu)	mg/L		0.0005	0.00258	0.00274	0.00264	0.00266	0.00184	0.00192	0.00134	0.00128	0.00116	0.00121	0.00092	0.00093	0.00114	0.00101	0.00123	0.00125
Iron (Fe)	mg/L		0.01	<0.010	<0.010	0.114	0.110	0.015	0.015	0.038	0.039	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.100	0.092
Lead (Pb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.005	7.03	7.17	2.77	2.77	1.41	1.43	1.31	1.28	1.11	1.15	0.807	0.811	1.05	1.04	1.26	1.24
Manganese (Mn)	mg/L		0.00005	0.0633	0.0674	0.0498	0.0499	0.00152	0.00164	0.00341	0.00332	0.00148	0.00148	0.000352	0.000385	0.000355	0.000320	0.00222	0.00218
Mercury (Hg)	mg/L		0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.0001	0.0380	0.0396	0.00808	0.00805	0.00449	0.00460	0.00298	0.00299	0.00258	0.00269	0.00157	0.00160	0.00104	0.00092	0.00201	0.00199
Phosphorus (P)	mg/L		0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.05	0.798	0.793	0.313	0.316	0.340	0.343	0.287	0.274	0.318	0.327	0.270	0.270	0.315	0.314	0.361	0.354
Selenium (Se)	mg/L		0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.05	1.81	1.81	3.35	3.32	0.469	0.472	0.857	0.854	0.262	0.258	0.185	0.184	0.344	0.344	0.759	0.751
Silver (Ag)	mg/L		0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.01	2.08	2.11	1.37	1.36	0.693	0.699	0.767	0.751	0.590	0.607	0.478	0.477	0.517	0.511	0.769	0.761
Strontium (Sr)	mg/L		0.0001	0.0995	0.105	0.0328	0.0331	0.00798	0.00799	0.0188	0.0187	0.0104	0.0105	0.00561	0.00554	0.00564	0.00567	0.00656	0.00652
Thallium (Tl)	mg/L		0.00005 - 0.0001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.0001	<0.00010	<0.00010	<0.00010	0.00015	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.00005	<0.000050	<0.000050	0.000151	0.000135	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000090	0.000090
Zinc (Zn)	mg/L		0.003	0.0163	0.0174	0.0057	0.0058	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Shaded cells indicate values that are both above analytical detection limits and exceed CCME guidelines for the protection of freshwater aquatic life.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, Updated January 2011.

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realized detection limit

Appendix 3.3-2

Stream Water Quality QA/QC Results, Back River Project, 2011

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Appendix 3.3-2. Stream Water Quality QA/QC Results, Back River Project, 2011

Site Abbreviation: Replicate: Date Sampled: ALS Sample ID:		CCME Guideline for the Protection of Freshwater Aquatic Life[a]	RDL[h]	Freshet Field Blank 18-Jun-11 L1020118-1	Freshet Travel Blank 18-Jun-11 L1020118-2	Summer Field Blank 14-Aug-11 L1047634-14	Summer Travel Blank 14-Aug-11 L1047634-13	Fall Field Blank 09-Sep-11 L1056717-20	Fall Travel Blank 08-Sep-11 L1056717-19
Physical Tests									
Conductivity	µS/cm		2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Hardness (as $CaCO_3$)	mg/L		0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
pH	pH	6.5-9.0	0.1	5.72	5.49	5.66	5.76	5.68	5.71
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Suspended Solids	mg/L	dependent on background levels	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	<10	<10	<10	<10	<10	<10
Turbidity	NTU	dependent on background levels	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nutrients									
Ammonia (as N)	mg/L	pH- and temperature-dependent	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0197
Nitrate (as N)	mg/L	2.935b	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Ortho Phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus	mg/L	Trigger ranges from guidance framework	0.002	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Anions									
Bromide (Br)	mg/L		0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L		0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride (F)	mg/L	0.12[b]	0.02	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Sulphate (SO_4)	mg/L		0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Cyanides									
Cyanide, Weak Acid Dissociable	mg/L		0.001	-	-	-	-	<0.0010	<0.0010
Cyanide, Total	mg/L		0.001 - 0.002	<0.0010	<0.0010	<0.0020	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	**0.001 - 0.005**	<0.0050	<0.0050	<0.0010	<0.0010	<0.0010	0.0012
Organic / Inorganic Carbon									
Total Organic Carbon	mg/L		**0.5**	<0.50	<0.50	0.75	0.73	<0.50	1.14
Total Metals									
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.003	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Antimony (Sb)	mg/L		0.00005 - 0.0001	<0.00010	<0.00010	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.00003	<0.000030	<0.000030	<0.000030	<0.000030	<0.000030	<0.000030

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, Updated January 2011.

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realized detection limit

Appendix 3.3-2. Stream Water Quality QA/QC Results, Back River Project, 2011

Site Abbreviation: Replicate: Date Sampled: ALS Sample ID:		CCME Guideline for the Protection of Freshwater Aquatic Life[a]	RDL[h]	Freshet Field Blank 18-Jun-11 L1020118-1	Freshet Travel Blank 18-Jun-11 L1020118-2	Summer Field Blank 14-Aug-11 L1047634-14	Summer Travel Blank 14-Aug-11 L1047634-13	Fall Field Blank 09-Sep-11 L1056717-20	Fall Travel Blank 08-Sep-11 L1056717-19
Total Metals *(continued)*									
Barium (Ba)	mg/L		0.00005	<0.000050	<0.000050	0.000131	<0.000050	<0.000050	<0.000050
Beryllium (Be)	mg/L		0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.001 - 0.005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0050	<0.0050
Cadmium (Cd)	mg/L	equation[b,d]	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.02	<0.020	<0.020	<0.020	<0.020	0.032	0.022
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt (Co)	mg/L		0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	≥0.002[e]	0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)	mg/L	0.3	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead (Pb)	mg/L	≥0.001[f]	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Manganese (Mn)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	0.000053	<0.000050	<0.000050
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073[d]	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	≥0.025[g]	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Phosphorus (P)	mg/L		0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Selenium (Se)	mg/L	0.001	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Silver (Ag)	mg/L	0.0001	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.01	<0.010	<0.010	<0.010	<0.010	0.078	<0.010
Strontium (Sr)	mg/L		0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Thallium (Tl)	mg/L	0.0008	0.00005 - 0.0001	<0.00010	<0.00010	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Zinc (Zn)	mg/L	0.03	0.003	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals									
Aluminum (Al)	mg/L		0.003	-	-	<0.0030	<0.0030	<0.0030	<0.0030
Antimony (Sb)	mg/L		0.00005	-	-	<0.000050	<0.000050	<0.000050	<0.000050

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, Updated January 2011.

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realized detection limit

Appendix 3.3-2. Stream Water Quality QA/QC Results, Back River Project, 2011

Site Abbreviation: Replicate: Date Sampled: ALS Sample ID:		CCME Guideline for the Protection of Freshwater Aquatic Life[a]	RDL[h]	Freshet Field Blank 18-Jun-11 L1020118-1	Freshet Travel Blank 18-Jun-11 L1020118-2	Summer Field Blank 14-Aug-11 L1047634-14	Summer Travel Blank 14-Aug-11 L1047634-13	Fall Field Blank 09-Sep-11 L1056717-20	Fall Travel Blank 08-Sep-11 L1056717-19
Dissolved Metals *(continued)*									
Arsenic (As)	mg/L		0.00003	-	-	<0.000030	<0.000030	<0.000030	<0.000030
Barium (Ba)	mg/L		0.00005	-	-	0.000112	<0.000050	0.000097	<0.000050
Beryllium (Be)	mg/L		0.0002	-	-	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.0005	-	-	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.001 - 0.005	-	-	<0.0010	<0.0010	<0.0050	<0.0050
Cadmium (Cd)	mg/L		0.00001	-	-	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.02	-	-	<0.020	<0.020	0.093	<0.020
Chromium (Cr)	mg/L		0.0001	-	-	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt (Co)	mg/L		0.0001	-	-	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L		0.0005	-	-	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)	mg/L		0.01	-	-	<0.010	<0.010	<0.010	<0.010
Lead (Pb)	mg/L		0.00005	-	-	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.005	-	-	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.005	-	-	<0.0050	<0.0050	0.009400	<0.0050
Manganese (Mn)	mg/L		0.00005	-	-	<0.000050	<0.000050	<0.000050	<0.000050
Mercury (Hg)	mg/L		0.00001	-	-	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.00005	-	-	<0.000050	<0.000050	0.000087	<0.000050
Nickel (Ni)	mg/L		0.0001	-	-	<0.00010	<0.00010	<0.00010	<0.00010
Phosphorus (P)	mg/L		0.3	-	-	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.05	-	-	<0.050	<0.050	<0.050	<0.050
Selenium (Se)	mg/L		0.0001	-	-	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.05	-	-	<0.050	<0.050	<0.050	<0.050
Silver (Ag)	mg/L		0.00001	-	-	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.01	-	-	<0.010	<0.010	0.171	<0.010
Strontium (Sr)	mg/L		0.0001	-	-	<0.00010	<0.00010	0.00014	<0.00010
Thallium (Tl)	mg/L		0.00005	-	-	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.0001	-	-	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.01	-	-	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.00001	-	-	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.00005	-	-	<0.000050	<0.000050	<0.000050	<0.000050
Zinc (Zn)	mg/L		0.003	-	-	<0.0030	<0.0030	<0.0030	<0.0030

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, Updated January 2011.

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realized detection limit

Appendix 3.4-1

Lake Sediment Quality Descriptions, Back River Project, August 2011

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Appendix 3.4-1. Lake Sediment Quality Descriptions, Back River Project, 2011

Lake	Date	Zone	Replicate	Depth (m)	Physical Description	Munsell Colour Classification	Biological Material	Debriss Notes	Photos
Llama	06-Aug-11	shallow	1	5	less prominent orange layer, very fine sediments below	10R 5/4 surface, greyish below	-	-	yes
			2	5	very fine sediments, less prominent orange layer	10R 5/4 surface, greyish below	-	-	yes
			3	5	very fine sediments, less prominent orange layer	10R 5/4 surface, greyish below	-	-	yes
Llama	06-Aug-11	deep	1	14	1 cm horizon, very fine sediments, silty, some black flecks in surface	2.5Y 3/1 over 5Y 5/1	-	orange debris	yes
			2	11.5	very fine sediments, layer of orange on top	10R 5/4 over 5Y 5/1	-	orange debris	yes
			3	12	top layer of orange, very fine sediments	10R 5/4 over 5Y 5/11	-	orange debris	yes
Umwelt	05-Aug-11	shallow	1	2	homogenous silt clay, no horizon, lots of detritus, small stones present	5Y 5/4		orange globs on surface	yes
			2	2	jelly like textured silt, yellow/orange detritus on surface, small stones present	5Y 4/3		orange globs on surface	yes
			3	2	jelly like textured silt, yellow/orange detritus on surface, small stones present	5Y 4/3		orange globs on surface	yes
Giraffe	11-Aug-11	shallow	1	3.6	silty, with black and orange flecks	10YR 2/2	worm casts present	orange debris	no
			2	3.7	silty, with black speckles and flecks of orange	5Y 3/2	worm casts present	orange debris	no
			3	3.7	silty, blacker than the other replicates	10Y 3/2	worm casts present	orange debris	no
	11-Aug-11	deep	1	5.8	very fine sediments, clay below dark brown layer	2.5Y 3/2 over 2.5Y 6/4	-	-	no
			2	5.8	very fine dark brown sediment, no horizons	5Y 3/2	few worm casts	-	no
			3	5.6	very fine, dark brown, soft	5Y 3/2	-	decomposing twigs present	no
Goose Neck	07-Aug-11	shallow	1						yes
			2						
			3						
Goose Central	14-Aug-11	shallow	1	4.5	orange surface over grey fine silt	5Y 4/2	-	-	no
			2	4.7	orange flecks over grey fine silt	5Y 4/2	surface algae present	orange debris	no
			3	4.5	orange flecks over grey fine silt	5Y 4/2	worm casts present	orange debris	no
Goose Tail	17-Aug-11	shallow	1	2.4	orange surface over fine silt sediments	2.5Y 4/2	worm casts present		no
			2	2.7	fine sediments with some sand and gravel presesnt	10YR 4/2	worm casts present		no
			3	2.6	orange surface over fine silt sediments	2.5Y 4/2	worm casts present		no
Propellor	11-Aug-11	deep	1	7.6	one layer of very fine silt (yellowish brown colour)	10YR 3/2	-	-	no
			2	7.5	one layer of very fine silt (yellowish brown colour)	2.5Y 3/2	-	some debris present, disintegrates in hands	no
			3	7.6	one layer of very fine silt (yellowish brown colour)	5Y 3/2	-	some debris present, disintegrates in hands	no
Reference B	08-Aug-11	shallow	1	4.5	reddy fine sediments over very fine silt/clay bottom	5YR 3/4 over 2.5Y 4/3	worm casts present	orange debris	yes
			2	4	thin orange surface layer over very fine silt/clay bottom	5YR 4/6 over 5Y 4/2	-	orange debris	yes
			3	4.5	orange girt and sand over very fine silt/clay bottom	10YR 3/4 over 2.5 Y 4/2	worm casets present	orange debris	yes

Appendix 3.4-2

Lake Sediment Quality Analytical Results, Back River Project, August 2011

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Appendix 3.4-2. Lake Sediment Quality Analytical Results, Back River Project, 2011

Site ID:		CCME Guidelines for the Protection of Aquatic Life[a]			Llama Lake	Llama Lake	Llama Lake	Llama Lake	Llama Lake	Llama Lake	Umwelt Lake	Umwelt Lake	Umwelt Lake	Giraffe Lake	Giraffe Lake	Giraffe Lake	Giraffe Lake	Giraffe Lake	Giraffe Lake
Depth (m):					5	5.1	5	14.1	11.6	12	2	2	2	3.7	3.7	3.7	5.9	5.9	5.7
Replicate:					1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled:					06-Aug-11	06-Aug-11	06-Aug-11	06-Aug-11	06-Aug-11	06-Aug-11	05-Aug-11	05-Aug-11	05-Aug-11	11-Aug-11	11-Aug-11	11-Aug-11	11-Aug-11	11-Aug-11	11-Aug-11
ALS Sample ID:	Units	ISQG[b]	PEL[c]	RDL[d]	L1041632-15	L1041632-16	L1041632-17	L1041632-12	L1041632-13	L1041632-14	L1041632-9	L1041632-10	L1041632-11	L1043853-4	L1043853-5	L1043853-6	L1043853-7	L1043853-8	L1043853-9
Physical Tests																			
Moisture	%			0.25	84.4	83.9	85.1	77.1	76.1	72.9	83.9	79.2	78.4	87.7	87.6	87.8	67.0	62.5	84.0
pH	pH			0.10	6.40	6.62	6.51	6.33	6.66	6.41	6.45	6.22	6.68	5.61	5.56	6.04	5.90	5.89	5.90
Particle Size																			
% Gravel (>2 mm)	%			0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	2.99	0.61	<0.10	<0.10	<0.10	16	0.55	<0.10
% Sand (2.0 mm - 0.063 mm)	%			0.10	8.72	23.30	12.30	9.16	12.50	10.50	20.10	35.30	42.30	5.43	5.94	5.46	44.50	61.70	19.30
% Silt (0.063 mm - 4 µm)	%			0.10	59.5	52.9	55.7	72.0	69.8	71.6	68.3	54.0	50.3	80.8	78.4	85.3	37.9	36.4	69.7
% Clay (<4 µm)	%			0.10	31.8	23.8	32.0	18.8	17.7	17.9	11.70	7.67	06.8	13.8	15.7	09.2	01.6	01.4	11.0
Leachable Nutrients																			
Total Nitrogen	%			0.020	0.643	0.486	0.601	0.335	0.277	0.327	0.694	0.383	0.484	0.897	0.818	0.822	0.164	0.215	0.640
Cyanides																			
Cyanide, Weak Acid Dissociable	mg/kg			3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Cyanide, Total	mg/kg			3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	3.1	<3.0	<3.0	<3.0	<3.0	<3.0
Organic / Inorganic Carbon																			
Total Organic Carbon	%			0.10	7.93	6.11	7.23	3.98	3.26	3.83	7.91	4.16	5.38	11.70	10.80	10.90	2.14	2.78	8.35
Plant Available Nutrients																			
Available Ammonium (as N)	mg/kg			1 - 6.4	36.1	27.4	31.2	33.8	17.4	18.2	37.0	28.6	30.4	15.6	9.3	13.3	2.1	4.7	15.7
Nitrate and Nitrite (as N)	mg/kg			2 - 20.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<2.0	<2.0	<6.0
Nitrate (as N)	mg/kg			2 - 20.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<2.0	<2.0	<6.0
Nitrite (as N)	mg/kg			0.4 - 4.0	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<0.40	<0.40	<1.2
Available Phosphate (as P)	mg/kg			2 - 10.0	6.7	4.5	5.3	7.7	36.6	25.5	14.1	7.4	10.3	<4.0	<4.0	<4.0	12.1	5.8	8.2
Metals																			
Aluminum (Al)	mg/kg			50	11000	10200	10100	11000	10200	9930	8090	8570	5550	10500	10600	10300	8210	5400	8910
Antimony (Sb)	mg/kg			0.10	0.1	0.11	0.1	<0.10	<0.10	<0.10	0.1	<0.10	<0.10	0.12	<0.10	0.11	<0.10	<0.10	0.1
Arsenic (As)	mg/kg	5.9	17	0.050	26.3	21	39.8	15.7	14.5	22.2	10.3	12.3	5.82	13.3	13.4	12.5	8.78	7.47	9.98
Barium (Ba)	mg/kg			0.50	82.7	76.4	80.5	62.7	61.1	58.3	65.9	54.8	45.1	54.9	56.7	66.9	47.7	26.9	65.6
Beryllium (Be)	mg/kg			0.20	0.45	0.44	0.41	0.33	0.31	0.31	0.29	0.29	<0.20	0.71	0.71	0.85	0.56	0.42	0.63
Bismuth (Bi)	mg/kg			0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg	0.6	3.5	0.050	0.388	0.388	0.377	0.301	0.175	0.196	0.31	0.732	0.162	0.565	0.626	0.638	0.13	0.114	0.451
Calcium (Ca)	mg/kg			50	3090	2850	2900	2460	2370	2410	3350	2630	2700	2900	2650	3250	1860	1260	3070
Chromium (Cr)	mg/kg	37.3	90	0.50	32.2	30.8	30.8	38.5	32.3	31.6	26.9	29	18.1	25.6	28.3	26.2	25	14	24.4
Cobalt (Co)	mg/kg			0.10	15.2	12.4	17.6	22.4	12.1	14.5	8.57	10.5	5.81	16.9	13.6	16.1	11.1	7.26	19.3
Copper (Cu)	mg/kg	35.7	197	0.50	92.1	90.3	92.2	79.8	66.8	63.4	73.9	61.1	39.5	115	128	127	82.5	43.9	106
Iron (Fe)	mg/kg			50	27100	21900	34900	20100	21200	25500	14300	16100	9500	13900	14300	12500	17400	12200	13200
Lead (Pb)	mg/kg	35	91.3	0.5 - 0.7	5.96	5.73	5.39	5.52	4.91	5.09	5.1	4.67	3.73	5.4	4.88	5.6	4.45	2.69	5.47
Lithium (Li)	mg/kg			1.0	14.4	13.9	12.5	15.8	15	14.4	11.5	12.7	8.9	10.5	10.5	9.3	17.2	10.7	14.6
Magnesium (Mg)	mg/kg			20	4470	4400	4280	5720	4850	4870	3750	4090	2870	2680	3050	2850	3630	2090	2950
Manganese (Mn)	mg/kg			1.0	172	136	390	194	210	274	87.4	100	65.3	66.5	75.7	67.5	90	53.4	80.4
Mercury (Hg)	mg/kg	0.17	0.486	0.0050	0.0571	0.0454	0.0524	0.0658	0.0484	0.05	0.072	0.0457	0.04	0.103	0.0889	0.101	0.0352	0.0355	0.0892
Molybdenum (Mo)	mg/kg			0.50	1.09	1	1.16	0.73	0.7	0.71	0.6	0.78	<0.50	1.07	0.99	0.84	0.55	<0.50	0.68
Nickel (Ni)	mg/kg			0.50	70.2	65.7	69.7	54.9	39.4	39.7	55.1	47.8	28.7	135	117	127	82.8	45.1	102
Phosphorus (P)	mg/kg			50	616	543	635	788	730	731	656	554	521	554	574	579	636	435	590
Potassium (K)	mg/kg			100	980	1000	960	1040	890	880	840	830	600	610	660	630	720	340	580
Selenium (Se)	mg/kg			0.20	0.48	0.38	0.47	0.45	0.39	0.4	0.4	0.43	0.23	0.72	0.59	0.58	0.34	0.25	0.5
Silver (Ag)	mg/kg			0.10	0.18	0.18	0.2	0.23	0.16	0.15	0.1	<0.10	<0.10	0.28	0.28	0.28	0.16	0.11	0.22
Sodium (Na)	mg/kg			100	150	150	130	160	130	140	140	140	110	110	130	120	<100	<100	120
Strontium (Sr)	mg/kg			0.50	20.1	17.3	17.4	13.8	13.4	12.6	19	15.1	14	18.2	17.5	20.2	13.9	7.15	16.6
Sulphur (S)	mg/kg			500	2600	2100	2300	2100	1500	1600	5500	2300	2300	4100	4100	3900	700	1000	3200
Thallium (Tl)	mg/kg			0.050	0.114	0.105	0.101	0.127	0.089	0.096	0.083	0.165	0.054	0.115	0.109	0.115	0.068	<0.050	0.106
Tin (Sn)	mg/kg			2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg			1.0	326	310	265	419	393	417	317	361	263	208	232	217	352	172	274
Uranium (U)	mg/kg			0.050	1.42	1.37	1.33	1.16	1.15	1.05	1.02	1.02	0.617	2.1	2.17	2.12	1.58	0.839	1.66
Vanadium (V)	mg/kg			0.20	34.5	33.7	34.1	37.9	33.8	34.1	30.7	31	21.6	24.9	26.9	25.7	28.1	17.7	27.3
Zinc (Zn)	mg/kg	123	315	1.0	76.3	77.5	78.5	66.4	49.7	48.6	62.6	120	35.2	105	108	115	62.1	41.1	81.3

Notes:

Depths are the mean of the two grabs in each replicate.

Shaded cells indicate values that exceed CCME guidelines

a) Canadian sediment quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, Updated January 2011

b) ISQG = Interim Sediment Quality Guideline

c) PEL = Probable Effects Level

d) Realized Detection Limits

Appendix 3.4-2. Lake Sediment Quality Analytical Results, Back River Project, 2011

Site ID:		CCME Guidelines for the Protection of Aquatic Life[a]			Goose Lake Neck	Goose Lake Neck	Goose Lake Neck	Goose Lake Central	Goose Lake Central	Goose Lake Central	Goose Lake Tail	Goose Lake Tail	Goose Lake Tail	Propellor Lake	Propellor Lake	Propellor Lake	Reference B Lake	Reference B Lake	Reference B Lake
Depth (m):					3	3	3	4.5	4.8	4.5	2.5	2.7	2.7	7.6	7.5	7.7	4.4	4.4	4.5
Replicate:					1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled:					07-Aug-11	07-Aug-11	07-Aug-11	07-Aug-11	07-Aug-11	07-Aug-11	17-Aug-11	17-Aug-11	17-Aug-11	11-Aug-11	11-Aug-11	11-Aug-11	08-Aug-11	08-Aug-11	08-Aug-11
ALS Sample ID:	Units	ISQG[b]	PEL[c]	RDL[d]	L1041632-18	L1041632-19	L1041632-20	L1041632-6	L1041632-7	L1041632-8	L1047401-1	L1047401-2	L1047401-3	L1047656-10	L1047656-11	L1047656-12	L1043853-1	L1043853-2	L1043853-3
Physical Tests																			
Moisture	%			0.25	91.5	91.3	92.2	84.4	85.4	86.4	44.2	63.5	63.9	76.6	78.5	76.5	70.5	69.7	68.1
pH	pH			0.10	6.35	6.03	6.23	6.70	6.80	6.68	6.16	6.29	6.33	6.16	6.00	6.02	6.38	6.38	6.36
Particle Size																			
% Gravel (>2 mm)	%			0.10	<0.10	<0.10	<0.10	0.17	0.57	<0.10	3	2.66	0.97	<0.10	<0.10	<0.10	1.78	0.69	1.52
% Sand (2.0 mm - 0.063 mm)	%			0.10	5.21	9.86	2.43	6.80	6.57	7.17	70.70	66.00	64.60	20.90	18.20	23.60	68.10	75.90	77.00
% Silt (0.063 mm - 4 µm)	%			0.10	64.2	16.3	61.0	65.6	66.4	67.1	23.8	27.2	31.3	74.0	74.7	72.7	28.5	22.2	20.3
% Clay (<4 µm)	%			0.10	30.6	73.9	36.6	27.4	26.5	25.8	02.5	04.1	03.1	05.1	07.1	03.7	01.6	01.2	01.2
Leachable Nutrients																			
Total Nitrogen	%			0.020	1.160	1.240	1.130	0.468	0.496	0.583	0.095	0.151	0.182	0.345	0.361	0.302	0.358	0.327	0.279
Cyanides																			
Cyanide, Weak Acid Dissociable	mg/kg			3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Cyanide, Total	mg/kg			3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Organic / Inorganic Carbon																			
Total Organic Carbon	%			0.10	14.20	14.80	13.70	5.53	5.80	6.81	1.03	1.75	1.93	3.89	3.99	3.33	4.51	3.97	3.50
Plant Available Nutrients																			
Available Ammonium (as N)	mg/kg			1 - 6.4	54.1	68.6	58.8	43.8	51.9	50.7	2.0	2.3	4.4	5.9	8.8	4.8	15.4	15.2	8.8
Nitrate and Nitrite (as N)	mg/kg			2 - 20.0	<6.0	<16	<8.0	<8.0	<6.0	<8.0	<2.0	<2.0	<4.0	<4.0	<6.0	<4.0	<2.0	<2.0	<2.0
Nitrate (as N)	mg/kg			2 - 20.0	<6.0	<16	<8.0	<8.0	<6.0	<8.0	<2.0	<2.0	<4.0	<4.0	<6.0	<4.0	<2.0	<2.0	<2.0
Nitrite (as N)	mg/kg			0.4 - 4.0	<1.2	<3.2	<1.6	<1.6	<1.2	<1.6	<0.40	<0.40	<0.80	<0.80	<1.2	<0.80	<0.40	<0.40	<0.40
Available Phosphate (as P)	mg/kg			2 - 10.0	13.5	22	6.6	16.1	21.1	7.4	12.8	8.3	5.7	58.3	65.6	59.9	5.9	7.2	3
Metals																			
Aluminum (Al)	mg/kg			50	9590	8080	10600	11100	10800	9980	4190	5420	4530	7790	7220	7070	2430	2450	2510
Antimony (Sb)	mg/kg			0.10	0.14	<0.10	0.16	<0.10	0.11	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Arsenic (As)	mg/kg	5.9	17	0.050	8.15	6.98	10.8	11	17.1	22.8	2.74	4.39	3.06	4.31	4.02	3.59	3.05	3.03	3.51
Barium (Ba)	mg/kg			0.50	81.5	69.2	86.3	59.5	59.3	55	24.9	35.1	29.4	47.6	45.4	43.6	20.5	18.4	17.5
Beryllium (Be)	mg/kg			0.20	0.53	0.42	0.6	0.56	0.56	0.54	<0.20	0.24	0.21	0.33	0.29	0.27	<0.20	<0.20	<0.20
Bismuth (Bi)	mg/kg			0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg	0.6	3.5	0.050	1.13	0.601	1.43	0.182	0.238	0.232	0.052	0.12	0.093	0.249	0.364	0.217	0.055	<0.050	0.058
Calcium (Ca)	mg/kg			50	3660	3370	3620	2590	2690	2650	1230	1620	1430	1980	1990	1960	1000	984	882
Chromium (Cr)	mg/kg	37.3	90	0.50	22.7	19.9	25.4	31.2	29.8	28	11.1	15.2	12.8	24.9	23	22	6.76	7.02	6.78
Cobalt (Co)	mg/kg			0.10	11.8	10.5	12.5	17.7	18.7	26.3	5.11	6.67	5.94	10.7	10.4	9.44	2.11	2.18	2.2
Copper (Cu)	mg/kg	35.7	197	0.50	146	108	166	77.2	79.5	78.2	15.8	34	25.7	46.6	41.7	38.4	12.4	11.1	12.3
Iron (Fe)	mg/kg			50	8430	8190	9500	19600	25100	31400	6130	8280	6420	11700	10100	10500	6640	6830	7110
Lead (Pb)	mg/kg	35	91.3	0.5 - 0.7	6.2	5.05	6.49	5.14	5.86	5.92	1.79	2.72	2.12	4.47	4.96	5.16	1.79	1.68	1.76
Lithium (Li)	mg/kg			1.0	8.5	7.4	9.2	11.1	10.3	9.2	7.1	7.7	6.8	7.7	6.9	6.8	3.1	4.3	3.6
Magnesium (Mg)	mg/kg			20	2520	2280	2730	3370	3170	2960	1850	2150	1770	2700	2590	2530	980	1120	1050
Manganese (Mn)	mg/kg			1.0	65.8	69.1	69.4	113	178	309	47.5	61.1	46.8	108	103	103	37.3	39.3	37.3
Mercury (Hg)	mg/kg	0.17	0.486	0.0050	0.0984	0.101	0.0873	0.0603	0.0718	0.0775	0.011	0.0253	0.0168	0.0306	0.0347	0.0324	0.012	0.0104	0.0122
Molybdenum (Mo)	mg/kg			0.50	0.73	0.6	0.97	1.15	1.16	1.18	<0.50	<0.50	<0.50	0.5	0.52	<0.50	<0.50	<0.50	<0.50
Nickel (Ni)	mg/kg			0.50	85.2	71	91.7	56.4	54.2	56	19.9	30.6	22.2	33.8	30.8	28.9	10.3	10.2	9.77
Phosphorus (P)	mg/kg			50	523	510	485	607	608	604	377	411	379	834	699	670	226	204	172
Potassium (K)	mg/kg			100	630	570	680	700	690	700	370	440	350	550	530	520	280	290	270
Selenium (Se)	mg/kg			0.20	0.61	0.54	0.84	0.48	0.49	0.51	<0.20	<0.20	<0.20	0.32	0.29	0.26	<0.20	<0.20	<0.20
Silver (Ag)	mg/kg			0.10	0.3	0.24	0.33	0.14	0.14	0.15	<0.10	<0.10	<0.10	<0.10	0.1	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	mg/kg			100	<100	<100	110	130	130	130	<100	<100	<100	120	130	120	<100	<100	<100
Strontium (Sr)	mg/kg			0.50	22.9	21.3	23.5	17.4	17.8	17	6.25	9.05	7.66	11.7	11.6	11.4	6.21	5.92	5.48
Sulphur (S)	mg/kg			500	4600	4500	4500	4100	3800	7900	500	700	700	1300	1400	1200	1200	1000	900
Thallium (Tl)	mg/kg			0.050	0.117	0.08	0.177	0.072	0.074	0.074	<0.050	<0.050	<0.050	0.071	0.085	0.062	<0.050	<0.050	<0.050
Tin (Sn)	mg/kg			2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg			1.0	141	118	153	308	279	233	229	215	197	271	259	260	123	126	116
Uranium (U)	mg/kg			0.050	1.87	1.54	2.2	1.41	1.4	1.34	0.515	0.779	0.623	0.893	0.869	0.805	0.244	0.226	0.534
Vanadium (V)	mg/kg			0.20	18.6	15.8	21.9	34.5	33.3	31	13.1	17.5	15.5	30.4	27.9	26.4	11	12.1	13.1
Zinc (Zn)	mg/kg	123	315	1.0	92.9	66.9	142	64.7	72.1	70.8	25.5	37.5	29.6	48.7	49.8	41.2	11.1	10.8	11.2

Notes:

Depths are the mean of the two grabs in each replicate.

Shaded cells indicate values that exceed CCME guidelines

a) Canadian sediment quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, Updated January 2011

b) ISQG = Interim Sediment Quality Guideline

c) PEL = Probable Effects Level

d) Realized Detection Limits

Appendix 3.5-1

Stream Sediment Quality Analytical Results, Back River Project, August 2011

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Appendix 3.5-1. Stream Sediment Quality Analytical Results, Back River Project, 2011

Sample ID		CCME Guidelines for the Protection of Aquatic Life[a]			Chair OF 1	Chair OF 2	Chair OF 3	Giraffe OF 1	Giraffe OF 2	Giraffe OF 3	Wolf OF 1	Wolf OF 2	Wolf OF 3	Goose OF 1	Goose OF 2	Goose OF 3	Propellor Downstream 1	Ref. B OF 1	Ref. B OF 2	Ref. B OF 3
Date Sampled					13-Aug-11	13-Aug-11	13-Aug-11	12-Aug-11	12-Aug-11	12-Aug-11	13-Aug-11	13-Aug-11	13-Aug-11	16-Aug-11	16-Aug-11	16-Aug-11	15-Aug-11	14-Aug-11	14-Aug-11	14-Aug-11
Time Sampled																				
ALS Sample ID	Units	ISQG[b]	PEL[c]	RDL[d]	L1047656-13	L1047656-14	L1047656-15	L1047656-1	L1047656-2	L1047656-3	L1047656-4	L1047656-5	L1047656-6	L1047401-5	L1047401-6	L1047401-7	L1047401-4	L1047656-7	L1047656-8	L1047656-9
Physical Tests																				
Moisture	%			0.25	44.3	71.5	63.1	24.8	82.0	27.2	48.2	38.1	40.7	87.7	85.9	68.0	61.9	87.6	77.4	79.9
pH (1:2 soil:water)	pH			0.10	5.27	5.18	5.23	6.34	5.56	6.28	4.45	4.62	4.92	6.51	6.35	5.88	6.31	4.84	5.07	5.16
Particle Size																				
% Gravel (>2mm)	%			0.10	2.47	4.30	4.93	29.5	77.2	59.4	4.09	0.22	0.54	<0.10	<0.10	17.2	26.2	2.11	9.78	3.99
% Sand (2.0mm - 0.063mm)	%			0.10	76.3	51.0	64.1	65.7	16.9	34.1	80.5	82.6	78.9	18.8	64.8	69.7	53.1	57.9	74.1	78.2
% Silt (0.063mm - 4um)	%			0.10	20.1	34.2	25.5	4.22	4.28	5.56	14.8	16.5	19.6	62.3	29.1	12.8	9.82	32.3	13.8	16.9
% Clay (<4um)	%			0.10	1.16	10.5	5.40	0.57	1.64	0.95	0.63	0.63	0.95	18.9	6.13	0.43	10.9	7.68	2.37	0.86
Anions and Nutrients																				
Total Nitrogen by LECO	%			0.020	0.160	0.545	0.561	0.045	0.922	0.125	0.097	0.152	0.150	1.55	1.30	0.218	0.845	1.29	0.686	0.781
Cyanides																				
Cyanide, Weak Acid Dissociable				3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Cyanide, Total				3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Organic / Inorganic Carbon																				
Total Organic Carbon	%			0.10	2.93	8.66	8.66	0.54	15.9	1.62	1.43	2.29	2.26	23.4	21.4	3.41	9.78	23.3	11.0	14.5
Plant Available Nutrients																				
Available Ammonium (as N)	mg/kg			1.0 - 6.4	<2.4	35.4	16.5	1.7	31.0	5.9	3.4	12.9	20.8	41.2	15.1	5.6	21.6	41.5	30.6	38.6
Nitrate and Nitrite (as N)	mg/kg			2.0 - 20.0	<4.0	<6.0	<4.0	<2.0	<12	<2.0	<4.0	<4.0	<4.0	<12	<10	<4.0	<6.0	<20	<8.0	<10
Nitrate (as N)	mg/kg			2.0 - 20.0	<4.0	<6.0	<4.0	<2.0	<12	<2.0	<4.0	<4.0	<4.0	<12	<10	<4.0	<6.0	<20	<8.0	<10
Nitrite (as N)				0.4 - 4.0	<0.80	<1.2	<0.80	<0.40	<2.4	<0.40	<0.80	<0.80	<0.80	<2.4	<2.0	<0.80	<1.2	<4.0	<1.6	<2.0
Available Phosphate (as P)	mg/kg			2.0 - 8.0	<2.0	6.1	8.2	<2.0	<6.0	<2.0	<2.0	<2.0	<2.0	<8.0	<6.0	<2.0	<4.0	<8.0	<4.0	<6.0
Metals																				
Aluminum (Al)	mg/kg			50	5240	10800	9680	6760	5860	8730	2500	2990	2600	5080	3450	4170	5280	3990	3260	3460
Antimony (Sb)	mg/kg			0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Arsenic (As)	mg/kg	5.9	17.0	0.050	3.35	18.1	14.5	3.46	16.2	9.90	1.28	3.03	2.07	21.9	14.1	3.50	5.63	3.96	2.27	2.64
Barium (Ba)	mg/kg			0.50	19.3	58.9	39.7	23.8	81.0	29.8	15.5	16.9	14.8	88.4	78.7	32.9	65.0	77.3	50.0	36.2
Beryllium (Be)	mg/kg			0.20	<0.20	0.32	0.27	<0.20	0.25	<0.20	<0.20	<0.20	<0.20	0.29	0.22	<0.20	0.24	<0.20	<0.20	<0.20
Bismuth (Bi)	mg/kg			0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg	0.6	3.5	0.050	0.057	0.161	0.187	<0.050	0.248	<0.050	<0.050	0.053	<0.050	0.711	0.341	0.102	0.116	0.296	0.292	0.131
Calcium (Ca)	mg/kg			50	811	1740	1460	1360	3120	1440	986	987	884	4340	4530	1830	2240	3250	2490	1430
Chromium (Cr)	mg/kg	37.3	90.0	0.50	15.9	34.7	31.7	22.2	17.7	28.8	6.37	8.06	6.46	15.7	11.1	11.4	23.2	12.8	9.04	13.1
Cobalt (Co)	mg/kg			0.10	2.13	8.71	6.66	7.86	8.39	8.59	1.79	2.54	1.89	118	25.2	8.41	10.0	4.78	3.61	3.41
Copper (Cu)	mg/kg	35.7	197	0.50	11.9	40.0	46.2	18.9	44.5	22.0	5.57	7.69	6.40	54.4	42.4	15.0	20.2	62.2	50.5	17.6
Iron (Fe)	mg/kg			50	6590	17200	13200	12000	26400	17300	4440	8660	6310	29700	27800	10900	23600	12900	8220	8730
Lead (Pb)	mg/kg	35	91.3	0.50	1.43	5.23	3.93	2.39	3.83	2.69	1.14	2.08	1.34	9.08	5.18	2.57	6.27	6.74	1.85	1.72
Lithium (Li)	mg/kg			1.0	10.6	18.1	17.0	13.9	7.0	18.0	4.9	5.4	4.8	4.3	3.0	7.7	8.8	2.3	2.5	4.8
Magnesium (Mg)	mg/kg			20	2970	5170	4740	4860	3120	6140	1360	1540	1330	2190	1800	2740	3440	1110	1200	1580
Manganese (Mn)	mg/kg			1.0	64.3	124	110	129	133	168	42.1	38.6	31.3	2880	573	172	328	65.0	51.5	48.9
Mercury (Hg)	mg/kg	0.17	0.486	0.0050	0.0066	0.0421	0.0337	0.0061	0.0460	0.0053	0.0051	0.0126	0.0074	0.111	0.0695	0.0244	0.0292	0.0824	0.0532	0.0366
Molybdenum (Mo)	mg/kg			0.50	<0.50	0.57	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.74	0.52	<0.50	1.01	1.24	<0.50	<0.50
Nickel (Ni)	mg/kg			0.50	12.1	40.6	31.1	22.5	54.3	27.5	7.42	11.4	8.59	122	68.8	22.1	28.0	26.5	16.2	14.8
Phosphorus (P)	mg/kg			50	193	543	482	282	481	410	207	249	206	912	601	406	372	698	533	417
Potassium (K)	mg/kg			100	130	570	500	710	640	690	150	180	140	640	490	490	980	250	150	170
Selenium (Se)	mg/kg			0.20	<0.20	0.27	0.25	<0.20	0.32	<0.20	<0.20	<0.20	<0.20	0.66	0.41	<0.20	<0.20	0.87	0.38	0.25
Silver (Ag)	mg/kg			0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	0.14	<0.10	<0.10
Sodium (Na)	mg/kg			100	<100	100	<100	<100	<100	<100	<100	<100	<100	180	<100	<100	<100	<100	<100	<100
Strontium (Sr)	mg/kg			0.50	4.19	15.4	11.3	5.50	19.6	5.13	6.13	5.20	4.98	27.5	32.0	11.1	11.0	15.1	10.2	6.43
Sulfur (S)-Total	mg/kg			500	600	1700	1600	<500	3000	600	<500	700	600	3200	3100	700	2000	3000	1700	1900
Thallium (Tl)	mg/kg			0.050	<0.050	0.092	0.071	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.168	0.056	<0.050	0.054	<0.050	<0.050	<0.050
Tin (Sn)	mg/kg			2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg			1.0	154	377	334	330	237	327	160	165	130	134	107	255	278	125	101	162
Uranium (U)	mg/kg			0.050	0.412	1.07	1.00	0.422	0.793	0.608	0.226	0.254	0.272	0.972	0.613	0.388	0.691	0.654	0.662	0.521
Vanadium (V)	mg/kg			0.20	17.9	41.8	29.0	21.1	25.8	28.4	7.85	11.4	9.03	21.3	17.8	15.6	26.5	22.3	24.1	22.1
Zinc (Zn)	mg/kg	123	315	1.0	15.8	44.1	37.9	30.5	40.5	33.4	9.9	16.0	11.9	60.4	43.6	22.1	56.4	18.2	10.0	13.1

Notes:

Shaded cells indicate values that exceed CCME guidelines

a) Canadian sediment quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, Updated January 2011

b) ISQG = Interim Sediment Quality Guideline

c) PEL = Probable Effects Level

d) RDL = Realized detection limit

Appendix 3.6-1

Lake Phytoplankton Biomass as Chl a Results, Back River Project, 2011

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Appendix 3.6-1. Lake Phytoplankton Biomass as Chl *a* Results, Back River Project, 2011

Lake	Replicate	Date Sampled	ALS Sample ID	Chlorophyll *a* (µg/L)	Mean	SE
Llama Lake	1	06-Aug-11	L1043878-4	0.446	0.46	0.01
	2	06-Aug-11	L1043878-5	0.484		
	3	06-Aug-11	L1043878-6	0.444		
Umwelt Lake	1	05-Aug-11	L1043878-1	0.730	0.56	0.10
	2	05-Aug-11	L1043878-2	0.578		
	3	05-Aug-11	L1043878-3	0.384		
Giraffe Lake	1	10-Aug-11	L1043878-16	0.128	0.14	0.01
	2	10-Aug-11	L1043878-17	0.163		
	3	10-Aug-11	L1043878-18	0.132		
Goose Lake Neck	1	07-Aug-11	L1043878-10	0.538	0.35	0.13
	2	07-Aug-11	L1043878-11	0.113		
	3	07-Aug-11	L1043878-12	0.413		
Goose Lake Central	1	07-Aug-11	L1043878-7	0.542	0.55	0.06
	2	07-Aug-11	L1043878-8	0.650		
	3	07-Aug-11	L1043878-9	0.459		
Reference B Lake	1	08-Aug-11	L1043878-13	0.866	0.61	0.16
	2	08-Aug-11	L1043878-14	0.304		
	3	08-Aug-11	L1043878-15	0.651		

SE = standard error of the mean

All samples were from 1 m depth.

Appendix 3.6-2

Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2011

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Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2011

Site ID	Llama Lake	Llama Lake	Llama Lake	Umwelt Lake	Umwelt Lake	Umwelt Lake	Giraffe Lake	Giraffe Lake	Giraffe Lake	Goose Lake Neck	Goose Lake Neck	Goose Lake Neck	Goose Lake Central	Goose Lake Central	Goose Lake Central	Reference B Lake	Reference B Lake	Reference B Lake
Rep	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Date sampled	6-Aug-11	6-Aug-11	6-Aug-11	5-Aug-11	5-Aug-11	5-Aug-11	10-Aug-11	10-Aug-11	10-Aug-11	7-Aug-11	7-Aug-11	7-Aug-11	7-Aug-11	7-Aug-11	7-Aug-11	8-Aug-11	8-Aug-11	8-Aug-11
LAB ID	BIO-04	BIO-05	BIO-06	BIO-01	BIO-02	BIO-03	BIO-16	BIO-17	BIO-18	BIO-10	BIO-11	BIO-12	BIO-07	BIO-08	BIO-09	BIO-13	BIO-14	BIO-15
	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density
DIATOMS																		
Achnanthes minutissima Kuetzing	0	0	7292	7292	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Centric Diatom: 4 µm (*Cyclotella/Stephanodiscus*)	80222	116687	116687	123980	386528	306305	140997	153152	131273	29171	68067	63205	145859	72929	63205	116687	175031	145859
Centric Diatom: 10-16 µm (*Cyclotella/Stephanodiscus*)	80222	65636	80222	29171	21878	51050	29171	21878	7292	14585	38895	19447	102101	43757	24309	94807	58343	72929
Cocconeis sp	0	0	0	7292	0	0	0	0	0	0	0	0	0	0	0	7292	0	0
Eunotia spp	0	0	0	0	0	0	0	0	0	0	0	4861	0	0	0	0	0	0
Nitzschia sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7292	0	14585
Synedra/Nitzschia sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7292	0
Synedra sp	0	0	0	0	0	0	0	0	0	0	0	4861	7292	0	4861	14585	0	0
Tabellaria flocculosa (Roth) Kuetzing	0	0	0	0	0	0	4861	0	0	7292	0	0	7292	0	4861	7292	0	0
GREEN ALGAE - CHLOROPHYCEAE																		
Ankistrodesmus bernardii Komarek	0	0	0	0	0	0	4861	0	0	0	0	0	7292	0	0	0	0	0
Ankistrodesmus falcatus (Corda) Ralfs	0	0	0	7292	7292	0	0	0	0	0	0	0	7292	14585	0	36464	14585	14585
Ankistrodesmus falcatus var. *mirabilis* West	0	0	0	0	0	0	4861	29171	7292	0	0	0	0	0	0	43757	189617	153152
Ankistrodesmus fasciculatus (Lundb.) Komarkova-Legenerova	0	0	0	21878	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ankistrodesmus gracilis (Reinsch) Kors.	0	0	0	0	0	0	0	7292	0	0	0	0	0	0	0	0	0	0
Ankistrodesmus spiralis (Turner) Lemmermann	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7292	0	0
Arthrodesmus incus (Brebisson) Hassall	0	14585	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthrodesmus incus var. *ralfsii* (West) Teiling	0	0	0	7292	0	0	0	0	0	0	0	0	0	0	0	0	7292	0
Chlamydomonas sp	0	0	0	0	0	0	0	0	0	0	0	0	7292	0	0	0	0	7292
Cosmarium abbreviatum Raciborski	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7292	0
Cosmarium bioculatum Brebisson	0	0	0	0	0	0	4861	0	0	0	0	0	0	0	0	7292	0	0
Cosmarium sp	0	0	0	0	0	0	0	0	0	0	0	0	14585	0	0	7292	0	0
Crucigenia quadrata Morren	0	0	0	0	0	0	0	7292	0	0	0	0	0	0	0	0	0	0
Ecballocystis sp	0	0	0	0	0	0	0	0	7292	0	0	0	0	0	0	0	0	0
Elakatothrix gelatinosa Wille	0	0	0	0	0	0	4861	0	0	0	0	0	0	0	0	0	0	0
Elakatothrix genevensis (Reverdin) Hindak	43757	43757	51050	138566	102101	131273	68067	87515	87515	43757	19447	14585	58343	43757	9723	29171	29171	72929
Euastrum ansatum Ehrenberg	0	0	0	0	0	0	0	0	0	0	0	4861	0	0	0	0	0	0
Euastrum bidentatum Naegeli	0	0	0	0	0	0	0	0	0	0	4861	0	0	0	0	0	0	0
Gloeocystis sp	0	0	0	7292	7292	7292	19447	0	0	0	9723	0	14585	0	14585	7292	14585	0
Gloeotilia sp	0	0	0	0	0	7292	0	0	0	0	0	0	0	0	0	14585	0	29171
Korshikoviella sp	0	0	0	7292	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monoraphidium braunii Naegeli	0	0	7292	43757	14585	7292	0	0	0	0	0	0	0	0	0	0	0	0
Monoraphidium contortum (Thuret) Komarkova-Legenerova	0	0	0	0	0	0	0	0	0	7292	0	4861	7292	0	0	0	0	0
Monoraphidium convolutum (Corda)	21878	7292	14585	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monoraphidium dybowskii (Wolosz) Hindak et. Komarkova-Legenerova	0	0	51050	21878	0	7292	4861	21878	0	7292	14585	0	7292	21878	9723	7292	7292	14585
Monoraphidium griffithii (Berkeley) Komarkova-Legenerova	0	0	0	0	14585	14585	213927	116687	226082	7292	9723	9723	14585	7292	0	14585	0	0
Monoraphidium irregulare (G.M. Smith) Komarkova-Legenerova	0	0	0	29171	0	7292	4861	7292	0	0	0	4861	0	0	0	14585	65636	21878
Monoraphidium minutum (Nag.) Komarkova-Legenerova	0	0	0	0	0	0	0	0	0	0	9723	0	0	7292	0	0	0	0
Mougeotia sp	0	0	7292	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oocystis borgei Snow	7292	7292	0	0	0	0	0	0	0	7292	0	0	0	0	0	7292	7292	0
Oocystis gigas Archer	0	0	0	0	7292	0	0	0	0	0	0	0	0	0	0	0	0	0
Oocystis parva West & West	65636	36464	36464	21878	65636	87515	24309	7292	0	21878	0	9723	21878	7292	9723	0	14585	0
Oocystis solitaria Wittrock	0	0	0	0	0	0	0	0	0	0	0	0	0	7292	0	7292	0	0
Quadrigula pfitzeri (Schoeder) G. M. Smith	0	0	0	0	7292	0	0	0	0	0	0	0	0	0	0	0	0	0
Scenedesmus ecornis var. *bicellularis* (Ehrenberg) Chodat	0	0	0	0	7292	0	0	0	0	0	0	0	0	0	0	0	0	0
Schroederia robusta Kors.	0	0	0	0	0	7292	0	0	0	0	0	0	0	0	0	0	0	0
Spondylosium planum (Wolle) West & West	0	0	0	0	0	7292	0	0	7292	0	0	0	7292	0	0	0	0	7292
Staurastrum alternans Brebisson	0	0	0	0	0	0	0	0	7292	0	0	0	0	0	0	0	0	0
Staurastrum sp	7292	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tetraedron muticum (A. Braun) Hansgrig	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4861	0	0	0
Tetraedron minimum (A. Braun) Hansgirg	0	0	7292	0	0	0	29171	0	14585	14585	0	0	14585	0	0	0	0	0
Tetraedron mimimum var. *tetralobulatum* Reins	7292	7292	0	0	0	0	0	0	7292	0	14585	4861	0	0	0	0	0	0

Note: all units are in cells/L

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2011

Site ID	Llama Lake	Llama Lake	Llama Lake	Umwelt Lake	Umwelt Lake	Umwelt Lake	Giraffe Lake	Giraffe Lake	Giraffe Lake	Goose Lake Neck	Goose Lake Neck	Goose Lake Neck	Goose Lake Central	Goose Lake Central	Goose Lake Central	Reference B Lake	Reference B Lake	Reference B Lake
Rep	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Date sampled	6-Aug-11	6-Aug-11	6-Aug-11	5-Aug-11	5-Aug-11	5-Aug-11	10-Aug-11	10-Aug-11	10-Aug-11	7-Aug-11	7-Aug-11	7-Aug-11	7-Aug-11	7-Aug-11	7-Aug-11	8-Aug-11	8-Aug-11	8-Aug-11
LAB ID	BIO-04	BIO-05	BIO-06	BIO-01	BIO-02	BIO-03	BIO-16	BIO-17	BIO-18	BIO-10	BIO-11	BIO-12	BIO-07	BIO-08	BIO-09	BIO-13	BIO-14	BIO-15
	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density
CHRYSOPHYCEAE																		
Bitrichia chodatii (Reverdin) Chodat	0	0	0	0	7292	0	19447	14585	7292	7292	24309	14585	29171	0	24309	14585	0	0
Chromulina sp 1	7292	14585	29171	21878	21878	7292	0	0	0	21878	4861	4861	14585	7292	0	0	0	0
Chromulina sp 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4861	0	0	0
Dicronema cf. *vlklanum* Prauser	29171	14585	14585	14585	43757	21878	0	0	0	21878	4861	4861	7292	0	0	0	7292	0
Dinobryon acuminatum Ruttner	0	7292	0	0	0	0	0	0	0	7292	0	0	0	0	0	0	0	0
Dinobryon bavaricum var. *medium* (Lemmermann) Krieger	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21878	51050	0
Dinobryon bavaricum Imhof	7292	7292	0	0	0	0	0	0	0	0	0	0	0	7292	0	7292	0	51050
Dinobryon borgei Lemmermann	14585	0	0	0	7292	0	4861	7292	0	14585	0	0	7292	7292	4861	14585	14585	0
Dinobryon sp (loose monad)	0	0	0	7292	7292	14585	0	14585	21878	0	4861	0	0	0	4861	0	0	0
Dinobryon sertularia Ehrenberg	0	0	0	0	0	0	0	0	0	0	4861	0	0	0	0	0	0	0
Dinobryon sociale Ehrenberg	0	7292	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7292	0
Epipyxis sp	29171	14585	36464	14585	29171	14585	0	0	0	7292	0	0	0	0	4861	7292	7292	0
Kephyrion boreale Skuja	7292	0	0	0	7292	7292	14585	14585	14585	29171	9723	9723	14585	14585	0	0	7292	7292
Kephyrion sp	0	0	0	7292	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mallomonas pseudocoronata Prescott	0	0	0	0	0	0	0	0	0	0	0	9723	0	0	4861	0	0	7292
Mallomonas sp	0	0	7292	14585	0	0	0	0	0	0	0	0	0	7292	4861	0	0	0
Ochromonas sp	0	0	14585	0	0	0	0	0	0	0	0	0	0	0	0	7292	0	0
Pedinella sp	0	0	7292	0	7292	0	0	0	7292	0	0	4861	7292	0	0	0	0	0
Pseudokephyrion ellipsoideum (Pascher) Schmid	0	7292	7292	7292	0	7292	0	0	0	7292	4861	4861	0	0	0	7292	0	0
Pseudokephyrion minutissimum Conrad	0	0	0	0	0	0	0	0	0	0	0	9723	0	0	0	0	0	0
Stichogloea doederleinii (Schmidle) Wille	0	0	0	7292	0	0	0	0	14585	7292	0	9723	29171	14585	4861	0	14584	7292
Unidentified naked Chrysophyte sp (*Ochromonas* / *Chromulina*) - large	175031	255254	233375	284426	160445	131273	58343	80222	102101	211496	121549	136135	218789	160445	131273	175031	291719	233375
Unidentified naked Chrysophyte sp (*Ochromonas* / *Chromulina*) - small	386528	342770	269840	138566	145859	160445	121549	131273	182324	87515	106963	145859	160445	123980	97239	94808	160445	131273
Haptophyte *(Erkenia/Chrysochromulina)*	7292	7292	7292	29171	0	0	0	21878	7292	7292	4861	34033	14585	0	14585	0	21878	0
CRYPTOPHYCEAE																		
Cryptomonas marsonii Skuja	0	0	0	109394	51050	109394	0	0	7292	7292	4861	19447	7292	7292	0	7292	7292	0
Cryptomonas pyrenoidifera Geitler	7292	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cryptomonas reflexa Skuja	0	0	0	7292	0	0	0	0	0	0	0	0	7292	0	0	0	0	0
Cryptomonas tenuis Pascher	0	0	0	0	0	0	0	0	0	7292	0	0	0	0	4861	0	0	0
Katablepharis ovalis Skuja	7292	0	43757	21878	0	0	0	0	0	0	4861	4861	0	14585	9723	7292	0	0
Rhodomonas lens Pascher & Ruttner	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7292	0	0
Rhodomonas minuta Skuja	29171	21878	36463	21878	14585	43757	19447	58343	36464	43757	14585	24309	21878	29171	24309	14585	0	36464
CYANOBACTERIA																		
Anabaena flos-aquae Brebisson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7292	0
Aphanocapsa delicatissima West & West	58343	14585	21878	80222	87515	109394	97239	80222	94808	58343	0	19447	58343	43757	9723	29171	58343	36464
Aphanocapsa elachista West & West	14585	0	0	7292	14585	29171	4861	7292	0	0	4861	4861	14585	21878	4861	7292	7292	14585
Aphanothece clathrata West & West	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7292	0	0
Aphanothece sp	0	0	0	0	7292	7292	4861	0	0	7292	0	0	0	0	0	21878	0	14585
Chroococcus limneticus Lemmermann	0	0	0	7292	0	0	0	0	7292	0	0	0	0	0	0	0	0	0
Limnothrix sp	0	7292	0	14585	7292	7292	4861	0	7292	0	4861	0	51050	0	29171	116687	299012	306305
Merismopedia tenuissima Lemmermann	0	0	0	0	0	29171	19447	14585	58343	14585	0	0	7292	21878	0	0	0	7292
Phormidium formosum (Bory ex Gomont) Anagnostidis et Komarek	0	0	0	0	0	0	0	0	7292	0	0	0	0	0	0	0	0	0
Pseudanabaena limnetica Komarek	0	0	0	0	0	0	0	0	0	0	0	4861	0	0	0	0	0	0
Rhabdoderma lineare Schmidle & Lauterborn	7292	0	0	0	0	0	19447	58343	7292	7292	0	0	21878	0	4861	0	7292	0
Snowella lacustris (Chodat) Komarek et Hindak	0	0	0	0	0	0	0	0	0	0	0	0	29171	0	4861	0	0	0
EUGLENOIDS - EUGLENOPHYCEAE																		
Phacus acuminatus Stokes	7292	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DINOFLAGELLATES - DINOPHYCEAE																		
Glenodinium sp	7292	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnodinium ordinatum Skuja	0	7292	0	72929	21878	36464	0	0	7292	7292	9723	4861	0	14585	9723	21878	7292	7292
Gymnodinium sp	0	0	0	0	0	0	0	0	0	0	0	0	7292	0	0	0	0	0
Peridinium pusillum (Penard) Lemmermann	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7292	0
TOTAL	**1115804**	**1028291**	**1108512**	**1363757**	**1283540**	**1378349**	**948064**	**962654**	**1093923**	**743856**	**525071**	**617444**	**1174137**	**721983**	**549377**	**1042860**	**1582549**	**1414818**

Note: all units are in cells/L

Appendix 3.6-3

Lake Phytoplankton Richness and Diversity Results, Back River Project, 2011

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Appendix 3.6-3. Lake Phytoplankton Richness and Diversity Results, Back River Project, 2011

Lake	Replicate	Date Sampled	Richness (genera/sample)	Diversity (Simpson's Index)
Llama Lake	1	06-Aug-11	21	0.82
	2	06-Aug-11	18	0.79
	3	06-Aug-11	20	0.85
Umwelt Lake	1	05-Aug-11	28	0.90
	2	05-Aug-11	23	0.85
	3	05-Aug-11	23	0.88
Giraffe Lake	1	10-Aug-11	20	0.87
	2	10-Aug-11	16	0.89
	3	10-Aug-11	25	0.89
Goose Lake Neck	1	07-Aug-11	24	0.88
	2	07-Aug-11	21	0.85
	3	07-Aug-11	25	0.87
Goose Lake Central	1	07-Aug-11	30	0.89
	2	07-Aug-11	18	0.87
	3	07-Aug-11	25	0.87
Reference B Lake	1	08-Aug-11	26	0.89
	2	08-Aug-11	23	0.87
	3	08-Aug-11	20	0.87

Appendix 3.6-4

Stream Periphyton Biomass Results, Back River Project, 2011

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Appendix 3.6-4. Stream Periphyton Biomass Results, Back River Project, 2011

Site ID	Replicate	Sampling Date	Area sampled (cm^2)	ALS Sample ID	Chlorophyll *a* ($\mu g/cm^2$)	Mean	SE
Chair OF	1	13-Aug-11	47.7 cm^2	L1047626-13	3.67	2.51	0.61
	2	13-Aug-11	47.7 cm^2	L1047626-14	2.22		
	3	13-Aug-11	47.7 cm^2	L1047626-15	1.63		
Llama OF	1	17-Aug-11	47.7 cm^2	L1047626-4	3.90	1.81	1.04
	2	17-Aug-11	47.7 cm^2	L1047626-5	0.82		
	3	17-Aug-11	47.7 cm^2	L1047626-6	0.71		
Giraffe OF	1	12-Aug-11	47.7 cm^2	L1047626-22	1.26	1.28	0.07
	2	12-Aug-11	47.7 cm^2	L1047626-23	1.18		
	3	12-Aug-11	47.7 cm^2	L1047626-24	1.41		
Wolf OF	1	13-Aug-11	47.7 cm^2	L1047626-7	1.56	1.40	0.17
	2	13-Aug-11	47.7 cm^2	L1047626-8	1.06		
	3	13-Aug-11	47.7 cm^2	L1047626-9	1.57		
Goose OF	1	16-Aug-11	47.7 cm^2	L1047626-1	1.93	1.03	0.46
	2	16-Aug-11	47.7 cm^2	L1047626-2	0.42		
	3	16-Aug-11	47.7 cm^2	L1047626-3	0.74		
Propellor OF	1	15-Aug-11	47.7 cm^2	L1047626-19	3.12	2.16	0.75
	2	16-Aug-11	47.7 cm^2	L1047626-20	2.66		
	3	16-Aug-11	47.7 cm^2	L1047626-21	0.69		
Propellor D/S	1	15-Aug-11	47.7 cm^2	L1047626-16	1.30	1.58	0.14
	2	15-Aug-11	47.7 cm^2	L1047626-17	1.68		
	3	15-Aug-11	47.7 cm^2	L1047626-18	1.76		
Ref. B OF	1	14-Aug-11	47.7 cm^2	L1047626-10	0.59	0.96	0.37
	2	14-Aug-11	47.7 cm^2	L1047626-11	0.60		
	3	14-Aug-11	47.7 cm^2	L1047626-12	1.70		

SE = standard error of the mean

Note: Echo OF was dry in August so no data could be collected.

Appendix 3.6-5

Stream Periphyton Density and Taxonomic Results, Back River Project, 2011

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Appendix 3.6-5. Stream Periphyton Density and Taxonomic Results, Back River Project, 2011

Site ID		Chair OF	Chair OF	Chair OF	Llama OF	Llama OF	Llama OF	Giraffe OF	Giraffe OF	Giraffe OF	Wolf OF	Wolf OF	Wolf OF
Replicate		1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled		13-Aug-11	13-Aug-11	13-Aug-11	17-Aug-11	17-Aug-11	17-Aug-11	12-Aug-11	12-Aug-11	12-Aug-11	13-Aug-11	13-Aug-11	13-Aug-11
		BIO-01	BIO-02	BIO-03	BIO-04	BIO-05	BIO-06	BIO-07	BIO-08	BIO-09	BIO-10	BIO-11	BIO-12
OLD NAME	NEW NAME	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density
DIATOMS	DIATOMS												
Achananthes delicatula (Kuetzing) Grunow	*Planothidium delicatulum* (Kuetzing) Round & Bukht.	0	0	0	0	0	0	0	0	0	0	0	0
Achnanthes detha Hohn & Hellerman	*Planothidium subatomoides* (Hustedt) Round & Bukht.	52977	50836	39706	5137	4195	10702	24972	14269	0	10702	6992	16053
Achnanthes exigua Grunow	*Achnanthidium exiguum* (Grunow) Czarn.	0	0	0	0	0	0	0	0	0	0	0	0
Achnanthes flexella (Kuetzing) Brun	*Eucocconeis flexella* (Kuetzing) Cleve	5886	5351	28361	0	0	0	0	0	0	32107	6992	16053
Achnanthes kriegeri Krasske	*Achnanthes kriegeri* Krasske	11772	8026	11344	20548	33563	42809	0	57079	0	14269	0	0
Achnanthes lanceolata (Brebisson) Grunow	*Planothidium lanceolatum* (Breb.) Round & Bukht.	0	0	0	0	0	0	0	0	0	0	0	0
Achnanthes lapisosa Krasske	*Achnanthes lapisosa* Krasske	0	0	0	0	0	0	0	0	0	0	0	0
Achnanthes levanderi Hustedt	*Psammothidium levanderi* (Hust.) Bukht. & Round	0	5351	11344	0	0	5351	7134	0	0	0	3496	5351
Achnanthes minutissima Kuetzing	*Achnanthidium minutissimum* (Kuetzing) Czarn.	1353865	489638	1372701	1926448	356606	888306	659986	1255758	647500	870469	895013	1519753
Achnanthes pusilla (Grunow) De Toni	*Achnanthes pusilla* (Grunow) De Toni	11772	2675	17016	5137	10488	21404	0	14269	0	0	0	0
Achnanthes sp	*Achnanthes* sp	0	0	0	0	0	0	0	0	0	0	0	0
Anomoeoneis brachysira (Brebisson) Grunow	*Anomoeoneis brachysira* (Brebisson) Grunow	0	0	0	15411	0	0	21404	28539	5351	17837	3496	10702
Anomoeoneis procera Lange-Bertalot & Moser	*Anomoeoneis procera* Lange-Bertalot & Moser	176591	123078	260926	82195	4195	90971	420964	913279	294318	160537	118868	165888
Anomoeoneis vitrea (Grunow) Ross	*Brachysira vitrea* (Grunow) Ross in Hartley	0	0	0	0	0	0	3567	14269	0	0	0	5351
Anomoeoneis zellensis (Grunow) Cleve	*Brachysira zellensis* (Grunow) Round & Mann	0	0	0	0	0	0	0	0	0	7134	0	0
Asterionella ralfsii W. Smith	*Asterionella ralfsii* W. Smith	0	2675	0	0	0	0	0	0	0	0	0	0
Aulacoseira distans (Ehrenberg) Simonsen	*Aulacoseira distans* (Ehrenberg) Simonsen	0	0	0	0	0	16053	0	0	0	0	0	0
Caloneis bacillum (Grunow) Cleve	*Caloneis bacillum* (Grunow) Cleve	0	0	0	0	0	0	0	0	0	0	0	0
Caloneis silicula (Ehrenberg) Cleve	*Caloneis ventricosa* (Ehren.) Meister	0	0	0	0	0	0	0	0	0	0	3496	0
Caloneis sp	*Caloneis* sp	0	0	0	0	0	0	0	0	0	0	0	0
Cyclotella ocellata Pantocsek	*Cyclotella ocellata* Pantocsek	0	2675	0	0	0	0	0	14269	10702	0	0	0
Cyclotella pseudostelligera Hustedt	*Cyclotella pseudostelligera* Hustedt	0	5351	0	0	0	0	0	28539	0	0	0	0
Cymbella arctica (Lagerstedt) Schmidt	*Cymbella arctica* (Lagerstedt) Schmidt	0	2675	0	0	0	0	0	0	0	0	0	0
Cymbella cesatii (Rabenhorst) Grunow	*Cymbella cesatii* (Rabenhorst) Grunow	17659	58863	73740	0	0	32107	121294	142699	230103	107024	76915	96322
Cymbella gracilis (Ehrenberg) Kuetzing	*Encyonema gracilis* Rabenh.	0	0	0	0	0	0	3567	28539	0	0	3496	0
Cymbella microcephala Grunow	*Cymbella microcephala* Grunow	0	0	0	0	0	0	3567	0	0	0	0	0
Cymbella incerta (Grunow) Cleve	Cymbella incerta (Grunow) Cleve	0	0	0	0	0	0	0	0	0	0	3496	5351
Cymbella minuta Hilse	*Encyonema minutum* (Hilse ex Rabenh.) Mann in Round, Crawford & Mann	0	0	0	46234	4195	101673	3567	0	0	0	0	0
Cymbella naviculiformis Auersw ex Heib.	*Cymbella naviculiformis* Auersw ex Heib.	0	0	0	0	0	0	0	0	0	3567	0	0
Cymbella pusilla Grunow	*Cymbella pusilla* Grunow	23545	0	0	0	0	0	0	0	0	0	0	0
Cymbella minuta var. silesiaca (Bleisch ex. Rabenhorst) Reimer	*Encyonema silesiacum* (Bleisch ex. Rabenh.) Mann in Round, Crawford & Mann	35318	0	0	0	0	0	3567	28539	0	3567	0	0
Cymbella sp	*Cymbella* sp Agardh	5886	2675	0	0	0	0	0	0	0	0	0	0
Eunotia arcus Ehrenberg	*Eunotia arcus* Ehrenberg	0	5351	0	10274	81809	0	3567	0	0	0	3496	0
Eunotia bidentula W. Smith	*Eunotia bidentula* W. Smith	0	0	0	0	0	0	0	0	0	0	0	3496
Eunotia bilunaris var. *mucophila* Lange-Bertalot & Norpel	*Eunotia bilunaris* var. *mucophila* Lange-Bertalot & Norpel	0	2675	0	0	2097	0	0	0	0	3567	0	0
Eunotia diodon Ehrenberg	*Eunotia diodon* Ehrenberg	0	0	0	0	0	0	0	0	0	0	0	0
Eunotia exigua Brebisson (Rabenhorst)	*Eunotia exigua* Brebisson (Rabenhorst)	35318	0	0	0	2097	0	0	0	0	0	17480	5351
Eunotia incisa W. Smith	*Eunotia incisa* W. Smith	11772	18729	0	0	4195	16053	3567	14269	0	0	3496	10702
Eunotia monodon Ehrenberg	*Eunotia monodontiforma* Lange-Bert & Nopel	0	0	0	0	0	0	0	0	0	0	0	5351
Eunotia naegeli Migula	*Eunotia naegelii* Migula	5886	0	0	0	0	0	0	0	0	3567	0	0
Eunotia paludosa var trincaria (Krasske) Norpel	*Eunotia paludosa var trincaria* (Krasske) Norpel	23545	18729	5672	0	0	10702	10702	0	0	0	0	5351
Eunotia pectinalis (O. Mull.) Rabenhorst	*Eunotia pectinalis* (O. Mull.) Rabenhorst	0	0	11344	0	0	0	7134	0	0	0	3496	0
Eunotia sp	*Eunotia* sp	0	0	11344	20548	8390	0	0	0	0	7134	0	0
Eunotia steineckii Petersen	*Eunotia steineckii* Petersen	0	0	0	0	0	0	0	0	0	0	3496	0
Eunotia subarcuatoides Alles, Norpel & Lange-Bertalot	*Eunotia subarcuatoides* Alles, Norpel & Lange-Bertalot	0	0	0	5137	0	0	0	0	0	0	0	0
Eunotia triodon Ehrenberg	*Eunotia triodon* Ehrenberg	0	2675	0	0	0	0	0	0	0	0	0	0
Fragilaria brevistriata Grunow	*Pseudostaurosira brevistriata* (Grunow in VanHeurck) Williams & Round	0	26756	0	0	0	0	0	0	0	0	0	0
Fragilaria pinnata (Ehrenberg)	*Staurosirella pinnata* (Ehreb.) Williams & Round	0	0	0	0	0	0	0	0	0	0	0	0
Fragilaria vaucheriae (Kuetzing) Petersen	*Fragilaria vaucheriae* (Kuetzing) Petersen	176591	58863	96429	10274	6293	10702	21404	0	0	7134	27969	0
Fragilaria virescens var. *exigua*	*Fragilariforma virescens* var exigua (Ralfs) Williams & Round	0	0	0	0	0	0	3567	0	21404	0	0	0
Frustulia pseudomagaliesmontana Camburn & Charles	*Frustulia pseudomagaliesmontana* Camburn & Charles	11772	8026	0	0	0	0	0	0	0	0	0	0
Frustulia rhomboides var. saxonica (Ehrenberg) de Toni	*Frustulia rhomboides var. saxonica* (Ehrenberg) de Toni	0	5351	5672	0	0	0	64214	71349	117727	32107	34961	42809
Gomphonema acuminatum Ehrenberg	*Gomphonema acuminatum* Ehrenberg	0	0	0	0	0	0	0	0	0	0	0	0
Gomphonema parvulum (Kuetzing) Kuetzing	*Gomphonema parvulum* (Kuetzing) Kuetzing	0	0	0	5137	0	0	0	0	0	0	0	0
Gomphonema pumilum (Grunow) Reichardt & Lange-Bertalot	*Gomphonema pumilum* (Grunow) Reichardt & Lange-Bertalot	0	0	0	0	0	0	0	0	0	7134	0	0
Gomphonema sp	*Gomphonema* sp	11772	0	0	0	0	0	0	0	0	0	0	10702
Hannaea arcus (Ehrenberg) Patrick	*Hannaea arcus* (Ehrenberg) Patrick	0	0	0	15411	0	0	0	0	0	0	0	0
Navicula cryptocephala Kuetzing	*Navicula cryptocephala* Lange-Bertlot	0	2675	0	0	0	0	0	0	0	3567	0	0

Note: all units are in cells/cm ^{2}

Echo OF was dry during summer sampling, so no periphyton data could be collected.

Appendix 3.6-5. Stream Periphyton Density and Taxonomic Results, Back River Project, 2011

Site ID		Chair OF	Chair OF	Chair OF	Llama OF	Llama OF	Llama OF	Giraffe OF	Giraffe OF	Giraffe OF	Wolf OF	Wolf OF	Wolf OF
Replicate		1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled		13-Aug-11	13-Aug-11	13-Aug-11	17-Aug-11	17-Aug-11	17-Aug-11	12-Aug-11	12-Aug-11	12-Aug-11	13-Aug-11	13-Aug-11	13-Aug-11
		BIO-01	BIO-02	BIO-03	BIO-04	BIO-05	BIO-06	BIO-07	BIO-08	BIO-09	BIO-10	BIO-11	BIO-12
OLD NAME	NEW NAME	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density
DIATOMS (continued)													
Navicula cryptotenella Lange-Bertalot	*Navicula cryptotenella* Lange-Bertalot	0	0	0	0	0	0	0	0	0	0	0	0
Navicula gregaria Donkin	*Navicula gregaria* Donkin	0	0	0	0	0	0	0	0	0	3567	0	0
Navicula pupula Kuetzing	*Sellaphora mutata* (Kuetz.) Mereschk	0	8026	0	0	0	0	0	0	0	0	0	0
Navicula subtilissima Cleve	*Kobayasia subtilissima* (Cleve) Lange-Bertalot	0	0	0	0	0	0	0	0	0	0	0	5351
Navicula sp	*Navicula* sp	0	0	0	0	0	0	0	0	0	3567	0	0
Neidium bisculatum (Lagerstedt) Cleve	*Neidium bisculatum* (Lagerstedt) Cleve	0	0	0	0	0	0	0	0	0	0	0	0
Neidium sp.	*Neidium* sp.	0	0	5672	0	0	0	0	0	0	0	0	0
Nitzschia angustata Grunow	*Tryblionella angustata* W. Smith	0	0	0	0	0	0	42809	0	26756	3567	0	53512
Nitzschia dissipata (Kuetzing) Grunow	*Nitzschia dissipata* (Kuetzing) Grunow	0	5351	0	0	0	0	0	14269	0	0	0	0
Nitzschia fonticola Grunow	*Nitzschia fonticola* Grunow	0	0	0	0	0	0	0	0	0	0	0	0
Nitzschia frustulum (Kuetzing) Grunow	*Nitzschia frustulum* (Kuetzing) Grunow	0	0	0	0	0	0	0	114159	10702	0	17480	0
Nitzschia gracilis Hantzsch	*Nitzschia gracilis* Hantzsch	0	2675	0	0	0	0	21404	0	0	0	0	0
Nitzschia heufleriana Grunow	*Nitzschia heufleriana* Grunow	0	0	0	0	0	0	0	0	0	0	0	0
Nitzschia inconspicua Grunow	*Nitzschia inconspicua* Grunow	5886	8026	17016	0	0	0	39242	256859	101673	7134	0	16053
Nitzschia palea (Kuetzing) W. Smith	*Nitzschia palea* (Kuetzing) W. Smith	5886	0	0	0	0	0	0	0	0	0	0	0
Nitzschia perminuta (Grunow) Perag.	*Nitzschia perminuta* (Grunow) M.Perag.	347295	232779	346011	184939	83907	342479	570799	2468707	802686	292534	139845	278264
Peronia fibula (Brebisson) Ross	*Peronia fibula* (Brebisson) Ross	0	0	0	0	0	0	7134	0	5351	0	3496	0
Pinnularia abaujensis (Pantocsek) Ross	*Pinnularia abaujensis* (Pantocsek) R. Ross	0	0	0	0	0	0	0	0	0	0	0	0
Pinnularia divergentissima (Grunow) Cleve	*Pinnularia divergentissima* (Grunow) Cleve	11772	10702	0	0	0	0	0	0	0	0	3496	0
Pinnularia sp.	*Pinnularia* sp.	0	0	0	0	0	0	0	0	0	0	0	0
Stauroneis anceps Ehrenberg	*Stauroneis anceps* Ehrenberg	17659	0	22689	0	0	0	0	0	0	3567	0	5351
Stauroneis phoenicenteron (Nitzsch) Ehrenberg	*Stauroneis phoenicenteron* (Nitzsch) Ehrenberg	0	0	0	0	0	0	0	0	0	0	0	0
Stephanodiscus binderanus (Kuetzing) Krieger	*Stephanodiscus binderanus* (Kuetzing) Krieger	23545	0	0	0	0	0	0	0	0	0	0	0
Stenopterobia curvala (W. Smith) Hustedt	*Stenopterobia curvala* (W. Smith) Hustedt	0	0	0	0	0	0	0	28539	5351	0	0	0
Synedra famelica Kuetzing	*Synedra famelica* Kuetzing	64750	96322	73740	0	44051	117727	14269	0	5351	32107	6992	10702
Synedra filiformis Grunow	*Synedra filiformis* Grunow	0	0	0	0	0	0	0	0	0	0	0	0
Synedra ostenfeldii Sommer & Yang	*Synedra ostenfeldii* Sommer & Yang	0	0	0	0	0	0	0	0	0	0	0	0
Synedra rumpens Kuetzing	*Synedra rumpens* Kuetzing	105954	32107	68067	5137	6293	53512	39242	0	5351	7134	13984	26756
Tabellaria flocculosa (Roth) Kuetzing	*Tabellaria flocculosa* (Roth) Kuetzing	364954	171239	181514	231173	117470	984628	321074	1569698	171239	214049	248226	224752
CHLOROPHYCEAE	**GREEN ALGAE - CHLOROPHYCEAE**												
Ankistrodesmus spiralis (Turner) Lemmermann	*Ankistrodesmus spiralis* (Turner) Lemmermann	129500	0	113446	0	0	0	0	0	0	0	0	0
Ankistrodesmus stipitatus (Chodat)	*Ankistrodesmus stipitatus* (Chodat)	5886	0	5672	0	0	0	0	0	5351	0	0	0
Arthrodesmus crassus West	*Arthrodesmus crassus* West	0	0	5672	0	0	0	0	0	0	0	0	0
Arthrodesmus incus var. *ralfsii* (West) Teiling	*Arthrodesmus incus* var. *ralfsii* (West) Teiling	5886	0	0	0	0	0	3567	0	0	0	0	0
Bulbochaete De Bary	*Bulbochaete* De Bary	0	0	85084	0	0	0	14269	0	0	0	0	0
Chlamydomonas sp	*Chlamydomonas* sp	0	0	5672	0	0	0	0	0	0	0	0	0
Cladophora sp	*Cladophora* sp	0	0	0	0	0	0	0	0	0	0	0	0
Closterium dianae Ehrenberg	*Closterium dianae* Ehrenberg	5886	2675	5672	0	0	5351	0	14269	5351	3567	0	0
Cosmarium abbreviatum Raciborski	*Cosmarium abbreviatum* Raciborski	0	0	0	0	0	0	7134	0	0	0	0	0
Cosmarium bioculatum Brebisson	*Cosmarium bioculatum* Brebisson	0	0	11344	0	0	0	0	0	0	0	0	0
Cosmarium formosulum Hoff	*Cosmarium formosulum* Hoff	0	0	0	0	0	0	0	0	0	0	3496	5351
Cosmarium granatum Brebisson	*Cosmarium granatum* Brebisson	0	0	0	0	0	0	3567	0	0	0	0	0
Cosmarium impressulum Elfv.	*Cosmarium impressulum* Elfv.	0	0	0	0	0	0	0	0	0	3567	0	0
Cosmarium phaseolus Brebisson	*Cosmarium phaseolus* Brebisson	5886	0	0	0	0	0	0	0	5351	3567	0	0
Cosmarium subcrenatum Hantz.	*Cosmarium subcrenatum* Hantz.	0	0	0	0	0	0	0	0	0	0	0	0
Cosmarium sp	*Cosmarium* sp	5886	0	5672	0	0	0	3567	0	0	3567	0	0
Cosmarium subcrenatum Hantz.	*Cosmarium subcrenatum* Hantz.	0	0	0	0	0	0	0	0	0	3567	0	0
Cylindrocystis brebissonii (Menegh. ex Ralfs) De Bary	*Cylindrocystis brebissonii* (Menegh. ex Ralfs) De Bary	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Elakatothrix genevensis (Reverdin) Hindak	*Elakatothrix genevensis* (Reverdin) Hindak	0	0	0	0	0	0	3567	0	5351	0	6992	0
Euastrum ansatum Ehrenberg	*Euastrum ansatum* Ehrenberg	0	2675	5672	0	0	0	0	28539	0	3567	0	0
Euastrum bidentatum Naegeli	*Euastrum bidentatum* Naegeli	11772	0	0	0	0	0	0	0	0	0	0	0
Euastrum insulare (Wittrock) Roy	*Euastrum insulare* (Wittrock) Roy	0	0	5672	0	0	0	3567	0	5351	0	3496	0
Gloeocystis sp	*Gloeocystis* sp	0	0	0	0	0	0	0	285399	0	0	0	0
Monoraphidium griffithii (Berkeley) Komarkova-Legenerova	*Monoraphidium griffithii* (Berkeley) Komarkova-Legenerova	58863	2675	5672	0	0	0	3567	0	5351	0	0	5351
Monoraphidium irregulare (G.M. Smith) Komarkova-Legenerova	*Monoraphidium irregulare* (G.M. Smith) Komarkova-Legenerova	5886	0	0	0	0	0	0	0	0	0	6992	0
Mougeotia sp	*Mougeotia* sp	58863	2675	17016	0	0	0	57079	142699	10702	0	0	0
Oocystis borgei Snow	*Oocystis borgei* Snow	23545	0	0	0	0	0	0	0	0	0	0	0
Oocystis gigas Archer	*Oocystis gigas* Archer	23545	0	0	0	0	0	0	0	0	0	3496	0
Oocystis lacustris Chodat	*Oocystis lacustris* Chodat	11772	0	0	0	0	0	0	0	0	0	0	0
Oocystis parva West & West	*Oocystis parva* West & West	141272	0	45378	0	0	0	0	0	0	14269	0	0
Oocystis solitaria Wittrock	*Oocystis solitaria* Wittrock	0	2675	11344	0	0	0	0	14269	0	0	0	0
Pediastrum tetras (Ehrenberg) Ralfs	*Pediastrum tetras* (Ehrenberg) Ralfs	0	0	0	0	0	5351	0	0	0	0	0	0
Penium polymorphum (Perty) Perty	*Penium polymorphum* (Perty) Perty	0	0	0	0	0	0	0	0	0	0	0	0
Scenedesmus bijuga (Turp.) Lagerheim	*Scenedesmus bijuga* (Turp.) Lagerheim	11772	0	0	0	0	0	0	0	0	0	0	0
Scenedesmus ecornis (Ehrenberg) Chodat	*Scenedesmus ecornis* (Ehrenberg) Chodat	23545	0	0	0	0	0	0	0	0	0	0	0
Scenedesmus obliquus (Turpin) Kuetzing	*Scenedesmus obliquus* (Turpin) Kuetzing	105954	32107	34033	0	0	0	0	0	0	14269	6992	0
Scenedesmus ovalternus Chodat	*Scenedesmus ovalternus* Chodat	0	42809	0	0	0	0	0	0	0	0	0	0

Note: all units are in cells/cm ^{2}

Echo OF was dry during summer sampling, so no periphyton data could be collected.

Appendix 3.6-5. Stream Periphyton Density and Taxonomic Results, Back River Project, 2011

Site ID		Chair OF	Chair OF	Chair OF	Llama OF	Llama OF	Llama OF	Giraffe OF	Giraffe OF	Giraffe OF	Wolf OF	Wolf OF	Wolf OF
Replicate		1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled		13-Aug-11	13-Aug-11	13-Aug-11	17-Aug-11	17-Aug-11	17-Aug-11	12-Aug-11	12-Aug-11	12-Aug-11	13-Aug-11	13-Aug-11	13-Aug-11
		BIO-01	BIO-02	BIO-03	BIO-04	BIO-05	BIO-06	BIO-07	BIO-08	BIO-09	BIO-10	BIO-11	BIO-12
OLD NAME	NEW NAME	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density
CHLOROPHYCEAE (continued)	**GREEN ALGAE - CHLOROPHYCEAE (continued)**												
Schizomeris cf. *leibleinii* Kuetzing	*Schizomeris* cf. *leibleinii* Kuetzing	0	0	0	0	0	0	0	0	0	356749	0	0
Spondylosium planum (Wolle) West & West	*Spondylosium planum* (Wolle) West & West	88294	13377	51050	10274	2097	0	35674	0	10702	0	0	0
Staurastrum alternans Brebisson	*Staurastrum alternans* Brebisson	0	0	0	0	0	0	0	0	0	0	0	0
Staurastrum muticum Brebisson	*Staurastrum muticum* Brebisson	0	0	0	0	0	0	3567	14269	0	0	0	0
Staurastrum sp	*Staurastrum* sp	5886	0	5672	0	0	0	0	0	0	0	0	0
Tetraedron triangulare Korshikov	*Tetraedron triangulare* Korshikov	0	0	0	0	0	0	0	0	5351	0	0	0
Ulothrix sp	*Ulothrix* sp	0	0	170169	25685	10488	32107	0	0	0	0	0	0
Zygnema sp	*Zygnema* sp	0	0	0	0	0	10702	0	0	0	32107	0	0
CHRYSOPHYCEAE	**CHRYSOPHYCEAE**												
Chromulina sp	*Chromulina* sp.	0	0	0	0	0	0	0	0	0	0	0	0
Dinobryon setularia Ehrenberg	*Dinobryon setularia* Ehrenberg	0	0	0	0	0	0	7134	0	0	0	0	0
Unidentified naked Chrysophyte sp (*Ochromonas* / *Chromulina*) - large	Unidentified naked Chrysophyte sp (*Ochromonas* / *Chromulina*) - large	0	0	0	0	0	0	3567	0	0	0	0	0
Ochromonas sp	*Ochromonas* sp	0	0	0	0	0	0	0	0	0	0	0	0
Stichogloea doederleinii (Schmidle) Wille	*Stichogloea doederleinii* (Schmidle) Wille	0	0	0	0	0	0	0	0	26756	0	0	0
Synura sp	*Synura* sp	5886	0	0	0	0	0	0	0	0	0	0	0
CRYPTOPHYCEAE	**CRYPTOPHYCEAE**												
Cryptomonas erosa Ehrenberg	*Cryptomonas erosa* Ehrenberg	0	0	0	0	0	0	0	14269	0	0	0	0
CYANOBACTERIA	**CYANOBACTERIA**												
Anabaena inaequalis (Kuetzing) Bornet & Flahault	*Anabaena inaequalis* (Kuetzing) Bornet & Flahault	0	0	56723	0	0	0	0	0	0	0	0	0
Aphanocapsa delicatissima West & West	*Aphanocapsa delicatissima* West & West	0	0	0	0	0	0	0	570799	0	0	0	0
Aphanocapsa elachista West & West	*Aphanocapsa elachista* West & West	0	107024	0	0	0	0	0	0	0	0	0	0
Aphanocapsa sp	*Aphanocapsa* sp	0	0	170169	0	0	0	0	0	0	0	0	0
Calothrix sp	*Calothrix* sp	0	0	0	0	0	0	0	0	0	0	0	0
Chroococcus dispersus (Keissler) Lemmermann	*Chroococcus dispersus* (Keissler) Lemmermann	0	0	0	0	0	0	0	0	0	0	0	0
Chroococcus limneticus Lemmermann	*Chroococcus limneticus* Lemmermann	0	0	22689	0	0	0	0	0	21404	0	0	0
Chroococcus sp	*Chroococcus* sp	0	0	0	0	0	0	0	0	0	0	0	0
Cylindrospermum sp	*Cylindrospermum* sp	0	0	0	0	0	0	0	0	0	0	0	0
Leibleinia sp	*Leibleinia* sp	0	0	0	123292	0	0	107024	3139397	240806	374587	104884	278264
Limnothrix sp	*Limnothrix* sp	1088978	93646	0	190076	125861	535124	767011	2425897	668905	71349	727198	802686
Merismopedia glauca (Ehrenberg) Naegeli	*Merismopedia glauca* (Ehrenberg) Naegeli	376727	42809	90757	0	0	0	0	0	0	228319	0	0
Merismopedia tenuissima Lemmermann	*Merismopedia tenuissima* Lemmermann	0	0	0	0	0	0	0	0	0	0	0	0
Oscillatoria sp	*Oscillatoria* sp	0	0	0	0	0	0	0	0	107024	0	0	0
Phormidium chalybeum (Mertens ex Gomont) Anagnostidis et Komarek	*Phormidium chalybeum* (Mertens ex Gomont) Anagnostidis et Komarek	0	0	0	0	0	0	0	0	0	0	0	0
Phormidium formosum (Bory ex Gomont) Anagnostidis et Komarek	*Phormidium formosum* (Bory ex Gomont) Anagnostidis et Komarek	559205	321074	2263255	0	41953	267562	0	0	374587	0	0	0
Phormidium sp	*Phormidium* sp	0	0	0	0	20976	160537	0	0	0	0	0	0
Rhabdoderma lineare Schmidle & Lauterborn	*Rhabdoderma lineare* Schmidle & Lauterborn	188363	42809	0	0	0	0	0	0	21404	0	0	10702
Snowella lacustris (Chodat) Komarek et Hindak	*Snowella lacustris* (Chodat) Komarek et Hindak	1707047	0	0	0	0	0	0	0	0	0	0	0
EUGLENOPHYCEAE	**EUGLENOIDS - EUGLENOPHYCEAE**												
Euglena acus Ehrenberg	*Euglena acus* Ehrenberg	0	2675	0	0	0	0	0	0	0	0	0	0
Trachemolomas volvocina Ehrenberg	*Trachemolomas volvocina* Ehrenberg	0	0	0	0	0	0	0	0	0	0	0	0
	XANTHOPHYCEAE												
Characiopsis pyriformis (A. Braun) Borzi	*Characiopsis pyriformis* (A. Braun) Borzi	0	0	0	0	0	0	0	0	0	0	0	0
Ophiocytium majus Nageli	*Ophiocytium majus* Nageli	0	0	0	0	0	0	0	0	0	0	0	5351
TOTAL		**7575733**	**2188631**	**5853813**	**2938467**	**971219**	**3761913**	**3467578**	**13727702**	**3981312**	**2971700**	**2513719**	**3653032**

Note: all units are in cells/cm ^{2}

Echo OF was dry during summer sampling, so no periphyton data could be collected.

Appendix 3.6-5. Stream Periphyton Density and Taxonomic Results, Back River Project, 2011

Site ID		Goose OF	Goose OF	Goose OF	Propellor OF	Propellor OF	Propellor OF	Propellor D/S	Propellor D/S	Propellor D/S	Ref. B OF	Ref. B OF	Ref. B OF
Replicate		1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled		16-Aug-11	16-Aug-11	16-Aug-11	15-Aug-11	16-Aug-11	16-Aug-11	15-Aug-11	15-Aug-11	15-Aug-11	14-Aug-11	14-Aug-11	14-Aug-11
		BIO-13	BIO-14	BIO-15	BIO-16	BIO-17	BIO-18	BIO-19	BIO-20	BIO-21	BIO-22	BIO-23	BIO-24
OLD NAME	NEW NAME	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density
DIATOMS	DIATOMS												
Achananthes delicatula (Kuetzing) Grunow	*Planothidium delicatulum* (Kuetzing) Round & Bukht.	0	0	0	0	0	0	5137	0	0	0	0	0
Achnanthes detha Hohn & Hellerman	*Planothidium subatomoides* (Hustedt) Round & Bukht.	5244	2268	19103	0	5351	0	0	0	0	749	4195	0
Achnanthes exigua Grunow	*Achnanthidium exiguum* (Grunow) Czarn.	0	0	2729	1872	5351	0	0	0	0	0	0	0
Achnanthes flexella (Kuetzing) Brun	*Eucocconeis flexella* (Kuetzing) Cleve	0	4537	0	0	0	0	10274	0	7848	0	2097	3496
Achnanthes kriegeri Krasske	*Achnanthes kriegeri* Krasske	20976	0	13645	13110	32107	0	5137	25525	0	0	8390	3496
Achnanthes lanceolata (Brebisson) Grunow	*Planothidium lanceolatum* (Breb.) Round & Bukht.	0	0	0	1872	0	0	0	0	0	0	0	0
Achnanthes lapisosa Krasske	*Achnanthes lapisosa* Krasske	0	2268	0	0	0	0	0	0	0	0	0	0
Achnanthes levanderi Hustedt	*Psammothidium levanderi* (Hust.) Bukht. & Round	2622	2268	0	3745	0	0	0	0	0	749	0	0
Achnanthes minutissima Kuetzing	*Achnanthidium minutissimum* (Kuetzing) Czarn.	765656	258657	281100	267829	872252	117727	498307	777107	945743	65178	520226	230745
Achnanthes pusilla (Grunow) De Toni	*Achnanthes pusilla* (Grunow) De Toni	2622	0	2729	1872	5351	0	2568	0	3924	0	0	0
Achnanthes sp	*Achnanthes* sp	0	0	0	0	0	0	0	0	0	0	2097	0
Anomoeoneis brachysira (Brebisson) Grunow	*Anomoeoneis brachysira* (Brebisson) Grunow	0	4537	0	1872	0	0	15411	113446	0	749	2097	0
Anomoeoneis procera Lange-Bertalot & Moser	*Anomoeoneis procera* Lange-Bertalot & Moser	5244	22689	38207	164818	722418	313939	226036	201367	196212	40455	102786	69922
Anomoeoneis vitrea (Grunow) Ross	*Brachysira vitrea* (Grunow) Ross in Hartley	0	2268	10916	0	5351	3567	2568	8508	39242	0	0	0
Anomoeoneis zellensis (Grunow) Cleve	*Brachysira zellensis* (Grunow) Round & Mann	0	0	0	0	0	0	0	0	0	0	0	0
Asterionella ralfsii W. Smith	*Asterionella ralfsii* W. Smith	0	0	0	0	0	0	0	0	0	0	0	0
Aulacoseira distans (Ehrenberg) Simonsen	*Aulacoseira distans* (Ehrenberg) Simonsen	0	0	0	0	0	0	0	0	0	0	0	0
Caloneis bacillum (Grunow) Cleve	*Caloneis bacillum* (Grunow) Cleve	0	0	2729	0	0	0	0	0	0	0	0	0
Caloneis silicula (Ehrenberg) Cleve	*Caloneis ventricosa* (Ehren.) Meister	5244	0	0	0	5351	0	7705	0	0	0	0	0
Caloneis sp	*Caloneis* sp	0	0	0	0	0	0	0	0	0	0	4195	0
Cyclotella ocellata Pantocsek	*Cyclotella ocellata* Pantocsek	2622	9075	8187	13110	0	0	0	0	0	0	0	0
Cyclotella pseudostelligera Hustedt	*Cyclotella pseudostelligera* Hustedt	0	4537	5458	5618	0	0	0	0	0	0	0	0
Cymbella arctica (Lagerstedt) Schmidt	*Cymbella arctica* (Lagerstedt) Schmidt	0	0	0	0	0	0	5137	0	0	0	2097	10488
Cymbella cesatii (Rabenhorst) Grunow	*Cymbella cesatii* (Rabenhorst) Grunow	28843	47647	60040	31839	133781	3567	179801	181514	200136	15732	44051	31465
Cymbella gracilis (Ehrenberg) Kuetzing	*Encyonema gracilis* Rabenh.	2622	9075	2729	5618	0	0	0	0	0	0	0	0
Cymbella microcephala Grunow	*Cymbella microcephala* Grunow	0	0	0	0	0	0	0	0	0	0	0	0
Cymbella incerta (Grunow) Cleve	Cymbella incerta (Grunow) Cleve	2622	4537	2729	0	0	0	0	0	0	0	0	0
Cymbella minuta Hilse	*Encyonema minutum* (Hilse ex Rabenh.) Mann in Round, Crawford & Mann	0	0	0	1872	0	0	0	0	7848	0	0	0
Cymbella naviculiformis Auersw ex Heib.	*Cymbella naviculiformis* Auersw ex Heib.	0	2268	0	0	0	0	0	0	0	0	2097	0
Cymbella pusilla Grunow	*Cymbella pusilla* Grunow	0	0	0	0	0	0	0	0	0	0	0	0
Cymbella minuta var. silesiaca (Bleisch ex. Rabenhorst) Reimer	*Encyonema silesiacum* (Bleisch ex. Rabenh.) Mann in Round, Crawford & Mann	0	13613	0	0	0	0	10274	2836	15696	0	0	0
Cymbella sp	*Cymbella* sp Agardh	0	0	0	0	0	0	0	0	0	0	2097	6992
Eunotia arcus Ehrenberg	*Eunotia arcus* Ehrenberg	0	0	0	0	0	0	2568	8508	0	1498	2097	3496
Eunotia bidentula W. Smith	*Eunotia bidentula* W. Smith	0	0	0	0	0	0	0	0	0	0	0	0
Eunotia bilunaris var. *mucophila* Lange-Bertalot & Norpel	*Eunotia bilunaris* var. *mucophila* Lange-Bertalot & Norpel	0	2268	13645	0	0	0	0	2836	0	2247	2097	0
Eunotia diodon Ehrenberg	*Eunotia diodon* Ehrenberg	0	4537	10916	0	0	0	0	0	0	0	0	0
Eunotia exigua Brebisson (Rabenhorst)	*Eunotia exigua* Brebisson (Rabenhorst)	0	9075	5458	0	0	0	0	0	0	5993	0	13984
Eunotia incisa W. Smith	*Eunotia incisa* W. Smith	2622	0	2729	1872	0	0	0	0	0	2996	31465	0
Eunotia monodon Ehrenberg	*Eunotia monodontiforma* Lange-Bert & Nopel	0	0	0	0	0	0	0	0	0	0	0	0
Eunotia naegeli Migula	*Eunotia naegelii* Migula	0	2268	2729	0	10702	0	0	0	0	0	0	0
Eunotia paludosa var trincaria (Krasske) Norpel	*Eunotia paludosa var trincaria* (Krasske) Norpel	5244	6806	5458	0	0	0	0	0	3924	749	10488	10488
Eunotia pectinalis (O. Mull.) Rabenhorst	*Eunotia pectinalis* (O. Mull.) Rabenhorst	0	0	0	0	0	0	0	0	0	0	0	0
Eunotia sp	*Eunotia* sp	2622	2268	0	5618	0	7134	0	5672	0	0	0	0
Eunotia steineckii Petersen	*Eunotia steineckii* Petersen	0	0	0	0	0	0	0	0	0	0	0	0
Eunotia subarcuatoides Alles, Norpel & Lange-Bertalot	*Eunotia subarcuatoides* Alles, Norpel & Lange-Bertalot	0	0	0	0	0	0	0	0	0	0	0	0
Eunotia triodon Ehrenberg	*Eunotia triodon* Ehrenberg	0	0	0	0	0	0	0	0	0	0	0	0
Fragilaria brevistriata Grunow	*Pseudostaurosira brevistriata* (Grunow in VanHeurck) Williams & Round	0	9075	0	0	0	0	0	0	0	0	0	0
Fragilaria pinnata (Ehrenberg)	*Staurosirella pinnata* (Ehreb.) Williams & Round	0	0	0	0	0	0	0	0	3924	0	0	0
Fragilaria vaucheriae (Kuetzing) Petersen	*Fragilaria vaucheriae* (Kuetzing) Petersen	18354	4537	0	0	5351	0	0	0	0	2247	2097	31465
Fragilaria virescens var. *exigua*	*Fragilariforma virescens* var exigua (Ralfs) Williams & Round	0	0	0	0	0	0	0	0	0	0	0	0
Frustulia pseudomagaliesmontana Camburn & Charles	*Frustulia pseudomagaliesmontana* Camburn & Charles	0	0	0	0	0	0	0	0	0	0	0	0
Frustulia rhomboides var. saxonica (Ehrenberg) de Toni	*Frustulia rhomboides var. saxonica* (Ehrenberg) de Toni	2622	9075	16374	1872	16053	35674	66783	45378	0	5993	25172	20976
Gomphonema acuminatum Ehrenberg	*Gomphonema acuminatum* Ehrenberg	0	0	0	0	0	0	0	0	3924	0	0	0
Gomphonema parvulum (Kuetzing) Kuetzing	*Gomphonema parvulum* (Kuetzing) Kuetzing	0	0	0	0	0	0	0	0	0	0	0	0
Gomphonema pumilum (Grunow) Reichardt & Lange-Bertalot	*Gomphonema pumilum* (Grunow) Reichardt & Lange-Bertalot	0	0	0	0	0	0	0	0	0	0	0	0
Gomphonema sp	*Gomphonema* sp	0	0	0	0	0	0	0	0	3924	1498	0	0
Hannaea arcus (Ehrenberg) Patrick	*Hannaea arcus* (Ehrenberg) Patrick	0	0	0	0	0	0	0	0	0	0	0	0
Navicula cryptocephala Kuetzing	*Navicula cryptocephala* Lange-Bertlot	0	0	0	0	0	0	0	0	0	0	0	0

Note: all units are in cells/cm ^{2}

Echo OF was dry during summer sampling, so no periphyton data could be collected.

Appendix 3.6-5. Stream Periphyton Density and Taxonomic Results, Back River Project, 2011

Site ID		Goose OF	Goose OF	Goose OF	Propellor OF	Propellor OF	Propellor OF	Propellor D/S	Propellor D/S	Propellor D/S	Ref. B OF	Ref. B OF	Ref. B OF
Replicate		1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled		16-Aug-11	16-Aug-11	16-Aug-11	15-Aug-11	16-Aug-11	16-Aug-11	15-Aug-11	15-Aug-11	15-Aug-11	14-Aug-11	14-Aug-11	14-Aug-11
		BIO-13	BIO-14	BIO-15	BIO-16	BIO-17	BIO-18	BIO-19	BIO-20	BIO-21	BIO-22	BIO-23	BIO-24
OLD NAME	NEW NAME	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density
DIATOMS (continued)													
Navicula cryptotenella Lange-Bertalot	*Navicula cryptotenella* Lange-Bertalot	0	0	0	0	0	0	0	2836	0	0	0	0
Navicula gregaria Donkin	*Navicula gregaria* Donkin	0	0	0	0	0	0	0	0	0	0	0	0
Navicula pupula Kuetzing	*Sellaphora mutata* (Kuetz.) Mereschk	0	0	2729	0	0	0	0	0	0	0	4195	6992
Navicula subtilissima Cleve	*Kobayasia subtilissima* (Cleve) Lange-Bertalot	0	0	0	0	0	0	0	0	0	0	6292	3496
Navicula sp	*Navicula* sp	0	0	0	0	0	0	0	0	0	0	0	0
Neidium bisculatum (Lagerstedt) Cleve	*Neidium bisculatum* (Lagerstedt) Cleve	0	2268	0	0	0	0	0	0	0	0	0	0
Neidium sp.	*Neidium* sp.	0	0	0	0	0	0	0	0	0	0	0	0
Nitzschia angustata Grunow	*Tryblionella angustata* W. Smith	7866	2268	5458	3745	0	0	64214	65231	35318	749	8390	3496
Nitzschia dissipata (Kuetzing) Grunow	*Nitzschia dissipata* (Kuetzing) Grunow	0	0	0	0	0	0	0	0	0	0	0	0
Nitzschia fonticola Grunow	*Nitzschia fonticola* Grunow	0	2268	0	0	0	0	2568	0	0	0	0	0
Nitzschia frustulum (Kuetzing) Grunow	*Nitzschia frustulum* (Kuetzing) Grunow	10488	18151	2729	3745	0	3567	0	5672	0	0	2097	0
Nitzschia gracilis Hantzsch	*Nitzschia gracilis* Hantzsch	0	0	0	0	0	0	2568	0	0	0	0	0
Nitzschia heufleriana Grunow	*Nitzschia heufleriana* Grunow	0	0	0	0	0	0	10274	0	0	0	0	0
Nitzschia inconspicua Grunow	*Nitzschia inconspicua* Grunow	0	6806	0	11237	21404	0	0	2836	15696	0	0	0
Nitzschia palea (Kuetzing) W. Smith	*Nitzschia palea* (Kuetzing) W. Smith	0	0	2729	0	0	0	0	0	0	0	4195	0
Nitzschia perminuta (Grunow) Perag.	*Nitzschia perminuta* (Grunow) M.Perag.	83907	47647	57311	237862	369235	67782	156684	323322	294318	20227	121665	48946
Peronia fibula (Brebisson) Ross	*Peronia fibula* (Brebisson) Ross	0	0	0	0	0	0	0	0	0	0	0	0
Pinnularia abaujensis (Pantocsek) Ross	*Pinnularia abaujensis* (Pantocsek) R. Ross	0	0	0	0	0	0	0	0	0	749	0	0
Pinnularia divergentissima (Grunow) Cleve	*Pinnularia divergentissima* (Grunow) Cleve	0	0	0	0	0	0	0	0	0	0	0	0
Pinnularia sp.	*Pinnularia* sp.	0	0	0	0	0	0	0	0	0	749	4195	0
Stauroneis anceps Ehrenberg	*Stauroneis anceps* Ehrenberg	0	2268	0	0	0	0	0	0	0	0	0	0
Stauroneis phoenicenteron (Nitzsch) Ehrenberg	*Stauroneis phoenicenteron* (Nitzsch) Ehrenberg	0	0	2729	0	0	0	0	0	0	0	0	0
Stephanodiscus binderanus (Kuetzing) Krieger	*Stephanodiscus binderanus* (Kuetzing) Krieger	0	0	0	0	0	0	0	0	0	0	0	0
Stenopterobia curvala (W. Smith) Hustedt	*Stenopterobia curvala* (W. Smith) Hustedt	0	0	0	0	0	0	0	0	0	0	0	0
Synedra famelica Kuetzing	*Synedra famelica* Kuetzing	41953	18151	16374	11237	112376	21404	17980	2836	11772	1498	4195	0
Synedra filiformis Grunow	*Synedra filiformis* Grunow	0	0	0	0	0	0	0	0	0	0	2097	0
Synedra ostenfeldii Sommer & Yang	*Synedra ostenfeldii* Sommer & Yang	0	0	0	0	0	0	2568	0	0	0	0	0
Synedra rumpens Kuetzing	*Synedra rumpens* Kuetzing	83907	11344	40937	20602	112376	24972	7705	0	3924	0	2097	0
Tabellaria flocculosa (Roth) Kuetzing	*Tabellaria flocculosa* (Roth) Kuetzing	133727	181512	139185	187292	856198	153402	48803	53887	121651	28468	67126	87403
CHLOROPHYCEAE	**GREEN ALGAE - CHLOROPHYCEAE**												
Ankistrodesmus spiralis (Turner) Lemmermann	*Ankistrodesmus spiralis* (Turner) Lemmermann	0	0	0	0	0	0	0	0	11772	0	0	0
Ankistrodesmus stipitatus (Chodat)	*Ankistrodesmus stipitatus* (Chodat)	0	0	0	0	0	0	0	0	0	0	0	0
Arthrodesmus crassus West	*Arthrodesmus crassus* West	0	0	0	0	0	0	0	0	0	0	0	0
Arthrodesmus incus var. *ralfsii* (West) Teiling	*Arthrodesmus incus* var. *ralfsii* (West) Teiling	0	0	0	0	0	0	0	0	0	0	0	0
Bulbochaete De Bary	*Bulbochaete* De Bary	5244	0	0	5618	0	0	5137	0	0	0	0	0
Chlamydomonas sp	*Chlamydomonas* sp	0	0	0	0	0	0	0	0	0	0	0	0
Cladophora sp	*Cladophora* sp	0	0	0	0	32107	0	0	0	0	0	0	0
Closterium dianae Ehrenberg	*Closterium dianae* Ehrenberg	0	0	0	0	0	0	0	0	0	0	0	0
Cosmarium abbreviatum Raciborski	*Cosmarium abbreviatum* Raciborski	0	0	0	0	0	0	0	0	0	0	0	0
Cosmarium bioculatum Brebisson	*Cosmarium bioculatum* Brebisson	0	0	0	0	0	0	0	2836	0	0	0	0
Cosmarium formosulum Hoff	*Cosmarium formosulum* Hoff	0	0	0	0	0	0	0	0	0	0	0	0
Cosmarium granatum Brebisson	*Cosmarium granatum* Brebisson	0	0	0	0	5351	0	0	0	0	0	0	0
Cosmarium impressulum Elfv.	*Cosmarium impressulum* Elfv.	0	0	0	0	0	0	0	0	0	0	0	0
Cosmarium phaseolus Brebisson	*Cosmarium phaseolus* Brebisson	0	0	0	0	0	0	0	0	0	0	0	0
Cosmarium subcrenatum Hantz.	*Cosmarium subcrenatum* Hantz.	0	2268	0	0	0	0	0	0	0	0	0	0
Cosmarium sp	*Cosmarium* sp	0	0	0	0	0	0	0	0	0	0	0	0
Cosmarium subcrenatum Hantz.	*Cosmarium subcrenatum* Hantz.	0	0	0	0	0	0	0	0	0	0	0	0
Cylindrocystis brebissonii (Menegh. ex Ralfs) De Bary	*Cylindrocystis brebissonii* (Menegh. ex Ralfs) De Bary	**0**	**0**	**0**	**1872**	**0**	**0**	**0**	**0**	**0**	**0**	0	**0**
Elakatothrix genevensis (Reverdin) Hindak	*Elakatothrix genevensis* (Reverdin) Hindak	0	0	0	0	0	0	0	0	11772	0	0	0
Euastrum ansatum Ehrenberg	*Euastrum ansatum* Ehrenberg	0	0	0	0	0	0	0	0	0	0	0	0
Euastrum bidentatum Naegeli	*Euastrum bidentatum* Naegeli	0	0	0	0	0	0	0	0	0	0	0	0
Euastrum insulare (Wittrock) Roy	*Euastrum insulare* (Wittrock) Roy	0	0	0	0	0	0	0	0	0	0	0	0
Gloeocystis sp	*Gloeocystis* sp	0	0	0	0	0	0	0	0	0	0	0	0
Monoraphidium griffithii (Berkeley) Komarkova-Legenerova	*Monoraphidium griffithii* (Berkeley) Komarkova-Legenerova	2622	0	2729	0	0	0	0	0	0	0	0	0
Monoraphidium irregulare (G.M. Smith) Komarkova-Legenerova	*Monoraphidium irregulare* (G.M. Smith) Komarkova-Legenerova	0	0	0	0	0	0	0	0	0	0	0	0
Mougeotia sp	*Mougeotia* sp	0	0	0	1872	53512	10702	0	0	7848	0	0	17480
Oocystis borgei Snow	*Oocystis borgei* Snow	0	0	0	0	0	0	0	0	0	0	0	0
Oocystis gigas Archer	*Oocystis gigas* Archer	0	0	0	0	0	0	0	0	0	0	0	0
Oocystis lacustris Chodat	*Oocystis lacustris* Chodat	0	0	0	0	0	0	0	0	0	0	0	0
Oocystis parva West & West	*Oocystis parva* West & West	0	0	0	0	0	0	0	0	0	0	2097	0
Oocystis solitaria Wittrock	*Oocystis solitaria* Wittrock	0	0	0	0	0	0	2568	0	0	0	4195	0
Pediastrum tetras (Ehrenberg) Ralfs	*Pediastrum tetras* (Ehrenberg) Ralfs	0	0	0	0	0	0	0	0	0	0	0	0
Penium polymorphum (Perty) Perty	*Penium polymorphum* (Perty) Perty	0	0	0	0	0	0	0	0	0	749	0	0
Scenedesmus bijuga (Turp.) Lagerheim	*Scenedesmus bijuga* (Turp.) Lagerheim	0	0	0	0	0	0	0	0	0	0	0	0
Scenedesmus ecornis (Ehrenberg) Chodat	*Scenedesmus ecornis* (Ehrenberg) Chodat	0	0	0	0	0	0	0	0	0	0	0	0
Scenedesmus obliquus (Turpin) Kuetzing	*Scenedesmus obliquus* (Turpin) Kuetzing	0	0	0	0	0	0	0	0	15696	2996	8390	41953
Scenedesmus ovalternus Chodat	*Scenedesmus ovalternus* Chodat	0	0	0	0	0	0	0	0	0	0	0	0

Note: all units are in cells/cm ^{2}

Echo OF was dry during summer sampling, so no periphyton data could be collected.

Appendix 3.6-5. Stream Periphyton Density and Taxonomic Results, Back River Project, 2011

Site ID		Goose OF	Goose OF	Goose OF	Propellor OF	Propellor OF	Propellor OF	Propellor D/S	Propellor D/S	Propellor D/S	Ref. B OF	Ref. B OF	Ref. B OF
Replicate		1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled		16-Aug-11	16-Aug-11	16-Aug-11	15-Aug-11	16-Aug-11	16-Aug-11	15-Aug-11	15-Aug-11	15-Aug-11	14-Aug-11	14-Aug-11	14-Aug-11
		BIO-13	BIO-14	BIO-15	BIO-16	BIO-17	BIO-18	BIO-19	BIO-20	BIO-21	BIO-22	BIO-23	BIO-24
OLD NAME	NEW NAME	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density	Density
CHLOROPHYCEAE (continued)	**GREEN ALGAE - CHLOROPHYCEAE (continued)**												
Schizomeris cf. *leibleinii* Kuetzing	*Schizomeris* cf. *leibleinii* Kuetzing	0	0	0	0	0	0	0	0	0	0	0	0
Spondylosium planum (Wolle) West & West	*Spondylosium planum* (Wolle) West & West	0	0	0	0	0	0	0	5672	11772	0	0	0
Staurastrum alternans Brebisson	*Staurastrum alternans* Brebisson	0	0	0	0	0	0	2568	0	7848	0	0	0
Staurastrum muticum Brebisson	*Staurastrum muticum* Brebisson	0	0	0	0	0	0	0	0	0	0	0	0
Staurastrum sp	*Staurastrum* sp	2622	0	0	0	0	0	0	0	0	0	2097	0
Tetraedron triangulare Korshikov	*Tetraedron triangulare* Korshikov	0	0	0	0	0	0	0	0	0	0	0	0
Ulothrix sp	*Ulothrix* sp	0	0	0	0	0	0	12842	0	0	0	0	0
Zygnema sp	*Zygnema* sp	0	0	0	0	149834	0	0	11344	0	0	0	0
CHRYSOPHYCEAE	**CHRYSOPHYCEAE**												
Chromulina sp	*Chromulina* sp.	0	0	0	0	0	0	0	0	0	749	0	0
Dinobryon setularia Ehrenberg	*Dinobryon setularia* Ehrenberg	0	0	0	5618	0	0	0	0	0	0	0	0
Unidentified naked Chrysophyte sp (*Ochromonas* / *Chromulina*) - large	Unidentified naked Chrysophyte sp (*Ochromonas* / *Chromulina*) - large	0	0	0	0	0	0	0	0	0	0	0	0
Ochromonas sp	*Ochromonas* sp	0	0	0	0	0	0	0	0	0	749	0	0
Stichogloea doederleinii (Schmidle) Wille	*Stichogloea doederleinii* (Schmidle) Wille	0	0	0	0	0	0	0	0	0	0	0	0
Synura sp	*Synura* sp	0	0	0	0	0	0	0	0	0	0	0	0
CRYPTOPHYCEAE	**CRYPTOPHYCEAE**												
Cryptomonas erosa Ehrenberg	*Cryptomonas erosa* Ehrenberg	0	0	0	0	0	0	0	0	0	0	0	0
CYANOBACTERIA	**CYANOBACTERIA**												
Anabaena inaequalis (Kuetzing) Bornet & Flahault	*Anabaena inaequalis* (Kuetzing) Bornet & Flahault	0	0	0	0	0	0	0	0	0	0	0	0
Aphanocapsa delicatissima West & West	*Aphanocapsa delicatissima* West & West	0	45378	81874	0	0	0	513719	0	0	0	629306	0
Aphanocapsa elachista West & West	*Aphanocapsa elachista* West & West	0	0	0	0	0	0	0	0	0	0	0	0
Aphanocapsa sp	*Aphanocapsa* sp	0	0	0	0	0	0	0	0	0	0	0	0
Calothrix sp	*Calothrix* sp	78663	0	0	0	0	0	0	85084	0	0	0	0
Chroococcus dispersus (Keissler) Lemmermann	*Chroococcus dispersus* (Keissler) Lemmermann	0	45378	0	0	0	0	0	0	0	0	0	0
Chroococcus limneticus Lemmermann	*Chroococcus limneticus* Lemmermann	0	0	0	0	0	14269	0	0	0	0	0	0
Chroococcus sp	*Chroococcus* sp	0	0	0	0	0	0	0	5672	0	0	0	0
Cylindrospermum sp	*Cylindrospermum* sp	0	0	0	0	0	0	0	0	0	0	41953	0
Leibleinia sp	*Leibleinia* sp	117994	0	0	112376	187293	53512	51371	0	0	0	73419	209768
Limnothrix sp	*Limnothrix* sp	91773	79412	111894	103011	107024	71349	89900	141808	274697	49445	83907	122365
Merismopedia glauca (Ehrenberg) Naegeli	*Merismopedia glauca* (Ehrenberg) Naegeli	0	0	0	0	0	0	0	0	0	0	0	0
Merismopedia tenuissima Lemmermann	*Merismopedia tenuissima* Lemmermann	0	0	0	0	0	0	0	0	0	0	0	59434
Oscillatoria sp	*Oscillatoria* sp	0	0	0	0	0	0	0	0	0	0	0	0
Phormidium chalybeum (Mertens ex Gomont) Anagnostidis et Komarek	*Phormidium chalybeum* (Mertens ex Gomont) Anagnostidis et Komarek	0	0	0	37458	0	0	0	170169	0	11237	0	0
Phormidium formosum (Bory ex Gomont) Anagnostidis et Komarek	*Phormidium formosum* (Bory ex Gomont) Anagnostidis et Komarek	0	0	0	162945	0	35674	179801	0	235454	2996	41953	0
Phormidium sp	*Phormidium* sp	0	0	0	0	0	0	0	0	0	59933	0	34961
Rhabdoderma lineare Schmidle & Lauterborn	*Rhabdoderma lineare* Schmidle & Lauterborn	0	72605	0	0	0	0	0	0	0	0	0	0
Snowella lacustris (Chodat) Komarek et Hindak	*Snowella lacustris* (Chodat) Komarek et Hindak	0	0	0	0	0	0	0	0	0	0	125861	0
EUGLENOPHYCEAE	**EUGLENOIDS - EUGLENOPHYCEAE**												
Euglena acus Ehrenberg	*Euglena acus* Ehrenberg	0	0	0	0	0	0	0	0	0	0	0	0
Trachemolomas volvocina Ehrenberg	*Trachemolomas volvocina* Ehrenberg	0	0	0	0	0	0	0	0	0	749	0	0
	XANTHOPHYCEAE												
Characiopsis pyriformis (A. Braun) Borzi	*Characiopsis pyriformis* (A. Braun) Borzi	0	0	0	0	5351	0	0	0	0	0	0	0
Ophiocytium majus Nageli	*Ophiocytium majus* Nageli	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL		**1536547**	**977877**	**974288**	**1430899**	**3831480**	**938241**	**2208976**	**2251902**	**2491883**	**328876**	**2009563**	**1073307**

Note: all units are in cells/cm ^{2}

Echo OF was dry during summer sampling, so no periphyton data could be collected.

Appendix 3.6-6

Stream Periphyton Richness and Diversity Results, Back River Project, 2011

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Appendix 3.6-6. Stream Periphyton Richness and Diversity Results, Back River Project, 2011

Stream	Replicate	Date Sampled	Richness (genera/sample)	Diversity (Simpson's Index)
Chair OF	1	13-Aug-11	36	0.87
	2	13-Aug-11	33	0.88
	3	13-Aug-11	36	0.77
Llama OF	1	17-Aug-11	18	0.52
	2	17-Aug-11	16	0.81
	3	17-Aug-11	20	0.82
Giraffe OF	1	12-Aug-11	30	0.83
	2	12-Aug-11	24	0.83
	3	12-Aug-11	31	0.85
Wolf OF	1	13-Aug-11	29	0.84
	2	13-Aug-11	26	0.75
	3	13-Aug-11	24	0.74
Goose OF	1	16-Aug-11	23	0.72
	2	16-Aug-11	26	0.86
	3	16-Aug-11	20	0.85
Propellor OF	1	15-Aug-11	23	0.85
	2	16-Aug-11	20	0.81
	3	16-Aug-11	16	0.86
Propellor D/S	1	15-Aug-11	23	0.84
	2	15-Aug-11	21	0.78
	3	15-Aug-11	23	0.78
Ref. B OF	1	14-Aug-11	24	0.83
	2	14-Aug-11	27	0.80
	3	14-Aug-11	21	0.87

Note: Echo OF was dry during summer sampling, so no periphyton data could be collected.

Appendix 3.7-1

Lake Zooplankton Density and Taxonomic Results, Back River Project, 2011

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Appendix 3.7-1. Lake Zooplankton Density and Taxonomic Results, Back River Project, 2011

Lake/Sample ID		Llama Lake						Umwelt Lake						Giraffe Lake					
Date		9-Aug-11						5-Aug-11						10-Aug-11					
Tow type		Vertical from 11.5 m depth			Mean			Horizontal tow at 0.5 m depth			Mean			Vertical tow from 4 m depth			Mean		
Volume sampled (m^3)		0.63982	0.62463	0.47844	(Org/m^3)	SE	%	0.71423	0.66104	0.60595	(Org/m^3)	SE	%	0.25834	0.23934	0.23364	(Org/m^3)	SE	%
Replicate		**3**	**4**	**5**				**1**	**2**	**3**				**1**	**2**	**3**			
ROTIFERA																			
Kellicottia longispina		3437	4320	3551				1400	2269	1485				1974	3134	2782			
Keratella cochlearis		47	160	418				0	0	0				0	0	0			
Conochilus sp.	colony	78	64	63				0	15	33				31	63	17			
Plautius		16	160	0				0	151	0				0	0	0			
Subtotal Rotifers		**3577**	**4704**	**4032**	**4105**	**327**	**10%**	**1400**	**2436**	**1518**	**1785**	**327**	**9%**	**2005**	**3196**	**2799**	**2667**	**350**	**18%**
CLADOCERA																			
Holopedium gibberum		17	77	132				64	17	18				1277	2549	3552			
Daphnia middendorffiana		106	50	40				1	0	0				116	192	235			
Bosmina longirostris		5	6	4				0	2	0				619	794	471			
Subtotal Cladocerans		**128**	**133**	**175**	**145**	**15**	**0%**	**66**	**18**	**18**	**34**	**16**	**0%**	**2013**	**3535**	**4259**	**3269**	**662**	**22%**
COPEPODS - CALANOIDA																			
Leptodiaptomus pribilofensis	M	547	464	480				1540	182	297				1277	1212	642			
Leptodiaptomus pribilofensis	F	719	656	564				1680	1498	1881				697	543	984			
Leptodiaptomus ashlandi	M	47	64	0				0	0	0				0	0	0			
Leptodiaptomus ashlandi	F	47	64	84				0	15	0				0	0	0			
Leptodiaptomus sicilis	M	0	0	0				0	0	0				0	0	0			
Leptodiaptomus sicilis	F	0	16	0				0	0	0				0	8	4			
Leptodiaptomus sp.	V	30462	20642	10863				12041	16035	11387				3213	3802	3467			
Leptodiaptomus sp.	IV	1718	1440	1253				294	424	825				426	292	385			
Leptodiaptomus sp.	III	0	48	0				0	76	50				0	0	0			
Leptodiaptomus sp.	II	0	0	0				14	0	33				0	0	0			
Leptodiaptomus sp.	I	0	0	0				0	0	17				0	0	0			
Heterocope septentrionalis	M	9	6	8				90	18	10				8	33	4			
Heterocope septentrionalis	F	17	11	13				15	5	8				35	8	30			
Epischura lacustris	M	109	112	146				6	0	3				62	38	13			
Epischura lacustris	F	156	352	125				53	29	40				58	29	77			
Epischura lacustris	V	0	10	19				6	2	2				0	0	0			
Epischura lacustris	IV	0	0	0				0	0	0				0	0	0			
Epischura lacustris	III	0	0	0				0	15	0				0	0	0			
Epischura lacustris	II	16	0	0				28	61	0				0	0	0			
Epischura lacustris	I	0	0	0				0	15	0				0	0	0			
Unidentified Calanoida*	nauplius	0	0	0				0	0	0				0	0	0			
Subtotal Copepods - Calanoida		**33847**	**23885**	**13556**	**23763**	**5858**	**59%**	**15767**	**18373**	**14552**	**16230**	**1127**	**85%**	**5775**	**5966**	**5607**	**5783**	**104**	**38%**
COPEPODS - CYCLOPOIDA																			
Cyclops bicuspidatus thomasi	F	0	0	0				0	0	0				0	4	0			
Cyclops scutifer	M	0	3	2				0	0	0				0	0	0			
Cyclops scutifer	F	28	37	209				0	0	0				0	4	0			
Cyclops sp.	copepodite	5311	5600	7312				210	333	396				1858	1838	2739			
Unidentified Cyclopoida*	nauplius	2499	10081	5432				210	1513	792				890	1128	1926			
Subtotal Copepods - Cyclopoida		**7839**	**15721**	**12954**	**12171**	**2309**	**30%**	**420**	**1846**	**1188**	**1151**	**412**	**6%**	**2748**	**2975**	**4665**	**3463**	**605**	**23%**
TOTAL DENSITY		**45391**	**44444**	**30718**	**40184**	**4741**	**100%**	**17653**	**22672**	**17277**	**19200**	**1739**	**100%**	**12542**	**15672**	**17330**	**15181**	**1404**	**100%**

Note: Data represent numbers of zooplankton/m^3

Volume sampled is calculated based on flowmeter readings as outlined in methods section.

**these taxa were excluded from the diversity analyses as they could not be accurately assigned to a genera*

Appendix 3.7-1. Lake Zooplankton Density and Taxonomic Results, Back River Project, 2011

Lake/Sample ID		Goose Lake Neck						Goose Lake Central						Reference B Lake					
Date		14-Aug-11						7-Aug-11						8-Aug-11					
Tow type		Horizontal tow at 0.5 m depth			Mean			Horizontal tow at 0.5 m depth			Mean			Horizontal tow at 0.5 m depth			Mean		
Volume sampled (m^3)		0.26974	0.37041	0.38751	(Org/m^3)	SE	%	0.42170	0.24124	0.22795	(Org/m^3)	SE	%	0.22795	0.21845	0.20705	(Org/m^3)	SE	%
Replicate		**4**	**5**	**6**				**1**	**2**	**3**				**1**	**2**	**3**			
ROTIFERA																			
Kellicottia longispina		1780	2673	1961				6640	5223	7458				2544	2426	4781			
Keratella cochlearis		0	0	0				0	0	0				0	0	0			
Conochilus sp.	colony	44	57	103				26	12	70				0	0	0			
Plautius		0	0	0				0	0	0				0	0	0			
Subtotal Rotifers		**1824**	**2729**	**2064**	**2206**	**271**	**20%**	**6666**	**5235**	**7528**	**6476**	**669**	**28%**	**2544**	**2426**	**4781**	**3251**	**766**	**51%**
CLADOCERA																			
Holopedium gibberum		15	0	28				28	33	101				0	0	0			
Daphnia middendorffiana		11	0	0				0	0	0				9	0	0			
Bosmina longirostris		100	270	0				50	12	0				0	0	5			
Subtotal Cladocerans		**126**	**270**	**28**	**141**	**70**	**1%**	**78**	**46**	**101**	**75**	**16**	**0%**	**9**	**0**	**5**	**5**	**3**	**0%**
COPEPODS - CALANOIDA																			
Leptodiaptomus pribilofensis	M	297	270	387				28	37	219				746	60	77			
Leptodiaptomus pribilofensis	F	779	837	723				26	8	307				790	238	82			
Leptodiaptomus ashlandi	M	1817	1053	774				1660	1824	1360				0	0	5			
Leptodiaptomus ashlandi	F	408	999	1135				2134	788	2018				0	0	0			
Leptodiaptomus sicilis	M	0	0	0				0	4	0				0	0	0			
Leptodiaptomus sicilis	F	0	0	0				0	4	0				0	0	0			
Leptodiaptomus sp.	V	3077	4023	4516				6166	6798	13600				1492	412	353			
Leptodiaptomus sp.	IV	37	162	77				1423	912	834				0	5	0			
Leptodiaptomus sp.	III	37	27	0				0	41	0				0	0	0			
Leptodiaptomus sp.	II	74	189	0				0	0	0				0	0	0			
Leptodiaptomus sp.	I	0	81	181				0	0	0				0	0	0			
Heterocope septentrionalis	M	7	11	39				7	4	4				4	0	0			
Heterocope septentrionalis	F	22	13	59				0	17	9				4	0	0			
Epischura lacustris	M	7	13	23				2	12	13				0	0	0			
Epischura lacustris	F	41	24	49				57	29	53				0	0	0			
Epischura lacustris	V	4	0	0				17	4	26				0	0	0			
Epischura lacustris	IV	0	0	0				0	0	0				0	0	0			
Epischura lacustris	III	0	0	0				0	0	0				0	0	0			
Epischura lacustris	II	0	0	0				0	0	0				0	0	0			
Epischura lacustris	I	0	0	0				0	0	0				0	0	0			
Unidentified Calanoida*	nauplius	37	27	0				142	41	132				0	0	0			
Subtotal Copepods - Calanoida		**6644**	**7729**	**7964**	**7446**	**407**	**67%**	**11662**	**10525**	**18575**	**13587**	**2515**	**59%**	**3036**	**714**	**517**	**1422**	**809**	**22%**
COPEPODS - CYCLOPOIDA																			
Cyclops bicuspidatus thomasi	F	0	0	0				0	0	0				0	0	0			
Cyclops scutifer	M	0	0	0				0	0	0				0	0	0			
Cyclops scutifer	F	41	135	77				38	29	79				0	0	0			
Cyclops sp.	copepodite	741	918	1316				1897	1700	2808				1623	778	227			
Unidentified Cyclopoida*	nauplius	185	189	310				949	580	219				132	1236	1063			
Subtotal Copepods - Cyclopoida		**968**	**1242**	**1703**	**1304**	**215**	**12%**	**2884**	**2309**	**3106**	**2766**	**237**	**12%**	**1755**	**2014**	**1290**	**1686**	**212**	**26%**
TOTAL DENSITY		**9561**	**11970**	**11760**	**11097**	**770**	**100%**	**21290**	**18115**	**29310**	**22905**	**3331**	**100%**	**7344**	**5155**	**6593**	**6364**	**642**	**100%**

Note: Data represent numbers of zooplankton/m^3

Volume sampled is calculated based on flowmeter readings as outlined in methods section.

**these taxa were excluded from the diversity analyses as they could not be accurately assigned to a genera*

Appendix 3.7-2

Lake Zooplankton Richness and Diversity Results, Back River Project, 2011

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Appendix 3.7-2. Lake Zooplankton Richness and Diversity Results, Back River Project, 2011

Lake	Replicate	Date Sampled	Richness (genera/sample)	Diversity (Simpson's Index)
Llama Lake	3	06-Aug-11	11	0.37
	4	06-Aug-11	11	0.49
	5	06-Aug-11	10	0.62
Umwelt Lake	1	05-Aug-11	7	0.20
	2	05-Aug-11	9	0.25
	3	05-Aug-11	7	0.22
Giraffe Lake	1	10-Aug-11	9	0.70
	2	10-Aug-11	9	0.74
	3	10-Aug-11	9	0.75
Goose Lake Neck	1	07-Aug-11	9	0.47
	2	07-Aug-11	7	0.52
	3	07-Aug-11	7	0.49
Goose Lake Central	1	07-Aug-11	8	0.56
	2	07-Aug-11	8	0.55
	3	07-Aug-11	7	0.52
Reference B Lake	1	08-Aug-11	5	0.65
	2	08-Aug-11	3	0.54
	3	08-Aug-11	4	0.24

Note: Zooplankton tows were vertical at the deeper Llama Lake and Giraffe Lake, and horizontal at all other lakes.

Appendix 3.7-3

Lake Benthos Density and Taxonomic Results, Back River Project, 2011

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Appendix 3.7-3. Lake Benthos Density and Taxonomic Results, Back River Project, 2011

Site					Llama Lake Shallow					Llama Lake Deep					Umwelt Lake					Giraffe Lake Shallow				
Date Sampled					9-Aug-11					9-Aug-11					10-Aug-11					11-Aug-11				
Depth (m)					5	5	5	5	5	13.8	13.4	14.5	14	13.8	2	2	2	2	2	3.7	3.7	3.7	3.7	3.7
Major Group	Family	Subfamily	Tribe	Genus	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5
Microturbellaria	Typhloplanidae	-	-	*Mesostoma*	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Microturbellaria Subtotal	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***14.3***	***0.0***	***0.0***	***14.3***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***
Oligochaeta	Enchytraeidae	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lumbriculidae	-	-	-	86.0	43.0	57.3	57.3	28.7	0.0	14.3	0.0	0.0	0.0	43.0	157.7	114.7	172.0	43.0	30.7	46.0	30.7	30.7	61.3
	Naididae	Tubificinae	-	-	14.3	14.3	0.0	0.0	0.0	114.7	114.7	86.0	286.7	215.1	0.0	0.0	0.0	0.0	0.0	0.0	76.6	46.0	46.0	0.0
				Oligochaeta Subtotal	***100.4***	***57.3***	***57.3***	***57.3***	***28.7***	***114.7***	***129.0***	***86.0***	***286.7***	***215.1***	***43.0***	***157.7***	***114.7***	***172.0***	***43.0***	***30.7***	***122.6***	***76.6***	***76.6***	***61.3***
Gastropoda	Valvatidae	-	-	*Valvata sincera*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Gastropoda Subtotal	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***
Bivalvia	Sphaeriidae	-	-	(i/d)	229.4	358.4	157.7	157.7	587.8	0.0	14.3	28.7	0.0	86.0	258.1	215.1	172.0	315.4	0.0	137.9	199.2	199.2	76.6	107.3
		-	-	*Sphaerium*	43.0	43.0	28.7	28.7	57.3	0.0	0.0	0.0	0.0	0.0	57.3	28.7	14.3	28.7	14.3	30.7	46.0	15.3	0.0	46.0
		-	-	*Pisidium*	301.1	344.1	114.7	86.0	129.0	172.0	172.0	114.7	129.0	143.4	329.7	974.9	487.5	487.5	487.5	168.6	153.3	122.6	137.9	92.0
				Bivalvia Subtotal	***573.5***	***745.5***	***301.1***	***272.4***	***774.2***	***172.0***	***186.4***	***143.4***	***129.0***	***229.4***	***645.2***	***1218.6***	***673.8***	***831.5***	***501.8***	***337.2***	***398.5***	***337.2***	***214.6***	***245.2***
Hydracarina	-	-	-	-	0.0	28.7	0.0	0.0	14.3	14.3	57.3	28.7	0.0	28.7	143.4	157.7	100.4	28.7	57.3	15.3	30.7	0.0	0.0	0.0
				Hydracarina Subtotal	***0.0***	***28.7***	***0.0***	***0.0***	***14.3***	***14.3***	***57.3***	***28.7***	***0.0***	***28.7***	***143.4***	***157.7***	***100.4***	***28.7***	***57.3***	***15.3***	***30.7***	***0.0***	***0.0***	***0.0***
Ostracoda	-	-	-	-	43.0	0.0	0.0	0.0	43.0	0.0	28.7	0.0	43.0	28.7	243.7	774.2	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Ostracoda Subtotal	***43.0***	***0.0***	***0.0***	***0.0***	***43.0***	***0.0***	***28.7***	***0.0***	***43.0***	***28.7***	***243.7***	***774.2***	***14.3***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***
Notostraca	Triopsidae	-	-	*Lepidurus*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Notostraca Subtotal	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***
Trichoptera	Limnephilidae	-	-	(i/d)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		-	-	*Grensia praeterica*	0.0	28.7	0.0	14.3	14.3	0.0	0.0	0.0	0.0	0.0	14.3	57.3	0.0	0.0	0.0	15.3	0.0	0.0	0.0	30.7
				Trichoptera Subtotal	***0.0***	***28.7***	***0.0***	***14.3***	***14.3***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***14.3***	***57.3***	***0.0***	***0.0***	***0.0***	***15.3***	***0.0***	***0.0***	***0.0***	***30.7***
Diptera	Chironomidae	-	-	(pupa)	14.3	28.7	28.7	43.0	14.3	43.0	100.4	86.0	86.0	157.7	0.0	14.3	0.0	0.0	14.3	0.0	0.0	0.0	0.0	0.0
		Tanypodinae	Pentaneurini	(i/d)	0.0	0.0	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0	15.3	0.0	0.0
				Ablabesmyia	43.0	28.7	71.7	100.4	43.0	0.0	14.3	0.0	0.0	14.3	71.7	272.4	157.7	57.3	71.7	0.0	0.0	0.0	0.0	0.0
				Thienemannimyia group	14.3	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Procladiini	*Procladius*	71.7	157.7	186.4	57.3	100.4	71.7	86.0	86.0	172.0	129.0	430.1	888.9	444.4	587.8	702.5	199.2	199.2	306.5	291.2	168.6
		Diamesinae	Protanypini	*Protanypus*	28.7	0.0	0.0	0.0	14.3	14.3	28.7	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.7	0.0	0.0	15.3	30.7
		Prodiamesinae		*Monodiamesa*	129.0	28.7	43.0	157.7	129.0	86.0	71.7	215.1	71.7	43.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.3	0.0	0.0
		Orthocladiinae	Orthocladiini	*Cricotopus/Orthocladius*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Heterotanytarsus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.3	15.3	0.0
				Heterotrissocladius	0.0	0.0	0.0	0.0	14.3	186.4	215.1	186.4	200.7	415.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.7
				Hydrobaenus	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Psectrocladius	243.7	258.1	157.7	315.4	200.7	14.3	86.0	100.4	272.4	28.7	372.8	1548.4	501.8	444.4	817.2	122.6	275.9	137.9	153.3	122.6
				Zalutschia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.3	0.0	15.3	30.7	46.0
		Chironominae	Chironomini	*Chironomus*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86.0	129.0	57.3	157.7	243.7	0.0	15.3	0.0	0.0	0.0
				Cladopelma	0.0	28.7	14.3	14.3	0.0	0.0	0.0	0.0	0.0	0.0	602.2	1749.1	917.6	731.2	630.8	30.7	46.0	92.0	92.0	46.0
				Cryptochironomus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	129.0	86.0	71.7	157.7	100.4	0.0	0.0	0.0	0.0	15.3
				Dicrotendipes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71.7	28.7	14.3	100.4	0.0	15.3	0.0	0.0	0.0
				Microtendipes	71.7	114.7	0.0	28.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.3	0.0	0.0	0.0
				Pagastiella	0.0	0.0	14.3	14.3	28.7	0.0	0.0	0.0	0.0	0.0	0.0	14.3	14.3	14.3	0.0	199.2	92.0	46.0	122.6	107.3
				Polypedilum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	888.9	1376.3	1161.3	473.1	444.4	0.0	15.3	0.0	15.3	0.0
				Sergenta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Stictochironomus	688.2	1362.0	215.1	215.1	387.1	0.0	14.3	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0	122.6	76.6	30.7	275.9	367.8
			Tanytarsini	(i/d)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Cladotanytarsus	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.7	143.4	100.4	57.3	0.0	229.9	168.6	46.0	107.3	15.3
				Corynocera	172.0	71.7	0.0	14.3	0.0	0.0	57.3	0.0	0.0	0.0	444.4	1161.3	3096.8	2222.2	759.9	137.9	92.0	46.0	183.9	76.6
				Micropsectra	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.3	0.0	0.0	0.0	0.0
				Micropsectra / Tanytarsus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.3	0.0	0.0	0.0	0.0
				Paratanytarsus	14.3	14.3	14.3	0.0	43.0	0.0	0.0	0.0	0.0	0.0	14.3	14.3	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Tanytarsus	0.0	0.0	0.0	14.3	0.0	100.4	71.7	14.3	43.0	129.0	100.4	372.8	387.1	100.4	344.1	137.9	214.6	92.0	199.2	153.3
	Empididae	-	-	*Chelifera*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Diptera Subtotal	***1505.4***	***2121.9***	***745.5***	***989.2***	***974.9***	***516.1***	***745.5***	***716.8***	***860.2***	***917.6***	***3182.8***	***7885.3***	***6953.4***	***5017.9***	***4229.4***	***1256.7***	***1226.1***	***858.2***	***1501.9***	***1180.1***
				TOTAL BENTHOS	***2222.2***	***2982.1***	***1103.9***	***1333.3***	***1849.5***	***817.2***	***1161.3***	***974.9***	***1319.0***	***1433.7***	***4272.4***	***10250.9***	***7856.6***	***6050.2***	***4831.5***	***1655.2***	***1777.8***	***1272.0***	***1793.1***	***1517.2***
Non Macrobenthic Invertebrates*																								
Nematoda	-	-	-	-	28.7	0.0	0.0	0.0	14.3	14.3	43.0	14.3	0.0	0.0	0.0	14.3	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0
				Nematoda Subtotal	***28.7***	***0.0***	***0.0***	***0.0***	***14.3***	***14.3***	***43.0***	***14.3***	***0.0***	***0.0***	***0.0***	***14.3***	***0.0***	***14.3***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***
Copepoda - Calanoida	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	43.0	14.3	14.3	14.3	28.7	14.3	14.3	28.7	57.3	15.3	0.0	0.0	15.3	0.0
				Copepoda - Calanoida Subtotal	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***43.0***	***14.3***	***14.3***	***14.3***	***28.7***	***14.3***	***14.3***	***28.7***	***57.3***	***15.3***	***0.0***	***0.0***	***15.3***	***0.0***
Copepoda - Cyclopoida	Cyclopidae	Cyclopinae	-	*Acanthocyclops*	43.0	14.3	14.3	0.0	14.3	0.0	0.0	14.3	0.0	0.0	28.7	86.0	28.7	71.7	0.0	0.0	30.7	0.0	0.0	0.0
				Copepoda - Cyclopoida Subtotal	***43.0***	***14.3***	***14.3***	***0.0***	***14.3***	***0.0***	***0.0***	***14.3***	***0.0***	***0.0***	***28.7***	***86.0***	***28.7***	***71.7***	***0.0***	***0.0***	***30.7***	***0.0***	***0.0***	***0.0***
Cladocera	Bosminidae	-	-	*Bosmina*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chydoridae	-	-	*Eurycercus*	258.1	57.3	114.7	57.3	86.0	0.0	0.0	0.0	0.0	0.0	157.7	100.4	172.0	86.0	14.3	183.9	183.9	122.6	137.9	153.3
	Chydoridae	-	-	-	28.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Daphnidae	-	-	*Daphnia*	0.0	0.0	0.0	0.0	14.3	28.7	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Macrothricidae	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Cladocera Subtotal	***286.7***	***57.3***	***114.7***	***57.3***	***100.4***	***28.7***	***14.3***	***0.0***	***0.0***	***0.0***	***157.7***	***100.4***	***172.0***	***86.0***	***14.3***	***183.9***	***183.9***	***122.6***	***137.9***	***153.3***
Terrestrial	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				TOTAL CAPTURED	***2580.6***	***3053.8***	***1233.0***	***1390.7***	***1978.5***	***860.2***	***1261.6***	***1017.9***	***1333.3***	***1448.0***	***4487.5***	***10465.9***	***8071.7***	***6250.9***	***4903.2***	***1854.4***	***1992.3***	***1394.6***	***1946.4***	***1670.5***

Data represents organisms/m²

i/d = immature or damaged individuals

**These taxa were not included in the total density calculation or other data analysis.*

Environment Canada (2011) states that as nematodes and copepods are meiofauna, samples using 500 µm mesh will not be representative so should be excuded from analysis.

Cladocera (water fleas) are mobile, and were not considered permanent members of the benthos so were excluded form analysis.

The terrestrial organisms found in these samples were adult chironomids or midges which probably got into to sample during sieving.

Appendix 3.7-3. Lake Benthos Density and Taxonomic Results, Back River Project, 2011

Site					Giraffe Lake Deep					Goose Lake Neck					Goose Lake Central					Reference B Lake				
Date Sampled					11-Aug-11					7-Aug-11 and 14-Aug-11					7-Aug-11					8-Aug-11				
Depth (m)					5.8	5.8	5.8	5.8	5.8	3.5	3.5	3.5	3.5	3.5	5	5.4	5.2	5.2	5.2	4.8	4.8	4.8	4	4.7
Major Group	Family	Subfamily	Tribe	Genus	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5
Microturbellaria	Typhloplanidae	-	-	*Mesostoma*	15.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71.7	0.0
				Microturbellaria Subtotal	***15.3***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***71.7***	***0.0***
Oligochaeta	Enchytraeidae	-	-	-	0.0	0.0	0.0	0.0	0.0	43.0	0.0	15.3	0.0	61.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lumbriculidae	-	-	-	61.3	76.6	122.6	30.7	122.6	86.0	61.3	76.6	76.6	61.3	28.7	129.0	28.7	57.3	43.0	0.0	129.0	100.4	157.7	157.7
	Naididae	Tubificinae	-	-	0.0	61.3	46.0	30.7	0.0	14.3	15.3	15.3	46.0	0.0	143.4	28.7	100.4	172.0	157.7	0.0	43.0	57.3	114.7	57.3
				Oligochaeta Subtotal	***61.3***	***137.9***	***168.6***	***61.3***	***122.6***	***143.4***	***76.6***	***107.3***	***122.6***	***122.6***	***172.0***	***157.7***	***129.0***	***229.4***	***200.7***	***0.0***	***172.0***	***157.7***	***272.4***	***215.1***
Gastropoda	Valvatidae	-	-	*Valvata sincera*	0.0	0.0	0.0	0.0	0.0	57.3	30.7	107.3	30.7	76.6	86.0	258.1	200.7	157.7	86.0	0.0	0.0	0.0	0.0	0.0
				Gastropoda Subtotal	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***57.3***	***30.7***	***107.3***	***30.7***	***76.6***	***86.0***	***258.1***	***200.7***	***157.7***	***86.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***
Bivalvia	Sphaeriidae	-	-	(i/d)	352.5	413.8	183.9	306.5	367.8	387.1	0.0	122.6	137.9	306.5	587.8	1175.6	587.8	659.5	845.9	415.8	258.1	372.8	401.4	358.4
		-	-	*Sphaerium*	15.3	0.0	0.0	0.0	0.0	43.0	0.0	0.0	15.3	0.0	28.7	57.3	57.3	43.0	28.7	0.0	14.3	0.0	28.7	0.0
		-	-	*Pisidium*	291.2	183.9	214.6	183.9	306.5	286.7	46.0	168.6	61.3	76.6	186.4	215.1	143.4	57.3	86.0	960.6	688.2	874.6	573.5	645.2
				Bivalvia Subtotal	***659.0***	***597.7***	***398.5***	***490.4***	***674.3***	***716.8***	***46.0***	***291.2***	***214.6***	***383.1***	***802.9***	***1448.0***	***788.5***	***759.9***	***960.6***	***1376.3***	***960.6***	***1247.3***	***1003.6***	***1003.6***
Hydracarina	-	-	-	-	46.0	15.3	61.3	0.0	122.6	14.3	0.0	30.7	61.3	30.7	0.0	14.3	28.7	14.3	14.3	43.0	71.7	186.4	28.7	71.7
				Hydracarina Subtotal	***46.0***	***15.3***	***61.3***	***0.0***	***122.6***	***14.3***	***0.0***	***30.7***	***61.3***	***30.7***	***0.0***	***14.3***	***28.7***	***14.3***	***14.3***	***43.0***	***71.7***	***186.4***	***28.7***	***71.7***
Ostracoda	-	-	-	-	30.7	0.0	0.0	0.0	15.3	186.4	168.6	321.8	183.9	245.2	845.9	573.5	401.4	0.0	315.4	0.0	0.0	86.0	114.7	401.4
				Ostracoda Subtotal	***30.7***	***0.0***	***0.0***	***0.0***	***15.3***	***186.4***	***168.6***	***321.8***	***183.9***	***245.2***	***845.9***	***573.5***	***401.4***	***0.0***	***315.4***	***0.0***	***0.0***	***86.0***	***114.7***	***401.4***
Notostraca	Triopsidae	-	-	*Lepidurus*	15.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Notostraca Subtotal	***15.3***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***
Trichoptera	Limnephilidae	-	-	(i/d)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	0.0	0.0	0.0
		-	-	*Grensia praeterica*	30.7	30.7	0.0	0.0	15.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	14.3	28.7
				Trichoptera Subtotal	***30.7***	***30.7***	***0.0***	***0.0***	***15.3***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***14.3***	***0.0***	***0.0***	***14.3***	***14.3***	***28.7***
Diptera	Chironomidae	-	-	(pupa)	30.7	0.0	15.3	76.6	30.7	57.3	0.0	30.7	30.7	61.3	71.7	200.7	28.7	71.7	114.7	57.3	0.0	186.4	14.3	71.7
		Tanypodinae	Pentaneurini	(i/d)	0.0	0.0	46.0	0.0	0.0	43.0	0.0	0.0	0.0	0.0	0.0	28.7	0.0	43.0	14.3	0.0	14.3	0.0	0.0	0.0
				Ablabesmyia	30.7	15.3	15.3	15.3	61.3	114.7	76.6	76.6	153.3	76.6	86.0	329.7	43.0	129.0	143.4	0.0	43.0	71.7	0.0	71.7
				Thienemannimyia group	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	14.3	57.3	0.0
			Procladiini	*Procladius*	61.3	30.7	61.3	61.3	30.7	28.7	46.0	46.0	46.0	46.0	200.7	516.1	229.4	286.7	315.4	1046.6	903.2	1935.5	1333.3	1906.8
		Diamesinae	Protanypini	*Protanypus*	0.0	0.0	0.0	0.0	0.0	28.7	0.0	0.0	0.0	0.0	28.7	0.0	0.0	14.3	71.7	0.0	0.0	0.0	0.0	0.0
		Prodiamesinae		*Monodiamesa*	30.7	76.6	61.3	46.0	15.3	0.0	0.0	0.0	0.0	0.0	43.0	0.0	28.7	57.3	71.7	0.0	0.0	0.0	0.0	0.0
		Orthocladiinae	Orthocladiini	*Cricotopus/Orthocladius*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0
				Heterotanytarsus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.3	0.0	0.0	0.0	0.0	0.0	0.0	28.7	0.0	0.0	57.3	0.0
				Heterotrissocladius	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	129.0	172.0	114.7	71.7	71.7	0.0	0.0	0.0	0.0	28.7
				Hydrobaenus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Psectrocladius	107.3	245.2	275.9	260.5	521.1	229.4	199.2	567.0	337.2	827.6	372.8	530.5	215.1	415.8	874.6	229.4	200.7	415.8	272.4	86.0
				Zalutschia	15.3	76.6	15.3	15.3	76.6	0.0	0.0	0.0	0.0	0.0	43.0	86.0	57.3	28.7	57.3	0.0	0.0	0.0	0.0	0.0
		Chironominae	Chironomini	*Chironomus*	0.0	0.0	0.0	0.0	15.3	0.0	0.0	0.0	0.0	30.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Cladopelma	137.9	122.6	76.6	107.3	413.8	0.0	15.3	46.0	0.0	0.0	28.7	28.7	0.0	28.7	14.3	172.0	0.0	329.7	57.3	71.7
				Cryptochironomus	0.0	15.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.7	0.0	0.0	0.0	71.7	71.7	0.0	86.0	28.7
				Dicrotendipes	15.3	0.0	0.0	0.0	0.0	28.7	0.0	92.0	30.7	46.0	71.7	100.4	186.4	28.7	71.7	0.0	0.0	0.0	0.0	0.0
				Microtendipes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.7	71.7	57.3	71.7	0.0	28.7	28.7	114.7	57.3	0.0
				Pagastiella	199.2	321.8	199.2	291.2	429.1	0.0	15.3	15.3	0.0	61.3	57.3	100.4	57.3	57.3	14.3	0.0	0.0	0.0	0.0	0.0
				Polypedilum	0.0	0.0	0.0	0.0	0.0	516.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86.0	0.0	129.0	71.7	172.0	114.7	0.0
				Sergenta	15.3	0.0	0.0	0.0	0.0	0.0	0.0	30.7	15.3	92.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	114.7	71.7	57.3
				Stictochironomus	582.4	643.7	689.7	567.0	1425.3	57.3	30.7	122.6	30.7	490.4	974.9	2107.5	1304.7	1118.3	1519.7	0.0	0.0	0.0	57.3	129.0
			Tanytarsini	(i/d)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	14.3	28.7	14.3	0.0	0.0	0.0	0.0	114.7
				Cladotanytarsus	15.3	15.3	15.3	30.7	122.6	0.0	0.0	15.3	30.7	0.0	28.7	0.0	28.7	14.3	57.3	28.7	0.0	71.7	57.3	0.0
				Corynocera	30.7	0.0	30.7	46.0	61.3	0.0	229.9	30.7	30.7	61.3	329.7	243.7	272.4	186.4	114.7	989.2	1648.7	3828.0	1175.6	3340.5
				Micropsectra	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Micropsectra / Tanytarsus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	0.0
				Paratanytarsus	0.0	0.0	0.0	0.0	15.3	989.2	597.7	1256.7	674.3	3325.7	573.5	831.5	702.5	587.8	917.6	28.7	0.0	28.7	57.3	0.0
				Tanytarsus	92.0	15.3	15.3	0.0	30.7	57.3	0.0	46.0	46.0	0.0	71.7	315.4	215.1	100.4	129.0	43.0	157.7	114.7	172.0	57.3
	Empididae	-	-	*Chelifera*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0
				Diptera Subtotal	***1364.0***	***1578.5***	***1517.2***	***1517.2***	***3249.0***	***2150.5***	***1210.7***	***2375.5***	***1440.6***	***5118.8***	***3139.8***	***5706.1***	***3555.6***	***3455.2***	***4602.2***	***2853.0***	***3154.1***	***7397.8***	***3641.6***	***5964.2***
				TOTAL BENTHOS	***2222.2***	***2360.2***	***2145.6***	***2069.0***	***4199.2***	***3268.8***	***1532.6***	***3233.7***	***2053.6***	***5977.0***	***5046.6***	***8157.7***	***5103.9***	***4616.5***	***6193.5***	***4272.4***	***4358.4***	***9089.6***	***5147.0***	***7684.6***
Non Macrobenthic Invertebrates*																								
Nematoda	-	-	-	-	0.0	0.0	0.0	0.0	0.0	71.7	15.3	0.0	15.3	15.3	57.3	86.0	86.0	114.7	71.7	0.0	0.0	14.3	0.0	0.0
				Nematoda Subtotal	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***71.7***	***15.3***	***0.0***	***15.3***	***15.3***	***57.3***	***86.0***	***86.0***	***114.7***	***71.7***	***0.0***	***0.0***	***14.3***	***0.0***	***0.0***
Copepoda - Calanoida	-	-	-	-	0.0	15.3	15.3	0.0	0.0	0.0	0.0	0.0	0.0	15.3	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0	14.3	14.3
				Copepoda - Calanoida Subtotal	***0.0***	***15.3***	***15.3***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***15.3***	***0.0***	***14.3***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***14.3***	***14.3***
Copepoda - Cyclopoida	Cyclopidae	Cyclopinae	-	*Acanthocyclops*	0.0	15.3	0.0	0.0	0.0	71.7	0.0	0.0	15.3	30.7	129.0	258.1	86.0	28.7	43.0	0.0	86.0	57.3	57.3	0.0
				Copepoda - Cyclopoida Subtotal	***0.0***	***15.3***	***0.0***	***0.0***	***0.0***	***71.7***	***0.0***	***0.0***	***15.3***	***30.7***	***129.0***	***258.1***	***86.0***	***28.7***	***43.0***	***0.0***	***86.0***	***57.3***	***57.3***	***0.0***
Cladocera	Bosminidae	-	-	*Bosmina*	15.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chydoridae	-	-	*Eurycercus*	137.9	122.6	137.9	153.3	92.0	0.0	0.0	15.3	0.0	15.3	0.0	0.0	0.0	0.0	0.0	57.3	215.1	243.7	28.7	272.4
	Chydoridae	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	57.3
	Daphnidae	-	-	*Daphnia*	15.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	0.0	0.0	0.0	14.3
	Macrothricidae	-	-	-	15.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71.7	172.0	86.0	0.0	57.3	0.0	0.0	0.0	0.0	0.0
				Cladocera Subtotal	***183.9***	***122.6***	***137.9***	***153.3***	***92.0***	***0.0***	***0.0***	***15.3***	***0.0***	***15.3***	***71.7***	***172.0***	***86.0***	***14.3***	***57.3***	***57.3***	***215.1***	***258.1***	***28.7***	***344.1***
Terrestrial	-	-	-	-	0.0	0.0	0.0	0.0	15.3	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				TOTAL CAPTURED	***2406.1***	***2513.4***	***2298.9***	***2222.2***	***4306.5***	***3412.2***	***1547.9***	***3249.0***	***2084.3***	***6053.6***	***5319.0***	***8688.2***	***5362.0***	***4774.2***	***6365.6***	***4329.7***	***4659.5***	***9419.4***	***5247.3***	***8043.0***

Data represents organisms/m²

i/d = immature or damaged individuals

**These taxa were not included in the total density calculation or other data analysis.*

Environment Canada (2011) states that as nematodes and copepods are meiofauna, samples using 500 µm mesh will not be representative so should be excuded from analysis.

Cladocera (water fleas) are mobile, and were not considered permanent members of the benthos so were excluded form analysis.

The terrestrial organisms found in these samples were adult chironomids or midges which probably got into to sample during sieving.

Appendix 3.7-4

Lake Benthos Richness and Diversity Results, Back River Project, 2011

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Appendix 3.7-4. Lake Benthos Richness and Diversity Results, Back River Project, 2011

Lake	Shallow or Deep	Date Sampled	Richness (families/sample)	Diversity (Simpson's Index)
Llama	Shallow	09-Aug-11	5	0.86
	Shallow	09-Aug-11	6	0.71
	Shallow	09-Aug-11	3	0.87
	Shallow	09-Aug-11	4	0.85
	Shallow	09-Aug-11	6	0.87
Llama	Deep	09-Aug-11	4	0.85
	Deep	09-Aug-11	7	0.90
	Deep	09-Aug-11	4	0.85
	Deep	09-Aug-11	4	0.84
	Deep	09-Aug-11	6	0.81
Umwelt	Shallow	10-Aug-11	6	0.89
	Shallow	10-Aug-11	6	0.89
	Shallow	10-Aug-11	5	0.80
	Shallow	10-Aug-11	4	0.81
	Shallow	10-Aug-11	4	0.88
Giraffe	Shallow	11-Aug-11	5	0.91
	Shallow	11-Aug-11	5	0.91
	Shallow	11-Aug-11	4	0.88
	Shallow	11-Aug-11	4	0.90
	Shallow	11-Aug-11	4	0.89
Giraffe	Deep	11-Aug-11	8	0.87
	Deep	11-Aug-11	6	0.85
	Deep	11-Aug-11	5	0.84
	Deep	11-Aug-11	4	0.84
	Deep	11-Aug-11	6	0.81
Goose Neck	Shallow	07-Aug-11	8	0.83
	Shallow	14-Aug-11	6	0.79
	Shallow	14-Aug-11	8	0.78
	Shallow	14-Aug-11	7	0.82
	Shallow	14-Aug-11	7	0.63
Goose Central	Shallow	07-Aug-11	6	0.89
	Shallow	07-Aug-11	7	0.88
	Shallow	07-Aug-11	7	0.88
	Shallow	07-Aug-11	7	0.87
	Shallow	07-Aug-11	8	0.85
Reference B	Shallow	08-Aug-11	3	0.79
	Shallow	08-Aug-11	5	0.78
	Shallow	08-Aug-11	7	0.75
	Shallow	08-Aug-11	8	0.84
	Shallow	08-Aug-11	7	0.72

Appendix 3.7-5

Stream Benthos Density and Taxonomic Results, Back River Project, 2011

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Appendix 3.7-5. Stream Benthos Density and Taxonomic Results, Back River Project, 2011

					Chair OF					Llama OF		Giraffe OF					Wolf Of					Goose OF				
					13-Aug-11					17-Aug-11		12-Aug-11					13-Aug-11					16-Aug-11				
Major Group	Family	Subfamily	Tribe	Genus	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5	Rep-1	Rep-2	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5
Coelenterata	Hydridae	-	-	*Hydra*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	555.6	0.0
				Coelenterata Subtotal	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**555.6**	**0.0**
Oligochaeta	Enchytraeidae	-	-	-	3.5	6.9	38.2	10.4	3.5	27.8	34.7	0.0	13.9	0.0	0.0	41.7	3.5	0.0	0.0	0.0	0.0	31.3	59.0	138.9	20.8	34.7
	Lumbriculidae	-	-	-	6.9	6.9	27.8	13.9	13.9	0.0	3.5	79.9	0.0	10.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.2	38.2	34.7	10.4	72.9
	Naididae	Naidinae	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	69.4	0.0	420.1	24.3	66.0	48.6	0.0	27.8	27.8	215.3	3.5
		Tubificinae	-	-	222.2	31.3	34.7	180.6	34.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Oligochaeta Subtotal	**232.6**	**45.1**	**100.7**	**204.9**	**52.1**	**27.8**	**38.2**	**79.9**	**13.9**	**10.4**	**0.0**	**111.1**	**3.5**	**420.1**	**24.3**	**66.0**	**48.6**	**69.4**	**125.0**	**201.4**	**246.5**	**111.1**
Gastropoda	Physidae	-	-	*Physa*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.1	0.0	0.0	0.0	13.9	0.0	0.0	0.0	0.0	0.0	0.0	3.5	55.6	17.4	31.3
	Valvatidae	-	-	*Valvata sincera*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Gastropoda Subtotal	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**45.1**	**0.0**	**0.0**	**0.0**	**13.9**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**3.5**	**55.6**	**17.4**	**31.3**
Hydracarina	-	-	-	-	93.8	180.6	69.4	218.8	156.3	666.7	111.1	69.4	41.7	41.7	27.8	31.3	3.5	166.7	6.9	0.0	0.0	62.5	145.8	27.8	0.0	0.0
				Hydracarina Subtotal	**93.8**	**180.6**	**69.4**	**218.8**	**156.3**	**666.7**	**111.1**	**69.4**	**41.7**	**41.7**	**27.8**	**31.3**	**3.5**	**166.7**	**6.9**	**0.0**	**0.0**	**62.5**	**145.8**	**27.8**	**0.0**	**0.0**
Ostracoda	-	-	-	-	277.8	48.6	191.0	555.6	20.8	0.0	13.9	277.8	361.1	222.2	250.0	55.6	6.9	694.4	34.7	6.9	59.0	444.4	194.4	253.5	312.5	111.1
				Ostracoda Subtotal	**277.8**	**48.6**	**191.0**	**555.6**	**20.8**	**0.0**	**13.9**	**277.8**	**361.1**	**222.2**	**250.0**	**55.6**	**6.9**	**694.4**	**34.7**	**6.9**	**59.0**	**444.4**	**194.4**	**253.5**	**312.5**	**111.1**
Collembola	Sminthuridae	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Collembola Subtotal	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Ephemeroptera	Ameletidae	-	-	*Ameletus*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Baetidae	-	-	*Baetis*	0.0	3.5	0.0	0.0	0.0	41.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Ephemerellidae	-	-	*Ephemerella*	3.5	3.5	3.5	0.0	6.9	472.2	31.3	0.0	0.0	0.0	0.0	0.0	0.0	6.9	0.0	3.5	20.8	3.5	0.0	0.0	0.0	0.0
	Heptageniidae	-	-	*Heptagenia*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Ephemeroptera Subtotal	**3.5**	**6.9**	**3.5**	**0.0**	**6.9**	**513.9**	**31.3**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**6.9**	**0.0**	**3.5**	**20.8**	**3.5**	**0.0**	**0.0**	**0.0**	**0.0**
Plecoptera	Nemouridae	-	-	*Nemoura*	27.8	0.0	0.0	0.0	0.0	97.2	20.8	66.0	3.5	0.0	3.5	0.0	0.0	0.0	0.0	3.5	3.5	17.4	72.9	138.9	55.6	62.5
	Perlodidae	-	-	*Isoperla*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0
		-	-	*Skwala*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Plecoptera Subtotal	**27.8**	**0.0**	**0.0**	**0.0**	**0.0**	**97.2**	**20.8**	**66.0**	**3.5**	**0.0**	**3.5**	**0.0**	**0.0**	**0.0**	**0.0**	**3.5**	**3.5**	**17.4**	**72.9**	**142.4**	**55.6**	**62.5**
Trichoptera		-	-	(i/d)	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Brachycentridae	-	-	*Brachycentrus*	0.0	31.3	3.5	17.4	93.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Hydroptilidae	-	-	*Agraylea*	0.0	0.0	0.0	10.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	3.5	6.9	0.0	0.0	0.0	0.0	3.5	0.0
		-	-	*Oxyethira*	3.5	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Leptoceridae			*Ceraclea*	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		-	-	*Mystacides*	0.0	0.0	0.0	10.4	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Limnephilidae	-	-	(i/d)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0
				Limnephilus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0
		-	-	*Grensia praeterica*	10.4	0.0	0.0	3.5	13.9	0.0	10.4	6.9	0.0	3.5	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.3	0.0	0.0
	Phryganeidae	-	-	*Agrypnia*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Trichoptera Subtotal	**13.9**	**41.7**	**3.5**	**41.7**	**111.1**	**0.0**	**10.4**	**6.9**	**0.0**	**10.4**	**3.5**	**0.0**	**3.5**	**27.8**	**3.5**	**6.9**	**0.0**	**6.9**	**0.0**	**24.3**	**3.5**	**0.0**
Coleoptera	Dytiscidae	-	-	*Agabus*	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		-	-	*Hydroporus*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		-	-	*Oreodytes*	0.0	10.4	0.0	3.5	3.5	0.0	0.0	17.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	3.5	0.0	0.0
	Haliplidae	-	-	*Haliplus*	0.0	0.0	0.0	0.0	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.8	0.0	0.0	0.0	0.0	0.0	31.3	3.5	0.0
				Coleoptera Subtotal	**0.0**	**13.9**	**0.0**	**3.5**	**10.4**	**0.0**	**0.0**	**17.4**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**27.8**	**0.0**	**0.0**	**3.5**	**0.0**	**0.0**	**34.7**	**3.5**	**0.0**
Hemiptera	Corixidae	-	-	(i/d)	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Hemiptera Subtotal	**0.0**	**0.0**	**0.0**	**3.5**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Diptera	Chironomidae	-	-	(pupa)	0.0	0.0	0.0	69.4	0.0	83.3	41.7	27.8	0.0	27.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	27.8
		Tanypodinae	Pentaneurini	*Ablabesmyia*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.7	0.0
				Thienemannimyia group	503.5	180.6	277.8	100.7	128.5	111.1	27.8	163.2	76.4	41.7	17.4	0.0	27.8	420.1	27.8	34.7	76.4	66.0	72.9	166.7	48.6	3.5
			Procladiini	*Procladius*	0.0	0.0	17.4	97.2	0.0	13.9	27.8	38.2	0.0	149.3	6.9	13.9	3.5	0.0	0.0	0.0	0.0	3.5	10.4	0.0	6.9	62.5
		Diamesinae	Diamesini	*Diamesa*	0.0	0.0	0.0	0.0	0.0	2805.6	319.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Potthastia longimana group	0.0	0.0	0.0	0.0	10.4	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	27.8	6.9	3.5	10.4	27.8	0.0	55.6	0.0	0.0
		Orthocladiinae	Orthocladiini	(i/d)	0.0	0.0	0.0	0.0	0.0	27.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	55.6	0.0	0.0
				Acamptocladius dentolatens	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Cricotopus/Orthocladius	0.0	0.0	0.0	0.0	10.4	2194.4	388.9	197.9	0.0	27.8	0.0	41.7	0.0	55.6	10.4	45.1	48.6	222.2	27.8	222.2	191.0	55.6
				Corynoneura	0.0	0.0	17.4	0.0	0.0	0.0	13.9	0.0	0.0	27.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Eukiefferiella	0.0	6.9	34.7	6.9	27.8	680.6	125.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Euryhapsis	3.5	17.4	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.8	0.0	0.0	17.4	3.5	0.0	0.0	0.0	0.0
				Heterotanytarsus	0.0	6.9	0.0	6.9	10.4	0.0	17.4	27.8	0.0	0.0	0.0	13.9	3.5	27.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Data represents organisms/m²

i/d = immature or damaged individuals

**These taxa were not included in the total density calculation or other data analysis.*

Environment Canada (2011) states that as nematodes and copepods are meiofauna, samples using 500µm mesh will not be representative so should be excuded from analysis.

Cladocera (water fleas) are mobile, and were not considered permanent members of the benthos so were excluded form analysis.

The terrestrial organisms found in these samples were adult chironomids or midges which probably got into to sample during sieving.

Appendix 3.7-5. Stream Benthos Density and Taxonomic Results, Back River Project, 2011

					Chair OF					Llama OF		Giraffe OF					Wolf Of					Goose OF				
					13-Aug-11					17-Aug-11		12-Aug-11					13-Aug-11					16-Aug-11				
Major Group	Family	Subfamily	Tribe	Genus	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5	Rep-1	Rep-2	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5
Diptera	Chironomidae	Orthocladiinae	Orthocladiini	*Heterotrissocladius*	0.0	0.0	17.4	69.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.8	0.0	0.0	0.0
				Parakiefferiella	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	13.9	27.8	0.0	0.0	0.0	0.0	86.8	0.0	0.0	194.4
				Psectrocladius	27.8	0.0	0.0	0.0	3.5	13.9	0.0	368.1	13.9	86.8	69.4	27.8	6.9	0.0	0.0	0.0	3.5	145.8	83.3	59.0	20.8	3.5
				Pseudosmittia	0.0	0.0	0.0	0.0	72.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.8	6.9	6.9	6.9	0.0	0.0	6.9	0.0	0.0
				Tvetenia	0.0	0.0	34.7	0.0	27.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Zalutschia	0.0	0.0	0.0	0.0	3.5	0.0	138.9	0.0	41.7	166.7	69.4	69.4	0.0	0.0	0.0	0.0	0.0	27.8	27.8	0.0	0.0	55.6
		Chironominae	Chironomini	(i/d)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.8	0.0	0.0
				Chironomus	31.3	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Cryptochironomus	3.5	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.4	0.0	0.0	3.5	10.4
				Demicryptochironomus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.8	3.5	83.3	3.5	0.0	0.0	0.0	3.5	3.5	0.0	0.0
				Dicrotendipes	0.0	3.5	10.4	69.4	83.3	0.0	0.0	34.7	41.7	17.4	0.0	6.9	10.4	861.1	90.3	79.9	69.4	0.0	0.0	3.5	3.5	0.0
				Parachironomus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	454.9	52.1	27.8
				Polypedilum	430.6	3.5	225.7	2152.8	24.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	364.6	0.0	0.0	0.0	111.1	0.0	0.0	17.4	0.0
				Saetheria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	83.3	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0
				Stictochironomus	0.0	0.0	0.0	6.9	0.0	0.0	3.5	0.0	0.0	0.0	3.5	0.0	13.9	156.3	0.0	0.0	0.0	52.1	107.6	6.9	13.9	364.6
			Pseudochironomini	*Pseudochironomus*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Tanytarsini	(i/d)	3.5	0.0	0.0	69.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Cladotanytarsus	111.1	3.5	86.8	972.2	10.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Micropsectra	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Micropsectra / Tanytarsus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Paratanytarsus	0.0	3.5	0.0	0.0	45.1	0.0	13.9	2506.9	322.9	527.8	125.0	618.1	3.5	253.5	17.4	13.9	24.3	267.4	204.9	111.1	322.9	500.0
				Rheotanytarsus	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Stempellina	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Tanytarsus	138.9	0.0	34.7	1041.7	0.0	69.4	0.0	55.6	0.0	27.8	0.0	0.0	0.0	0.0	0.0	0.0	13.9	0.0	55.6	3.5	0.0	27.8
	Ceratopogonidae	Ceratopogoninae	-	*Bezzia*	0.0	0.0	0.0	3.5	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	6.9	0.0	0.0	0.0	10.4	34.7	13.9	3.5
			-	*Culicoides*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Empididae	-	-	(pupa)	3.5	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		-	-	*Chelifera*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.4	3.5	3.5	0.0	13.9
		-	-	*Clinocera*	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Muscidae	-	-	*Limnophora*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.3	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Simulidae	-	-	(pupa)	0.0	0.0	0.0	0.0	0.0	13.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Tipulidae	-	-	*Limnophila*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0
		-	-	*Tipula*	104.2	34.7	31.3	55.6	0.0	27.8	41.7	17.4	0.0	0.0	0.0	3.5	27.8	0.0	0.0	0.0	27.8	20.8	31.3	111.1	38.2	3.5
				Diptera Subtotal	**1361.1**	**260.4**	**791.7**	**4729.2**	**465.3**	**6041.7**	**1163.2**	**3479.2**	**510.4**	**1107.6**	**291.7**	**850.7**	**114.6**	**2416.7**	**170.1**	**184.0**	**302.1**	**972.2**	**756.9**	**1326.4**	**770.8**	**1354.2**
				TOTAL BENTHOS	**2010.4**	**597.2**	**1159.7**	**5756.9**	**822.9**	**7347.2**	**1388.9**	**4041.7**	**930.6**	**1392.4**	**576.4**	**1062.5**	**131.9**	**3760.4**	**239.6**	**270.8**	**437.5**	**1576.4**	**1298.6**	**2066.0**	**1965.3**	**1670.1**
Non Macrobenthic Invertebrates*																										
Nematoda	-	-	-	-	34.7	52.1	24.3	3.5	34.7	69.4	34.7	27.8	13.9	0.0	0.0	0.0	34.7	229.2	0.0	6.9	31.3	170.1	111.1	232.6	118.1	0.0
				Nematoda Subtotal	**34.7**	**52.1**	**24.3**	**3.5**	**34.7**	**69.4**	**34.7**	**27.8**	**13.9**	**0.0**	**0.0**	**0.0**	**34.7**	**229.2**	**0.0**	**6.9**	**31.3**	**170.1**	**111.1**	**232.6**	**118.1**	**0.0**
Copepoda - Cyclopoida	Cyclopidae	Cyclopinae	-	*Acanthocyclops*	444.4	38.2	208.3	763.9	66.0	0.0	69.4	194.4	125.0	55.6	13.9	69.4	10.4	416.7	24.3	10.4	27.8	166.7	31.3	27.8	34.7	27.8
	Ergasilidae	-	-	*Ergasilus*	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.8	0.0	0.0	0.0
				Copepoda - Cyclopoida Subtotal	**444.4**	**38.2**	**208.3**	**763.9**	**66.0**	**0.0**	**72.9**	**194.4**	**125.0**	**55.6**	**13.9**	**69.4**	**10.4**	**416.7**	**24.3**	**10.4**	**27.8**	**166.7**	**59.0**	**27.8**	**34.7**	**27.8**
Cladocera	Chydoridae	-	-	*Eurycercus*	121.5	62.5	114.6	802.1	62.5	69.4	45.1	90.3	48.6	111.1	17.4	13.9	3.5	656.3	17.4	20.8	24.3	118.1	118.1	55.6	0.0	201.4
	Chydoridae	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	138.9	27.8	0.0	0.0	13.9	52.1	27.8	6.9	3.5	3.5	138.9	194.4	111.1	17.4	0.0
	Macrothricidae	-	-	-	250.0	3.5	34.7	416.7	0.0	0.0	0.0	250.0	222.2	305.6	250.0	97.2	0.0	55.6	3.5	3.5	0.0	194.4	222.2	222.2	17.4	555.6
				Cladocera Subtotal	**371.5**	**66.0**	**149.3**	**1218.8**	**62.5**	**69.4**	**45.1**	**479.2**	**298.6**	**416.7**	**267.4**	**125.0**	**55.6**	**739.6**	**27.8**	**27.8**	**27.8**	**451.4**	**534.7**	**388.9**	**34.7**	**756.9**
Terrestrial	-	-	-	-	13.9	0.0	3.5	17.4	3.5	13.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fish	Gasterosteidae	-	-	*Pungitius pungitius* (Ninespine Stickleback)	0.0	0.0	17.4	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				TOTAL CAPTURED	2875.0	753.5	1562.5	7763.9	989.6	7500.0	1541.7	4743.1	1368.1	1864.6	857.6	1256.9	232.6	5145.8	291.7	316.0	524.3	2364.6	2003.5	2715.3	2152.8	2454.9

Data represents organisms/m²

i/d = immature or damaged individuals

**These taxa were not included in the total density calculation or other data analysis.*

Environment Canada (2011) states that as nematodes and copepods are meiofauna, samples using 500 µm mesh will not be representative so should be excuded from analysis.

Cladocera (water fleas) are mobile, and were not considered permanent members of the benthos so were excluded form analysis.

The terrestrial organisms found in these samples were adult chironomids or midges which probably got into to sample during sieving.

Appendix 3.7-5. Stream Benthos Density and Taxonomic Results, Back River Project, 2011

					Propellor OF					Propellor D/S					Ref. B OF				
					16-Aug-11					15-Aug-11					17-Aug-11				
Major Group	Family	Subfamily	Tribe	Genus	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5
Coelenterata	Hydridae	-	-	*Hydra*	0.0	0.0	0.0	0.0	83.3	10.4	13.9	0.0	13.9	13.9	0.0	0.0	0.0	0.0	0.0
				Coelenterata Subtotal	**0.0**	**0.0**	**0.0**	**0.0**	**83.3**	**10.4**	**13.9**	**0.0**	**13.9**	**13.9**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Oligochaeta	Enchytraeidae	-	-	-	0.0	0.0	0.0	0.0	0.0	3.5	0.0	6.9	3.5	13.9	55.6	10.4	6.9	27.8	83.3
	Lumbriculidae	-	-	-	3.5	3.5	0.0	3.5	0.0	6.9	3.5	20.8	17.4	17.4	59.0	27.8	31.3	52.1	72.9
	Naididae	Naidinae	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.9	13.9	27.8	0.0	0.0	0.0	0.0
		Tubificinae	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	281.3	142.4	66.0	55.6	215.3
				Oligochaeta Subtotal	**3.5**	**3.5**	**0.0**	**3.5**	**0.0**	**10.4**	**3.5**	**27.8**	**34.7**	**45.1**	**423.6**	**180.6**	**104.2**	**135.4**	**371.5**
Gastropoda	Physidae	-	-	*Physa*	0.0	0.0	0.0	0.0	0.0	72.9	41.7	45.1	27.8	138.9	0.0	0.0	0.0	0.0	0.0
	Valvatidae	-	-	*Valvata sincera*	55.6	118.1	3.5	97.2	340.3	0.0	3.5	0.0	13.9	0.0	0.0	0.0	0.0	0.0	0.0
				Gastropoda Subtotal	**55.6**	**118.1**	**3.5**	**97.2**	**340.3**	**72.9**	**45.1**	**45.1**	**41.7**	**138.9**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Hydracarina	-	-	-	-	0.0	3.5	0.0	83.3	128.5	34.7	62.5	72.9	145.8	34.7	86.8	62.5	166.7	0.0	138.9
				Hydracarina Subtotal	**0.0**	**3.5**	**0.0**	**83.3**	**128.5**	**34.7**	**62.5**	**72.9**	**145.8**	**34.7**	**86.8**	**62.5**	**166.7**	**0.0**	**138.9**
Ostracoda	-	-	-	-	114.6	250.0	361.1	138.9	777.8	107.6	66.0	62.5	197.9	83.3	27.8	62.5	0.0	27.8	55.6
				Ostracoda Subtotal	**114.6**	**250.0**	**361.1**	**138.9**	**777.8**	**107.6**	**66.0**	**62.5**	**197.9**	**83.3**	**27.8**	**62.5**	**0.0**	**27.8**	**55.6**
Collembola	Sminthuridae	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.8
				Collembola Subtotal	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**27.8**
Ephemeroptera	Ameletidae	-	-	*Ameletus*	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	27.8	0.0	0.0	0.0	0.0	0.0	0.0
	Baetidae	-	-	*Baetis*	0.0	3.5	0.0	0.0	27.8	3.5	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0
	Ephemerellidae	-	-	*Ephemerella*	0.0	38.2	3.5	55.6	152.8	38.2	31.3	6.9	31.3	38.2	3.5	0.0	0.0	0.0	0.0
	Heptageniidae	-	-	*Heptagenia*	0.0	0.0	0.0	0.0	0.0	10.4	10.4	0.0	13.9	0.0	0.0	0.0	0.0	0.0	0.0
				Ephemeroptera Subtotal	**0.0**	**41.7**	**3.5**	**55.6**	**180.6**	**55.6**	**41.7**	**6.9**	**76.4**	**38.2**	**3.5**	**0.0**	**0.0**	**0.0**	**0.0**
Plecoptera	Nemouridae	-	-	*Nemoura*	6.9	3.5	0.0	3.5	6.9	24.3	10.4	6.9	45.1	52.1	0.0	3.5	3.5	0.0	0.0
	Perlodidae	-	-	*Isoperla*	0.0	0.0	0.0	0.0	0.0	10.4	17.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		-	-	*Skwala*	0.0	0.0	0.0	0.0	0.0	0.0	10.4	3.5	3.5	0.0	0.0	0.0	0.0	0.0	0.0
				Plecoptera Subtotal	**6.9**	**3.5**	**0.0**	**3.5**	**6.9**	**34.7**	**38.2**	**10.4**	**48.6**	**52.1**	**0.0**	**3.5**	**3.5**	**0.0**	**0.0**
Trichoptera		-	-	(i/d)	0.0	0.0	0.0	0.0	27.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Brachycentridae	-	-	*Brachycentrus*	3.5	17.4	10.4	232.6	55.6	0.0	3.5	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Hydroptilidae	-	-	*Agraylea*	10.4	59.0	10.4	41.7	27.8	10.4	6.9	10.4	34.7	6.9	0.0	0.0	0.0	0.0	0.0
		-	-	*Oxyethira*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Leptoceridae			*Ceraclea*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		-	-	*Mystacides*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.9	0.0	0.0	0.0	0.0	0.0	0.0
	Limnephilidae	-	-	(i/d)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Limnephilus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		-	-	*Grensia praeterica*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Phryganeidae	-	-	*Agrypnia*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.9	0.0	0.0	0.0
				Trichoptera Subtotal	**13.9**	**76.4**	**20.8**	**274.3**	**111.1**	**10.4**	**10.4**	**17.4**	**48.6**	**6.9**	**0.0**	**6.9**	**0.0**	**0.0**	**0.0**
Coleoptera	Dytiscidae	-	-	*Agabus*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		-	-	*Hydroporus*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0
		-	-	*Oreodytes*	0.0	3.5	3.5	3.5	0.0	0.0	0.0	0.0	6.9	24.3	0.0	0.0	0.0	0.0	0.0
	Haliplidae	-	-	*Haliplus*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.2
				Coleoptera Subtotal	**0.0**	**3.5**	**3.5**	**3.5**	**0.0**	**0.0**	**0.0**	**0.0**	**6.9**	**24.3**	**0.0**	**0.0**	**3.5**	**0.0**	**38.2**
Hemiptera	Corixidae	-	-	(i/d)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Hemiptera Subtotal	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Diptera	Chironomidae	-	-	(pupa)	0.0	31.3	0.0	0.0	55.6	3.5	10.4	6.9	17.4	13.9	0.0	27.8	0.0	0.0	0.0
		Tanypodinae	Pentaneurini	*Ablabesmyia*	55.6	31.3	0.0	55.6	27.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Thienemannimyia group	20.8	125.0	62.5	55.6	76.4	187.5	156.3	232.6	319.4	350.7	55.6	34.7	66.0	3.5	17.4
			Procladiini	*Procladius*	31.3	27.8	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	66.0	6.9	6.9	128.5
		Diamesinae	Diamesini	*Diamesa*	3.5	10.4	6.9	17.4	13.9	0.0	3.5	0.0	0.0	0.0	59.0	0.0	0.0	0.0	0.0
				Potthastia longimana group	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Orthocladiinae	Orthocladiini	(i/d)	0.0	0.0	3.5	0.0	27.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Acamptocladius dentolatens	27.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Cricotopus/Orthocladius	441.0	770.8	454.9	1423.6	1208.3	66.0	145.8	111.1	204.9	97.2	0.0	3.5	0.0	55.6	0.0
				Corynoneura	0.0	0.0	0.0	27.8	55.6	0.0	0.0	0.0	13.9	0.0	0.0	0.0	0.0	0.0	0.0
				Eukiefferiella	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Euryhapsis	0.0	0.0	0.0	0.0	0.0	125.0	208.3	100.7	441.0	114.6	0.0	0.0	0.0	0.0	0.0
				Heterotanytarsus	0.0	0.0	0.0	0.0	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Data represents organisms/m²

i/d = immature or damaged individuals

**These taxa were not included in the total density calculation or other data analysis.*

Environment Canada (2011) states that as nematodes and copepods are meiofauna, samples using 500µm mesh will not be representative so should be excuded from analysis.

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Appendix 3.7-5. Stream Benthos Density and Taxonomic Results, Back River Project, 2011

					Propellor OF					Propellor D/S					Ref. B OF				
					16-Aug-11					15-Aug-11					17-Aug-11				
Major Group	Family	Subfamily	Tribe	Genus	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5	Rep-1	Rep-2	Rep-3	Rep-4	Rep-5
Diptera	Chironomidae	Orthocladiinae	Orthocladiini	*Heterotrissocladius*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Parakiefferiella	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.9	0.0	0.0	0.0	0.0	0.0	0.0
				Psectrocladius	524.3	1270.8	281.3	277.8	423.6	3.5	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0
				Pseudosmittia	27.8	0.0	0.0	0.0	0.0	0.0	0.0	6.9	13.9	0.0	0.0	0.0	0.0	0.0	0.0
				Tvetenia	0.0	31.3	0.0	0.0	27.8	0.0	0.0	6.9	17.4	0.0	0.0	0.0	0.0	0.0	0.0
				Zalutschia	586.8	55.6	27.8	166.7	347.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Chironominae	Chironomini	(i/d)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Chironomus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.8
				Cryptochironomus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.4	3.5	0.0	20.8
				Demicryptochironomus	0.0	0.0	0.0	0.0	0.0	6.9	0.0	3.5	0.0	0.0	0.0	0.0	0.0	6.9	3.5
				Dicrotendipes	90.3	111.1	17.4	229.2	243.1	0.0	6.9	191.0	201.4	253.5	0.0	3.5	31.3	0.0	3.5
				Parachironomus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Polypedilum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.3	38.2	0.0	0.0	336.8
				Saetheria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Stictochironomus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	17.4	6.9	0.0	27.8
			Pseudochironomini	*Pseudochironomus*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.8
			Tanytarsini	(i/d)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.9	0.0	0.0	0.0	0.0	0.0	0.0
				Cladotanytarsus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55.6	208.3	27.8	309.0	1114.6
				Micropsectra	0.0	0.0	3.5	0.0	0.0	0.0	0.0	13.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Micropsectra / Tanytarsus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Paratanytarsus	597.2	708.3	159.7	586.8	708.3	0.0	6.9	34.7	86.8	27.8	0.0	0.0	0.0	0.0	0.0
				Rheotanytarsus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.8	0.0	0.0	0.0
				Stempellina	0.0	0.0	0.0	0.0	0.0	38.2	10.4	0.0	27.8	41.7	0.0	0.0	0.0	0.0	0.0
				Tanytarsus	83.3	0.0	0.0	0.0	0.0	13.9	20.8	20.8	69.4	0.0	0.0	173.6	55.6	83.3	333.3
	Ceratopogonidae	Ceratopogoninae	-	*Bezzia*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	149.3	357.6	59.0	31.3	180.6
			-	*Culicoides*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.8	0.0	3.5
	Empididae	-	-	(pupa)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		-	-	*Chelifera*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		-	-	*Clinocera*	0.0	0.0	0.0	0.0	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Muscidae	-	-	*Limnophora*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0
	Simulidae	-	-	(pupa)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Tipulidae	-	-	*Limnophila*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.8	0.0	0.0	0.0	10.4
		-	-	*Tipula*	0.0	3.5	0.0	0.0	0.0	6.9	0.0	6.9	27.8	17.4	3.5	0.0	0.0	0.0	0.0
				Diptera Subtotal	**2489.6**	**3177.1**	**1017.4**	**2840.3**	**3229.2**	**458.3**	**569.4**	**739.6**	**1468.8**	**916.7**	**385.4**	**972.2**	**284.7**	**496.5**	**2236.1**
				TOTAL BENTHOS	**2684.0**	**3677.1**	**1409.7**	**3500.0**	**4857.6**	**795.1**	**850.7**	**982.6**	**2083.3**	**1354.2**	**927.1**	**1288.2**	**562.5**	**659.7**	**2868.1**
Non Macrobenthic Invertebrates*																			
Nematoda	-	-	-	-	59.0	194.4	27.8	27.8	55.6	59.0	142.4	45.1	121.5	55.6	256.9	576.4	291.7	645.8	753.5
				Nematoda Subtotal	**59.0**	**194.4**	**27.8**	**27.8**	**55.6**	**59.0**	**142.4**	**45.1**	**121.5**	**55.6**	**256.9**	**576.4**	**291.7**	**645.8**	**753.5**
Copepoda - Cyclopoida	Cyclopidae	Cyclopinae	-	*Acanthocyclops*	55.6	0.0	0.0	0.0	27.8	38.2	0.0	41.7	69.4	27.8	83.3	281.3	361.1	83.3	388.9
	Ergasilidae	-	-	*Ergasilus*	0.0	10.4	3.5	0.0	20.8	0.0	0.0	0.0	0.0	0.0	27.8	83.3	83.3	55.6	0.0
				Copepoda - Cyclopoida Subtotal	**55.6**	**10.4**	**3.5**	**0.0**	**48.6**	**38.2**	**0.0**	**41.7**	**69.4**	**27.8**	**111.1**	**364.6**	**444.4**	**138.9**	**388.9**
Cladocera	Chydoridae	-	-	*Eurycercus*	34.7	222.2	0.0	0.0	83.3	0.0	3.5	0.0	45.1	0.0	0.0	0.0	0.0	0.0	3.5
	Chydoridae	-	-	-	222.2	305.6	111.1	0.0	0.0	0.0	0.0	6.9	13.9	27.8	0.0	0.0	0.0	27.8	0.0
	Macrothricidae	-	-	-	444.4	194.4	27.8	0.0	55.6	0.0	0.0	6.9	0.0	0.0	0.0	27.8	27.8	55.6	55.6
				Cladocera Subtotal	**701.4**	**722.2**	**138.9**	**0.0**	**138.9**	**0.0**	**3.5**	**13.9**	**59.0**	**27.8**	**0.0**	**27.8**	**27.8**	**83.3**	**59.0**
Terrestrial	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	3.5	0.0	3.5	0.0
Fish	Gasterosteidae	-	-	*Pungitius pungitius* (Ninespine Stickleback)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				TOTAL CAPTURED	3500.0	4604.2	1579.9	3527.8	5100.7	892.4	1000.0	1083.3	2333.3	1465.3	1295.1	2260.4	1326.4	1531.3	4069.4

Data represents organisms/m²

i/d = immature or damaged individuals

**These taxa were not included in the total density calculation or other data analysis.*

Environment Canada (2011) states that as nematodes and copepods are meiofauna, samples using 500 µm mesh will not be representative so should be excuded from analysis.

Cladocera (water fleas) are mobile, and were not considered permanent members of the benthos so were excluded form analysis.

The terrestrial organisms found in these samples were adult chironomids or midges which probably got into to sample during sieving.

Appendix 3.7-6

Stream Benthos Richness and Diversity Results, Back River Project, 2011

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Appendix 3.7-6. Stream Benthos Richness and Diversity Results, Back River Project, 2011

Stream	Replicate	Date Sampled	Richness (families/sample)	Diversity (Simpson's Index)
Chair OF	1	13-Aug-11	12	0.57
	2	13-Aug-11	13	0.75
	3	13-Aug-11	9	0.54
	4	13-Aug-11	14	0.33
	5	13-Aug-11	12	0.63
Llama OF	1	17-Aug-11	8	0.32
	2	17-Aug-11	9	0.34
Giraffe OF	1	12-Aug-11	12	0.28
	2	12-Aug-11	5	0.55
	3	12-Aug-11	7	0.34
	4	12-Aug-11	5	0.55
	5	12-Aug-11	7	0.35
Wolf OF	1	13-Aug-11	6	0.52
	2	13-Aug-11	7	0.54
	3	13-Aug-11	6	0.50
	4	13-Aug-11	6	0.48
	5	13-Aug-11	7	0.57
Goose OF	1	16-Aug-11	10	0.56
	2	16-Aug-11	11	0.66
	3	16-Aug-11	15	0.65
	4	16-Aug-11	12	0.75
	5	16-Aug-11	10	0.35
Propellor OF	1	16-Aug-11	7	0.14
	2	16-Aug-11	12	0.25
	3	16-Aug-11	7	0.41
	4	16-Aug-11	10	0.33
	5	16-Aug-11	11	0.52
Propellor D/S	1	15-Aug-11	15	0.64
	2	15-Aug-11	13	0.54
	3	15-Aug-11	13	0.43
	4	15-Aug-11	19	0.51
	5	15-Aug-11	13	0.54
Ref. B OF	1	17-Aug-11	10	0.80
	2	17-Aug-11	9	0.68
	3	17-Aug-11	8	0.75
	4	17-Aug-11	6	0.48
	5	17-Aug-11	10	0.48

Appendix 3.7-7

Lake and Stream Benthos Sorting Efficiencies, Back River Project, 2011

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Appendix 3.7-7. Lake and Stream Benthos Sorting Efficiencies, Back River Project, 2011

Lake, Depth and Replicate	% Sorting Efficiency
Llama Lake - shallow – C	[1-(0/(86+0))]*100 = 100
Giraffe Lake - shallow - B	[1-(1/(130+1))]*100 = 99.2
Goose Lake Central – deep - D	[1-(3/(333+3))]*100 = 99.1
Reference B Lake - shallow - B	[1-(4/(325+4))]*100 = 98.8
	Average efficiency - 99.3%
Stream and Replicate	
Propellor D/S – A	[1-(4/(257+4))]*100 = 98.5
Wolf OF – E	[1-(3/(151+3))]*100 = 98.1
Chair OF – E	[1-(6/(285+6))]*100 = 97.9
Giraffe OF – B	[1-(8/(394+8))]*100 = 98.0
	Average efficiency - 98.1%

% Sorting Efficiency = [1-(# in QA/AC re-sort / (# sorted originally + # QA/QC resort))] 100*

Appendix V6-3C

Back River Project: 2012 Freshwater Baseline Report

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BACK RIVER PROJECT
2012 Freshwater Baseline Report

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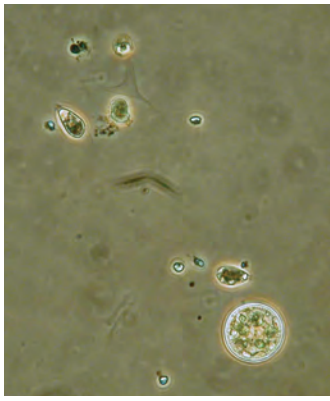

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Rescan™ Engineers & Scientists

December 2012

BACK RIVER PROJECT
2012 FRESHWATER BASELINE REPORT

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Prepared by:

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Vancouver, British Columbia

Executive Summary

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Executive Summary

The Back River Project (the Project) is an exploration gold project owned by Sabina Gold and Silver Corporation (Sabina) located in the West Kitikmeot region of Nunavut. For 2012, Sabina contracted Rescan Environmental Services (Rescan) to conduct a comprehensive baseline program that covered the geographical area of the Goose Property, the George Property, and a Marine Laydown Area located on the southern part of Bathurst Inlet.

The 2012 baseline program was designed around potential infrastructure and known deposits at the Goose Property, the George Property, and the Marine Laydown Area along Bathurst Inlet. It was assumed that access from the Marine Laydown Area to George and Goose properties would be by winter road, and that access between the George and Goose properties would also be by winter road.

This report presents the results from the freshwater portion of the 2012 baseline program. The freshwater baseline program included the sampling of lakes and streams in the Goose and George properties and at two far-field reference locations.

The 2012 freshwater baseline program involved collecting information for the following: lake water quality and physical limnology (under-ice and open water), lake sediment quality, lake phytoplankton, lake zooplankton, lake benthos, stream water quality (freshet, summer and fall), stream sediment quality, stream periphyton, and stream benthos. The program included collecting samples from lakes and streams in areas that could potentially be influenced by the development of known deposits and proposed infrastructure. A reference lake and two reference streams, located well away from known deposits and proposed infrastructure, were also sampled.

A total of 20 lakes (24 sampling sites) and 16 streams (17 sampling sites) were sampled in the Goose and George areas in 2012. Lakes sampled in the Goose Property included Moby, Gander, Pond 19, Big, Rabbit, Fox, Echo, Rascal, Giraffe, Goose and Propellor. Lakes sampled in the George Property included Lower Long, Fold, George, Lytle, Occurrence, Sleigh, Dragon, Komatic and Reference C. Streams sampled in the Goose Property were Moby Outflow, Gander River, Pond 19 Outflow, Chair Watershed Outflow, Llama Watershed Outflow, Echo Watershed Outflow, Giraffe Watershed Outflow, Wolf Watershed Outflow, Goose Watershed Outflow, Propellor Watershed Outflow and Reference B Outflow. Streams sampled within the George Property were George Outflow, Sleigh Outflow, Dragon Outflow, Komatic Inflow and Reference C Outflow.

Lakes tended to be stratified in April and well mixed in August. Dissolved oxygen concentrations at bottom depths were below CCME minimum dissolved oxygen guidelines at most lakes sampled, with lakes in the George Property tending to be below guidelines at all depths in August. Lakes in the study area had slightly acidic to slightly basic pH, with Rabbit Lake and Rascal Lake in August being slightly below the CCME guideline of 6.5. Generally, lakes sampled had low hardness and conductivity. Reference Lake C in April and August and Dragon and Komatic lakes in April had higher hardness values and could be classified as moderately hard. Nutrients were generally low at all lake sampling sites, particularly bioavailable forms, and lake trophic status was usually ultra-oligotrophic to oligotrophic.

All lakes except Lower Long had naturally occurring waters that were higher than CCME guidelines in at least one sample for at least one of the following metals: total aluminum, total cadmium, total copper, total iron, total lead and total nickel. Average concentrations were naturally greater than CCME guidelines for at least one parameter out of aluminum, cadmium, copper, iron and lead at over two

thirds of lakes. The soft waters meant lower hardness-dependent CCME guideline concentrations, which were in some cases lower than achievable analytical detection limits (e.g., for cadmium at Big Lake, Rabbit Lake and Propellor Lake). Goose Property lakes tended to have higher naturally occurring metal concentrations compared to George Property Lakes.

Lake sediments had high concentrations of arsenic, cadmium, chromium, copper, and zinc that often were greater than their respective CCME ISQG. All lakes except Pond 19 had at least one sample greater than the CCME ISQGs for at least one metal, with most lakes having naturally elevated arsenic or copper. Over half of the sampled lakes had average lake sediment arsenic concentrations that were greater than CCME PELs, with the highest average concentrations 16.5 and 20.3 times the PEL (found at Fold and Komatic lakes, within the George Property).

Phytoplankton communities were made up of Chlorophyceae (green algae), Myxophyceae (cyanobacteria), Cryptophyceae (a class of flagellated algae), Bacillariophyceae (diatoms) and Chrysophyceae (golden algae) with compositions and densities varying between April and August samples, and between lakes. Zooplankton communities were mainly composed of rotifers and crustaceans. Rotifers tended to be more dominant in Goose Property lakes, while crustaceans tended to be more dominant in George Property lakes. Benthic communities at all lake sites were dominated by dipterans (true flies) and bivalves (small to tiny clams from the family Sphaeriidae), and densities varied between lakes.

Echo Outflow in the Goose Property was dry during the August sampling, and many of the other streams in both the Goose Property and George Property had dry or underground sections. Streams in August had dissolved oxygen concentrations below 10.0 mg/L, with a third of the sampling sites below the CCME minimum dissolved oxygen guideline for the protection of freshwater aquatic life for early life stages (9.5 mg/L).

Streams and rivers in the study area had slightly acidic to slightly basic pH. The lowest pH values observed were outside of the CCME guideline range for freshwater aquatic health (pH range 6.5 to 9), at Chair Outflow in June (6.1), and Echo Outflow in June and Sept (6.0). Hardness, conductivity and total dissolved solids were low in most streams, although considerably higher in Llama OF and also Reference C Outflow during August and September (moderately hard). Nitrate, nitrite and ammonia concentrations were generally low, often near or below detection limits, with most sites reflecting ultra-oligotrophic to oligotrophic conditions.

All streams except Dragon Outflow and Reference C Outflow had naturally occurring waters that were greater than CCME guidelines in at least one sample for at least one of the following metals: total aluminum, total cadmium, total copper, total iron and total nickel. Average concentrations were greater than CCME guidelines for at least one metal parameter at most streams. Parameters where average stream concentrations were naturally greater than guidelines included aluminum (two streams), cadmium (most streams), copper (almost a third of streams), iron (one stream) and nickel (one stream).

Goose Property streams tended to have higher naturally occurring metal concentrations compared to George Property streams. The small Echo Outflow in the Goose Property had the greatest number of naturally elevated parameters (aluminum, cadmium and copper) with average aluminum concentrations 22 times higher and average cadmium concentrations 18 times higher than the CCME guidelines.

Stream sediments had metal concentrations that were similar or lower than in lake sediments, and in some cases were greater than the CCME ISQGs. Over half of the streams had at least one sediment sample that was naturally greater than the CCME ISQG for at least one of the following metals; arsenic,

chromium and copper. Arsenic was the most commonly naturally elevated metal, with almost half of streams having average concentrations that were greater than ISQGs. Arsenic was the metal most naturally elevated in sediments, and concentrations were above the CCME PEL at Propellor Outflow, George Outflow and Dragon Outflow with the maximum concentration being 3.4 times the PEL.

Periphyton communities were dominated by cyanobacteria and diatoms, and densities varied between streams. Benthos communities were mainly composed of chironomid dipterans (nonbiting midges), and densities also varied between streams with highest densities at Pond 19 Outflow (Goose Property) and Sleigh Outflow (George Property).

A comprehensive summary table of results from all lake and streams sampled in 2012 is included in this report.

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Appendix 4-1. Summary of 2012 Freshwater Baseline Results for Lakes

Appendix 4-2. Summary of 2012 Freshwater Baseline Results for Streams

Glossary and Abbreviations

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Glossary and Abbreviations

Terminology used in this document is defined where it is first used. The following list will assist readers who may choose to review only portions of the document.

°C	Degrees Celsius
ALS	ALS Environmental Services
Autotrophic	Organisms which manufacture their food, usually via photosynthesis
$CaCO_3$	Calcium carbonate
CCME	Canadian Council of Ministers of the Environment
Chl *a*	Chlorophyll *a*
DDI	Double de-ionized water
DGPS	Differential Global Positioning System
EZD	Euphotic Zone Depth
Heterotrophic	Organisms unable to synthesize their own food, e.g., animals and fungi
IDW	Inverse Distance Weighting
IF	Inflow
ISQG	Interim Sediment Quality Guideline
NTU	Nephelometric Turbidity Unit
OF	Outflow
PEL	Probable Effects Level
QA/QC	Quality Assurance and Quality Control
RDL	Realized Detection Limit
RPD	Relative Percent Difference
sp.	Refers to a single species in a genus
spp.	Refers to multiple species within a genus
Thermocline	A section of the water column where the temperature changes rapidly with depth
TIN	Triangular Irregular Network
TKN	Total Kjeldahl Nitrogen
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
TOC	Total Organic Carbon
WAD Cyanide	Weak Acid Dissociable Cyanide

1. Introduction

Rescan™
Engineers and Scientists

1. Introduction

The Back River Project (the Project) is an exploration gold project owned by Sabina Gold and Silver Corporation (Sabina) located in the West Kitikmeot region of Nunavut. Exploration programs were run out of both the Goose and George camps in 2012 (Figure 1-1).

For 2012, Sabina contracted Rescan Environmental Services (Rescan 2011; Rescan 2012a) to conduct a comprehensive baseline program that covered the geographical area of the Goose Property, the George Property, and a Marine Laydown Area located on the southern part of Bathurst Inlet. The following components were included in the 2012 baseline program:

- Meteorology
- Air Quality & Dust
- Noise
- Hydrology & Bathymetry
- Freshwater Water Quality, Sediment Quality, Aquatic Biology
- Freshwater Fish & Fish Habitat
- Marine Water Quality, Sediment Quality, Aquatic Biology
- Marine Fish & Fish Habitat
- Wildlife (Terrestrial & Marine)
- Wildlife DNA Study (Grizzly Bear & Wolverine)
- Ecosystem Mapping
- Vegetation & Wetlands (including Rare Plants)
- Soils & Terrain
- Country Foods
- Archaeology
- Socio-Economics
- Land Use
- Metal Leaching/Acid Rock Drainage (ML/ARD)

The 2012 baseline program was designed around potential infrastructure and known deposits at the Goose Property, the George Property, and the Marine Laydown Area along Bathurst Inlet. It was assumed that access from the Marine Laydown Area to George and Goose properties would be by winter road, and that access between the George and Goose properties would also be by winter road.

This report presents the results from the freshwater portion of the 2012 baseline program. The freshwater baseline program included the sampling of lakes and streams in the Goose and George properties and at two far-field reference locations.

Sabina GOLD & SILVER CORP.

Back River Project Location

Figure 1-1

Rescan™ Engineers & Scientists

For lakes, the sampling program included bathymetry, physical limnology, water quality, sediment quality, phytoplankton communities, zooplankton communities and benthic macroinvertebrate communities.

For streams, the sampling program included temperature and dissolved oxygen, water quality, sediment quality, periphyton communities and benthic macroinvertebrate communities.

Chapter 2 of this report presents the methods, and Chapter 3 of this report presents the results. Chapter 4 presents a summary of all results, and all raw data collected are included as appendices to this report.

2. Methods

2. Methods

2.1 SAMPLING DESIGN

In 2012, baseline data were collected from lakes and streams within the Goose and George Properties. Sampling sites were selected based on the proposed infrastructure and known deposits as shown in Figure 2.1-1. A reference lake (George Property) and two reference streams (Goose and George Properties) well away from potential infrastructure were also sampled. Two years of baseline data are already available for the reference lake associated with the Goose Property, Reference Lake B (Rescan 2011; Rescan 2012a).

The following components were sampled as part of the 2012 freshwater baseline program.

Lakes

- Bathymetry
- Physical Limnology
- Water Quality
- Sediment Quality
- Phytoplankton Communities
- Zooplankton Communities
- Benthic Macroinvertebrate Communities

Streams

- Water Quality
- Temperature And Dissolved Oxygen
- Sediment Quality
- Periphyton Communities
- Benthic Macroinvertebrate Communities

The sampling locations for lakes and streams are shown in Figure 2.1-1 and presented in Tables 2.1-1 and 2.1-2. The dates when each component was sampled are provided in Tables 2.1-3 and 2.1-4, and sampling details are provided in Table 2.1-5.

Sampling was conducted during April (under-ice) and August (open-water) of 2012 at lakes, and during June (freshet), August (summer), and September (fall) of 2012 at streams. Overall 24 lakes and 17 streams were sampled in total.

Lakes were selected that could be affected by proposed infrastructure (Figure 2.1-1). Table 2.1-6 outlines the rationale for each lake site. Within each lake, sampling locations were selected either where historical data existed, or in the deepest section in the lake, or in a spatially significant location (i.e., a central location where water from multiple inflows mix). April sampling occurred near the middle of the lake, or in the middle of any obvious basins as estimated by the topography if no bathymetric information or prior sampling history was available. August sampling locations were moved when new bathymetric information collected in July found deeper or more suitable sites.

Table 2.1-1. Sampling Locations in Lakes, Back River Project, 2012

Watershed	Lake Site Name	Abbreviated Name	April		August	
			Easting	Northing	Easting	Northing
Goose Area						
Moby	Moby Lake	Moby	419608	7267004	419683	7267187
Gander	Gander Lake	Gander	424020	7261516	424915	7261016
Big	Pond 19	Pond 19	430324	7265782	430338	7265844
Big	Big Lake	Big	426647	7269386	425421	7269247
Llama	Rabbit Lake	Rabbit	431916	7265216	431382	7265621
Llama	Fox Lake	Fox	431051	7266506	431248	7266944
Echo	Echo Lake	Echo	432425	7268344	432401	7268312
Wolf	Rascal Lake	Rascal	434056	7267445	434107	7267369
Giraffe	Giraffe Lake North	Giraffe North	432210	7272642	same as winter	
Giraffe	Giraffe Lake South	Giraffe South	432709	7271906	432730	7271819
Goose	Goose Lake Neck	Goose Neck	432944	7270323	same as winter	
Goose	Goose Lake Central	Goose Central	433887	7270990	same as winter	
Goose	Goose Lake Tail	Goose Tail	434645	7271418	434487	7271355
Propellor	Propellor Lake	Propellor	435154	7274437	same as winter	
George Area						
Long	Lower Long Lake	Lower Long	387165	7316913	same as winter	
George	Fold Lake	Fold	388780	7314053	same as winter	
George	George Lake Central	George Central	388063	7313739	388076	7313844
George	George Lake South	George South	388271	7313310	388274	7313299
George	Lytle Lake	Lytle	386924	7313881	386867	7314138
George	Occurrence Lake	Occurrence	387540	7313175	387692	7313112
George	Sleigh Lake	Sleigh	387945	7312652	388005	7312627
George	Dragon Lake	Dragon	390729	7310736	same as winter	
George	Komatic Lake	Komatic	391575	7308605	same as winter	
Reference C	Reference Lake C	Reference C	395127	7336790	395766	7336279

Notes:

April sampling at the Goose Lake Central and George Lake Central sites were moved by approximately 75 m to avoid ice airstrips.

All co-ordinates are UTM Zone 13N.

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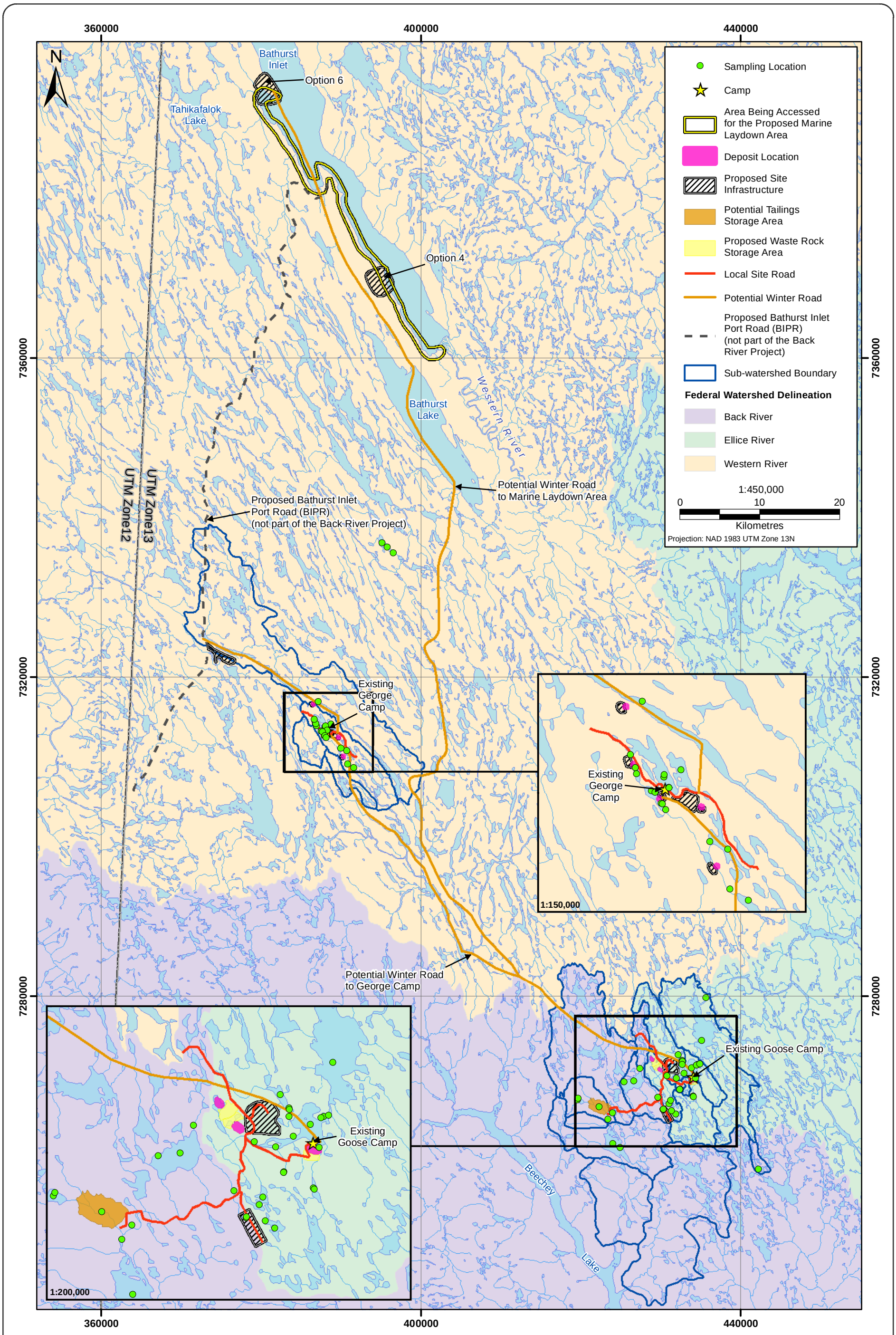

Figure 2.1-1

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Overview of Lake and Stream Sampling Locations, Back River Project, 2012

Figure 2.1-1

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Table 2.1-2. Sampling Locations in Streams, Back River Project, 2012

Watershed	Stream Site Name	Abbreviated Name	Name Used on Field Sheets, Workplan etc.	June		August		September	
				Easting	Northing	Easting	Northing	Easting	Northing
Goose Area									
Moby	Moby Outflow	Moby OF	Mn-01 OF	422563	7266158	422297	7266127	422367	7266117
Moby	Gander Inflow	Gander IF	Mn-02 OF	423350	7264244	423413	7264584	423413	7264456
Swan	Gander River Upstream	Gander US	Mn-02 US	423952	7265362	423968	7265386	423925	7265342
Big	Pond 19 Outflow	Pond 19 OF	-	429629	7267368	429650	7267296	429637	7267316
Chair	Chair Watershed Outflow	Chair OF	-	427380	7270929	427385	7270934	427382	7270928
Llama	Llama Watershed Outflow	Llama OF	-	430778	7270008	430776	7270012	430785	7270001
Echo	Echo Watershed Outflow	Echo OF	-	431993	7269678	431972	7269728	431985	7269715
Giraffe	Giraffe Watershed Outflow	Giraffe OF	-	432743	7271454	432709	7271427	432779	7271448
Wolf	Wolf Watershed Outflow	Wolf OF	-	434364	7269670	434379	7269696	434366	7269664
Goose	Goose Watershed Outflow	Goose OF	-	434904	7271495	434908	7271500	434853	7271453
Propellor	Propellor Watershed Outflow	Propellor OF	-	435684	7279797	435671	7279808	435705	7279836
Reference B	Reference B Outflow	Reference B OF	-	442556	725779	442226	7258310	442547	7257779
George Area									
George	George Outflow	George OF	-	386695	7314655	386671	7314688	386657	7314585
George	Sleigh Outflow	Sleigh OF	-	388153	7312405	388141	7312386	388489	7312024
George	Dragon Outflow	Dragon OF	-	390003	7311042	389983	7311054	389996	7311036
George	Komatic Inflow	Komatic IF	-	391021	7309005	390823	7309071	390909	7309035
Reference C	Reference C Outflow	Reference C OF	-	396595	7335509	396532	7335544	396543	7335549

Notes:

Echo OF was completely dry during August sampling.

All co-ordinates are UTM Zone 13N.

Table 2.1-3. Sampling Dates for Lakes, Back River Project, 2012

Watershed	Site	Bathymetry	Water Quality and Limnology		Sediment Quality	August Aquatic Biology		
			April	August	August	Phytoplankton	Zooplankton	Benthos
Goose Area								
Moby	Moby	nc	10-Apr	22-Aug	nc	nc	nc	nc
Gander	Gander	15-Jul, 16-Jul, and 18-Jul	10-Apr	18-Aug	18-Aug	18-Aug	18-Aug	18-Aug
Big	Pond 19	nc	10-Apr	21-Aug	21-Aug	nc	nc	21-Aug
Big	Big	17-Jul	10-Apr	16-Aug	16-Aug	16-Aug	16-Aug	16-Aug
Llama	Rabbit	18-Jul	10-Apr	15-Aug	15-Aug	15-Aug	15-Aug	15-Aug
Llama	Fox	13-Jul and 17-Jul	10-Apr	20-Aug	20-Aug	20-Aug	20-Aug	20-Aug
Echo	Echo	nc	12-Apr	17-Aug	17-Aug	nc	nc	nc
Wolf	Rascal	nc	11-Apr	15-Aug	15-Aug	nc	nc	15-Aug
Giraffe	Giraffe North	13-Jul	11-Apr	19-Aug	19-Aug	nc	nc	19-Aug
Giraffe	Giraffe South	13-Jul	11-Apr	19-Aug	19-Aug	19-Aug	19-Aug	19-Aug*
Goose	Goose Neck	nc	11-Apr	14-Aug	14-Aug	14-Aug	14-Aug	14-Aug
Goose	Goose Central	nc	11-Apr	17-Aug	17-Aug	17-Aug	17-Aug	17-Aug
Goose	Goose Tail	nc	11-Apr	18-Aug	18-Aug	nc	nc	nc
Propellor	Propellor	nc	12-Apr	21-Aug	21-Aug	nc	nc	21-Aug
George Area								
Long	Lower Long	nc	13-Apr	21-Aug	21-Aug	21-Aug	21-Aug	21-Aug
George	Fold	nc	15-Apr	19-Aug	19-Aug	19-Aug	19-Aug	19-Aug
George	George Central	10-Jul	13-Apr	18-Aug	18-Aug	18-Aug	18-Aug	18-Aug
George	George South	10-Jul	13-Apr	18-Aug	18-Aug	nc	nc	17-Aug
George	Lytle	12-Jul	15-Apr	23-Aug	23-Aug	23-Aug	23-Aug	23-Aug
George	Occurrence	7-Jul and 9-Jul	15-Apr	21-Aug	21-Aug	21-Aug	21-Aug	21-Aug
George	Sleigh	9-Jul	15-Apr	22-Aug	22-Aug	22-Aug	22-Aug	22-Aug
George	Dragon	nc	15-Apr	20-Aug	20-Aug	20-Aug	20-Aug	20-Aug
George	Komatic	nc	13-Apr	20-Aug and 21-Aug	20-Aug	20-Aug	21-Aug	21-Aug
Reference C	Reference C	8-Jul	13-Apr	22-Aug	22-Aug	22-Aug	22-Aug	22-Aug

Notes:

nc = not collected

April sampling at the central Goose and George Lake sites were moved by approximately 75 m to avoid ice airstrips.

** Could only collect four benthos samples at Giraffe South site due to sediment type.*

Table 2.1-4. Sampling Dates for Streams, Back River Project, 2012

Watershed	Site	Name Used on Field Sheets, etc.	Water Quality			Sediment Quality	August Aquatic Biology	
			June	August	September	August	Periphyton	Benthos
Goose Area								
Moby	Moby OF	Mn-01 OF	12-Jun	12-Aug	18-Sep	12-Aug	12-Aug	12-Aug
Moby	Gander IF	Mn-02 OF	12-Jun	11-Aug	18-Sep	11-Aug	11-Aug	11-Aug
Swan	Gander US	Mn-02 US	12-Jun	11-Aug	18-Sep	11-Aug	11-Aug	11-Aug
Big	Pond 19 OF	-	12-Jun	13-Aug	18-Sep	13-Aug	13-Aug	13-Aug*
Chair	Chair OF	-	12-Jun	12-Aug	18-Sep	13-Aug	12-Aug	13-Aug
Llama	Llama OF	-	12-Jun	8-Aug	18-Sep	nc	8-Aug	nc
Echo	Echo OF	-	13-Jun	nc	18-Sep	nc	nc	nc
Giraffe	Giraffe OF	-	13-Jun	8-Aug	19-Sep	8-Aug	8-Aug	8-Aug
Wolf	Wolf OF	-	12-Jun	7-Aug	18-Sep	7-Aug	8-Aug	7-Aug
Goose	Goose OF	-	13-Jun	7-Aug	19-Sep	7-Aug	9-Aug	7-Aug
Propellor	Propellor OF	-	12-Jun	9-Aug	17-Sep	9-Aug	9-Aug	9-Aug
Reference B	Reference B OF	-	12-Jun	10-Aug	17-Sep	10-Aug	10-Aug	10-Aug
George Area								
George	George OF	-	13-Jun	5-Aug	19-Sep	5-Aug	5-Aug	5-Aug
George	Sleigh OF	-	13-Jun	5-Aug	19-Sep	5-Aug	5-Aug	5-Aug
George	Dragon OF	-	13-Jun	5-Aug	19-Sep	5-Aug	5-Aug	5-Aug
George	Komatic IF	-	13-Jun	6-Aug	19-Sep	6-Aug	6-Aug^	6-Aug
Reference C	Reference C OF	-	13-Jun	6-Aug	19-Sep	6-Aug	6-Aug	6-Aug

Notes:

Echo OF was completely dry during August sampling.

nc = data could not be collected at these sites due to either low water levels, lack of fine sediments, or unsuitable sediment at the site.

** Only two benthos samples could be collected due to low water levels and flow.*

^ Periphyton was collected using a modified method at Komatic due to the absense of rocks.

Table 2.1-5. Sampling Details for Lakes and Streams, Back River Project, 2012

Monitoring Parameter	Sampling Frequency	Sampling Replication	Sampling Equipment	Sampling Dates/Timing
LAKES				
Winter Physical Limnology				
Dissolved oxygen/temperature profile	1 x	n=1	ODO Probe	April
Summer Physical Limnology				
Dissolved oxygen/temperature profile; Secchi depth	1 x	n=1	ODO Probe	August
Winter Lake Water Quality				
Physical, cyanides, total & dissolved metals, nutrients and total organic carbon	1 x	n=1 at 1 m below the ice and at 1.5 m to 2 m above the water-sediment interface in lake sites deeper than approximately 6 m, + 20% replication	Modified 2.5 L Niskin bottle; preservatives	April
Summer Lake Water Quality				
Physical, cyanides, total & dissolved metals, nutrients and total organic carbon	1 x	n=1 at 1 m depth and at mid depth in lake sites deeper than approximately 6 m), + 20% replication. Surface grabs at lake sites shallower than 2 m.	5 L GO-FLO bottle; preservatives	August
Lake Sediment Quality				
Physical, nutrients, cyanide, and metals	1 x	n=3, each replicate was from a single grab	Ekman Grab	August
Phytoplankton				
Biomass (as chlorophyll *a*)	1 x	n=3 at 1 m below surface	5 L GO-FLO bottle; filtration with 0.45 µm filters	April, August
Abundance and taxonomy	1 x	April, n=1 at 1 m below surface; August n=3 at 1 m below surface	5 L GO-FLO bottle; Lugols solution to preserve	April, August
Zooplankton				
Abundance and taxonomy	1 x	n=3 horizontal tows at 30 cm depth where lake site was <2 m depth, oblique tows where lake site was 2 m to 6 m depth, or vertical hauls where lake site was <6 m depth from approximately 1.5 m above the water sediment interface	120 µm mesh with a 30 cm mouth diameter; with General Oceanics flow meter attached to calculate volume filtered	August
Lake Benthos				
Density and taxonomy	1 x	n=5, each sample was a composite samples of three grabs	Ekman grab and 500 µm seive bucket; formalin to preserve	August
STREAMS				
Stream Water Quality				
Dissolved oxygen and temperature	1 x	n=1	ODO Probe, CTD	August, September
Physical, cyanides, total & dissolved metals, nutrients and total organic carbon	3 x	n=2	grab samples; preservatives	June, August, September
Stream Sediment Quality				
Physical, nutrients, cyanide, metals	1 x	n=3	Ekman sampler where possible, alternatively bowl and spoon	August
Periphyton				
Biomass (as chlorophyll *a*)	1 x	n=3, periphyton collected from 4.5 cm diameter circle templates; periphyton from six circles from a single rock were pooled and then split in half for biomass and density/taxonomy samples	4.5 cm diameter template and scrubber; filtration with 0.45 µm filters	August
Density and taxonomy	1 x		4.5 cm diameter template and scrubber; Lugols solution to preserve	August
Stream Benthos				
Density and taxonomy	1 x	n=5; each a composite of three Ekman grabs	Hess sampler; 500 µm seive bucket; formalin to preserve	August

Table 2.1-6. Sampling Rationale for Lakes, Back River Project, 2012

Watershed	Lake Site Name	Summer Max Depth (m)	Sampling Program	Reason for Site Selection in Early 2012
Goose Area				
Moby	Moby Lake	14.8	WQ, UIP	Upstream of TSF Alternative 1
Gander	Gander Lake	2.4	Bath, WQ, SQ, UIP, OWP, Z, B	Large lake in same watershed as proposed Tailings Storage Facilities alternatives
Big	Pond 19	1.5	WQ, SQ, B	Under proposed Tailings Facility Prefered alternative
Big	Big Lake	5.0	Bath, WQ, SQ, UIP, OWP, Z, B	Large lake in same watershed as Proposed Tailings Facilities alternatives
Llama	Rabbit Lake	3.6	Bath, WQ, SQ, OWP, Z, B	Lake that could be influenced by flow from proposed nearby development
Llama	Fox Lake	5.8	Bath, WQ, SQ, UIP, OWP, Z, B	Lake that could be influenced by flow from proposed nearby development
Echo	Echo Lake	0.4	WQ, SQ	Lake upstream of the Echo deposit
Wolf	Rascal Lake	2.8	WQ, SQ, UIP, B	Lake that could be influenced by flow from proposed nearby development
Giraffe	Giraffe Lake North	3.7	Bath, WQ, SQ, UIP, B	Lake that could be influenced by flow from proposed nearby development (shallow site)
Giraffe	Giraffe Lake South	7.7	Bath, WQ, SQ, UIP, OWP, Z, B	Lake that could be influenced by flow from proposed nearby development (deep site)
Goose	Goose Lake Neck	3.0	WQ, SQ, UIP, OWP, Z, B	Downstream of deposits and near future proposed Project activities
Goose	Goose Lake Central	4.7	WQ, SQ, UIP, OWP, Z, B	Downstream of deposits and near future proposed Project activities
Goose	Goose Lake Tail	2.8	WQ, SQ, UIP	Downstream of deposits and near future proposed Project activities
Propellor	Propellor Lake	7.8	WQ, SQ, UIP B	Lake downstream of watersheds with proposed developments
George Area				
Long	Lower Long Lake	5.2	WQ, SQ, UIP, OWP, Z, B	Lake near potential underground development
George	Fold Lake	9.8	WQ, SQ, UIP, OWP, Z, B	Lake near potential underground development
George	George Lake Central	14.5	Bath, WQ, SQ, UIP, OWP, Z, B	Lake near potential underground development
George	George Lake South	3.0	Bath, WQ, SQ, B	Lake near potential underground development
George	Lytle Lake	1.4	Bath, WQ, SQ, OWP, Z, B	Lake near potential underground development
George	Occurrence Lake	1.5	Bath, WQ, SQ, OWP, Z, B	Lake near potential underground development
George	Sleigh Lake	1.5	Bath, WQ, SQ, OWP, Z, B	Lake near potential underground development
George	Dragon Lake	3.4	WQ, SQ, UIP, OWP, Z, B	Lake near potential underground development
George	Komatic Lake	7.0	WQ, SQ, UIP, OWP, Z, B	Lake near potential underground development
Reference C	Reference Lake C	35.0	Bath, WQ, SQ, UIP, OWP, Z, B	Reference lake away from potential development

Notes:

Bath = bathymetry; WQ = water quality and limnology, SQ = sediment quality; UIP = under-ice phytoplankton; OWP= open-water phytoplankton; Z = zooplankton; B = benthos

Sampling locations in streams were selected to be on the outflows of the major watersheds and lakes in the area, and in areas upstream and downstream of proposed infrastructure (Figure 2.1-1). At a local scale, sites were chosen to be close to hydrometric stations and in areas of laminar flow to avoid suspended sediments.

Figures 2.1-2 and 2.1-3 present sampling locations within the Goose and George Properties. Arrows show the direction of water flow. Note that the stream locations are shown at their August sampling site, which in some cases differed from water quality collection sites in June and September due to the flow and water level requirements of biological sampling. Figures 2.1-4 through to 2.1-14 show sampling locations on lakes with known bathymetry.

2.2 BATHYMETRY

2.2.1 Field Data Collection

Bathymetric surveys of ten lakes were undertaken in July 2012. Lakes surveyed in the Goose area were Gander Lake, Big Lake, Fox Lake, Rabbit Lake and Giraffe Lake. Lakes surveyed in the George area were George Lake, Lytle Lake, Occurrence Lake, Sleigh Lake and Reference Lake C. Bathymetric maps for the surveyed lakes are shown in Figures 2.1-3 through to 2.1-13.

The surveys consisted of two parts:

1. The collection of continuous depth measurements along perpendicular and perimeter transects on the lake and pond surfaces using Differential Global Positioning System (DGPS) and Garmin depth sounder; and
2. Establishing on-land benchmarks via DGPS surveys of the lake shorelines.

A Trimble PF Power Differential Global Positioning System (DGPS) was used for positioning during the depth survey, and a Garmin depth sounder and a Trimble TSC1 datalogger were used to collect and store the depth data in electronic files. The DGPS and sounder were mounted on the boat for surveys along the lake surfaces (Plate 2.2-1).

Depth surveys were carried out by navigating a course of regular spaced transects across the width of each lake, followed by a longitudinal transect through the long-axis of the lake (i.e., e-line). A hand-held GPS, pre-loaded with transect tracks, was used to maintain the correct course with the boat. An example of a typical track is shown in Plate 2.2-2 for Occurrence Lake. Manual survey methods (entering single-point measurements manually) were used along shorelines and in areas too shallow for reliable depth readings.

2.2.2 Map Creation

To create bathymetric contours, the depth data (saved as .ssf files) were converted into shapefiles using GPS Pathfinder Office. Outlier points were screened for accuracy and removed from the dataset based on whether the difference in depth between the closest surveyed location and distance to surface was largely different from the outlier point. This was done to account for sampling errors associated with boat movement (i.e., pitch and roll of the boat).

A Triangular Irregular Network (TIN) model was then created using the surveyed depth locations to model lake morphology. To smooth out the results, locations and depths were then taken from the TIN and interpolated into a surface raster using an inverse distance weighting (IDW) approach. The IDW interpolation method uses the assumption that all predicted values within the surface will be influenced more by the measured values that are closest to it. The interpolated surface raster was then converted into bathymetric contours (line features) to be used for the mapping of all ten lakes.

Results are presented in sampling maps in Methods section, complete with morphometric characteristics. Note these maps provide bathymetry to help illustrate the freshwater data collected, and are not intended for engineering use.

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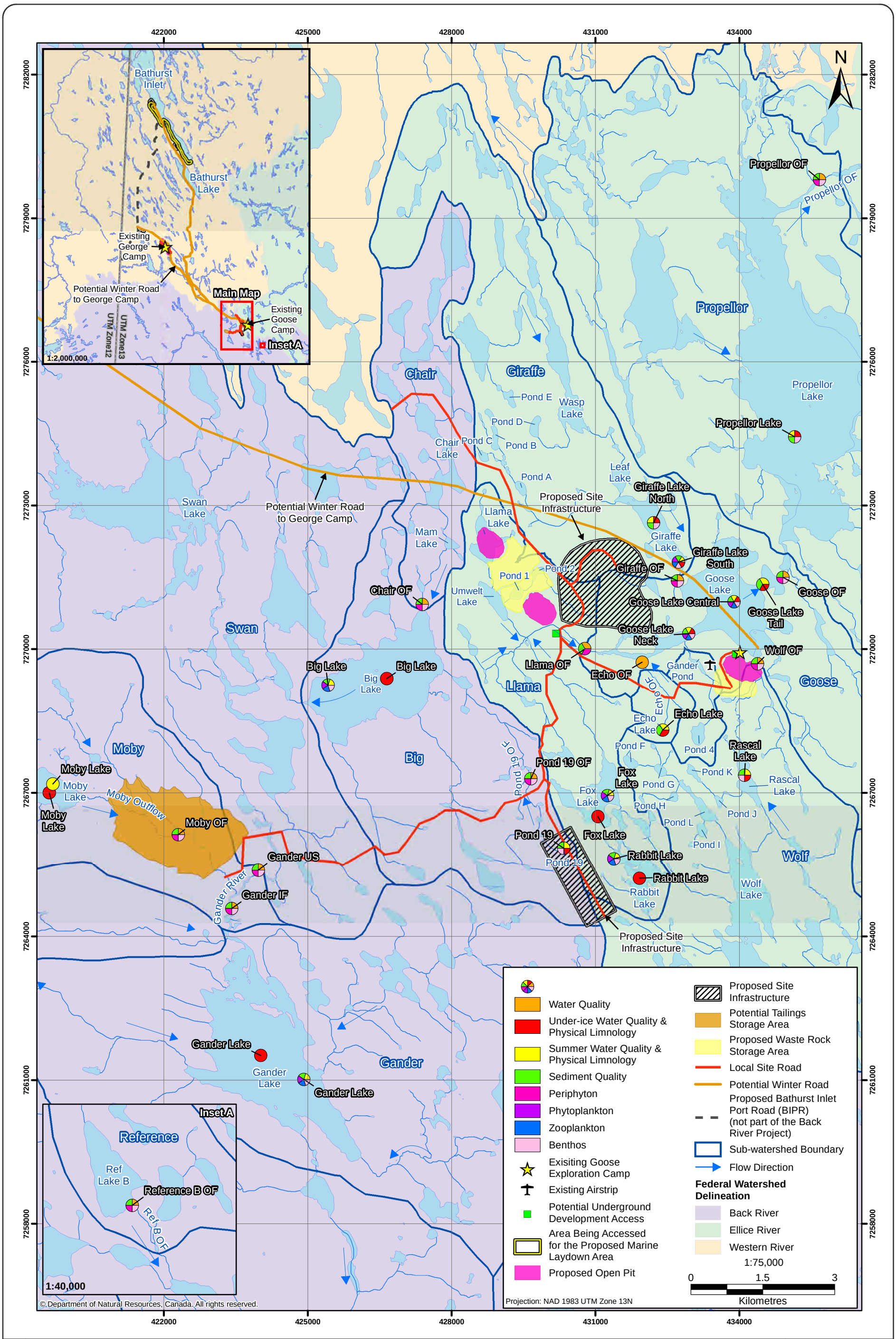

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Figure 2.1-2

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Lake and Stream Sampling Locations within the Goose Property, Back River Project, 2012

Figure 2.1-2

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PROJECT #0833-002-03 GIS # BAC-01-016 December 22 2012

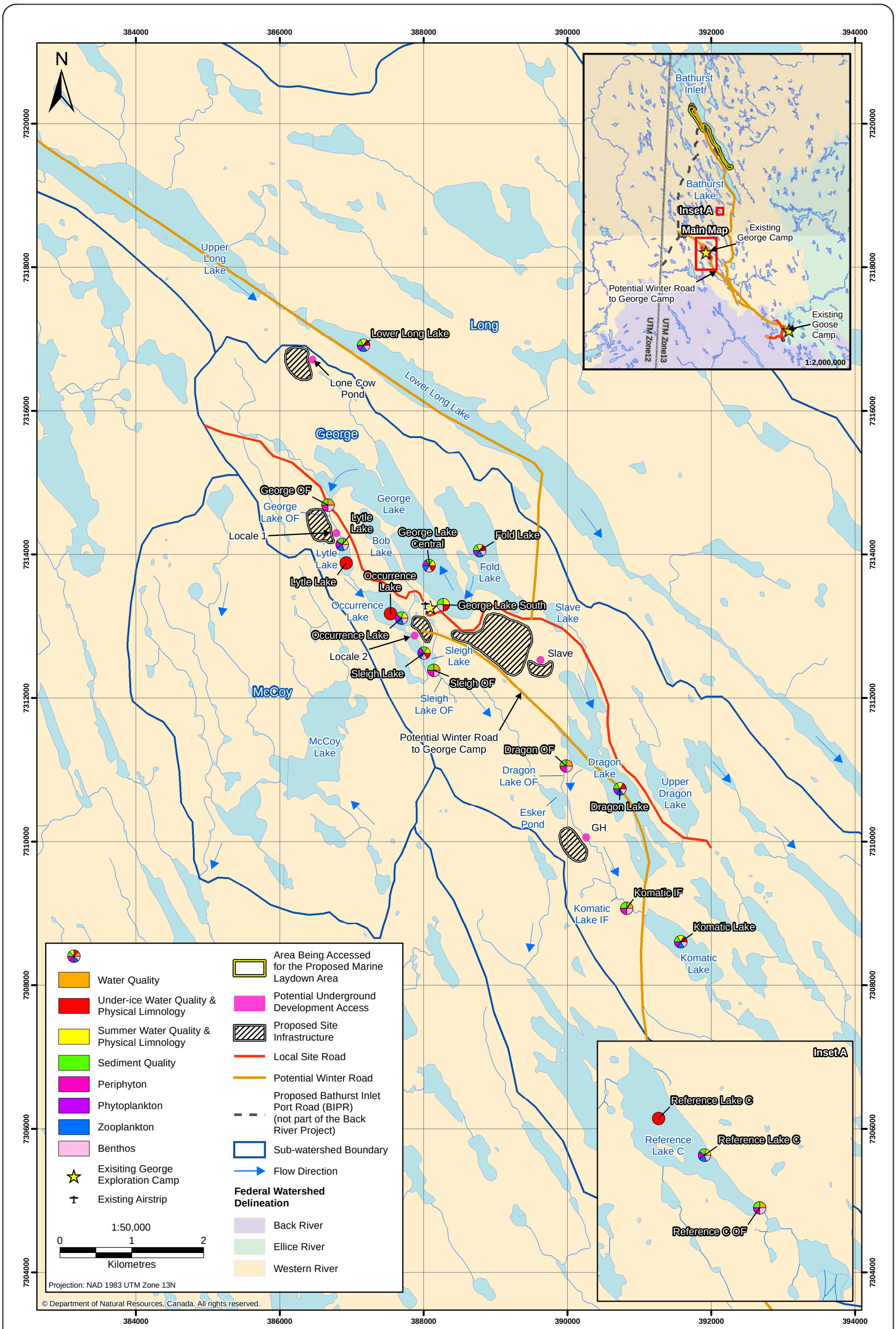

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Figure 2.1-3

Sabina GOLD & SILVER CORP

Lake and Stream Sampling Locations within the George Property, Back River Project, 2012

Figure 2.1-3

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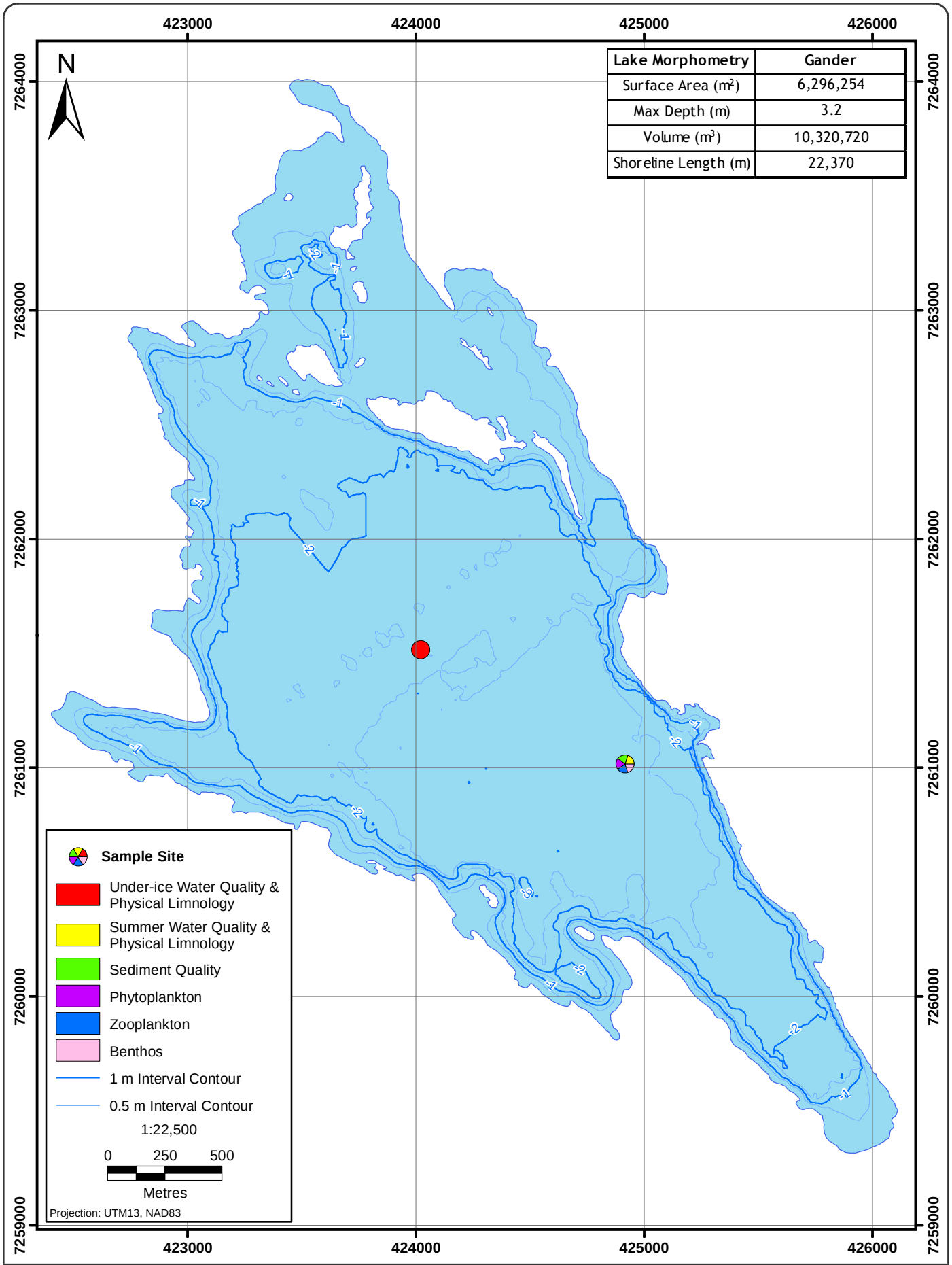

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Bathymetry and Sampling Locations in Gander Lake, Back River Project, 2012

Figure 2.1-4

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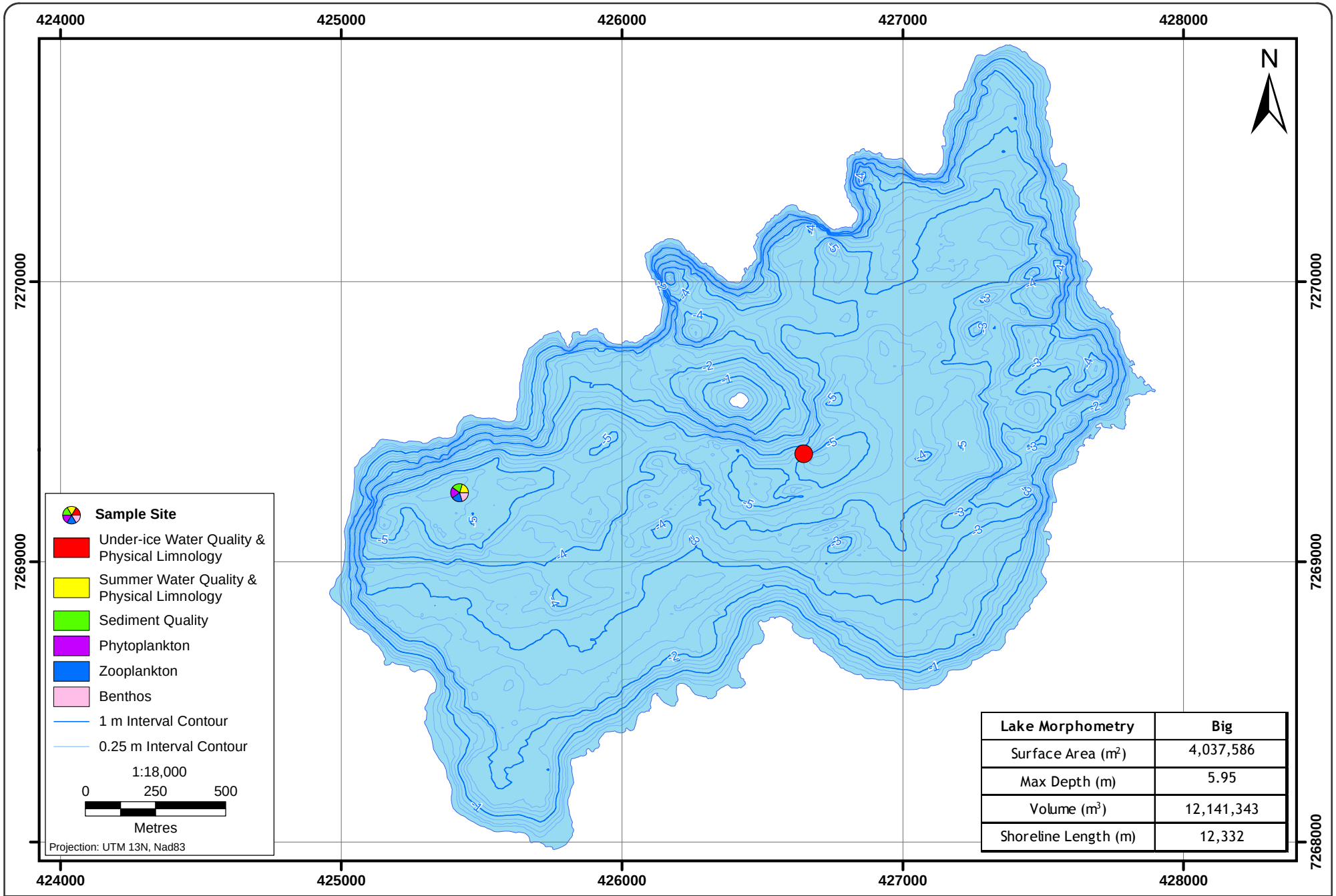

Lake Morphometry	Big
Surface Area (m^2)	4,037,586
Max Depth (m)	5.95
Volume (m^3)	12,141,343
Shoreline Length (m)	12,332

Figure 2.1-5

Sabina GOLD & SILVER CORP

Bathymetry and Sampling Locations in Big Lake, Back River Project, 2012

Figure 2.1-5

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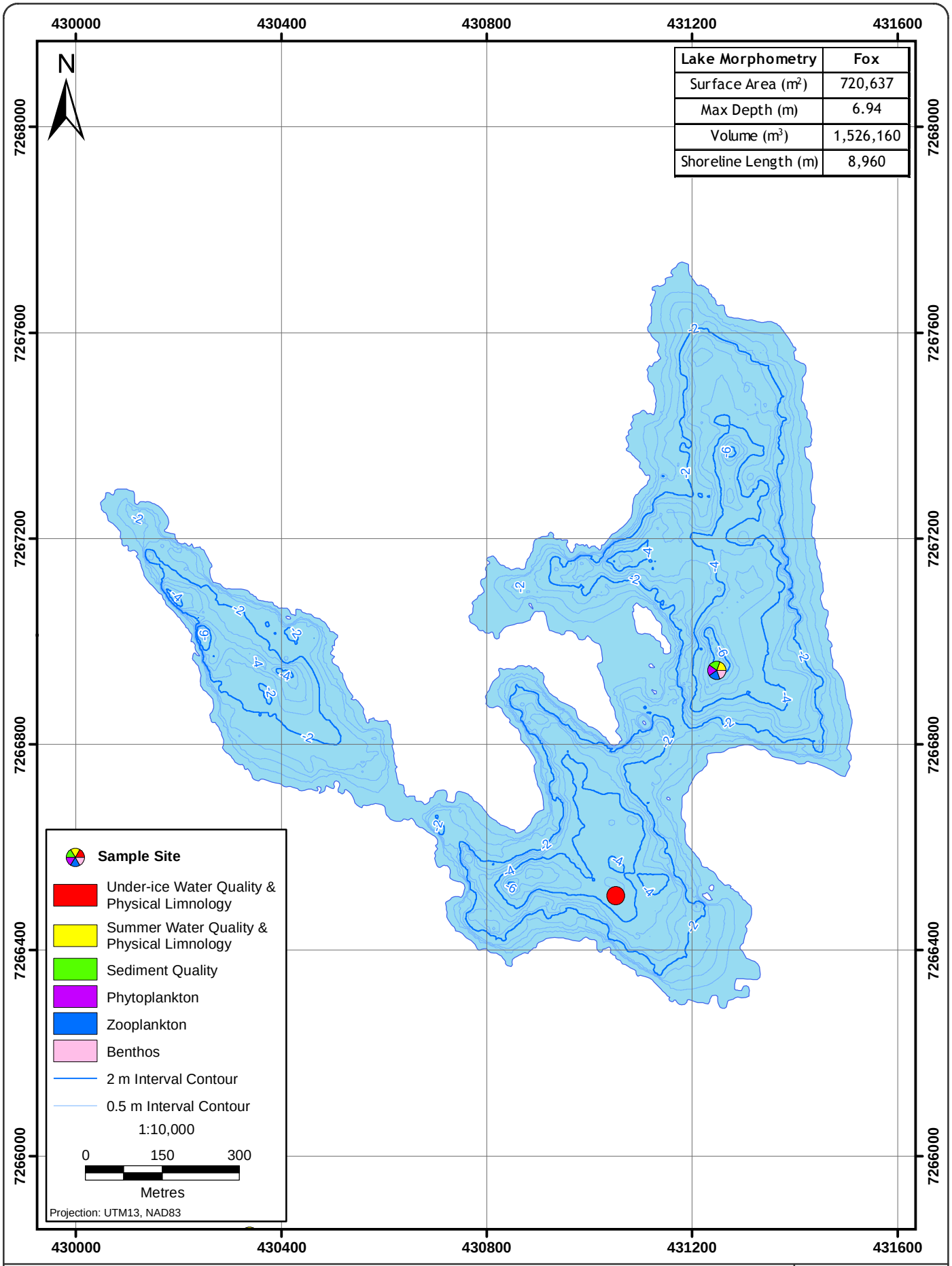

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Bathymetry and Sampling Locations in Fox Lake, Back River Project, 2012

Figure 2.1-6

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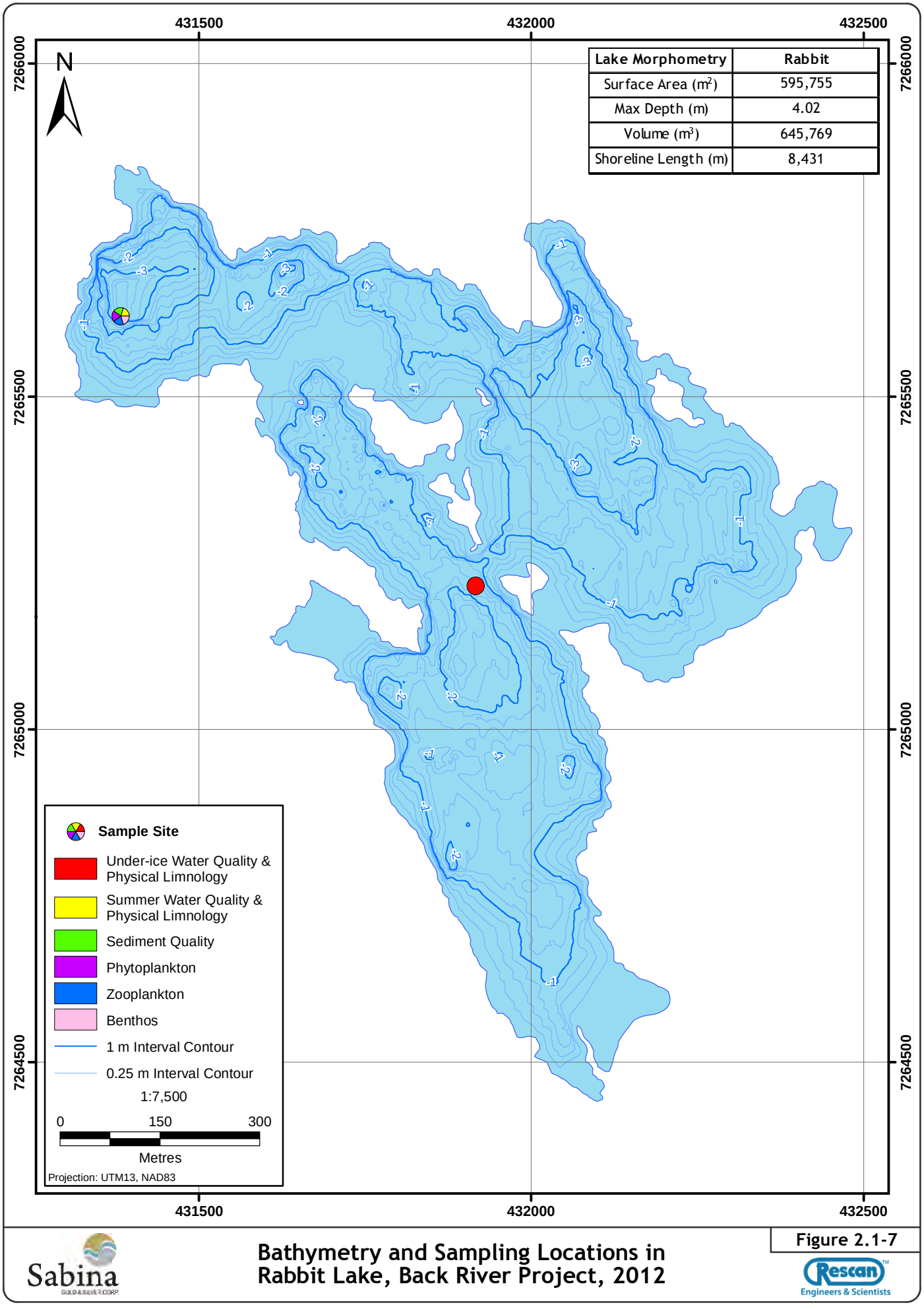

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Bathymetry and Sampling Locations in Rabbit Lake, Back River Project, 2012

Figure 2.1-7

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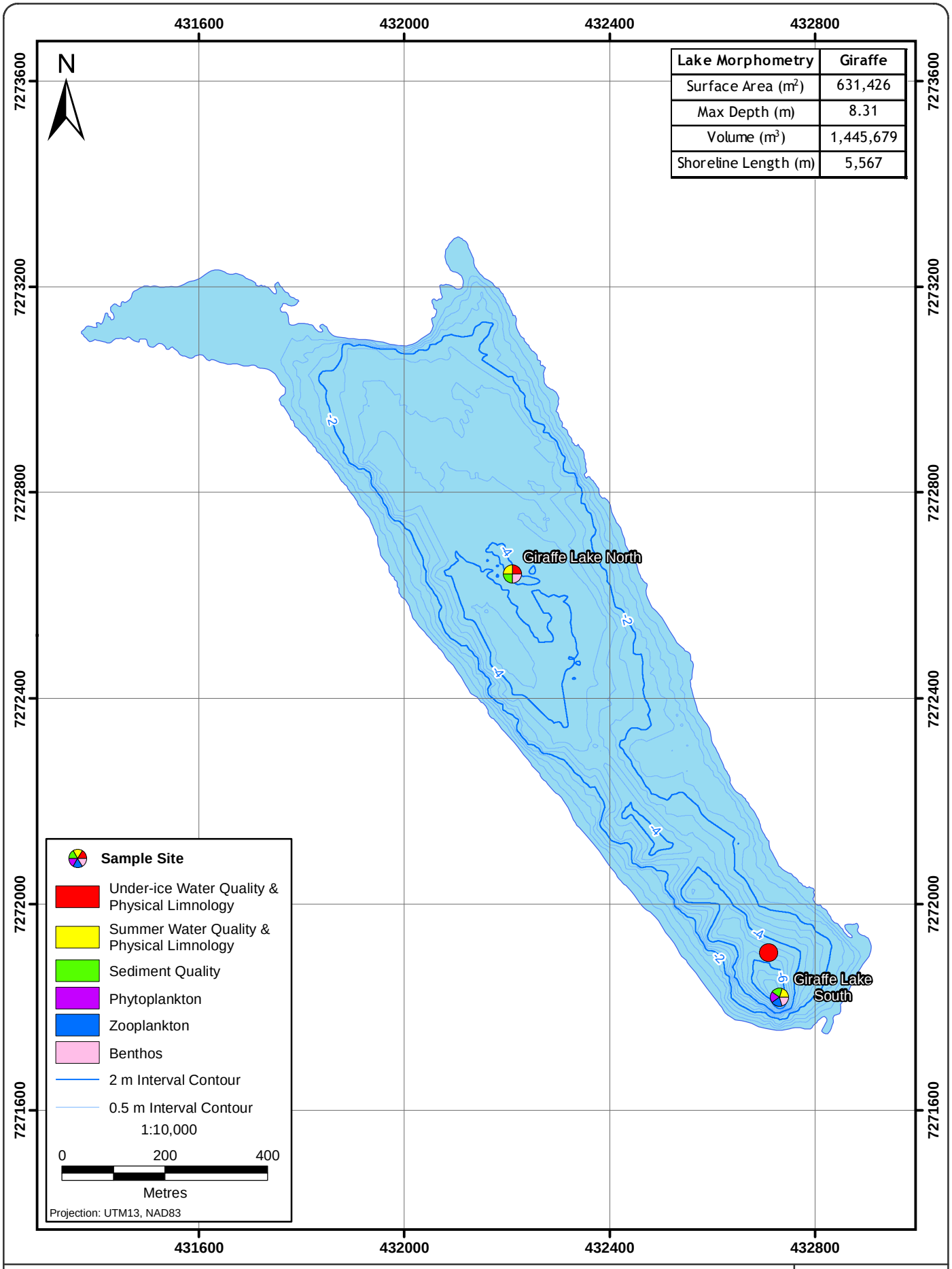

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Bathymetry and Sampling Locations in Giraffe Lake, Back River Project, 2012

Figure 2.1-8

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2.3 TEMPERATURE AND DISSOLVED OXYGEN

Dissolved oxygen and temperature profiles were collected in April and August of 2012. Secchi depth measurements were recorded in August. Surface temperature and dissolved oxygen concentrations were measured at each stream during the reduced flow periods of August and September 2012.

2.3.1 Under-ice Field Data Collection

Lake sampling sites were accessed by helicopter or snowmobile during April. Before collecting the physical profiles (and later water samples), an ice auger was used to drill a 25-cm diameter hole through the ice (Plate 2.3-1). Snow and loose ice were cleared from the hole with a slotted spoon.

Temperature and dissolved oxygen profiles were recorded at 0.5 m intervals down the water column using a calibrated YSI Pro-ODO optical dissolved oxygen meter (Plate 2.3-2). The profiles ended at approximately 0.5 m above the sediment surface to avoid suspension of bottom sediments.

2.3.2 Open-water Lake Field Data Collection

Open-water temperature and dissolved oxygen profiles were collected from boat in August at the same locations that under-ice samples were collected, unless new bathymetric information prompted relocation to a more suitable location (see bathymetry maps). Data was collected using a calibrated YSI Pro-ODO optical dissolved oxygen meter as described above in the under-ice section.

Light attenuation was estimated in each lake using a 20-cm, black and white Secchi disk. Measurements were collected at each site by lowering the disk on a metred line through the water column on the shaded side of the boat until it disappeared from sight. The depth of disappearance was identified as the Secchi depth.

2.3.3 Stream Data Collection

Surface temperature and dissolved oxygen concentrations were measured using a calibrated YSI Pro-ODO optical dissolved oxygen meter (Plate 2.3-2) or a RBR-420 conductivity, temperature, and depth probe fitted with an Aanderaa Optode dissolved oxygen sensor (model# 3835) (in George area streams in August).

2.3.4 Quality Assurance/Quality Control (QA/QC)

The YSI Pro-ODO optical dissolved oxygen meters were calibrated before each sampling trip to ensure accurate readings. Measurements were only taken after probe had stabilized.

2.3.5 Data Management

Dissolved oxygen and temperature profiles were graphed for each lake. Canadian Council for Ministers of the Environment (CCME) dissolved oxygen guidelines for the protection of aquatic life were included on graphs for reference (CCME 2012). Stream data is presented in Table 3.1-2, and compared against CCME guidelines.

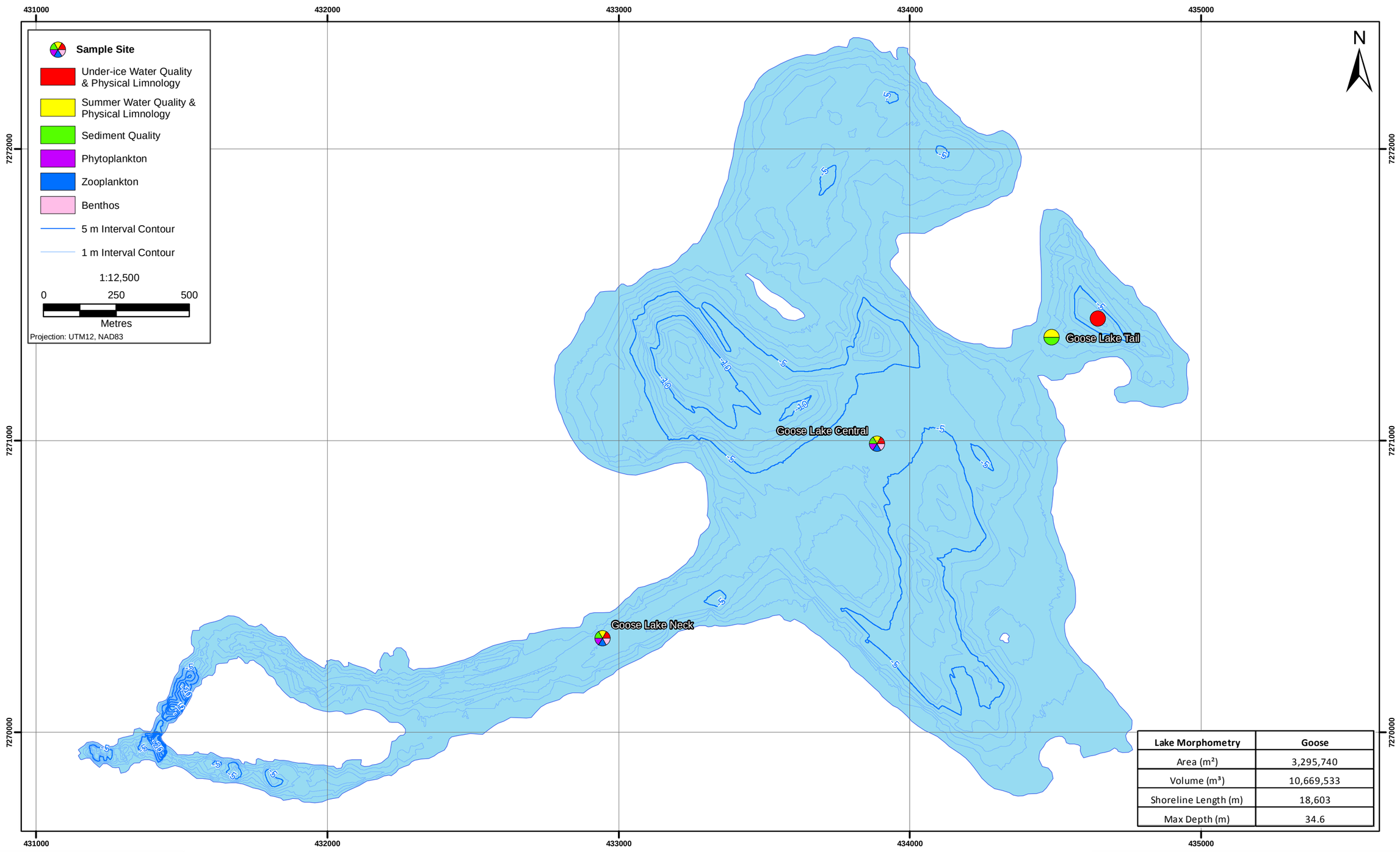
Secchi depths were used to calculate the euphotic zone depth (EZD), which is defined in this report as the depth at which 1% of surface radiation occurs. This generally represents the zone in a waterbody where integrated photosynthesis equals the integrated respiration (i.e., compensation depth). Above this depth net primary production is possible given sufficient nutrients. The EZD was calculated as follows:

$$k' = 1.7/D_s \ ;$$

where k' = light extinction coefficient, D_s is the Secchi depth, and 1.7 is a constant derived from experimental data (Parsons, Maita, and Lalli 1984).

$$EZD = 4.6/k'$$

PROJECT # **0833-02-25** GIS # **BAC-01-011** *December 22, 2012*



Lake Morphometry	Goose
Area (m²)	3,295,740
Volume (m³)	10,669,533
Shoreline Length (m)	18,603
Max Depth (m)	34.6

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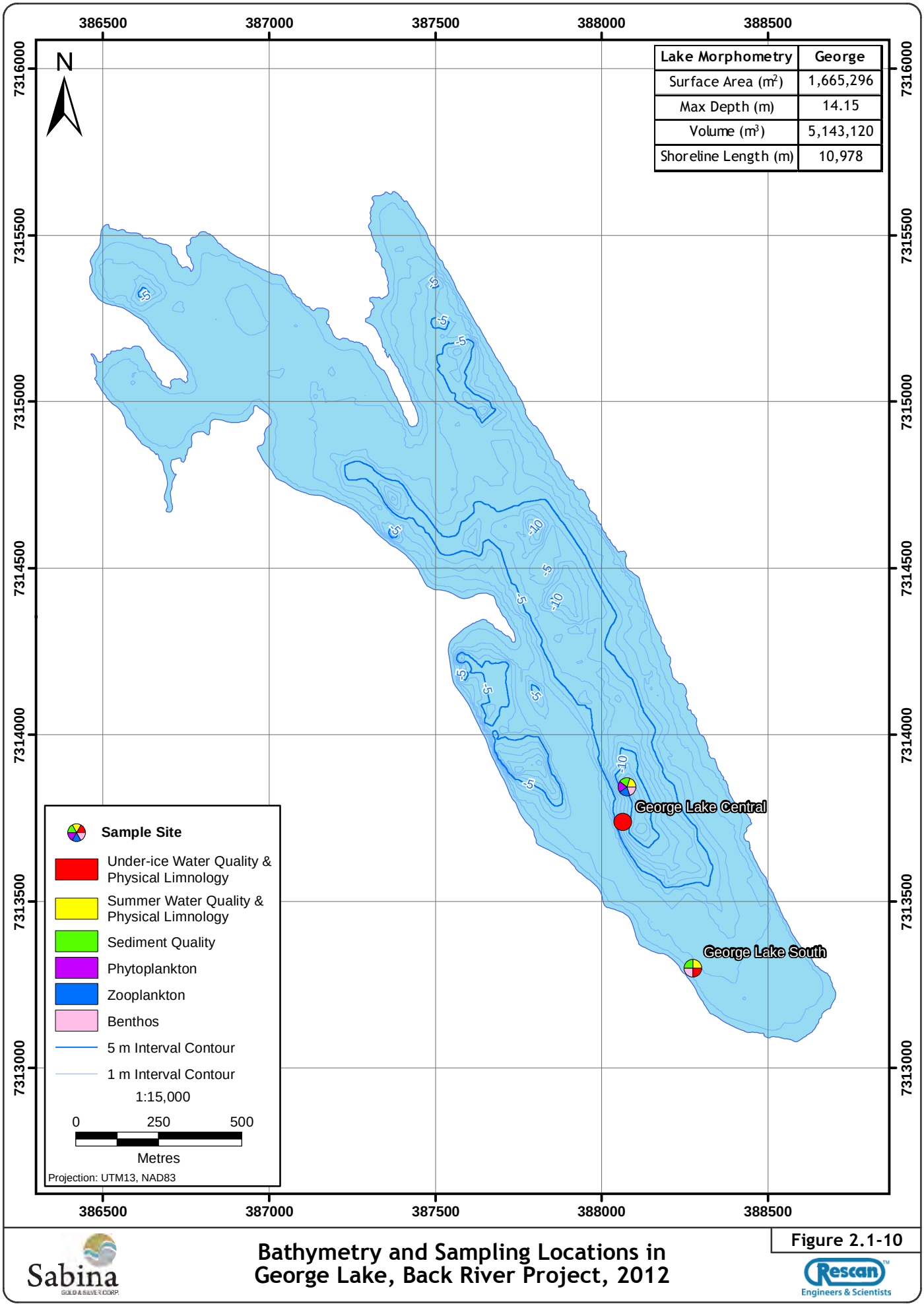
Figure 2.1-9

Bathymetry and Sampling Locations in Goose Lake, Back River Project, 2012

PROJECT #0833-002-03 GIS # BAC-01-020 December 22 2012



Sabina GOLD & SILVER CORP.

Bathymetry and Sampling Locations in George Lake, Back River Project, 2012

Figure 2.1-10

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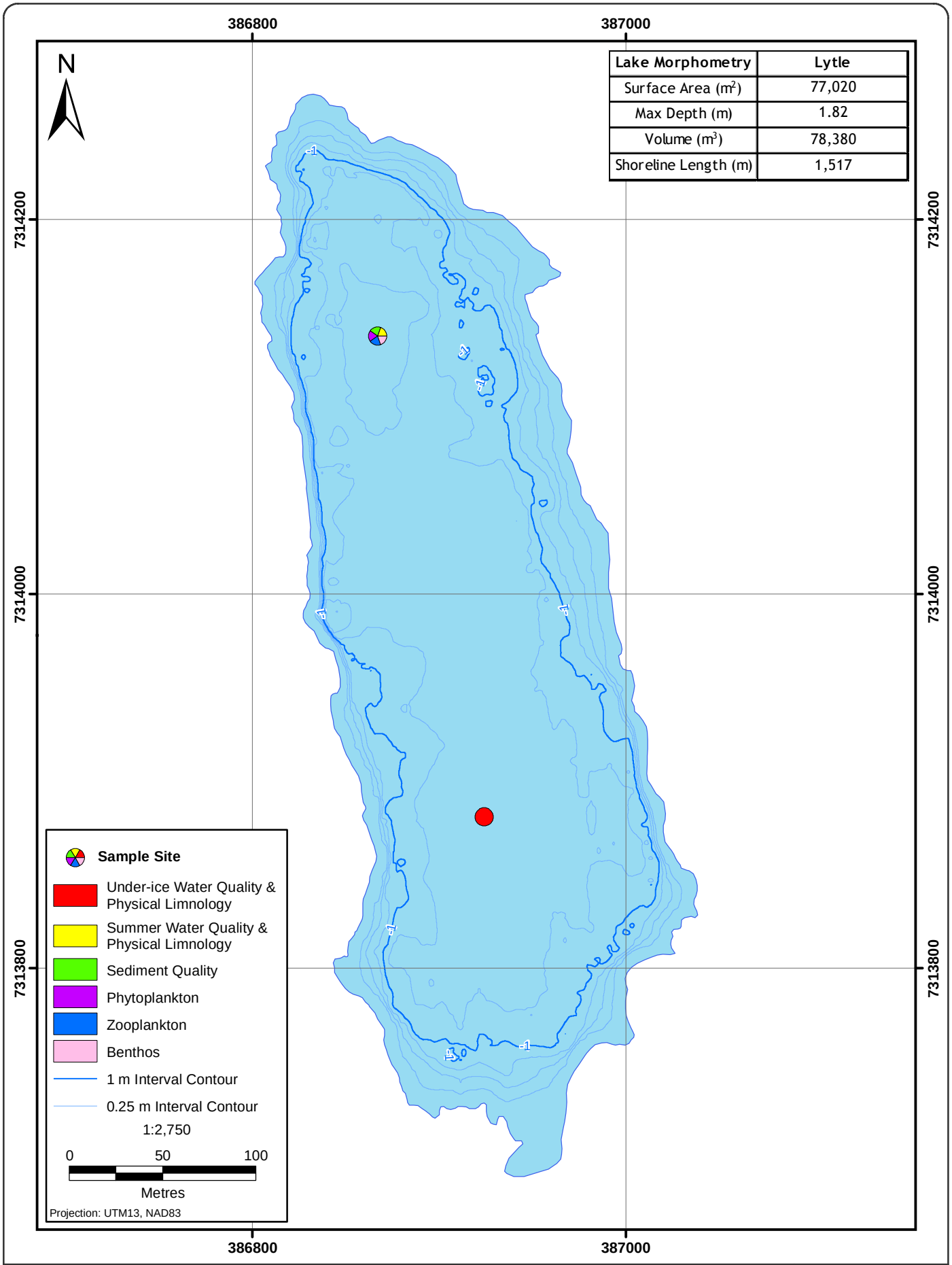

Sabina GOLD & SILVER CORP.

Bathymetry and Sampling Locations in Lytle Lake, Back River Project, 2012

Figure 2.1-11

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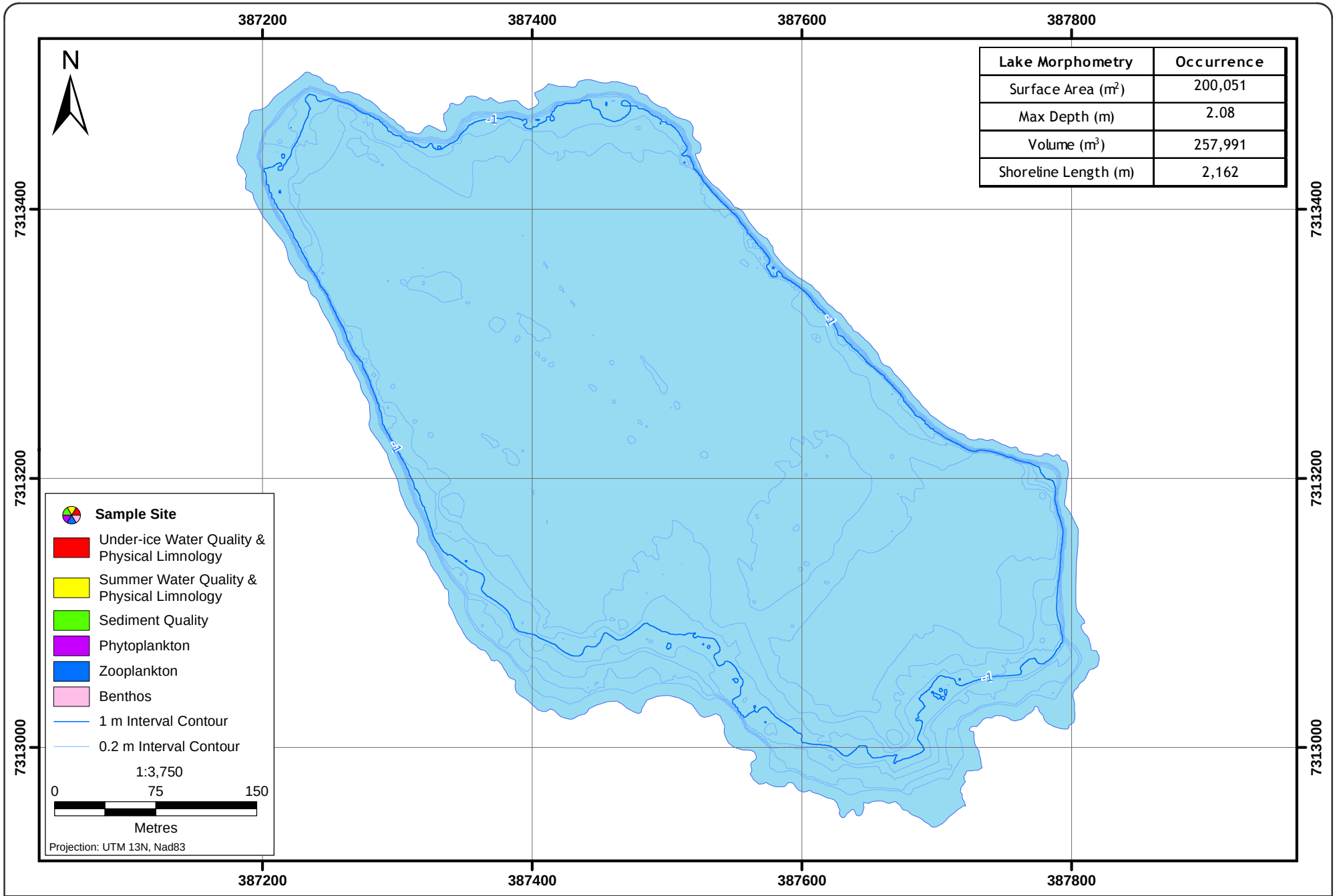

Figure 2.1-12

Sabina GOLD & SILVER CORP

Bathymetry and Sampling Locations in Occurrence Lake, Back River Project, 2012

Figure 2.1-12

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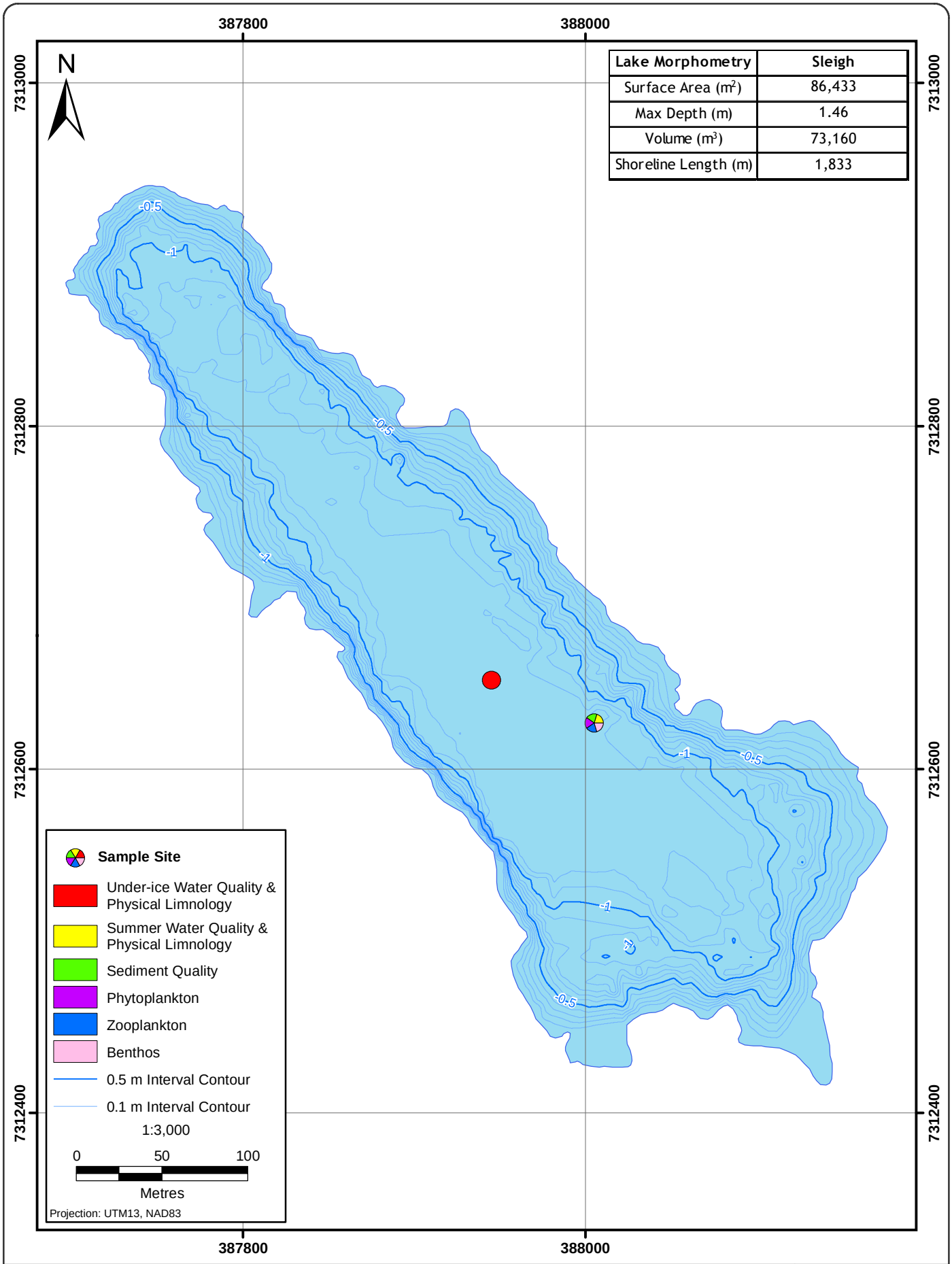

Sabina GOLD & SILVER CORP.

Bathymetry and Sampling Locations in Sleigh Lake, Back River Project, 2012

Figure 2.1-13

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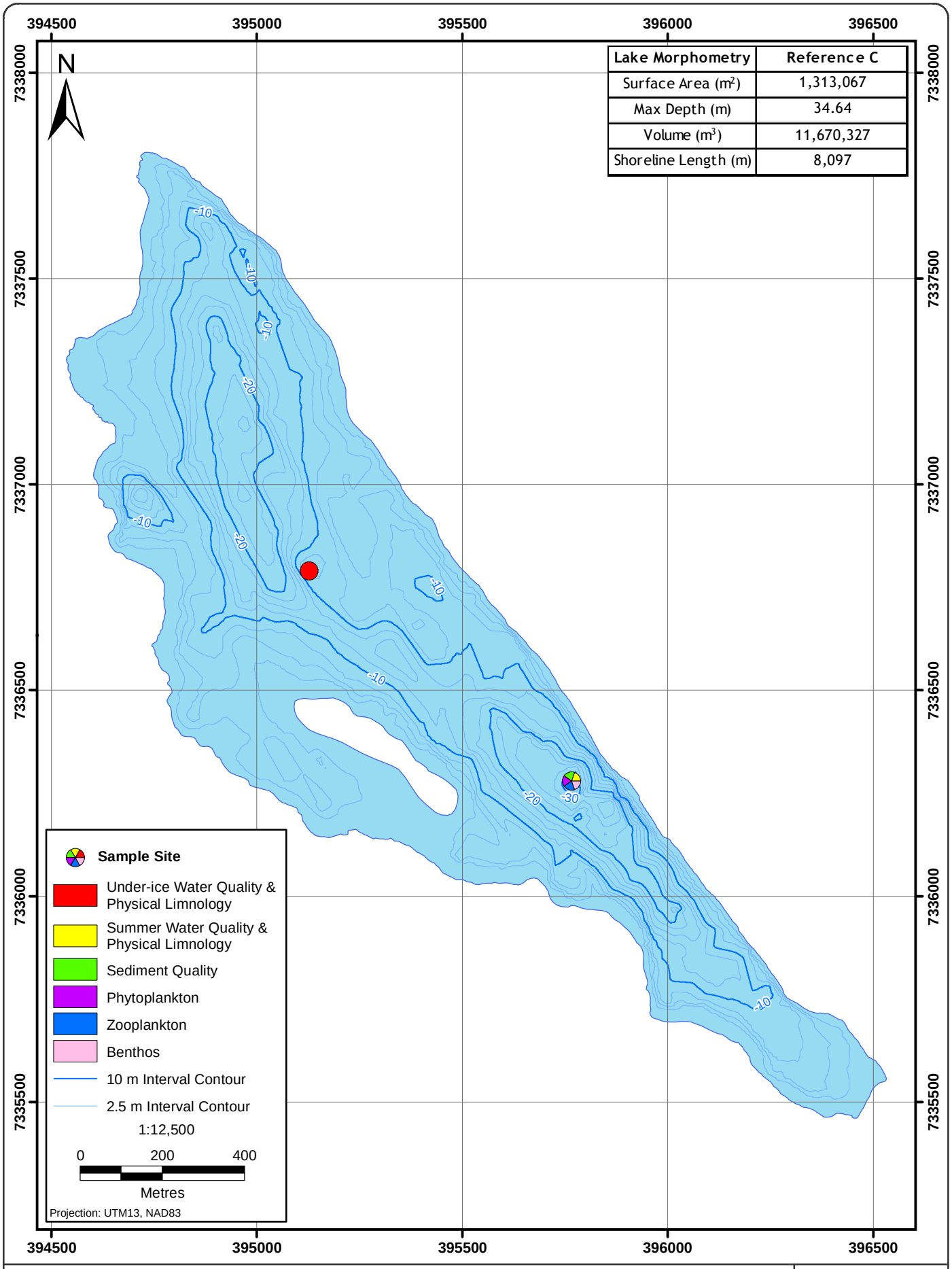

Sabina GOLD & SILVER CORP.

Bathymetry and Sampling Locations in Reference Lake C, Back River Project, 2012

Figure 2.1-14

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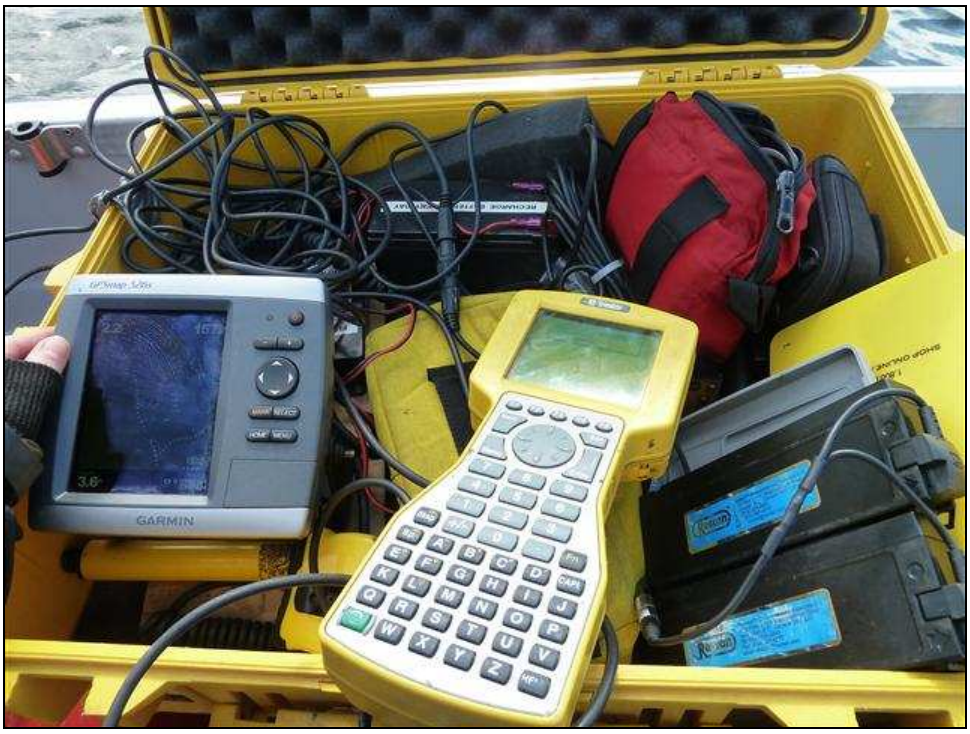


Plate 2.2-1. A Trimble DGPS was used to collect global northing and easting positions and a Garmin depth sounder was used to collect lake-bottom depths. A TSC1 data collector was used to record the positions and depths.

Plate 2.2-2. A pre-loaded transect route was used to collect bathymetric data in lakes; above is Occurrence Lake, July 2012.

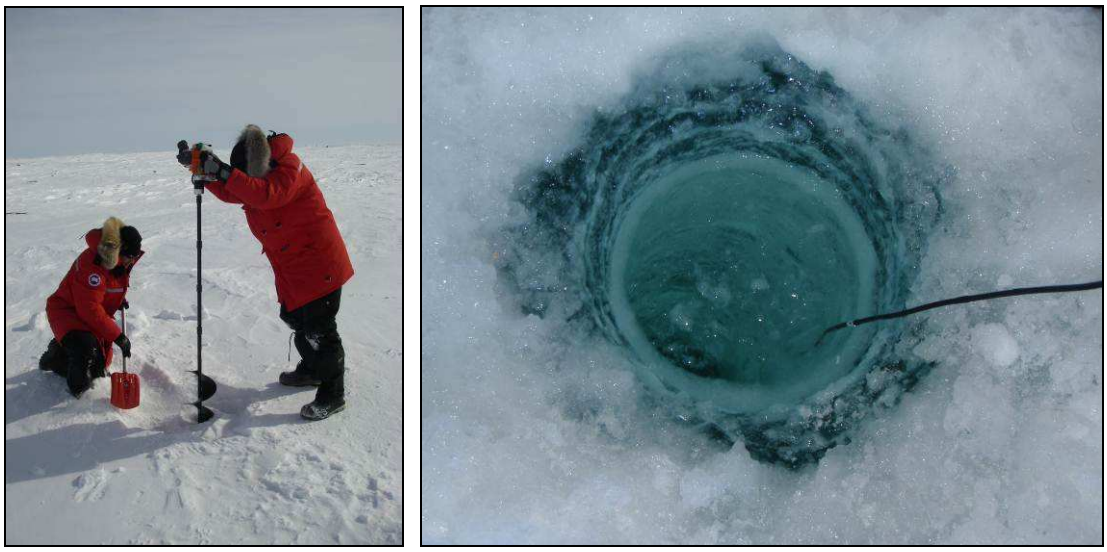


Plate 2.3-1. Left, auguring through the ice; right, measuring dissolved oxygen and temperature through the augered hole.

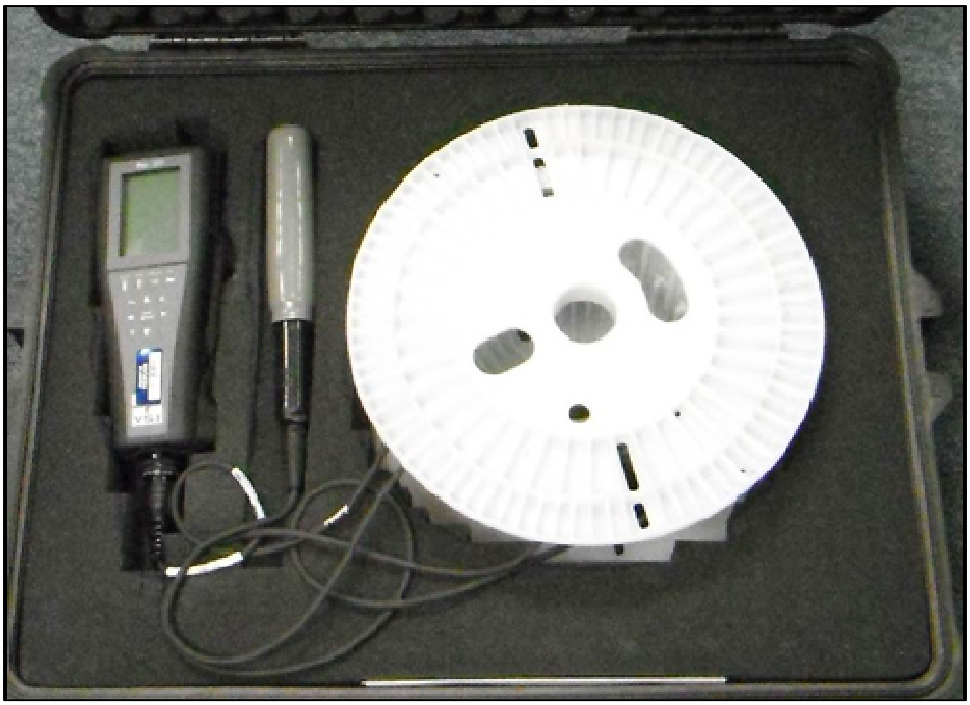


Plate 2.3-2. A calibrated YSI Pro-ODO optical dissolved oxygen meter was used to collect dissolved oxygen and temperature data.

2.4 LAKE WATER QUALITY

The 2012 lake water quality sampling focused on characterizing the natural variation in water quality with water column depth, time of year (under ice and open water), and geographical location. A total of twenty four lake sampling sites in twenty lakes in the Back River area were sampled, including one reference lake located approximately 25 km away from George Camp. Fourteen of the lake sites were

in the Goose area, and ten in the George area. All sites were sampled in both April (under ice) and August (open water).

2.4.1 Under-ice Field Sample Collection

Under-ice water quality samples were collected in April from the ice hole augered for the physical limnology measurements. Samples were collected from 1 m below the base of the ice layer and from 1.5 m from the bottom where lake sites were deep enough (> 6 m). One sample was collected at each depth with 25% replication for QA/QC. At the shallow Rascal Lake, water quality samples were taken at the ice-water interface to avoid disturbing sediments

A modifed 2.5 L "skinny" Niskin bottle was used for April sampling as GO-FLO sampling bottles (generally preferred for sampling waters with low metal concentrations) are prone to freezing open in cold waters.

The Niskin bottles were acid-cleaned at ALS Environmental Services (ALS), Burnaby, British Columbia (BC), and contained acid-cleaned clear silicone tubing in the interior of the bottle to reduce potential metal contamination. A dual rope system was used for bottle closure (Plate 2.4-1).

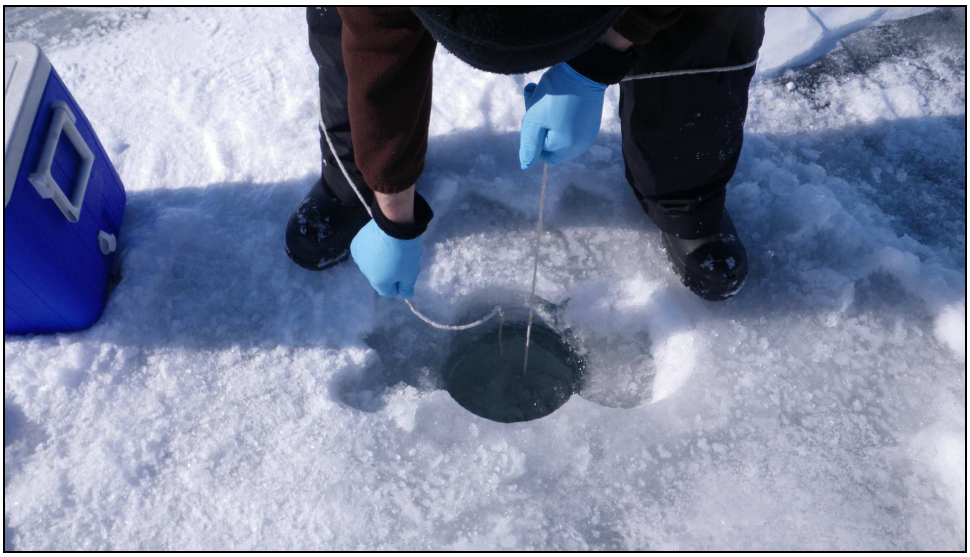


Plate 2.4-1. Under-ice water quality samples were collected with a modified 'skinny' Niskin, using a dual rope triggering system instead of a messenger.

The water collected in the Niskin was used to fill the appropriate laboratory-provided sample containers (Plate 2.4-2). All water samples were analyzed for general physical parameters, cyanides, nutrients, total organic carbon (TOC), and total and dissolved metals at the lowest feasible detection limits by ALS (Table 2.4-1). Preservatives were added in the field to the cyanide (sodium hydroxide), nutrient (sulphuric acid), TOC (hydrochloric acid), and total metals (ultra-pure nitric acid) sample containers.

Table 2.4-1. Water Quality Parameters and Method Detection Limits, Back River Project, 2012

Parameter	Detection Limit
Physical Tests	
Conductivity	2 µS/cm
Hardness (as $CaCO_3$)	0.5
pH	0.01 pH
Alkalinity, Bicarbonate (as $CaCO_3$)	2
Alkalinity, Carbonate (as $CaCO_3$)	2
Alkalinity, Hydroxide (as $CaCO_3$)	2
Alkalinity, Total (as $CaCO_3$)	2
Total Suspended Solids	3
Total Dissolved Solids	10
Turbidity	0.1 NTU
Nutrients	
Ammonia (as N)	0.005
Nitrate (as N)	0.005
Nitrite (as N)	0.001
Total Kjeldahl Nitrogen	0.05
Ortho Phosphate (as P)	0.001
Total Phosphorus	0.002
Major Anions	
Bromide (Br)	0.05
Chloride (Cl)	0.5
Fluoride (F)	0.02
Sulphate (SO_4)	0.5
Organic Carbon	
Total Organic Carbon	0.5
Cyanides	
Free Cyanide	0.001
Total Cyanide	0.001
Metals (Total and Dissolved)	
Aluminum (Al)	0.003
Antimony (Sb)	0.00005
Arsenic (As)	0.00003

Parameter	Detection Limit
Metals (Total and Dissolved) (con'd)	
Barium (Ba)	0.00005
Beryllium (Be)	0.0002
Bismuth (Bi)	0.0005
Boron (B)	0.005
Cadmium (Cd)	0.00001
Calcium (Ca)	0.02
Chromium (Cr)	0.0001
Cobalt (Co)	0.0001
Copper (Cu)	0.0005
Iron (Fe)	0.01
Lead (Pb)	0.00005
Lithium (Li)	0.005
Magnesium (Mg)	0.005
Manganese (Mn)	0.00005
Mercury (Hg)	0.00001
Molybdenum (Mo)	0.00005
Nickel (Ni)	0.0001
Phosphorus (P)	0.3
Potassium (K)	0.05
Selenium (Se)	0.0001
Silicon (Si)	0.05
Silver (Ag)	0.00001
Sodium (Na)	0.01
Strontium (Sr)	0.0001
Thallium (Tl)	0.00005
Tin (Sn)	0.0001
Titanium (Ti)	0.01
Uranium (U)	0.00001
Vanadium (V)	0.00005
Zinc (Zn)	0.003

Note: Detection limits are mg/L unless otherwise indicated.

All water samples were kept cold, but above freezing, and sent to ALS in Yellowknife, Northwest Territories (NT) on the first available flight from camp. Samples were then sent to ALS's Burnaby laboratory where the lowest metal detection limits were available. Due to logistical constraints, hold times for some parameters and some samples were exceeded. Dissolved metals samples were filtered by ALS in their Burnaby laboratory to avoid contamination issues related to field filtration.

Plate 2.4-2. Labeled laboratory supplied sample containers (from back to front: routine, cyanides, total metals, dissolved metals, nutrients and total organic carbon).

Detection limits were the lowest achievable by the lab. Detection limits were occasionally higher than the theoretical minimum presented in Table 2.4-1. This occurred when dilution of a sample was required to compensate for other interfering parameters (e.g., turbidity). Realized detection limit ranges are indicated on all relevant figures in this report.

2.4.2 Open-water Field Sample Collection

Open-water water quality samples were collected by boat in August, using an acid-washed 5 L Teflon-lined GO-FLO sampling bottle (Plate 2.4-3). The GO-FLO was lowered on a metred line to a depth 0.5 m lower than the desired sampling depth, before being raised to the sampling depth and closed using a weighted messenger. The water collected was used to fill the laboratory-provided sample containers.

Water quality samples were collected from 1 m below the surface and from mid-depth where lake sites were deep enough (> 6 m). For deeper stratified lakes, samples were collected from the mid point of the bottom layer to avoid collecting water at the thermocline. One sample was collected at each depth with 20% replication for QA/QC.

Water quality samples were taken from the surface (0.1 m) at the shallow Pond 19 and Echo lakes and from 0.5 m below the surface at the shallow George Lake South, Lytle Lake and Sleigh Lake sampling sites to avoid disturbing sediments. At the shallow Pond 19 and Echo Lake water quality samples were taken from a boat, using an anchor and the wind to drift out to the centre of the lake to avoid disturbing sediments.

Water quality samples were preserved, handled, transported and analyzed as described in the April water quality section.

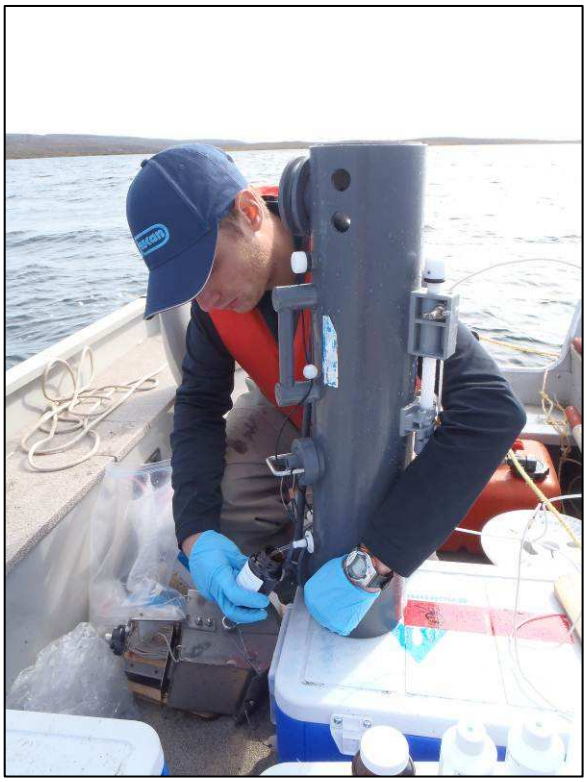


Plate 2.4-3. Laboratory-provided sample containers were filled with water collected using a 5 L GO-FLO bottle.

2.4.3 Quality Assurance/Quality Control (QA/QC)

A quality assurance and quality control program (QA/QC) was incorporated into the design of the freshwater baseline program to account for within-site variability and any contamination that originated from sampling equipment, field sampling, or sample transportation. This included the use of replicates, blanks, and chain of custody forms.

Twenty five percent of the water samples were collected in duplicate to assess the magnitude and potential causes of variability between samples.

Equipment blanks, field blanks, and travel blanks comprised approximately 20% of the total number of lake water quality samples collected. Equipment blanks were designed to detect contamination from the sampling equipment, including the sampling bottle (GO-FLO or Niskin). Field blanks measured potential contamination from sample exposure to air, while travel blanks were designed to detect potential contamination from travel and storage during sampling.

Equipment blanks were collected in the field by first rinsing an acid-washed GO-FLO with double de-ionized water (DDI water; provided by ALS) then filling the GO-FLO bottle with DDI water, allowing the water to sit for approximately one minute (as would occur with a real sample), repeating this, and then drawing sub-samples from the bottle. Equipment blanks were preserved and handled in the same fashion as real samples.

Field blanks were processed in the field by opening the bottles provided by ALS (containing DDI water) and exposing the sample to air for approximately one minute. The bottles were preserved and handled the same as the regular samples.

Travel blanks were provided by ALS and were never opened, but were otherwise handled in the same way as the regular samples.

All samples, including blanks, were recorded on a chain of custody form and sent to ALS Burnaby via ALS Yellowknife. Blanks were tested for general parameters, nutrients, anions, cyanides and total metals.

2.4.4 Data Management

Parameters of interest, including parameters with CCME water quality guidelines for the protection of aquatic life, were graphed unless values were consistently below detection limits (CCME 2012).

Values below analytical detection limits were replaced with half the realized sample detection limit for graphing and analysis. Water quality concentrations at each lake were compared to the CCME guidelines. The factor of exceedance, the factor by which concentrations exceeded CCME guidelines, was calculated for each sample. The average factor of exceedance was calculated for each lake.

The water sample duplicates were assessed for the magnitude of variability between samples using relative percent difference (RPD) as calculated by:

$$RPD = | [(dupeA - dupeB) / ((dupeA + dupeB) / 2)]| \times 100$$

The results of RPD calculations were examined to detect patterns of sampling heterogeneity, sample contamination, or analytical errors. For example, duplicate samples having several water quality parameters with RPDs greater than 20% could suggest one sample had higher particulate matter than the other sample leading elevated concentrations of several parameters; thus, indicating *in situ* sampling variability. On the other hand, duplicate samples having only one or a few parameters with RPDs above 20% could suggest analytical inconsistencies.

Water quality variables where one or both values were less than five times the detection limit were not included in the RPD calculations because analytical results near the detection limit are increasingly unreliable (BC MWLAP 2003). Field duplicates with RPD values exceeding 20% were noted and all duplicates and RPDs are listed in Appendix 3.2-2.

2.5 STREAM WATER QUALITY

The 2012 stream water quality sampling focused on characterizing the potential natural variation both seasonally and geographically. Samples were collected during June (freshet), August (low-flow period, and September (the higher flow period). Seventeen stream sites within the Goose and George areas were sampled, including one reference stream approximately 25 km from George Camp and one reference stream 15 km from Goose Camp. Twelve of these stream sites were in the Goose Property and five were in the George Property.

2.5.1 Field Sample Collection

Duplicate stream water samples were collected from each site using clean techniques. Where reduced flow was present, samples were collected from banks or rocks to prevent contamination from sediments. Samples were always collected where flow was evident. Where flow was high, the field sampler stood facing upstream being careful not to disturb sediments. Where possible, samples were

collected from 10 cm depth. Water quality samples were preserved immediately in the field (as described in lakes water quality section).

In August, water quality samples could not be collected for Echo OF as it was dry, and Reference B OF had to be sampled 600 m upstream near the outflow (Plate 2.5-1).

Plate 2.5-1. August water quality samples could not be collected from Echo OF due to dry stream bed (left), and had to be collected in a new location from Reference B OF due to low water levels at original Reference B OF sampling site (right).

Stream water samples were analyzed for the same parameter list as lake water quality samples, and handled and transported identically to the lake water quality samples.

2.5.2 Quality Assurance/Quality Control (QA/QC)

As with lake water quality component, QA/QC measures were included with stream water quality sampling. The program included the use of duplicates, blanks, and chain of custody forms.

Duplicate samples were collected at all sites to allow identification of natural variability, which tends to be higher in the more turbulent streams compared to lakes due to heterogeneously suspended matter (such as organic debris, small insects, etc.).

Field blanks and travel blanks comprised 9% of the total number of stream water quality samples. Field blanks and travel blanks were collected as described in the lake water quality section above.

2.5.3 Data Management

Streams water quality data was managed identically to the lakes water quality data. RPDs were calculated as described in the lakes water quality data management section.

2.6 LAKE SEDIMENT QUALITY

The 2012 sediment quality sampling focused on characterizing the natural variation in lake sediments with depth and by lake. Samples were collected in August from the same twenty four lake sampling sites sampled for water quality, and included one reference lake located approximately 50 km away from George Camp. Thirteen of these lake sites were in the Goose Property and ten were in the George Property.

2.6.1 Field Sample Collection

Triplicate sediment quality samples were collected using an Ekman grab sampler (surface area: 0.0225 m^2). The Ekman was lowered to the sediment layer, trigged shut with a weighted messenger, and then brought gently to the surface, with care taken to not agitate the collected sediments. At the surface, the sediment was carefully transferred onto a white plastic tray, photographed, and described for colour, texture, and other characteristics. The top 2-3 cm of sediment was collected and homogenized in a plastic bowl before being split into two whirl-pak bags, one for particle size and one for sediment chemistry. Plate 2.6-1 shows the collection of sediment samples.

Plate 2.6-1. Sediment quality samples were collected using an Ekman grab. Left, setting the grab; Centre, ready to release the sediment; Right, the sediment ready for the top layer to be sampled (Gander Lake).

Sediment samples were kept cold and sent to ALS in Yellowknife, NT on the first available flight from camp. Samples were then sent to ALS's Burnaby laboratory where they were analyzed for grain size, moisture, nutrients, cyanide and solid-phase metals.

Table 2.6-1 presents the sediment quality parameters that were analyzed and their detection limits. Note that realized detection limits may differ from these theoretical values. The realized detection limit ranges are indicated on all relevant figures.

Table 2.6-1. Sediment Quality Parameters and Detection Limits, Back River Project, 2012

Parameter	Units	Detection Limit	Parameter	Units	Detection Limit
Physical Tests			***Leachable Nutrients***		
% Moisture	%	0.25	Total Nitrogen	%	0.02
pH	pH	0.1	***Plant Available Nutrients***		
Particle Size			Available Ammonium (as N)	mg/kg	1
% Gravel (>2 mm)	%	0.1	Available Nitrate (as N)	mg/kg	2
% Sand (2.0 mm - 0.063 mm)	%	0.1	Nitrite (as N)	mg/kg	0.4
% Silt (0.063 mm – 4 µm)	%	0.1	Available Phosphate (as P)	mg/kg	2
% Clay (<4 µm)	%	0.1	***Cyanides***		
Organic Carbon			Total Cyanide	mg/kg	3
Total Organic Carbon	%	0.1	Weak-acid dissociable Cyanide	mg/kg	3

(continued)

Table 2.6-1. Sediment Quality Parameters and Detection Limits, Back River Project, 2012 (completed)

Parameter	Units	Detection Limit	Parameter	Units	Detection Limit
Metals			***Metals (continued)***		
Aluminum (Al)	mg/kg	50	Mercury (Hg)	mg/kg	0.005
Antimony (Sb)	mg/kg	0.1	Molybdenum (Mo)	mg/kg	0.5
Arsenic (As)	mg/kg	0.05	Nickel (Ni)	mg/kg	0.5
Barium (Ba)	mg/kg	0.5	Phosphorus (P)	mg/kg	50
Beryllium (Be)	mg/kg	0.2	Potassium (K)	mg/kg	100
Bismuth (Bi)	mg/kg	0.2	Selenium (Se)	mg/kg	0.2
Cadmium (Cd)	mg/kg	0.05	Silver (Ag)	mg/kg	0.1
Calcium (Ca)	mg/kg	50	Sodium (Na)	mg/kg	100
Chromium (Cr)	mg/kg	0.5	Strontium (Sr)	mg/kg	0.5
Cobalt (Co)	mg/kg	0.1	Sulphur (S)	mg/kg	500
Copper (Cu)	mg/kg	0.5	Thallium (Tl)	mg/kg	0.05
Iron (Fe)	mg/kg	50	Tin (Sn)	mg/kg	2
Lead (Pb)	mg/kg	0.5	Titanium (Ti)	mg/kg	1
Lithium (Li)	mg/kg	5	Uranium (U)	mg/kg	0.05
Magnesium (Mg)	mg/kg	20	Vanadium (V)	mg/kg	0.2
Manganese (Mn)	mg/kg	1	Zinc (Zn)	mg/kg	1

2.6.2 Quality Assurance/Quality Control (QA/QC)

All sediment quality samples were recorded on a chain of custody form and sent to ALS in Yellowknife. Samples were then sent to ALS's Burnaby laboratory for analysis, where lower detection limits could be obtained.

2.6.3 Data Management

All parameters for which CCME sediment quality guidelines for the protection of aquatic life exist, as well as other parameters of interest, were graphed.

Values below analytical detection limits were replaced with half the realized detection limit for graphing and analysis. All sediment samples collected were compared to the following CCME guidelines for the protection of aquatic life, including the interim sediment quality guidelines (ISQGs) and the probable effects levels (PELs; CCME 2012). The more conservative ISQGs are levels below which adverse biological effects are rarely observed, whereas the higher PELs correspond to concentrations above which negative effects frequently occur. The factor of exceedance, the factor by which concentrations exceeded CCME guidelines, was calculated for each sample. The average factor of exceedance was calculated for each lake.

2.7 STREAM SEDIMENT QUALITY

The seventeen stream sites were also sampled for sediment quality in August 2012 (Table 2.1-2). Twelve of these stream sites were in the Goose Property and five were in the George Property. Three replicate samples were collected per stream site.

2.7.1 Field Sample Collection

Stream sediments were collected with a plastic spoon. Each replicate sample was a composite of multiple spoonfuls from a single reach, homogenized in a plastic bowl, and collected in a whirl-pak bag (Plate 2.7-1). Depositional zones (where finer sediments accumulate) were preferentially sampled. All sediment quality samples were transported and analyzed as described in the lake sediment section above.

Plate 2.7-1. Three sediment quality samples were collected into labelled whirl-pak bags at each site. Left, samples were first homogenized in a plastic bowl (Komatic IF, replicate 2); right, the three sediment quality replicates from Giraffe Outflow.

2.7.2 Quality Assurance/Quality Control (QA/QC)

As with lake sediment quality samples, stream sediment samples were recorded on a chain of custody form and sent to ALS in Yellowknife. Samples were then sent to ALS's Burnaby laboratory for analysis, as lower detection limits could be obtained there.

Sediment quality samples could not be collected from Llama OF which runs through a boulder garden (Plate 2.7-2) or Echo OF as it was dry during the August sampling period.

Plate 2.7-2. Fine depositional sediments could not be collected from Llama OF as the stream runs through a boulder garden. Fine depositional sediments likely fall through gaps between large rocks.

2.7.3 Quality Assurance/Quality Control (QA/QC)

As with lake sediment quality samples, stream sediment samples were recorded on a chain of custody form and sent to ALS in Yellowknife. Samples were then sent to ALS's Burnaby laboratory for analysis, where lower detection limits could be obtained.

2.7.4 Data Management

Streams sediment quality data was managed identically to the lakes sediment quality data.

2.8 PRIMARY PRODUCERS

2.8.1 Phytoplankton

Phytoplankton are free-floating autotrophic algae that play an important role in many aquatic systems as primary producers and prey for higher trophic levels. Phytoplankton have short generation times and can respond rapidly to environmental change. These characteristics make them useful indicators of water quality and ecosystem health. Phytoplankton biomass, densities, and taxonomy samples were collected from a total of twelve lake sampling sites in the Goose Property and nine lake sampling sites in the George Property during April and/or August 2012.

2.8.2 Phytoplankton Field Sample Collection

In April, a single sample was collected from all lakes sampled for water quality. Under-ice samples were collected from 1 m below the ice water interface using a Niskin bottle. In August, triplicate samples were collected from 1 m below the surface using a 5 L GO-FLO bottle. One litre was collected for each biomass sample in an opaque plastic bottle, to ensure chlorophyll did not degrade and phytoplankton did not multiply before being filtered (Plate 2.8-1). For each density/taxonomy sample, 250 mL was collected.

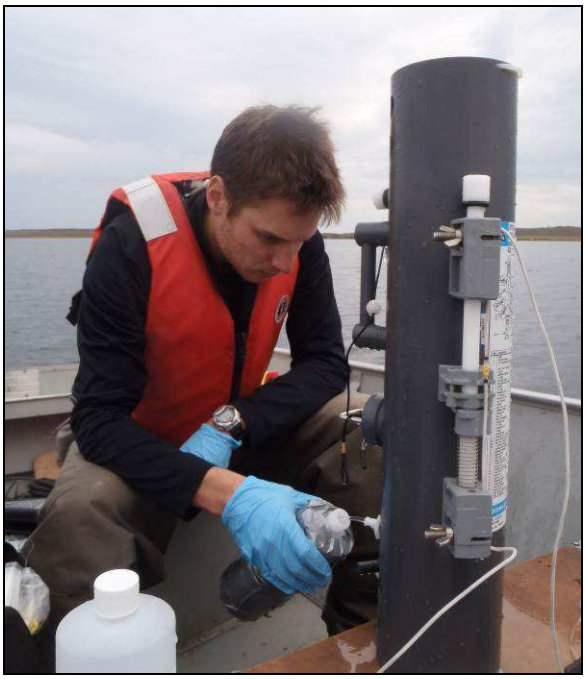


Plate 2.8-1. Phytoplankton samples were collected from 1 m depth using the GO-FLO. Above, biomass samples being collected in an opaque bottle at Fold Lake in August 2012.

Phytoplankton biomass samples were filtered onto 0.45 µm pore size filters back in camp and kept dark and frozen until analysis by ALS in Burnaby. Density/taxonomic samples were preserved with Lugol's iodine solution and were sent to EcoAnalysts, Idaho, USA for enumeration and identification.

2.8.3 Periphyton

Periphyton are algae that grow on the surfaces of rocks or larger plants and are an important food item for many benthic invertebrates, which are in turn the main food source for fish in streams and rivers. Because of their rapid generation rates, periphyton are among the first organisms to respond to environmental stressors or nutrients, and can exhibit taxon-specific changes making them good indicators of current environmental conditions. Three stream periphyton samples were collected from eleven streams in the Goose Property and five streams in the George Property during August 2012.

2.8.4 Periphyton Field Sample Collection

A circular template with a foam base was used to seal a known area of rock from the rest of the rock. Periphyton in this area were collected using tweezers, a modified toothbrush, a syringe, and distilled water. For each replicate, two rocks were selected with flat upper surfaces suitable for periphyton sampling. The periphyton were sampled from three circles on each of the two rocks for each replicate (i.e., a total of six circles; Plate 2.8-2).

Plate 2.8-2. Periphyton were collected from a known area using a circular template. Left, template and a periphyton-covered rock at Propellor OF; Right, after sampling the rocks from one replicate at MN-01 OF, note the six bare circles.

No periphyton samples could be collected at Echo OF as it was dry during August sampling. Substrate at Komatic IF was entirely soft sediments, with no rocks. The periphyton community was collected in a similar fashion to other streams, by holding a template onto the sediment, scraping the periphyton off the sediment, and using a syringe to collect the suspended periphyton.

The volume of periphyton samples were measured back at the lab. For biomass, each sample was homogenized, and a known volume (usually between 5 and 10%) was sampled using a syringe. This subsample was filtered onto 0.45 µm pore size filters back in camp and kept dark and frozen until analysis by ALS in Burnaby. The remaining volume was the density/taxonomy sample and was preserved with Lugol's solution and sent to EcoAnalysts, Idaho, USA for enumeration and identification.

2.8.5 Quality Assurance/Quality Control (QA/QC)

Primary producer samples had triplicate replication at each site, and used chain of custody forms. EcoAnalysts have their own internal QA/QC protocols including creating a digital image library of every taxon encountered in the project for future reference, and having an independent phycologist analyze 10% of samples to ensure taxonomic accuracy and reproducibility in the analysis methods.

2.8.6 Data Management and Analysis

The number of organisms per sample was converted to density, either cells/L for phytoplankton and cells/cm^2 for periphyton, by dividing each sample by the volume/area sampled.

Density, genus richness, and diversity were calculated from the taxonomic analysis. Richness is the simplest measure of biodiversity and is simply a count of the number of taxa (in this case genera) in a given area or volume. Diversity indices are quantitative measures of how evenly the taxon richness is distributed within a known area or volume.

For the calculation of richness and diversity, taxa were grouped by genera. Plankton and periphyton not identifiable to the genus level were excluded from the richness and diversity analysis (for phytoplankton an unknown Chlorophyte coccoid, for periphyton an unknown centric diatom and an unknown pennate diatom). The Simpson's diversity index (D) was used as the measure of diversity, and takes into account dominance, the number of taxa present, and relative abundance of each taxa (evenness). This was calculated by:

$$\textit{Simpson's Diversity Index (}D\textit{)} = 1 - \sum_{i=1}^{G} p_i^2$$

where G is the number of genera present, and p_i is the relative density of each genus calculated as n_i/N, where n_i is the number of individuals in genus i, and N is the total number of all individuals. Note that this formula for the Simpson's diversity index produces values that range from 0 (lowest diversity) to 1 (maximum diversity), and represents the probability that two genera taken randomly from a sample are from two different genera.

2.9 AQUATIC INVERTEBRATES

2.9.1 Zooplankton

Zooplankton are the heterotrophic component of aquatic plankton, and serve as an important link in the aquatic food web, acting as consumers of phytoplankton and prey to many fish species. Zooplankton samples were collected from seven lake sites in the Goose Property and nine lakes sites in the George Property during August 2012 (Table 2.1-1).

Field Collection

Three samples were collected using a 30 cm diameter, 118 µm mesh size zooplankton net fitted with an internally mounted flowmeter (General Oceanics, model 2030R). At locations deeper than 6 m, vertical hauls were used. At these sites, the net was lowered to within 1.5 m of the lake bottom and brought to the surface at a speed of 0.5 m/s. At sites between 2 m and 6 m depth, oblique tows were conducted by lowering the net to within 1.5 m of the lake bottom and hauling the net vertically while the boat was moved along the anchor line. Horizontal tows were conducted at the shallower sites less than 2 m by pulling the zooplankton net through the surface water (0.5 m depth) for approximately 10 s at a rate of 0.5 m/s.

The samples were preserved with 5% buffered formalin and sent to EcoAnalysts, Idaho, USA, for enumeration and identification (Plate 2.9-1).

Plate 2.9-1. Zooplankton collected at Rabbit Lake, August 2012.

Quality Assurance/Quality Control (QA/QC)

Zooplankton samples had triplicate replication at each site, and used chain of custody forms. EcoAnalysts have their own internal QA/QC protocols including creating a digital image library of every taxon encountered in the project for future reference, and having an independent taxonomist analyze 10% of samples to ensure taxonomic accuracy and reproducibility in the analysis methods.

Data Management

The internally-mounted flowmeter was used to allow the calculation of the volume of water passing through the net during all hauls. The volume sampled for zooplankton was calculated, as outlined in the General Oceanics instruction manual (General Oceanics Inc., accessed 2012), and shown by the following equation:

$$\textit{Volume in } m^3 = (\textit{number of flowmeter counts} \times 26{,}873/999{,}999) \times (\textit{diameter of net opening}^2/4) \times \pi$$

Zooplankton densities were calculated by dividing the number of individuals per sample by the volume of water filtered (in cubic metres).

Genus richness and diversity were calculated as outlined in the primary production section, with organisms unidentified to genus level excluded from analyses. Additionally, nauplii were excluded from all analyses, and copepodites were excluded from composition, richness, and diversity analyses.

2.9.2 Benthic Macroinvertebrates

Benthic macroinvertebrates (benthos) are organisms greater than 500 µm in size that inhabit lake and stream bottoms. Benthos are important indicators of environmental change as these organisms are in close contact with the sediments and feed on algae, bacteria, and detritus. Benthic invertebrates also less mobile than fish, making them good indicators of local conditions. Benthic organisms are also important food sources for fish, particularly in streams.

Lake Benthos Field Collection

Lake benthos samples were collected from eleven lake sites in the Goose Property and ten lake sites in the George Property during August 2012. Five replicate samples, each a composite of three Ekman grab

samples, were collected at each lake site. Samples were gently sieved in the field using a 500 µm sieve bucket (Plate 2.9-2). Samples were preserved in 10% buffered formalin and then sent to EcoAnalysts, Idaho, USA, for enumeration and identification.

Plate 2.9-2. Sediment was gently sieved out of the benthos samples.

Stream Benthos Field Collection

Benthos samples were collected from seventeen stream sites during August 2012. A 500 µm mesh size Hess sampler, with a sampling surface area of 0.096 m^2, was used to collect stream benthos samples (Plate 2.9-3). Five replicate samples, each a composite of three Hess samples were collected from each stream station. Most streams had limited flow during August. Consequently, replicate samples were collected where depth and substrate allowed. Notes were taken on depth and flow in the area. When required, flow was created by the sampler to ensure all benthic invertebrates were swept into the Hess sampler's cod end.

Plate 2.9-3. Benthos samples were collected using a Hess Sampler. Left, at Gander US, one of the streams with higher flow and volume; Right, a small benthos sample at bottom of plastic sample jar from Gander US.

Samples were preserved in 10% buffered formalin and sent to EcoAnalysts, Idaho, USA for enumeration and identification.

Quality Assurance/Quality Control (QA/QC)

Each lake and stream benthos sample was a composite of three subsamples. Five benthos replicate samples were collected at each site, and all samples were recorded on chain of custody forms. EcoAnalysts have their own internal QA/QC protocols including having an independent taxonomist analyze 10% of samples to ensure taxonomic accuracy and reproducibility in the analytical methods, and assessing their sorting efficiency.

To ensure consistent and accurate sorting of benthos samples (sorting efficacy), a quality assurance (QA) sort of benthic sample residues was conducted on a randomly selected 10% of the benthos samples. The criterion for an acceptable sort was that more than 90% of the total number of organisms found in both the initial and QA sort were recovered during the initial sort, as required by Environment Canada for invertebrate community surveys (Environment Canada 2002). Any sample not meeting the 90% removal criterion was re-sorted a third time.

This was calculated by the following equation:

$$\text{SortingEfficacy} = \frac{\text{OriginalCount}}{\text{OriginalCount} + \left(\frac{\text{QACount} * \text{QASquares}}{\text{QTSquares}} \right)} * 100$$

where OriginalCount = the number of organisms picked up by the first sorter; QACount = the number of organisms found in the Quality Assurance sort; QASquares = the number of grids sorted during the QA process; QTSquares = the total number of grids in the QA Caton sampling tray.

2.9.3 Data Management

The number of individuals per sample was converted to density (individuals/m^2) by dividing each sample by the volume/area sampled.

Richness and diversity were calculated as outlined in the primary producer section, but at the family level instead of the genus level. Organisms unidentified to genus level were excluded from analyses. Nematodes are meiofauna and samples collected using 500 µm mesh will not be representative, copepods are pelagic and cladocera (water fleas) are mobile and were not considered permanent members of the benthos (Environment Canada 2011).

3. Results and Discussion

3. Results and Discussion

3.1 TEMPERATURE AND DISSOLVED OXYGEN

3.1.1 Under-ice Physical Limnology

Ice thickness, temperature, and dissolved oxygen concentrations were measured in April 2012 (Figures 3.1-1a to 3.1-1c; Appendix 3.1-1).

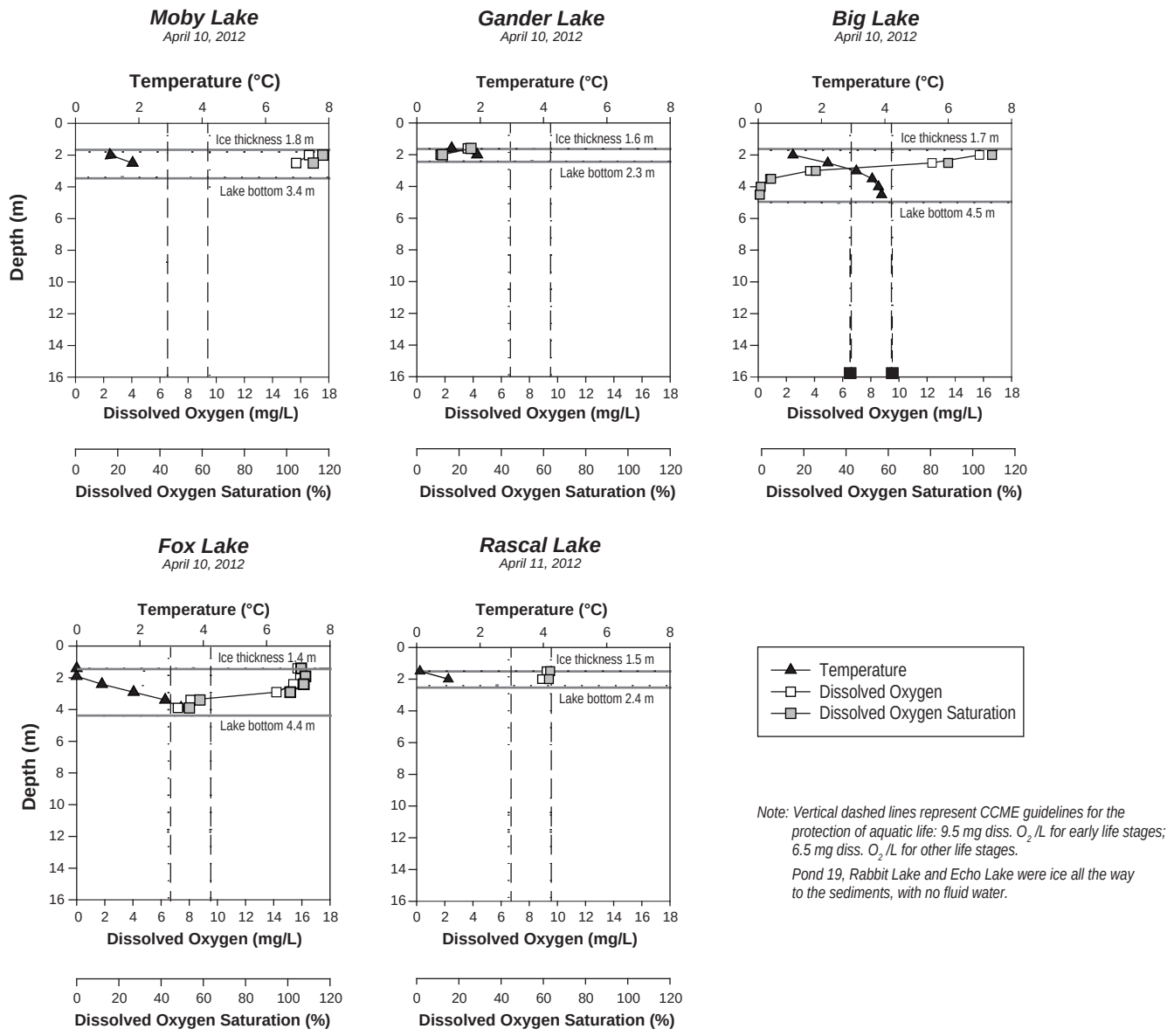
All lakes were isothermal. Temperatures near the ice-water interface were close to 1°C, and warmed to approximately 3°C to 4°C near the sediments of lakes deeper than 4 m. Temperatures in the deeper Reference Lake C, with a maximum lake depth of 35 m, were cooler ranging from 0.6°C at the ice-water interface to 1.1°C close to the bottom.

April temperature and dissolved oxygen profiles at sampling sites generally had lower temperatures and higher dissolved oxygen concentrations at the ice-water interface than near the sediments. Reference Lake C had more consistent temperatures and dissolved oxygen concentrations through the water column than the other lake sites. There was no clear difference in profiles between lakes in the Goose and George areas.

Dissolved oxygen concentrations tended to be highest near the water-ice interface: between 13.0 mg/L and 17.7 mg/L in most lakes. The water near the water-ice interface was at over 90% oxygen saturation at most lakes. Well-oxygenated water suggests there was higher primary productivity at the surface, with the actively photosynthesizing algae as the main oxygen source during the under-ice period since no atmospheric exchange was possible.

The two lakes that were not well oxygenated in April were the shallow Gander Lake (2.3 m) and Rascal Lake (2.4 m), both within the Goose Property. These lakes had dissolved oxygen concentrations that were below CCME guidelines for freshwater aquatic life. Established CCME guideline oxygen concentrations for the protection of cold-water aquatic life are 9.5 mg/L for early life stages and 6.5 mg/L for other life stages (CCME 2012). The maximum dissolved oxygen concentration at Gander Lake was 3.6 mg/L, well below the CCME guidelines for early and all other life stages. Rascal Lake had dissolved oxygen concentrations slightly below the CCME guideline for early life stages (9.22 mg/L and 8.9 mg/L). The highest dissolved oxygen concentrations were measured at the shallowest lake George Lake South (15.2 mg/L) (George Property). However there was only 0.4 m of fluid water, and results could be an artifact of the augering process in extremely low water conditions or a reflection of ice algae or periphyton photosynthesis.

Generally, dissolved oxygen concentrations declined gradually throughout the water column to minimum concentrations at the water-sediment interface. Many lakes had minimum dissolved oxygen concentrations below the CCME guidelines in their deeper waters; exceptions tended to be the shallow lakes (Moby, Giraffe North, Goose Neck, Goose Central, and George South) and the deeper lakes (Fold, George Central, and Reference C). Low levels of dissolved oxygen near the water-sediment interface are common in Arctic lakes over April, and are a result of oxygen depletion from decomposition and respiration in the water-sediment interface and a lack of atmospheric exchange due to ice cover (CCME 2012).



Note: Vertical dashed lines represent CCME guidelines for the protection of aquatic life: 9.5 mg diss. O_2 /L for early life stages; 6.5 mg diss. O_2 /L for other life stages.

Pond 19, Rabbit Lake and Echo Lake were ice all the way to the sediments, with no fluid water.

Figure 3.1-1a

Sabina GOLD & SILVER CORP.

Under-ice Temperature and Dissolved Oxygen Profiles in Goose Area Lakes, Back River Project, April 2012

Figure 3.1-1a

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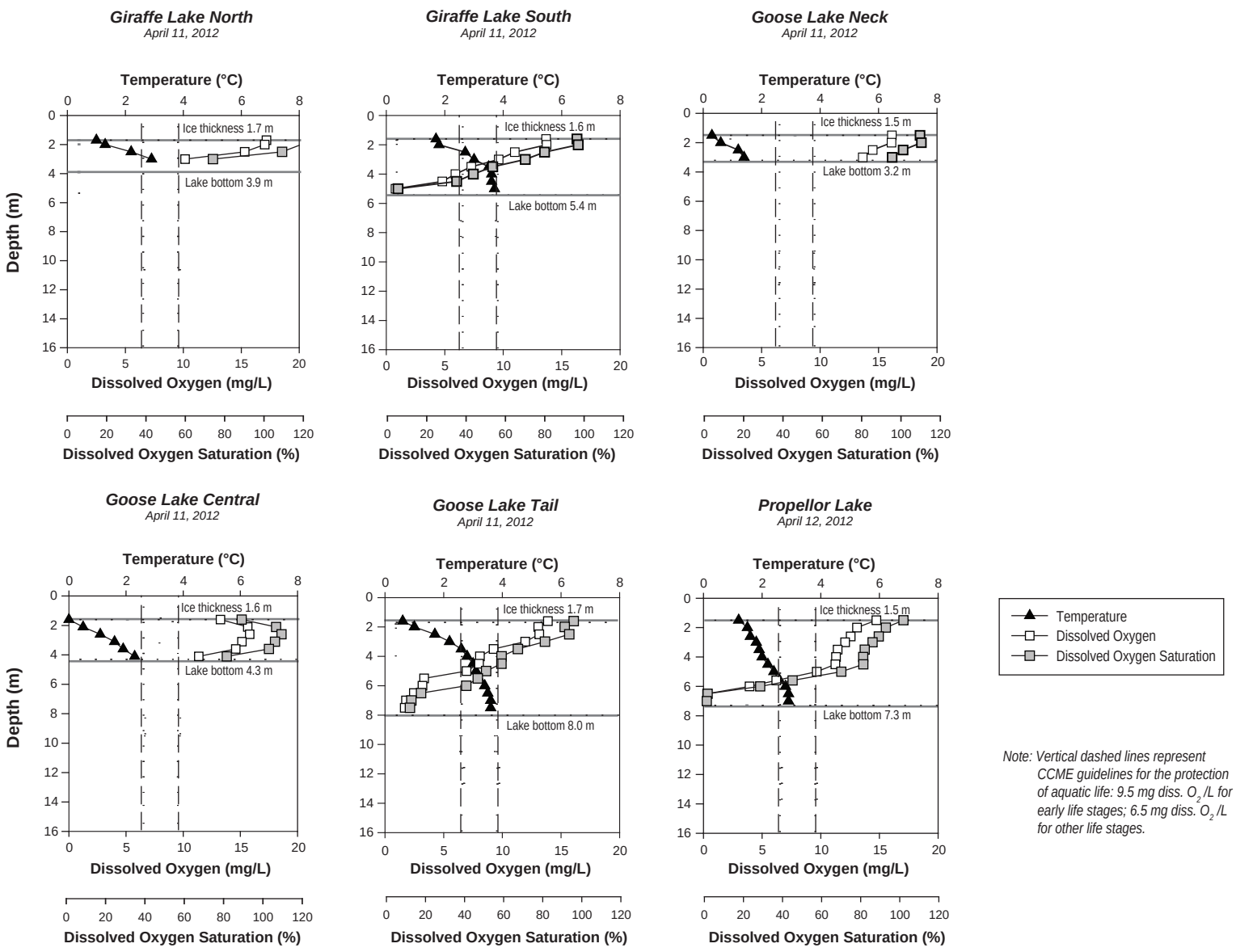


Note: Vertical dashed lines represent CCME guidelines for the protection of aquatic life: 9.5 mg diss. O_2 /L for early life stages; 6.5 mg diss. O_2 /L for other life stages.

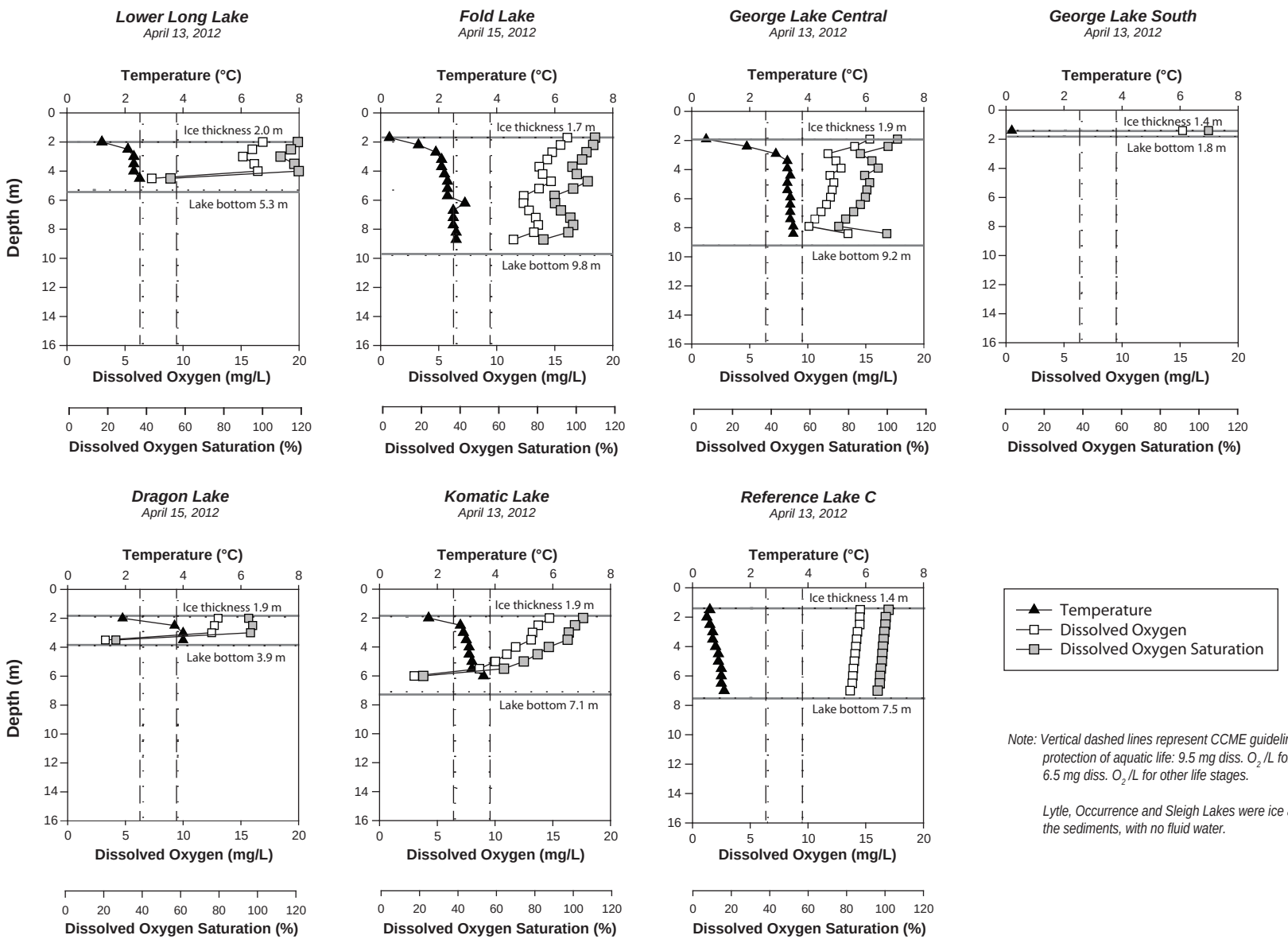
Figure 3.1-1b

Sabina GOLD & SILVER CORP.

Under-ice Temperature and Dissolved Oxygen Profiles in Goose Area Lakes, Back River Project, April 2012

Figure 3.1-1b

Rescan™ Engineers & Scientists



Note: Vertical dashed lines represent CCME guidelines for the protection of aquatic life: 9.5 mg diss. O_2 /L for early life stages; 6.5 mg diss. O_2 /L for other life stages.

Lytle, Occurrence and Sleigh Lakes were ice all the way to the sediments, with no fluid water.

Figure 3.1-1c

Sabina GOLD & SILVER CORP.

Under-ice Temperature and Dissolved Oxygen Profiles in George Area Lakes, Back River Project, April 2012

Figure 3.1-1c

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3.1.2 Open-water Physical Limnology

Limnological characteristics were measured during the open-water season in August 2012, and included temperature and dissolved oxygen profiles (Figures 3.1-2a to 3.1-2d) and Secchi depths. Surface temperatures tended to be higher, and dissolved oxygen concentrations and saturations lower, in August than in April. Lake temperature and dissolved oxygen profiles were also more stable down the water column in August than in April.

Depth profiles showed most lakes were well mixed in the August, with uniform temperatures and dissolved oxygen concentrations through the water column. The exception to this was Reference Lake C, a lake over twice as deep as the others sampled, which was stratified with a distinct thermocline at 19 m. Waters above the thermocline were warmer, with lower dissolved oxygen concentrations, although dissolved oxygen saturation was fairly constant throughout the water column.

Overall, surface temperatures varied between lakes from 8.5°C to 13°C, with the warmest lakes being Moby Lake, Fox Lake, Goose Lake Neck and Propellor Lake, all in the Goose area. Water temperatures below the thermocline at Reference Lake C were cooler, ranging from 6°C to 8.5°C (Figure 3.1-2d).

August dissolved oxygen concentrations and saturations were greater in the Goose area lakes than in the George area lakes. Dissolved oxygen concentrations ranged between 9.5 mg/L and 11.5 mg/L in Goose area lakes, and between 8 mg/L and 9.5 mg/L in the George area lakes (with the highest concentrations below the thermocline in Reference Lake C). Dissolved oxygen saturations followed a similar trend, ranging from 85% to 100% in Goose area lakes compared with 75% to 80% in George area lakes.

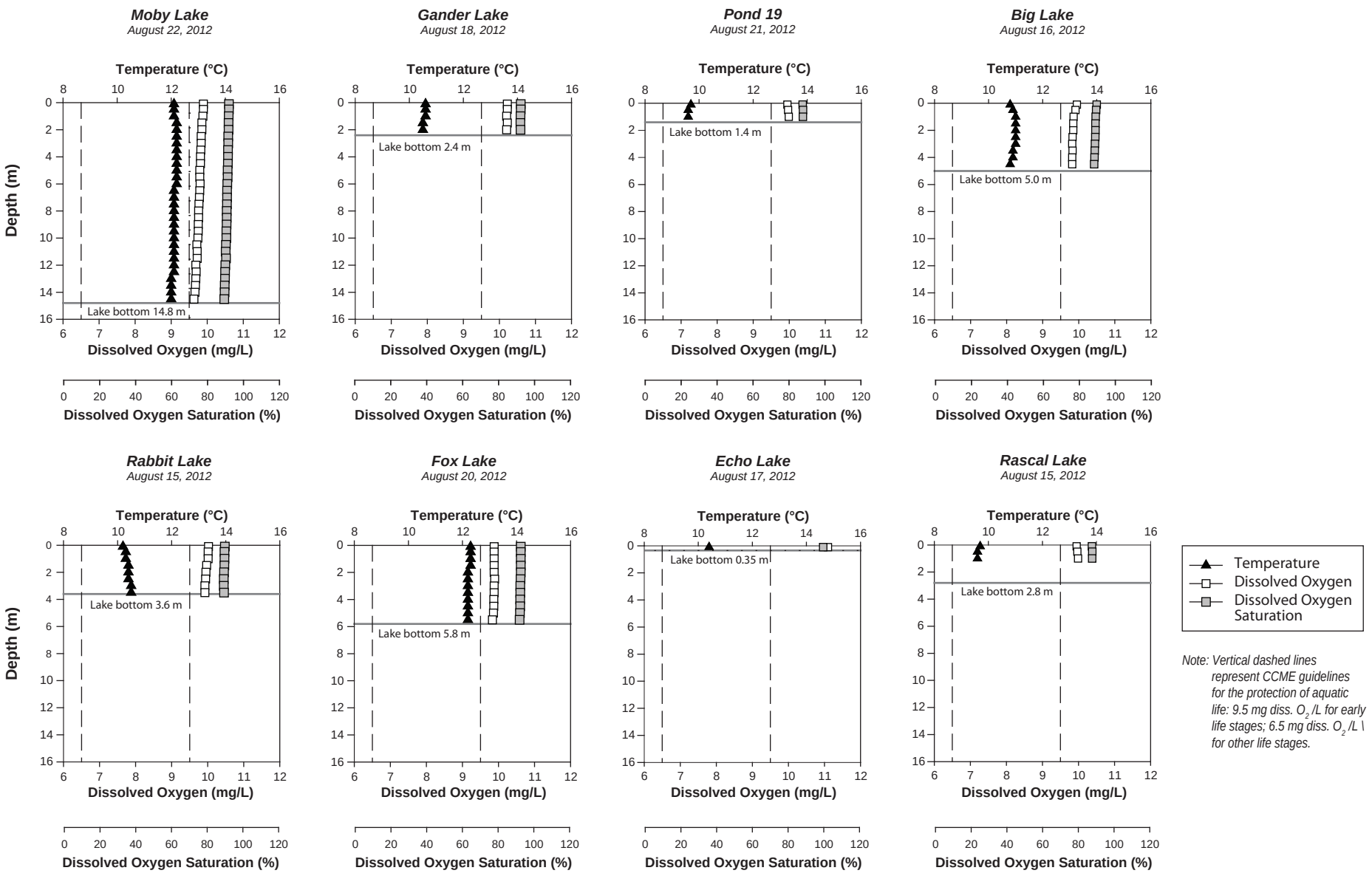
Dissolved oxygen concentrations were above the CCME guideline for the protection of aquatic life for early life stages (9.5 mg/L) at all Goose area lake sites at all depths. For lakes within the George Property, dissolved oxygen concentrations tended to be below the CCME guideline with the exception of Reference Lake C. All lakes at all depths were above the CCME guidelines for early life stages (6.5 mg/L; CCME 2012).

Secchi depth, a measure of water clarity, was deeper than the bottom in shallower lakes (i.e., light reached sediment layer), and ranged from 4.8 m to 8.4 m in the deeper lakes (Table 3.1-1). The euphotic depth, the depth with sufficient sunlight for net photosynthesis, extended throughout the water column in all lakes, except the deep Reference Lake C. This indicates that net photosynthesis could occur throughout the entire water column as well as in the benthic habitat. Reference Lake C had a euphotic depth 17 m, slightly above the observed August thermocline (19 m). This indicates this lake would be less favourable for phytoplankton growth during this period due to the algae being mixed into deeper, more poorly lit waters. Benthic primary production would be increasingly possible as the waters became shallower than 17 m.

3.1.3 Stream Temperature and Dissolved Oxygen

Stream temps and DO measurements were collected in June 2012, shortly after ice thaw, and in the lower flow August and September months. Streams had higher water levels and flow in June, and lower levels and flow in August, with moderate water levels and flow in September. Sections of many streams were either dry or flowed underground or through boulder fields during August sampling. Echo OF was dry during August sampling, and both Reference B OF and Reference C OF sampling sites had to be moved upstream to allow sampling. Plate 3.1-1 shows the stream flow and water level during the three sampling sessions; many streams also had hydrometric stations with quantitative data available in the 2012 hydrology report (Rescan 2012b).

Temperatures were measured in June, August, and September 2012, and dissolved oxygen concentrations were measured during the lower flow sampling surveys in August and September 2012.



Note: Vertical dashed lines represent CCME guidelines for the protection of aquatic life: 9.5 mg diss. O_2 /L for early life stages; 6.5 mg diss. O_2 /L \ for other life stages.

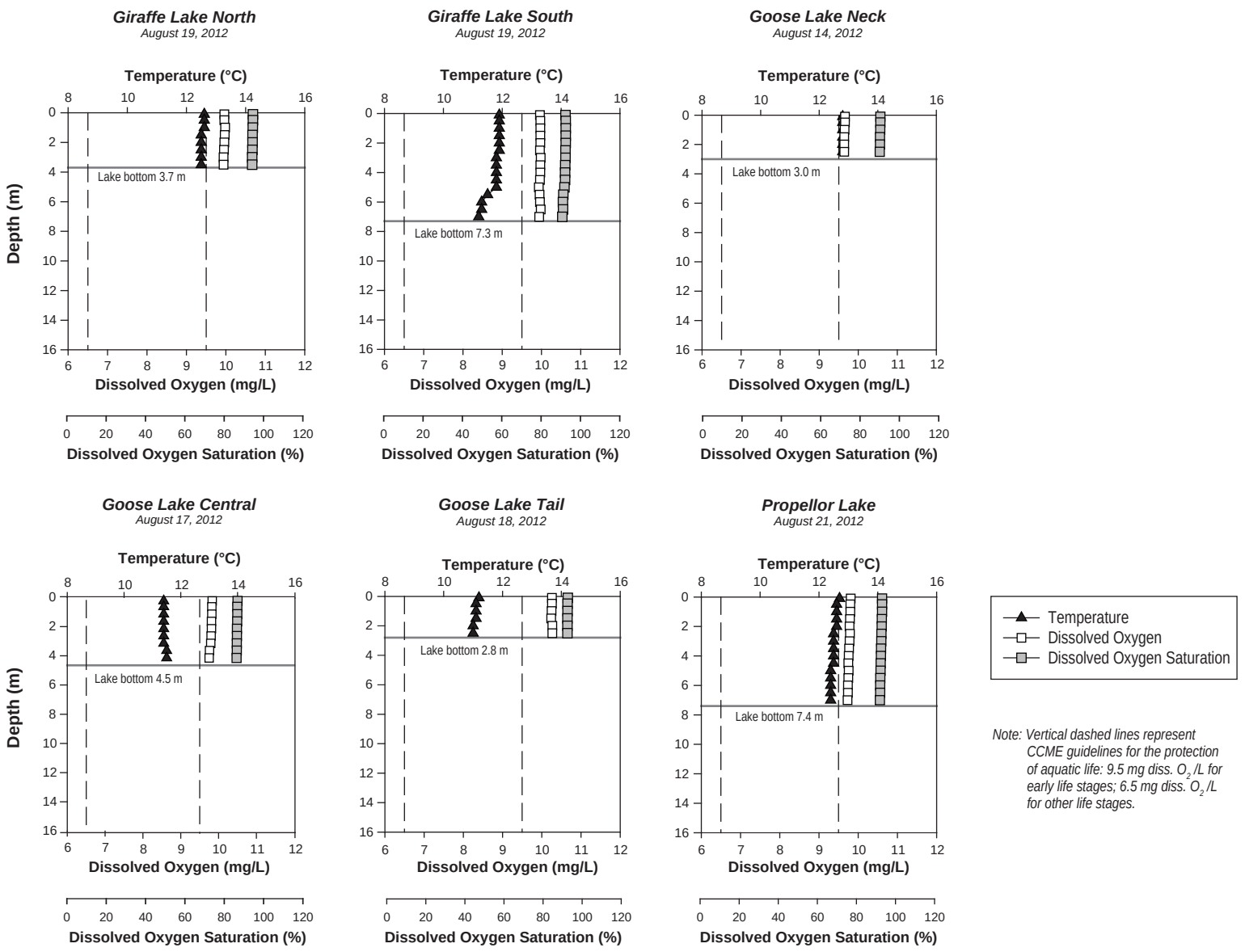
Figure 3.1-2a

Sabina GOLD & SILVER CORP.

Open-water Temperature and Dissolved Oxygen Profiles in Goose Area Lakes, Back River Project, August 2012

Figure 3.1-2a

Rescan™ Engineers & Scientists



Note: Vertical dashed lines represent CCME guidelines for the protection of aquatic life: 9.5 mg diss. O_2 /L for early life stages; 6.5 mg diss. O_2 /L for other life stages.

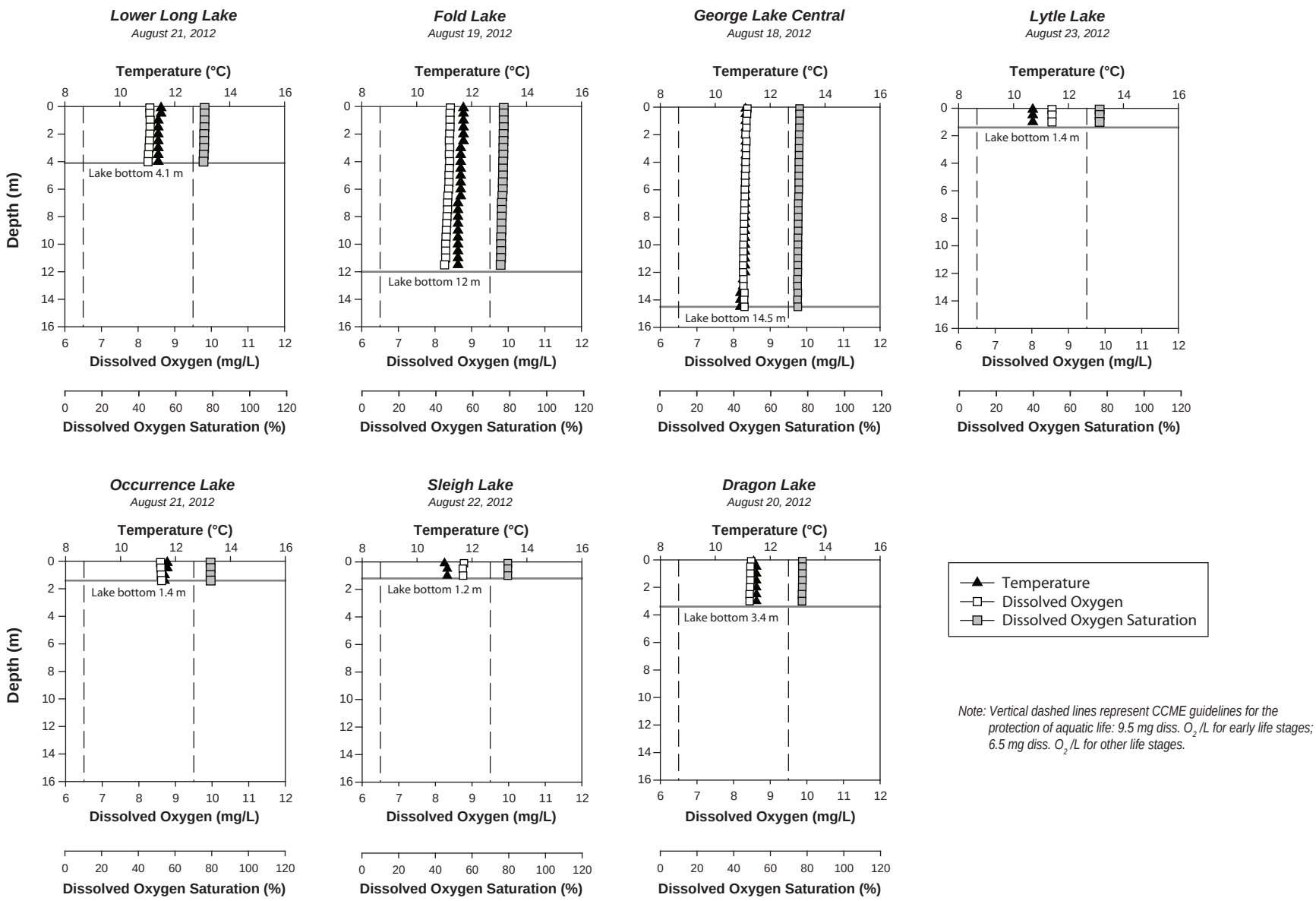
Figure 3.1-2b

Sabina GOLD & SILVER CORP.

Open-water Temperature and Dissolved Oxygen Profiles in Goose Area Lakes, Back River Project, August 2012

Figure 3.1-2b

Rescan™ Engineers & Scientists



Note: Vertical dashed lines represent CCME guidelines for the protection of aquatic life: 9.5 mg diss. O_2 /L for early life stages; 6.5 mg diss. O_2 /L for other life stages.

Figure 3.1-2c

Sabina GOLD & SILVER CORP.

Open-water Temperature and Dissolved Oxygen Profiles in George Area Lakes, Back River Project, August 2012

Figure 3.1-2c

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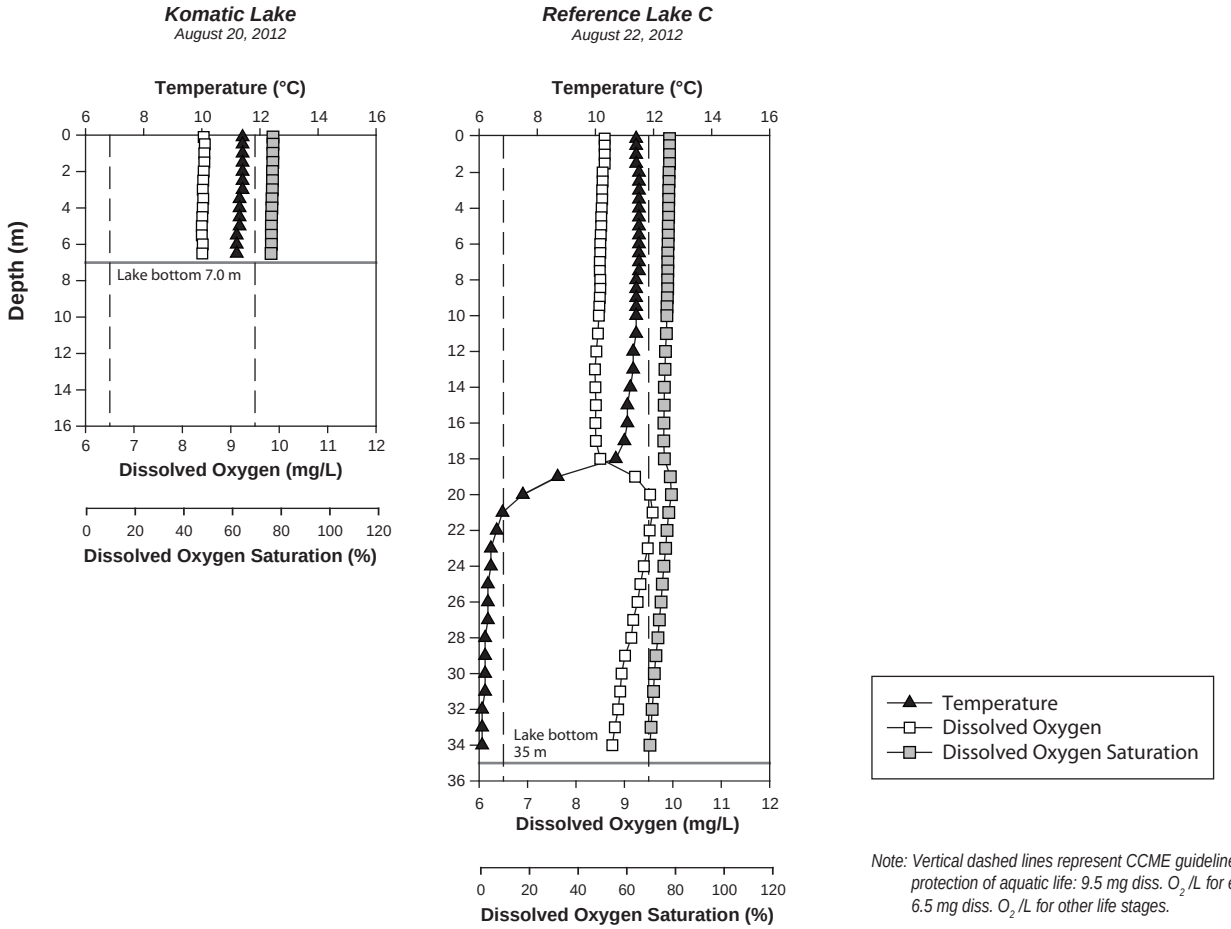

Note: Vertical dashed lines represent CCME guidelines for the protection of aquatic life: 9.5 mg diss. O_2 /L for early life stages; 6.5 mg diss. O_2 /L for other life stages.

Figure 3.1-2d

Sabina GOLD & SILVER CORP.

Open-water Temperature and Dissolved Oxygen Profiles in George Area Lakes, Back River Project, August 2012

Figure 3.1-2d

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Table 3.1-1. Secchi and Euphotic Zone Depths for the Back River Lakes, August 2012

Lake	Sampling Site Depth (m)	Secchi Depth D_s (m)	Euphotic Zone Depth EZD (m)
Goose Area			
Moby Lake	14.8	6.7	bottom (18.1)
Gander Lake	2.4	bottom	
Pond 19	1.4	bottom	
Big Lake	5.0	bottom	
Rabbit Lake	3.6	bottom	
Fox Lake	5.8	5.0	bottom (13.5)
Echo Lake	0.4	bottom	
Rascal Lake	2.8	bottom	
Giraffe Lake North	3.7	bottom	
Giraffe Lake South	7.3	5.5	bottom (14.9)
Goose Lake Neck	3.0	bottom	
Goose Lake Central	4.5	bottom	
Goose Lake Tail	2.8	bottom	
Propellor Lake	7.4	6.5	bottom (17.6)
George Area			
Lower Long Lake	4.1	bottom	
Fold Lake	12	6.7	bottom (18.1)
George Lake Central	14.5	8.4	bottom (22.7)
George Lake South	1.6	bottom	
Lytle Lake	1.4	bottom	
Occurrence Lake	1.4	bottom	
Sleigh Lake	1.2	bottom	
Dragon Lake	3.4	bottom	
Komatic Lake	7.0	4.8	bottom (13.0)
Reference Lake C	35.0	6.3	17.0

Note: Euphotic Zone Depth is the depth at which light penetration is 1% of the surface irradiance.

Temperatures varied seasonally in the Project streams, with the highest temperatures during the low-flow August period. Streams ranged from 3°C to 11°C in June, 8°C to 19°C in August, 3°C to 11°C in September. George area streams tended to be colder in June and warmer in August, with no clear trend in September (Table 3.1-2).

Dissolved oxygen concentrations in streams were lower in August than in September, with Llama OF having consistently lower concentrations than all other streams (Table 3.1-2). Streams in August had dissolved oxygen concentrations below 10.5 mg/L, with nine sampling sites below the CCME guideline for the protection of freshwater aquatic life for early life stages (9.5 mg/L; CCME 2012). Llama OF had dissolved oxygen concentrations below the CCME guideline for the protection of freshwater aquatic life for other life stages (6.5 mg/L) in both August and September. All other stream sampling sites had dissolved oxygen concentrations above CCME guidelines in September, with the maximum 11.7 mg/L at Wolf OF.

Goose Area Streams

Moby OF:

Gander IF:

Gander US:

Pond 19 OF:

Chair OF:

Llama OF:

(continued)

Plate 3.1-1. Stream water levels and flow varied between sampling events. From left to right, June (brown vegetation), August (green vegetation) and September (orange vegetation).

Echo OF:

Giraffe OF:

Wolf OF:

Goose OF:

Propellor OF:

Reference B OF (third from left is summer sampling location further upstream):

(continued)

Plate 3.1-1. Stream water levels and flow varied between sampling events. From left to right, June (brown vegetation), August (green vegetation) and September (orange vegetation) (continued).

George Area Streams

George OF:

Sleigh OF:

Dragon OF:

Komatic IF:

Reference C OF:

Plate 3.1-1. Stream water levels and flow varied between sampling events. From left to right, June (brown vegetation), August (green vegetation) and September (orange vegetation) (completed).

3.2 LAKE WATER QUALITY

Lake water quality samples were collected in April (under-ice) and August (open-water) 2012. Lake water quality data collected in 2012 are presented graphically in Figures 3.2-1a to 3.2-6. Raw water quality data for lakes are presented in Appendices 3.2-1 to 3.2-3.

Table 3.1-2. Temperature and Dissolved Oxygen in Streams, Back River Project, 2012

Stream	June	August			September		
	Temp (°C)	Temp (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen Saturation (%)	Temp (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen Saturation (%)
Goose Area							
Moby OF	4.6	10.6	9.59	86.1	4.2	10.91	83.7
Gander IF	3.5	11.8	9.56	88.3	4.1	11.25	86.0
Gander US	3.6	11.7	9.93	91.5	4.2	11.12	85.3
Pond 19 OF	5.6	8.5	7.92	67.5	3.3	10.47	78.4
Chair OF	6.4	12.0	9.86	91.5	4.6	10.79	83.6
Llama OF	5.0	9.9	4.55	40.1	5.9	5.75	46.1
Echo OF	8.5	nc	nc	nc	4.3	10.63	81.7
Giraffe OF	5.6	15.0	8.90	88.4	4.4	10.88	83.9
Wolf OF	9.2	11.9	9.99	92.5	2.2	11.72	85.2
Goose OF	6.2	18.9	9.64	101.7	4.5	10.99	84.9
Propellor OF	5.2	14.4	7.10	69.5	5.7	9.90	79.0
Reference B OF	10.5	13.1	8.57	81.5	6.0	10.93	87.6
George Area							
George OF	3.4	15.43	9.47	98.0	4.2	11.05	84.7
Sleigh OF	3.8	18.42	8.91	95.1	4.3	11.10	85.1
Dragon OF	3.7	17.34	8.96	93.5	5.2	11.01	86.7
Komatic IF	5.5	12.83	9.26	87.7	4.2	11.04	84.5
Reference C OF	3.3	13.77	10.24	99.1	7.3	10.62	88.2

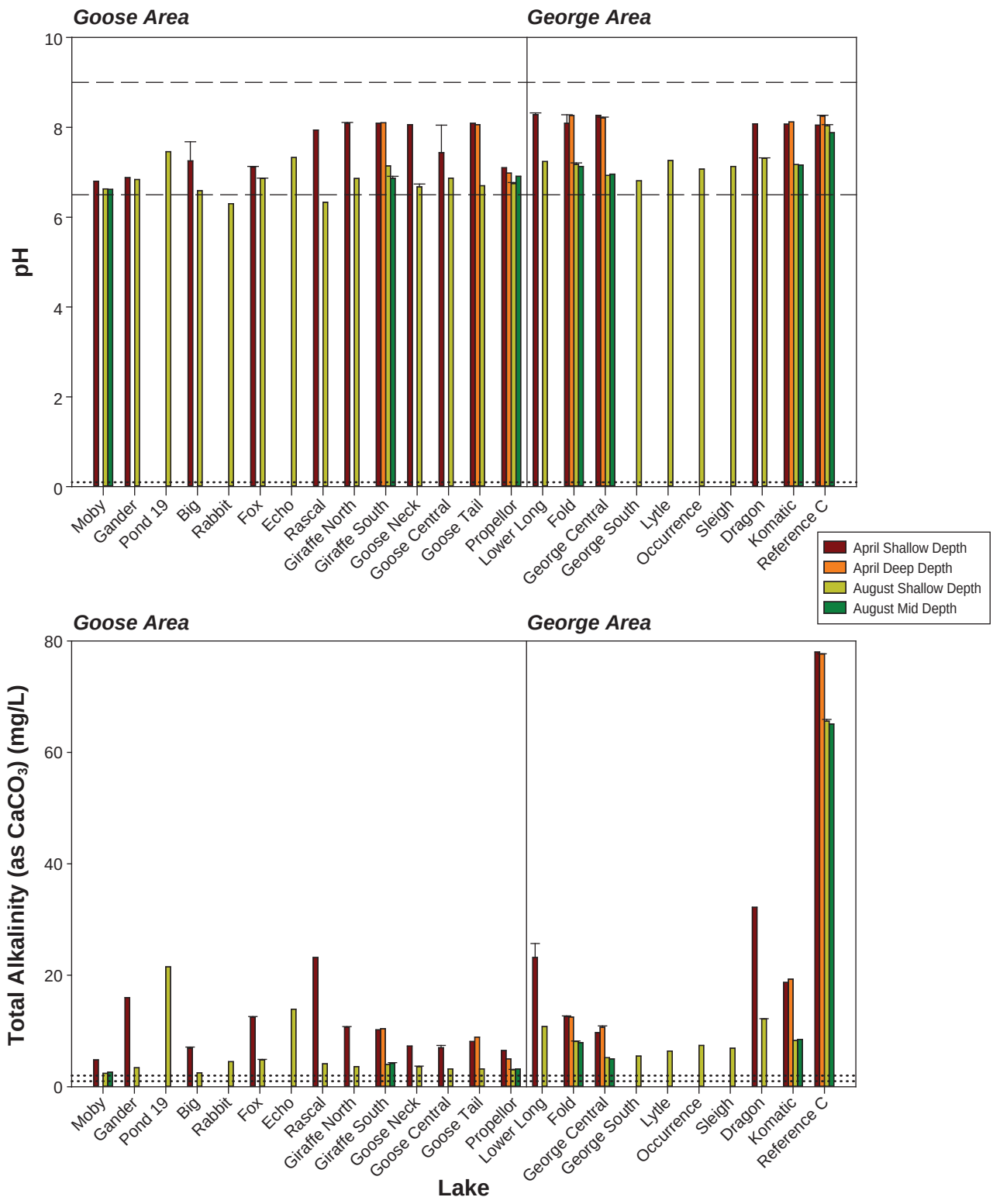
Note: Shaded values show concentrations below the CCME guidelines for freshwater aquatic life; light grey for early life stages (9.5 mg/L) and dark grey for all life stages (6.5 mg/L).

3.2.1 Physical Parameters

The lakes had slightly acidic to alkaline pH values ranging from 6.3 at Rabbit Lake in August to 8.32 at Lower Long Lake in April (Figure 3.2-1a). Lake water tended to be more acidic in August (average of 7.0) than in April (average of 7.8), and more acidic in Goose area lakes (average of 7.1) than in George area lakes (average of 7.7). Only Rabbit Lake and Rascal Lake during August had pH levels outside the CCME guideline range of 6.5 to 9.0 (CCME 2012), each with pH levels of 6.3.

Alkalinity measures the buffering capacity (i.e., ability to neutralize acids) of a lake, with greater alkalinities having greater buffering abilities and a more stable pH. Total alkalinities varied across seasons and spatially between George and Goose area lakes, with higher alkalinity observed in April than in August, and in George area lakes than in Goose area lakes. Overall, the Project lakes were poorly buffered with total alkalinity below 35 mg $CaCO_3$/L and as low as 2.4 mg $CaCO_3$/L at Moby Lake in August. The exception to this was Reference Lake C, which ranged from 65 to 78 mg $CaCO_3$/L.

Hardness, conductivity and total dissolved solids (TDS) followed similar patterns to total alkalinity, with higher concentrations of each in April than in August, and in George area lakes than in Goose area lakes (Figure 3.2-1b). The sampled lakes generally had soft water (< 60 mg $CaCO_3$/L), with hardness less than 40 mg $CaCO_3$/L, low conductivity (< 100 µS/cm), and low levels of total dissolved solids, below 80 mg/L. The exceptions were Dragon and Komatic lakes in April, and Reference Lake C in both April and August, which had higher concentrations for all three parameters.



Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (pH 0.1; alkalinity 1 or 2 mg/L).
Dashed lines represent CCME guideline for pH (6.5 - 9).

Sabina GOLD & SILVER CORP.

pH and Total Alkalinity in Lakes, Back River Project, 2012

Figure 3.2-1a

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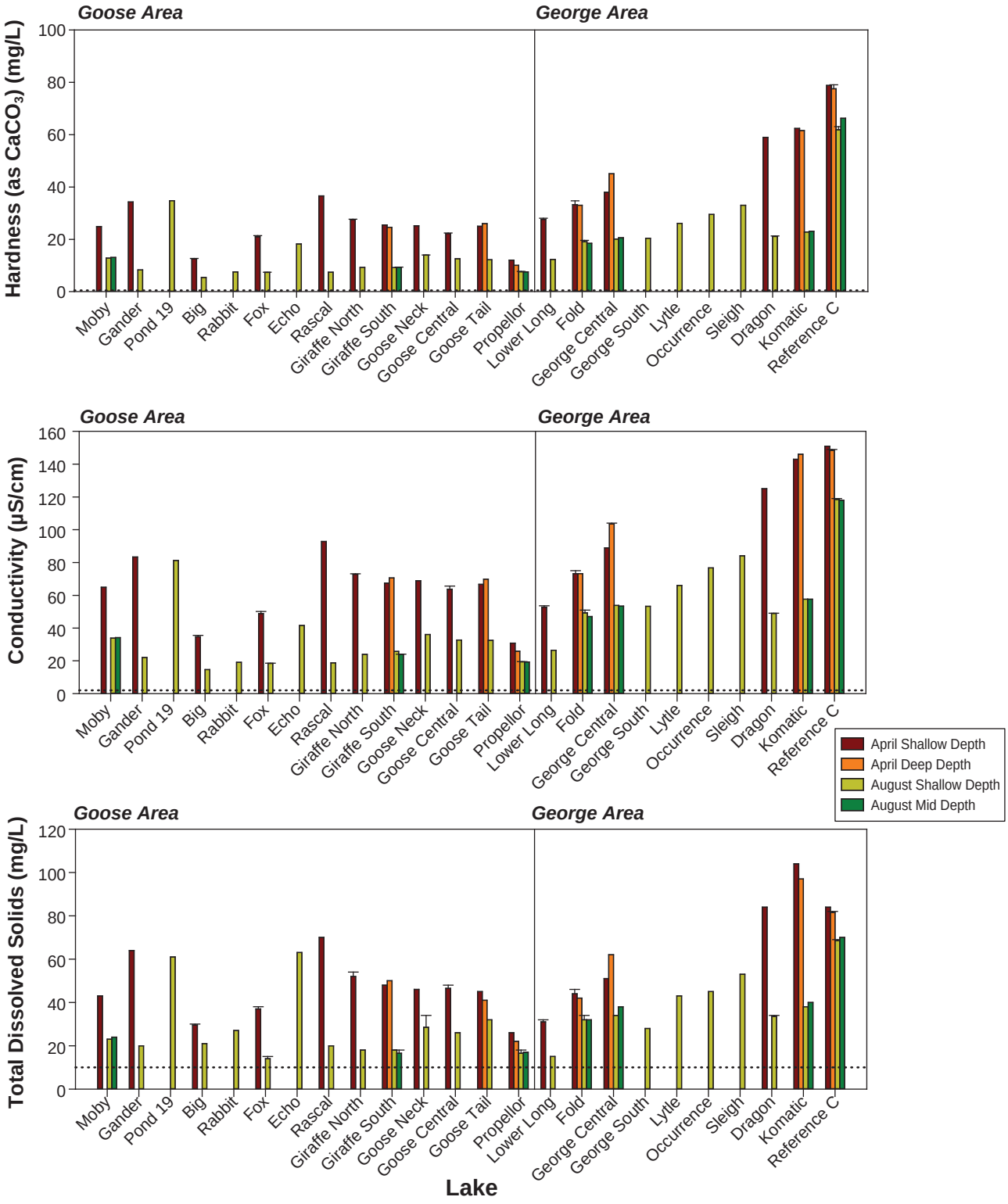

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (hardness 0.5 mg/L; conductivity 2.0 µS/cm; total dissolved solids 10 mg/L).

Sabina GOLD & SILVER CORP.

Hardness, Conductivity and Total Dissolved Solid Concentrations in Lakes, Back River Project, 2012

Figure 3.2-1b

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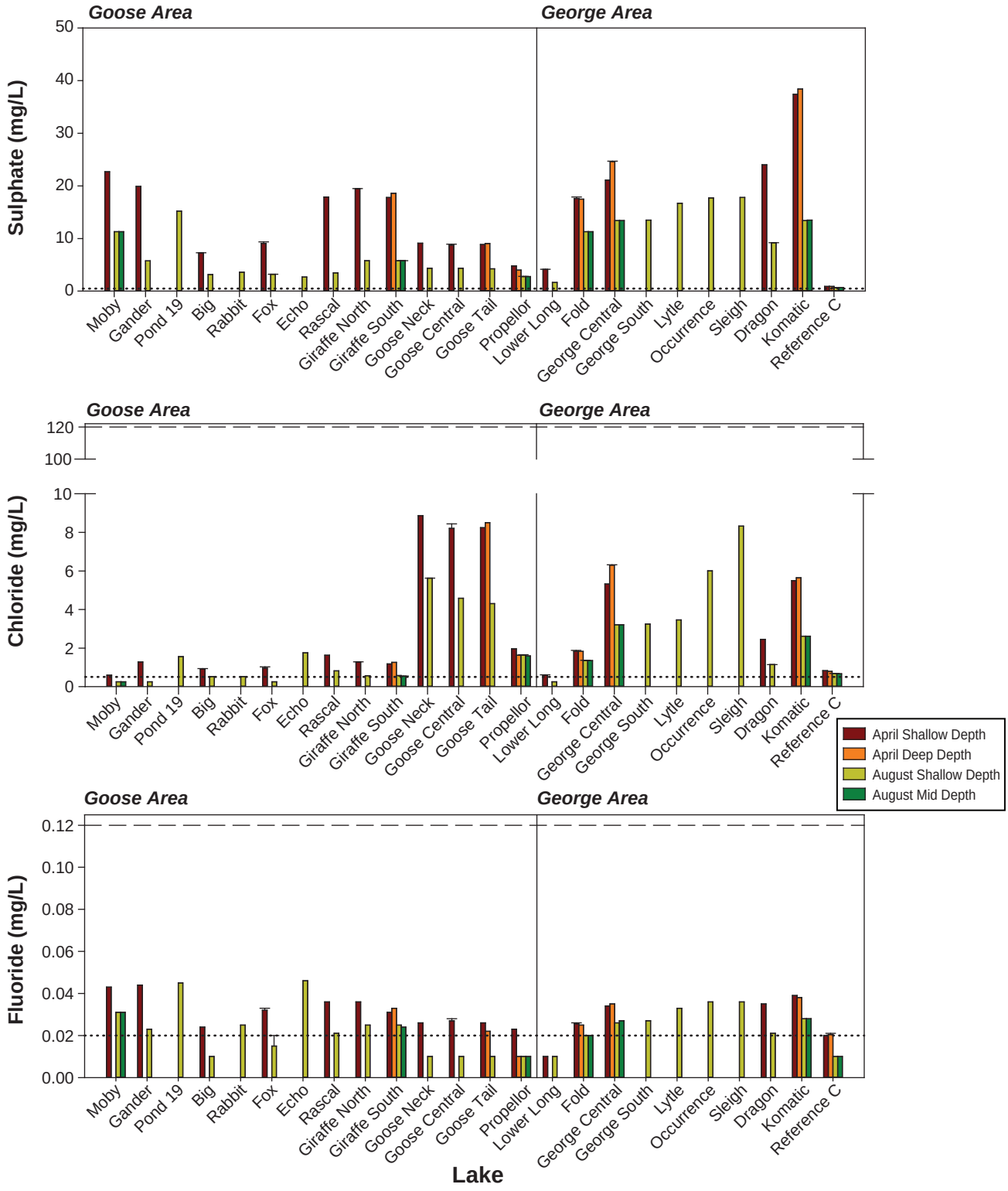

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (sulphate 0.5 mg/L; chloride 0.5 mg/L; fluoride 0.02 mg/L).
Values below the detection limit are plotted at half the detection limit.
Dashed red lines represent the CCME long-term guideline for chloride (120 mg/L) and the CCME interim guideline for fluoride (0.12 mg/L).
The CCME short-term guideline for chloride is 640 mg/L (not shown).

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Sulphate, Chloride and Fluoride Concentrations in Lakes, Back River Project, 2012

Figure 3.2-2

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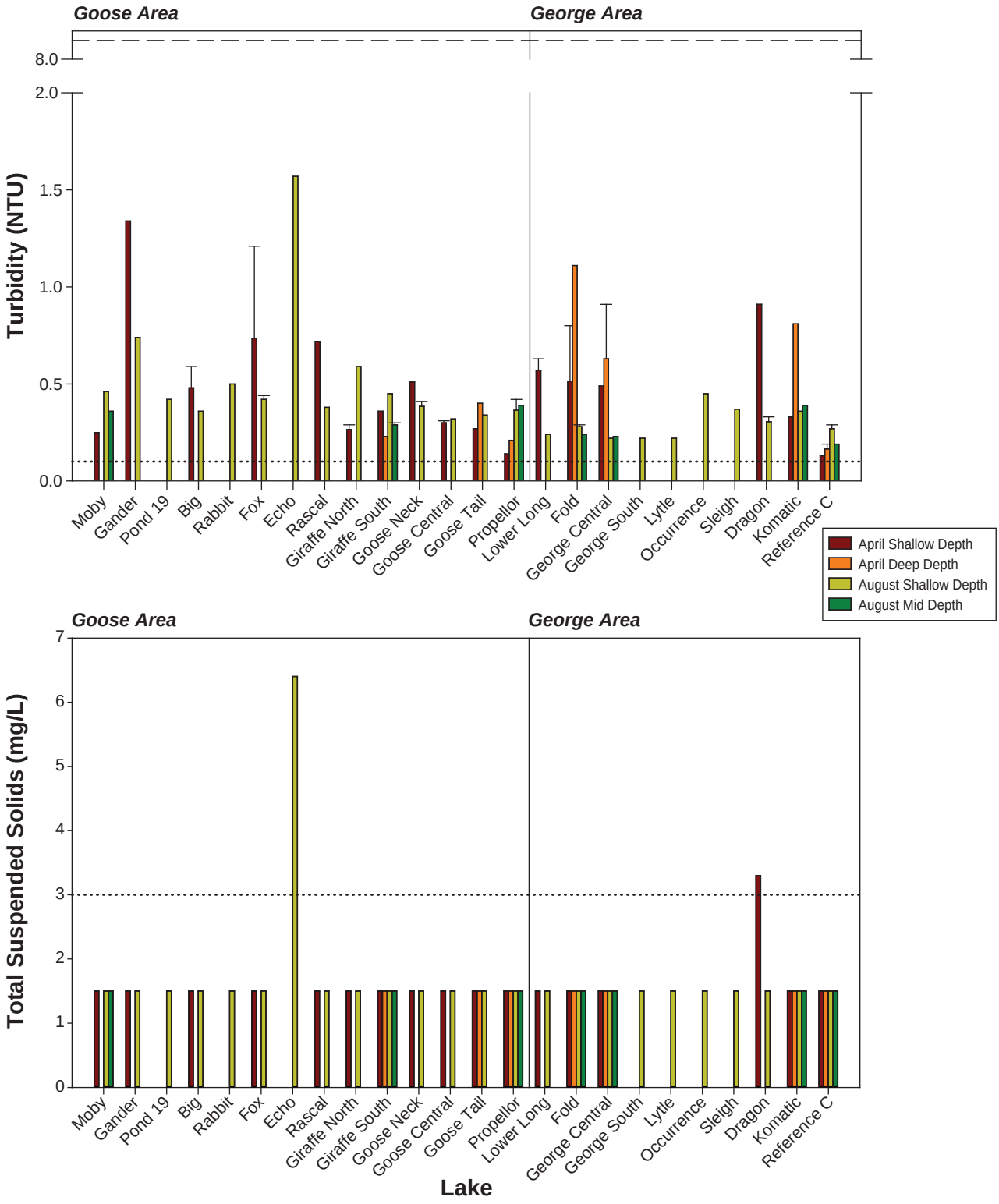

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (turbidity 0.1 mg/L; total suspended solids 3 mg/L).
Values below the detection limit are plotted at half the detection limit.
CCME guidelines for turbidity and total suspended solids are dependent upon background levels.

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Turbidity and Total Suspended Solids Concentrations in Lakes, Back River Project, 2012

Figure 3.2-3

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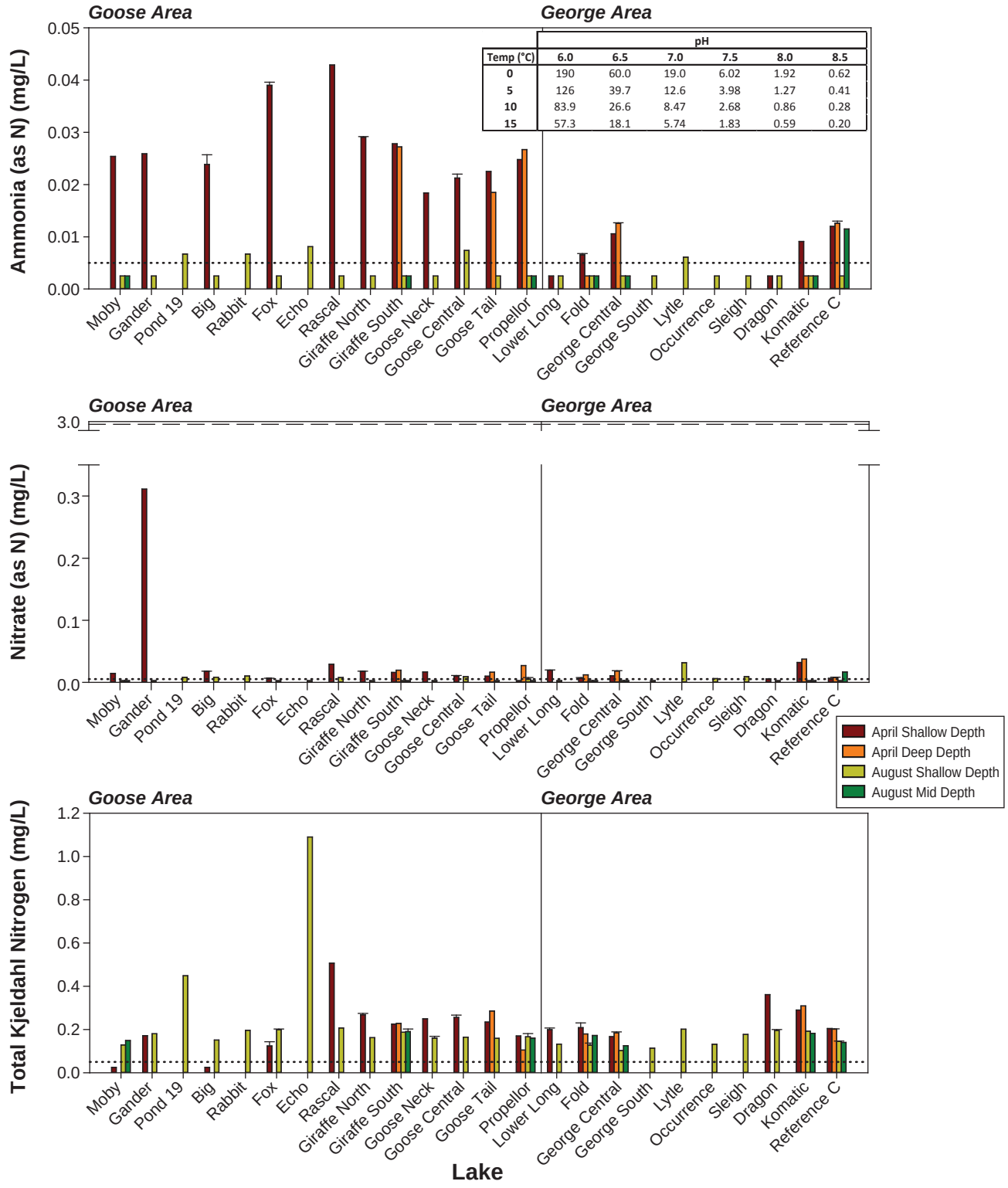

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (ammonia 0.005 mg/L; nitrate 0.005 mg/L; TKN 0.05 mg/L).
Values below the detection limit are plotted at half detection limit.Inset table shows temperature- and pH-dependent CCME guideline for ammonia.
Dashed lines represent CCME long-term guideline for nitrate (3 mg/L).
CCME short-term guideline for nitrate is 124 mg/L (not shown).Nitrite concentrations were always below detection limit (0.001 mg/L) so were not plotted.

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Ammonia, Nitrate, and Total Kjeldahl Nitrogen Concentrations in Lakes, Back River Project, 2012

Figure 3.2-4a

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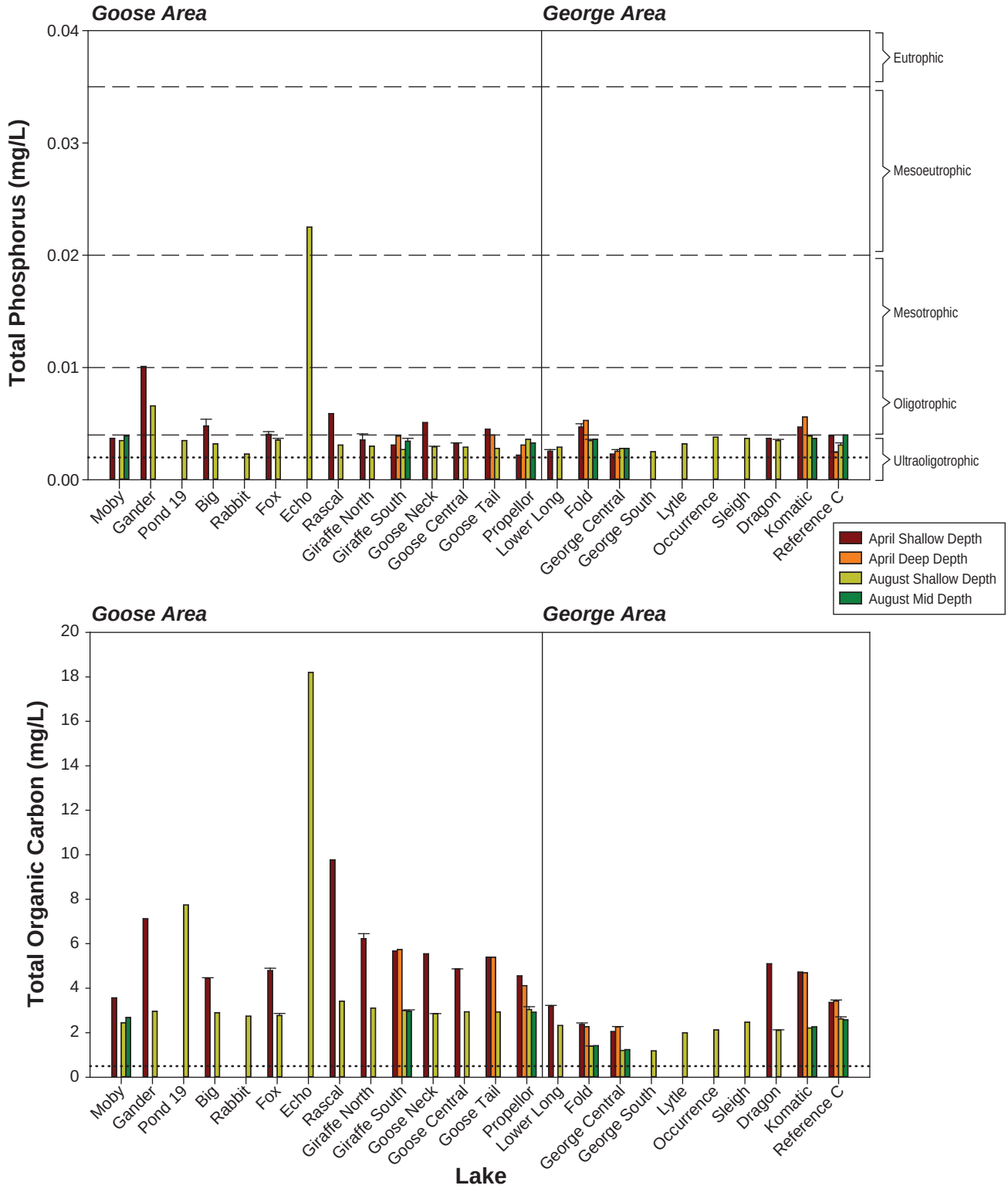

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (total phosphorus 0.002 mg/L; total organic carbon 0.5 mg/L).
Dashed lines represent CCME trigger ranges for total phosphorus(<0.004 mg/L = ultraoligotrophic; 0.004–0.010 mg/L = oligotrophic; 0.01–0.02 mg/L = mesotrophic; 0.02–0.035 mg/L = mesoeutrophic; 0.035–0.1 mg/L = eutrophic; >0.1 mg/L = hypereutrophic)

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Total Phosphorus and Total Organic Carbon Concentrations in Lakes, Back River Project, 2012

Figure 3.2-4b

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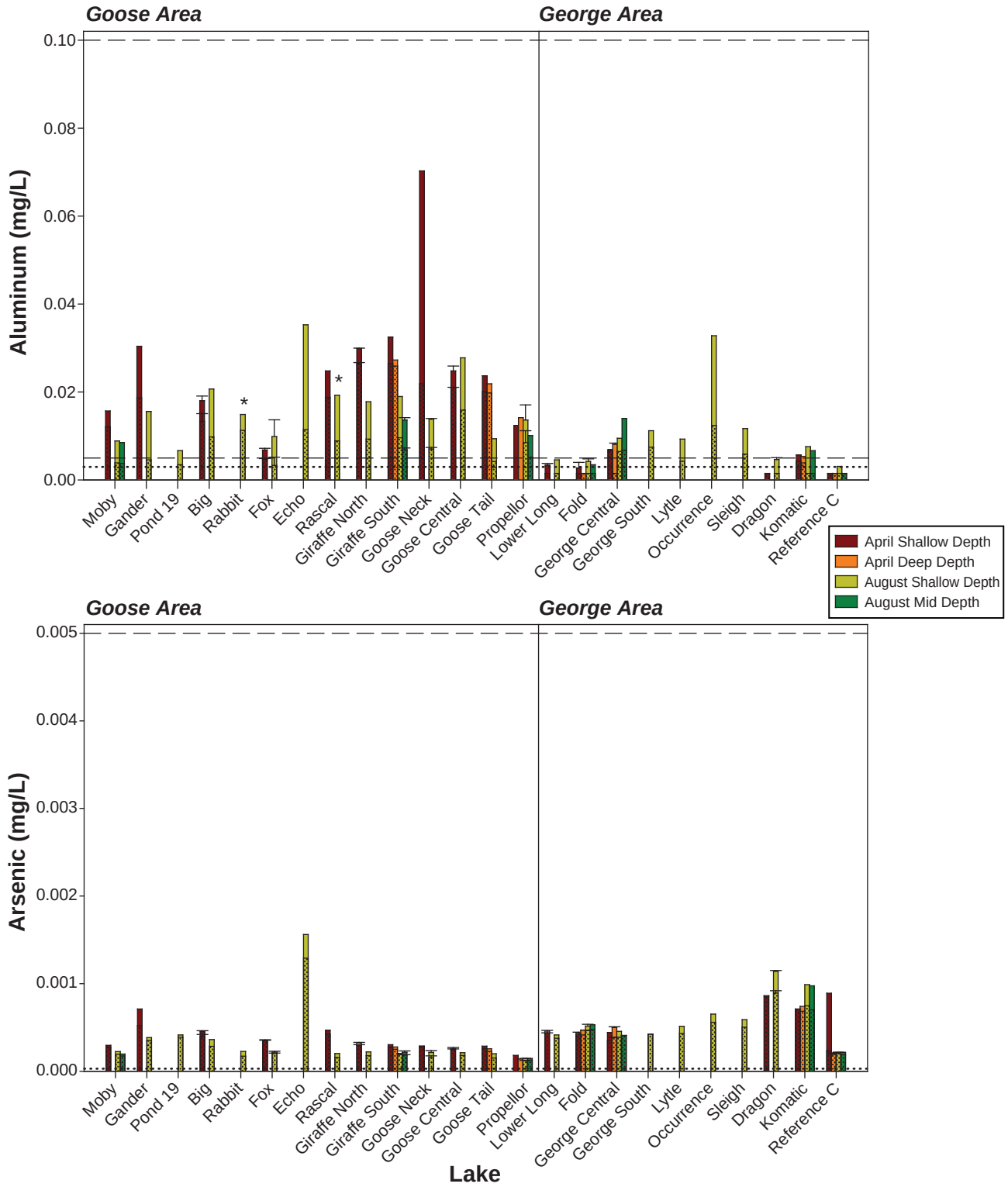

Notes: *Error bars represent standard error of the mean of replicates.*
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dotted lines represent analytical detection limit (aluminum 0.003 mg/L; arsenic 0.00003 mg/L).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guidelines.
The CCME guideline for arsenic is 0.005 mg/L.
CCME guidelines for aluminum are pH-dependent (0.005 mg/L at pH less than 6.5; 0.1 mg/L at pH greater than or equal to 6.5).
pH was above 6.5 at all sites except Rabbit and Rascal Lakes in shallow depths in August (6.3 and 6.33, respectively).
The CCME interim guideline for arsenic is 0.005 mg/L.
** Indicates mean total aluminum values that were higher than CCME guidelines.*

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Aluminum and Arsenic Concentrations in Lakes, Back River Project, 2012

Figure 3.2-5a

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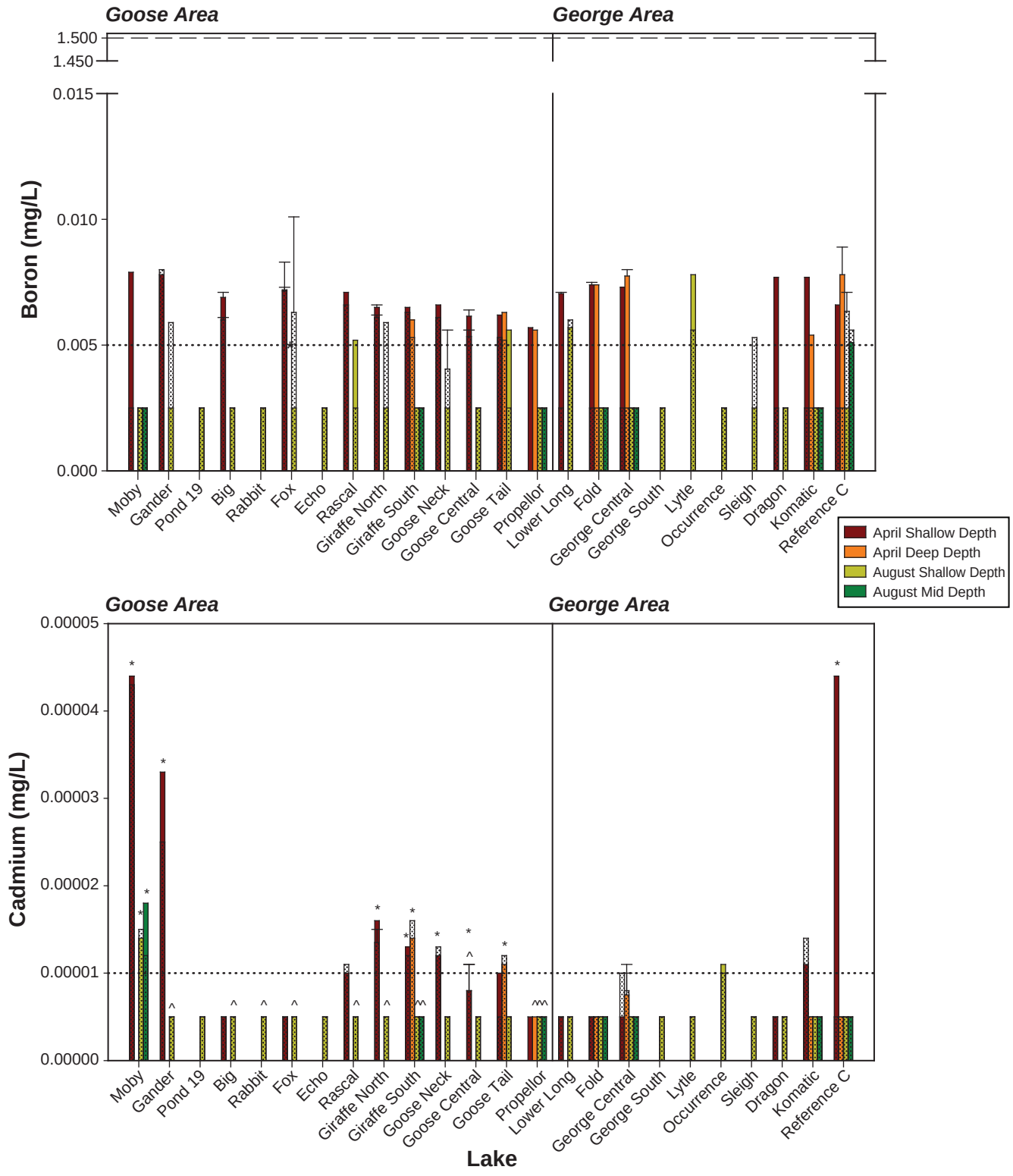

Notes: Error bars represent standard error of the mean of replicates.
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dotted lines represent analytical detection limit (boron 0.005; cadmium 0.00001 mg/L).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guidelines (boron 1.5 mg/L long term and 29 mg/L short-term [not shown]).
The interim CCME guideline for cadmium (in mg/L) is calculated using the equation $10^{(0.86[\log(\text{hardness})]-3.2)}/1000$.
** Indicates mean total cadmium values that are higher than CCME guidelines (hardness corrected in the case of cadmium).*
^ Indicates cadmium values below detection limits where 0.5 x the detection limit was above hardness-dependent guidelines.

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Boron and Cadmium Concentrations in Lakes, Back River Project, 2012

Figure 3.2-5b

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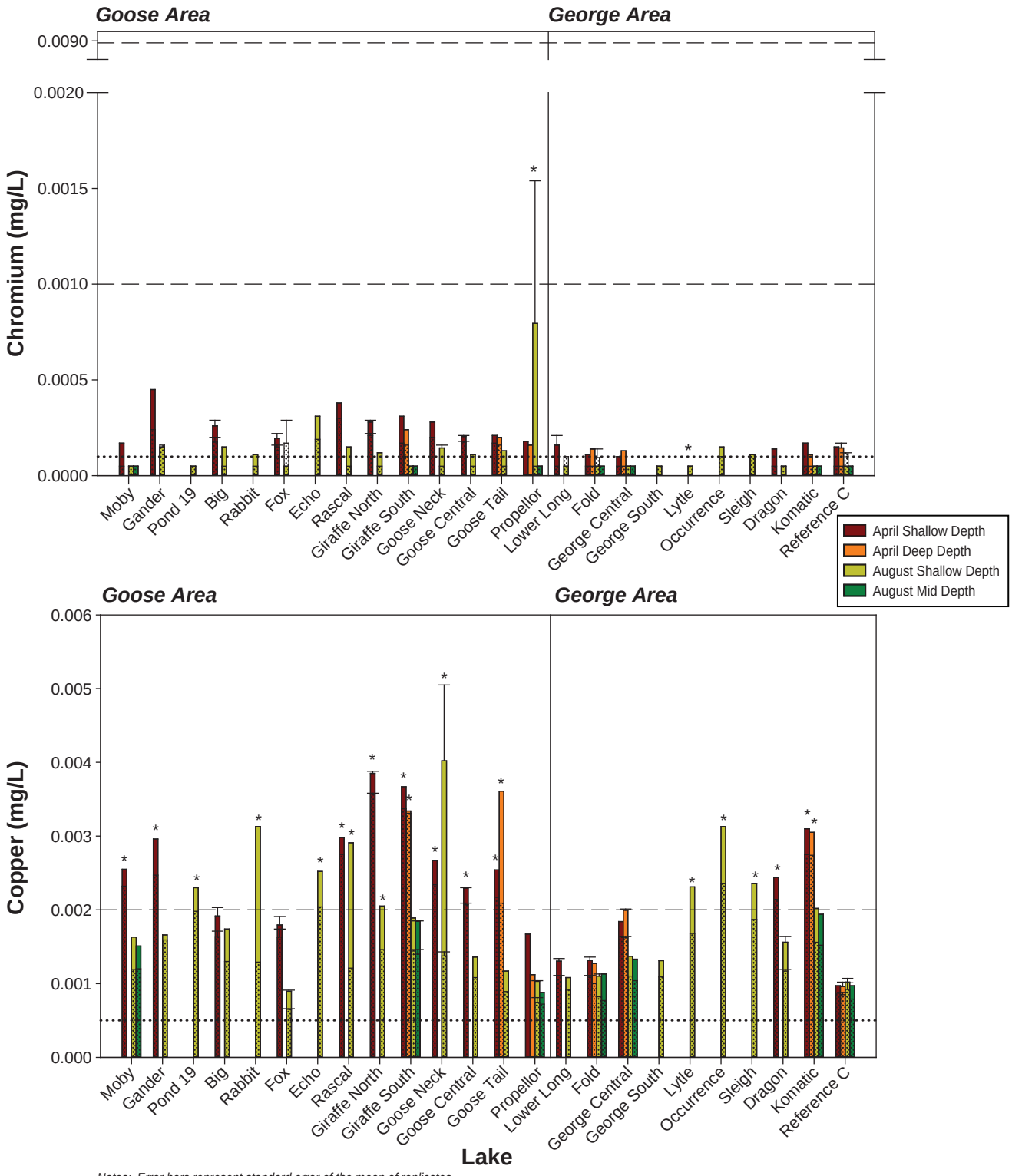

Notes: *Error bars represent standard error of the mean of replicates.*
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dotted lines represent analytical detection limit (chromium 0.0001; copper 0.0005 mg/L).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guidelines.
The CCME guideline for hexavalent chromium (0.001 mg/L) and interim guideline for trivalent chromium (0.0089 mg/L).
The CCME guideline for copper (in mg/L) is calculated using the equation: $e^{(0.8545[\ln(\text{hardness})]-1.465)} \times 0.0002$.
Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.
** Indicates mean total chromium and copper values that were higher than CCME guidelines (hardness corrected in the case of copper).*

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Chromium and Copper Concentrations in Lakes, Back River Project, 2012

Figure 3.2-5c

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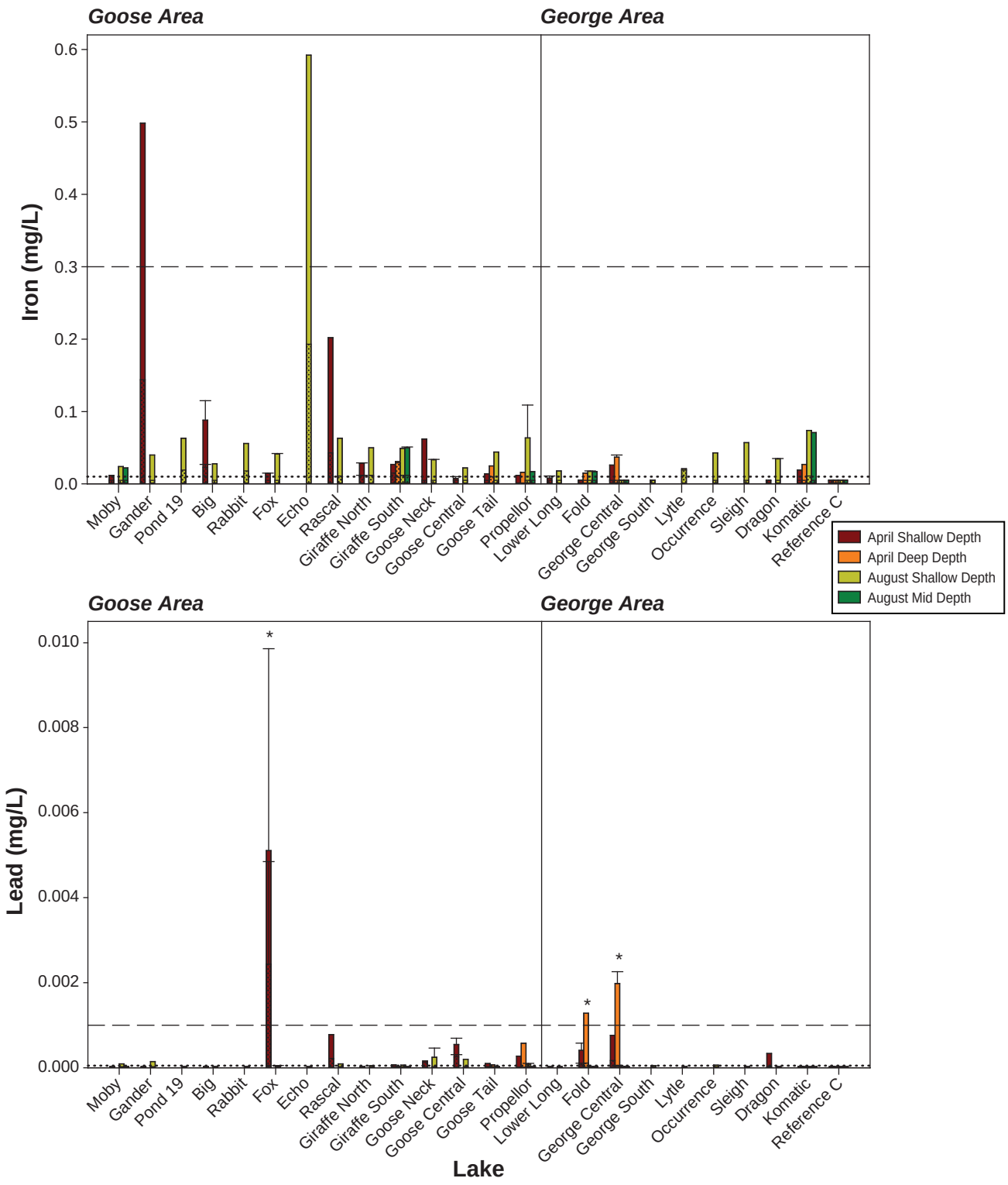

Notes: Error bars represent standard error of the mean of replicates.
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dotted lines represent analytical detection limit (iron 0.01 mg/L; lead 0.00005 mg/L).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guidelines.
The CCME guideline for iron is 0.3 mg/L.
The CCME guideline for lead (in mg/L) is calculated using the equation $e^{(1.273[\ln(\text{hardness})]-4705)}/1000$, and is a minimum of 0.001 mg/L regardless of hardness.
** Indicates mean total lead values that are higher than CCME guidelines.*

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Iron and Lead Concentrations in Lakes, Back River Project, 2012

Figure 3.2-5d

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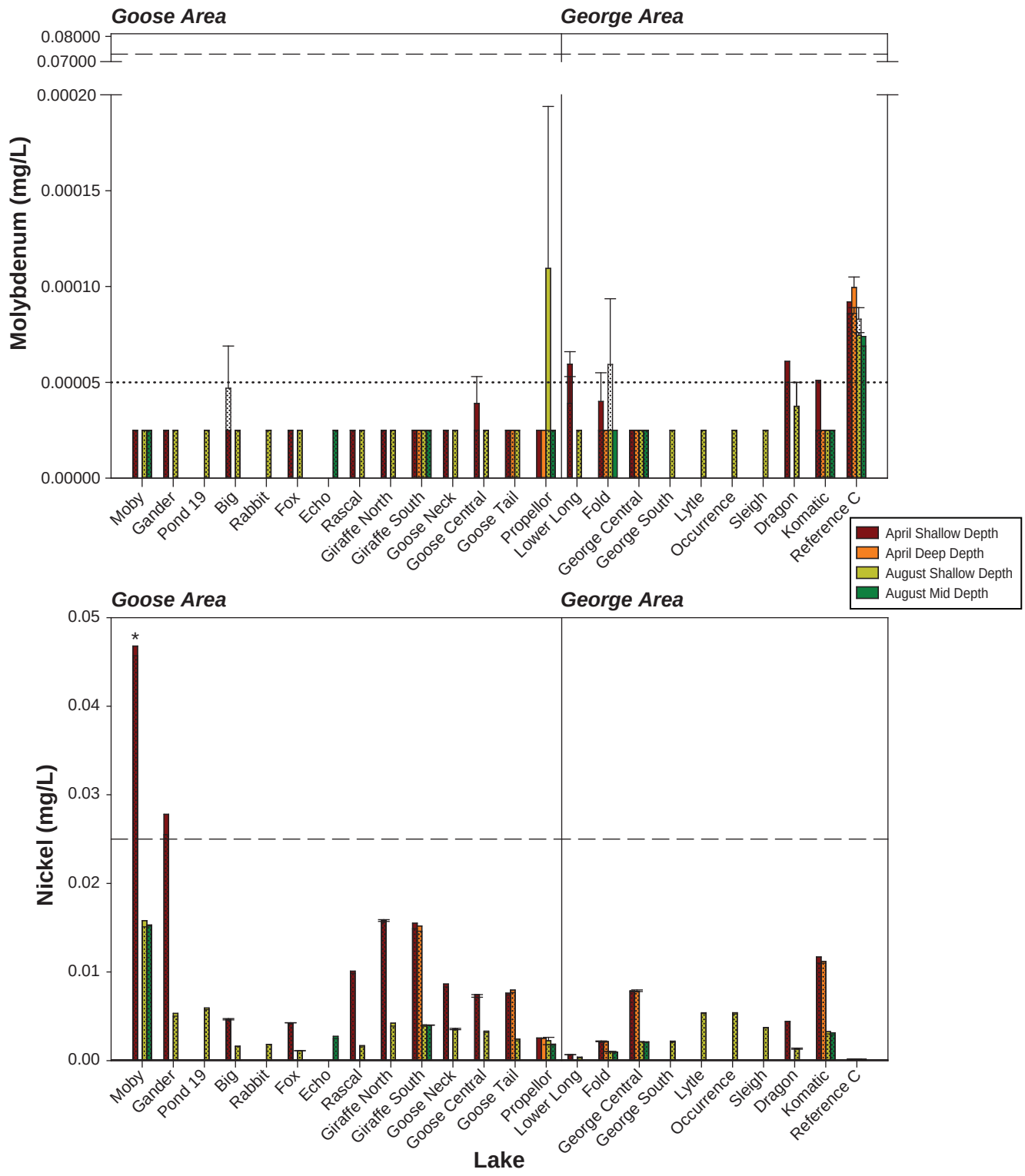

Notes: *Error bars represent standard error of the mean of replicates.*
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dotted lines represent analytical detection limit (molybdenum 0.00005 mg/L; nickel 0.0001 mg/L).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guidelines.
The interim CCME guideline for molybdenum is 0.073 mg/L.
The CCME guideline for nickel (in mg/L) can be calculated using the equation $e^{[1.273[\ln(\text{hardness})]-4.705]}/1000$.
Nickel guideline is a minimum of 0.025 mg/L regardless of hardness.
** Indicates mean total nickel values that were higher than CCME guidelines.*

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Molybdenum and Nickel Concentrations in Lakes, Back River Project, 2012

Figure 3.2-5e

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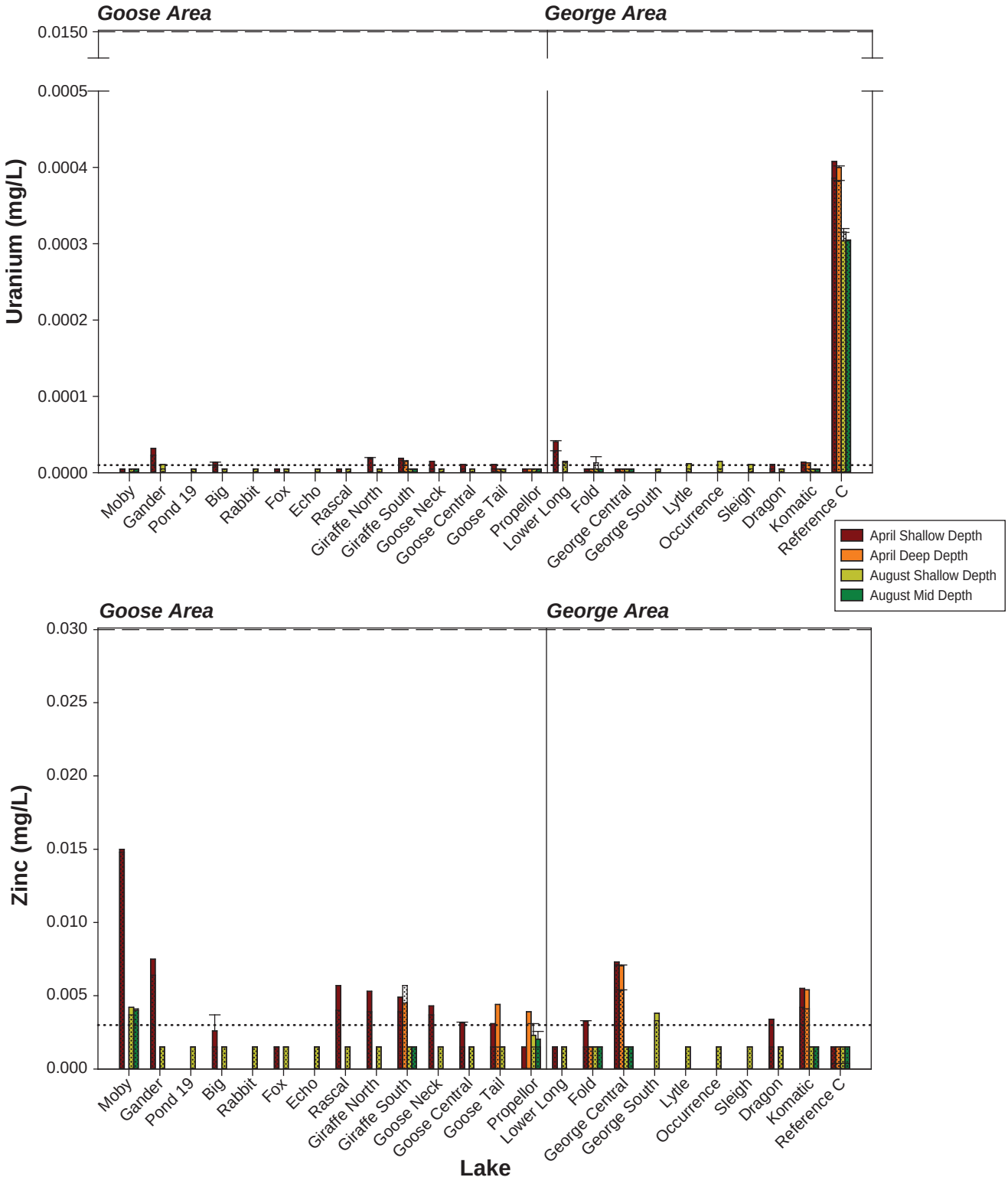

Notes: Error bars represent standard error of the mean of replicates.
Solid columns represent total metals and superimposed spotted columns represent dissolved metals.
Dotted lines represent analytical detection limits (uranium 0.00001 mg/L; zinc 0.003 mg/L).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guidelines (uranium long-term 0.015 mg/L and short-term 0.033 mg/L [not shown]; zinc 0.03 mg/L).

Sabina GOLD & SILVER CORP.

Uranium and Zinc Concentrations in Lakes, Back River Project, 2012

Figure 3.2-5f

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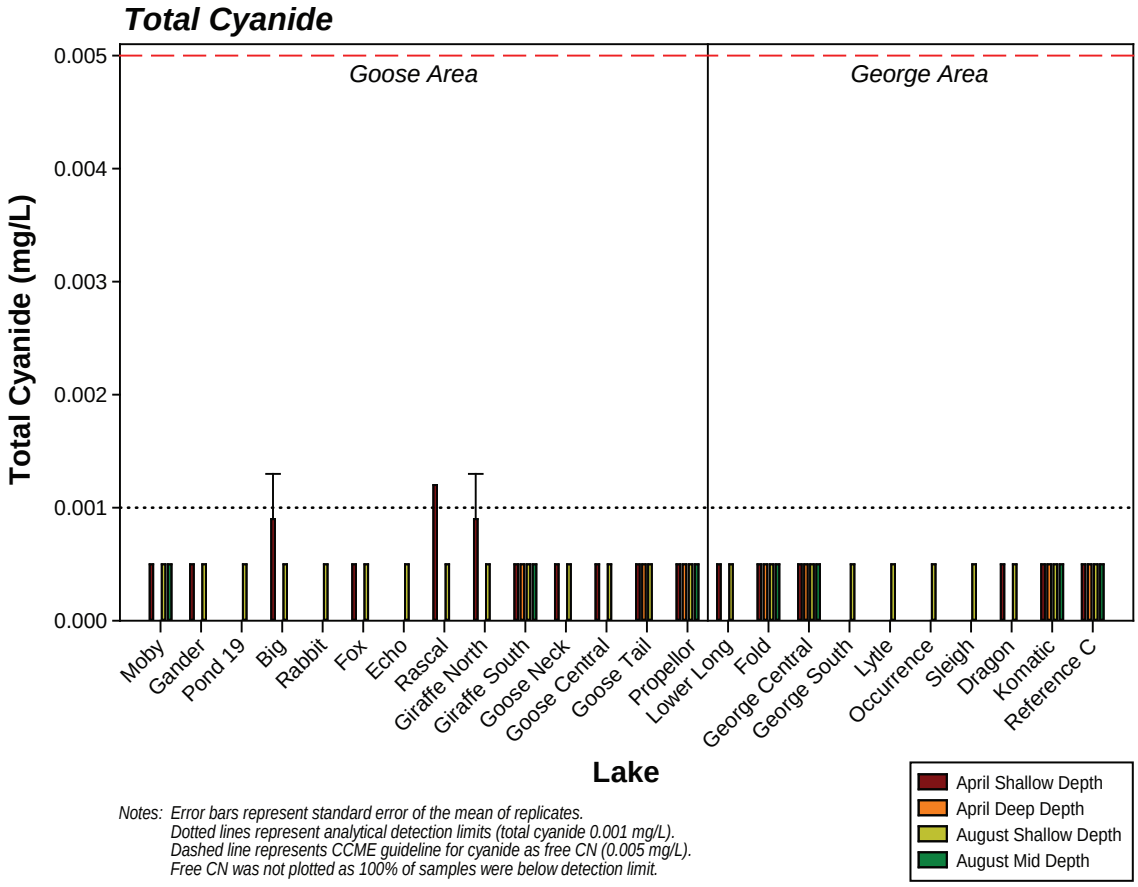

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (total cyanide 0.001 mg/L).
Dashed line represents CCME guideline for cyanide as free CN (0.005 mg/L).
Free CN was not plotted as 100% of samples were below detection limit.

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Total Cyanide Concentrations in Lakes, Back River Project, 2012

Figure 3.2-6

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Water hardness can influence the toxicity of some metals (e.g. cadmium, copper, lead and nickel), most lakes are sensitive to these metals due to their soft waters and have low hardness-dependent CCME guidelines. Lakes with harder water, such as Reference Lake C, are less sensitive to metals and have higher hardness-dependent CCME guidelines.

3.2.2 Major Anions

Sulphate, the dominant measured major anion, concentrations tended to be higher in April than in August and in the George area lakes than in the Goose area lakes (Figure 3.2-2). Sulphate concentrations were less than 25 mg/L, with the exception of Komatic Lake in April which had an average concentration of 37.9 mg/L. Sulphate concentrations were lowest in Reference Lake C, ranging from 0.65 mg/L to 0.9 mg/L.

Chloride concentrations ranged from below detection limit (0.5 mg/L) to 8.9 mg/L, with highest concentrations at the Goose Lake sampling sites in April, and in Sleigh Lake in August (Figure 3.2-2). Chloride concentrations were well below the short term and long term CCME guidelines (120 mg/L and 620 mg/L; CCME 2012).

Lake fluoride concentrations tended to be higher in April than in August, but were similar across Goose and George areas (Figure 3.2-2). Fluoride concentrations ranged from below detection limit (0.02 mg/L) to 0.046 in Echo Lake in August, well below the CCME interim guideline of 0.12 mg/L (CCME 2012).

3.2.3 Suspended Material

Turbidity levels were low in all lakes, with most below 0.9 NTU and all below 1.6 NTU (Figure 3.2-3). Lake turbidities varied between April and August with no clear overall seasonal trend. Lakes had low levels of total suspended solids (TSS), with concentrations below detection limits (3 mg/L) or less at all lakes, except Echo Lake (6.5 mg/L) and Dragon Lake (3.3 mg/L) in April. The highest turbidities and TSS concentrations were observed in the shallow Echo Lake (0.4 m), and may be an artifact of sampling in shallow waters or the ease of wind-driven re-suspension in shallow waters.

The low turbidity and TSS allowed greater light penetration in the water column, creating the high water clarity observed with the Secchi depths.

3.2.4 Nutrients

Nutrient concentrations were low, sometimes below detection limits, and the lakes can be considered nutrient-poor (Figures 3.2-4a and 3.2-4b). The shallow Echo Lake had relatively high total Kjeldahl nitrogen (TKN) concentrations, high total phosphorus, and high TOC concentrations, consistent with its higher turbidity and total suspended solid concentrations than other lakes.

Ammonia and nitrate concentrations tended to be higher in April than in August, and in the Goose area lakes than in George area lakes (Figure 3.2-4a). Ammonia concentrations were all below 0.05 mg/L, and well below relevant pH- and temperature-dependent CCME guidelines (CCME 2012). Nitrate concentrations were all below 0.04 mg/L, except Gander Lake, which was an order of magnitude higher at 0.31 mg/L in April only. Nitrite concentrations were all below detection limits. TKN concentrations ranged from below detection limits (0.05 mg/L) to 1.1 mg/L, with all but the shallow Echo Lake having concentrations under 0.5 mg/L.

Ortho-phosphate concentrations were at or below detection limits for all lakes and total phosphorus concentrations were generally low (Figure 3.2-4b). Most lakes sampled can be classified as ultra-oligotrophic (< 0.004 mg/L) to oligotrophic (0.004 to 0.01 mg/L) based on the CCME trigger ranges

for phosphorus in freshwater systems (CCME 2012). The exceptions were Gander Lake in April that had a total concentration of 0.0101 mg/L, just above the CCME trigger range for mesotrophic lakes (0.01 to 0.02 mg/L), and the shallow Echo Lake which would be defined as mesoeutrophic (0.02 to 0.035 mg/L).

Much of the nutrients in the lakes were in forms not as readily available to plant life. The vast majority of both nitrogen and phosphorus were tied up in the organic fraction, with TKN generally a magnitude greater than nitrate and ammonia concentrations, and phosphate was only detectable in the total phase.

TOC concentrations in lakes were higher in April than in August, and in Goose area lakes than in George area lakes (Figure 3.2-4b). Lake TOC concentrations were below 10 mg/L at all lakes, except the shallow Echo Lake with TOC concentrations of 18 mg/L in August.

3.2.5 Metals

Overall, lakes generally had low metal concentrations, with concentrations tending to be higher in April. Metals concentrations can be higher during the April due to natural processes, including solute exclusion during ice formation, changes in redox chemistry, increased remineralization, and decreased biological uptake. There was no clear spatial trend in metal concentrations, with no sites having consistently high or low metal concentrations. Graphs for all metals with CCME guidelines are presented in Figures 3.2-5a to 3.2-5f.

Total aluminum concentrations tended to be higher in Goose area lakes. All lakes had less than 0.04 mg/L aluminum, except Goose Lake Neck in April (Figure 3.2-5a), and all concentrations were below the pH-dependent CCME guideline, except Rabbit and Rascal lakes where the lower pH resulted in a lower guideline level (0.005 mg/L for pH < 6.5; 0.1 mg/L mg/L for pH ≥ 6.5; CCME 2012).

Lakes had total arsenic concentrations well below the CCME guideline (0.005 mg/L; CCME 2012), with George area lakes tending to have higher concentrations than Goose area lakes (Figure 3.2-5a). The highest arsenic concentrations were observed at the shallow Echo Lake (0.00156 mg/L).

Lake total boron and cadmium concentrations were higher in April than in August, with most samples over the detection limits in April and below in August (boron 0.005 mg/L; cadmium 0.00001 mg/L) (Figure 3.2-5b). All total boron concentrations were well below CCME guidelines, with the highest concentration still two orders of magnitude below the CCME guideline (1.5 mg/L; CCME 2012). Cadmium concentrations were highest in Moby, Gander and Reference Lake C. Moby, Gander, Rascal, Giraffe, Goose and Reference Lake C all had detectable cadmium concentrations above CCME guidelines in April. Only Moby Lake had detectable cadmium concentrations above the CCME guideline in August. The cadmium CCME guideline is hardness dependent, resulting in many of the soft-water Goose area lakes having cadmium guidelines below the detection limit (indicated with ^ in Figure 3.2-5b).

Total chromium concentrations in lakes were generally higher in April than in August (Figure 3.2-5c). In April, all lakes except George Lake had chromium concentrations above the detection limit (0.0001 mg/L), while approximately two thirds of samples in August were below detection limits. All total chromium concentrations were below 0.0005 mg/L, and below the CCME guideline for hexavalent chromium (0.001 mg/L; CCME 2012), with the exception of Propellor Lake at 1 m depth in August. The Propellor Lake sample measured 0.00154 mg/L in the regular sample and below detection limits in the field duplicate. Note both of these replicates had dissolved chromium below detection limits. It is possible that the high concentrations observed in replicate one are the result of a fleck of particulate material in the sample, or a reflection of an analytical error.

Lakes had naturally elevated total copper concentrations, with more than half of the lakes having concentrations above the CCME hardness-dependent guidelines (Figure 3.2-5c). Hardness-dependent guidelines tended to be low in most lakes. Exceedances were more common in April than in August, and in the Goose area lakes than the George area lakes. Concentrations ranged from 0.0009 mg/L in Fox Lake in August to 0.0040 mg/L in Goose Lake Neck in August, with the minimum copper hardness-dependent guideline being 0.002 mg/L (CCME 2012).

Total iron concentrations were below the CCME guideline of 0.3 mg/L at all lakes, expect Gander Lake in April (0.5 mg/L) and Echo Lake (0.6 mg/L) in August (Figure 3.2-5d). Most lakes had lead concentrations far below the CCME guideline of 0.001 mg/L (CCME 2012). Exceptions were Fox Lake shallow water, and Fold and Goose Lake Central deep water quality samples in April. The highest concentrations were in Fox Lake in April, which had an average lead concentration of 0.005 mg/L, but showed considerable variation between the two replicates (0.00035 mg/L and 0.009 mg/L).

Lake water quality samples mostly had total molybdenum concentrations below detection limits (Figure 3.2-5e). Dragon Lake and Reference Lake C were the only lakes with detectable total molybdenum concentrations in both April and August. CCME guidelines for molybdenum were two orders of magnitude higher than the maximum concentration observed in lake samples (CCME 2012).

Total nickel concentrations in lakes were below 0.02 mg/L, except in Moby and Gander lakes in April (0.047 mg/L and 0.028 mg/L; Figure 3.2-5e). Only Moby Lake in April exceeded the hardness-dependent CCME guideline for nickel (CCME 2012).

Lakes had low total uranium concentrations, with most below or near the 0.00001 mg/L detection limit (Figure 3.2-5e). The exception was Reference Lake C, which had considerably higher total uranium concentrations in both shallow and deep samples from April and August, ranging from 0.0003 mg/L to 0.0004 mg/L. All lakes had uranium concentrations below the CCME long-term guideline (0.015 mg/L; CCME 2012).

Generally, total zinc concentrations were above detection limits (0.003 mg/L) in April and below in August (Figure 3.2-5f). The highest zinc concentrations were observed in Moby Lake in April (0.015 mg/L), but were still below half the CCME guideline level (0.030 mg/L; CCME 2012).

Total mercury, selenium, silver and thallium concentrations were consistently below analytical detection limits in all samples so were not graphed.

3.2.6 Cyanides

Total cyanide concentrations in lakes were below the detection limit (0.001 mg/L) for all samples except Big Lake, Rascal Lake, and Giraffe Lake North in April (0.0012 to 0.0013 mg/L; Figure 3.2-6). All lakes had free cyanide concentrations below detection limits and all were below the CCME guideline for free cyanide (0.005 mg/L; CCME 2012).

3.2.7 Comparison with CCME Guidelines

Table 3.2-1 gives the percentage of lake water quality samples that were above their respective parameter CCME guideline level, and Table 3.2-2 provides the average factor by which the concentrations were higher than CCME guidelines.

Table 3.2-1. Lake Water Quality, Percent of Samples in which Concentrations were Higher than CCME Guidelines, Back River Project, 2012

			pH	Fluoride	Chloride	Ammonia (as N)	Nitrate	Nitrite	Total Phosphorus	Aluminum (Al)	Arsenic (As)	Boron (B)	Cadmium (Cd)	
													Hardness-based Equation[be]	
CCME Guideline Values[a]			6.5 - 9.0	0.12[b] mg/L	Short-term 640 mg/L; Long-term 120 mg/L	Temperature- and pH-dependent	Short-term 124 mg/L; Long-term 2.935 mg/L	0.06 mg/L	Trophic Status[c] Range	0.005 - 0.1[d] mg/L	0.005 mg/L	Short-term 29 mg/L; Long term 1.5 mg/L	Samples above Detection Limits	Samples below Detection Limits (using half the detection limit)
Lake	Total Number of Samples Collected	Number of Parameters with Exceedances												
Goose Area														
Moby Lake	3	3	0	0	0	0	0	0	ultraoligotrophic	0	0	0	100	0
Gander Lake	2	3	0	0	0	0	0	0	oligotrophic - mesotrophic	0	0	0	50	50
Pond 19	1	1	0	0	0	0	0	0	ultraoligotrophic	0	0	0	0	0
Big Lake	3	2	0	0	0	0	0	0	ultraoligotrophic - oligotrophic	0	0	0	0	33.3
Rabbit Lake	1	4	100	0	0	0	0	0	ultraoligotrophic	100	0	0	0	100
Fox Lake	4	2	0	0	0	0	0	0	ultraoligotrophic - oligotrophic	0	0	0	0	50
Echo Lake	1	2	0	0	0	0	0	0	mesoeutrophic	0	0	0	0	0
Rascal Lake	2	1	50	0	0	0	0	0	ultraoligotrophic - oligotrophic	50	0	0	0	50
Giraffe Lake North	3	2	0	0	0	0	0	0	ultraoligotrophic - oligotrophic	0	0	0	33.3	67.7
Giraffe Lake South	5	2	0	0	0	0	0	0	ultraoligotrophic	0	0	0	40	60
Goose Lake Neck	3	2	0	0	0	0	0	0	ultraoligotrophic - oligotrophic	0	0	0	33.3	0
Goose Lake Central	3	2	0	0	0	0	0	0	ultraoligotrophic	0	0	0	33.3	0
Goose Lake Tail	3	2	0	0	0	0	0	0	ultraoligotrophic - oligotrophic	0	0	0	66.7	0
Propellor Lake	5	2	0	0	0	0	0	0	ultraoligotrophic	0	0	0	0	80
George Area														
Lower Long Lake	3	0	0	0	0	0	0	0	ultraoligotrophic	0	0	0	0	0
Fold Lake	6	1	0	0	0	0	0	0	ultraoligotrophic - oligotrophic	0	0	0	0	0
George Lake Central	5	2	0	0	0	0	0	0	ultraoligotrophic	0	0	0	0	0
George Lake South	1	0	0	0	0	0	0	0	ultraoligotrophic	0	0	0	0	0
Lytle Lake	1	1	0	0	0	0	0	0	ultraoligotrophic	0	0	0	0	0
Occurrence Lake	1	1	0	0	0	0	0	0	ultraoligotrophic	0	0	0	0	0
Sleigh Lake	1	1	0	0	0	0	0	0	ultraoligotrophic	0	0	0	0	0
Dragon Lake	3	1	0	0	0	0	0	0	ultraoligotrophic	0	0	0	0	0
Komatic Lake	4	1	0	0	0	0	0	0	ultraoligotrophic - oligotrophic	0	0	0	0	0
Reference C Lake	6	1	0	0	0	0	0	0	ultraoligotrophic - oligotrophic	0	0	0	16.7	0

Notes: *(continued)*

a) Canadian water quality guidelines for the protection of aquatic life (CCME, accessed 2012).

b) Interim guideline.

c) < 0.004 mg/L = ultraoligotrophic; 0.004 - 0.01 mg/L = oligotrophic; 0.01 - 0.02 mg/L = mesotrophic; 0.02 - 0.035 mg/L = mesoeutrophic; 0.035 - 0.1 mg/L = eutrophic; > 0.1 mg/L = hypereutrophic.

d) 0.005 mg/L at pH < 6.5; 0.1 mg/L at pH ≥ 6.5

e) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000. There is no minimum guideline. Samples from sites where hardness was low may have guideline concentrations below analytical detection limits. Samples where half the detection limit was above their hardness-dependent guideline are shown in a separate column in the table.

f) Guideline concentration of hexavalent chromium. No concentrations were higher than the CCME guideline for trivalent chromium (0.0089 mg/L).

g) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ x 0.0002. Copper guideline is a minium of 0.002 mg/L regardless of hardness.

h) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minimum of 0.001 mg/L regardless of hardness.

i) Guideline concentration for inorganic mercury.

j) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

Table 3.2-1. Lake Water Quality, Percent of Samples in which Concentrations were Higher than CCME Guidelines, Back River Project, 2012 (completed)

		Chromium (Cr)	Copper (Cu)	Iron (Fe)	Lead (Pb)	Mercury (Hg)	Molybdenum (Mo)	Nickel (Ni)	Selenium (Se)	Silver (Ag)	Thallium (Tl)	Uranium (U)	Zinc (Zn)	Free Cyanide
CCME Guideline Values[a]		Cr (VI) 0.001[bf] mg/L	Hardness-dependent ≥ 0.002[g] mg/L	0.3 mg/L	Hardness-dependent ≥ 0.001[h] mg/L	0.000026[i] mg/L	0.073[b] mg/L	Hardness-dependent ≥ 0.025[j] mg/L	0.001 mg/L	0.0001 mg/L	0.0005 mg/L	Short-term 0.033 mg/L; Long-term 0.015 mg/L	0.03 mg/L	0.005 as Free CN
Lake	Total Number of Samples Collected													
Goose Area														
Moby Lake	3	0	33.3	0	0	0	0	33.3	0	0	0	0	0	0
Gander Lake	2	0	50	50	0	0	0	0	0	0	0	0	0	0
Pond 19	1	0	100	0	0	0	0	0	0	0	0	0	0	0
Big Lake	3	0	33.3	0	0	0	0	0	0	0	0	0	0	0
Rabbit Lake	1	0	100	0	0	0	0	0	0	0	0	0	0	0
Fox Lake	4	0	0	0	25	0	0	0	0	0	0	0	0	0
Echo Lake	1	0	100	100	0	0	0	0	0	0	0	0	0	0
Rascal Lake	2	0	100	0	0	0	0	0	0	0	0	0	0	0
Giraffe Lake North	3	0	100	0	0	0	0	0	0	0	0	0	0	0
Giraffe Lake South	5	0	40	0	0	0	0	0	0	0	0	0	0	0
Goose Lake Neck	3	0	100	0	0	0	0	0	0	0	0	0	0	0
Goose Lake Central	3	0	66.7	0	0	0	0	0	0	0	0	0	0	0
Goose Lake Tail	3	0	66.7	0	0	0	0	0	0	0	0	0	0	0
Propellor Lake	5	20	0	0	0	0	0	0	0	0	0	0	0	0
George Area														
Lower Long Lake	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Fold Lake	6	0	0	0	16.7	0	0	0	0	0	0	0	0	0
George Lake Central	5	0	20	0	40	0	0	0	0	0	0	0	0	0
George Lake South	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Lytle Lake	1	0	100	0	0	0	0	0	0	0	0	0	0	0
Occurrence Lake	1	0	100	0	0	0	0	0	0	0	0	0	0	0
Sleigh Lake	1	0	100	0	0	0	0	0	0	0	0	0	0	0
Dragon Lake	3	0	33.3	0	0	0	0	0	0	0	0	0	0	0
Komatic Lake	4	0	75	0	0	0	0	0	0	0	0	0	0	0
Reference C Lake	6	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes:

a) Canadian water quality guidelines for the protection of aquatic life (CCME, accessed 2012).

b) Interim guideline.

c) < 0.004 mg/L = ultraoligotrophic; 0.004 - 0.01 mg/L = oligotrophic; 0.01 - 0.02 mg/L = mesotrophic; 0.02 - 0.035 mg/L = mesoeutrophic; 0.035 - 0.1 mg/L = eutrophic; > 0.1 mg/L = hypereutrophic.

d) 0.005 mg/L at pH < 6.5; 0.1 mg/L at pH ≥ 6.5

e) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000. There is no minimum guideline. Samples from sites where hardness was low may have guideline concentrations below analytical detection limits. Samples where half the detection limit was above their hardness-dependent guideline are shown in a separate column in the table.

f) Guideline concentration of hexavalent chromium. No concentrations were higher than the CCME guideline for trivalent chromium (0.0089 mg/L).

g) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ x 0.0002. Copper guideline is a minium of 0.002 mg/L regardless of hardness.

h) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minimum of 0.001 mg/L regardless of hardness.

i) Guideline concentration for inorganic mercury.

j) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

Table 3.2-2. Lake Water Quality, Average Factor by which Concentrations were Higher than CCME Guidelines, Back River Project, 2012

			pH*	Fluoride	Chloride	Ammonia (as N)	Nitrate	Nitrite	Total Phosphorus	Aluminum (Al)	Arsenic (As)	Boron (B)	Cadmium (Cd)	Chromium (Cr)
CCME Guideline Values[a]			6.5 - 9.0	0.12[b] mg/L	Short-term 640 mg/L; Long-term 120 mg/L	Temperature- and pH-dependent	Short-term 124 mg/L; Long-term 2.935 mg/L	0.06 mg/L	Trophic Status[c] Range	0.005 - 0.1[d] mg/L	0.005 mg/L	Short-term 29 mg/L; Long-term 1.5 mg/L	Hardness-based Equation[be]	Cr (VI) 0.001[bf] mg/L
Lake	Total Number of Samples Collected	Number of Parameters with Exceedances												
Goose Area														
Moby Lake	3	1	-	-	-	-	-	-	ultraoligotrophic	-	-	-	3.33	-
Gander Lake	2	2	-	-	-	-	-	-	oligotrophic - mesotrophic	-	-	-	1.89	-
Pond 19	1	1	-	-	-	-	-	-	ultraoligotrophic	-	-	-	-	-
Big Lake	3	1	-	-	-	-	-	-	ultraoligotrophic - oligotrophic	-	-	-	1.21	-
Rabbit Lake	1	3	below	-	-	-	-	-	ultraoligotrophic	2.98	-	-	1.39	-
Fox Lake	4	2	-	-	-	-	-	-	ultraoligotrophic - oligotrophic	-	-	-	1.00	-
Echo Lake	1	2	-	-	-	-	-	-	mesoeutrophic	-	-	-	-	-
Rascal Lake	2	3	below	-	-	-	-	-	ultraoligotrophic - oligotrophic	2.05	-	-	1.07	-
Giraffe Lake North	3	2	-	-	-	-	-	-	ultraoligotrophic - oligotrophic	-	-	-	1.36	-
Giraffe Lake South	5	2	-	-	-	-	-	-	ultraoligotrophic	-	-	-	1.23	-
Goose Lake Neck	3	1	-	-	-	-	-	-	ultraoligotrophic - oligotrophic	-	-	-	-	-
Goose Lake Central	3	0	-	-	-	-	-	-	ultraoligotrophic	-	-	-	-	-
Goose Lake Tail	3	1	-	-	-	-	-	-	ultraoligotrophic - oligotrophic	-	-	-	-	-
Propellor Lake	5	1	-	-	-	-	-	-	ultraoligotrophic	-	-	-	1.23	-
George Area														
Lower Long Lake	3	0	-	-	-	-	-	-	ultraoligotrophic	-	-	-	-	-
Fold Lake	6	0	-	-	-	-	-	-	ultraoligotrophic - oligotrophic	-	-	-	-	-
George Lake Central	5	0	-	-	-	-	-	-	ultraoligotrophic	-	-	-	-	-
George Lake South	1	0	-	-	-	-	-	-	ultraoligotrophic	-	-	-	-	-
Lytle Lake	1	1	-	-	-	-	-	-	ultraoligotrophic	-	-	-	-	-
Occurrence Lake	1	1	-	-	-	-	-	-	ultraoligotrophic	-	-	-	-	-
Sleigh Lake	1	1	-	-	-	-	-	-	ultraoligotrophic	-	-	-	-	-
Dragon Lake	3	0	-	-	-	-	-	-	ultraoligotrophic	-	-	-	-	-
Komatic Lake	4	1	-	-	-	-	-	-	ultraoligotrophic - oligotrophic	-	-	-	-	-
Reference C Lake	6	0	-	-	-	-	-	-	ultraoligotrophic - oligotrophic	-	-	-	-	-

Notes: *(continued)*

Values represent the average factor by which 2012 samples were higher than CCME guidelines.

Half the detection limit was substituted for values that were below the detection limit for the calculation of exceedance factors. Shaded cells show sites where all samples that exceeded a particular parameter guideline were below the detection limit.

The average concentration of a particular parameter may be below the CCME guideline concentration even if a percentage of samples is higher than this guideline concentration.

** Note factor by which average concentrations exceeded pH guidelines was not calculated as pH guidelines are a range. Exceedances are shown for reference only.*

a) Canadian water quality guidelines for the protection of aquatic life (CCME, accessed 2012).

b) Interim guideline.

c) < 0.004 mg/L = ultraoligotrophic; 0.004 - 0.01 mg/L = oligotrophic; 0.01 - 0.02 mg/L = mesotrophic; 0.02 - 0.035 mg/L = mesoeutrophic; 0.035 - 0.1 mg/L = eutrophic; > 0.1 mg/L = hypereutrophic.

d) 0.005 mg/L at pH < 6.5; 0.1 mg/L at pH ≥ 6.5.

e) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000. There is no minimum guideline.

f) Guideline concentration of hexavalent chromium. No concentrations were higher than the CCME guideline for trivalent chromium (0.0089 mg/L).

g) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ x 0.0002. Copper guideline is a minium of 0.002 mg/L regardless of hardness.

h) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minimum of 0.001 mg/L regardless of hardness.

i) Guideline concentration for inorganic mercury.

j) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

Table 3.2-2. Lake Water Quality, Average Factor by which Concentrations were Higher than CCME Guidelines, Back River Project, 2012 (completed)

Lake	Total Number of Samples Collected	Copper (Cu)	Iron (Fe)	Lead (Pb)	Mercury (Hg)	Molybdenum (Mo)	Nickel (Ni)	Selenium (Se)	Silver (Ag)	Thallium (Tl)	Uranium (U)	Zinc (Zn)	Free Cyanide
CCME Guideline Values[a]		Hardness-dependent ≥ 0.002[g] mg/L	0.3 mg/L	Hardness-dependent ≥ 0.001[h] mg/L	0.000026[i] mg/L	0.073[b] mg/L	Hardness-dependent ≥ 0.025[j] mg/L	0.001 mg/L	0.0001 mg/L	0.0005 mg/L	Short-term 0.033 mg/L; Long-term 0.015 mg/L	0.03 mg/L	0.005 as Free CN
Goose Area													
Moby Lake	3	-	-	-	-	-	-	-	-	-	-	-	-
Gander Lake	2	1.16	-	-	-	-	-	-	-	-	-	-	-
Pond 19	1	1.15	-	-	-	-	-	-	-	-	-	-	-
Big Lake	3	-	-	-	-	-	-	-	-	-	-	-	-
Rabbit Lake	1	1.57	-	-	-	-	-	-	-	-	-	-	-
Fox Lake	4	-	-	2.57	-	-	-	-	-	-	-	-	-
Echo Lake	1	1.26	1.97	-	-	-	-	-	-	-	-	-	-
Rascal Lake	2	1.47	-	-	-	-	-	-	-	-	-	-	-
Giraffe Lake North	3	1.63	-	-	-	-	-	-	-	-	-	-	-
Giraffe Lake South	5	1.26	-	-	-	-	-	-	-	-	-	-	-
Goose Lake Neck	3	1.79	-	-	-	-	-	-	-	-	-	-	-
Goose Lake Central	3	-	-	-	-	-	-	-	-	-	-	-	-
Goose Lake Tail	3	1.22	-	-	-	-	-	-	-	-	-	-	-
Propellor Lake	5	-	-	-	-	-	-	-	-	-	-	-	-
George Area													
Lower Long Lake	3	-	-	-	-	-	-	-	-	-	-	-	-
Fold Lake	6	-	-	-	-	-	-	-	-	-	-	-	-
George Lake Central	5	-	-	-	-	-	-	-	-	-	-	-	-
George Lake South	1	-	-	-	-	-	-	-	-	-	-	-	-
Lytle Lake	1	1.16	-	-	-	-	-	-	-	-	-	-	-
Occurrence Lake	1	1.57	-	-	-	-	-	-	-	-	-	-	-
Sleigh Lake	1	1.18	-	-	-	-	-	-	-	-	-	-	-
Dragon Lake	3	-	-	-	-	-	-	-	-	-	-	-	-
Komatic Lake	4	1.26	-	-	-	-	-	-	-	-	-	-	-
Reference C Lake	6	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

Values represent the average factor by which 2012 samples were higher than CCME guidelines.

Half the detection limit was substituted for values that were below the detection limit for the calculation of exceedance factors. Shaded cells show sites where all samples that exceeded a particular parameter guideline were below the detection limit.

The average concentration of a particular parameter may be below the CCME guideline concentration even if a percentage of samples is higher than this guideline concentration.

** Note factor by which average concentrations exceeded pH guidelines was not calculated as pH guidelines are a range. Exceedances are shown for reference only.*

a) Canadian water quality guidelines for the protection of aquatic life (CCME, accessed 2012).

b) Interim guideline.

c) < 0.004 mg/L = ultraoligotrophic; 0.004 - 0.01 mg/L = oligotrophic; 0.01 - 0.02 mg/L = mesotrophic; 0.02 - 0.035 mg/L = mesoeutrophic; 0.035 - 0.1 mg/L = eutrophic; > 0.1 mg/L = hypereutrophic.

d) 0.005 mg/L at pH < 6.5; 0.1 mg/L at pH ≥ 6.5.

e) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000. There is no minimum guideline.

f) Guideline concentration of hexavalent chromium. No concentrations were higher than the CCME guideline for trivalent chromium (0.0089 mg/L).

g) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ x 0.0002. Copper guideline is a minium of 0.002 mg/L regardless of hardness.

h) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minimum of 0.001 mg/L regardless of hardness.

i) Guideline concentration for inorganic mercury.

j) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

All lakes had water quality within the CCME guidelines for pH (6.5 to 9), except Rabbit Lake and Rascal Lake in August (pH: 6.3). All lakes had water quality below CCME guidelines for chloride, fluoride, ammonia, nitrate, nitrite and free cyanide. All lakes except Lower Long exceeded CCME guidelines in at least one sample for at least one of the following metals: total aluminum, total cadmium, total chromium, total copper, total iron, total lead, and total nickel.

Average concentrations exceeded CCME guidelines for at least one parameter at over two thirds of lakes. Parameters where average lake concentrations exceeded guidelines included total aluminum, total cadmium, total copper, total iron, and total lead. Over a third of sites had average concentrations that exceeded cadmium guidelines, and over half had average concentrations that exceeded copper guidelines. Rabbit and Rascal lakes had the greatest number of parameters with average concentrations that exceeded CCME guidelines at three.

More average concentrations exceeded CCME guidelines in lakes in the Goose area than in the George area. Moby Lake had the greatest exceedance, with average cadmium concentrations 3.33 times greater than its hardness-dependent CCME guideline. Most other average exceedances were between one and two times greater than their respective CCME guidelines.

George area lakes, in particular Dragon, Komatic and Reference C, tended to have higher hardness levels than Goose area lakes, and this resulted in higher hardness-dependent CCME guideline concentrations for parameters that are hardness-dependent (total cadmium, copper, lead, and nickel). All other lakes had much lower hardness levels (i.e., were softer), meaning the hardness-dependent CCME guidelines were lower, and in the case of cadmium, sometimes below the analytical detection limit.

3.2.8 Lake Water Quality Assurance/Quality Control

In total, four equipment blanks, four field blanks, and four travel blanks were processed for 56 parameters as part of the 2012 lake water quality program.

Blanks were below detection limits for the vast majority of parameters (Appendix 3.2-2). A few parameters were either at or close to detection limits for some blanks; total selenium in the April Goose area field blank; total barium in the April George area equipment blank; conductivity, ammonia, chloride, total barium, total lead, total nickel and total sodium in the August Goose area equipment blank; and total lead in the August George equipment blank.

Concentrations of some parameters were clearly above detection levels, including nitrate, aluminum and manganese in the August Goose equipment blank, and barium in the August George equipment blank. Nitrate concentrations were 0.0463 mg/L in the August Goose area equipment blank, higher than all regular samples, with the exception of Gander Lake in April. Note the sampler bottles were acid washed with nitric acid, to prevent metal contamination. Aluminum concentrations were 0.0941 mg/L in the August Goose area equipment blank, higher than all other regular samples. Total manganese in the August Goose area equipment blank and total barium in the August George area equipment blank were above detection levels, but below all concentrations observed in regular samples.

There were 12 samples (four of each blank type) measured for 56 for a total of 452 potential hits. Fourteen were above detection limits (3%), but only four were clearly above the DL (0.9%). Based on these calculations, and the absence of consistent trends in the blanks, the lake water quality data was considered robust.

Fifteen pairs of field duplicates for sampled lakes were compared for each water quality parameter (Appendix 3.2-3). A total of 29% (386/1335) of the duplicate concentrations were at least five times greater than their detection limits and so used in RPD calculations. Of these RPD calculations, only 7% (26/386) had an RPD above 20%, only 2.6% (10/386) had an RPD equal or greater than 50%, and only 0.26% (1/386) had an RPD above 100%. The cause of the elevated RPDs is not known, but likely reflects

the environmental heterogeneity at lakes, although could also result from lab analysis errors or sampler handling. The low proportion of high RPDs suggests the lake water quality data is robust.

3.3 STREAM WATER QUALITY

Stream water quality samples were collected in June (freshet), August (summer), and September 2012. Stream water quality data collected in 2012 are presented graphically in Figures 3.3-1a to 3.3-5g. Raw water quality data for streams are presented in Appendices 3.3-1 to 3.3-3.

3.3.1 Physical Parameters

The streams in the Goose and George Properties were largely circumneutral, poorly buffered, with soft water'. The surveyed streams ranged in pH from an average of 6.0 (Echo OF) to 8.0 (Reference C OF), with streams tending to have their lowest pH in June and highest pH in August (Figure 3.3-1a). Streams in the Goose area streams tended to be more acidic than those in the George area, consistent with trends in lake pH. The highest pH levels in each season were observed in Reference C OF, with a pH ranging from 7.7 to 8.1. The lowest pH levels were below the lower CCME guideline limit for freshwater aquatic health (pH 6.5) at Chair OF in June (6.1) and Echo OF in June and Sept (6.0). Echo OF was outside of CCME guideline ranges in 2011 also with an average pH of 5.87 (Rescan 2012a).

Streams were poorly buffered, with low total alkalinity levels (Figure 3.3-1a). Total alkalinities were less than 16 mg/L at all streams, except at Reference C OF, which was higher in June (average of 26 mg/L) and considerably higher in August and September (averages of 68.3 mg/L and 66.8 mg/L).

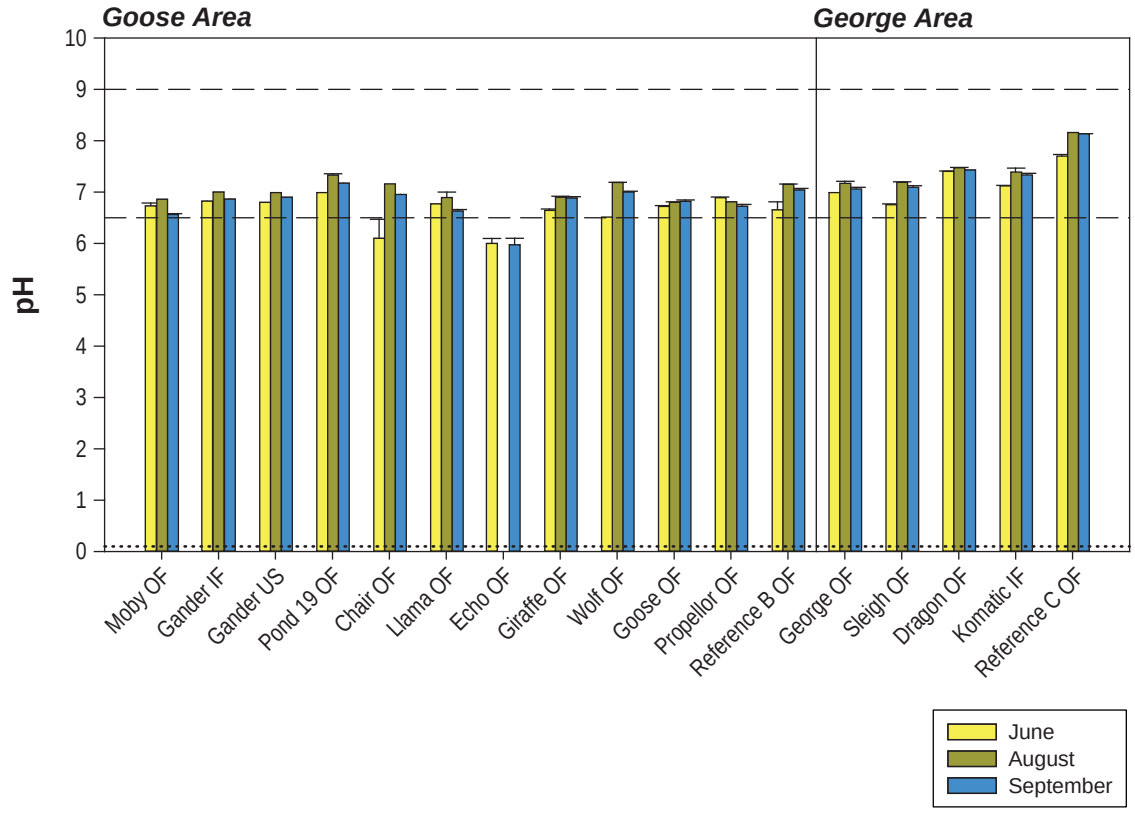
Overall streams tended to be soft (<60 mg $CaCO_3$/L), with softest water measured in June when freshet resulted in stream water diluted by ice and snowmelt, and harder water in August when streams had lower volumes and more surface contact (Figure 3.3-1b). Streams in the Goose area tended to be softer than those in the George area. Exceptions were Llama OF, which had moderately hard water (67 mg $CaCO_3$/L) in August, and had hard water in September (132 mg $CaCO_3$/L). This was considerably harder than all other streams sampled. This continued the trend observed in 2011 of Llama OF having considerably higher hardness than other streams in the area (Rescan 2012a). Reference C OF in August and September also had moderately hard water (63 mg/L).

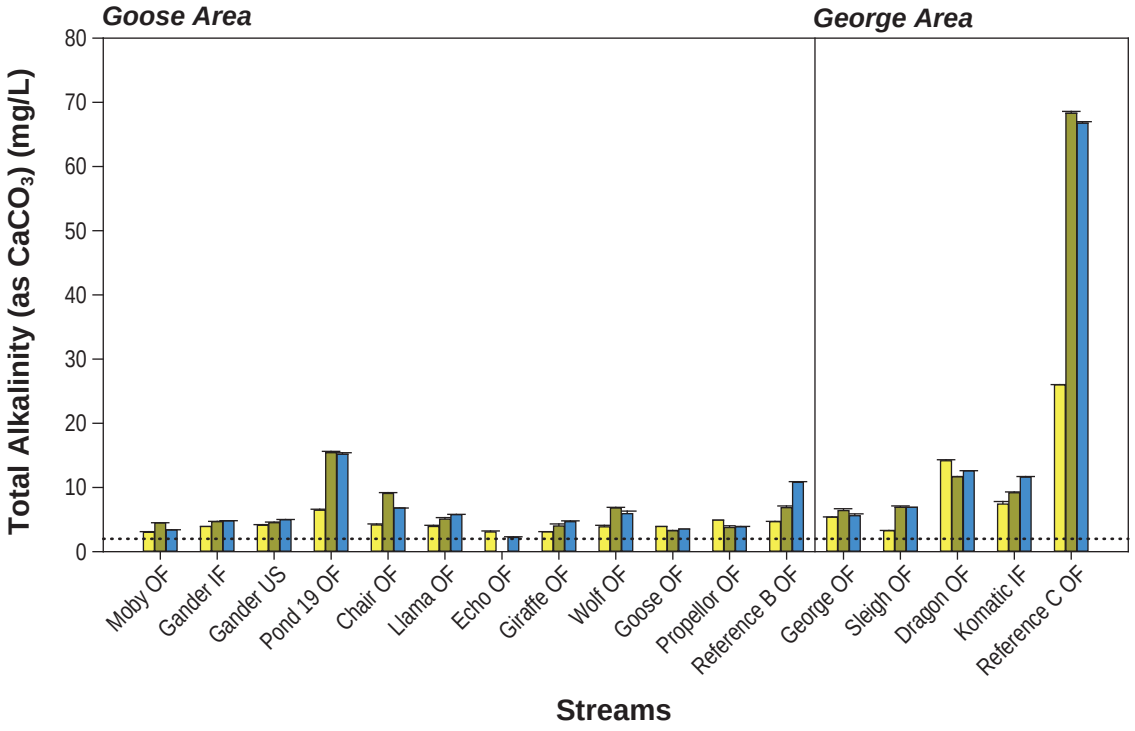
Patterns in conductivity and TDS followed those of hardness, with low conductivity (less than 125 µS/cm) and TDS (less than 100 mg/L) in all streams, except Llama OF, and generally lower concentrations in Goose area lakes than in George area lakes (Figure 3.3-1b). Llama OF had higher conductivities and TDS concentrations than all other stream in August (conductivity 175 µS/cm; TDS 121 mg/L) and September (conductivity 336 µS/cm; TDS 299 mg/L). Chloride and calcium concentrations were also higher at Llama OF in August and September than the other stream sites.

3.3.2 Major Anions

Sulphate was usually the dominant anion at stream sites, except for at Llama OF (chloride). Concentrations varied seasonally tending to be highest in September, and geographically tending to be highest in the George area streams (Figure 3.3-2). All streams had sulphate concentrations below 40 mg/L, with lowest concentrations in Reference C OF near detection limits in all seasons (0.5 mg/L).

Overall, streams had low chloride and fluoride concentrations with most streams being near detection limits (Figure 3.3-2). The exception was Llama OF, spiking above the detection limit for chloride (0.5 mg/L) in August (41 mg/L) and September (88 mg/L). Note Llama OF is downstream of exploration drilling sites, where drilling salts containing chlorides are used, elevated chloride levels may be a result of drilling salt influence. Fluoride ranged between 0.04 mg/L and the detection limit (0.02 mg/L) for all sites. All streams were below CCME guidelines for chloride and fluoride (CCME 2012).





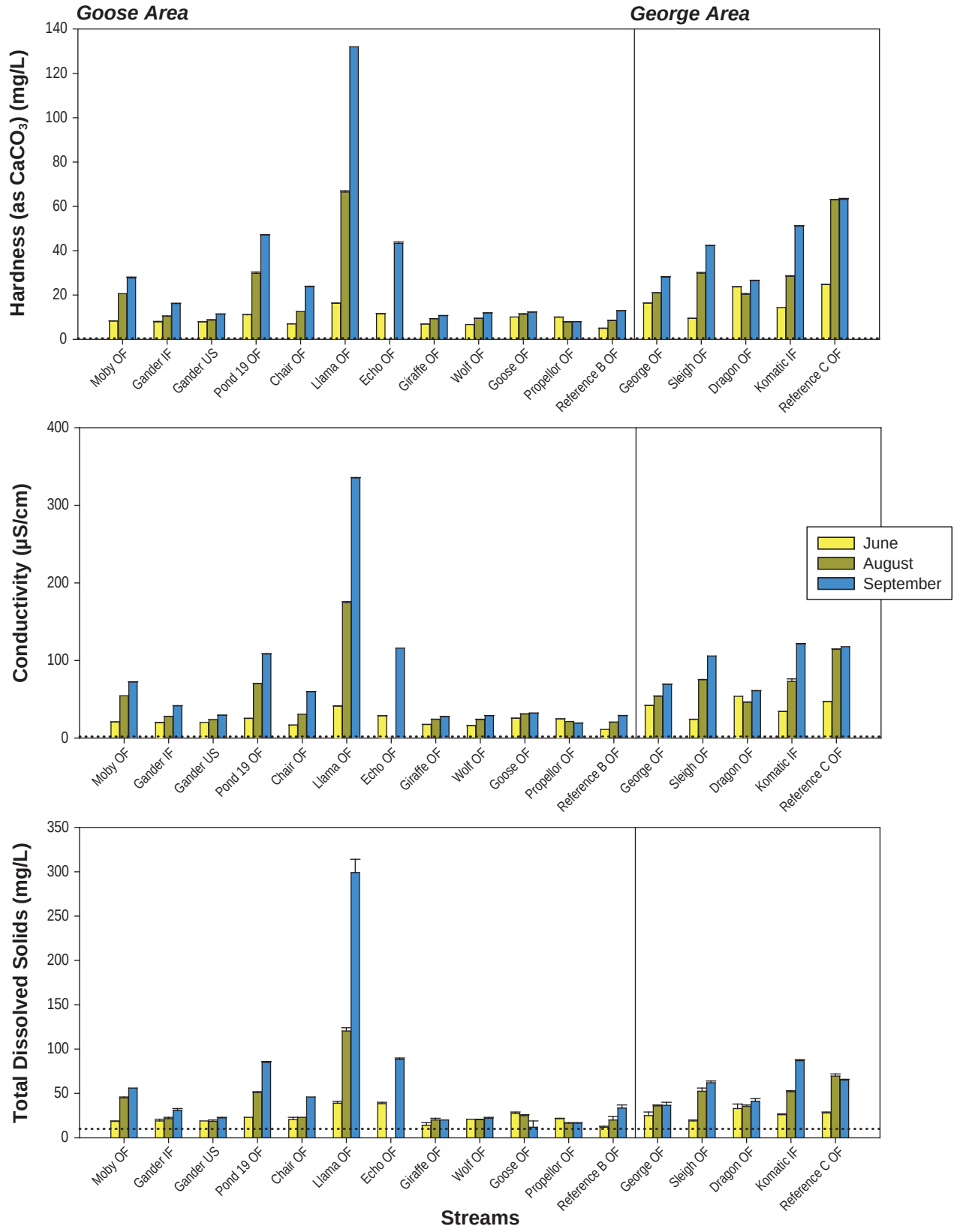
Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (pH 0.1; total alkalinity 2 mg/L).
Dashed lines represent CCME guideline for pH 6.5-9.

Sabina GOLD & SILVER CORP.

pH and Total Alkalinity in Streams, Back River Project, 2012

Figure 3.3-1a

Rescan™ Engineers & Scientists



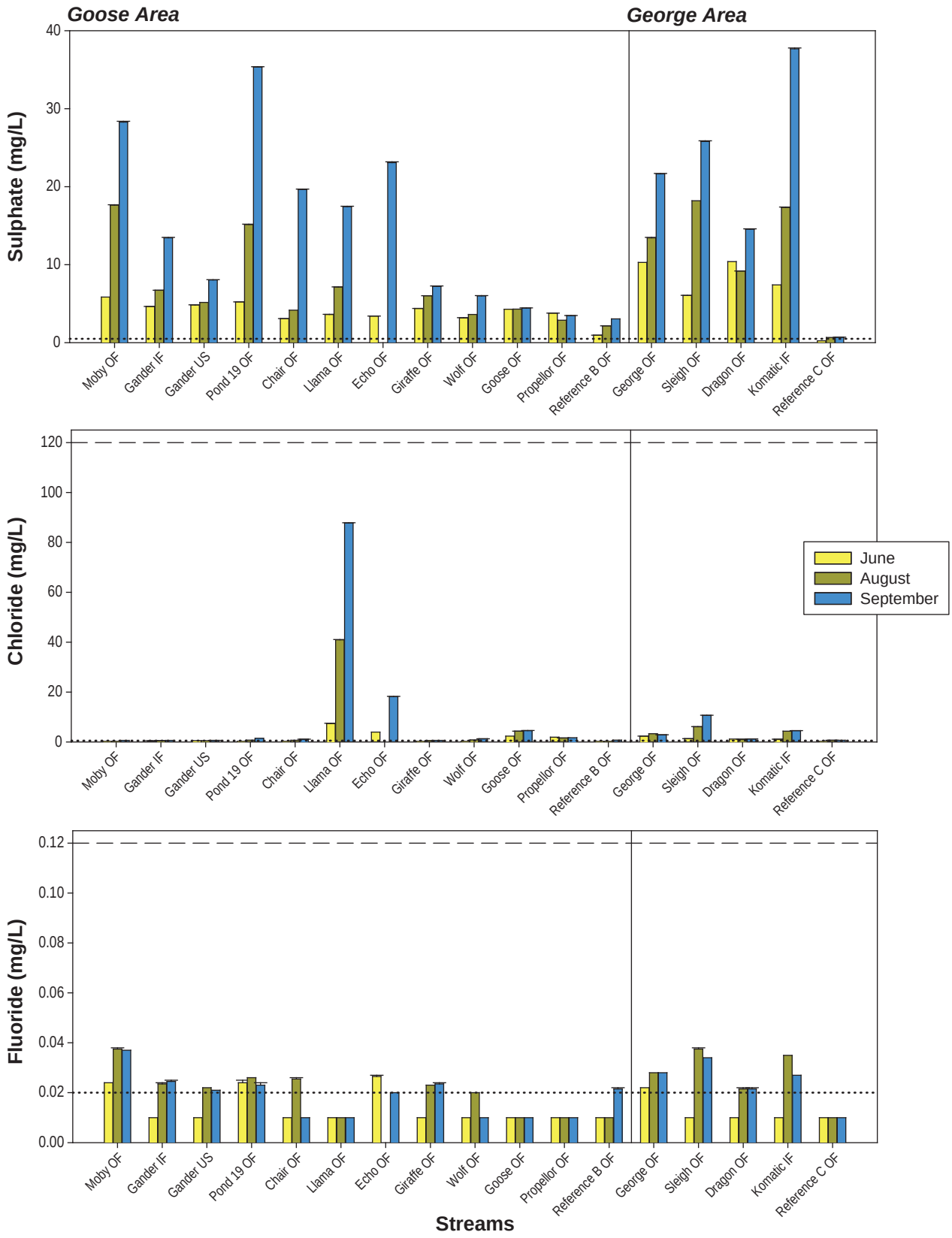
Notes: Error bars represent standard error of the mean of replicates.
Dotted black lines represent analytical detection limits (hardness 0.5 mg/L; conductivity 2 µs/cm; total dissolved solids 10 mg/L).
There are no CCME guidelines for hardness, conductivity, and total dissolved solids.

Sabina GOLD & SILVER CORP.

Hardness, Conductivity and Total Dissolved Solids in Streams, Back River Project, 2012

Figure 3.3-1b

Rescan™ Engineers & Scientists



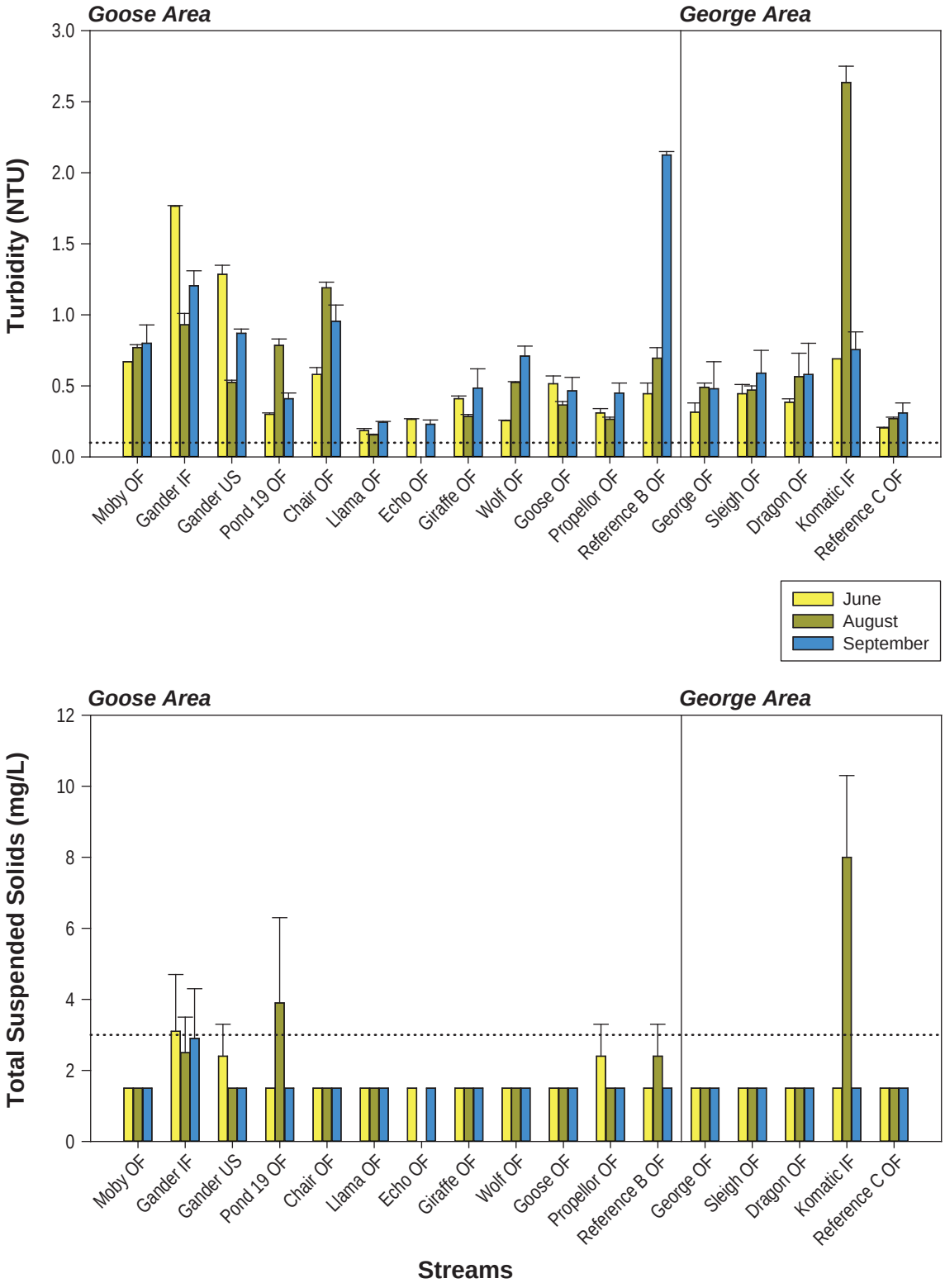
Notes: Error bars represent standard error of the mean of replicates.
Dotted black lines represent analytical detection limits (sulphate 0.5 mg/L; chloride 0.5 mg/L; fluoride 0.02 mg/L).
Values below detection limit were plotted as half of the detection limit.
Dashed lines represent the CCME long-term guideline for chloride (120 mg/L) and the CCME guideline for fluoride (0.12 mg/L).
The CCME short-term guideline for chloride is 640 mg/L (not shown).

Sabina GOLD & SILVER CORP.

Sulphate, Chloride and Fluoride Concentrations in Streams, Back River Project, 2012

Figure 3.3-2

Rescan™ Engineers & Scientists



Notes: Error bars represent standard error of the mean of replicates.
Dotted black lines represent analytical detection limits (turbidity 0.1 NTU; total suspended solids 3 mg/L).
Values below detection limit were plotted as half of the detection limit.
CCME guidelines for turbidity and total suspended solids are dependent on background levels.

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Turbidity and Total Suspended Solids in Streams, Back River Project, 2012

Figure 3.3-3

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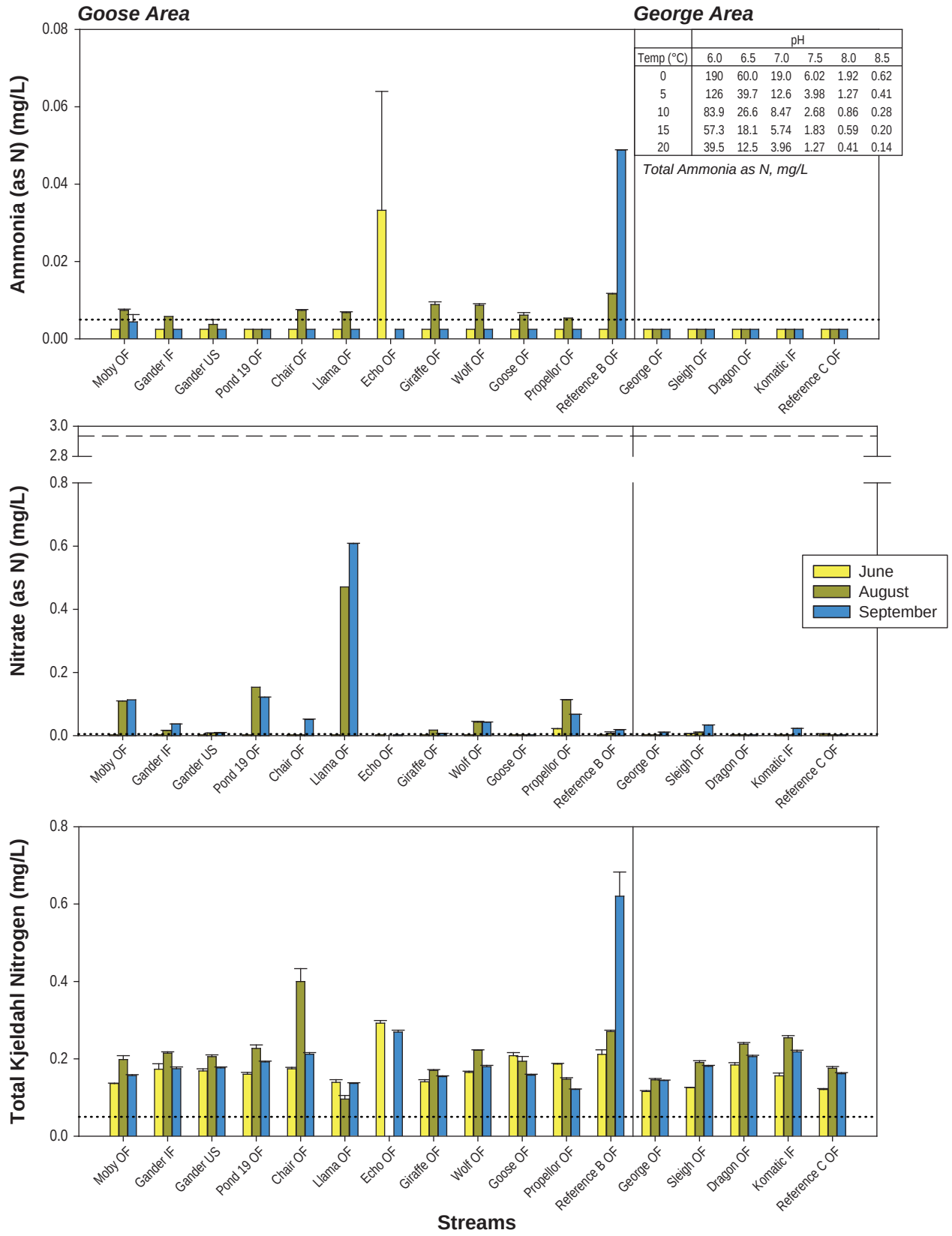

Notes: Error bars represent standard error of the mean of replicates.
Dotted black lines represent analytical detection limits (ammonia 0.005 mg/L; nitrate 0.005 mg/L; TKN 0.05 mg/L).
Values below the detection limit are plotted at half of the detection limit.
Inset table shows temperature- and pH-dependent CCME guidelines for ammonia.
Dashed red lines represent the CCME long-term guideline for nitrate (2.935 mg/L).
CCME short-term guideline for nitrate is 124 mg/L (not shown).
Nitrite concentrations were always below detection limit (0.001 mg/L) so were not plotted.

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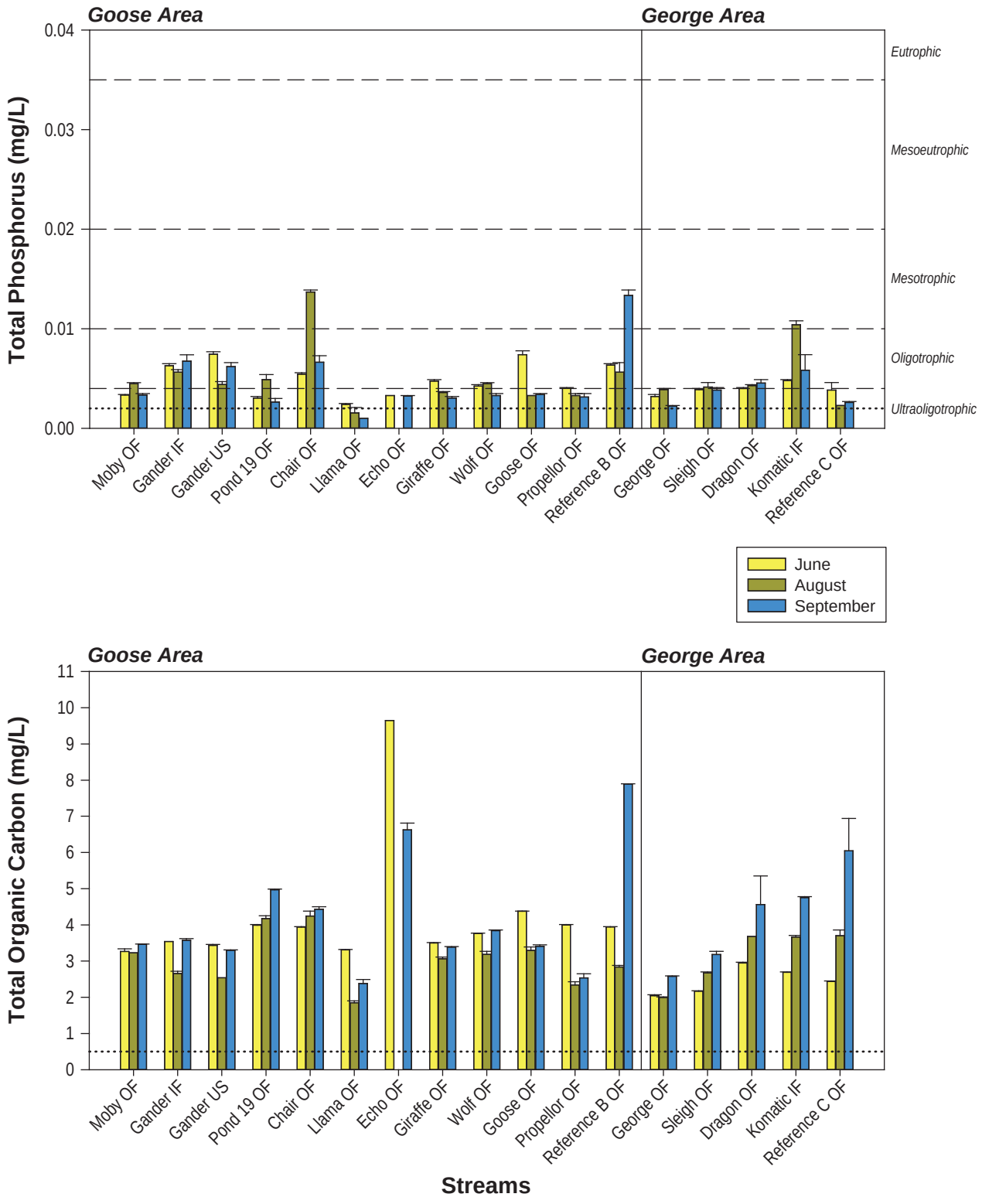
Ammonia, Nitrate and Total Kjeldahl Nitrogen Concentrations in Streams, Back River Project, 2012

Figure 3.3-4a

Rescan™ Engineers & Scientists



Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limits (total phosphorus 0.002 mg/L; total organic carbon 0.5 mg/L).
Values below detection limit were plotted as half of the detection limit.
Dashed lines represent CCME trigger ranges for total phosphorus (<0.004 mg/L = ultraoligotrophic; 0.004-0.01 mg/L = oligotrophic; 0.01-0.02 = mesotrophic; 0.02-0.035 mg/L = mesoeutrophic; 0.035-0.1 mg/L = eutrophic; >0.1 mg/L = hypereutrophic).
There is no CCME guideline for total organic carbon.

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Total Phosphorus and Total Organic Carbon Concentrations in Streams, Back River Project, 2012

Figure 3.3-4b

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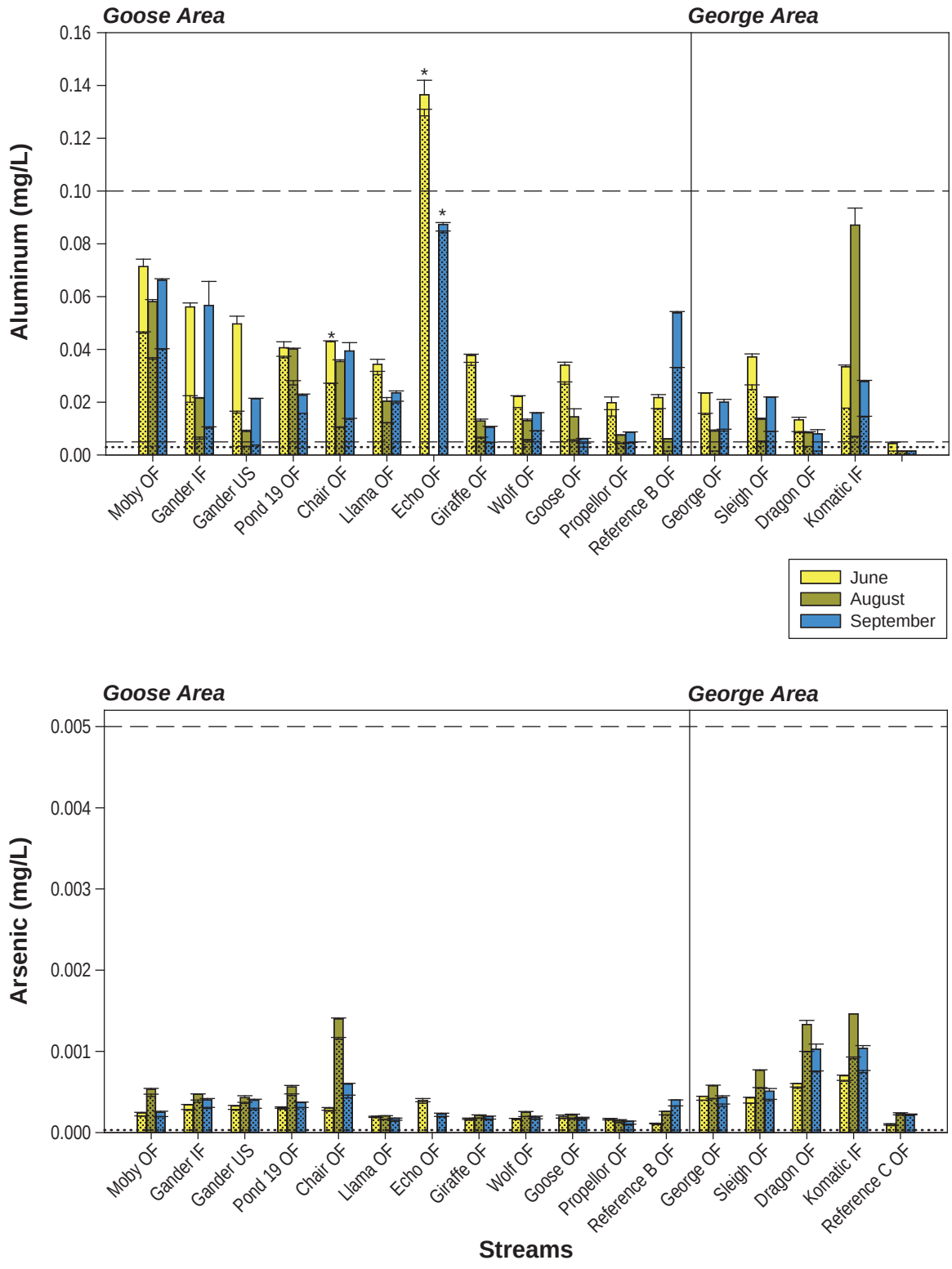

Notes: Error bars represent standard error of the mean of replicates.
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dotted lines represent analytical detection limits (aluminum 0.003 mg/L; arsenic 0.00003 mg/L).
Values below detection limit were plotted as half of the detection limit.
Dashed lines represent CCME guidelines. The CCME guideline for arsenic is 0.005 mg/L.
CCME guidelines for aluminum are pH-dependent (0.005 mg/L at pH less than 6.5; 0.1 mg/L at pH greater than or equal to 6.5).
pH was above 6.5 at all sites except Echo OF (June and September) and Chair OF (June).
**Indicates mean total metal values that were higher than CCME guidelines.*

Sabina GOLD & SILVER CORP.

Aluminum and Arsenic Concentrations in Streams, Back River Project, 2012

Figure 3.3-5a

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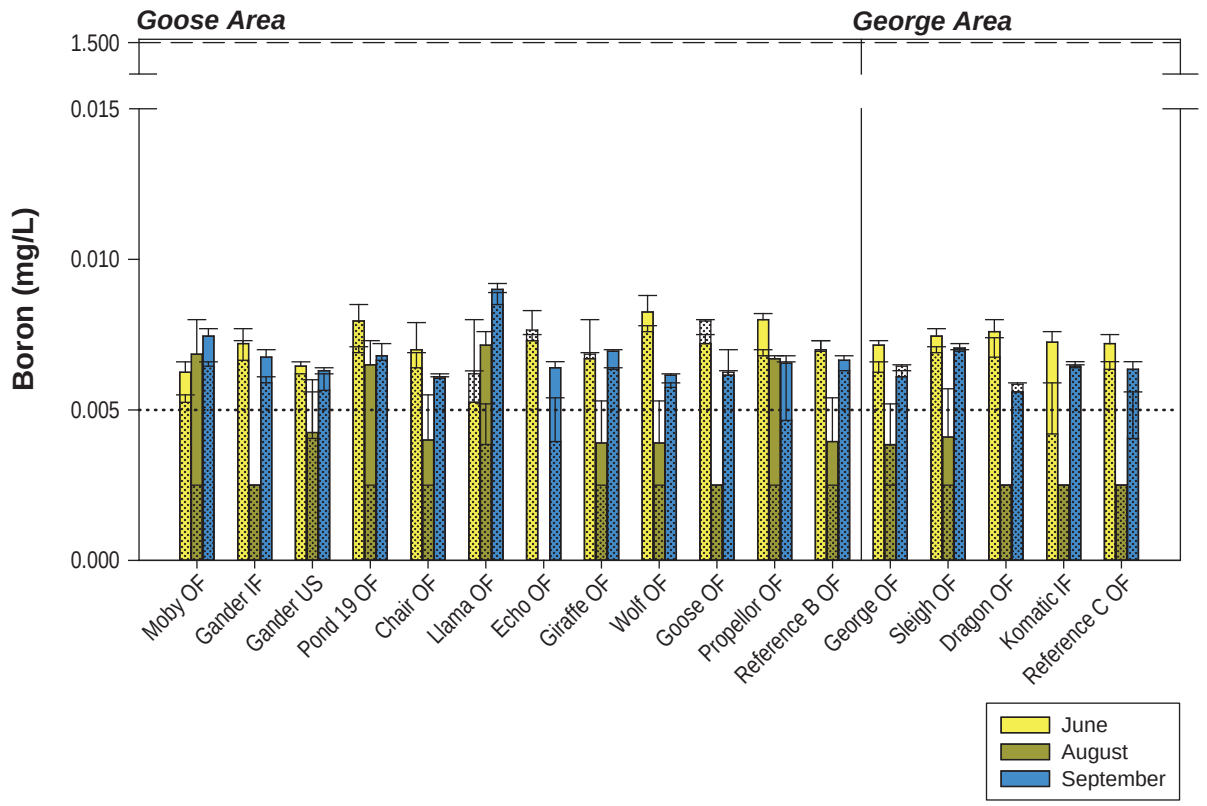

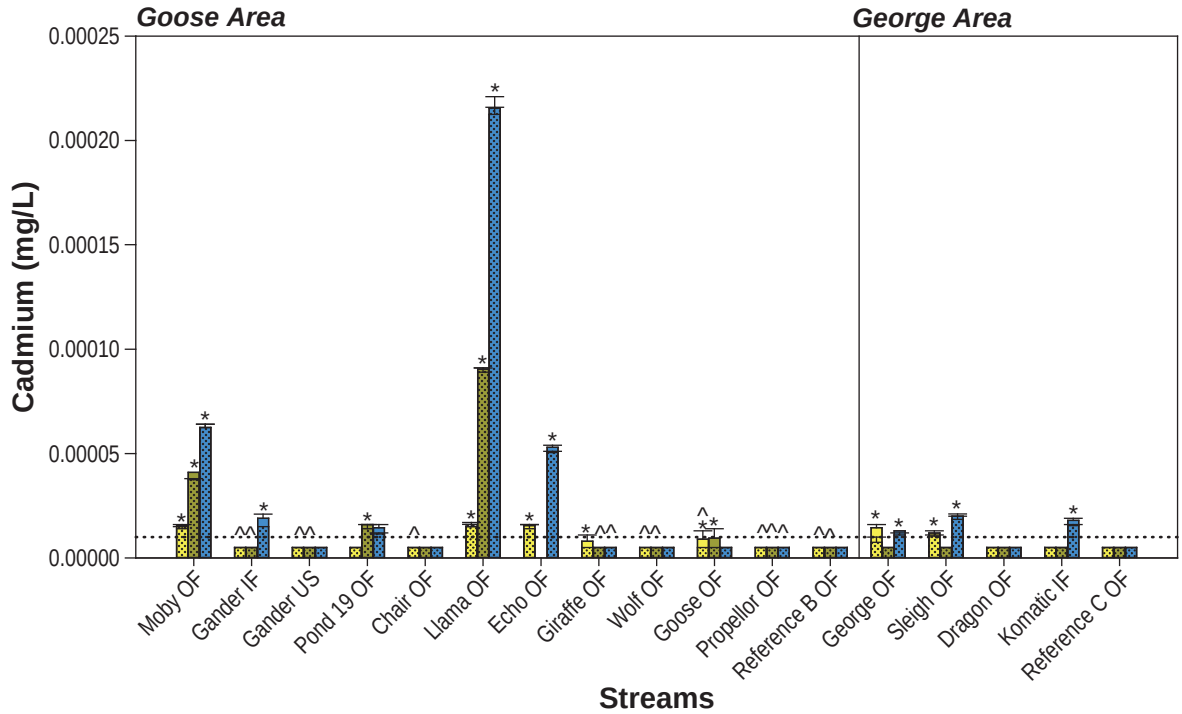

Notes: Error bars represent standard error of the mean of replicates.
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dotted lines represent analytical detection limits (boron 0.005 mg/L; cadmium 0.00001 mg/L).
Values below detection limit were plotted as half of the detection limit.
Dashed lines represent CCME guidelines. The CCME guidelines for boron are 1.5 mg/L long term and 29 mg/L short term [not shown]).
The CCME guideline for cadmium (in mg/L) can be calculated using the equation: $10^{(0.86[\log(\text{hardness})]-3.2)}/1000$.
** Indicates mean total metal values that were higher than CCME guidelines.*
^ Indicates cadmium values below detection limnts where 0.5 x the detection limit was above hardness-dependent guidelines.

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Boron and Cadmium Concentrations in Streams, Back River Project, 2012

Figure 3.3-5b

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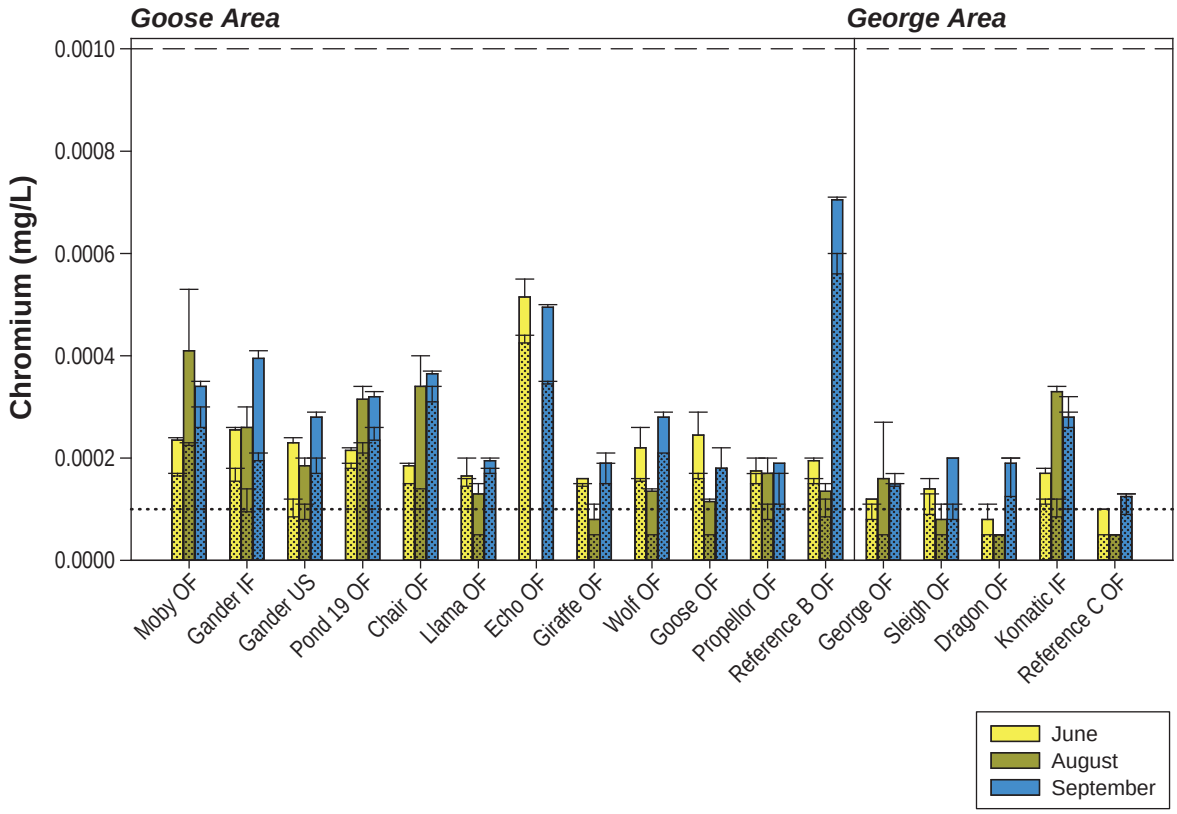

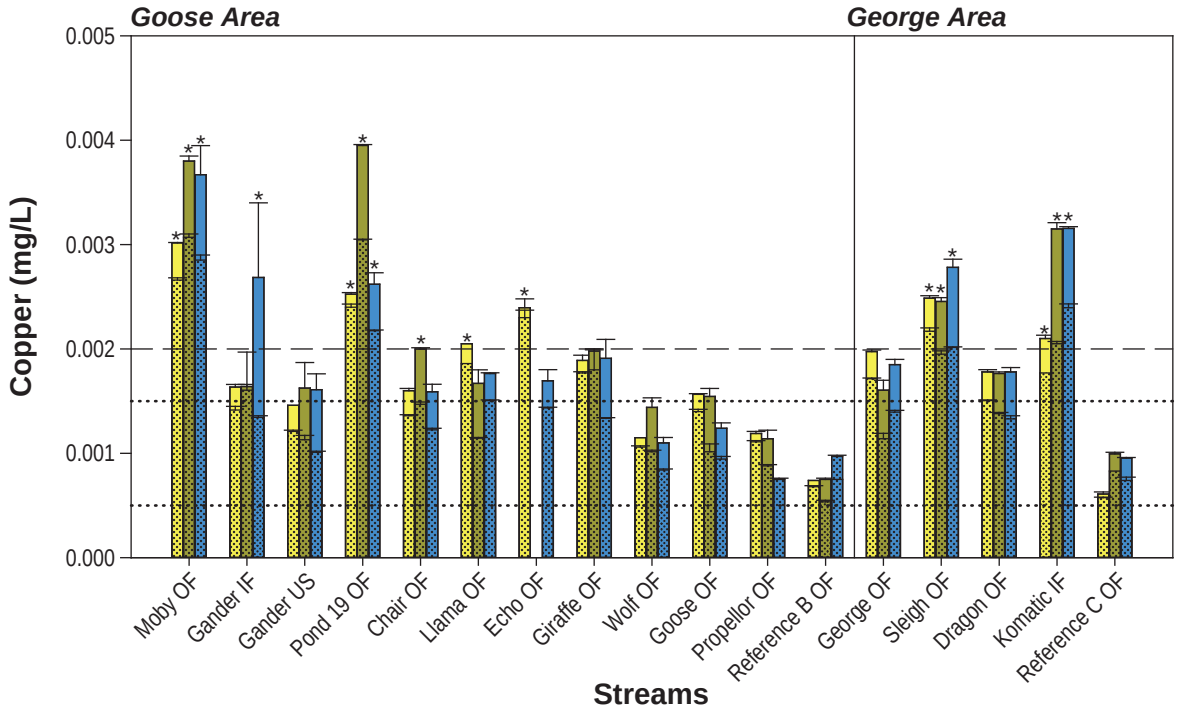

Notes: Error bars represent standard error of the mean of replicates.
Solid columns represent total metals and superimposed diagonal lined columns represent dissolved metals.
Dotted lines represent analytical detection limits (chromium 0.0001 mg/L; copper 0.0005 or 0.0015 mg/L).
Values below detection limit were plotted as half of the detection limit.
** Indicates mean total metal values that were higher than CCME guidelines.*

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Chromium and Copper Concentrations in Streams, Back River Project, 2012

Figure 3.3-5c

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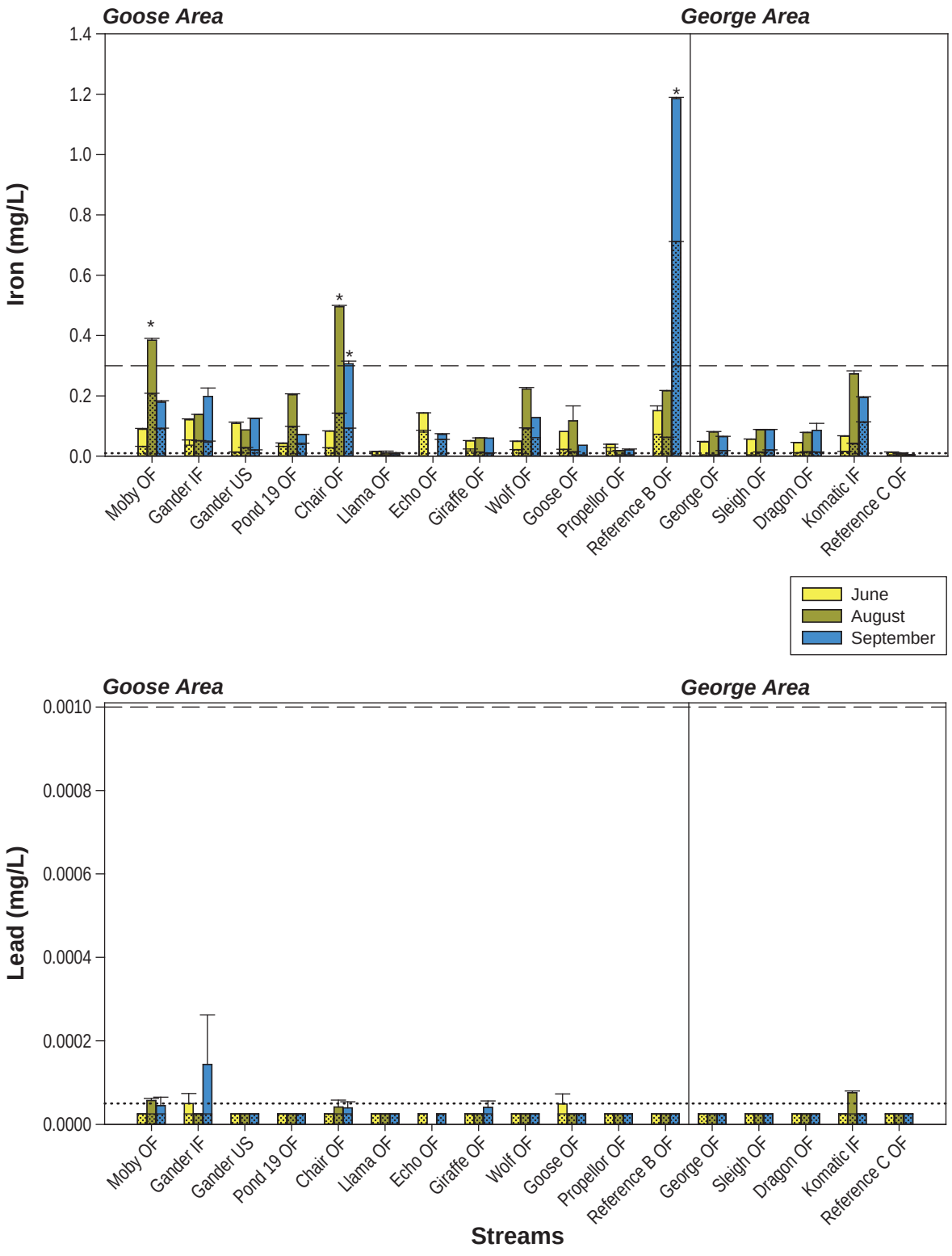

Notes: Error bars represent standard error of the mean of replicates.
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dotted lines represent analytical detection limits (iron 0.01 mg/L; lead 0.00005 mg/L).
Values below detection limit were plotted as half of the detection limit.
Dashed lines represent CCME guidelines. The CCME guideline for iron is 0.3 mg/L.
The CCME guideline for lead (in mg/L) can be calculated using the equation: $e^{(1.273[\ln(\text{hardness})]-4.705)}/1{,}000$.
Lead guideline is a minimum of 0.001 mg/L regardless of hardness.
** Indicates mean total metal values that were higher than CCME guidelines.*

Sabina GOLD & SILVER CORP.

Iron and Lead Concentrations in Streams, Back River Project, 2012

Figure 3.3-5d

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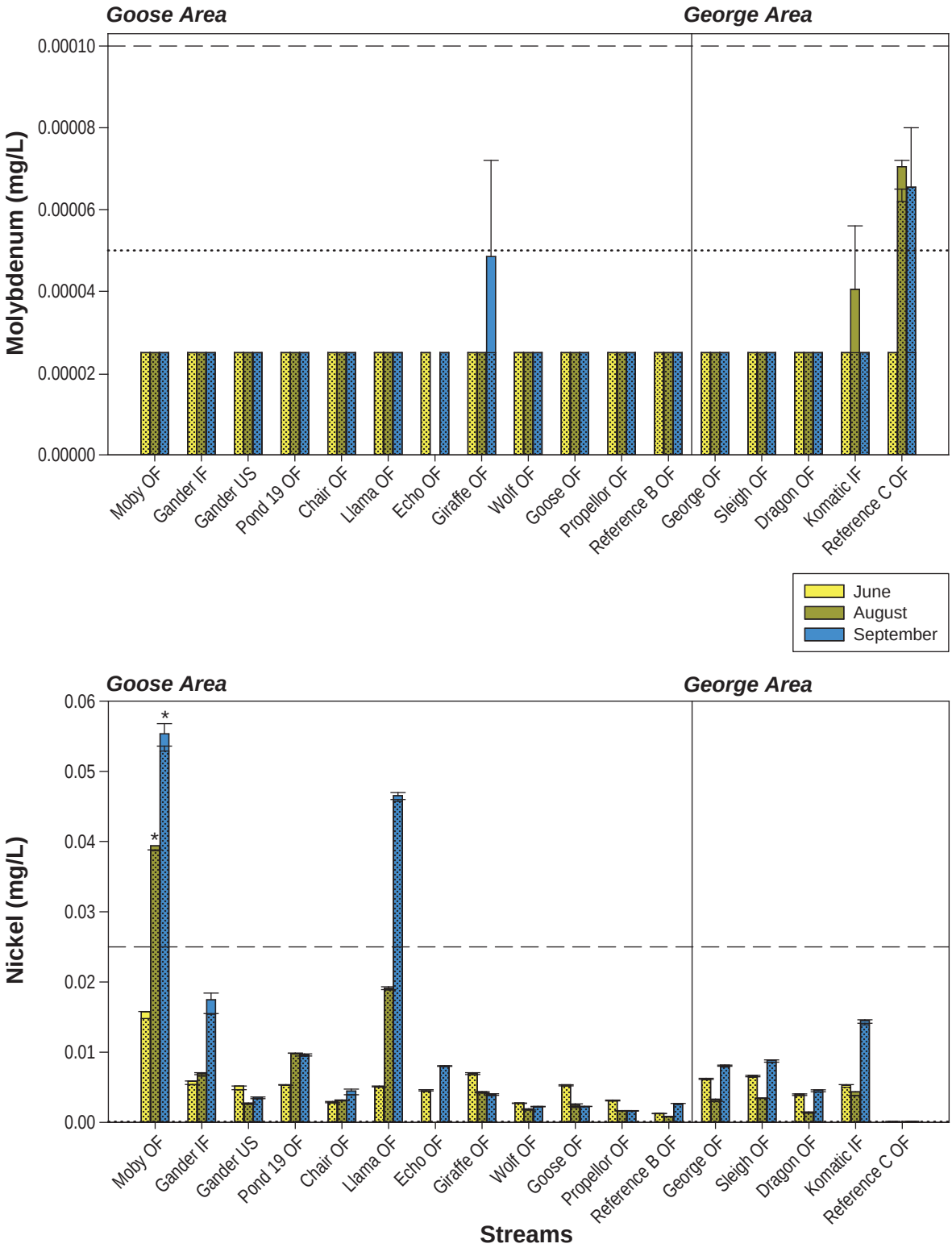

Notes: Error bars represent standard error of the mean of replicates.
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dotted lines represent analytical detection limits (molybdenum 0.00005 mg/L; nickel 0.0001 mg/L).
Values below detection limit were plotted as half of the detection limit.
Dashed lines represent CCME guidelines.The CCME guideline for nickel (in mg/L) can be calculated using the equation $e^{\{0.76[\ln(\text{hardness})]+1.06\}/1000}$.
Nickel guideline is a minimum of 0.025 mg/L regardless of hardness.
The interim CCME guideline for molybdenum is 0.073 mg/L.
** Indicates total mean nickel values that were higher than CCME guidelines.*

Sabina GOLD & SILVER CORP.

Molybdenum and Nickel Concentrations in Streams, Back River Project, 2012

Figure 3.3-5e

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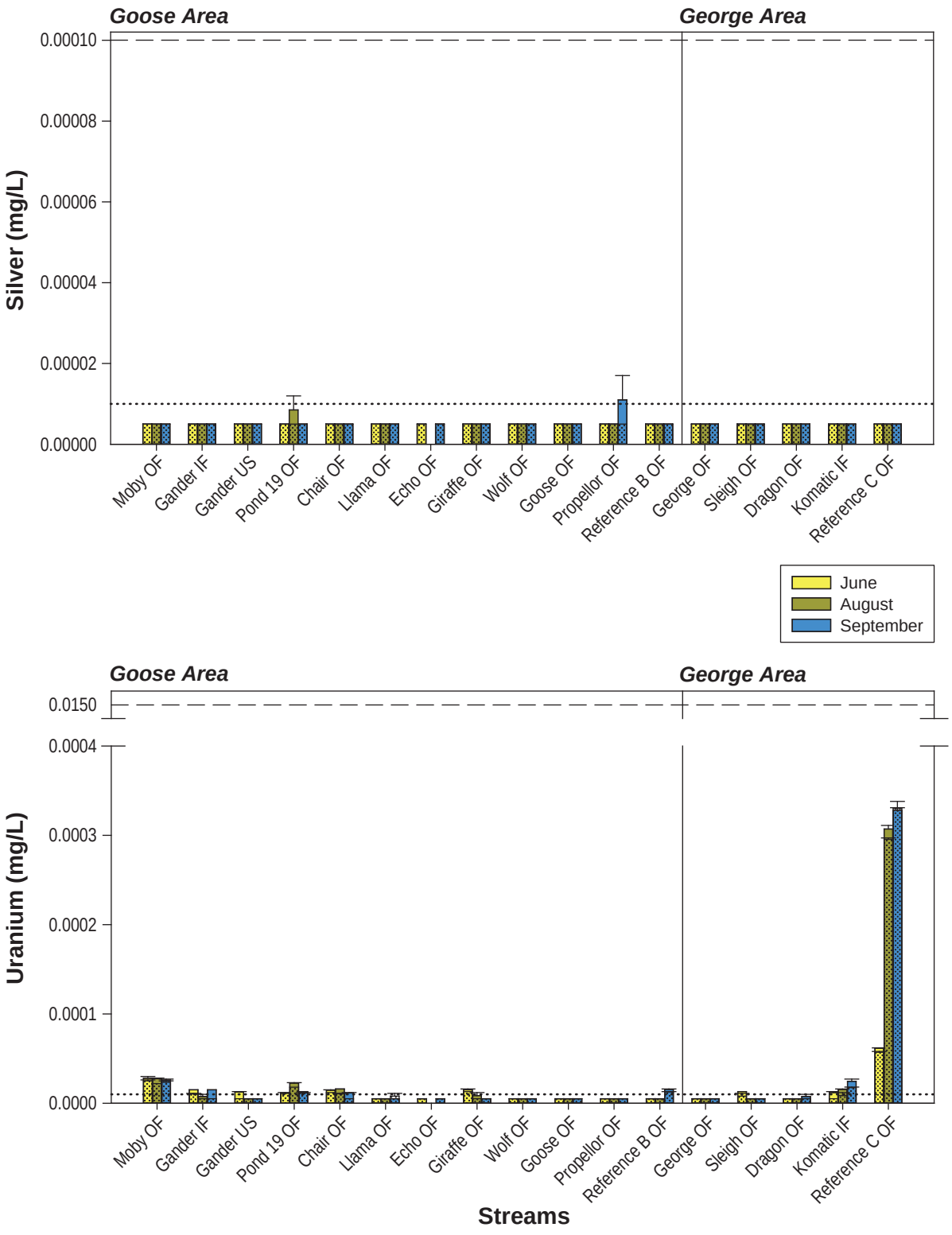

Notes: Error bars represent standard error of the mean of replicates.
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dotted lines represent analytical detection limits (silver 0.00001 mg/L; uranium 0.00001 mg/L).
Values below detection limit were plotted as half of the detection limit.
Dashed lines represent CCME guidelines (silver 0.0001 mg/L; uranium long-term 0.015 mg/L).
The short-term CCME guideline for uranium is not shown (0.033 mg/L).

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Silver and Uranium Concentrations in Streams, Back River Project, 2012

Figure 3.3-5f

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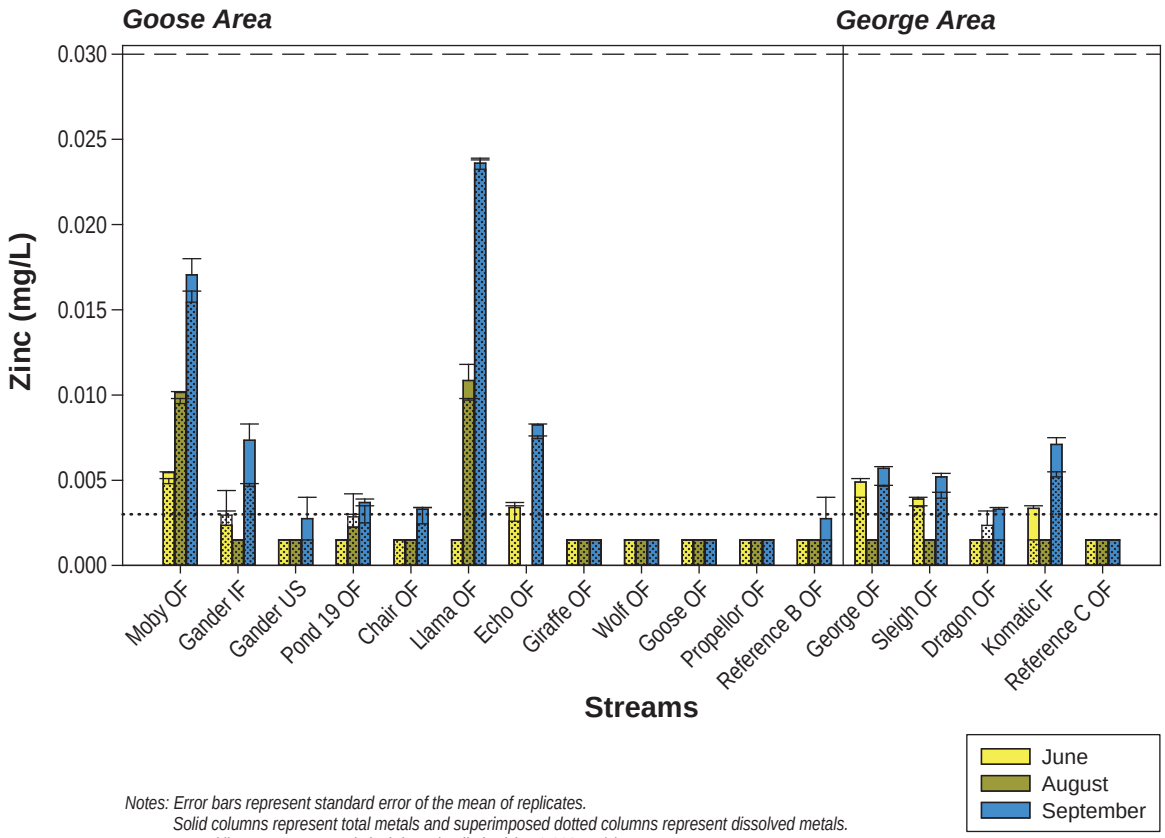

Notes: Error bars represent standard error of the mean of replicates.
Solid columns represent total metals and superimposed dotted columns represent dissolved metals.
Dotted lines represent analytical detection limits (zinc 0.003 mg/L).
Values below detection limit were plotted as half of the detection limit
Dashed lines represent CCME guidelines (zinc 0.03 mg/L).

Sabina GOLD & SILVER CORP.

Zinc Concentrations in Streams, Back River Project, 2012

Figure 3.3-5g

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3.3.3 Suspended Material

In general, Project streams had clear water with no apparent trend between Goose and George area streams. Turbidity levels were low at most streams, ranging from 0.15 to 1.3 NTU (Figure 3.3-3). The exceptions were Gander IF in June (1.8 NTU), Reference B OF in September (2.1 NTU) and Komatic IF in August (2.6 NTU). Most streams had TSS concentrations below the detection limit (3 mg/L), and only Gander IF had detectable levels in all seasons. The highest TSS concentration (8 mg/L) was measured in Komatic IF in August.

3.3.4 Nutrients

Streams surveyed had low nutrient concentrations overall, with no clear trend between Goose and George area streams.

Like the surveyed lakes, streams in the study area tended to have low concentrations of inorganic nitrogen (ammonia, nitrate, and nitrite; Figure 3.3-4a). Most stream sites had ammonia concentrations near the analytical detection limit (0.005 mg/L) in all seasons. The two exceptions were Echo OF with 0.033 mg/L ammonia in June and Reference B OF with 0.049 mg/L ammonia in September. Nitrate levels were lowest in June, with most streams below detection limits (0.005 mg/L). Higher nitrate levels were observed in August and September with most streams below 0.16 mg/L. The exception to this was Llama OF in August, which had nitrate concentrations approximately three to four times higher in August and September (0.47 mg/L and 0.61 mg/L). Nitrite levels were below detection limits (0.001 mg/L) at all stream sites in all seasons. TKN concentrations were similar across streams, generally less than 0.30 mg/L, with the exceptions of Chair OF in August (0.40 mg/L) and Reference B OF in September (0.62 mg/L). All streams had ammonia, nitrate and nitrite concentrations well below the CCME guidelines (CCME 2012).

All streams sampled had total phosphorus concentrations below 0.02 mg/L (Figure 3.3-4b), and most would be considered either ultraoligotrophic (< 0.004 mg/L) or oligotrophic (0.004 to 0.01 mg/L) based on the CCME trigger ranges for total phosphorus (CCME 2012). Chair OF in August, Reference B in September, and Komatic IF were mesotrophic (0.01 to 0.02 mg/L) in August.

TOC was similar across all streams, with most concentrations between 1.8 and 5.0 mg/L (Figure 3.3-4b). Exceptions to this were Echo OF in June and August and Reference B OF in September, which had concentrations between 6.6 and 9.7 mg/L and were similarly elevated in 2011 (Rescan 2012a), and Reference C OF which had August concentrations of 6.0 mg/L. Note these three streams also had the lowest water levels.

3.3.5 Metals

Overall, metal concentrations varied both spatially and temporally (Figures 3.3-5a to 3.3-5g). Aluminum, chromium and iron tended to be higher in several Goose area streams, while arsenic concentrations tended to be higher in the George area streams. Giraffe OF, Wolf OF, Goose OF, Propellor OF, Reference B OF, and Reference C OF often had lower concentrations of arsenic, cadmium, copper, nickel, uranium and zinc than other sites. Reference C OF had relatively high molybdenum and uranium concentrations. Metal concentrations were often higher in the low flow August and September sampling sessions.

Aluminum concentrations ranged from below detection limits (0.003 mg/L) at Reference C OF in August and September to 0.14 mg/L at Echo OF in June, with most being below 0.07 mg/L (Figure 3.3-5a). The CCME guideline for aluminum is pH-dependent, with a lower guideline for water with pH less than 6.5 (0.005 mg/L; CCME 2012). All three of the samples with pH below 6.5 exceeded the guidelines

(Chair OF in June, and Echo OF in August and September). Echo OF had the highest total aluminum concentrations of all streams, a trend also observed in 2011.

Overall, streams had low total arsenic levels, with all concentrations below 0.0015 mg/L and the CCME guideline of 0.005 mg/L (Figure 3.3-5a). Average concentrations tended to be highest in August, and higher in George area streams than in Goose area streams, similar to trends observed in lake water quality. Boron concentrations were similar across stream sites, ranging from below detection limits (0.005 mg/L) to 0.009 mg/L, and tended to be lowest in August (Figure 3.3-5b). All streams were well below the CCME guidelines for boron (1.5 mg/L).

Cadmium concentrations in most stream samples were below or near detection limits (0.00001 mg/L) (Figure 3.3-5b). Moby OF, Llama OF, and Echo OF had cadmium concentrations close to detection limits in June, but cadmium concentrations more than doubled in August and September. In particular, cadmium concentrations in Llama OF were 14 times greater in September than in June. CCME guidelines for cadmium are hardness-dependent, which resulted in some particularly soft streams having guideline concentrations below detection limits (0.00001 mg/L). Most streams exceeded CCME guidelines in at least one sampling session (including those where half the detection limit was above the hardness-dependent CCME guideline), the two exceptions were Dragon OF and Reference C OF.

Average total chromium concentrations ranged from below detection limits (0.0001 mg/L) to 0.0007 mg/L, and tended to be lowest in the George area streams (Figure 3.3-5c). The highest concentrations were observed in Echo OF (0.0005 mg/L) and in Reference B OF in September (0.0007 mg/L), and were below the CCME guideline for the protection of freshwater aquatic life (0.001 mg/L for hexavalent chromium).

Streams sampled had high total copper concentrations, with over a third of streams exceeding CCME guidelines in at least one sampling session (Figure 3.3-5c). The lowest copper concentrations were observed at Wolf OF, Goose OF, Propellor OF, Reference B OF and Reference C OF, all consistently below the 0.002 mg/L minimum CCME guideline for copper.

Most streams had total iron concentrations were below the CCME guideline for freshwater aquatic life of 0.3 mg/L (Figure 3.3-5d). Exceptions were Moby OF in August, Chair OF in August and September, and Reference B OF in September. Reference B OF had the highest recorded iron levels (average of 0.52 mg/L), with September concentrations three times greater than the CCME guideline (1.185 mg/L compared to CCME guideline 0.3 mg/L). High iron concentrations were also observed for Reference B OF in 2011 (Rescan 2012a). Llama OF, Propellor OF, and Reference C OF had the lowest iron concentrations, all below or near the detection limit (0.01 mg/L).

Total lead and molybdenum concentrations were below or near detection limits in all streams during all seasons (lead 0.00005 mg/L; molybdenum 0.00005 mg/L). All concentrations were below the CCME guidelines for the protection of freshwater aquatic life (lead 0.001 mg/L; molybdenum 0.0001 mg/L; Figures 3.3-5d and 3.3-5e).

Total nickel concentrations were below 0.02 mg/L at most streams (Figure 3.3-5e). Moby OF had higher average nickel concentrations in August (0.04 mg/L) and September (0.06 mg/L), which exceeded the CCME hardness-dependent guideline. Llama OF also had higher nickel concentrations in September (0.05 mg/L), but did not exceed the hardness-dependent CCME guideline due to high hardness levels. Nickel concentrations were lowest at Reference C OF, being near or below detection limits (0.0001 mg/L) in all sampling sessions.

Streams mostly had total silver and uranium concentrations below or near the detection limits (silver 0.00001 mg/L; uranium 0.00001 mg/L; Figure 3.3-5f). The exception to this was Reference C OF, which

had average uranium concentrations an order of magnitude greater than all other sites, with August and September concentrations averaging 0.000307 mg/L and 0.000328 mg/L while all other sites averaged below 0.00003 mg/L.

Zinc concentrations were often below the detection limit (0.003 mg/L), consistently so for Giraffe OF, Wolf OF, Goose OF, Propellor OF, and Reference C OF. Zinc concentrations followed a similar pattern to nickel, with September concentrations at Moby OF and Llama OF being relatively high (0.017 mg/L and 0.024 mg/L; Figure 3.3-5f). All streams were below the CCME guideline for zinc (0.03 mg/L).

All streams in all seasons had total mercury, selenium, and thallium concentrations below their respective detection limit.

3.3.6 Cyanides

Total and free cyanide concentrations were all below the detection limit of 0.001 mg/L, and therefore below the CCME guideline of 0.005 mg/L (CCME 2012).

3.3.7 Comparison with CCME Guidelines

The percentage of stream water quality samples where parameter concentrations were above CCME guidelines is presented in Table 3.3-1. Table 3.3-2 shows the average factor that concentrations at each stream were higher than CCME guidelines.

All streams had water quality within the CCME guidelines for pH, (6.5 to 9), except Chair OF in June (6.1), and Echo OF in June and Sept (6.0). All streams had water quality below CCME guidelines for chloride, fluoride, ammonia, nitrate, nitrite and free cyanide. All streams, except Dragon OF and Reference C OF, exceeded CCME guidelines in at least one sample for at least one of the following metals: total aluminum, total cadmium, total copper, total iron, and total nickel (Table 3.3-1).

Average concentrations exceeded CCME guidelines for at least one parameter at most streams. Parameters where average stream concentrations exceeded guidelines included aluminum, cadmium, copper, iron and nickel (Table 3.3-2). Thirteen of the seventeen of streams had average cadmium concentrations that exceeded the CCME guidelines (including all but one of the Goose area streams), although four of these streams had hardness-dependent guidelines and cadmium concentrations consistently below detection limits. Five streams had average copper concentrations that exceeded CCME guidelines. Echo OF exceeded CCME guidelines for the greatest number of parameters (aluminum, cadmium and copper) and had the highest exceedances with average aluminum concentrations 22 times higher and average cadmium concentrations 18 times higher than the CCME guidelines.

As observed with lake water quality, more average concentrations exceeded CCME guidelines in streams in the Goose area than in the George area.

CCME guidelines for total aluminum are pH dependent, with a lower total aluminum guideline for waters with a pH of less than 6.5. Only the two streams with average pH values below 6.5, Chair OF (June) and Echo OF (June and September), had average aluminum concentrations that exceeded the guideline concentration (by a factor of 3.1 and 22.4). Streams with higher hardness concentrations including Pond 19 OF, Llama OF, Sleigh OF, Dragon OF, Komatic IF and Reference C OF had higher hardness-dependent CCME guideline concentrations for total cadmium, copper, lead, and nickel. Softer streams had lower hardness-dependent CCME guidelines, and in the case of cadmium, sometimes the calculated guideline concentration was below the actual analytical detection limit.

Table 3.3-1. Stream Water Quality, Percent of Samples in which Concentrations were Higher than CCME Guidelines, Back River Project, 2012

			pH	Fluoride	Chloride	Ammonia (as N)	Nitrate	Nitrite	Total Phosphorus	Aluminum (Al)	Arsenic (As)	Boron (B)	Cadmium (Cd)	
													Hardness-based Equation[be]	
CCME Guideline Values[a]			6.5 - 9.0	0.12[b] mg/L	Short-term 640 mg/L; Long-term 120 mg/L	Temperature- and pH-dependent	Short-term 124 mg/L; Long-term 2.935 mg/L	0.06 mg/L	Trophic Status[c] Range	0.005 - 0.1[d] mg/L	0.005 mg/L	Short-term 29 mg/L; Long-term 1.5 mg/L	Samples above Detection Limits	Samples below Detection Limits (using half the detection limit)
Stream	Total Number of Samples Collected	Number of Parameters with Exceedances												
Goose Area														
Moby OF	6	4	0	0	0	0	0	0	ultraoligotrophic - oligotrophic	0	0	0	100	0
Gander IF	6	2	0	0	0	0	0	0	oligotrophic	0	0	0	33.3	66.7
Gander US	6	1	0	0	0	0	0	0	oligotrophic	0	0	0	0	66.7
Pond 19 OF	6	2	0	0	0	0	0	0	ultraoligotrophic - oligotrophic	0	0	0	33.3	0
Chair OF	6	5	33.3	0	0	0	0	0	oligotrophic - mestrophic	33.3	0	0	0	33.3
Llama OF	6	2	0	0	0	0	0	0	ultraoligotrophic	0	0	0	100	0
Echo OF	4	4	100	0	0	0	0	0	ultraoligotrophic	100	0	0	100	0
Giraffe OF	6	2	0	0	0	0	0	0	ultraoligotrophic - oligotrophic	0	0	0	16.7	83.3
Wolf OF	6	1	0	0	0	0	0	0	ultraoligotrophic - oligotrophic	0	0	0	0	66.7
Goose OF	6	1	0	0	0	0	0	0	ultraoligotrophic - oligotrophic	0	0	0	33.3	16.7
Propellor OF	6	1	0	0	0	0	0	0	ultraoligotrophic - oligotrophic	0	0	0	0	100
Reference B OF	6	2	0	0	0	0	0	0	oligotrophic - mestrophic	0	0	0	0	66.7
George Area														
George OF	6	1	0	0	0	0	0	0	ultraoligotrophic - oligotrophic	0	0	0	66.7	0
Sleigh OF	6	2	0	0	0	0	0	0	ultraoligotrophic - oligotrophic	0	0	0	66.7	0
Dragon OF	6	0	0	0	0	0	0	0	ultraoligotrophic - oligotrophic	0	0	0	0	0
Komatic IF	6	2	0	0	0	0	0	0	oligotrophic - mestrophic	0	0	0	16.7	0
Reference C OF	6	0	0	0	0	0	0	0	ultraoligotrophic - oligotrophic	0	0	0	0	0

Notes: *(continued)*

a) Canadian water quality guidelines for the protection of aquatic life (CCME, accessed 2012).

b) Interim guideline.

c) < 0.004 mg/L = ultraoligotrophic; 0.004 - 0.01 mg/L = oligotrophic; 0.01 - 0.02 mg/L = mesotrophic; 0.02 - 0.035 mg/L = mesoeutrophic; 0.035 - 0.1 mg/L = eutrophic; > 0.1 mg/L = hypereutrophic.

d) 0.005 mg/L at pH < 6.5; 0.1 mg/L at pH ≥ 6.5.

e) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000. There is no minimum guideline. Samples from sites where hardness was low may have guideline concentrations below analytical detection limits. Samples where half the detection limit was above their hardness-dependent guideline are shown in a separate column in the table.

f) Guideline concentration of hexavalent chromium. No concentrations were higher than the CCME guideline for trivalent chromium (0.0089 mg/L).

g) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ x 0.0002. Copper guideline is a minium of 0.002 mg/L regardless of hardness.

h) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minimum of 0.001 mg/L regardless of hardness.

i) Guideline concentration for inorganic mercury.

j) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

Table 3.3-1. Stream Water Quality, Percent of Samples in which Concentrations were Higher than CCME Guidelines, Back River Project, 2012 (completed)

		Chromium (Cr)	Copper (Cu)	Iron (Fe)	Lead (Pb)	Mercury (Hg)	Molybdenum (Mo)	Nickel (Ni)	Selenium (Se)	Silver (Ag)	Thallium (Tl)	Uranium (U)	Zinc (Zn)	Free Cyanide
CCME Guideline Values[a]		Cr (VI) 0.001[bf] mg/L	Hardness-dependent ≥ 0.002[g] mg/L	0.3 mg/L	Hardness-dependent ≥ 0.001[h] mg/L	0.000026[i] mg/L	0.073[b] mg/L	Hardness-dependent ≥ 0.025[j] mg/L	0.001 mg/L	0.0001 mg/L	0.0005 mg/L	Short-term 0.033 mg/L; Long-term 0.015 mg/L	0.03 mg/L	0.005 as Free CN
Stream	**Total Number of Samples Collected**													
Goose Area														
Moby OF	6	0	100	33.3	0	0	0	66.7	0	0	0	0	0	0
Gander IF	6	0	16.7	0	0	0	0	0	0	0	0	0	0	0
Gander US	6	0	0	0	0	0	0	0	0	0	0	0	0	0
Pond 19 OF	6	0	100	0	0	0	0	0	0	0	0	0	0	0
Chair OF	6	0	16.7	50	0	0	0	0	0	0	0	0	0	0
Llama OF	6	0	33.3	0	0	0	0	0	0	0	0	0	0	0
Echo OF	4	0	50	0	0	0	0	0	0	0	0	0	0	0
Giraffe OF	6	0	33.3	0	0	0	0	0	0	0	0	0	0	0
Wolf OF	6	0	0	0	0	0	0	0	0	0	0	0	0	0
Goose OF	6	0	0	0	0	0	0	0	0	0	0	0	0	0
Propellor OF	6	0	0	0	0	0	0	0	0	0	0	0	0	0
Reference B OF	6	0	0	33.3	0	0	0	0	0	0	0	0	0	0
George Area														
George OF	6	0	0	0	0	0	0	0	0	0	0	0	0	0
Sleigh OF	6	0	100	0	0	0	0	0	0	0	0	0	0	0
Dragon OF	6	0	0	0	0	0	0	0	0	0	0	0	0	0
Komatic IF	6	0	100	0	0	0	0	0	0	0	0	0	0	0
Reference C OF	6	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes:

a) Canadian water quality guidelines for the protection of aquatic life (CCME, accessed 2012).

b) Interim guideline.

c) < 0.004 mg/L = ultraoligotrophic; 0.004 - 0.01 mg/L = oligotrophic; 0.01 - 0.02 mg/L = mesotrophic; 0.02 - 0.035 mg/L = mesoeutrophic; 0.035 - 0.1 mg/L = eutrophic; > 0.1 mg/L = hypereutrophic.

d) 0.005 mg/L at pH < 6.5; 0.1 mg/L at pH ≥ 6.5.

e) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000. There is no minimum guideline. Samples from sites where hardness was low may have guideline concentrations below analytical detection limits. Samples where half the detection limit was above their hardness-dependent guideline are shown in a separate column in the table.

f) Guideline concentration of hexavalent chromium. No concentrations were higher than the CCME guideline for trivalent chromium (0.0089 mg/L).

g) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ x 0.0002. Copper guideline is a minium of 0.002 mg/L regardless of hardness.

h) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minimum of 0.001 mg/L regardless of hardness.

i) Guideline concentration for inorganic mercury.

j) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

Table 3.3-2. Stream Water Quality, Average Factor by which Concentrations were Higher than CCME Guidelines, Back River Project, 2012

Stream	Total Number of Samples Collected	Number of Parameters with Exceedances	pH*	Fluoride	Chloride	Ammonia (as N)	Nitrate	Nitrite	Total Phosphorus	Aluminum (Al)	Arsenic (As)	Boron (B)	Cadmium (Cd)	Chromium (Cr)
CCME Guideline Values[a]			6.5 - 9.0	0.12[b] mg/L	Short-term 640 mg/L; Long-term 120 mg/L	Temperature- and pH-dependent	Short-term 124 mg/L; Long-term 2.935 mg/L	0.06 mg/L	Trophic Status[c] Range	0.005 - 0.1[d] mg/L	0.005 mg/L	Short term 29 mg/L; Long-term 1.5 mg/L	Hardness-based Equation[be]	Cr (VI) 0.001[bf] mg/L
Goose Area														
Moby OF	6	4	-	-	-	-	-	-	ultraoligotrophic - oligotrophic	-	-	-	4.71	-
Gander IF	6	2	-	-	-	-	-	-	oligotrophic	-	-	-	1.71	-
Gander US	6	2	-	-	-	-	-	-	oligotrophic	-	-	-	1.18	-
Pond 19 OF	6	3	-	-	-	-	-	-	ultraoligotrophic - oligotrophic	-	-	-	1.07	-
Chair OF	6	2	exceed	-	-	-	-	-	oligotrophic - mestrophic	3.11	-	-	-	-
Llama OF	6	2	-	-	-	-	-	-	ultraoligotrophic	-	-	-	8.38	-
Echo OF	4	4	exceed	-	-	-	-	-	ultraoligotrophic	22.39	-	-	18.25	-
Giraffe OF	6	2	-	-	-	-	-	-	ultraoligotrophic - oligotrophic	-	-	-	4.12	-
Wolf OF	6	2	-	-	-	-	-	-	ultraoligotrophic - oligotrophic	-	-	-	1.21	-
Goose OF	6	2	-	-	-	-	-	-	ultraoligotrophic - oligotrophic	-	-	-	1.57	-
Propellor OF	6	2	-	-	-	-	-	-	ultraoligotrophic - oligotrophic	-	-	-	1.26	-
Reference B OF	6	3	-	-	-	-	-	-	Oligotrophic - mestrophic	-	-	-	1.37	-
George Area														
George OF	6	2	-	-	-	-	-	-	ultraoligotrophic - oligotrophic	-	-	-	1.28	-
Sleigh OF	6	3	-	-	-	-	-	-	ultraoligotrophic - oligotrophic	-	-	-	1.36	-
Dragon OF	6	1	-	-	-	-	-	-	ultraoligotrophic - oligotrophic	-	-	-	-	-
Komatic IF	6	2	-	-	-	-	-	-	oligotrophic - mestrophic	-	-	-	-	-
Reference C OF	6	1	-	-	-	-	-	-	ultraoligotrophic - oligotrophic	-	-	-	-	-

Notes: *(continued)*

Values represent the average factor by which 2012 samples are higher than CCME guidelines.

Half the detection limit was substituted for values that were below the detection limit for the calculation of exceedance factors. Shaded cells show sites where all samples that exceeded a particular parameters guideline were below the detection limit.

The average concentration of a particular parameter may be below the CCME guideline concentration even if a percentage of samples is higher than this guideline concentration.

** Note factor by which average concentrations exceeded pH guidelines was not calculated as pH guidelines are a range. Exceedances are shown for reference only.*

a) Canadian water quality guidelines for the protection of aquatic life (CCME, accessed 2012).

b) Interim guideline.

c) < 0.004 mg/L = ultraoligotrophic; 0.004 - 0.01 mg/L = oligotrophic; 0.01 - 0.02 mg/L = mesotrophic; 0.02 - 0.035 mg/L = mesoeutrophic; 0.035 - 0.1 mg/L = eutrophic; > 0.1 mg/L = hypereutrophic.

d) 0.005 mg/L at pH < 6.5; 0.1 mg/L at pH ≥ 6.5.

e) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000. There is no minimum guideline.

f) Guideline concentration of hexavalent chromium. No concentrations were higher than the CCME guideline for trivalent chromium (0.0089 mg/L).

g) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ x 0.0002. Copper guideline is a minium of 0.002 mg/L regardless of hardness.

h) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minimum of 0.001 mg/L regardless of hardness.

i) Guideline concentration for inorganic mercury.

j) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

Table 3.3-2. Stream Water Quality, Average Factor by which Concentrations were Higher than CCME Guidelines, Back River Project, 2012 (completed)

		Copper (Cu)	Iron (Fe)	Lead (Pb)	Mercury (Hg)	Molybdenum (Mo)	Nickel (Ni)	Selenium (Se)	Silver (Ag)	Thallium (Tl)	Uranium (U)	Zinc (Zn)	Free Cyanide
CCME Guideline Values[a]		Hardness-dependent ≥ 0.002[g] mg/L	0.3 mg/L	Hardness-dependent ≥ 0.001[h] mg/L	0.000026[i] mg/L	0.073[b] mg/L	Hardness-dependent ≥ 0.025[j] mg/L	0.001 mg/L	0.0001 mg/L	0.0005 mg/L	Short-term 0.033 mg/L; Long-term 0.015 mg/L	0.03 mg/L	0.005 as Free CN
Stream	Total Number of Samples Collected												
Goose Area													
Moby OF	6	1.75	-	-	-	-	1.18	-	-	-	-	-	-
Gander IF	6	-	-	-	-	-	-	-	-	-	-	-	-
Gander US	6	-	-	-	-	-	-	-	-	-	-	-	-
Pond 19 OF	6	1.52	-	-	-	-	-	-	-	-	-	-	-
Chair OF	6	-	-	-	-	-	-	-	-	-	-	-	-
Llama OF	6	-	-	-	-	-	-	-	-	-	-	-	-
Echo OF	4	1.02	-	-	-	-	-	-	-	-	-	-	-
Giraffe OF	6	-	-	-	-	-	-	-	-	-	-	-	-
Wolf OF	6	-	-	-	-	-	-	-	-	-	-	-	-
Goose OF	6	-	-	-	-	-	-	-	-	-	-	-	-
Propellor OF	6	-	-	-	-	-	-	-	-	-	-	-	-
Reference B OF	6	-	1.73	-	-	-	-	-	-	-	-	-	-
George Area													
George OF	6	-	-	-	-	-	-	-	-	-	-	-	-
Sleigh OF	6	1.29	-	-	-	-	-	-	-	-	-	-	-
Dragon OF	6	-	-	-	-	-	-	-	-	-	-	-	-
Komatic IF	6	1.40	-	-	-	-	-	-	-	-	-	-	-
Reference C OF	6	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

Values represent the average factor by which 2012 samples are higher than CCME guidelines.

Half the detection limit was substituted for values that were below the detection limit for the calculation of exceedance factors. Shaded cells show sites where all samples that exceeded a particular parameters guideline were below the detection limit.

The average concentration of a particular parameter may be below the CCME guideline concentration even if a percentage of samples is higher than this guideline concentration.

** Note factor by which average concentrations exceeded pH guidelines was not calculated as pH guidelines are a range. Exceedances are shown for reference only.*

a) Canadian water quality guidelines for the protection of aquatic life (CCME, accessed 2012).

b) Interim guideline.

c) < 0.004 mg/L = ultraoligotrophic; 0.004 - 0.01 mg/L = oligotrophic; 0.01 - 0.02 mg/L = mesotrophic; 0.02 - 0.035 mg/L = mesoeutrophic; 0.035 - 0.1 mg/L = eutrophic; > 0.1 mg/L = hypereutrophic.

d) 0.005 mg/L at pH < 6.5; 0.1 mg/L at pH ≥ 6.5.

e) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000. There is no minimum guideline.

f) Guideline concentration of hexavalent chromium. No concentrations were higher than the CCME guideline for trivalent chromium (0.0089 mg/L).

g) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ x 0.0002. Copper guideline is a minium of 0.002 mg/L regardless of hardness.

h) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minimum of 0.001 mg/L regardless of hardness.

i) Guideline concentration for inorganic mercury.

j) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

3.3.8 Stream Water Quality Assurance/Quality Control

Five field and five travel blanks were collected during stream sampling, representing 10% of the regular stream samples collected (Appendix 3.3-1). All blanks for all parameters were below detection limits, with two exceptions. In the June Goose area travel blank, TKN was slightly above the TKN detection limit, and in the September George area travel blank, ammonia was above the detection limit. In both cases, the other set of travel blanks collected during the same sampling period was below detection limits for all parameters.

Fifty pairs of field duplicates for sampled streams were compared for each water quality variable. The RPD value was used as a measure of the variability inherent in field sampling (Appendix 3.3-2). A total of 29% (1,303/4,450) of the duplicate concentrations were at least five times greater than their detection limits and so were used in the RPD calculations. Of these, only 0.5% (21/1,303) had an RPD above 20%, only 0.1% (4/1,303) had an RPD equal or greater than 50%, and none had an RPD above 100%.

These QA/QC samples show that the WQ samples collected were of high quality, and sampling heterogeneity was minimal during the stream sampling.

3.4 LAKE SEDIMENT QUALITY

Lake sediment quality samples were collected in August 2012, and the data are presented graphically in Figures 3.4-1 to 3.4-3d. Raw sediment quality data for lakes are presented in Appendix 3.4-1. The variability in sediment colour, texture, and sample volume of the samples is shown in Plate 3.4-1. Nutrient data for some lakes was unable to be analyzed due to the insufficient volume in the sample.

3.4.1 Particle Size

Most lake sediments were composed of over 50% sand, with lesser amounts of clay and silt (Figure 3.4-1). Exceptions were Pond 19, Rascal, Giraffe South, and Goose Lake Tail in the Goose area, which had a more even split between sand and silt. In the George area, George Central, George South and Sleigh lakes were composed of over 50% silt. Gravel composed over 1% of sediments only at Pond 19 (18.5%), Giraffe South (5.1%), and Dragon lakes(13.5%).

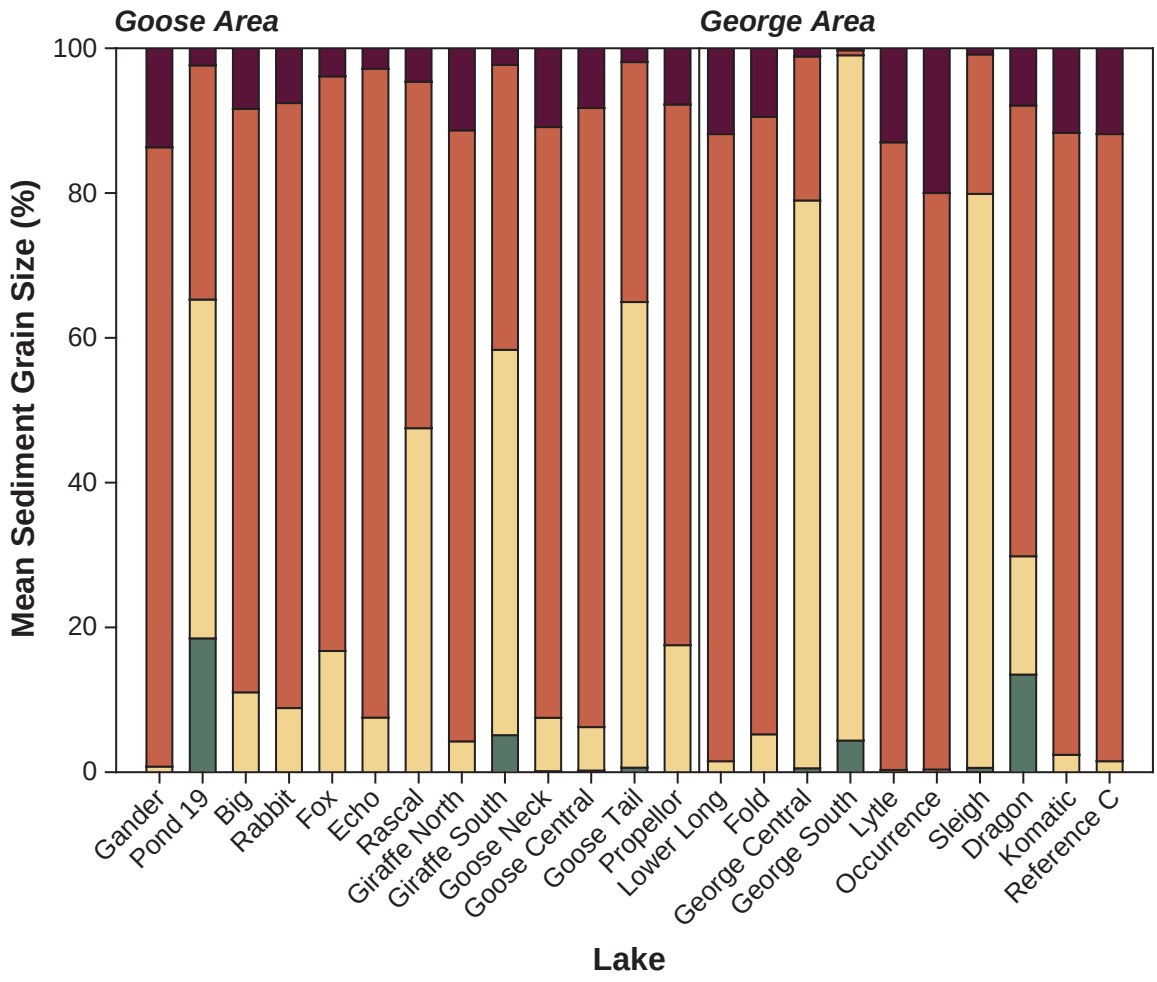
3.4.2 Nutrients

Overall, nutrient concentrations tended to be higher in sediments from Goose area lakes compared to George area lakes (Figures 3.4-2a and 3.4-2b). Nutrient concentrations were related to sediment composition with the three lakes sites with the lowest proportion of silt, such as in George Lake Central (deep), George Lake South and Sleigh Lake, having lower nutrient concentrations.

Available ammonium ranged from below detection limits (1 mg/L) at Sleigh Lake to 32.3 mg/kg at Goose Lake Neck. Total nitrogen was similarly variable, ranging from very close to detection limits (0.02%) to 0.91% at Echo OF. Available phosphate (as P) was less than 15 mg/kg for most lakes. Fold Lake and Reference Lake C had higher phosphate concentrations at 19.9 mg/kg and 23.5 mg/kg, and the highest were observed at Propellor Lake, which had 48 mg/kg phosphate similar to concentrations measured in August 2011 (Rescan 2012a). Lake sediments contained between 0.2% and 15% TOC, following very closely the patterns observed for total nitrogen.

3.4.3 Metals

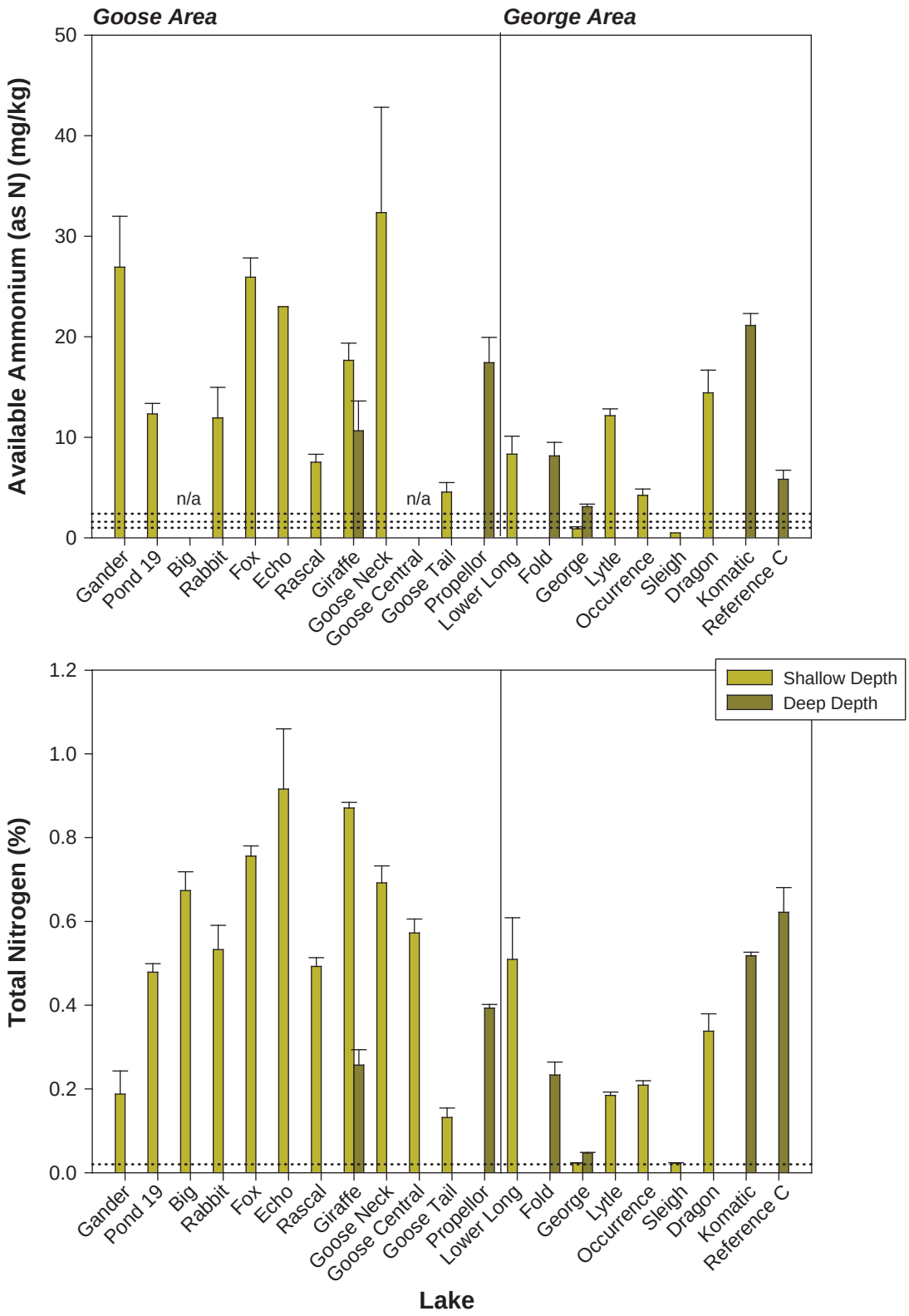
Metal concentrations varied considerably among lake sites. Komatic Lake tended to have the highest concentrations of metals, while Goose Lake Tail and Sleigh Lake tended to have the lowest concentrations.



Note: Stacked bars are means of triplicate samples.

Figure 3.4-1

Sediment Grain Size Composition in Lakes, Back River Project, 2012



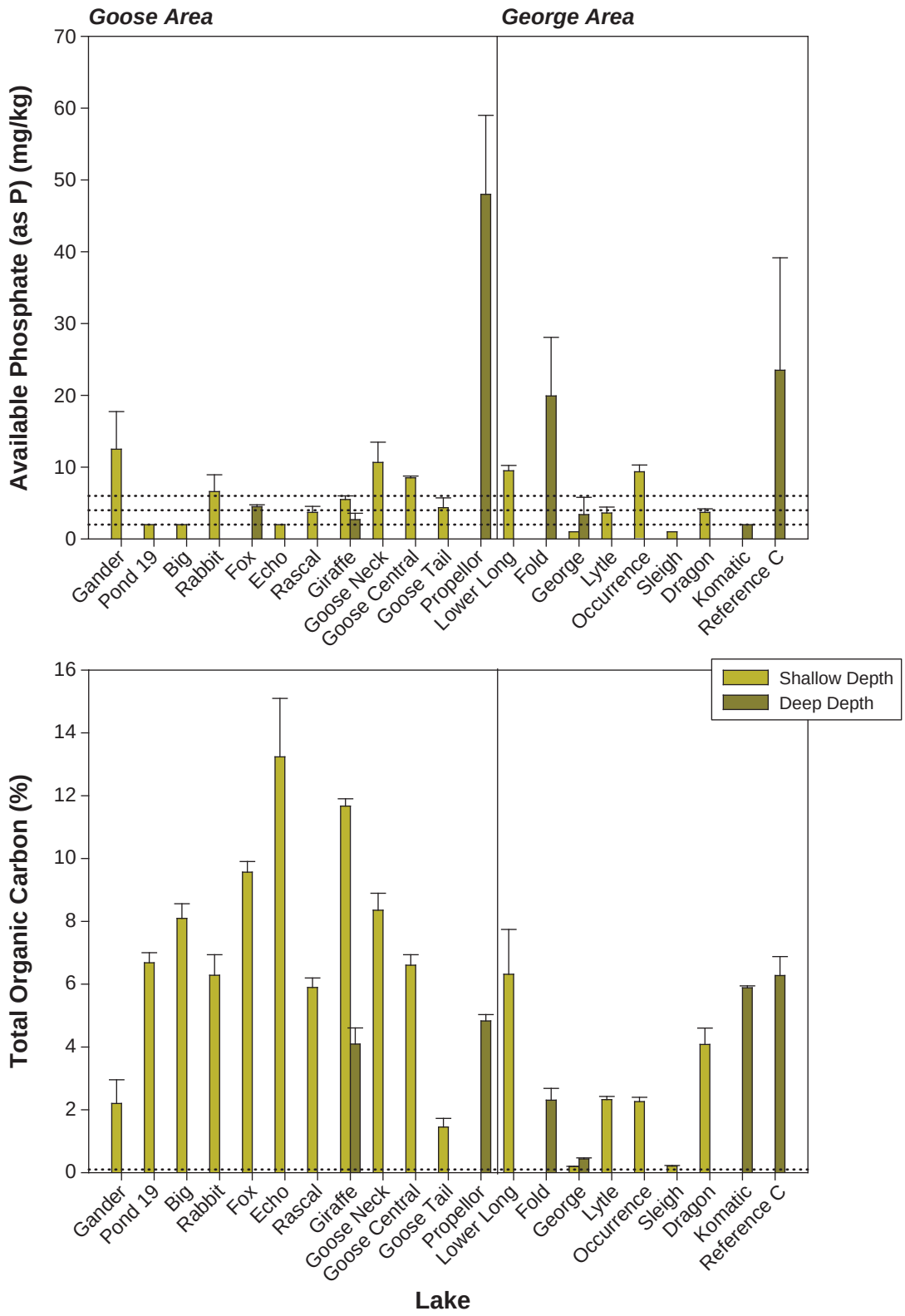
Notes: n/a = available ammonium could not be analyzed for some samples due to insufficient sample volume.
Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (available ammonia 1 - 2.4 mg/kg; total nitrogen 0.02%).
Values below the detection limit are plotted at half the detection limit.

Sabina GOLD & SILVER CORP.

Available Ammonium and Total Nitrogen Concentrations in Lake Sediments, Back River Project, 2012

Figure 3.4-2a

Rescan™ Engineers & Scientists



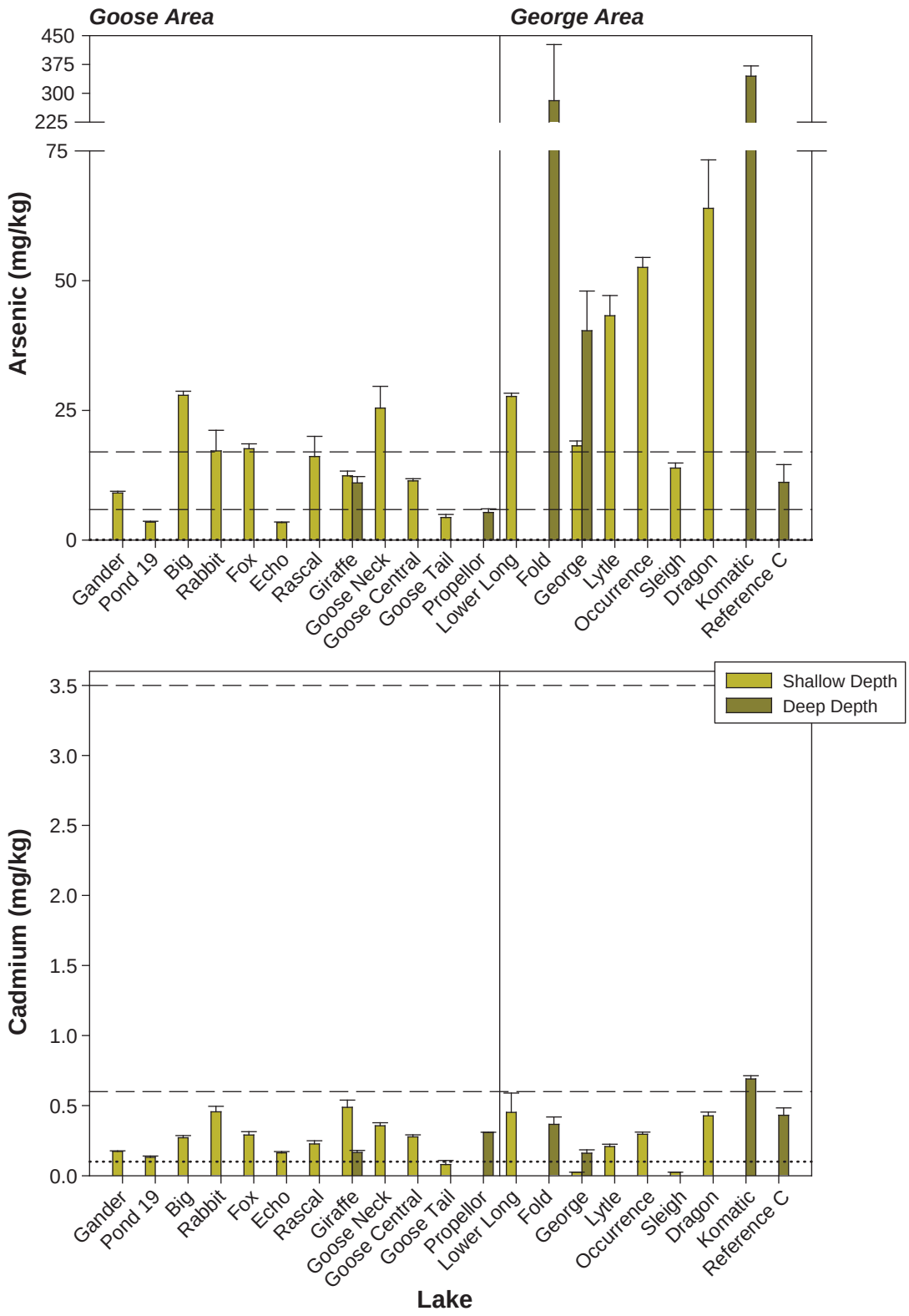
Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (available phosphate 2.0 - 6.0 mg/kg; total organic carbon 0.1%).
Values below the detection limit are plotted at half the detection limit.

Sabina GOLD & SILVER CORP.

Available Phosphate and Total Organic Carbon Concentrations in Lake Sediments, Back River Project, 2012

Figure 3.4-2b

Rescan™ Engineers & Scientists



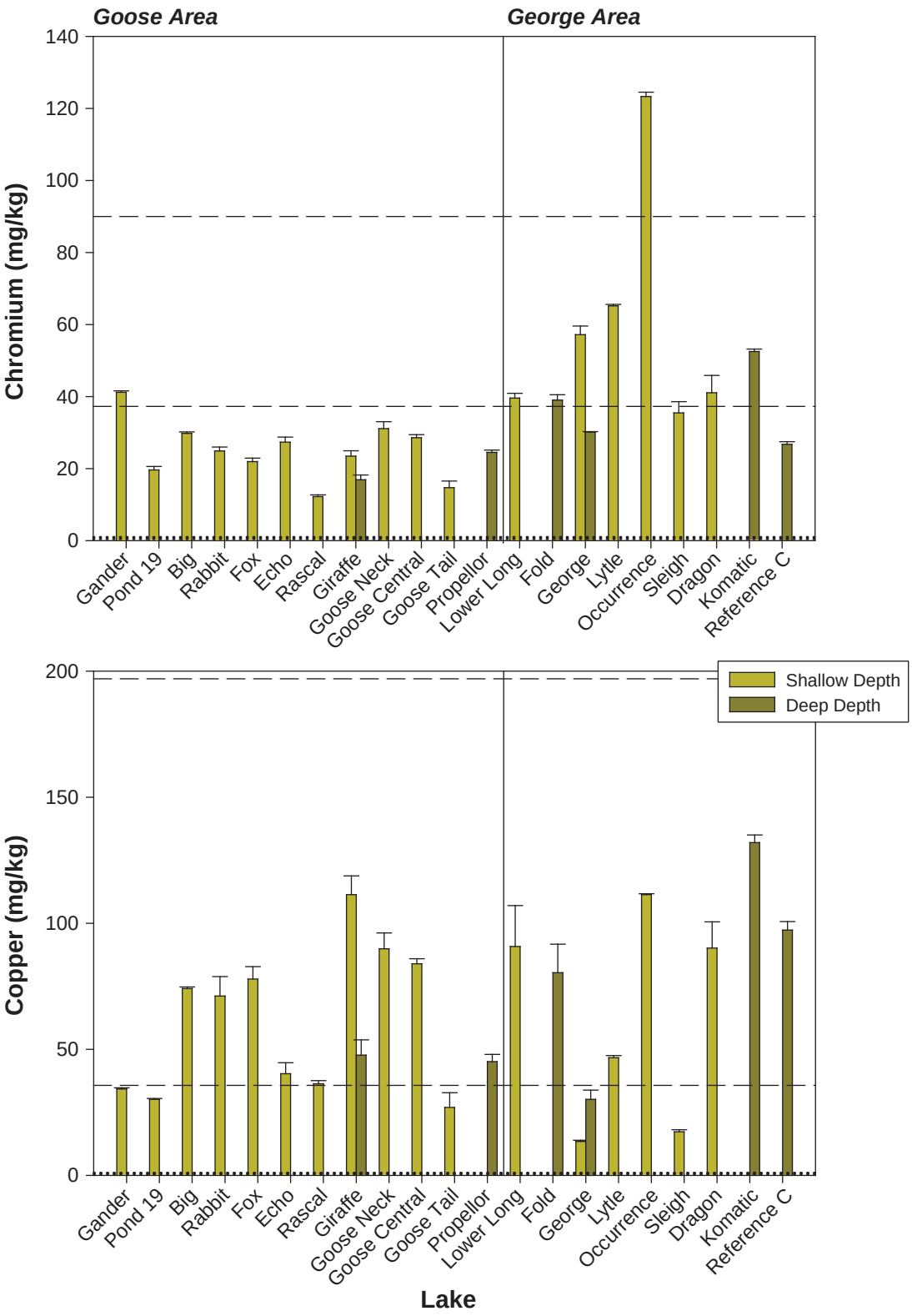
Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (arsenic 0.05 - 0.10 mg/kg; cadmium 0.05 - 0.10 mg/kg).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guidelines.
For arsenic, the ISQG is 5.9 mg/kg and the PEL is 17 mg/kg.
For cadmium, the ISQG is 0.6 mg/kg and the PEL is 3.5 mg/kg.

Sabina GOLD & SILVER CORP.

Arsenic and Cadmium Concentrations in Lake Sediments, Back River Project, 2012

Figure 3.4-3a

Rescan™ Engineers & Scientists



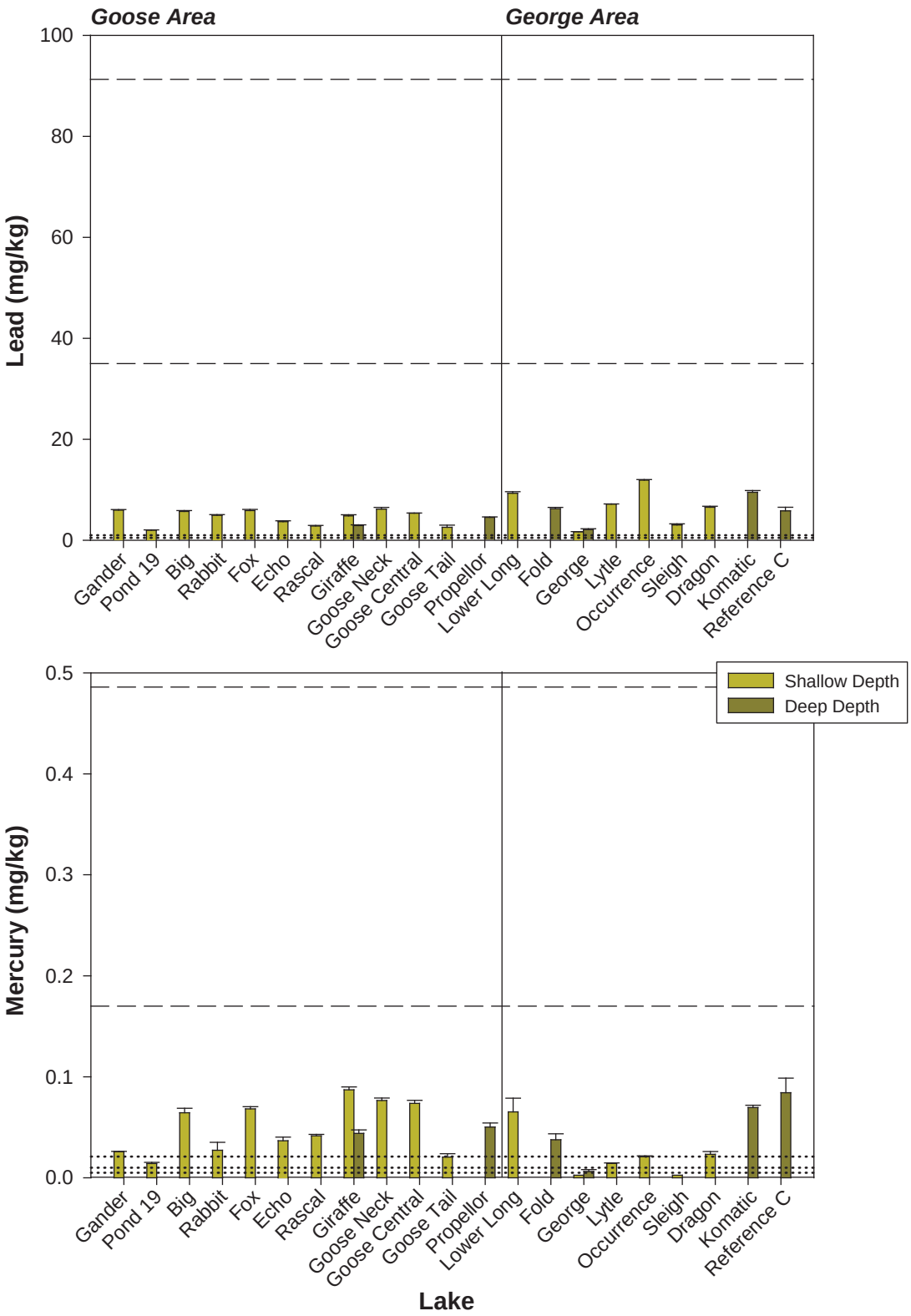
Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (chromium 0.05 - 1.0 mg/kg; copper 0.50 - 1.0 mg/kg).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guidelines.
For chromium, the ISQG is 37.3 mg/kg and the PEL is 90 mg/kg.
For copper, the interim sediment quality guideline is 35.7 mg/kg and the probable effect level is 197 mg/kg.

Sabina GOLD & SILVER CORP.

Chromium and Copper Concentrations in Lake Sediments, Back River Project, 2012

Figure 3.4-3b

Rescan™ Engineers & Scientists



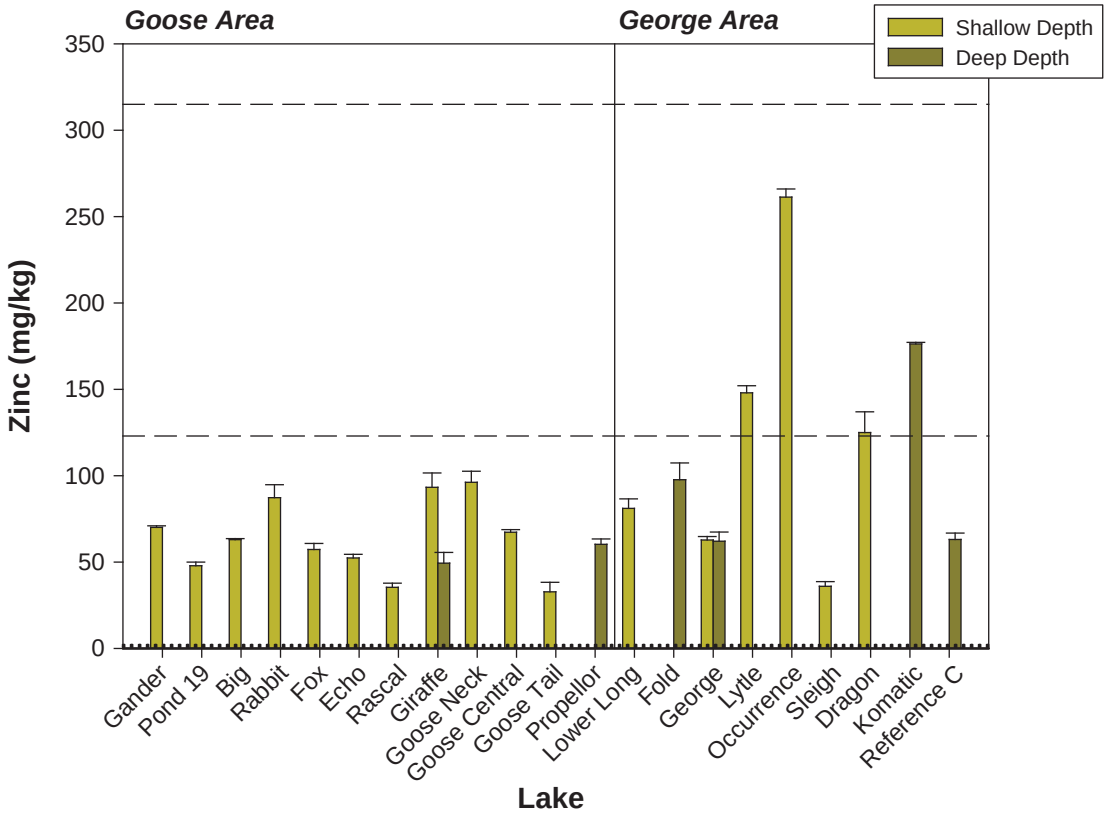
Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (lead 0.50 - 1.0 mg/kg; mercury 0.0050 - 0.0210 mg/kg).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guidelines.
For lead, the ISQG is 35 mg/kg and the PEL is 91.3 mg/kg.
For mercury, the ISQG is 0.17 mg/kg and the PEL is 0.486 mg/kg.

Sabina GOLD & SILVER CORP.

Lead and Mercury Concentrations in Lake Sediments, Back River Project, 2012

Figure 3.4-3c

Rescan™ Engineers & Scientists



Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (zinc 1.0 - 2.0 mg/kg).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guidelines.
For zinc, the ISQG is 123 mg/kg and the PEL is 315 mg/kg.

Sabina GOLD & SILVER CORP.

Zinc Concentrations in Lake Sediments, Back River Project, 2012

Figure 3.4-3d

Rescan™ Engineers & Scientists

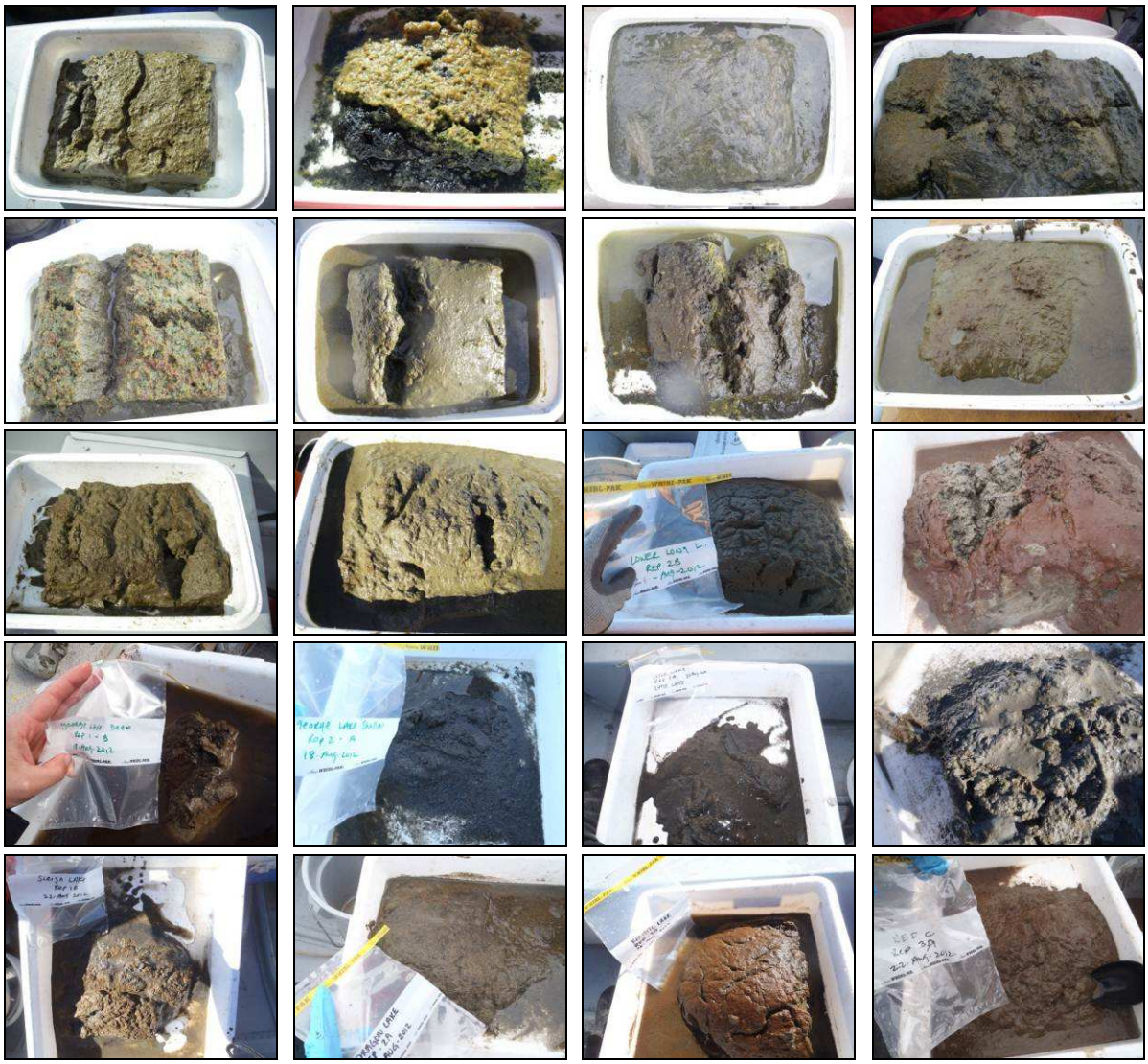


Plate 3.4-1. Some of the sediment samples collected in August. From top left to bottom; Gander Lake, Pond 19, Rabbit Lake, Fox Lake, Rascal Lake, Giraffe Lake North, Giraffe Lake South, Goose Lake Central, Goose Lake Tail, Propellor Lake, Lower Long Lake, Fold Lake, George Lake Central, George Lake South, Lytle Lake, Occurrence Lake, Sleigh Lake, Dragon Lake, Komatic Lake, Reference Lake C.

Average arsenic concentrations were naturally elevated in sediments and were extremely variable among lakes, ranging from 3.3 mg/kg to 64 mg/kg at most lakes. George area lakes tended to have higher arsenic concentrations, with very high concentrations observed at Fold Lake (281 mg/kg) and Komatic Lake (354 mg/kg; Figure 3.4-3a). The majority of lakes had sediment arsenic concentrations that exceeded the CCME ISQG of 5.9 mg/kg, and over half exceeded the CCME PEL (17 mg/kg).

Cadmium sediment concentrations ranged from below detection limits at the shallow George Lake South site and Sleigh Lake to 0.69 mg/kg at Komatic Lake, which exceeded the CCME ISQG of 0.6 mg/kg (Figure 3.4-3a).

Goose area lakes tended to have lower concentrations of chromium in their sediments (Figure 3.4-3b). Chromium concentrations were high in lake sediments, with over a third exceeding the CCME ISQG concentration (37.3 mg/kg) and Occurrence Lake exceeding the CCME PEL of 90 mg/kg by a factor of 1.4.

Overall, lake sediments had naturally high concentrations of copper, as almost three quarters of sites were above CCME ISQGs, with the highest concentration in Occurrence Lake (132 mg/kg), exceeding the CCME PEL also (90 mg/kg; Figure 3.4-3b). Lead concentrations followed a similar spatial patterns to copper, but were at naturally low levels, with all concentrations less than half the CCME ISQG (35 mg/kg; Figure 3.4-3c).

Mercury levels were generally low (Figure 3.4-3c), and followed similar spatial patterns to cadmium. Patterns of zinc concentrations in lake sediments were very similar to those seen in chromium, with highest concentrations in the George area lakes. Lytle, Occurrence, Dragon and Komatic lakes all exceeded the CCME ISQG for zinc (123 mg/kg; Figure 3.4-3d).

3.4.4 Cyanides

Total cyanide concentrations ranged from below detection limits (0.05 mg/kg) in George Lake Central, George Lake South, and Sleigh Lake to 0.38 mg/kg in Fox Lake and Goose Lake Neck. Weak acid dissociable (WAD) cyanide concentrations followed a similar trend but were lower, with a third below detection limits and the maximum concentration at 0.125 mg/kg in Fox Lake.

3.4.5 Comparison with CCME Guidelines

Table 3.4-1 summarizes the percentage of sediment sample that metal concentrations were higher than CCME guidelines, and Table 3.4-2 presents the average factor that the sediment metal concentrations at each site were higher than their respective CCME guideline.

Lake sediments had high concentrations of arsenic, chromium, copper and zinc that often exceeded at CCME ISQGs. George area lakes had higher sediment metal concentrations than Goose area lakes. All lakes, except Pond 19, had at least one sample that exceeded the CCME ISQG for at least one metal, with most lakes exceeding for arsenic and copper. Exceedance of chromium guidelines was common in George area lakes (seven out of ten lakes exceeded), and only observed in Gander Lake out of the thirteen Goose area lakes. Thirteen of the twenty three lakes sampled had at least one sample that exceeded CCME PELs for arsenic, and all samples at Occurrence Lake exceeded the chromium CCME PEL.

Lakes had average concentrations for arsenic that often exceeded CCME ISQGs and PELs, and average cadmium, copper and zinc concentrations that in many cases exceeded CCME ISQGs. Cadmium and zinc ISQGs were only exceeded in George area lakes, where in general exceedances tended to be more frequent and greater in magnitude than those in Goose area lakes. Komatic Lake had the greatest number of exceedances (four), and the greatest magnitude of exceedance with arsenic concentrations almost sixty times the CCME ISQG.

The majority of lake sediments had average arsenic concentrations greater than the CCME ISQG (5.9 mg/kg), and almost half also exceeded the higher CCME PELs (17 mg/kg). Fold and Komatic lakes had particularly high arsenic concentration, exceeding the higher CCME PELs by an average factor of 16.5 and 20.3 respectively. Almost three quarters of streams had average copper concentrations that exceeded CCME ISQGs, with the maximum average exceedance being 3.1 at Giraffe Lake North.

3.5 STREAM SEDIMENT QUALITY

Stream sediment samples were collected in August 2012, and Figures 3.5-1 to 3.5-3d present the stream sediment quality results. All raw sediment quality data for streams are presented in Appendix 3.5-1.

Table 3.4-1. Lake Sediment Quality, Percent of Samples in which Concentrations were Higher than CCME Guidelines, Back River Project, 2012

			Percent of Samples that Exceeded the ISQG[b] Guidelines						
			Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Zinc (Zn)
CCME Guideline Value[a] (mg/kg)			5.9	0.6	37.3	35.7	35	0.17	123
Lake	Total Number of Samples Collected	Number of Parameters with Exceedances							
Goose Area									
Gander	3	2	100	0	100	0	0	0	0
Pond 19	3	0	0	0	0	0	0	0	0
Big	3	2	100	0	0	100	0	0	0
Rabbit	3	2	100	0	0	100	0	0	0
Fox	3	2	100	0	0	100	0	0	0
Echo	3	2	100	0	0	66.7	0	0	0
Rascal	3	1	0	0	0	66.7	0	0	0
Giraffe North	3	2	100	0	0	100	0	0	0
Giraffe South	3	2	100	0	0	100	0	0	0
Goose Neck	3	2	100	0	0	100	0	0	0
Goose Central	3	2	100	0	0	100	0	0	0
Goose Tail	3	1	0	0	0	33.3	0	0	0
Propellor	3	2	33.3	0	0	100	0	0	0
George Area									
Lower Long	3	3	100	0	100	100	0	0	0
Fold	3	3	100	0	66.7	100	0	0	0
George Central	3	1	100	0	0	0	0	0	0
George South	3	2	100	0	100	0	0	0	0
Lytle	3	4	100	0	100	100	0	0	100
Occurrence	3	4	100	0	100	100	0	0	100
Sleigh	3	2	100	0	33.3	0	0	0	0
Dragon	3	4	100	0	33.3	100	0	0	67.7
Komatic	3	5	100	100	100	100	0	0	100
Reference C	3	2	66.7	0	0	100	0	0	0

(continued)

Table 3.4-1. Lake Sediment Quality, Percent of Samples in which Concentrations were Higher than CCME Guidelines, Back River Project, 2012 (completed)

			Percent of Samples that Exceeded the PEL[c] Guidelines						
			Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Zinc (Zn)
CCME Guideline Value[a] (mg/kg)			17	3.5	90	197	91.3	0.486	315
Lake	Total Number of Samples Collected	Number of Parameters with Exceedances							
Goose Area									
Gander	3	0	0	0	0	0	0	0	0
Pond 19	3	0	0	0	0	0	0	0	0
Big	3	1	100	0	0	0	0	0	0
Rabbit	3	1	33.3	0	0	0	0	0	0
Fox	3	1	33.3	0	0	0	0	0	0
Echo	3	1	33.3	0	0	0	0	0	0
Rascal	3	0	0	0	0	0	0	0	0
Giraffe North	3	0	0	0	0	0	0	0	0
Giraffe South	3	0	0	0	0	0	0	0	0
Goose Neck	3	1	100	0	0	0	0	0	0
Goose Central	3	0	0	0	0	0	0	0	0
Goose Tail	3	0	0	0	0	0	0	0	0
Propellor	3	0	0	0	0	0	0	0	0
George Area									
Lower Long	3	1	100	0	0	0	0	0	0
Fold	3	1	100	0	0	0	0	0	0
George Central	3	1	100	0	0	0	0	0	0
George South	3	1	66.7	0	0	0	0	0	0
Lytle	3	1	100	0	0	0	0	0	0
Occurrence	3	2	100	0	100	0	0	0	0
Sleigh	3	0	0	0	0	0	0	0	0
Dragon	3	1	100	0	0	0	0	0	0
Komatic	3	1	100	0	0	0	0	0	0
Reference C	3	0	0	0	0	0	0	0	0

All values represent the percent of samples that were higher than CCME guidelines.

a) Canadian sediment quality guidelines for the protection of aquatic life (CCME, accessed 2012).

b) ISQG = Interim sediment quality guideline.

c) PEL = Probable Effects Level.

Table 3.4-2. Lake Sediment Quality, Average Factor by which Concentrations were Higher than CCME Guidelines, Back River Project, 2012

			Average Factor by which Samples Exceeded the ISQG[b] Guidelines						
			Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Zinc (Zn)
CCME Guideline Value[a] (mg/kg)			5.9	0.6	37.3	35.7	35	0.17	123
Lake	Total Number of Samples Collected	Parameters with Exceedances							
Goose Area									
Gander	3	2	1.5	-	1.1	-	-	-	-
Pond 19	3	0	-	-	-	-	-	-	-
Big	3	2	4.7	-	-	2.1	-	-	-
Rabbit	3	2	2.9	-	-	2.0	-	-	-
Fox	3	2	3.0	-	-	2.2	-	-	-
Echo	3	2	2.7	-	-	1.1	-	-	-
Rascal	3	1	-	-	-	1.0	-	-	-
Giraffe North	3	2	2.1	-	-	3.1	-	-	-
Giraffe South	3	2	1.9	-	-	1.3	-	-	-
Goose Neck	3	2	4.3	-	-	2.5	-	-	-
Goose Central	3	2	1.9	-	-	2.4	-	-	-
Goose Tail	3	0	-	-	-	-	-	-	-
Propellor	3	1	-	-	-	1.3	-	-	-
George Area									
Lower Long	3	3	4.7	-	1.1	2.5	-	-	-
Fold	3	3	47.7	-	1.0	2.3	-	-	-
George Central	3	1	6.8	-	-	-	-	-	-
George South	3	2	3.1	-	1.5	-	-	-	-
Lytle	3	4	7.3	-	1.7	1.3	-	-	1.2
Occurrence	3	4	8.9	-	3.3	3.1	-	-	2.1
Sleigh	3	1	2.4	-	-	-	-	-	-
Dragon	3	4	11.4	-	1.1	2.3	-	-	1.0
Komatic	3	5	58.4	1.2	1.4	3.7	-	-	1.4
Reference C	3	2	1.9	-	-	2.7	-	-	-

(continued)

Table 3.4-2. Lake Sediment Quality, Average Factor by which Concentrations were Higher than CCME Guidelines, Back River Project, 2012 (completed)

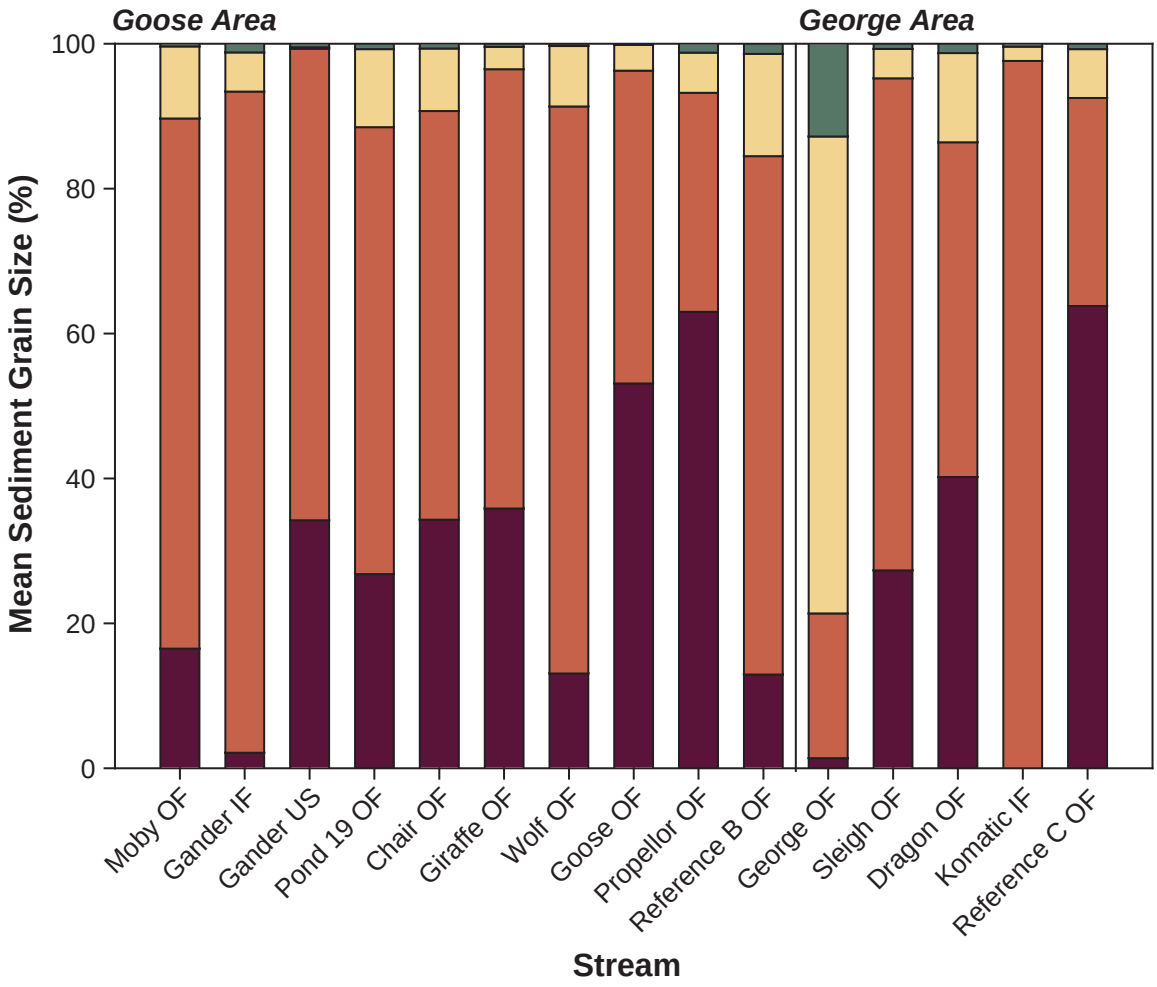
			Average Factor by which Samples Exceeded the PEL[c] Guidelines						
			Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Zinc (Zn)
CCME Guideline Value[a] (mg/kg)			17	3.5	90	197	91.3	0.486	315
Lake	Total Number of Samples Collected	Parameters with Exceedances							
Goose Area									
Gander	3	0	-	-	-	-	-	-	-
Pond 19	3	0	-	-	-	-	-	-	-
Big	3	1	1.6	-	-	-	-	-	-
Rabbit	3	1	1.0	-	-	-	-	-	-
Fox	3	1	1.0	-	-	-	-	-	-
Echo	3	0	-	-	-	-	-	-	-
Rascal	3	0	-	-	-	-	-	-	-
Giraffe North	3	0	-	-	-	-	-	-	-
Giraffe South	3	0	-	-	-	-	-	-	-
Goose Neck	3	1	1.5	-	-	-	-	-	-
Goose Central	3	0	-	-	-	-	-	-	-
Goose Tail	3	0	-	-	-	-	-	-	-
Propellor	3	0	-	-	-	-	-	-	-
George Area									
Lower Long	3	1	1.6	-	-	-	-	-	-
Fold	3	1	16.5	-	-	-	-	-	-
George Central	3	1	2.4	-	-	-	-	-	-
George South	3	1	1.1	-	-	-	-	-	-
Lytle	3	1	2.5	-	-	-	-	-	-
Occurrence	3	2	3.1	-	1.4	-	-	-	-
Sleigh	3	0	-	-	-	-	-	-	-
Dragon	3	1	3.8	-	-	-	-	-	-
Komatic	3	1	20.3	-	-	-	-	-	-
Reference C	3	0	-	-	-	-	-	-	-

Values represent the average factor by which 2012 samples were higher than CCME guidelines.

a) Canadian sediment quality guidelines for the protection of aquatic life (CCME, accessed 2012).

b) ISQG = Interim sediment quality guideline.

c) PEL = Probable Effects Level.



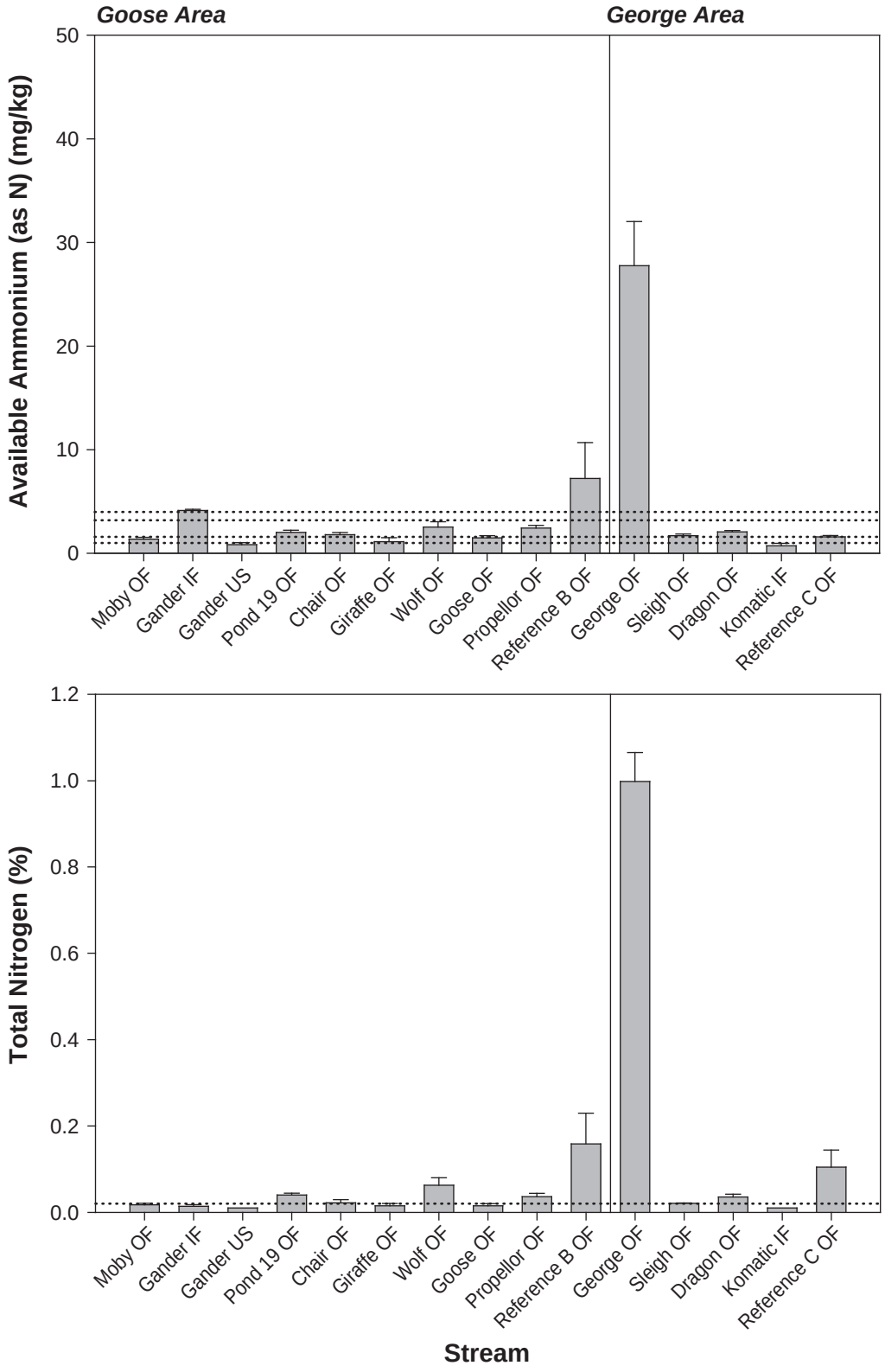
Note: Stacked bars are means of triplicate samples.

Sabina GOLD & SILVER CORP.

Sediment Grain Size Composition in Streams, Back River Project, 2012

Figure 3.5-1

Rescan™ Engineers & Scientists



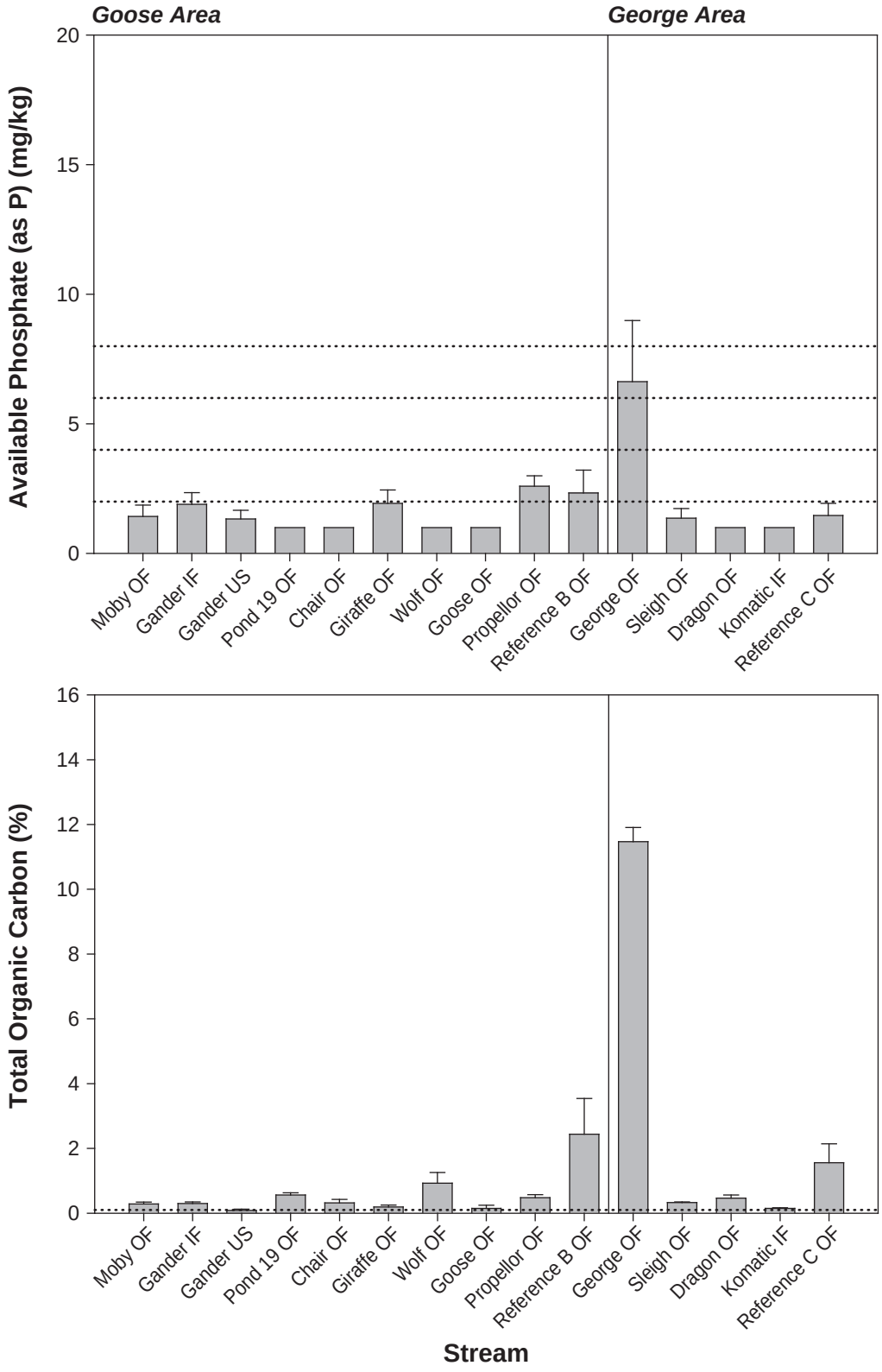
Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (available ammonium 1 - 4.0 mg/kg; total nitrogen 0.02%)
Values below the detection limit are plotted at half the detection limit.

Sabina GOLD & SILVER CORP.

Available Ammonium and Total Nitrogen Concentrations in Stream Sediments, Back River Project, 2012

Figure 3.5-2a

Rescan™ Engineers & Scientists



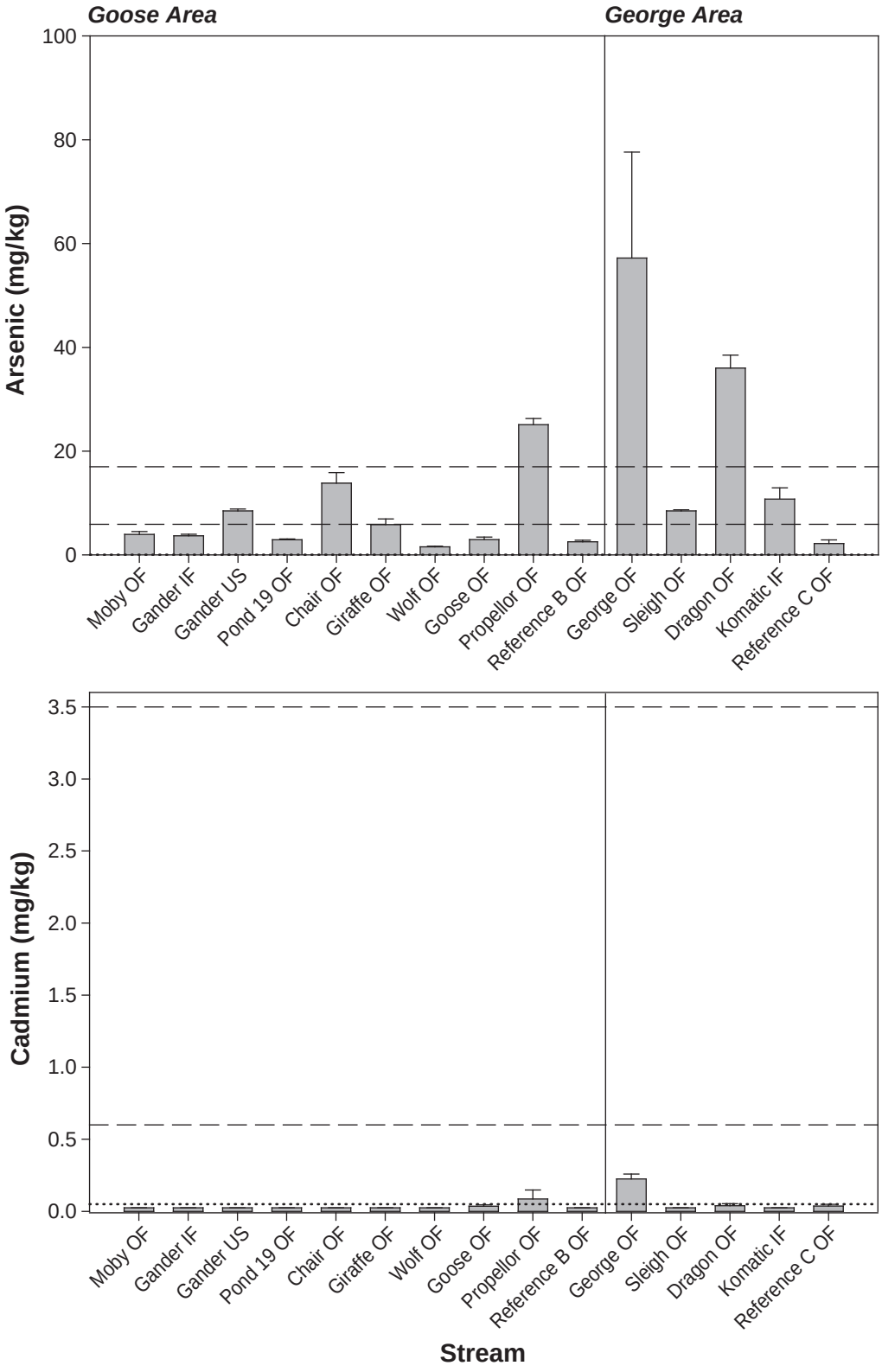
Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (available phosphate 2.0 - 8.0 mg/kg; total organic carbon 0.1%)
Values below the detection limit are plotted at half the detection limit.

Sabina GOLD & SILVER CORP.

Available Phosphate and Total Organic Carbon Concentrations in Stream Sediments, Back River Project, 2012

Figure 3.5-2b

Rescan™ Engineers & Scientists



Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (arsenic 0.05 mg/kg; cadmium 0.05 mg/kg).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guideline.
For arsenic, the ISQG is 5.9 mg/kg and the PEL is 17 mg/kg.
For cadmium, the ISQG is 0.6 mg/kg and the PEL is 3.5 mg/kg.

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Arsenic and Cadmium Concentrations in Stream Sediments, Back River Project, 2012

Figure 3.5-3a

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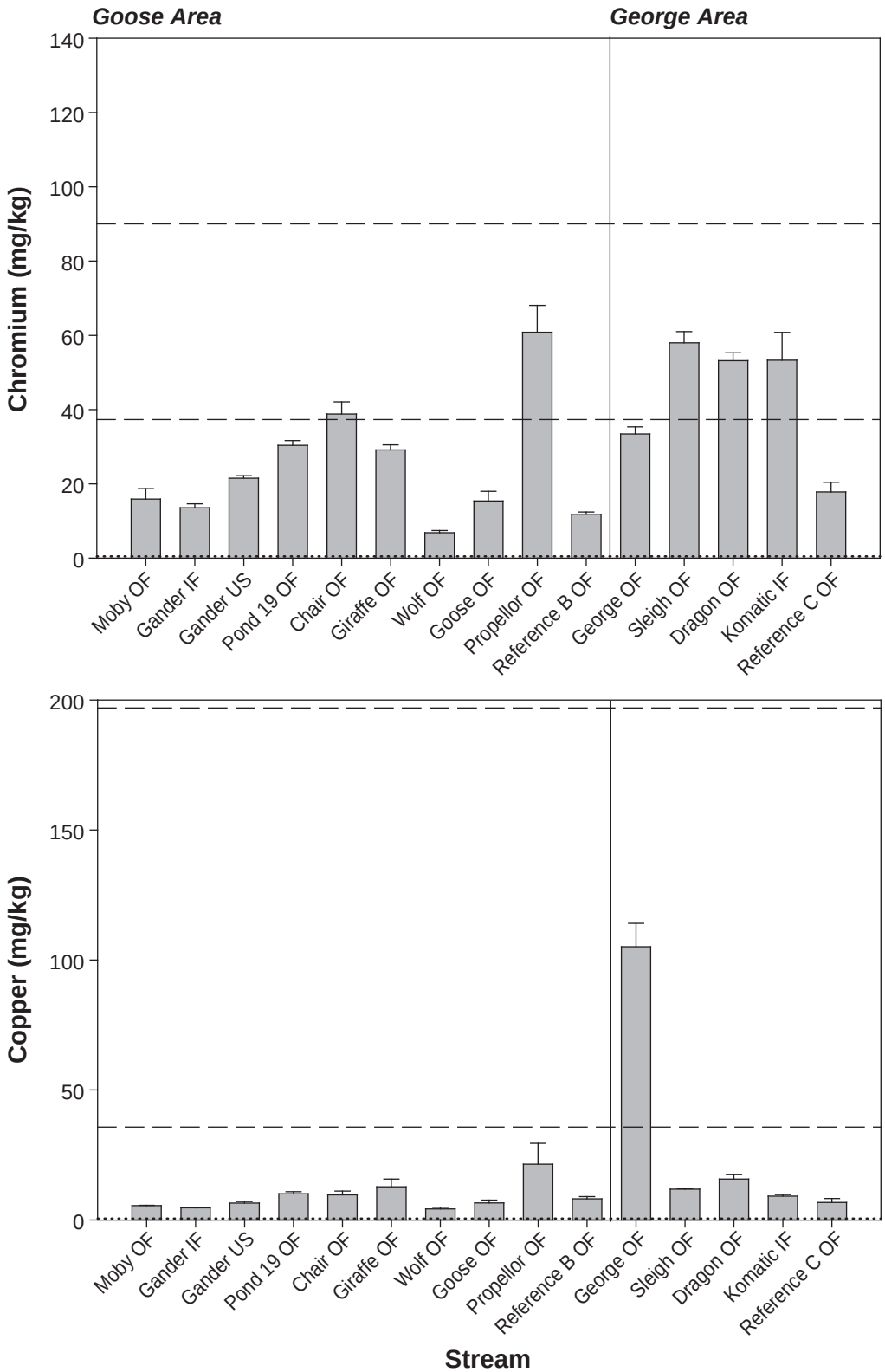

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (chromium 0.5 mg/kg; copper 0.5 mg/kg).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guideline.
For chromium, the ISQG is 37.3 mg/kg and the PEL is 90 mg/kg.
For copper, the ISQG is 35.7 mg/kg and the PEL is 197 mg/kg.

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Chromium and Copper Concentrations in Stream Sediments, Back River Project, 2012

Figure 3.5-3b

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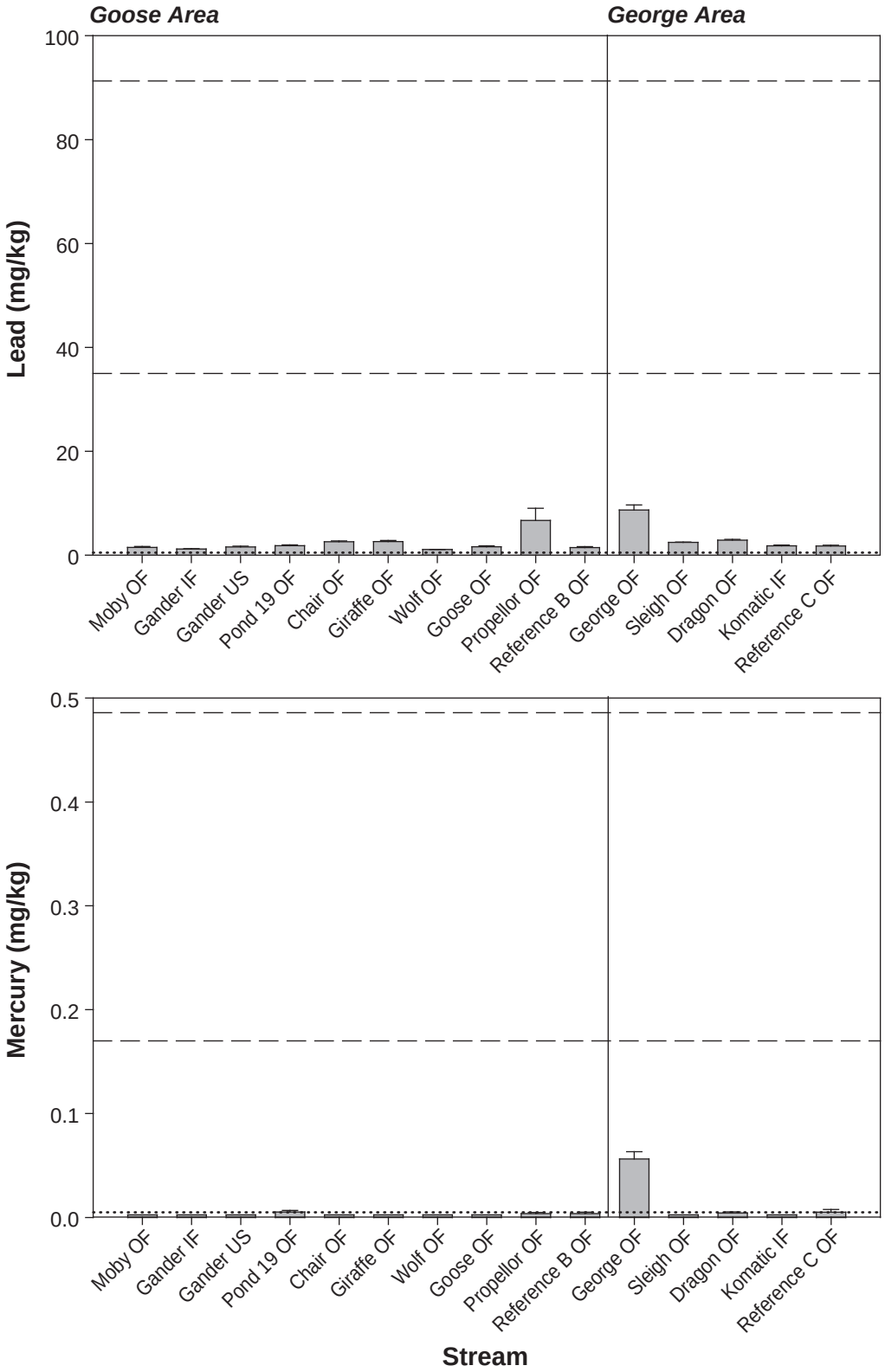

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (lead 0.5 mg/kg; mercury 0.005 mg/kg).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guideline.
For lead, the ISQG is 35 mg/kg and the PEL is 91.3 mg/kg.
For mercury, the ISQG is 0.17 mg/kg and the PEL is 0.486 mg/kg.

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Lead and Mercury Concentrations in Stream Sediments, Back River Project, 2012

Figure 3.5-3c

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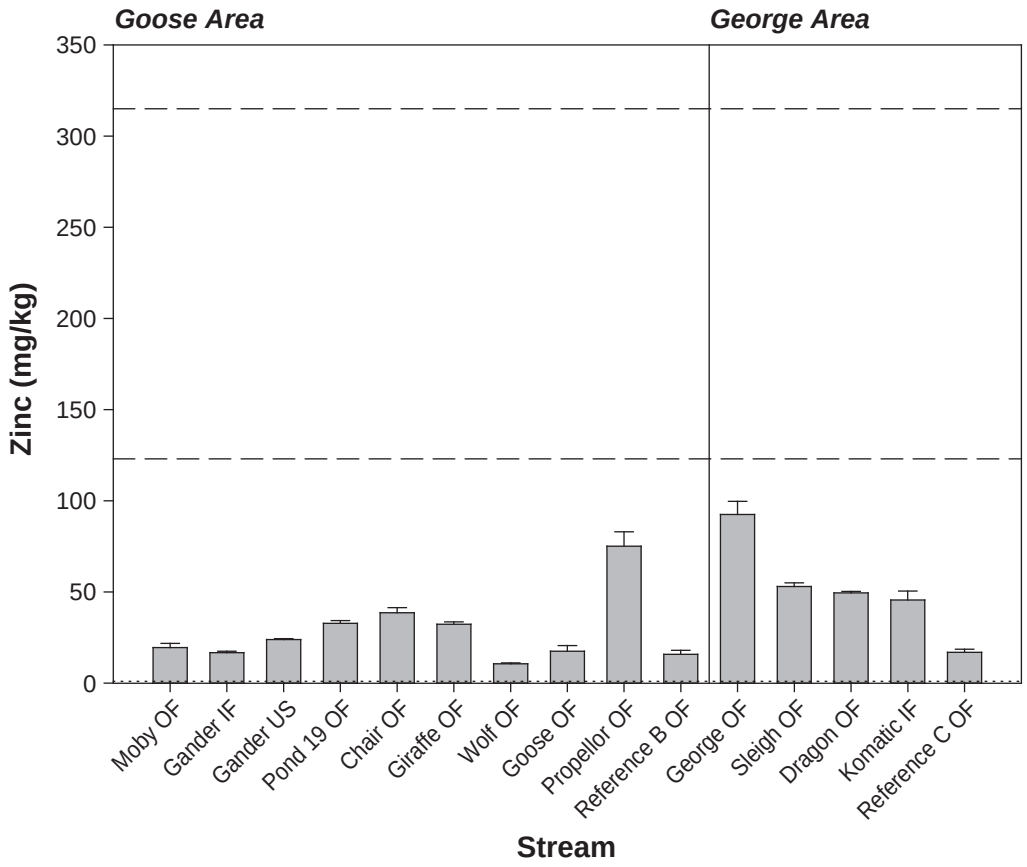

Notes: Error bars represent standard error of the mean of replicates.
Dotted lines represent analytical detection limit (zinc 1.0 mg/kg).
Values below the detection limit are plotted at half the detection limit.
Dashed lines represent CCME guideline.
For zinc, the ISQG is 123 mg/kg and the PEL is 315 mg/kg.

Sabina GOLD & SILVER CORP.

Zinc Concentrations in Stream Sediments, Back River Project, 2012

Figure 3.5-3d

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3.5.1 Particle Size

Stream sediments were a mixture of gravel, sand, silt and clay (Figure 3.5-1). Sand made up over half the sediments at most sites, except in Goose OF, Propellor OF, and Reference B OF where gravel was dominant, George OF where silt was dominant, and Dragon OF having an even split between gravel and sand. Clay made up 15% of George OF sediments, the only site where clay was a significant (> 2%) component.

3.5.2 Nutrients

Nutrients were low in sediments, tending to be below or close to detection limits, with the exception of George OF. George OF had much higher nutrient concentrations than other stream sites, mirroring the much higher proportions of fine sediments present there. Reference B OF and Reference C OF tended to have slightly higher nutrient concentrations than other stream sites.

Average available ammonium ranged between 0.8 mg/kg to 7.3 mg/kg in most stream sediments, the exception being George OF which had ammonium concentrations of 27.8 mg/kg (Figure 3.5-2a). Ammonium values in stream sediments sampled in 2011 were higher, with all streams averaging above 10.2 mg/kg (Rescan 2012a).

Total nitrogen followed the same pattern as ammonium, with considerably higher values observed at George OF (average 1.0%) than in all other streams (average of 0.04%; Figure 3.5-2a). Nitrate and nitrite were consistently below detection limits. Available phosphate concentrations were either near or below detection limits for all samples, except George OF, which again had higher concentrations (6.6 mg/kg; Figure 3.5-2b).

Total organic carbon (TOC) content followed the same trend observed for ammonium and nitrogen, averaging less than 2.5% in all stream sediments, except George OF, which averaged over four times higher at 11.5% (Figure 3.5-2b).

3.5.3 Metals

Stream sediments had metal concentrations that were similar or lower than those in lake sediments (Figures 3.5-3a to 3.5-3d). Metal concentrations tended to be lower in Goose area streams than in George area streams. George OF often had the highest metal concentrations in sediments, corresponding with the high proportion of fine silts and clays. As observed in 2011, Wolf OF often had the lowest metal concentrations in sediments (Rescan 2012a).

Arsenic concentrations were high in stream sediments, with almost half the sites having average concentrations that exceeded CCME ISQGs (5.9 mg/kg). Propellor OF, George OF, and Dragon OF had the highest arsenic concentrations in sediments with all samples above the CCME PEL of 17 mg/kg (Figure 3.5-3a).

Stream sediments had low cadmium levels, with most sites near or below the detection limit (0.05 mg/L). The exception was George OF, which had average cadmium concentrations of 0.23 mg/kg, below the CCME ISQG of 0.6 mg/kg (Figure 3.5-3a).

Chromium concentrations in stream sediments varied from 6.9 mg/kg at Wolf OF to above the CCME ISQG (37.3 mg/kg) for Chair OF, Propellor OF, Sleigh OF, Dragon OF and Komatic IF (Figure 3.5-3b). Copper concentrations followed similar patterns to arsenic, with considerably higher concentrations observed at George OF, exceeding the CCME ISQG (35.7 mg/kg), than in all other stream sediments (Figure 3.5-3b).

Lead and zinc showed similar patterns, with George OF and Propellor OF having higher concentrations in their sediments than other streams (Figure 3.5-3c and 3.5-3d). All stream sediments were below the CCME ISQGs for lead (35 mg/kg) and zinc (123 mg/kg).

Mercury concentrations were near or below detection limits (0.005 mg/kg) for in sediments at all streams, with the exception of George OF (0.056 mg/kg; Figure 3.5-3c).

3.5.4 Cyanides

Total and WAD cyanides were near or below their analytical detection limits (0.05 mg/kg) at most streams (0.05 mg/kg), with the exceptions of Reference B OF (0.086 mg/kg total cyanide) and George OF, which had concentrations an order of magnitude greater than detection limits (0.20 mg/kg for WAD cyanide; 0.47 mg/kg for total cyanide).

3.5.5 Comparison with CCME Guidelines

The percentage of sediment samples that metal concentrations were higher than CCME guidelines is summarized in Table 3.5-1. Table 3.5-2 presents the average factor by which sediment concentrations were higher than CCME guidelines.

Stream sediments had concentrations of arsenic, chromium, and copper that sometimes exceeded CCME ISQGs. Over half of the streams had at least one sample that exceeded the CCME ISQG for at least one metal, with arsenic being the most commonly exceeded metal (with almost half of streams sampled having average concentrations exceed ISQGs). Almost half the sites sampled had average concentrations that exceeded CCME ISQGs for arsenic, and over a quarter for chromium. George OF was the only site where average copper concentrations in sediments exceeded ISQGs. The CCME PELs were only exceeded for arsenic, and only at Propellor OF, George OF and Dragon OF.

In streams where average metal exceeded CCME ISQGs, concentrations tended to exceed by a factor of less than three. Exceptions were Propellor OF (4.3), George OF (9.7) and Dragon OF (6.1) for arsenic, which also exceeded the arsenic CCME .

3.6 PRIMARY PRODUCERS

3.6.1 Phytoplankton

Lake phytoplankton samples were collected in August 2012. Figures 3.6-1 to 3.6-3 present 2012 phytoplankton results, and all raw phytoplankton data are presented in Appendices 3.6-1 to 3.6-5. A variety of phytoplankton were observed, with some of the more abundant taxa shown in Plate 3.6-1.

3.6.1.1 Biomass, Density and Community Composition

Lakes had low phytoplankton biomass (as chlorophyll *a*), with concentrations consistently below 2 µg chl *a*/L. This can be considered ultra-oligotrophic (Vollenweider and Kerekes 1982; Figure 3.6-1). Chlorophyll *a* levels were highest in Fold, Dragon, and Komatic lakes during the under-ice period in April, ranging from 1.15 µg chl *a*/L to 1.71 µg chl *a*/L. All other lakes had concentrations below 1 µg chl *a*/L. Phytoplankton densities were also low in lakes, generally less than 2,000 cells/mL, with the exceptions of Fold, George Central, and Komatic lakes during August, which ranged from 3,900 to 5,600 cells/mL.

Differences in the patterns observed for biomass and density (peaks in April vs August, and in different lakes) may reflect varying levels of intracellular chlorophyll *a* in different phytoplankton cells.

Lakes in the study area contained a diverse assemblage of phytoplankton taxa, which differed between April and August and between lakes (Figure 3.6-2). Major phytoplankton groups observed were Myxophyceae (cyanobacteria), Cryptophyceae (a class of flagellated algae) and Chlorophyceae (green algae), which made up an average of 82% of all phytoplankton collected. Other important groups were Chrysophyceae (golden algae) and Bacillariophyceae (diatoms), averaging 9% and 8%, respectively. All other groups generally made up less than 1% of phytoplankton communities at lakes.

Table 3.5-1. Stream Sediment Quality, Percent of Samples in which Concentrations were Higher than CCME Guidelines, Back River Project, 2012

			Percent of Samples that Exceeded the ISQG[b] Guidelines						
			Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Zinc (Zn)
CCME Guideline Value[a] (mg/kg)			5.9	0.6	37.3	35.7	35	0.17	123
Stream	Total Number of Samples Collected	Parameters with Exceedances							
Goose Area									
Moby OF	3	0	0	0	0	0	0	0	0
Gander IF	3	0	0	0	0	0	0	0	0
Gander US	3	1	100	0	0	0	0	0	0
Pond 19 OF	3	0	0	0	0	0	0	0	0
Chair OF	3	2	100	0	66.7	0	0	0	0
Giraffe OF	3	1	66.7	0	0	0	0	0	0
Wolf OF	3	0	0	0	0	0	0	0	0
Goose OF	3	0	0	0	0	0	0	0	0
Propellor OF	3	3	100	0	100	33.3	0	0	0
Reference B OF	3	0	0	0	0	0	0	0	0
George Area									
George OF	3	2	100	0	0	100	0	0	0
Sleigh OF	3	2	100	0	100	0	0	0	0
Dragon OF	3	2	100	0	100	0	0	0	0
Komatic IF	3	2	100	0	100	0	0	0	0
Reference C OF	3	0	0	0	0	0	0	0	0

(continued)

Table 3.5-1. Stream Sediment Quality, Percent of Samples in which Concentrations were Higher than CCME Guidelines, Back River Project, 2012 (completed)

			Percent of Samples that Exceeded the PEL[c] Guidelines						
			Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Zinc (Zn)
CCME Guideline Value[a] (mg/kg)			17	3.5	90	197	91.3	0.486	315
Stream	Total Number of Samples Collected	Parameters with Exceedances							
Goose Area									
Moby OF	3	0	0	0	0	0	0	0	0
Gander IF	3	0	0	0	0	0	0	0	0
Gander US	3	0	0	0	0	0	0	0	0
Pond 19 OF	3	0	0	0	0	0	0	0	0
Chair OF	3	0	0	0	0	0	0	0	0
Giraffe OF	3	0	0	0	0	0	0	0	0
Wolf OF	3	0	0	0	0	0	0	0	0
Goose OF	3	0	0	0	0	0	0	0	0
Propellor OF	3	1	100	0	0	0	0	0	0
Reference B OF	3	0	0	0	0	0	0	0	0
George Area									
George OF	3	1	100	0	0	0	0	0	0
Sleigh OF	3	0	0	0	0	0	0	0	0
Dragon OF	3	1	100	0	0	0	0	0	0
Komatic IF	3	0	0	0	0	0	0	0	0
Reference C OF	3	0	0	0	0	0	0	0	0

All values represent the percent of samples that were higher than CCME guidelines.

a) Canadian sediment quality guidelines for the protection of aquatic life (CCME, accessed 2012).

b) ISQG = Interim sediment quality guideline.

c) PEL = Probable Effects Level.

Table 3.5-2. Stream Sediment Quality, Average Factor by which Concentrations were Higher than CCME Guidelines, Back River Project, 2012

			Average Factor by which Samples Exceeded the ISQG[b] Guidelines						
			Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Zinc (Zn)
CCME Guideline Value[a] (mg/kg)			5.9	0.6	37.3	35.7	35	0.17	123
Stream	Total Number of Samples Collected	Parameters with Exceedances							
Goose Area									
Moby OF	3	0	-	-	-	-	-	-	-
Gander IF	3	0	-	-	-	-	-	-	-
Gander US	3	1	1.4	-	-	-	-	-	-
Pond 19 OF	3	0	-	-	-	-	-	-	-
Chair OF	3	2	2.3	-	1.0	-	-	-	-
Giraffe OF	3	0	-	-	-	-	-	-	-
Wolf OF	3	0	-	-	-	-	-	-	-
Goose OF	3	0	-	-	-	-	-	-	-
Propellor OF	3	2	4.3	-	1.6	-	-	-	-
Reference B OF	3	0	-	-	-	-	-	-	-
George Area									
George OF	3	2	9.7	-	-	2.9	-	-	-
Sleigh OF	3	2	1.4	-	1.6	-	-	-	-
Dragon OF	3	2	6.1	-	1.4	-	-	-	-
Komatic IF	3	2	1.8	-	1.4	-	-	-	-
Reference C OF	3	0	-	-	-	-	-	-	-

(continued)

Table 3.5-2. Stream Sediment Quality, Average Factor by which Concentrations were Higher than CCME Guidelines, Back River Project, 2012 (completed)

			Average Factor by which Samples Exceeded the PEL[c] Guidelines						
			Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Zinc (Zn)
CCME Guideline Value[a] (mg/kg)			17	3.5	90	197	91.3	0.486	315
Stream	Total Number of Samples Collected	Parameters with Exceedances							
Goose Area									
Moby OF	3	0	-	-	-	-	-	-	-
Gander IF	3	0	-	-	-	-	-	-	-
Gander US	3	0	-	-	-	-	-	-	-
Pond 19 OF	3	0	-	-	-	-	-	-	-
Chair OF	3	0	-	-	-	-	-	-	-
Giraffe OF	3	0	-	-	-	-	-	-	-
Wolf OF	3	0	-	-	-	-	-	-	-
Goose OF	3	0	-	-	-	-	-	-	-
Propellor OF	3	1	1.5	-	-	-	-	-	-
Reference B OF	3	0	-	-	-	-	-	-	-
George Area									
George OF	3	1	3.4	-	-	-	-	-	-
Sleigh OF	3	0	-	-	-	-	-	-	-
Dragon OF	3	1	2.1	-	-	-	-	-	-
Komatic IF	3	0	-	-	-	-	-	-	-
Reference C OF	3	0	-	-	-	-	-	-	-

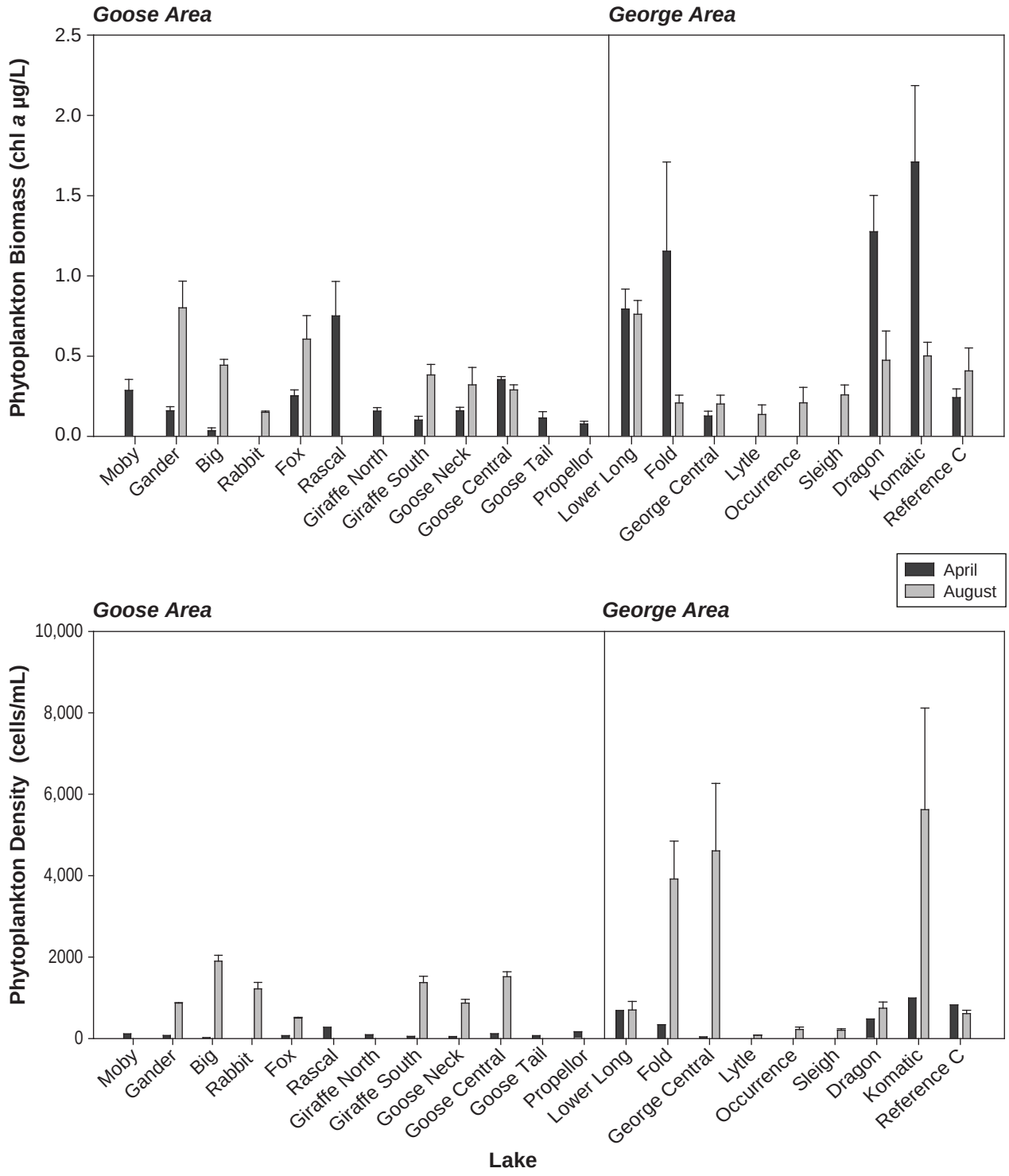
Values represent the average factor by which 2012 samples were higher than CCME guidelines.

Even though a percentage of samples may be higher than a guideline amount, the calculated stream average may not be higher than a guideline amount.

a) Canadian sediment quality guidelines for the protection of aquatic life (CCME, accessed 2012).

b) ISQG = Interim sediment quality guideline.

c) PEL = Probable Effects Level.



Note: Error bars represent standard error of the mean (except for density in April, where a single replicate was collected).

Sabina GOLD & SILVER CORP.

Phytoplankton Biomass and Density in Lakes, Back River Project, 2012

Figure 3.6-1

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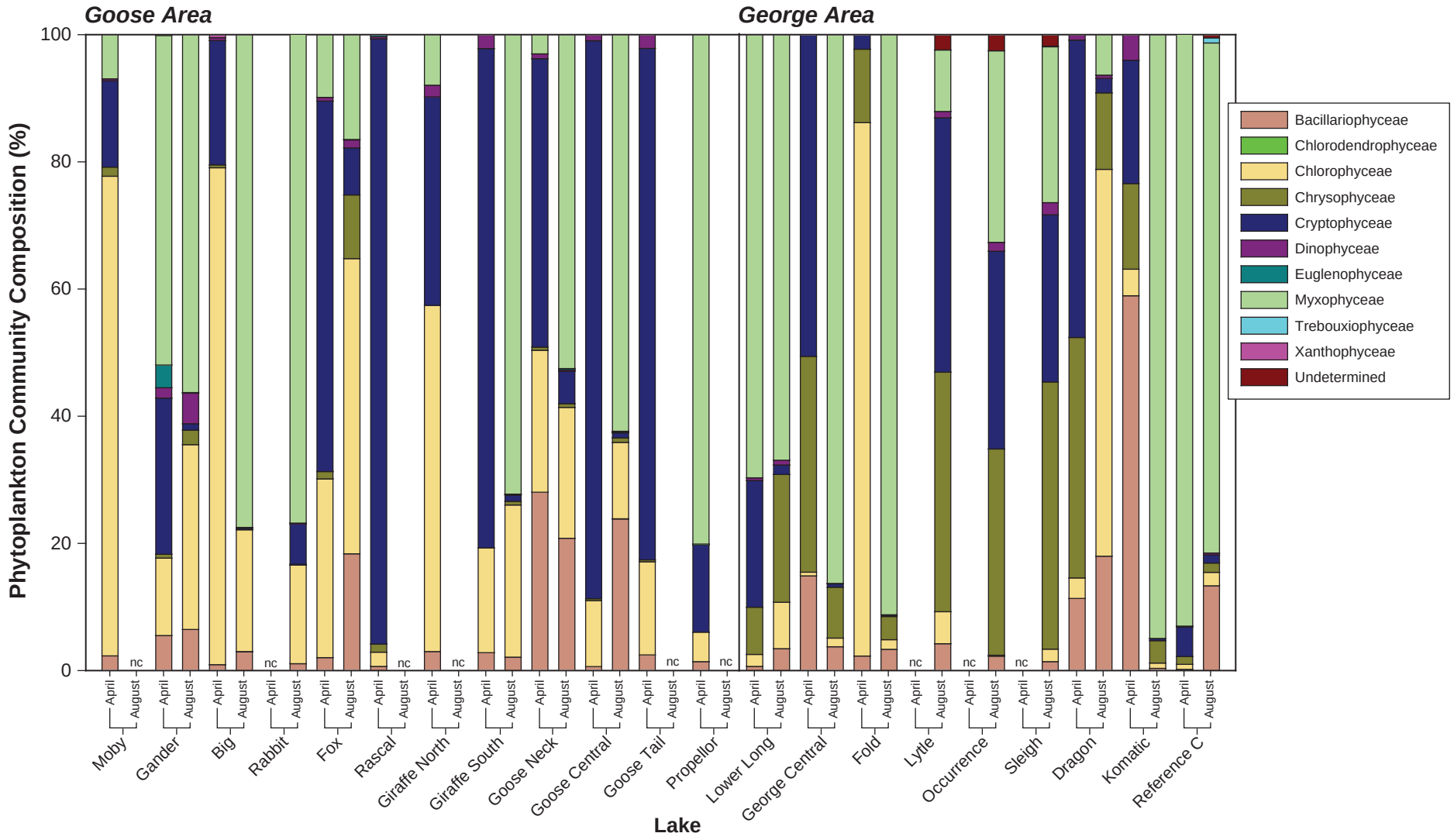

Note: Community composition values represent a single replicate in April, and the mean of replicates in August.
nc = Not Collected.

Figure 3.6-2

Sabina GOLD & SILVER CORP.

Phytoplankton Community Composition in Lakes, Back River Project, 2012

Figure 3.6-2

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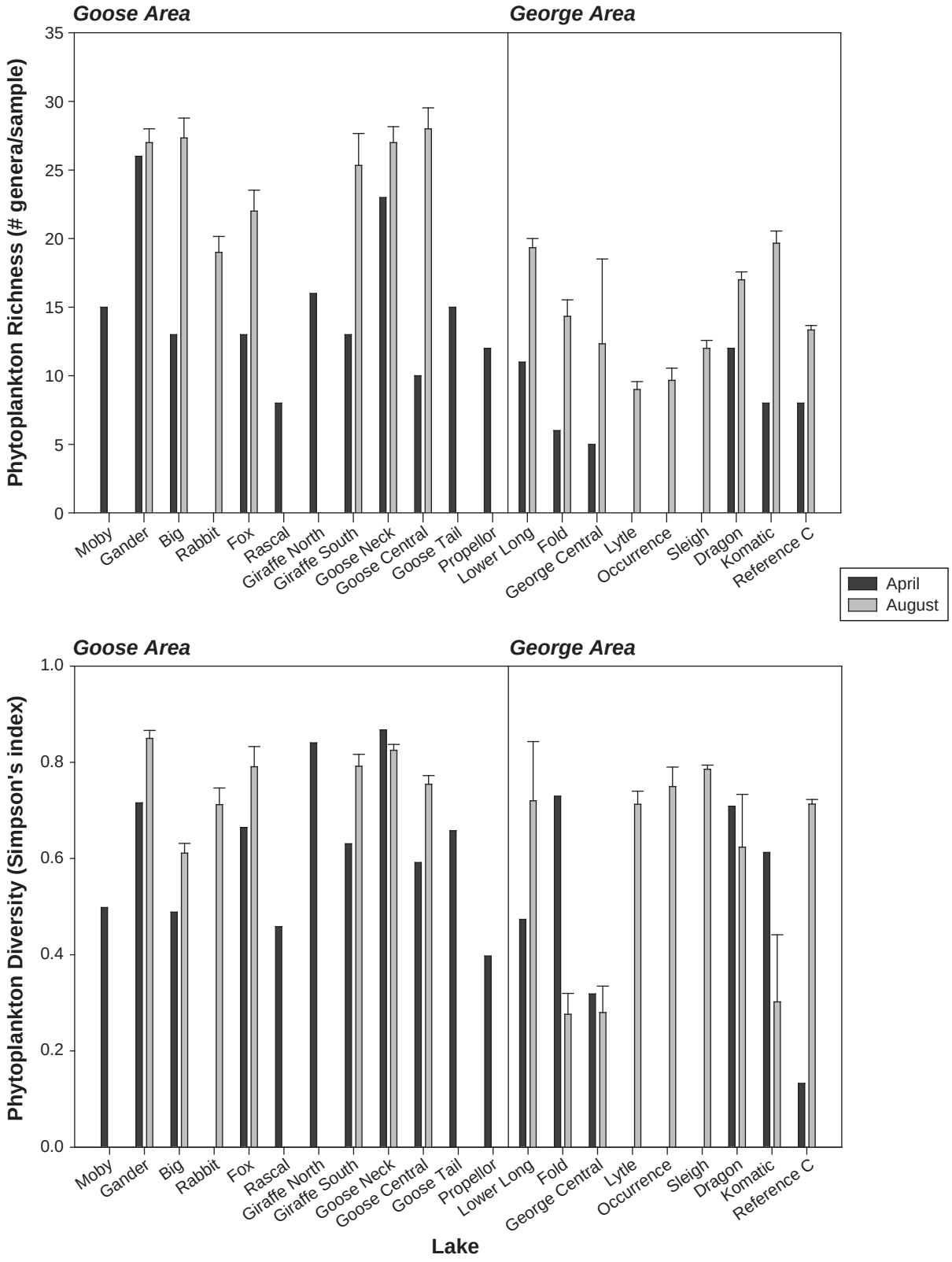

Notes: Data represent a single replicate in April, and the standard error of the mean in August.
Diversity was analysed at the genus level.

Sabina GOLD & SILVER CORP.

Phytoplankton Richness and Diversity in Lakes, Back River Project, 2012

Figure 3.6-3

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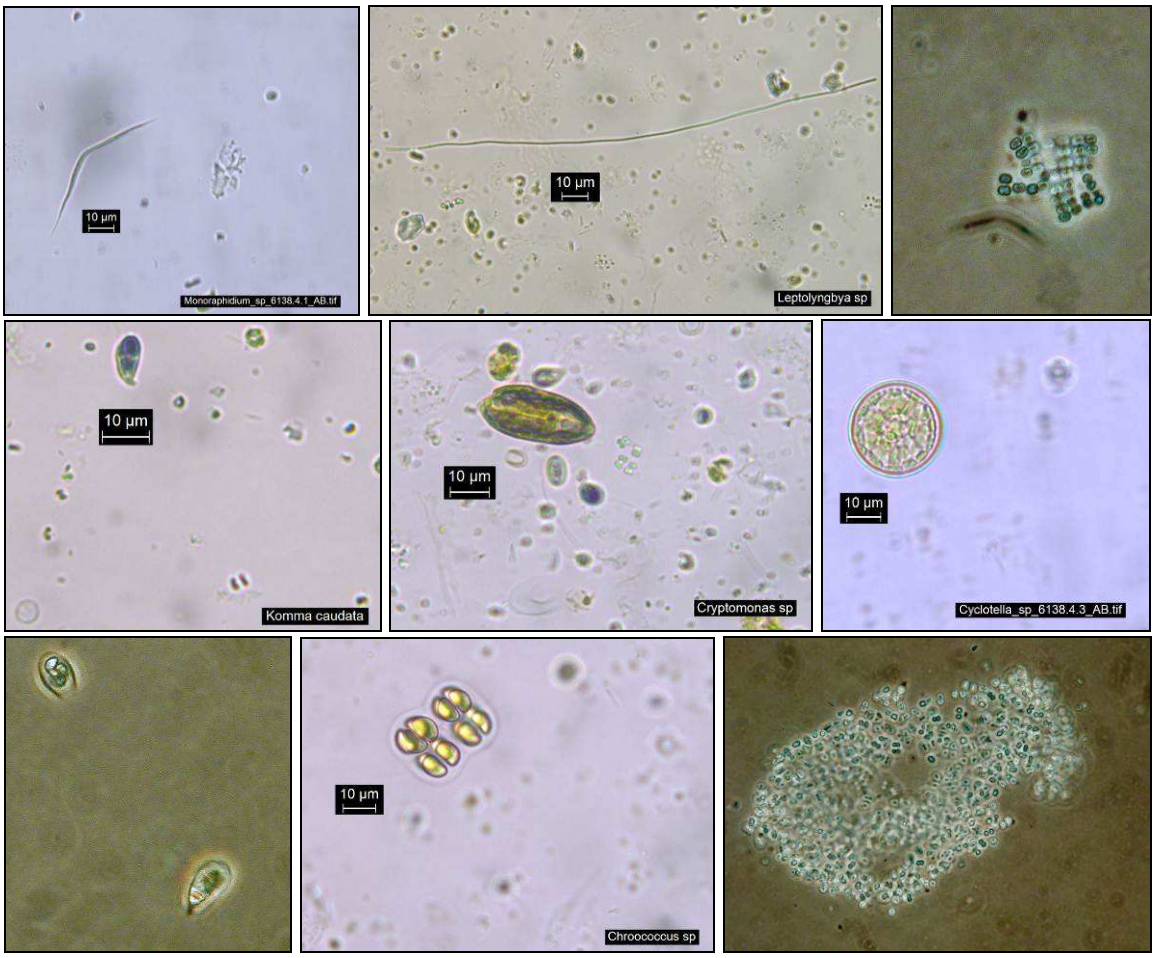


Plate 3.6-1. Some of the most abundant phytoplankton taxa observed in Goose and George area lakes. From top left to bottom right; most abundant in Goose area lakes, Monoraphidium sp.*, Leptolyngbya* sp.*, Merismopedia* sp.*, Komma caudata, Cryptomonas* sp.*; most abundant in George area lakes, Cyclotella* sp.*, Kephyrion* sp.*, Chroococcus* sp. *and Aphanocapsa* sp.

Cryptophytes were more dominant in April than in August, while cyanobacteria were more dominant in August than in April. Lakes had highly variable proportions of green algae, ranging from 84% to less than 1%, with dramatic seasonal (April vs August) differences seen in Big Lake, George Lake Central, and Dragon Lake. George area lakes tended to have greater proportions of chrysophytes than Goose area lakes. Cyanobacteria made up more than 90% of the phytoplankton communities in George Central in August, Komatic in August, and Reference C in April.

Phytoplankton communities were dominated by the three most abundant genera, which comprised between 50% and 96% of phytoplankton sampled (Table 3.6-1). The most abundant genera tended to be in either the myxophycean, chlorophycean or cryptophycean classes. Goose area and George area lakes had different genera dominate the phytoplankton communities. Only one genus was observed in the three most abundant genera in both Goose and George area lakes, the chryosphyte *Dinobryon,* the third most abundant phytoplankton genus at Fox (9.4%), Rascal (1.3%), and Fold (4.8%) lakes.

Table 3.6-1. Most Abundant Phytoplankton Genera in Lakes, Back River Project, 2012

Lake	Most Abundant Phytoplankton Genera		
	Major Taxonomic Group	Genus	% of Sample
Goose Area			
Moby	Chlorophyceae	*Monoraphidium*	69.4
	Cryptophyceae	*Cryptomonas*	11.8
	Myxophyceae	*Anabaena*	6.9
Gander	Myxophyceae	*Anabaena*	29.2
	Chlorophyceae	*Monoraphidium*	12.1
	Myxophyceae	*Merismopedia*	10.5
Big	Myxophyceae	*Leptolyngbya*	60.3
	Chlorophyceae	*Elakatothrix*	11.2
	Myxophyceae	*Coelosphaerium*	5.8
Rabbit	Myxophyceae	*Leptolyngbya*	44.4
	Myxophyceae	*Microcystis*	20.5
	Chlorophyceae	*Monoraphidium*	8.3
Fox	Chlorophyceae	*Monoraphidium*	34.5
	Bacillariophyceae	*Tabellaria*	16.1
	Chrysophyceae	*Dinobryon*	9.4
Rascal	Cryptophyceae	*Komma*	68.6
	Cryptophyceae	*Cryptomonas*	26.6
	Chlorophyceae and Chrysophyceae	*Carteria* and *Dinobryon*	1.3
Giraffe North	Cryptophyceae	*Komma*	25.2
	Chlorophyceae	*Pediastrum*	23.2
	Chlorophyceae	*Sphaerocystis*	14.4
Giraffe South	Myxophyceae	*Merismopedia*	27.3
	Myxophyceae	*Leptolyngbya*	24.7
	Myxophyceae	*Coelosphaerium*	16.8
Goose Neck	Myxophyceae	*Leptolyngbya*	27.1
	Bacillariophyceae	*Tabellaria*	18.3
	Myxophyceae	*Merismopedia*	15.2
Goose Central	Myxophyceae	*Leptolyngbya*	40.2
	Bacillariophyceae	*Tabellaria*	21.7
	Myxophyceae	*Merismopedia*	10.2
Goose Tail	Cryptophyceae	*Cryptomonas*	48.0
	Cryptophyceae	*Komma*	32.4
	Chlorophyceae	*Monoraphidium*	3.7
Propellor	Myxophyceae	*Aphanothece*	76.7
	Cryptophyceae	*Komma*	9.4
	Cryptophyceae	*Cryptomonas*	4.4
George Area			
Lower Long	Myxophyceae	*Aphanocapsa*	38.8
	Myxophyceae	*Planktolyngbya*	17.2
	Chrysophyceae	*Chrysocapsa*	7.0

(continued)

Table 3.6-1. Most Abundant Phytoplankton Genera in Lakes, Back River Project, 2012 (completed)

Lake	Most Abundant Phytoplankton Genera		
	Major Taxonomic Group	Genus	% of Sample
George Area *(cont'd)*			
Fold	Myxophyceae	*Aphanocapsa*	47.5
	Myxophyceae	*Cyanodictyon*	36.4
	Chrysophyceae	*Dinobryon*	4.8
George Central	Myxophyceae	*Aphanothece*	59.4
	Myxophyceae	*Aphanocapsa*	29.8
	Bacillariophyceae	*Cyclotella*	3.1
Lytle	Chrysophyceae	*Kephyrion*	34.9
	Cryptophyceae	*Rhodomonas*	31.8
	Myxophyceae	*Chroococcus*	9.7
Occurrence	Cryptophyceae	*Rhodomonas*	26.0
	Chrysophyceae	*Kephyrion*	18.2
	Myxophyceae	*Chroococcus*	17.5
Sleigh	Chrysophyceae	*Kephyrion*	31.8
	Cryptophyceae	*Rhodomonas*	15.3
	Myxophyceae	*Chroococcus*	12.7
Dragon	Chlorophyceae	*Coenococcus*	48.0
	Bacillariophyceae	*Cyclotella*	15.9
	Chrysophyceae	*Chrysochromulina*	8.7
Komatic	Myxophyceae	*Aphanocapsa*	83.4
	Myxophyceae	*Chroococcus*	5.5
	Bacillariophyceae	*Cyclotella*	3.5
Reference C	Myxophyceae	*Planktolyngbya*	47.7
	Myxophyceae	*Aphanocapsa*	16.8
	Myxophyceae	*Pseudanabaena*	13.6

Note: Individuals not identified to genus level were used only to calculate relative abundance. April and August data was pooled for these calculations.

At the lakes with the highest phytoplankton densities, a few cyanobacteria (*Aphanocapsa*, *Aphanothece* and *Cyanodicton*), made up over 45% of the community during the august sampling. Cyanobacteria genera have small cell sizes relative to other phytoplankton, allowing larger densities to exist than other phytoplankton. Other dominant genera at lakes included the green algae *Monoraphidium*, the cyanobacteria Chroococcus, *Leptolyngbya* and *Mersmopedia*, the cryptophytes *Cryptomonas*, Kephyrion and *Komma* and the diatom *Cyclotella*.

There was visual evidence of benthic primary producers in Pond 19, Rascal Lake, Goose Lake, Occurrence Lake, Sleigh Lake and Reference Lake C during sediment and benthos sample collection (Plate 3.6-2). The most interesting find was the presence of algae in Reference Lake C on top of sediments at 35 m deep, far below both the thermocline (19 m) and the calculated euphotic zone depth (17 m). The algae are thought to be *Nostoc* balls, but were not formally identified, and may have sank out of the euphotic zone (Plate 3.6-3).

Plate 3.6-2. Benthic primary producers were found in some lakes during sediment and benthos sample collection. Top row; left, Pond 19 biofilm in situ*, biofilm on sediment sample and biofilm covered macrophytes; right biofilm on Rascal Lake. Bottom row left Goose Central Lake sediment grabs collected green algae shown in field, and pressed; algal balls observed at Occurrence Lake and Reference Lake C.*

Plate 3.6-3. Algal balls, thought to be Nostoc, were found in Reference Lake C sediment grabs from 35 m depth in August 2012.

3.6.1.2 Richness and Diversity

Genera richness tended to be lower in April than in August, and lower in George area lakes than in Goose area lakes (Figure 3.6-3). Richness averaged between five genera per sample (George Central in April) to 28 genera per sample (Goose Central in August), and tended to be highest at the Gander, Big, Giraffe South, Goose Neck and George Central sites.

Phytoplankton diversity followed a similar trend to richness at most lakes, tending to be lower in George area lakes (Figure 3.6-3). Diversity was highly variable, with most lakes ranging from 0.32 to 0.87. The lowest diversity was measured in Reference Lake C in April, with a Simpson's diversity index of 0.13. Reference C was dominated the cyanobacteria *Planktolyngbya limnetica* (93%) in April, with only eight other taxa present.

3.6.2 Periphyton

Stream periphyton samples were collected in August 2012. Figures 3.6-4 to 3.6-6 present 2012 periphyton results, and all raw periphyton biomass and taxonomic data are presented in Appendices 3.6-4 to 3.6-6. A variety of primary producers were observed in streams during field sampling, with selected examples shown in Plate 3.6-4.

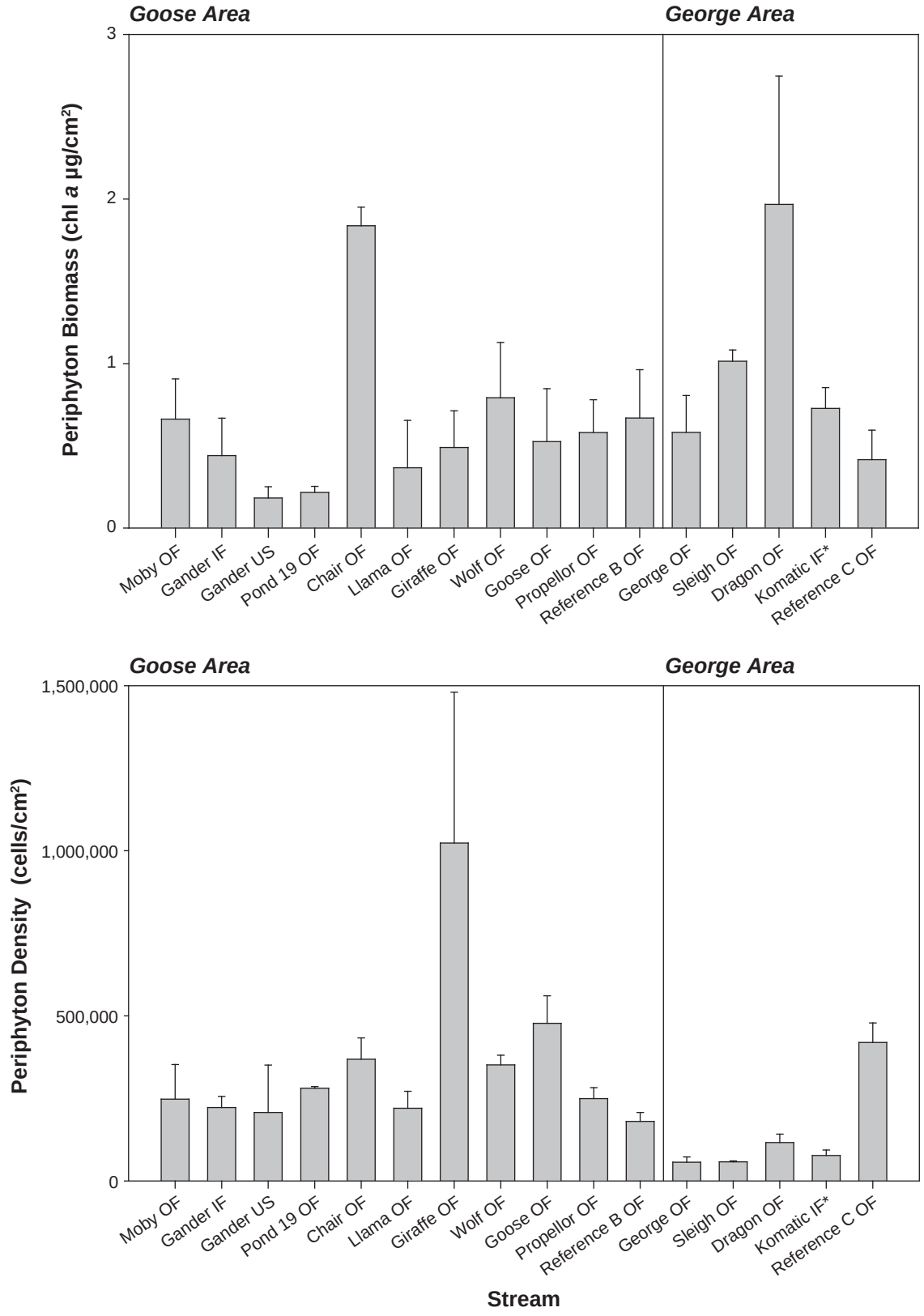
Plate 3.6-4. Examples of benthic primary producers observed in streams. From top left to bottom right, typical periphyton cover observed at most sites (Wolf OF), macrophyte Hippuris vulgaris *growing in Moby OF (*in situ *and* ex situ*), small turfing liverwort growing on rocks at Gander IF (*Jungermannia *sp.); filamentous algae growing on rocks at Propellor OF, and an aquatic moss (Polytrichaceae, likely* Polytrichum *sp.) from Propellor OF.*

3.6.2.1 Biomass, Density and Community Composition

Average periphyton biomass (as chlorophyll *a*) largely ranged from 0.18 µg chl *a*/cm^2 at Gander US to 1.0 chl *a*/cm^2 at Sleigh OF, although biomass levels were much higher in Chair OF (1.83 chl *a*/cm^2) and Dragon OF (1.97 µg chl *a*/cm^2) (Figure 3.6-3). Spatial patterns in biomass did not closely follow densities, which may have reflected variation in the size of the dominant algae and the chlorophyll *a* content in different taxa.

Streams differed in periphyton density with Goose area streams tending to have higher average diversities, with most averaging between 180,000 cells/cm^2 and 478,000 cells/cm^2, and George area streams tending to have lower average diversities, averaging between 56,000 cells/cm^2 and 420,000 cells/cm^2. Periphyton densities were highest and most variable at Giraffe OF, averaging 1,000,000 cells/cm^2. Giraffe OF also had the lowest densities of benthic invertebrates, so the high periphyton densities may have reflected reduced benthic grazing pressure.

Periphyton communities were dominated by Myxophyceae (cyanobacteria) and Bacillariophyceae (diatoms), which averaged over 70% of the community (Figure 3.6-2). Chlorophyceae (green algae) were also a considerable component of stream periphyton communities, averaging up to 30% at some sites. Goose area streams tended to have smaller proportions of diatoms and greater proportions of cyanobacteria than George area lakes, with a few exceptions.



Notes: Error bars represent standard error of the mean.
**Komatic IF had no rocks so periphyton was collected from sediment surface using modified methods.*

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Periphyton Biomass and Density in Streams, Back River Project, 2012

Figure 3.6-4

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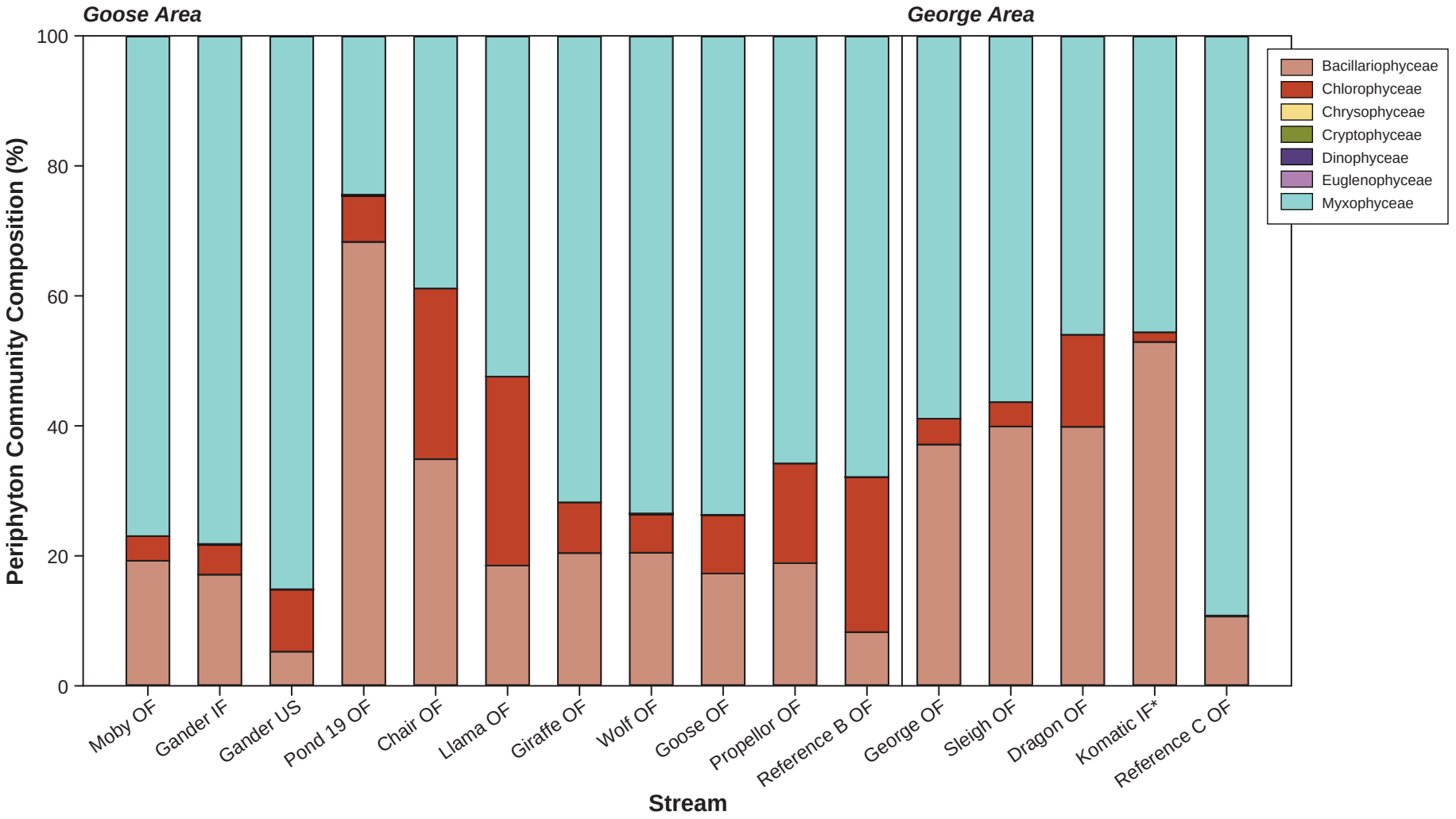


Notes: Community composition values represent the mean of replicates.
**Komatic IF had no rocks so periphyton was collected from sediment surface using modified methods.*

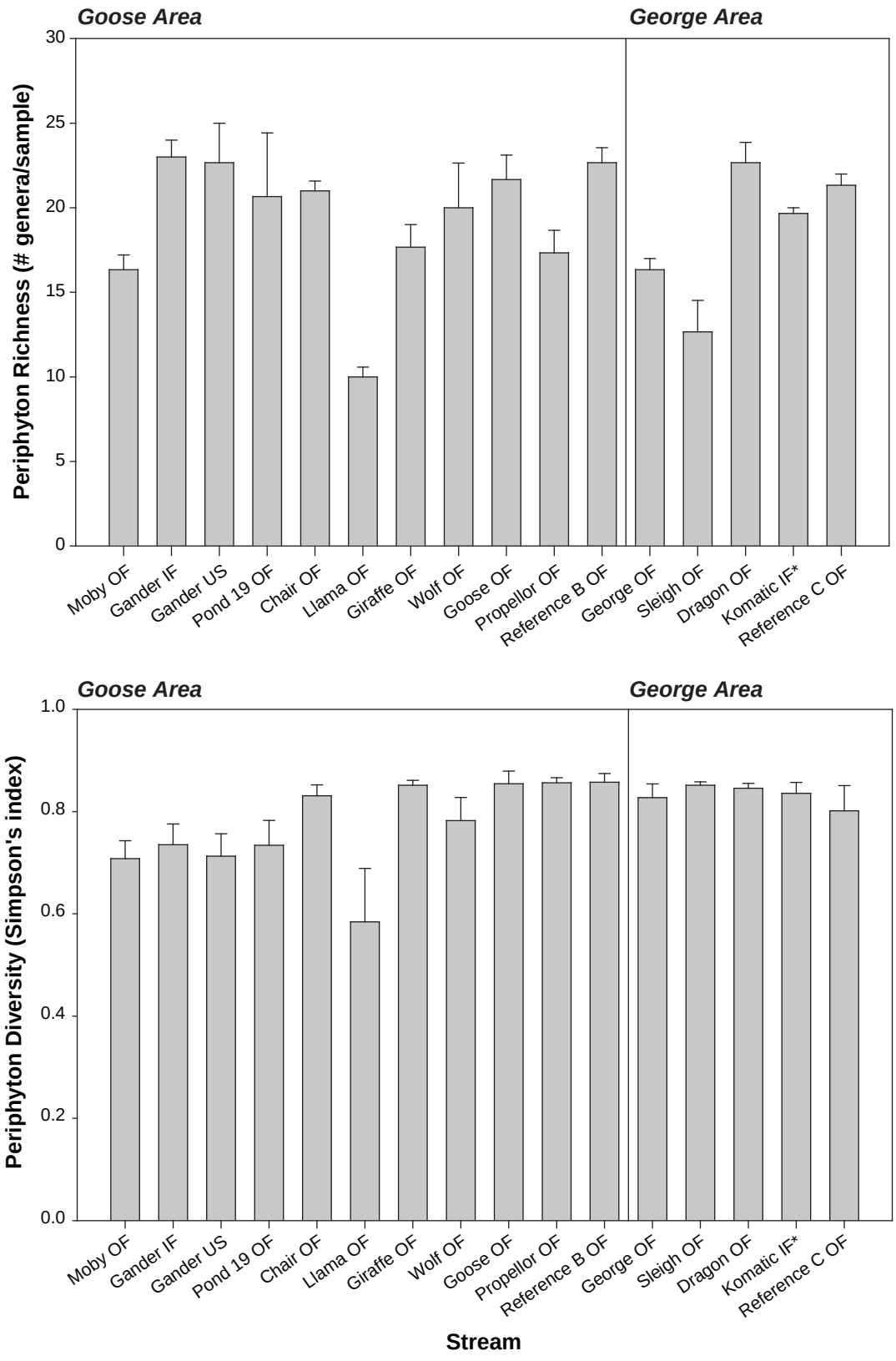
Figure 3.6-5

Sabina GOLD & SILVER CORP.

Periphyton Community Composition in Streams, Back River Project, 2012

Figure 3.6-5

Rescan™ Engineers & Scientists



Notes: Error bars represent standard error of the mean.
**Komatic IF had no rocks so periphyton was collected from sediment surface using modified methods.*

Sabina GOLD & SILVER CORP.

Periphyton Richness and Diversity in Streams, Back River Project, 2012

Figure 3.6-6

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The three most abundant genera averaged between 45% and 80% of stream periphyton communities, and showed some spatial differentiation (Table 3.6-2). *Tabellaria* (large pennate diatom) and *Woronchinia* (small colonial cyanobacteria) were in the top three genera for a third of streams in the Goose area, but no George area streams. Conversely, *Achnanthidium* (small pennate diatom) and *Leptolyngbya* (filamentous cyanobacteria) were in the top three most abundant taxa in most George area streams, but never for Goose area streams (Plate 3.6-5). The two most abundant periphyton genera at Reference C OF were the cynobacteria *Nostoc* (colonial) and *Scytonema* (filamentous). These were not abundant in any other stream.

Table 3.6-2. Most Abundant Periphyton Genera in Streams, Back River Project, 2012

Stream	Most Abundant Periphyton Genera		
	Major Taxonomic Group	Genus	% of Relative Abundance
Goose Area			
Moby OF	Myxophyceae	*Woronichinia*	40.6
	Myxophyceae	*Oscillatoria*	26.0
	Bacillariophyceae	*Tabellaria*	12.6
Gander IF	Myxophyceae	*Merismopedia*	36.2
	Myxophyceae	*Woronichinia*	30.0
	Myxophyceae	*Microcystis*	7.3
Gander US	Myxophyceae	*Gloeotrichia*	41.7
	Myxophyceae	*Woronichinia*	11.5
	Myxophyceae	*Stigonema*	10.8
Pond 19 OF	Bacillariophyceae	*Tabellaria*	39.5
	Bacillariophyceae	*Navicula*	19.3
	Myxophyceae	*Calothrix*	11.5
Chair OF	Bacillariophyceae	*Tabellaria*	25.5
	Chlorophyceae	*Scenedesmus*	17.2
	Myxophyceae	*Woronichinia*	13.8
Llama OF	Myxophyceae	*Homoeothrix*	50.6
	Chlorophyceae	*Bulbochaete*	13.5
	Bacillariophyceae	*Tabellaria*	9.5
Giraffe OF	Myxophyceae	*Woronichinia*	18.6
	Myxophyceae	*Stigonema*	14.2
	Bacillariophyceae	*Tabellaria*	13.4
Wolf OF	Myxophyceae	*Woronichinia*	24.1
	Myxophyceae	*Gloeotrichia*	16.3
	Bacillariophyceae	*Tabellaria*	11.7
Goose OF	Myxophyceae	*Aphanocapsa*	23.1
	Myxophyceae	*Woronichinia*	13.6
	Myxophyceae	*Dichothrix*	12.0
Propellor OF	Bacillariophyceae	*Tabellaria*	19.9
	Myxophyceae	*Dichothrix*	15.2
	Myxophyceae	*Calothrix*	12.0
Reference B OF	Myxophyceae	*Woronichinia*	20.2
	Myxophyceae	*Calothrix*	19.3
	Myxophyceae	*Merismopedia*	9.0

(continued)

Table 3.6-2. Most Abundant Periphyton Genera in Streams, Back River Project, 2012 (completed)

Stream	Most Abundant Periphyton Genera		
	Major Taxonomic Group	Genus	% of Relative Abundance
George Area			
George OF	Myxophyceae	*Leptolyngbya*	19.2
	Myxophyceae	*Stigonema*	15.7
	Bacillariophyceae	*Achnanthidium*	14.8
Sleigh OF	Myxophyceae	*Leptolyngbya*	22.4
	Bacillariophyceae	*Achnanthidium*	14.6
	Myxophyceae	*Calothrix*	12.5
Dragon OF	Bacillariophyceae	*Achnanthidium*	21.6
	Myxophyceae	*Dichothrix*	14.5
	Myxophyceae	*Leptolyngbya*	9.8
Komatic IF*	Bacillariophyceae	*Achnanthidium*	24.5
	Myxophyceae	*Merismopedia*	19.9
	Myxophyceae	*Leptolyngbya*	12.0
Reference C OF	Myxophyceae	*Nostoc*	25.5
	Myxophyceae	*Scytonema*	16.5
	Myxophyceae	*Aphanocapsa*	11.8

Note: Individuals not identified to genus level were used only to calculate relative abundance.

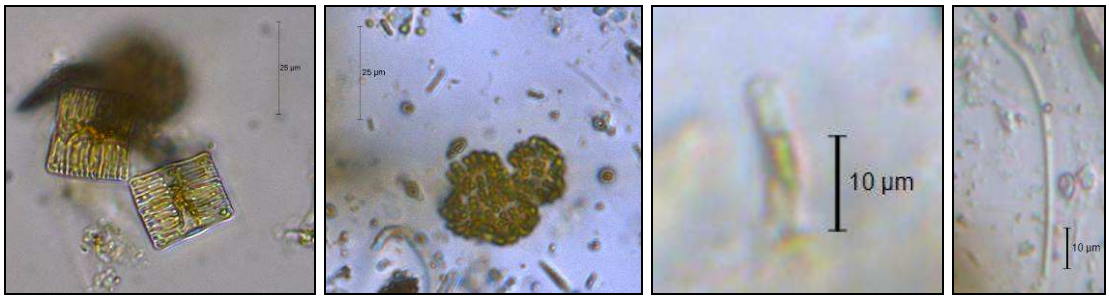


Plate 3.6-5. Tabellaria flocculosa *and* Woronichinia naegeliana *were highly abundant in Goose area streams;* Achnanthidium *sp. and* Leptolyngbya *sp. were highly abundant in George area streams.*

3.6.2.2 Richness and Diversity

Periphyton genera richness averaged from 10 to 23 genera/sample, with most streams over16 genera/sample (Figure 3.6-3). Llama OF had the lowest average periphyton richness in all streams measured in both 2012 (10 genera/sample) and 2011 (18 genera/sample; Rescan 2012a). This stream had quite different substrate from all other streams sampled, running through a boulder field.

Periphyton diversity was high and very similar among all stream sites, averaging between 0.71 and 0.86 (Simpson's index). The exception was Llama OF, which had the lowest and most variable diversity, averaging at 0.58 on the Simpson's diversity index.

3.7 AQUATIC INVERTEBRATES

3.7.1 Zooplankton

Lake zooplankton samples were collected in August 2012. Figures 3.7-1 and 3.7-2 present 2012 zooplankton results, and all raw zooplankton data are presented in Appendices 3.7-1 to 3.7-4. A variety of zooplankton were observed, with some of the more abundant taxa shown in Plate 3.7-1.

3.7.1.1 Density and Community Composition

Zooplankton densities, excluding nauplii, tended to be higher at Goose area lakes than at George area lakes (Figure 3.7-1). Twelve out of the sixteen of lakes had densities below 30,000 individuals/m^3, and all were below 58,000 individuals/m^3, except Gander Lake with 83,000 individuals/m^3. The lowest densities were observed at Occurrence Lake, with approximately 680 individuals/m^3. Patterns in copepodite densities did not match with zooplankton densities, and varied between lakes. Copepodites were absent in over a quarter of lakes (Rabbit, Lower Long, Occurrence, Sleigh, Dragon, and Reference Lake C) and were highest in Fold Lake (15,000 individuals/m^3).

Rotifers and crustaceans dominated the zooplankton communities in all lakes (Figure 3.7-2). Rotifers tended to be more dominant in Goose area lakes and made up almost all of the zooplankton community in Gander Lake. Crustaceans were more dominant in George area lakes and made up almost all of the communities in Lytle, Occurrence, and Sleigh lakes. The most dominant crustacean families were Diaptomidae, a family of calanoid copepods, and Daphniidae, a family of water fleas. The most dominant rotifer families were Brachionidae and Conochilidae.

Lakes were dominated by a few highly abundant genera. The three most abundant genera comprised between 60% and 100% of zooplankton communities at all lakes, with the exception of Reference Lake C where unidentified cyclopoid copepods made up 77% of the community (Table 3.7-1). Common zooplankton genera included the rotifers *Kellicottia* and *Conochilus,* and the crustaceans *Leptodiaptomus*, *Daphnia,* and *Holopedium*.

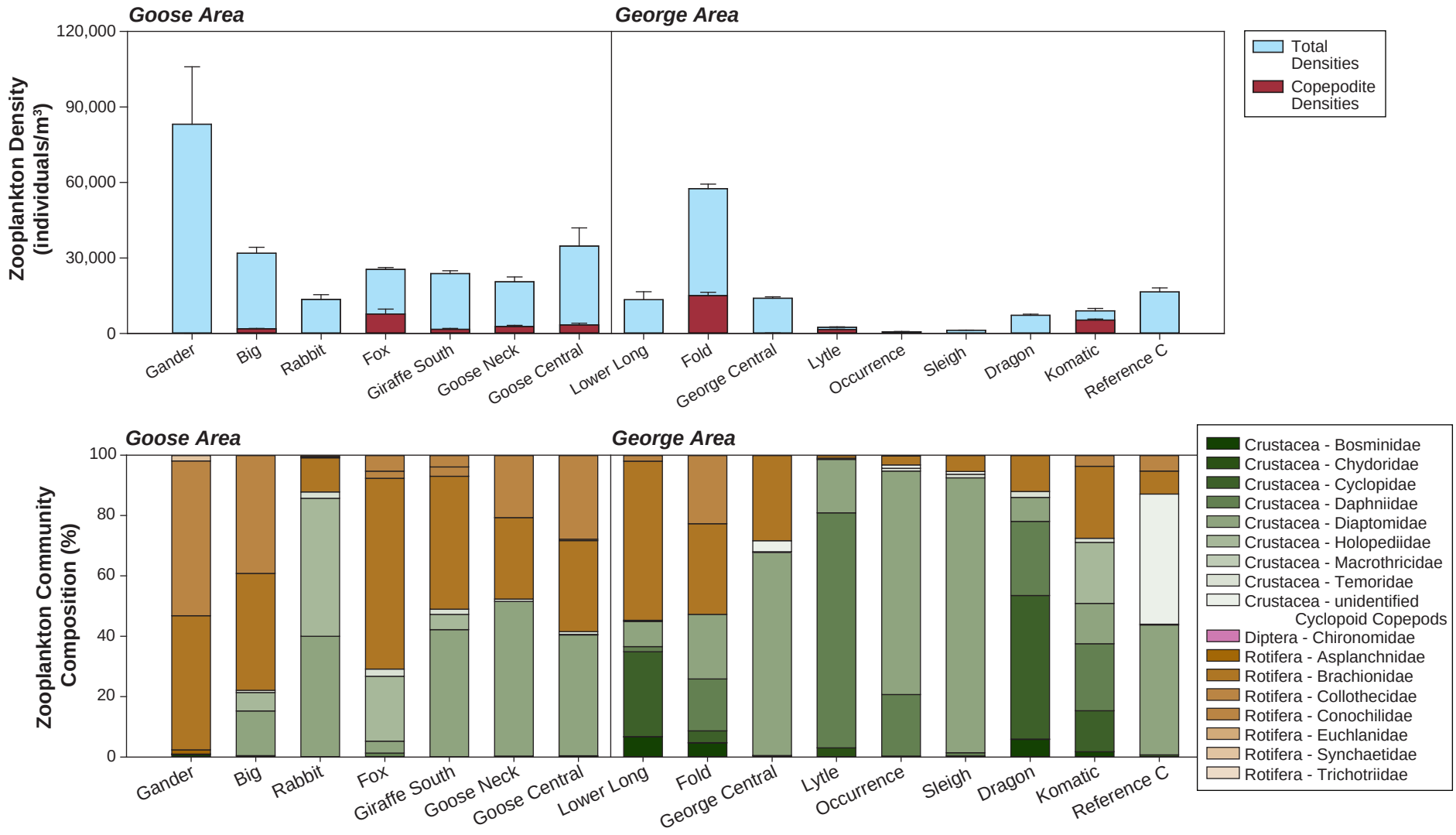
Note over two thirds of zooplankton individuals at George Lake Central were not able to be identified to genus level, with most of these being copepods from the Diaptomidae family.

3.7.1.2 Richness and Diversity

Note, due to differences in depth and sampling, the volume of water sampled for zooplankton varied between sites from an average of 0.54 m^3 to 0.98 m^3 at most lakes, with the much deeper Reference Lake C having sampled 1.57 m^3. Additionally, taxonomists analyzed a subsample of each sample, which differed between replicates. This could affect diversity and richness calculations, which were done per sample and do not linearly correlate with sampling volume or effort.

Average zooplankton genera richness varied between lakes, with Goose area lakes tending to having higher richness than George area lakes (Figure 3.7-2). The average genera richness ranged from 5.0 to 10.3 genera/sample, with the exception of George Lake Central which had a particularly low richness of just 2.7 genera/sample.

Diversity was also variable between lakes, ranging between 0.3 and 0.8 on the Simpson's diversity index. The exceptions were two George area lakes, George Lake Central and Sleigh, which had much lower diversity averaging 0.05 and 0.14, respectively (Figure 3.7-2). George Central was dominated mainly by individuals unidentified to the genus level (mostly copepods from the Diaptomidae family), while Sleigh Lake was 88% *Leptodiaptomus*.



Notes: Error bars represent the standard error of the mean of the total density.
Community composition values represent the mean of triplicate replicates.
Density data does not include nauplii, composition data does not include nauplii or copepodites.

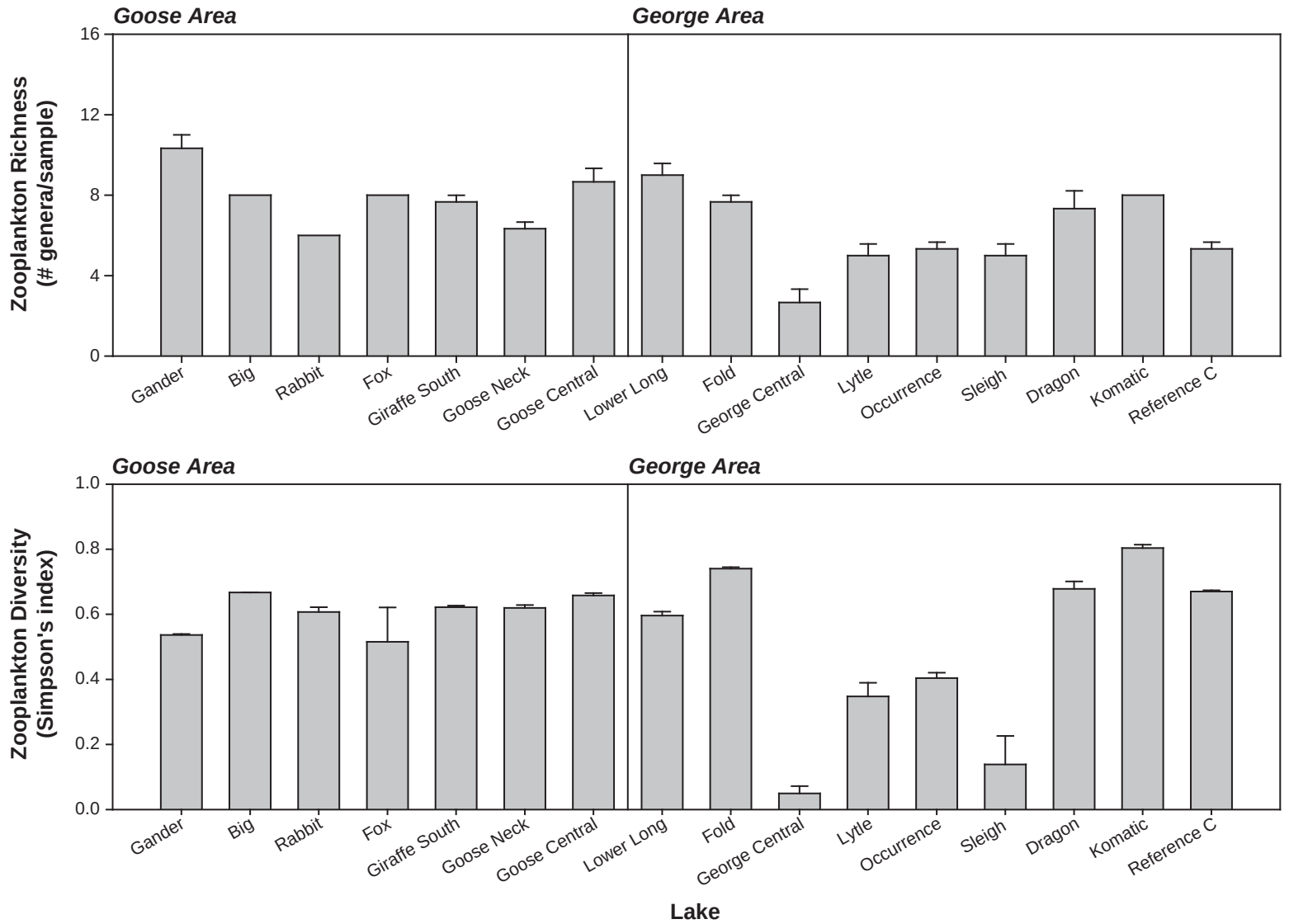
Figure 3.7-1

Sabina GOLD & SILVER CORP.

Zooplankton Density and Community Composition in Lakes, Back River Project, 2012

Figure 3.7-1

Rescan™ Engineers & Scientists



Notes: Error bars represent standard error of the mean.
Diversity and richness data does not include nauplii or copepodites or organisms not identified to the genus level.

Figure 3.7-2

Sabina GOLD & SILVER CORP.

Zooplankton Richness and Diversity in Lakes, Back River Project, 2012

Figure 3.7-2

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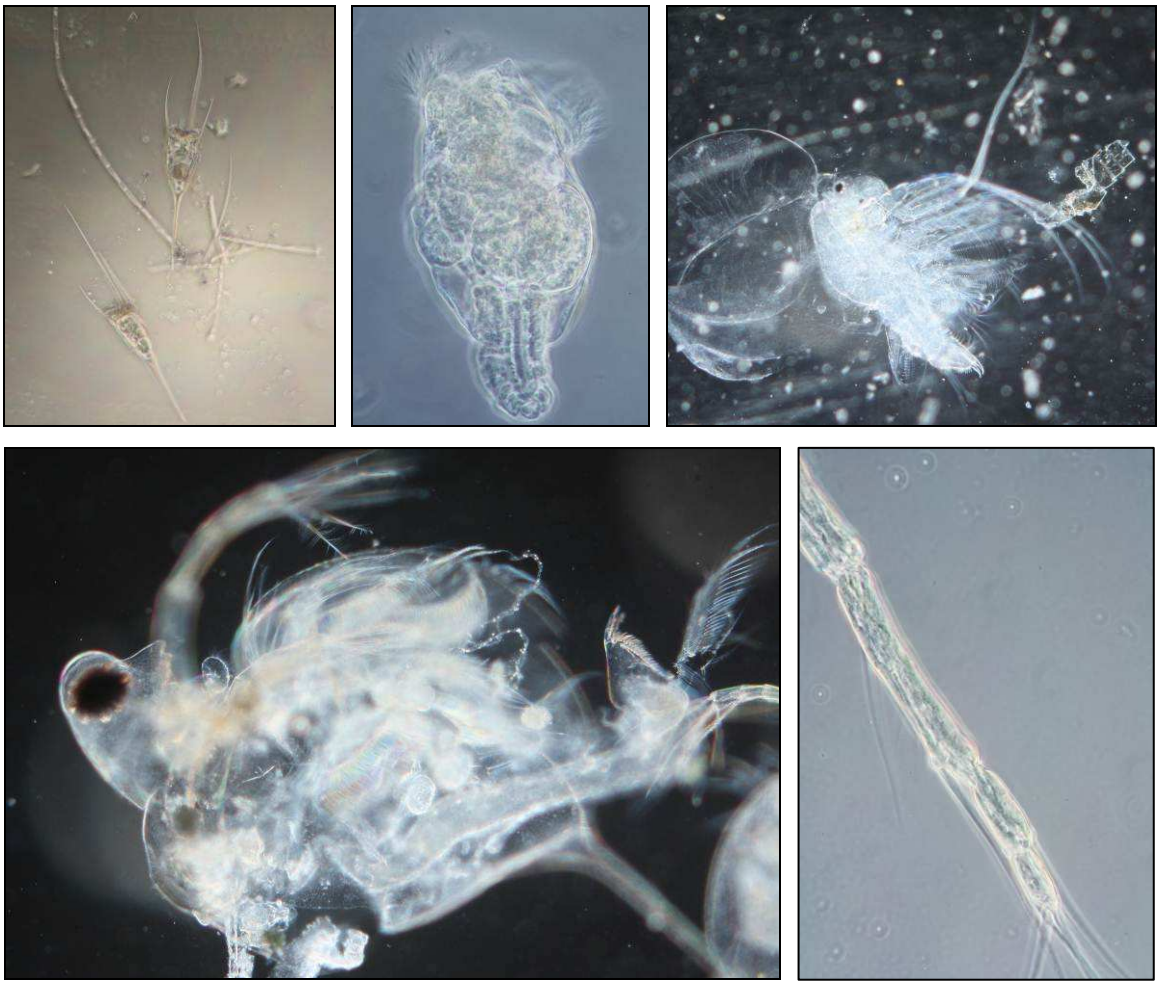


Plate 3.7-1. Some of the most abundant zooplankton taxa observed. From top left to bottom right, Kellicottia longispina, Conochilus unicornis, Holopedium gibberum, Daphnia middenorffiana *and the antennae of a* Leptodiaptomus pribilofensis *used in taxonomic identification.*

Table 3.7-1. Most Abundant Zooplankton Genera in Lakes, Back River Project, 2012

Lake	Most Abundant Zooplankton Genera		
	Major Taxonomic Group	Genus	% Relative Abundance
Goose Area			
Gander	Rotifera - Conochilidae	*Conochilus*	51.3
	Rotifera - Brachionidae	*Kellicottia*	44.3
	Rotifera - Synchaetidae	*Synchaeta*	1.9
Big	Rotifera - Conochilidae	*Conochilus*	39.2
	Rotifera - Brachionidae	*Kellicottia*	38.7
	Crustacea - Diaptomidae	*Leptodiaptomus*	14.8
Rabbit	Crustacea - Holopedidae	*Holpedium*	45.7
	Crustacea - Diaptomidae	*Leptodiaptomus*	40.0
	Rotifera - Brachionidae	*Kellicottia*	11.4
Fox	Rotifera - Brachionidae	*Kellicottia*	63.2

(continued)

Table 3.7-1. Most Abundant Zooplankton Genera in Lakes, Back River Project, 2012 (completed)

Lake	Most Abundant Zooplankton Genera		
	Major Taxonomic Group	Genus	% Relative Abundance
Goose Area *(cont'd)*			
	Crustacea - Holopedidae	*Holpedium*	21.5
	Rotifera - Conochilidae	*Conochilus*	5.3
Giraffe South	Rotifera - Brachionidae	*Kellicottia*	44.0
	Crustacea - Diaptomidae	*Leptodiaptomus*	42.1
	Crustacea - Holopedidae	*Holpedium*	5.1
Goose Neck	Crustacea - Diaptomidae	*Leptodiaptomus*	51.2
	Rotifera - Brachionidae	*Kellicottia*	27.0
	Rotifera - Conochilidae	*Conochilus*	20.6
Goose Central	Crustacea - Diaptomidae	*Leptodiaptomus*	40.0
	Rotifera - Brachionidae	*Kellicottia*	30.1
	Rotifera - Conochilidae	*Conochilus*	27.8
George Area			
Lower Long	Rotifera - Brachionidae	*Kellicottia*	52.6
	Crustacea - Cyclopidae	*Cyclops*	28.1
	Crustacea - Bosminidae	*Eubosmina*	6.7
Fold	Rotifera - Brachionidae	*Kellicottia*	29.6
	Rotifera - Conochilidae	*Conochilus*	22.7
	Crustacea - Daphniidae	*Daphnia*	17.2
George Central	Rotifera - Brachionidae	*Kellicottia*	28.4
	Crustacea - Cyclopidae	*Cyclops*	0.4
	Crustacea - Temoridae	*Heterocope*	0.3
Lytle	Crustacea - Daphniidae	*Daphnia*	77.9
	Crustacea - Diaptomidae	*Leptodiaptomus*	17.7
	Crustacea - Chydoridae	*Eurycercus*	1.3
Occurrence	Crustacea - Diaptomidae	*Leptodiaptomus*	70.5
	Crustacea - Daphniidae	*Daphnia*	20.4
	Rotifera - Brachionidae	*Kellicottia*	3.1
Sleigh	Crustacea - Diaptomidae	*Leptodiaptomus*	88.4
	Rotifera - Brachionidae	*Kellicottia*	5.4
	Crustacea - Temoridae	*Heterocope*	1.2
Dragon	Crustacea - Cyclopidae	*Cyclops*	47.5
	Crustacea - Daphniidae	*Daphnia*	24.5
	Rotifera - Brachionidae	*Kellicottia*	12.0
Komatic	Rotifera - Brachionidae	*Kellicottia*	23.9
	Crustacea - Daphniidae	*Daphnia*	22.2
	Crustacea - Holopedidae	*Holpedium*	20.2
Reference C	Crustacea - Diaptomidae	*Leptodiaptomus*	8.9
	Rotifera - Conochilidae	*Conochilus*	5.2
	Rotifera - Brachionidae	*Kellicottia*	4.8

Note: Nauplii and copepodites were not included in this table, individuals not identified to genus level were used only to calculate relative abundance.

3.7.2 Lake Benthic Macroinvertebrates

Lake benthic macroinvertebrate (benthos) samples were collected in August 2012. Figures 3.7-3 and 3.7-4 present 2012 lake benthos results, and all raw data are presented in Appendices 3.7-5 to 3.7-7. Note only four replicates were collected at Giraffe Lake South due to the substrate type limiting the sampling success with the Ekman. Sorting efficiencies for lake benthos samples were above 90% on the first sort for all but two samples, suggesting robust data free of sorting bias.

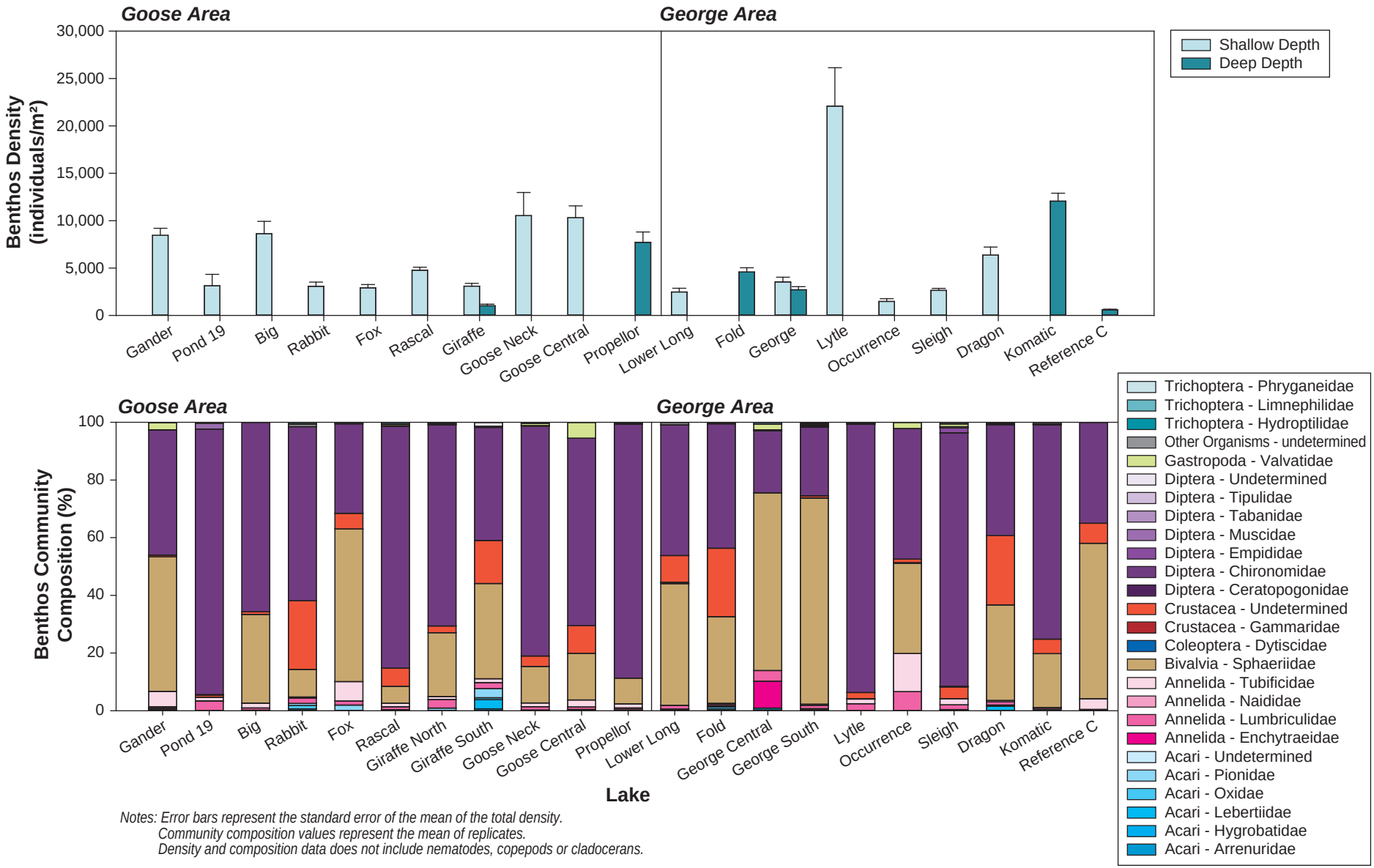
3.7.2.1 Density and Community Composition

Average benthos densities varied considerably between lakes (Figure 3.7-3). Most lakes ranged from 600 individuals/m^2 (Reference Lake C; deep depth) to 10,500 individuals/m^2 (Goose Lake Neck), with considerably more benthic invertebrates at Lytle Lake (22,000 individuals/m^2).

Benthic communities at all lake sites were dominated by dipterans (true flies) and bivalves (small to tiny pea clams from the family Sphaeriidae; Plate 3.7-2). These two taxa averaged between 70% and 97% of lake benthic communities (Figure 3.7-3). Other benthic invertebrates found in lakes included annelids (ringed worms), crustaceans, coleopterans (true beetles) and trichopterans (caddisflies).

Plate 3.7-2. Bivalves from family Sphaeriidae were common in lake benthic communities, above seen on sediment surface at Rascal Lake in August 2012.

The most abundant three genera made up on average between 34% and 89% of the benthic community at each lake (Table 3.7-2). Approximately half the lakes had *Psidium* (the bivalve pea clam) and *Procladius* (the chironomid dipterans that are non-biting midges) in the top three genera. Other genera in the top three taxa for approximately a quarter of lakes sampled included the chironomid dipterans: *Paratanytarsus, Psectrocladius, Stictochironomus,* and *Tanytarsus*. There was no clear difference between abundant taxa in Goose area lakes and George area lakes.



Notes: Error bars represent the standard error of the mean of the total density.
Community composition values represent the mean of replicates.
Density and composition data does not include nematodes, copepods or cladocerans.

Figure 3.7-3

Sabina GOLD & SILVER CORP.

Benthos Density and Community Composition in Lakes, Back River Project, 2012

Figure 3.7-3

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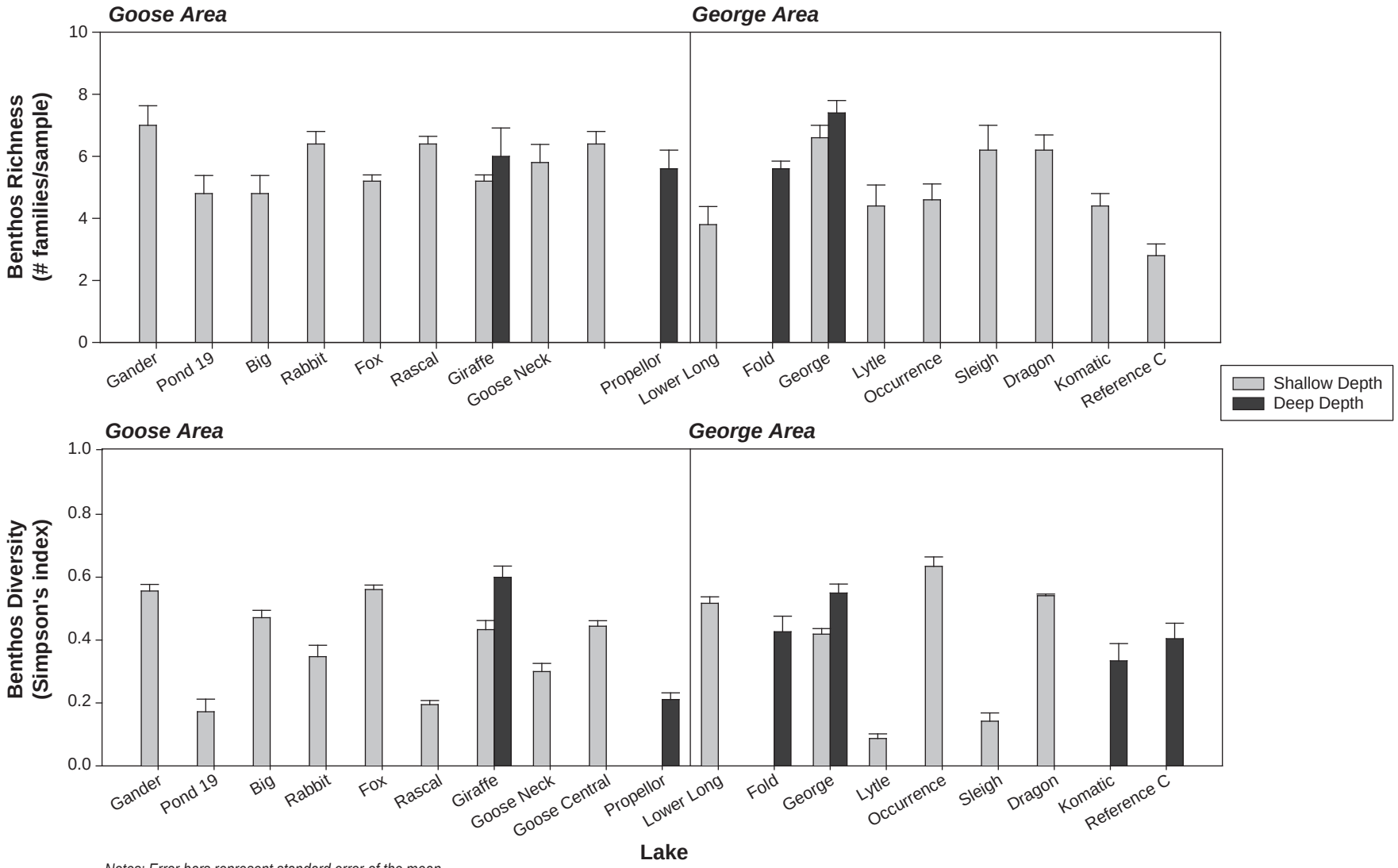

Notes: Error bars represent standard error of the mean.
Diversity and richness data does not include nematodes, copepods, cladocerans or organisms not identified to the family level.

Figure 3.7-4

Sabina GOLD & SILVER CORP.

Benthos Richness and Diversity in Lakes, Back River Project, 2012

Figure 3.7-4

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Table 3.7-2. Most Abundant Benthic Macroinvertebrate Genera in Lakes, Back River Project, 2012

Lake	Most Abundant Lake Benthos Genera		
	Major Taxonomic Group	Genus	% Relative Abundance
Goose Area			
Gander	Bivalvia	*Pisidium*	31.4
	Insecta - Diptera	*Dicrotendipes*	12.7
	Insecta - Diptera	*Procladius*	7.6
Pond 19	Insecta - Diptera	*Paratanytarsus*	35.9
	Insecta - Diptera	*Tanytarsus*	18.9
	Insecta - Diptera	*Psectrocladius*	13.5
Big	Insecta - Diptera	*Cladotanytarsus*	35.4
	Bivalvia	*Pisidium*	22.3
	Insecta - Diptera	*Tanytarsus*	12.7
Rabbit	Insecta - Diptera	*Psectrocladius*	20.0
	Insecta - Diptera	*Procladius*	16.2
	Insecta - Diptera	*Tanytarsus*	10.2
Fox	Bivalvia	*Pisidium*	44.7
	Insecta - Diptera	*Procladius*	10.0
	Insecta - Diptera	*Cladotanytarsus*	4.9
Rascal	Insecta - Diptera	*Corynocera*	34.4
	Insecta - Diptera	*Cladotanytarsus*	9.9
	Insecta - Diptera	*Paratanytarsus*	8.4
Giraffe North	Bivalvia	*Pisidium*	15.0
	Insecta - Diptera	*Procladius*	14.5
	Insecta - Diptera	*Tanytarsus*	12.9
Giraffe South	Bivalvia	*Pisidium*	15.8
	Insecta - Diptera	*Zalutschia*	9.8
	Insecta - Diptera	*Pagastiella*	8.4
Goose Neck	Insecta - Diptera	*Pagastiella*	49.4
	Insecta - Diptera	*Psectrocladius*	7.0
	Insecta - Diptera	*Stictochironomus*	6.7
Goose Central	Insecta - Diptera	*Stictochironomus*	15.5
	Insecta - Diptera	*Tanytarsus*	13.0
	Insecta - Diptera	*Corynocera*	8.7
Propellor	Insecta - Diptera	*Zalutschia*	61.1
	Bivalvia	*Pisidium*	6.2
	Insecta - Diptera	*Corynocera*	4.8
George Area			
Lower Long	Bivalvia	*Pisidium*	25.4
	Insecta - Diptera	*Paratanytarsus*	15.7
	Insecta - Diptera	*Microtendipes*	9.8
Fold	Insecta - Diptera	*Stictochironomus*	21.5
	Bivalvia	*Pisidium*	20.3
	Insecta - Diptera	*Procladius*	5.6

(continued)

Table 3.7-2. Most Abundant Benthic Macroinvertebrate Genera in Lakes, Back River Project, 2012 (completed)

Lake	Most Abundant Lake Benthos Genera		
	Major Taxonomic Group	Genus	% Relative Abundance
George Area *(cont'd)*			
George South	Bivalvia	*Pisidium*	41.5
	Insecta - Diptera	*Procladius*	7.4
	Insecta - Diptera	*Thienemannimyia*	4.5
George Central	Bivalvia	*Pisidium*	31.5
	Insecta - Diptera	*Procladius*	12.3
	Insecta - Diptera	*Psectrocladius*	4.5
Lytle	Insecta - Diptera	*Paratanytarsus*	83.4
	Insecta - Diptera	*Procladius*	3.9
	Insecta - Diptera	*Psectrocladius*	2.1
Occurrence	Insecta - Diptera	*Paratanytarsus*	19.1
	Bivalvia	*Pisidium*	17.7
	Insecta - Diptera	*Procladius*	7.6
Sleigh	Insecta - Diptera	*Paratanytarsus*	63.0
	Insecta - Diptera	*Tanytarsus*	6.3
	Insecta - Diptera	*Stictochironomus*	4.9
Dragon	Bivalvia	*Pisidium*	21.0
	Insecta - Diptera	*Procladius*	14.7
	Insecta - Diptera	*Stictochironomus*	8.2
Komatic	Insecta - Diptera	*Corynocera*	23.2
	Insecta - Diptera	*Micropsectra*	16.2
	Insecta - Diptera	*Microtendipes*	13.2
Reference C	Bivalvia	*Pisidium*	26.8
	Insecta - Diptera	*Stictochironomus*	23.4
	Insecta - Diptera	*Procladius*	4.9

Note: Nematodes, copepods and cladocerans were not included in this table, individuals not identified to genus level were used only to calculate relative abundance.

3.7.2.2 Richness and Diversity

Benthos family richness ranged from 2.4 to 7.4 families/sample, with Reference Lake C having the lowest family richness and George Lake Central and Gander Lake had the highest (Figure 3.7-4). Richness and diversities showed no clear patterns with depth.

Diversity in lake benthos communities was highly variable, ranging from low levels at Lytle (average Simpson's diversity index of 0.09) to moderate levels at Giraffe Lake South and Occurrence Lake (average Simpson's diversity index of 0.6). Note at Lytle Lake where diversity was particularly low, 83% of the community was made up of a single genus (*Paratanytarsus*).

3.7.3 Stream Benthic Macroinvertebrates

Stream benthos samples were collected in August 2012. No benthos samples could be collected at Echo OF as it was dry during August sampling; no samples could be collected from Llama OF due to the boulder substrate type. Only two replicates could be collected at Pond 19 OF due to the low water levels and flow.

Figures 3.7-5 and 3.7-6 present the 2012 results, and all raw data are presented in Appendices 3.7-8 to 3.7-10.

3.7.3.1 Density and Community Composition

In most streams, benthos densities ranged from an average of 500 organisms/m^2 (Chair OF) to 4,700 organisms/m^2 (Sleigh OF; Figure 3.7-5), which was a similar range of densities to those observed in the 2011 stream sampling program (Rescan 2012). There were no clear spatial patterns between Goose and George area lakes in 2012.

Stream benthos communities were dominated by dipterans, which averaged over half of the benthic organisms sampled at all streams (Figure 3.7-5). The majority of the dipterans were chironomids, also known as non-biting midges. Acari (arachnid mites and ticks) and annelid worms were also present, averaging between 5% and 10% of the benthos community.

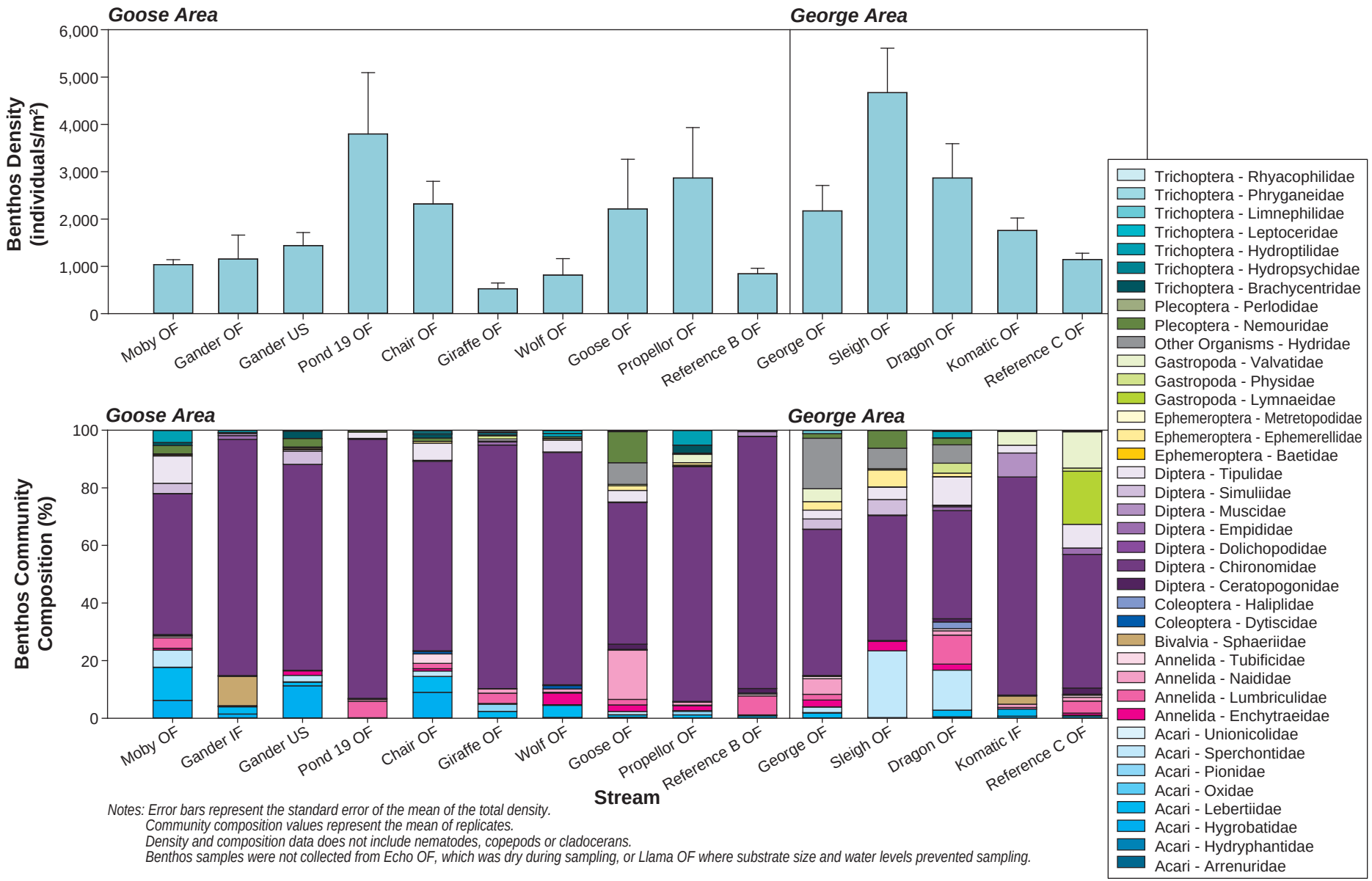
The remainder of the community was made up of bivalves (in the pea clam family Sphaeriidae), Coleoptera (snails and slugs), Ephemeroptera (mayflies), Gastropoda (snails), hydra (in the same phylum as jellies), Plecoptera (stoneflies) and Trichoptera (caddisflies), generally averaging less than 5% of the community. Ephemeroptera, Plecoptera, and Trichoptera (together termed EPT) are pollution sensitive taxa, often used as indicators of good water quality. On average, EPT made up between 0.3% (Komatic IF) and 12.9% (Goose OF) of the stream benthos communities. There was no clear spatial trend in EPT densities between Goose and George area streams.

The most abundant three genera averaged between 29% and 31% of stream benthic communities (Table 3.7-3). In several streams, a single genus made up over 20% of the benthic community, with the most dramatic example being the chironomid *Paratantarsus* at Giraffe OF, which made up 40.5%. Abundant genera were mainly dipterans, with the chironomid *Thienemannimyia* as the most common dominant genus being in the top three genera in a quarter of all stream benthic communities. Other abundant genera were acarins, gastropods, hydrozoans, and annelids.

3.7.3.2 Richness and Diversity

Family richness was higher in stream benthos communities than in lake benthos communities, and was somewhat variable among streams, ranging from 7.2 families/sample at Reference B OF to 17.6 families/sample at Dragon OF (Figure 3.7-6). The lowest richness was observed in the Goose area streams Gander IF, Pond 19 OF, Giraffe OF and Reference B OF.

Stream benthos communities had low to moderately high diversities, ranging from 0.19 at Pond 19 to 0.77 at Dragon OF on the Simpson's index. Spatial patterns in diversity followed those of richness, with lower richness and diversity at Gander IF, Pond 19 OF, Giraffe OF and Reference B OF, and highest richness and diversity at Dragon OF.



Notes: Error bars represent the standard error of the mean of the total density.
Community composition values represent the mean of replicates.
Density and composition data does not include nematodes, copepods or cladocerans.
Benthos samples were not collected from Echo OF, which was dry during sampling, or Llama OF where substrate size and water levels prevented sampling.

Figure 3.7-5

Sabina GOLD & SILVER CORP.

Benthos Density and Community Composition in Streams, Back River Project, 2012

Figure 3.7-5

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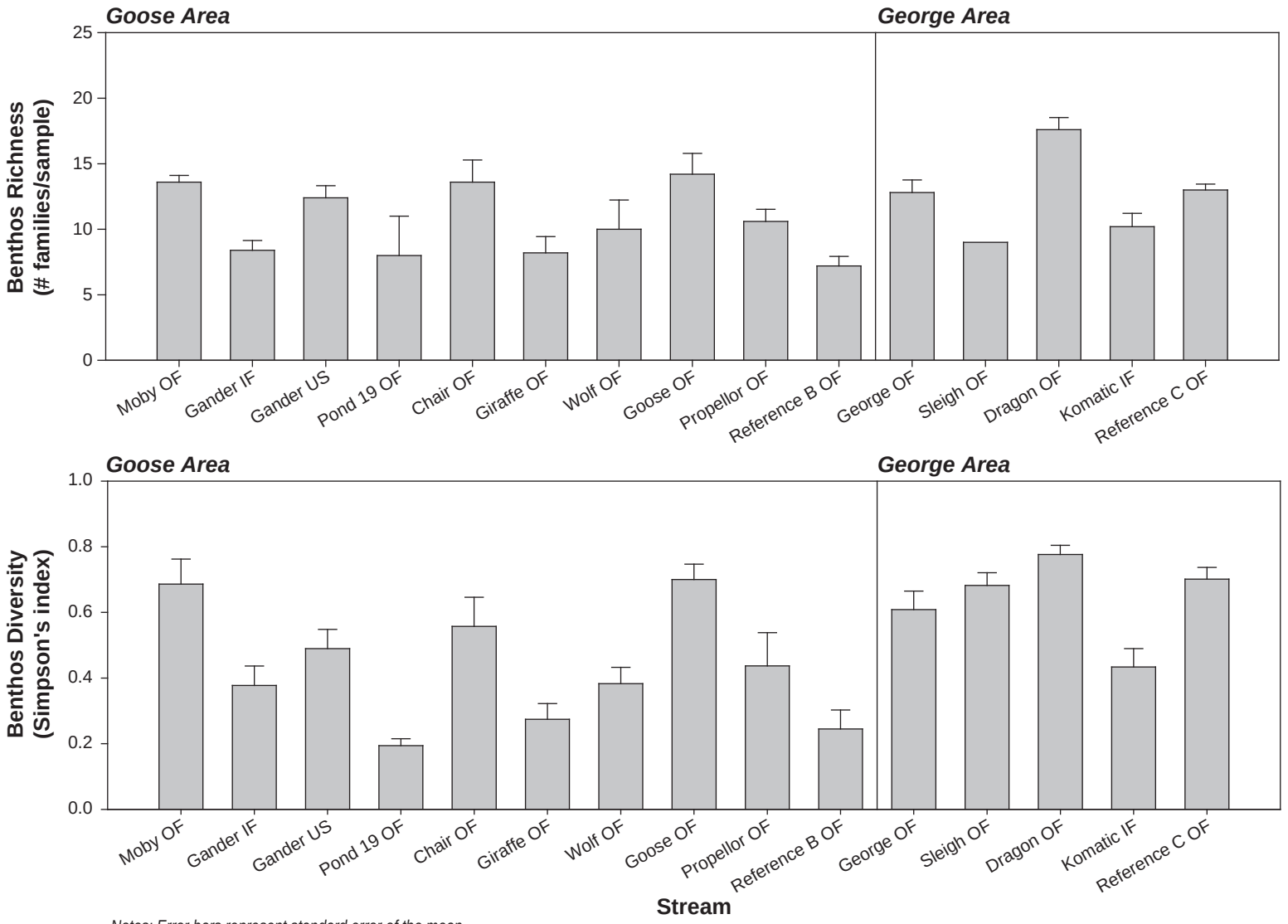

Notes: Error bars represent standard error of the mean.
Diversity and richness data does not include nematodes, copepods, cladocerans or organisms not identified to the family level.
Benthos samples were not collected from Echo OF, which was dry during sampling, or Llama OF where boulders and low water levels prevented sampling.

Figure 3.7-6

Sabina GOLD & SILVER CORP.

Benthos Richness and Diversity in Streams, Back River Project, 2012

Figure 3.7-6

Rescan™ Engineers & Scientists

Table 3.7-3. Most Abundant Benthic Macroinvertebrate Genera in Streams, Back River Project, 2012

Stream	Most Abundant Stream Benthos Genera		
	Major Taxonomic Group	Genus	% Relative Abundance
Goose Area			
Moby OF	Acari	*Lebertia*	11.4
	Insecta - Diptera	*Thienemannimyia*	10.3
	Insecta - Diptera	*Tipula*	7.0
Gander IF	Insecta - Diptera	*Cladotanytarsus*	17.7
	Insecta - Diptera	*Polypedilum*	15.4
	Insecta - Diptera	*Stempellina*	12.4
Gander US	Insecta - Diptera	*Rheotanytarsus*	20.3
	Insecta - Diptera	*Euryhapsis*	18.2
	Insecta - Diptera	*Tvetenia*	15.5
Pond 19 OF	Insecta - Diptera	*Paratanytarsus*	25.3
	Insecta - Diptera	*Psectrocladius*	19.0
	Insecta - Diptera	*Zalutschia*	12.4
Chair OF	Insecta - Diptera	*Thienemannimyia*	20.7
	Insecta - Diptera	*Polypedilum*	19.8
	Acari	*Hygrobates*	8.9
Giraffe OF	Insecta - Diptera	*Paratanytarsus*	40.5
	Insecta - Diptera	*Psectrocladius*	12.0
	Insecta - Diptera	*Dicrotendipes*	8.4
Wolf OF	Insecta - Diptera	*Thienemannimyia*	14.6
	Insecta - Diptera	*Dicrotendipes*	13.0
	Insecta - Diptera	*Cricotopus*	8.3
Goose OF	Insecta - Diptera	*Cricotopus*	17.7
	Annelida	*Nais*	15.9
	Hydrozoa	*Hydra*	7.4
Propellor OF	Insecta - Diptera	*Cricotopus*	29.6
	Insecta - Diptera	*Zalutschia*	17.6
	Insecta - Diptera	*Paratanytarsus*	10.9
Reference B OF	Insecta - Diptera	*Procladius*	28.7
	Insecta - Diptera	*Psectrocladius*	20.0
	Insecta - Diptera	*Tanytarsus*	7.1
George Area			
George OF	Hydrozoa	*Hydra*	17.5
	Insecta - Diptera	*Cricotopus*	15.4
	Insecta - Diptera	*Thienemannimyia*	12.0
Sleigh OF	Acari	*Sperchon*	23.0
	Insecta - Diptera	*Euryhapsis*	18.3
	Insecta - Diptera	*Saetheria*	7.9
Dragon OF	Insecta - Diptera	*Thienemannimyia*	21.7
	Acari	*Sperchon*	13.7

(continued)

Table 3.7-3. Most Abundant Benthic Macroinvertebrate Genera in Streams, Back River Project, 2012 (completed)

Stream	Most Abundant Stream Benthos Genera		
	Major Taxonomic Group	Genus	% Relative Abundance
George Area *(cont'd)*			
	Insecta - Diptera	*Tipula*	9.7
Komatic IF	Insecta - Diptera	*Procladius*	17.0
	Insecta - Diptera	*Polypedilum*	16.5
	Insecta - Diptera	*Saetheria*	13.3
Reference C OF	Insecta - Diptera	*Paratanytarsus*	16.8
	Insecta - Diptera	*Thienemannimyia*	14.5
	Gastropoda	*Valvata*	12.4

Note: Nematodes, copepods, cladocerans and fish were not included in this table, individuals not identified to genus level were used only to calculate relative abundance.

4. Summary

4. Summary

The 2012 freshwater baseline program involved collecting information for the following: lake water quality and physical limnology (under-ice and open water), lake sediment quality, lake phytoplankton, lake zooplankton, lake benthos, stream water quality (freshet, summer and fall), stream sediment quality, stream periphyton, and stream benthos. The program included collecting samples from lakes and streams in areas that could potentially be influenced by the development of known deposits and proposed infrastructure. A reference lake and two reference streams, located well away from known deposits and proposed infrastructure, were also sampled.

A total of 20 lakes (24 sampling sites) and 16 streams (17 sampling sites) were sampled in the Goose and George areas in 2012. Lakes sampled in the Goose Property included Moby, Gander, Pond 19, Big, Rabbit, Fox, Echo, Rascal, Giraffe, Goose and Propellor. Lakes sampled in the George Property included Lower Long, Fold, George, Lytle, Occurrence, Sleigh, Dragon, Komatic and Reference C. Streams sampled in the Goose Property were Moby Outflow, Gander River, Pond 19 Outflow, Chair Watershed Outflow, Llama Watershed Outflow, Echo Watershed Outflow, Giraffe Watershed Outflow, Wolf Watershed Outflow, Goose Watershed Outflow, Propellor Watershed Outflow and Reference B Outflow. Streams sampled within the George Property were George Outflow, Sleigh Outflow, Dragon Outflow, Komatic Inflow and Reference C Outflow.

Lakes tended to be stratified in April and well mixed in August. Dissolved oxygen concentrations at bottom depths were below CCME minimum dissolved oxygen guidelines at most lakes sampled, with lakes in the George Property tending to be below guidelines at all depths in August. Lakes in the study area had slightly acidic to slightly basic pH, with Rabbit Lake and Rascal Lake in August being slightly below the CCME guideline of 6.5. Generally, lakes sampled had low hardness and conductivity. Reference Lake C in April and August and Dragon and Komatic lakes in April had higher hardness values and could be classified as moderately hard. Nutrients were generally low at all lake sampling sites, particularly bioavailable forms, and lake trophic status was usually ultra-oligotrophic to oligotrophic.

All lakes except Lower Long had naturally occurring waters that were higher than CCME guidelines in at least one sample for at least one of the following metals: total aluminum, total cadmium, total copper, total iron, total lead and total nickel. Average concentrations were naturally greater than CCME guidelines for at least one parameter out of aluminum, cadmium, copper, iron and lead at over two thirds of lakes. The soft waters meant lower hardness-dependent CCME guideline concentrations, which were in some cases lower than achievable analytical detection limits (e.g., for cadmium at Big Lake, Rabbit Lake and Propellor Lake). Goose Property lakes tended to have higher naturally occurring metal concentrations compared to George Property lakes.

Lake sediments had high concentrations of arsenic, cadmium, chromium, copper, and zinc that often were greater than their respective CCME ISQG. All lakes except Pond 19 had at least one sample greater than the CCME ISQGs for at least one metal, with most lakes having naturally elevated arsenic or copper. Over half of the sampled lakes had average lake sediment arsenic concentrations that were greater than CCME PELs, with the highest average concentrations 16.5 and 20.3 times the PEL (found at Fold and Komatic lakes, within the George Property).

Phytoplankton communities were made up of Chlorophyceae (green algae), Myxophyceae (cyanobacteria), Cryptophyceae (a class of flagellated algae), Bacillariophyceae (diatoms) and Chrysophyceae (golden algae) with compositions and densities varying between April and August

samples, and between lakes. Zooplankton communities were mainly composed of rotifers and crustaceans. Rotifers tended to be more dominant in Goose Property lakes, while crustaceans tended to be more dominant in George Property lakes. Benthic communities at all lake sites were dominated by dipterans (true flies) and bivalves (small to tiny clams from the family Sphaeriidae), and densities varied between lakes.

Echo Outflow in the Goose Property was dry during the August sampling, and many of the other streams in both the Goose Property and George Property had dry or underground sections. Streams in August had dissolved oxygen concentrations below 10.0 mg/L, with a third of the sampling sites below the CCME minimum dissolved oxygen guideline for the protection of freshwater aquatic life for early life stages (9.5 mg/L).

Streams and rivers in the study area had slightly acidic to slightly basic pH. The lowest pH values observed were outside of the CCME guideline range for freshwater aquatic health (pH range 6.5 to 9), at Chair Outflow in June (6.1), and Echo Outflow in June and Sept (6.0). Hardness, conductivity and total dissolved solids were low in most streams, although considerably higher in Llama OF and also Reference C Outflow during August and September (moderately hard). Nitrate, nitrite and ammonia concentrations were generally low, often near or below detection limits, with most sites reflecting ultra-oligotrophic to oligotrophic conditions.

All streams except Dragon Outflow and Reference C Outflow had naturally occurring waters that were greater than CCME guidelines in at least one sample for at least one of the following metals: total aluminum, total cadmium, total copper, total iron and total nickel. Average concentrations were greater than CCME guidelines for at least one metal parameter at most streams. Parameters where average stream concentrations were naturally greater than guidelines included aluminum (two streams), cadmium (most streams), copper (almost a third of streams), iron (one stream) and nickel (one stream).

Goose Property streams tended to have higher naturally occurring metal concentrations compared to George Property streams. The small Echo Outflow in the Goose Property had the greatest number of naturally elevated parameters (aluminum, cadmium and copper) with average aluminum concentrations 22 times higher and average cadmium concentrations 18 times higher than the CCME guidelines.

Stream sediments had metal concentrations that were similar or lower than in lake sediments, and in some cases were greater than the CCME ISQGs. Over half of the streams had at least one sediment sample that was naturally greater than the CCME ISQG for at least one of the following metals; arsenic, chromium and copper. Arsenic was the most commonly naturally elevated metal, with almost half of streams having average concentrations that were greater than ISQGs. Arsenic was the metal most naturally elevated in sediments, and concentrations were above the CCME PEL at Propellor Outflow, George Outflow and Dragon Outflow with the maximum concentration being 3.4 times the PEL.

Periphyton communities were dominated by cyanobacteria and diatoms, and densities varied between streams. Benthos communities were mainly composed of chironomid dipterans (nonbiting midges), and densities also varied between streams with highest densities at Pond 19 Outflow (Goose Property) and Sleigh Outflow (George Property).

A comprehensive summary table of results from all lakes sampled in 2012 is provided in Table 4-1, and a summary table of results from all streams sampled is provided in Table 4-2.

Table 4-1. Summary of 2012 Freshwater Baseline Results for Lakes

		Dissolved Oxygen	Water Quality			Sediment Quality	Primary producers	Aquatic Macroinvertebrates	
Lake	Summer Sampling Max Depth (m)	Seasons and Depths that Exceed CCME Guidelines*	General Description	Nutrient Status	CCME Guideline Exceedances*	CCME Guideline Exceedances*	Phytoplankton	Zooplankton	Benthos
Goose Area									
Moby	14.8	none	near neutral, soft, low TDS	ultraoligotrophic	Cd	nc	moderate chl a biomass, low densities, more than 60% chlorophytes	nc	nc
Gander	2.4	all life stages: Apr, all depths	near neutral, soft, low TDS	oligotrophic - mesotrophic	Cd, Cu	ISQG: As, Cr	euglenophytes present; highest richness	highest densities; vast majority rotifers; highest richness	high densities; high richness and diverstiy
Pond 19	1.5	none	slightly basic, soft, low TDS	ultraoligotrophic	Cu	PEL: As	nc	nc	low densities; vast majority dipteran; low richness and diversity
Big	5.0	all life stages: Apr, bottom depths	near neutral, soft, low TDS	ultraoligotrophic - oligotrophic	Cd	ISQG: As, Cu; PEL: As	moderate chl *a* biomass and densities, highest richness in Aug	rotifer dominated; high richness	high densities; over half dipteran; low richness; moderate diversity
Rabbit	3.6	none	slightly acidic, soft, low TDS	ultraoligotrophic	pH, Al, Cd and Cu	ISQG: As, Cu; PEL: As	low chl a biomass; almost 80% myxophyte (cyanobacteria)	moderate densities; crustacean dominated; moderate richness; high diversity	low densities; over half dipteran; high richness
Fox	5.8	early life stages: Apr, bottom depths	near neutral, soft, low TDS	ultraoligotrophic - oligotrophic	Cd and Pb	ISQG: As, Cu; PEL: As	low densities, only Goose area lake with significant chrysophyte component	highest copepodite densities; rotifer dominated; high richness	low densities; over half bivalves
Echo	0.4	none	near neutral, soft, low TDS	mesoeutrophic	Cu and Fe	ISQG: As, Cu	nc	nc	nc
Rascal	2.8	all life stages: Apr, all depths	near neutral, soft, low TDS	ultraoligotrophic - oligotrophic	pH, Al, Cd and Cu	ISQG: Cu	relatively high chl *a* biomass, low density, more than 90% cryptophytes, lowest richness and low diversity	nc	vast majority dipteran; moderate richness; low diversity
Giraffe North	3.7	none	near neutral, soft, low TDS	ultraoligotrophic - oligotrophic	Cd and Cu	ISQG: As, Cu	low chl *a* biomass, low densities, moderate richness and high diversity	nc	low densities; over half dipteran
Giraffe South	7.7	all life stages: Apr, bottom depths; Early life stages: Apr, bottom depths	near neutral, soft, low TDS	ultraoligotrophic	Cd and Cu	ISQG: As, Cu	low Apr biomass and densities, over 80% cryptophyte in Apr; greatest genera richness in Aug, high diversity	moderate densities; moderate richness and diversity	low densities; high diversity
Goose Neck	3.0	none	near neutral, soft, low TDS	ultraoligotrophic - oligotrophic	Cu	ISQG: As, Cu; PEL: As	low Apr densities; greatest genera richness in Aug; high diversity	moderate densities; high richness and diversity	high densities; vast majority dipteran
Goose Central	4.7	none	near neutral, soft, low TDS	ultraoligotrophic	-	ISQG: As, Cu	moderate chl *a* biomass; low Apr densities; high genera richness and diversity in Aug	moderate densities; high richness and diversity	high densities; over half dipteran; low richness; moderate diversity
Goose Tail	2.8	all life stages: Apr, mid to bottom depths; Early life stages: Apr, bottom depths	near neutral, soft, low TDS	ultraoligotrophic - oligotrophic	Cu	ISQG: none	low chl *a* biomass and densities; more than 80% cryptophytes; moderate diversity	nc	nc
Propellor	7.8	all life stages: Apr, mid to bottom depths; Early life stages: Apr, bottom depths	near neutral, soft, low TDS	ultraoligotrophic	Cd	ISQG: Cu	low chl a biomass and density; dominated by myxophyte (cyanobacteria)s; low richness and diversity	nc	high densities; vast majority dipteran; low diverstiy

(continued)

Table 4-1. Summary of 2012 Freshwater Baseline Results for Lakes (completed)

Lake	Summer Sampling Max Depth (m)	Dissolved Oxygen: Seasons and Depths that Exceed CCME Guidelines*	Water Quality: General Description	Water Quality: Nutrient Status	Water Quality: CCME Guideline Exceedances*	Sediment Quality: CCME Guideline Exceedances*	Primary producers: Phytoplankton	Aquatic Macroinvertebrates: Zooplankton	Aquatic Macroinvertebrates: Benthos
George Area									
Lower Long	5.2	all life stages: Apr, mid to bottom depths, Aug, all depths; Early life stages: Apr, bottom depths	slightly basic, soft, low TDS	ultraoligotrophic	-	ISQG: As, Cr, Cu; PEL: As	high chl *a* biomass; moderate densities; more than 5% chrysophytes; moderate richness and diversity	moderate densities; high richness and moderately high diversity	low densities; low richness
Fold	9.8	all life stages: Aug, all depths	slightly basic, soft, low TDS	ultraoligotrophic - oligotrophic	-	ISQG: As, Cr, Cu; PEL: As	higher Apr chl *a* biomass; high Aug densities; more than 5% chrysophytes; low Aug diversity	highest densities; highest copepodite densities; high richness and diversity	moderate densities, richness and diversity
George Central	14.5	all life stages: Aug, all depths	near neutral, soft, low TDS	ultraoligotrophic	-	ISQG: As; PEL: As	low chl a biomass; high Aug densities; more than 90% myxophyte (cyanobacteria)s in Aug; more than 5% chrysophytes; low diversity	crustacean dominated; lowest richness; very low diversity	over half bivalves; moderately high richness and diversity
George South	3.0	none	slightly acidic, soft, low TDS	ultraoligotrophic	-	ISQG: As, Cr; PEL: As	nc	nc	over half bivalves; moderate high richness and diversity
Lytle	1.4	all life stages: Aug, all depths	near neutral, soft, low TDS	ultraoligotrophic	Cu	ISQG: As, Cr, Cu, Zn; PEL: As	low chl *a* biomass; more than 5% chrysophytes; lowest genera richness	lowest densities; crustacean dominated; low richness and diversity	highest densities; vast majority dipteran; lowest diversity
Occurrence	1.5	all life stages: Aug, all depths	slightly basic, soft, low TDS	ultraoligotrophic	Cu	ISQG: As, Cr, Cu, Zn; PEL: AS, Cr	low chl *a* biomass; more than 5% chrysophytes; lowest genera richness	lowest densities; crustacean dominated; low richness and diversity	low densities; highest diversity
Sleigh	1.5	all life stages: Aug, all depths	near neutral, soft, low TDS	ultraoligotrophic	Cu	ISQG: As	low chl *a* biomass; more than 5% chrysophytes	lowest densities; crustacean dominated; low richness and diversity	low densities; vast majority dipteran; low diversity
Dragon	3.4	all life stages: Apr, bottom depths, Aug, all depths; Early life stages: Apr, bottom depths	near neutral, almost moderately hard in Apr, higher TDS in Apr	ultraoligotrophic	-	ISQG: As, Cr, Cu, Zn; PEL: As	higher Apr chl *a* biomass; more than 5% chrysophytes	crustacean dominated; high richness	moderate densities, richness and diversity
Komatic	7.0	all life stages: Apr, bottom depths, Aug, all depths; Early life stages: Apr, bottom depths	slightly basic, moderately hard in Apr, higher TDS in Apr	ultraoligotrophic - oligotrophic	Cu	ISQG: As, Cd, Cr, Cu, Zn; PEL: As	high Apr chl a biomass; high Aug densities; more than 50% bacillariophyte (diatoms) in Apr; more than 90% myxophyte (cyanobacteria)s in Aug; more than 5% chrysophytes; low Aug diversity	highest copepodite densities; crustacean dominated; high richness and diversity	high densities; vast majority dipteran
Reference C	35.0	all life stages: Aug, all depths above thermocline and most depths below thermocline	slightly basic, moderately hard, higher TDS	ultraoligotrophic - oligotrophic	-	ISQG: As, Cu	moderate chl a biomass and density; more than 90% myxophyte (cyanobacteria)s in Apr; very low diversity in Apr	moderate densities; crustacean dominated; moderate richness and diversity	lowest densities; over half bivalves; lowest richness

nc = not collected

** Parameters which, on average, exceeded CCME guidelines as calculated in tables.*

Half the detection limit was substituted for values that were below the detection limit for the calculation of exceedance factors.

Underlined values show sites where all samples that exceeded a particular parameters guideline were below the detection limit.

Table 4-2. Summary of 2012 Freshwater Baseline Results for Streams

			Dissolved Oxygen	Water Quality			Sediment Quality	Primary Producers	Aquatic Macroinvertebrates
Stream	General Description	Substrate	Seasons that Exceed CCME Guidelines	General Description	Nutrient Status	CCME Guideline Exceedances*	Parameters that Exceed CCME Guidelines	Periphyton	Benthos
Goose Area									
Moby OF	Small stream running through flood plain.	Mainly silt, few small stones	-	Slightly acidic, soft, low TDS	Ultraoligotrophic - Oligotrophic	Cd, Cu, Ni	-	dominated by myxophyceae (cyanobacteria)	high richness and diverstiy
Gander IF	Wide and deep, slow moving stream.	Mainly silt, few small stones	-	Near neutral, soft, low TDS	Oligotrophic	Cd	-	dominated by myxophyceae (cyanobacteria); highest richness	over 80% chironomids; over 10% bivalves; lowest richness; low diversity
Gander US	Medium stream with medium flow over cobble to boulders.	Mainly cobbles, some large stones, boulders	-	Near neutral, soft, low TDS	Oligotrophic	Cd	ISQG: As	low chl a biomass; dominated by myxophyceae (cyanobacteria); highest richness	high richness; moderate diversity
Pond 19 OF	Very small stream, nearly dry during summer sampling.	Mainly silt, few small stones	Early life stages: Aug	Near neutral, soft, low TDS	Ultraoligotrophic - Oligotrophic	Cd, Cu	-	low chl *a* biomass; dominated by bacillariophyceae	high and variable densities; over 80% chironomids; lowest richness and diversity
Chair OF	Small stream through floodplain.	Mainly silt, few small stones	-	Variable pH, soft, low TDS	Oligotrophic - Mesotrophic	pH, Al	ISQG: As, Cr	high chl *a* biomass; more than 20% chlorophyceae; high diversity	high richness; moderate diversity
Llama OF	Medium stream through large boulder field.	Cobbles, large stones, boulders	Early life stages: Aug, Sept; All life stages: Aug, Sept	Slighty acidic, soft (June) to hard (Sept) water, highest TDS particularly high in Sept	Ultraoligotrophic	Cd	nc	low chl *a* biomass; more than 20% chlorophyceae; lowest richness and diversity	nc
Echo OF	Very small stream through flood plain, dry during summer sampling.	Mainly silt, few small stones	-	Slightly acidic, soft, low TDS	Ultraoligotrophic	pH, Al, Cd, Cu	nc	nc	nc
Giraffe OF	Short, medium-sized stream, cobbles.	Cobbles, large stones, boulders	Early life stages: Aug	Slightly acidic, soft, low TDS	Ultraoligotrophic - Oligotrophic	Cd	-	highest and most variable densities; dominated by myxophyceae (cyanobacteria); high diversity	lowest densities; over 80% chironomids; lowest richness; low diversity
Wolf OF	Small stream running through flood plain.	Mainly silt, few small stones	-	Near neutral, soft, low TDS	Ultraoligotrophic - Oligotrophic	Cd	-	dominated by myxophyceae (cyanobacteria)	lowest densities; over 80% chironomids
Goose OF	Short, medium-sized stream, cobbles.	Cobbles, large stones, boulders	-	Slightly acidic, soft, low TDS	Ultraoligotrophic - Oligotrophic	Cd	-	dominated by myxophyceae (cyanobacteria); high diversity	high richness and diversity
Propellor OF	Large stream draining largest lake in the area. Runs through boulder field.	Large stones, boulders	Early life stages: Aug	Slightly acidic, soft, low TDS	Ultraoligotrophic - Oligotrophic	<u>Cd</u>	ISQG: As, Cr; PEL: As	dominated by myxophyceae (cyanobacteria); high diversity	over 80% chironomids; moderate richness and diversity
Reference B OF	Small stream through floodplain.	Mainly silt, few small stones	Early life stages: Aug	Near neutral, soft, low TDS	Oligotrophic - Mesotrophic	Cd, Fe	-	dominated by myxophyceae (cyanobacteria); more than 20% chlorophyceae; high richness; high diversity	lowest densities; over 80% chironomids; lowest richness; low diversity
George Area									
George OF	Short, small-sized stream, cobbles. Split into two channels.	Cobbles, gravel, sand	-	Near neutral, soft, low TDS	Ultraoligotrophic - Oligotrophic	Cd	ISQG: As, Cu; PEL: As	low densities; high diversity	moderately high richness and diversity
Sleigh OF	Small stream running through flood plain.	Cobbles, silt	Early life stages: Aug	Near neutral, soft, low TDS	Ultraoligotrophic - Oligotrophic	Cd, Cu	ISQG: As, Cr	low densities; low richness; high diversity	high densities; moderate richness; high diversity
Dragon OF	Small stream running through flood plain.	Cobbles, silt	Early life stages: Aug	Slightly basic, soft, low TDS	Ultraoligotrophic - Oligotrophic	-	ISQG: As, Cr; PEL: As	high chl biomass; low densities; high richness; high diversity	highest richness and diversity
Komatic IF	Medium stream meandering through grass plain. No rocks present.	Mainly silt, no stones present	-	Slightly basic, soft, low TDS	Oligotrophic - Mesotrophic	Cu	ISQG: As, Cr	low densities; moderate richness; high diversity	moderate richness and diversity
Reference C OF	Short, small-sized stream, cobbles. Nearly dry during summer. Split into two channels.	Cobbles, gravel, silt	-	Slightly basic, soft to moderately hard, low TDS	Ultraoligotrophic - Oligotrophic	-	-	high densities; dominated by myxophyceae (cyanobacteria); high diversity	over 10% gastropods; moderate richness; high diversity

nc = not collected

** Parameters which, on average, exceeded CCME guidelines as calculated in tables.*

Half the detection limit was substituted for values that were below the detection limit for the calculation of exceedance factors.

Underlined values show sites where all samples that exceeded a particular parameters guideline were below the detection limit.

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Definitions of the acronyms and abbreviations used in this reference list can be found in the Glossary and Abbreviations section.

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Appendix 3.1-1

Under-ice Temperature and Dissolved Oxygen Profiles, Back River Project, April 2012

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Appendix 3.1-1. Under-ice Temperature and Dissolved Oxygen Profiles, Back River Project, April 2012

Moby Lake			
10-Apr-12			
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1 1.5	Ice thickness = 1.8 m		
2	1.1	16.59	117.1
2.5	1.8	15.67	112.6
Bottom depth = 3.4 m			

Gander Lake			
10-Apr-12			
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1	Ice thickness = 1.6 m		
1.6	1.1	3.62	25.6
2	1.9	1.68	12.1
Bottom depth = 2.3 m			

Pond 19			
10-Apr-12			
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5	Ice thickness = 0.6 m		
Ice to bottom			

Big Lake			
10-Apr-12			
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1 1.5	Ice thickness = 1.7 m		
2	1.1	15.72	110.8
2.5	2.2	12.35	90.0
3	3.1	3.67	27.3
3.5	3.6	0.82	6.1
4	3.8	0.16	1.2
4.5	3.9	0.08	0.8
Bottom depth = 4.5 m			

Rabbit Lake			
10-Apr-12			
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1	Ice thickness = 1.2 m		
Ice to bottom			

Fox Lake			
10-Apr-12			
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1	Ice thickness = 1.4 m		
1.4	0	15.70	106.4
1.9	0	15.90	108.4
2.4	0.8	15.40	107.6
2.9	1.8	14.20	101.2
3.4	2.8	8.10	58.4
3.9	3.3	7.20	53.4
Bottom depth = 4.4 m			

Echo Lake			
12-Apr-12			
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5	Ice thickness = 0.7 m		
Ice to bottom			

Rascal Lake			
11-Apr-12			
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1	Ice thickness = 1.5 m		
1.5	0.1	9.22	63.2
2	1	8.90	62.6
Bottom depth = 2.4 m			

Giraffe Lake North			
11-Apr-12			
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1	Ice thickness = 1.7 m		
1.7	1	17.17	121.2
2	1.3	17.02	121.0
2.5	2.2	15.29	111.1
3	2.9	10.15	75.3
Bottom depth = 3.9 m			

Giraffe Lake South			
11-Apr-12			
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1	Ice thickness = 1.6 m		
1.6	1.7	13.66	97.8
2	1.8	13.71	98.5
2.5	2.7	10.99	81.2
3	3	9.61	71.3
3.5	3.5	7.26	54.6
4	3.6	5.91	44.6
4.5	3.6	4.78	36.1
5	3.7	0.78	6.0
Bottom depth = 5.4 m			

Goose Lake Neck			
11-Apr-12			
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1	Ice thickness = 1.5 m		
1.5	0.3	16.14	111.3
2	0.6	16.11	112.0
2.5	1.2	14.50	102.6
3	1.4	13.65	97.0
Bottom depth = 3.2 m			

Goose Lake Central			
11-Apr-12			
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1	Ice thickness = 1.6 m		
1.6	0	13.26	90.7
2.1	0.5	15.65	108.8
2.6	1.1	15.82	111.6
3.1	1.6	15.14	108.2
3.6	1.9	14.60	105.0
4.1	2.3	11.37	82.9
Bottom depth = 4.3 m			

Goose Lake Tail			
11-Apr-12			
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1	Ice thickness = 1.7 m		
1.6	0.6	13.88	96.5
2	1	13.06	91.9
2.5	1.7	13.14	94.2
3	2.2	11.95	81.8
3.5	2.6	9.25	67.9
4	2.8	8.08	59.6
4.5	3	8.01	59.5
5	3.1	6.94	51.7
5.5	3.2	3.33	47.4
6	3.4	3.19	41.5
6.5	3.5	2.45	18.4
7	3.6	1.78	13.4
7.5	3.6	1.68	12.7
Bottom depth = 8.0 m			

Propellor Lake			
12-Apr-12			
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1	Ice thickness = 1.5 m		
1.5	1.2	14.74	102.3
2	1.5	13.09	93.3
2.5	1.6	12.55	89.7
3	1.8	12.08	86.5
3.5	1.9	11.44	82.5
4	2	11.30	81.7
4.5	2.2	11.25	81.8
5	2.4	9.66	70.5
5.5	2.6	6.21	45.6
6	2.8	3.93	29
6.5	2.9	0.31	2.2
7	2.9	0.23	1.7
Bottom depth = 7.3 m			

Lower Long Lake			
13-Apr-12			
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1 1.5	Ice thickness = 2.0 m		
2	1.2	16.87	119.3
2.5	2.1	15.96	115.7
3	2.3	15.15	110.4
3.5	2.3	16.13	117.5
4	2.3	16.43	119.8
4.5	2.5	7.3	53.5
Bottom depth = 5.3 m			

Appendix 3.1-1. Under-ice Temperature and Dissolved Oxygen Profiles, Back River Project, April 2012

	Fold Lake		
	15-Apr-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1	Ice thickness = 1.7 m		
1.7	0.3	16.08	110.8
2.2	1.3	15.50	109.9
2.7	1.9	14.77	106.4
3.2	2.1	14.35	104.1
3.7	2.1	13.66	99.1
4.2	2.2	13.95	101.4
4.7	2.3	14.68	107
5.2	2.3	13.64	99.5
5.7	2.3	12.33	89.9
6.2	2.9	12.3	90.1
6.7	2.5	12.78	93.2
7.2	2.5	13.36	98
7.7	2.5	13.58	99.5
8.2	2.6	13.2	97
8.7	2.6	11.44	84.1
	Bottom depth = 9.8 m		

	George Lake Central		
	13-Apr-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1 1.5	Ice thickness = 1.9 m		
1.9	0.5	15.35	106.4
2.4	1.9	14.04	101.5
2.9	2.9	11.74	87.2
3.4	3.3	12.43	93.2
3.9	3.3	12.88	96.4
4.4	3.4	11.92	89.4
4.9	3.3	12.25	92
5.4	3.3	12.11	90.6
5.9	3.4	11.96	89.8
6.4	3.4	11.61	87.2
6.9	3.4	11.15	83.7
7.4	3.4	10.61	79.6
7.9	3.5	10.1	76
8.4	3.5	13.47	100.9
	Bottom depth = 9.2 m		

	George Lake South		
	13-Apr-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1	Ice thickness = 1.4 m		
1.4	0.2	15.22	104.7
	Bottom depth = 1.8 m		

	Lytle Lake		
	15-Apr-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1 1.5	Ice thickness = ~ 1.2 m		
	Ice to bottom		

	Occurrence Lake		
	15-Apr-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1 1.5	Ice thickness = 1.3 m		
	Ice to bottom		

	Sleigh Lake		
	15-Apr-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1 1.5	Ice thickness = 1.1 m		
	Ice to bottom		

	Dragon Lake		
	15-Apr-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1 1.5	Ice thickness = 1.9 m		
2	1.9	13.03	94.0
2.5	3.7	12.70	96.1
3	4.0	12.46	95.0
3.5	4.0	3.26	25.0
	Bottom depth = 3.9 m		

	Komatic Lake		
	13-Apr-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1 1.5	Ice thickness = 1.9 m		
2	1.7	14.71	105.7
2.5	2.8	13.74	101.5
3	2.9	13.24	98.3
3.5	3	13.12	97.7
4	3.1	11.79	87.8
4.5	3.1	11.02	82.1
5	3.2	10.03	74.9
5.5	3.2	8.65	64.6
6	3.6	3.00	22.7
	Bottom depth = 7.1 m		

	Reference C Lake		
	13-Apr-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0 0.5 1	Ice thickness = 1.4 m		
1.5	0.6	14.52	101.9
2	0.5	14.48	100.4
2.5	0.6	14.40	100.2
3	0.7	14.29	99.7
3.5	0.7	14.21	99.3
4	0.8	14.15	99.0
4.5	0.9	14.08	98.7
5	0.9	14.02	98.4
5.5	1.0	13.92	97.9
6	1.0	13.87	97.5
6.5	1.0	13.84	97.3
7	1.1	13.65	96.2
	Bottom depth = 7.5 m		

Appendix 3.1-2

Open-water Temperature and Dissolved Oxygen Profiles, Back River Project, August 2012

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Appendix 3.1-2. Open Water Temperature and Dissolved Oxygen Profiles, Back River Project, August 2012

Moby Lake			
	22-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	12.1	9.89	92.0
0.5	12.1	9.89	92.0
1	12.1	9.88	91.9
1.5	12.2	9.85	91.8
2	12.2	9.85	91.8
2.5	12.2	9.83	91.6
3	12.2	9.83	91.6
3.5	12.2	9.82	91.5
4	12.2	9.81	91.5
4.5	12.2	9.81	91.4
5	12.2	9.79	91.3
5.5	12.2	9.79	91.3
6	12.2	9.80	91.1
6.5	12.1	9.79	91.0
7	12.1	9.78	91.0
7.5	12.1	9.77	90.9
8	12.1	9.76	90.8
8.5	12.1	9.76	90.8
9	12.1	9.75	90.7
9.5	12.1	9.75	90.6
10	12.1	9.74	90.6
10.5	12.1	9.71	90.3
11	12.1	9.72	90.2
11.5	12.1	9.72	90.4
12	12.1	9.68	90.0
12.5	12.1	9.69	89.9
13	12.0	9.68	89.8
13.5	12.0	9.67	89.7
14	12.0	9.66	89.6
14.5	12.0	9.63	89.4
Bottom depth = 14.8 m			

Gander Lake			
	18-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	10.6	10.22	91.8
0.5	10.6	10.22	91.8
1	10.6	10.20	91.7
1.5	10.5	10.22	91.6
2	10.5	10.20	91.7
Bottom depth = 2.4 m			

Pond 19			
	21-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	9.7	9.95	87.5
0.5	9.6	9.97	87.7
1	9.6	9.99	87.6
Bottom depth = 1.4 m			

Big Lake			
	16-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	10.8	9.95	90.0
0.5	10.9	9.91	89.7
1	11.0	9.86	89.4
1.5	11.0	9.85	89.3
2	11.0	9.85	89.3
2.5	11.0	9.83	89.2
3	11.0	9.82	89.0
3.5	10.9	9.83	88.9
4	10.9	9.82	88.8
4.5	10.8	9.82	88.6
Bottom depth = 5.0 m			

Rabbit Lake			
	15-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	10.2	10.02	89.5
0.5	10.3	10.01	89.3
1	10.3	10.01	89.3
1.5	10.4	9.97	89.2
2	10.4	9.95	89.0
2.5	10.4	9.94	88.9
3	10.5	9.92	88.9
3.5	10.5	9.92	89.0
Bottom depth = 3.6 m			

Fox Lake			
	20-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	12.3	9.88	92.3
0.5	12.3	9.88	92.3
1	12.3	9.88	92.3
1.5	12.3	9.88	92.3
2	12.2	9.88	92.3
2.5	12.2	9.89	92.2
3	12.2	9.88	92.1
3.5	12.2	9.88	92.1
4	12.2	9.87	92.0
4.5	12.2	9.87	92.0
5	12.2	9.86	91.9
5.5	12.2	9.83	91.7
Bottom depth = 5.8 m			

Echo Lake			
	17-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	10.4	11.10	99.3
Bottom depth = 0.35 m			

Rascal Lake			
	15-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	10.3	10.16	90.8
0.5	10.4	10.12	90.4
1	10.5	10.09	90.5
1.5	10.5	10.08	90.4
2	10.5	10.08	90.3
2.5	10.5	10.07	90.3
Bottom depth = 2.8 m			

Giraffe Lake North			
	19-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	12.6	9.96	93.7
0.5	12.6	9.96	93.7
1	12.6	9.98	93.6
1.5	12.5	9.97	93.5
2	12.5	9.96	93.5
2.5	12.5	9.95	93.4
3	12.5	9.94	93.3
3.5	12.5	9.94	93.3
Bottom depth = 3.7 m			

Giraffe Lake South			
	19-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	11.9	9.96	92.2
0.5	11.9	9.97	92.3
1	11.9	9.97	92.3
1.5	11.9	9.97	92.3
2	11.9	9.97	92.3
2.5	11.9	9.96	92.2
3	11.8	9.98	92.2
3.5	11.8	9.97	92.1
4	11.8	9.97	92.0
4.5	11.8	9.96	92.0
5	11.8	9.93	91.7
5.5	11.5	9.95	91.1
6	11.3	9.96	90.9
6.5	11.3	9.98	91.0
7	11.2	9.94	90.6
Bottom depth = 7.3 m			

Goose Lake Neck			
	14-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	12.8	9.66	91.3
0.5	12.8	9.66	91.3
1	12.8	9.65	91.2
1.5	12.8	9.64	91.1
2	12.8	9.64	91.1
2.5	12.8	9.64	91.0
Bottom depth = 3.0 m			

Goose Lake Central			
	17-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	11.4	9.83	90.0
0.5	11.4	9.82	89.9
1	11.4	9.82	89.9
1.5	11.4	9.81	89.8
2	11.4	9.81	89.7
2.5	11.4	9.80	89.7
3	11.4	9.79	89.6
3.5	11.5	9.76	89.6
4	11.5	9.75	89.5
Bottom depth = 4.5 m			

Goose Lake Tail			
	18-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	11.2	10.26	93.3
0.5	11.1	10.26	93.2
1	11.1	10.25	93.2
1.5	11.1	10.24	93.1
2	11.0	10.27	93.1
2.5	11.0	10.27	93.1
Bottom depth = 2.8 m			

Propellor Lake			
	21-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	12.7	9.81	92.2
0.5	12.6	9.80	92.2
1	12.6	9.80	92.2
1.5	12.6	9.79	92.1
2	12.6	9.78	92.0
2.5	12.5	9.79	91.9
3	12.5	9.78	91.8
3.5	12.5	9.77	91.7
4	12.5	9.76	91.6
4.5	12.5	9.75	91.5
5	12.4	9.76	91.4
5.5	12.4	9.75	91.3
6	12.4	9.74	91.2
6.5	12.4	9.74	91.2
7	12.4	9.73	91.1
Bottom depth = 7.4 m			

Appendix 3.1-2. Open Water Temperature and Dissolved Oxygen Profiles, Back River Project, August 2012

Lower Long Lake			
	21-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	11.5	8.32	76.3
0.5	11.5	8.32	76.3
1	11.4	8.33	76.3
1.5	11.4	8.33	76.2
2	11.4	8.32	76.1
2.5	11.4	8.31	76.1
3	11.4	8.30	76.0
3.5	11.4	8.28	75.8
4	11.4	8.27	75.7
Bottom depth = 4.1 m			

Fold Lake			
	19-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	11.7	8.42	77.5
0.5	11.7	8.41	77.5
1	11.7	8.41	77.5
1.5	11.7	8.41	77.5
2	11.7	8.40	77.4
2.5	11.7	8.39	77.4
3	11.6	8.40	77.3
3.5	11.6	8.39	77.3
4	11.6	8.40	77.2
4.5	11.6	8.39	77.1
5	11.6	8.38	77.1
5.5	11.6	8.38	77.0
6	11.6	8.37	77.0
6.5	11.6	8.35	76.8
7	11.5	8.34	76.5
7.5	11.5	8.34	76.5
8	11.5	8.33	76.4
8.5	11.5	8.32	76.3
9	11.5	8.31	76.3
9.5	11.5	8.30	76.1
10	11.5	8.29	76.1
10.5	11.5	8.29	76.1
11	11.5	8.29	76.0
11.5	11.5	8.26	75.8
Bottom depth ~ 12 m			

George Lake Central			
	18-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	11.1	8.38	76.1
0.5	11.1	8.37	76.1
1	11.1	8.35	76.1
1.5	11.1	8.35	76.0
2	11.1	8.33	75.9
2.5	11.1	8.35	75.9
3	11.1	8.34	75.8
3.5	11.1	8.34	75.8
4	11.1	8.33	75.7
4.5	11.1	8.33	75.7
5	11.1	8.32	75.6
5.5	11.1	8.32	75.6
6	11.1	8.31	75.6
6.5	11.1	8.31	75.5
7	11.1	8.30	75.4
7.5	11.1	8.30	75.4
8	11.1	8.29	75.4
8.5	11.1	8.29	75.3
9	11.1	8.28	75.3
9.5	11.1	8.28	75.2
10	11.1	8.27	75.2
10.5	11.1	8.27	75.1
11	11.1	8.27	75.1
11.5	11.1	8.26	75.1
12	11.1	8.26	75.1
12.5	11.0	8.27	75.0
13	11.0	8.27	75.0
13.5	10.9	8.30	75.1
14	10.9	8.29	75.0
14.5	10.9	8.30	75.1
Bottom depth = 14.5 m			

Lytle Lake			
	23-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	10.7	8.55	77.0
0.5	10.7	8.55	77.0
1	10.7	8.55	77.0
Bottom depth = 1.4 m			

Occurrence Lake			
	21-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	11.7	8.59	79.1
0.5	11.7	8.60	79.2
1	11.6	8.61	79.1
1.4	11.6	8.62	79.2
Bottom depth = 1.4 m			

Sleigh Lake			
	22-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	11.0	8.78	79.6
0.5	11.1	8.75	79.6
1	11.1	8.76	79.6
Bottom depth = 1.2 m			

Dragon Lake			
	20-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	11.4	8.48	77.6
0.5	11.5	8.46	77.6
1	11.5	8.46	77.6
1.5	11.5	8.46	77.6
2	11.5	8.45	77.5
2.5	11.5	8.44	77.4
3	11.5	8.44	77.4
Bottom depth = 3.4 m			

Komatic Lake			
	20-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0.1	11.4	8.44	77.4
0.5	11.4	8.46	77.4
1	11.4	8.45	77.3
1.5	11.4	8.45	77.3
2	11.4	8.44	77.2
2.5	11.4	8.43	77.2
3	11.4	8.42	77.1
3.5	11.3	8.43	77.0
4	11.3	8.42	76.9
4.5	11.3	8.41	76.8
5	11.3	8.40	76.7
5.5	11.2	8.40	76.7
6	11.2	8.42	76.7
6.5	11.2	8.41	76.6
Bottom depth = 7.0 m			

Reference C Lake			
	22-Aug-12		
Depth (m)	Temp (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
0	11.4	8.59	78.6
0.5	11.4	8.59	78.6
1	11.4	8.59	78.6
1.5	11.4	8.59	78.6
2	11.5	8.55	78.4
2.5	11.5	8.55	78.4
3	11.5	8.54	78.3
3.5	11.5	8.54	78.3
4	11.5	8.53	78.2
4.5	11.5	8.52	78.2
5	11.5	8.52	78.1
5.5	11.5	8.51	78.1
6	11.5	8.50	78.0
6.5	11.5	8.50	77.9
7	11.5	8.49	77.9
7.5	11.5	8.49	77.9
8	11.4	8.50	77.8
8.5	11.4	8.50	77.8
9	11.4	8.49	77.7
9.5	11.4	8.48	77.6
10	11.4	8.47	77.5
11	11.4	8.45	77.3
12	11.3	8.42	76.9
13	11.3	8.39	76.7
14	11.2	8.40	76.5
15	11.1	8.41	76.4
16	11.1	8.40	76.3
17	11	8.41	76.2
18	10.7	8.50	76.5
19	8.7	9.22	78.9
20	7.5	9.53	79.4
21	6.8	9.58	78.3
22	6.6	9.52	77.6
23	6.4	9.48	77.0
24	6.4	9.40	76.3
25	6.3	9.33	75.6
26	6.3	9.27	75.1
27	6.3	9.18	74.4
28	6.2	9.14	73.8
29	6.2	9.01	73.0
30	6.2	8.94	72.3
31	6.2	8.91	72.0
32	6.1	8.87	71.4
33	6.1	8.80	71.0
34	6.1	8.75	70.5
Bottom depth = 35 m			

Appendix 3.2-1

Lake Water Quality Analytical Results, Back River Project, 2012

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Appendix 3.2-1. Lake Water Quality Analytical Results, Back River Project, 2012

Area				Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location				Moby Lake	Gander Lake	Big Lake	Big Lake	Fox Lake	Fox Lake	Rascal Lake	Giraffe Lake North	Giraffe Lake North	Giraffe Lake South	Giraffe Lake South	Goose Lake Neck	Goose Lake Central	Goose Lake Central
Replicate				1	1	1	2	1	2	1	1	2	1	1	1	1	2
Duplicate?			Realised	-	-	-	duplicate	-	duplicate	-	-	duplicate	-	-	-	-	duplicate
Depth (m)		CCME Guideline	Detection	1	1	1	1	1	1	0	1	1	1	2	1	1	1
Date Sampled		for the Protection	Limit	10-Apr-12	10-Apr-12	10-Apr-12	10-Apr-12	10-Apr-12	10-Apr-12	11-Apr-12	11-Apr-12	11-Apr-12	11-Apr-12	11-Apr-12	11-Apr-12	11-Apr-12	11-Apr-12
ALS Sample ID	Units	of Freshwater Aquatic Life[a]	(RDL)	L1133356-5	L1133356-6	L1133356-3	L1133356-10	L1133356-9	L1133356-4	L1133911-11	L1133911-7	L1133911-10	L1133911-8	L1133911-9	L1133911-3	L1133911-1	L1133911-2
Physical Tests																	
Conductivity	µS/cm		2.0	64.9	83.4	34.0	35.6	50.1	47.6	92.9	72.6	73.1	67.5	70.6	68.9	65.7	61.8
Hardness (as $CaCO_3$)	mg/L		0.50	24.9	34.3	12.7	12.5	21.4	20.6	36.6	27.7	27.5	25.5	24.6	25.2	22.4	22.1
pH	pH	6.5-9.0	0.10	6.80	6.88	6.83	7.68	7.10	7.13	7.94	8.07	8.11	8.09	8.10	8.06	6.82	8.05
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		1.0 - 2.0	4.8	16.0	7.1	6.7	12.6	12.4	23.2	10.8	10.6	10.2	10.4	7.3	7.4	6.6
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		1.0 - 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		1.0 - 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		1.0 - 2.0	4.8	16.0	7.1	6.7	12.6	12.4	23.2	10.8	10.6	10.2	10.4	7.3	7.4	6.6
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	43	64	29	30	38	36	70	54	50	48	50	46	48	45
Turbidity	NTU	dependent on background levels	0.10	0.25	1.34	0.59	0.37	1.21	0.26	0.72	0.24	0.29	0.36	0.23	0.51	0.31	0.29
Nutrients																	
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	0.0254	0.0259	0.0257	0.0220	0.0396	0.0384	0.0429	0.0289	0.0292	0.0278	0.0272	0.0184	0.0205	0.0220
Nitrate (as N)	mg/L	2.935[b]	0.0050	0.0142	0.311	0.0176	0.0178	0.0066	0.0065	0.0289	0.0179	0.0170	0.0159	0.0195	0.0166	0.0109	0.0089
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	<0.050	0.171	<0.050	<0.050	0.143	0.104	0.506	0.261	0.274	0.225	0.228	0.249	0.266	0.245
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.0037	0.0101	0.0042	0.0054	0.0043	0.0038	0.0059	0.0041	0.0030	0.0031	0.0039	0.0051	0.0032	0.0033
Anions																	
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 120; long-term: 640	0.50	0.59	1.27	0.93	0.91	1.02	0.88	1.62	1.28	1.27	1.17	1.25	8.87	8.44	7.98
Fluoride (F)	mg/L	0.12[b]	0.02	0.043	0.044	0.024	0.024	0.033	0.031	0.036	0.036	0.036	0.031	0.033	0.026	0.028	0.026
Sulfate (SO_4)	mg/L		0.5	22.7	19.9	7.27	7.28	9.36	8.82	17.9	19.5	19.4	17.8	18.6	9.11	8.93	8.53
Cyanides																	
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	0.0013	<0.0010	<0.0010	0.0012	<0.0010	0.0013	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon																	
Total Organic Carbon	mg/L		0.50	3.57	7.12	4.47	4.45	4.90	4.68	9.77	6.01	6.45	5.68	5.74	5.55	4.87	4.85
Total Metals																	
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0157	0.0304	0.0191	0.0170	0.0072	0.0065	0.0248	0.0298	0.0300	0.0325	0.0273	0.0703	0.0237	0.0259
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000295	0.000711	0.000463	0.000440	0.000359	0.000350	0.000468	0.000304	0.000285	0.000304	0.000277	0.000288	0.000272	0.000243
Barium (Ba)	mg/L		0.000050	0.00886	0.0175	0.00553	0.00570	0.00629	0.00527	0.0197	0.00927	0.00952	0.00935	0.00908	0.0131	0.0106	0.0105
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	0.0079	0.0078	0.0067	0.0071	0.0067	0.0070	0.0073	0.0071	0.0064	0.0066	0.0065	0.0060	0.0066	0.0059	0.0064
Cadmium (Cd)	mg/L	equation[b,d]	0.000010	0.000044	0.000033	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	0.000016	0.000016	0.000013	0.000014	0.000012	0.000011	<0.000010
Calcium (Ca)	mg/L		0.020	5.39	7.72	2.64	2.66	4.61	4.53	7.58	5.14	5.23	4.99	4.85	5.86	5.27	5.21
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00017	0.00045	0.00023	0.00029	0.00022	0.00017	0.00038	0.00027	0.00029	0.00031	0.00024	0.00028	0.00021	0.00020
Cobalt (Co)	mg/L		0.00010	0.00355	0.00506	0.00072	0.00130	<0.00010	<0.00010	0.00037	0.00068	0.00069	0.00079	0.00076	0.00031	0.00029	0.00031
Copper (Cu)	mg/L	≥0.002[e]	0.00050	0.00255	0.00296	0.00203	0.00180	0.00191	0.00168	0.00298	0.00382	0.00388	0.00367	0.00334	0.00267	0.00230	0.00229
Iron (Fe)	mg/L	0.3	0.010	0.012	0.498	0.061	0.115	0.015	0.014	0.202	0.029	0.028	0.027	0.031	0.062	0.010	<0.010
Lead (Pb)	mg/L	≥0.001[f]	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00986	0.000351	0.000780	<0.000050	<0.000050	0.000066	<0.000050	0.000160	0.000693	0.000400
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	3.00	4.05	1.65	1.58	2.52	2.44	4.44	3.65	3.65	3.45	3.40	2.76	2.57	2.54
Manganese (Mn)	mg/L		0.000050	0.0334	0.0873	0.0214	0.0382	0.00391	0.00532	0.0195	0.00726	0.00732	0.0110	0.0120	0.00440	0.00428	0.00435
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000053
Nickel (Ni)	mg/L	≥0.025[g]	0.00010	0.0468	0.0278	0.00473	0.00460	0.00427	0.00406	0.0101	0.0159	0.0157	0.0155	0.0152	0.00864	0.00744	0.00745
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.481	0.734	0.468	0.450	0.647	0.619	0.861	0.631	0.630	0.622	0.597	0.556	0.509	0.502
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	1.35	2.58	0.590	0.601	0.796	0.764	2.46	1.68	1.71	1.58	1.54	1.10	0.968	0.960
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	1.13	1.87	0.943	0.887	1.09	1.04	2.02	1.51	1.53	1.50	1.41	1.26	1.13	1.12
Strontium (Sr)	mg/L		0.00010 - 0.00020	0.0215	0.0341	0.0115	0.0118	0.0151	0.0143	0.0294	0.0213	0.0216	0.0207	0.0204	0.0271	0.0245	0.0245
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

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Appendix 3.2-1. Lake Water Quality Analytical Results, Back River Project, 2012

Area				Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location				Moby Lake	Gander Lake	Big Lake	Big Lake	Fox Lake	Fox Lake	Rascal Lake	Giraffe Lake North	Giraffe Lake North	Giraffe Lake South	Giraffe Lake South	Goose Lake Neck	Goose Lake Central	Goose Lake Central
Replicate				1	1	1	2	1	2	1	1	2	1	1	1	1	2
Duplicate?				-	-	-	duplicate	-	duplicate	-	-	duplicate	-	-	-	-	duplicate
Depth (m)		CCME Guideline	Realised Detection	1	1	1	1	1	1	0	1	1	1	2	1	1	1
Date Sampled		for the Protection	Limit	10-Apr-12	10-Apr-12	10-Apr-12	10-Apr-12	10-Apr-12	10-Apr-12	11-Apr-12	11-Apr-12	11-Apr-12	11-Apr-12	11-Apr-12	11-Apr-12	11-Apr-12	11-Apr-12
ALS Sample ID	Units	of Freshwater Aquatic Life[a]	(RDL)	L1133356-5	L1133356-6	L1133356-3	L1133356-10	L1133356-9	L1133356-4	L1133911-11	L1133911-7	L1133911-10	L1133911-8	L1133911-9	L1133911-3	L1133911-1	L1133911-2
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	0.000032	0.000014	0.000013	<0.000010	<0.000010	<0.000010	0.000020	0.000019	0.000019	0.000015	0.000015	0.000011	0.000011
Vanadium (V)	mg/L		0.000050	<0.000050	0.000349	<0.000050	<0.000050	<0.000050	<0.000050	0.000069	0.000061	0.000051	0.000051	<0.000050	0.000128	<0.000050	<0.000050
Zinc (Zn)	mg/L	0.03	0.0030	0.0150	0.0075	0.0037	<0.0030	<0.0030	<0.0030	0.0057	0.0053	0.0053	0.0049	0.0045	0.0043	0.0032	0.0031
Dissolved Metals																	
Aluminum (Al)	mg/L		0.0030	0.0121	0.0187	0.0151	0.0116	0.0049	0.0044	0.0188	0.0263	0.0267	0.0264	0.0259	0.0219	0.0209	0.0211
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000273	0.000521	0.000419	0.000370	0.000354	0.000347	0.000422	0.000329	0.000318	0.000269	0.000250	0.000278	0.000237	0.000254
Barium (Ba)	mg/L		0.000050	0.00872	0.0166	0.00536	0.00555	0.00607	0.00518	0.0192	0.00914	0.00915	0.00896	0.00880	0.0126	0.0102	0.0101
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	<0.0050	0.0080	0.0061	0.0059	0.0061	0.0083	0.0066	0.0062	0.0060	0.0063	0.0053	0.0061	0.0051	0.0056
Cadmium (Cd)	mg/L		0.000010	0.000043	0.000025	<0.000010	<0.000010	<0.000010	<0.000010	0.000011	0.000012	0.000015	0.000012	0.000016	0.000013	0.000011	<0.000010
Calcium (Ca)	mg/L		0.020	5.17	7.20	2.53	2.51	4.52	4.37	7.43	5.17	5.10	4.75	4.64	5.65	4.95	4.86
Chromium (Cr)	mg/L		0.00010	<0.00010	0.00024	0.00020	0.00015	0.00016	0.00014	0.00030	0.00022	0.00020	0.00017	0.00016	0.00020	0.00017	0.00018
Cobalt (Co)	mg/L		0.00010	0.00314	0.00467	0.00072	0.00126	<0.00010	<0.00010	0.00028	0.00053	0.00054	0.00060	0.00083	0.00026	0.00022	0.00022
Copper (Cu)	mg/L		0.00050	0.00232	0.00247	0.00171	0.00156	0.00174	0.00152	0.00275	0.00358	0.00356	0.00337	0.00331	0.00234	0.00209	0.00205
Iron (Fe)	mg/L		0.010	<0.010	0.144	0.019	0.027	<0.010	<0.010	0.043	0.011	0.012	0.015	0.029	<0.010	<0.010	<0.010
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00485	<0.000050	0.000219	<0.000050	<0.000050	<0.000050	<0.000050	0.000123	0.000307	0.000210
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	2.92	3.96	1.56	1.51	2.47	2.36	4.39	3.59	3.58	3.31	3.15	2.69	2.44	2.41
Manganese (Mn)	mg/L		0.000050	0.0295	0.0810	0.0221	0.0386	0.000502	0.000169	0.0166	0.00481	0.00509	0.00780	0.0134	0.00388	0.00298	0.00309
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	0.000069	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.0457	0.0255	0.00460	0.00444	0.00426	0.00399	0.00985	0.0157	0.0155	0.0149	0.0146	0.00831	0.00710	0.00715
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.469	0.712	0.446	0.424	0.628	0.606	0.847	0.616	0.626	0.588	0.565	0.542	0.492	0.478
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	1.34	2.48	0.561	0.581	0.779	0.731	2.39	1.65	1.67	1.49	1.46	1.02	0.913	0.901
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	1.09	1.76	0.889	0.836	1.07	1.01	2.00	1.49	1.46	1.42	1.35	1.22	1.07	1.06
Strontium (Sr)	mg/L		0.00010 - 0.00020	0.0207	0.0314	0.0110	0.0111	0.0148	0.0138	0.0290	0.0214	0.0214	0.0197	0.0194	0.0264	0.0233	0.0228
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	0.000023	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000018	0.000018	0.000016	0.000016	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	<0.000050	0.000144	<0.000050	<0.000050	<0.000050	<0.000050	0.000062	0.000051	<0.000050	<0.000050	<0.000050	0.000053	<0.000050	<0.000050
Zinc (Zn)	mg/L		0.0030	0.0148	0.0064	<0.0030	<0.0030	<0.0030	<0.0030	0.0040	0.0039	0.0039	0.0039	0.0057	0.0037	<0.0030	<0.0030

** Due to a lab error, dissolved metals data is not available for Propellor Lake samples collected in April*

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, (accessed 2012).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realised detection limit

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Appendix 3.2-1. Lake Water Quality Analytical Results, Back River Project, 2012

Area				Goose	Goose	Goose	Goose	George	George	George	George	George	George	George	George	George
Location				Goose Lake Tail	Goose Lake Tail	Propellor Lake*	Propellor Lake*	Lower Long Lake	Lower Long Lake	Fold Lake	Fold Lake	Fold Lake	George Lake Central	George Lake Central	George Lake Central	Dragon Lake
Replicate				1	1	1	1	1	2	1	1	2	1	1	2	1
Duplicate?			Realised	-	-	-	-	-	duplicate	-	-	duplicate	-	-	duplicate	-
Depth (m)		CCME Guideline	Detection	1	3.8	1	5.3	1	1	1	6.2	1	1	5.5	5.5	1
Date Sampled		for the Protection	Limit	11-Apr-12	11-Apr-12	12-Apr-12	12-Apr-12	13-Apr-12	13-Apr-12	15-Apr-12	15-Apr-12	15-Apr-12	13-Apr-12	13-Apr-12	13-Apr-12	15-Apr-12
ALS Sample ID	Units	of Freshwater Aquatic Life[a]	RDL	L1133911-5	L1133911-6	L1134512-1	L1134512-2	L1135132-4	L1135132-5	L1135132-14	L1135132-15	L1135132-16	L1135132-9	L1135132-10	L1135132-11	L1135132-13
Physical Tests																
Conductivity	µS/cm		2.0	66.7	69.9	30.9	25.9	53.6	52.0	75.0	73.3	71.6	89.0	104	103	125
Hardness (as $CaCO_3$)	mg/L		0.50	25.0	26.0	12.1	10.1	27.2	28.1	34.7	33.0	31.8	38.0	45.1	45.1	59.0
pH	pH	6.5-9.0	0.10	8.09	8.06	7.10	6.98	8.32	8.25	8.28	8.26	7.90	8.27	8.19	8.23	8.08
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		1.0 - 2.0	8.1	8.9	6.5	5.0	25.7	20.7	12.7	12.5	12.5	9.7	10.9	10.4	32.2
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		1.0 - 2.0	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		1.0 - 2.0	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		1.0 - 2.0	8.1	8.9	6.5	5.0	25.7	20.7	12.7	12.5	12.5	9.7	10.9	10.4	32.2
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	3.3
Total Dissolved Solids	mg/L		10	45	41	26	22	32	30	46	42	42	51	62	62	84
Turbidity	NTU	dependent on background levels	0.10	0.27	0.40	0.14	0.21	0.51	0.63	0.80	1.11	0.23	0.49	0.35	0.91	0.91
Nutrients																
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	0.0225	0.0185	0.0248	0.0267	<0.0050	<0.0050	0.0068	<0.0050	0.0063	0.0106	0.0124	0.0127	<0.0050
Nitrate (as N)	mg/L	2.935[b]	0.0050	0.0097	0.0161	<0.0050	0.0269	0.0197	0.0195	0.0056	0.0119	0.0075	0.0104	0.0186	0.0174	0.0053
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.234	0.285	0.170	0.105	0.191	0.207	0.187	0.179	0.230	0.167	0.179	0.189	0.361
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.0045	0.0040	0.0022	0.0031	0.0024	0.0027	0.0050	0.0053	0.0044	0.0023	0.0027	0.0024	0.0037
Anions																
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 120; long-term: 640	0.50	8.24	8.50	1.96	1.62	0.61	0.59	1.88	1.83	1.80	5.32	6.32	6.29	2.46
Fluoride (F)	mg/L	0.12[b]	0.02	0.026	0.022	0.023	<0.020	<0.020	<0.020	0.026	0.025	0.025	0.034	0.035	0.035	0.035
Sulfate (SO_4)	mg/L		0.5	8.85	9.06	4.78	4.01	4.15	4.10	17.9	17.5	17.3	21.1	24.7	24.6	24.0
Cyanides																
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon																
Total Organic Carbon	mg/L		0.50	5.40	5.39	4.55	4.12	3.23	3.16	2.44	2.27	2.29	2.05	2.28	2.23	5.10
Total Metals																
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0237	0.0219	0.0124	0.0142	0.0038	0.0030	<0.0030	<0.0030	0.0040	0.0069	0.0079	0.0084	<0.0030
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000286	0.000256	0.000182	0.000139	0.000432	0.000439	0.000446	0.000471	0.000394	0.000442	0.000489	0.000508	0.000854
Barium (Ba)	mg/L		0.000050	0.0123	0.0137	0.00507	0.00544	0.00137	0.00129	0.00170	0.00198	0.00164	0.00384	0.00442	0.00453	0.00276
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	0.0062	0.0063	0.0057	0.0056	0.0071	0.0070	0.0075	0.0074	0.0073	0.0073	0.0080	0.0075	0.0077
Cadmium (Cd)	mg/L	equation[b,d]	0.000010	0.000010	0.000011	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	5.62	6.08	2.22	2.01	5.45	5.45	8.14	7.68	7.43	10.2	12.0	11.8	12.8
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00021	0.00020	0.00018	0.00016	0.00021	0.00011	0.00011	0.00014	0.00011	0.00010	0.00013	0.00013	0.00014
Cobalt (Co)	mg/L		0.00010	0.00021	0.00028	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00089	0.00090	0.00092	<0.00010
Copper (Cu)	mg/L	≥0.002[e]	0.00050	0.00254	0.00361	0.00167	0.00112	0.00127	0.00134	0.00136	0.00127	0.00127	0.00184	0.00201	0.00198	0.00244
Iron (Fe)	mg/L	0.3	0.010	0.014	0.025	0.012	0.016	0.011	<0.010	<0.010	0.015	<0.010	0.026	0.034	0.040	<0.010
Lead (Pb)	mg/L	≥0.001[f]	0.000050	0.000098	0.000068	0.000273	0.000573	<0.000050	<0.000050	0.000577	0.00128	0.000235	0.000764	0.00226	0.00170	0.000335
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	2.74	2.84	1.30	1.15	2.90	2.92	3.27	3.17	3.09	3.18	3.68	3.69	6.67
Manganese (Mn)	mg/L		0.000050	0.00579	0.00903	0.00131	0.00319	0.000576	0.000436	0.00114	0.00322	0.00120	0.0307	0.0275	0.0299	0.00188
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000066	0.000053	0.000055	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000061
Nickel (Ni)	mg/L	≥0.025[g]	0.00010	0.00761	0.00796	0.00254	0.00251	0.00064	0.00065	0.00212	0.00214	0.00206	0.00787	0.00797	0.00770	0.00440
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.570	0.585	0.383	0.331	0.346	0.348	0.590	0.571	0.549	0.576	0.658	0.650	0.805
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.993	1.06	0.303	0.307	0.592	0.596	0.274	0.311	0.259	0.447	0.469	0.466	1.09
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	1.26	1.28	0.719	0.622	0.550	0.550	1.08	1.04	0.994	1.20	1.39	1.38	1.33
Strontium (Sr)	mg/L		0.00010 - 0.00020	0.0274	0.0295	0.00992	0.00898	0.00943	0.00948	0.0267	0.0252	0.0241	0.0349	0.0421	0.0419	0.0259
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

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Appendix 3.2-1. Lake Water Quality Analytical Results, Back River Project, 2012

Area				Goose	Goose	Goose	Goose	George	George	George	George	George	George	George	George	George
Location				Goose Lake Tail	Goose Lake Tail	Propellor Lake*	Propellor Lake*	Lower Long Lake	Lower Long Lake	Fold Lake	Fold Lake	Fold Lake	George Lake Central	George Lake Central	George Lake Central	Dragon Lake
Replicate				1	1	1	1	1	2	1	1	2	1	1	2	1
Duplicate?			Realised	-	-	-	-	-	duplicate	-	-	duplicate	-	-	duplicate	-
Depth (m)		CCME Guideline	Detection	1	3.8	1	5.3	1	1	1	6.2	1	1	5.5	5.5	1
Date Sampled		for the Protection	Limit	11-Apr-12	11-Apr-12	12-Apr-12	12-Apr-12	13-Apr-12	13-Apr-12	15-Apr-12	15-Apr-12	15-Apr-12	13-Apr-12	13-Apr-12	13-Apr-12	15-Apr-12
ALS Sample ID	Units	of Freshwater Aquatic Life[a]	RDL	L1133911-5	L1133911-6	L1134512-1	L1134512-2	L1135132-4	L1135132-5	L1135132-14	L1135132-15	L1135132-16	L1135132-9	L1135132-10	L1135132-11	L1135132-13
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	0.000011	<0.000010	<0.000010	<0.000010	0.000042	0.000039	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000011
Vanadium (V)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Zinc (Zn)	mg/L	0.03	0.0030	0.0031	0.0044	<0.0030	0.0039	<0.0030	<0.0030	0.0033	<0.0030	0.0032	0.0073	0.0071	0.0070	0.0034
Dissolved Metals																
Aluminum (Al)	mg/L		0.0030	0.0201	0.0198	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0066	<0.0030	<0.0030	<0.0030
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000259	0.000226	-	-	0.000466	0.000449	0.000435	0.000413	0.000435	0.000350	0.000380	0.000390	0.000862
Barium (Ba)	mg/L		0.000050	0.0122	0.0134	-	-	0.00136	0.00129	0.00177	0.00199	0.00168	0.00392	0.00438	0.00487	0.00269
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	-	-	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	0.0053	0.0052	-	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cadmium (Cd)	mg/L		0.000010	<0.000010	0.000012	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	0.000011	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	5.57	5.82	-	-	5.11	5.00	7.04	6.64	6.61	8.58	9.91	10.0	10.8
Chromium (Cr)	mg/L		0.00010	0.00017	0.00016	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt (Co)	mg/L		0.00010	0.00018	0.00026	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00057	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L		0.00050	0.00217	0.00209	-	-	0.00111	0.00110	0.00111	0.00100	0.00106	0.00164	0.00160	0.00164	0.00214
Iron (Fe)	mg/L		0.010	<0.010	0.010	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	-	-	<0.000050	<0.000050	0.000105	0.000112	<0.000050	0.000170	0.000056	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	-	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	2.70	2.79	-	-	2.92	2.89	3.19	3.07	3.07	3.11	3.52	3.63	6.44
Manganese (Mn)	mg/L		0.000050	0.00523	0.00830	-	-	0.000098	0.000097	0.000075	0.000069	0.000066	0.0221	0.00869	0.00954	0.000229
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	-	-	<0.000050	0.000053	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050
Nickel (Ni)	mg/L		0.00010	0.00740	0.00769	-	-	0.00065	0.00067	0.00221	0.00209	0.00203	0.00776	0.00780	0.00773	0.00441
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	-	-	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.565	0.577	-	-	0.352	0.345	0.587	0.560	0.550	0.568	0.636	0.654	0.786
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.974	1.04	-	-	0.594	0.580	0.276	0.292	0.256	0.427	0.448	0.465	1.08
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	1.24	1.28	-	-	0.562	0.544	1.05	1.01	1.00	1.16	1.37	1.40	1.31
Strontium (Sr)	mg/L		0.00010 - 0.00020	0.0271	0.0281	-	-	0.00919	0.00907	0.0233	0.0218	0.0216	0.0309	0.0354	0.0358	0.0217
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	<0.000010	-	-	0.000028	0.000029	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	<0.000050	<0.000050	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Zinc (Zn)	mg/L		0.0030	<0.0030	<0.0030	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0071	0.0054	0.0053	<0.0030

** Due to a lab error, dissolved metals data is not available for Propellor Lake samples collected in April*

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, (accessed 2012).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ /1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ /1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ /1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realised detection limit

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Appendix 3.2-1. Lake Water Quality Analytical Results, Back River Project, 2012

Area				George	George	George	George	George	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location				Komatic Lake	Komatic Lake	Reference Lake C	Reference Lake C	Reference Lake C	Moby Lake	Moby Lake	Gander Lake	Pond 19	Big Lake	Rabbit Lake	Fox Lake	Fox Lake	Echo Lake
Replicate				1	1	1	1	2	1	1	1	1	1	1	1	2	1
Duplicate?			Realised	-	-	-	-	duplicate	-	-	-	-	-	-	-	duplicate	-
Depth (m)		CCME Guideline	Detection	1	5	1	5.5	5.5	1	7.4	1	0.1	1	1	1	1	0.1
Date Sampled		for the Protection	Limit	13-Apr-12	13-Apr-12	13-Apr-12	13-Apr-12	13-Apr-12	22-Aug-12	22-Aug-12	18-Aug-12	21-Aug-12	16-Aug-12	15-Aug-12	20-Aug-12	20-Aug-12	17-Aug-12
ALS Sample ID	Units	of Freshwater Aquatic Life[a]	RDL	L1135132-6	L1135132-7	L1135132-1	L1135132-2	L1135132-3	L1198584-11	L1198584-12	L1196499-3	L1198584-7	L1195581-8	L1195581-6	L1198584-5	L1198584-6	L1196499-2
Physical Tests																	
Conductivity	µS/cm		2.0	143	146	151	148	149	33.9	34.2	22.1	81.3	14.6	19.0	18.5	18.3	41.6
Hardness (as $CaCO_3$)	mg/L		0.50	62.4	61.6	78.8	76.0	79.1	12.8	13.1	8.32	34.8	5.44	7.55	7.28	7.41	18.2
pH	pH	6.5-9.0	0.10	8.07	8.12	8.05	8.23	8.27	6.63	6.62	6.84	7.46	6.59	6.30	6.85	6.87	7.33
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		1.0 - 2.0	18.7	19.3	78.0	77.7	77.6	2.4	2.6	3.4	21.5	2.5	4.5	4.9	4.7	13.9
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		1.0 - 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		1.0 - 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<1.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		1.0 - 2.0	18.7	19.3	78.0	77.7	77.6	2.4	2.6	3.4	21.5	2.5	4.5	4.9	4.7	13.9
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	6.4
Total Dissolved Solids	mg/L		10	104	97	84	82	81	23	24	20	61	21	27	13	15	63
Turbidity	NTU	dependent on background levels	0.10	0.33	0.81	0.13	0.14	0.19	0.46	0.36	0.74	0.42	0.36	0.50	0.44	0.40	1.57
Nutrients																	
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	0.0091	<0.0050	0.0120	0.0122	0.0130	<0.0050	<0.0050	<0.0050	0.0067	<0.0050	0.0067	<0.0050	<0.0050	0.0081
Nitrate (as N)	mg/L	2.935[b]	0.0050	0.0320	0.0374	0.0061	0.0075	0.0083	<0.0050	<0.0050	<0.0050	0.0080	0.0082	0.0100	<0.0050	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.290	0.309	0.204	0.199	0.203	0.128	0.149	0.180	0.448	0.151	0.196	0.202	0.196	1.09
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.0047	0.0056	0.0039	0.0024	0.0025	0.0035	0.0039	0.0066	0.0035	0.0032	0.0023	0.0034	0.0037	0.0225
Anions																	
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 120; long-term: 640	0.50	5.50	5.65	0.82	0.79	0.79	<0.50	<0.50	<0.50	1.55	0.52	0.52	<0.50	<0.50	1.75
Fluoride (F)	mg/L	0.12[b]	0.02	0.039	0.038	0.020	0.020	0.021	0.031	0.031	0.023	0.045	<0.020	0.025	0.020	<0.020	0.046
Sulfate (SO_4)	mg/L		0.5	37.4	38.4	0.90	0.88	0.88	11.3	11.3	5.76	15.2	3.14	3.59	3.23	3.22	2.67
Cyanides																	
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon																	
Total Organic Carbon	mg/L		0.50	4.72	4.69	3.36	3.38	3.47	2.45	2.68	2.96	7.74	2.90	2.74	2.87	2.68	18.2
Total Metals																	
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0057	0.0054	<0.0030	<0.0030	<0.0030	0.0089	0.0085	0.0156	0.0067	0.0207	0.0149	0.0137	0.0061	0.0353
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000708	0.000741	0.000890	0.000206	0.000207	0.000224	0.000197	0.000383	0.000413	0.000361	0.000227	0.000208	0.000229	0.00156
Barium (Ba)	mg/L		0.000050	0.00554	0.00576	0.0254	0.0249	0.0247	0.00435	0.00423	0.00365	0.00671	0.00197	0.00206	0.00172	0.00171	0.00803
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	0.0077	0.0054	0.0066	0.0067	0.0089	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cadmium (Cd)	mg/L	equation[b,d]	0.000010	0.000011	<0.000010	0.000044	<0.000010	<0.000010	0.000014	0.000018	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	14.3	15.0	19.3	19.2	20.1	2.72	2.71	1.66	7.17	0.924	1.65	1.47	1.57	3.69
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00017	0.00011	0.00015	0.00017	0.00012	<0.00010	<0.00010	0.00015	<0.00010	0.00015	0.00011	<0.00010	<0.00010	0.00031
Cobalt (Co)	mg/L		0.00010	<0.00010	0.00013	<0.00010	<0.00010	<0.00010	0.00047	0.00045	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00029
Copper (Cu)	mg/L	≥0.002[e]	0.00050	0.00310	0.00305	0.00097	0.00102	0.00090	0.00163	0.00151	0.00166	0.00230	0.00174	0.00313	0.00091	0.00088	0.00252
Iron (Fe)	mg/L	0.3	0.010	0.019	0.027	<0.010	<0.010	<0.010	0.024	0.022	0.040	0.063	0.028	0.056	0.042	0.041	0.592
Lead (Pb)	mg/L	≥0.001[f]	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000092	<0.000050	0.000144	<0.000050	<0.000050	<0.000050	<0.000050	0.000051	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	5.92	5.93	7.53	7.37	7.44	1.55	1.51	1.10	4.20	0.729	0.873	0.883	0.894	2.24
Manganese (Mn)	mg/L		0.000050	0.00309	0.00518	0.00123	0.00151	0.00147	0.00694	0.00690	0.00103	0.000474	0.00148	0.000709	0.00160	0.00151	0.00436
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	0.000051	<0.000050	0.000092	0.000105	0.000094	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	≥0.025[g]	0.00010	0.0117	0.0112	0.00015	0.00016	0.00013	0.0158	0.0153	0.00532	0.00594	0.00159	0.00183	0.00109	0.00112	0.00273
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.803	0.804	0.303	0.296	0.298	0.278	0.269	0.285	0.913	0.307	0.342	0.268	0.273	0.748
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	1.51	1.54	1.23	1.21	1.21	0.420	0.406	0.065	0.707	0.116	0.372	0.224	0.209	0.126
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	1.74	1.75	0.597	0.542	0.546	0.599	0.585	0.587	1.88	0.476	0.493	0.441	0.445	1.48
Strontium (Sr)	mg/L		0.00010 - 0.00020	0.0461	0.0489	0.00885	0.00863	0.00854	0.0108	0.0108	0.00757	0.0215	0.00504	0.00589	0.00486	0.00508	0.0149
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

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Appendix 3.2-1. Lake Water Quality Analytical Results, Back River Project, 2012

Area				George	George	George	George	George	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location				Komatic Lake	Komatic Lake	Reference Lake C	Reference Lake C	Reference Lake C	Moby Lake	Moby Lake	Gander Lake	Pond 19	Big Lake	Rabbit Lake	Fox Lake	Fox Lake	Echo Lake
Replicate				1	1	1	1	2	1	1	1	1	1	1	1	2	1
Duplicate?			Realised	-	-	-	-	duplicate	-	-	-	-	-	-	-	duplicate	-
Depth (m)		CCME Guideline	Detection	1	5	1	5.5	5.5	1	7.4	1	0.1	1	1	1	1	0.1
Date Sampled		for the Protection	Limit	13-Apr-12	13-Apr-12	13-Apr-12	13-Apr-12	13-Apr-12	22-Aug-12	22-Aug-12	18-Aug-12	21-Aug-12	16-Aug-12	15-Aug-12	20-Aug-12	20-Aug-12	17-Aug-12
ALS Sample ID	Units	of Freshwater Aquatic Life[a]	RDL	L1135132-6	L1135132-7	L1135132-1	L1135132-2	L1135132-3	L1198584-11	L1198584-12	L1196499-3	L1198584-7	L1195581-8	L1195581-6	L1198584-5	L1198584-6	L1196499-2
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	0.000014	0.000013	0.000408	0.000402	0.000398	<0.000010	<0.000010	0.000011	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	0.000050	0.000050	0.000113	0.000107	0.000300	0.000127	0.000360	0.000435	0.000066	0.000108	0.000450
Zinc (Zn)	mg/L	0.03	0.0030	0.0055	0.0054	<0.0030	<0.0030	<0.0030	0.0042	0.0040	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals																	
Aluminum (Al)	mg/L		0.0030	0.0043	0.0039	<0.0030	<0.0030	<0.0030	0.0039	0.0038	0.0046	0.0035	0.0098	0.0113	0.0052	<0.0030	0.0115
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000711	0.000685	0.000232	0.000185	0.000198	0.000195	0.000174	0.000351	0.000387	0.000284	0.000172	0.000207	0.000202	0.00129
Barium (Ba)	mg/L		0.000050	0.00562	0.00577	0.0256	0.0251	0.0251	0.00415	0.00440	0.00352	0.00670	0.00209	0.00208	0.00174	0.00172	0.00754
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0059	<0.0050	<0.0050	<0.0050	0.0101	<0.0050	<0.0050
Cadmium (Cd)	mg/L		0.000010	0.000014	<0.000010	<0.000010	<0.000010	<0.000010	0.000015	0.000012	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	13.3	13.7	18.7	18.6	18.7	2.62	2.74	1.60	7.20	1.08	1.65	1.44	1.49	3.65
Chromium (Cr)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00016	<0.00010	<0.00010	<0.00010	0.00029	<0.00010	0.00019
Cobalt (Co)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00030	0.00028	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00013
Copper (Cu)	mg/L		0.00050	0.00275	0.00274	0.00087	0.00088	0.00082	0.00119	0.00120	0.00159	0.00198	0.00130	0.00129	0.00064	0.00066	0.00204
Iron (Fe)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.019	<0.010	0.018	<0.010	<0.010	0.193
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	5.85	5.98	7.38	7.31	7.39	1.52	1.53	1.05	4.07	0.670	0.835	0.895	0.893	2.21
Manganese (Mn)	mg/L		0.000050	0.000252	0.000181	0.000082	0.000117	0.000107	0.00474	0.00471	0.000624	0.000382	0.000717	0.000547	0.000412	0.000200	0.00111
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	0.000086	0.000083	0.000089	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.0110	0.0110	0.00013	0.00016	0.00015	0.0151	0.0152	0.00502	0.00576	0.00162	0.00181	0.00112	0.00107	0.00247
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.800	0.809	0.312	0.300	0.296	0.273	0.276	0.285	0.890	0.256	0.327	0.277	0.271	0.734
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	1.50	1.49	1.20	1.19	1.20	0.404	0.408	<0.050	0.709	0.109	0.360	0.211	0.197	0.102
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	1.73	1.77	0.572	0.558	0.551	0.583	0.590	0.577	1.78	0.446	0.480	0.442	0.439	1.47
Strontium (Sr)	mg/L		0.00010 - 0.00020	0.0441	0.0449	0.00834	0.00828	0.00842	0.0104	0.0108	0.00712	0.0227	0.00484	0.00586	0.00494	0.00485	0.0144
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	0.000010	<0.000010	0.000386	0.000381	0.000383	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000085	<0.000050	<0.000050	0.000114	<0.000050	<0.000050	0.000134
Zinc (Zn)	mg/L		0.0030	0.0042	0.0041	<0.0030	<0.0030	<0.0030	0.0037	0.0041	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

** Due to a lab error, dissolved metals data is not available for Propellor Lake samples collected in April*

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, (accessed 2012).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ /1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ /1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ /1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realised detection limit

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Appendix 3.2-1. Lake Water Quality Analytical Results, Back River Project, 2012

Area				Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	George
Location				Rascal Lake	Giraffe Lake North	Giraffe Lake South	Giraffe Lake South	Giraffe Lake South	Goose Lake Neck	Goose Lake Neck	Goose Lake Central	Goose Lake Tail	Propellor Lake	Propellor Lake	Propellor Lake	Lower Long Lake
Replicate				1	1	1	1	2	1	2	1	1	1	2	1	1
Duplicate?			Realised	-	-	-	-	duplicate	-	duplicate	-	-	-	duplicate	-	-
Depth (m)		CCME Guideline	Detection	1	1	1	3.7	3.7	1	1	1	1	1	1	3.7	1
Date Sampled		for the Protection	Limit	15-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	14-Aug-12	14-Aug-12	17-Aug-12	18-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12
ALS Sample ID	Units	of Freshwater Aquatic Life[a]	RDL	L1195581-7	L1198584-3	L1198584-1	L1198584-2	L1198584-4	L1195581-4	L1195581-5	L1196499-1	L1196499-4	L1198584-8	L1198584-9	L1198584-10	L1198951-1
Physical Tests																
Conductivity	µS/cm		2.0	18.7	24.0	25.8	24.1	24.0	36.1	36.1	32.8	32.5	19.5	19.3	19.2	26.5
Hardness (as $CaCO_3$)	mg/L		0.50	7.41	9.28	9.20	9.34	9.40	13.9	14.0	12.6	12.2	7.51	7.76	7.59	12.3
pH	pH	6.5-9.0	0.10	6.33	6.86	7.14	6.91	6.82	6.74	6.61	6.87	6.70	6.77	6.73	6.91	7.24
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		1.0 - 2.0	4.1	3.6	4.0	4.1	4.3	3.5	3.7	3.2	3.2	3.0	3.1	3.2	10.8
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		1.0 - 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		1.0 - 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		1.0 - 2.0	4.1	3.6	4.0	4.1	4.3	3.5	3.7	3.2	3.2	3.0	3.1	3.2	10.8
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	20	18	18	18	15	23	34	26	32	18	15	17	15
Turbidity	NTU	dependent on background levels	0.10	0.38	0.59	0.45	0.28	0.30	0.41	0.36	0.32	0.34	0.42	0.31	0.39	0.24
Nutrients																
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0074	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate (as N)	mg/L	2.935[b]	0.0050	0.0075	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0090	<0.0050	<0.0050	0.0076	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.207	0.162	0.187	0.202	0.179	0.168	0.151	0.164	0.159	0.181	0.151	0.160	0.132
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.0031	0.0030	0.0027	0.0032	0.0037	0.0029	0.0030	0.0029	0.0028	0.0036	0.0036	0.0033	0.0029
Anions																
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 120; long-term: 640	0.50	0.81	0.56	0.57	0.53	0.54	5.62	5.63	4.59	4.31	1.65	1.61	1.59	<0.50
Fluoride (F)	mg/L	0.12[b]	0.02	0.021	0.025	0.025	0.024	0.024	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Sulfate (SO_4)	mg/L		0.5	3.47	5.80	5.78	5.79	5.78	4.34	4.34	4.35	4.26	2.78	2.80	2.78	1.66
Cyanides																
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon																
Total Organic Carbon	mg/L		0.50	3.42	3.11	3.00	2.89	3.03	2.84	2.86	2.94	2.93	3.17	2.92	2.92	2.32
Total Metals																
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0193	0.0178	0.0190	0.0131	0.0142	0.0140	0.0137	0.0278	0.0094	0.0171	0.0102	0.0101	0.0046
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000202	0.000221	0.000204	0.000202	0.000231	0.000236	0.000195	0.000211	0.000200	0.000148	0.000147	0.000146	0.000414
Barium (Ba)	mg/L		0.000050	0.00324	0.00322	0.00316	0.00311	0.00303	0.00738	0.00694	0.00573	0.00501	0.00366	0.00361	0.00363	0.00111
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	0.0052	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0056	<0.0050	<0.0050	<0.0050	0.0057
Cadmium (Cd)	mg/L	equation[b,d]	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	1.52	1.67	1.73	1.67	1.66	3.63	3.49	2.96	2.85	1.72	1.62	1.58	2.48
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00015	0.00012	<0.00010	<0.00010	<0.00010	0.00013	0.00016	0.00011	0.00013	0.00154	<0.00010	<0.00010	<0.00010
Cobalt (Co)	mg/L		0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	0.00013	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	≥0.002[e]	0.00050	0.00291	0.00205	0.00189	0.00184	0.00185	0.00505	0.00299	0.00136	0.00117	0.00102	0.00104	0.00088	0.00108
Iron (Fe)	mg/L	0.3	0.010	0.063	0.050	0.049	0.051	0.049	0.034	0.033	0.022	0.044	0.109	0.018	0.017	0.018
Lead (Pb)	mg/L	≥0.001[f]	0.000050	0.000089	0.000053	0.000059	<0.000050	<0.000050	0.000462	<0.000050	0.000199	<0.000050	0.000102	0.000065	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	0.918	1.32	1.24	1.22	1.22	1.40	1.33	1.34	1.35	0.871	0.870	0.868	1.53
Manganese (Mn)	mg/L		0.000050	0.000676	0.00154	0.00146	0.00147	0.00152	0.00286	0.00287	0.00211	0.00250	0.00412	0.00281	0.00279	0.00123
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000194	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	≥0.025[g]	0.00010	0.00168	0.00422	0.00403	0.00394	0.00403	0.00363	0.00352	0.00332	0.00242	0.00263	0.00185	0.00185	0.00032
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.291	0.327	0.304	0.300	0.300	0.394	0.359	0.340	0.347	0.269	0.271	0.271	0.210
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.280	0.223	0.203	0.205	0.205	0.249	0.243	0.221	0.201	0.129	0.126	0.126	0.292
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.496	0.630	0.593	0.585	0.587	0.639	0.613	0.643	0.639	0.474	0.465	0.470	0.414
Strontium (Sr)	mg/L		0.00010 - 0.00020	0.00655	0.00711	0.00790	0.00712	0.00705	0.0208	0.0196	0.0159	0.0149	0.00812	0.00766	0.00750	0.00455
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

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Appendix 3.2-1. Lake Water Quality Analytical Results, Back River Project, 2012

Area				Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	George
Location				Rascal Lake	Giraffe Lake North	Giraffe Lake South	Giraffe Lake South	Giraffe Lake South	Goose Lake Neck	Goose Lake Neck	Goose Lake Central	Goose Lake Tail	Propellor Lake	Propellor Lake	Propellor Lake	Lower Long Lake
Replicate				1	1	1	1	2	1	2	1	1	1	2	1	1
Duplicate?			Realised	-	-	-	-	duplicate	-	duplicate	-	-	-	duplicate	-	-
Depth (m)		CCME Guideline	Detection	1	1	1	3.7	3.7	1	1	1	1	1	1	3.7	1
Date Sampled		for the Protection	Limit	15-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	14-Aug-12	14-Aug-12	17-Aug-12	18-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12
ALS Sample ID	Units	of Freshwater Aquatic Life[a]	RDL	L1195581-7	L1198584-3	L1198584-1	L1198584-2	L1198584-4	L1195581-4	L1195581-5	L1196499-1	L1196499-4	L1198584-8	L1198584-9	L1198584-10	L1198951-1
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000014
Vanadium (V)	mg/L		0.000050	0.000432	0.000154	0.000121	0.000123	0.000129	0.000645	0.000461	0.000188	0.000191	0.000138	0.000119	0.000123	0.000387
Zinc (Zn)	mg/L	0.03	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0031	<0.0030	<0.0030
Dissolved Metals																
Aluminum (Al)	mg/L		0.0030	0.0089	0.0093	0.0096	0.0064	0.0073	0.0074	0.0067	0.0159	0.0042	0.0112	0.0058	0.0052	<0.0030
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000156	0.000178	0.000192	0.000182	0.000189	0.000175	0.000132	0.000179	0.000152	0.000125	0.000118	0.000124	0.000377
Barium (Ba)	mg/L		0.000050	0.00313	0.00307	0.00317	0.00379	0.00313	0.00701	0.00671	0.00567	0.00483	0.00352	0.00358	0.00343	0.00107
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	<0.0050	0.0059	<0.0050	<0.0050	<0.0050	<0.0050	0.0056	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0060
Cadmium (Cd)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	1.50	1.68	1.68	1.68	1.72	3.44	3.44	2.88	2.78	1.57	1.71	1.63	2.58
Chromium (Cr)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010
Cobalt (Co)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L		0.00050	0.00121	0.00146	0.00144	0.00134	0.00146	0.00143	0.00132	0.00108	0.00089	0.00068	0.00081	0.00072	0.00091
Iron (Fe)	mg/L		0.010	0.011	0.012	0.012	0.012	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	0.892	1.23	1.22	1.25	1.24	1.28	1.31	1.32	1.28	0.870	0.849	0.853	1.43
Manganese (Mn)	mg/L		0.000050	0.000476	0.00123	0.00122	0.00119	0.00117	0.00147	0.00115	0.000396	0.000933	0.000166	0.000216	0.000192	0.000141
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.00153	0.00390	0.00388	0.00399	0.00393	0.00343	0.00348	0.00318	0.00222	0.00179	0.00176	0.00176	0.00039
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.284	0.303	0.303	0.309	0.307	0.381	0.356	0.335	0.322	0.271	0.275	0.270	0.211
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.258	0.203	0.200	0.193	0.206	0.230	0.226	0.218	0.189	0.124	0.112	0.115	0.284
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.485	0.588	0.588	0.592	0.593	0.622	0.610	0.631	0.598	0.468	0.460	0.455	0.339
Strontium (Sr)	mg/L		0.00010 - 0.00020	0.00624	0.00712	0.00714	0.00732	0.00720	0.0191	0.0194	0.0151	0.0143	0.00734	0.00799	0.00759	0.00495
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000015
Vanadium (V)	mg/L		0.000050	0.000097	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000114	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Zinc (Zn)	mg/L		0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

** Due to a lab error, dissolved metals data is not available for Propellor Lake samples collected in April*

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, (accessed 2012).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ /1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ /1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ /1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realised detection limit

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Appendix 3.2-1. Lake Water Quality Analytical Results, Back River Project, 2012

Area				George	George	George	George	George	George	George	George	George	George	George	George
Location				George Lake Central	George Lake South	Lytle Lake	Occurrence Lake	Sleigh Lake	Dragon Lake	Dragon Lake	Komatic Lake	Komatic Lake	Reference C Lake	Reference C Lake	Reference C Lake
Replicate				1	1	1	1	1	1	2	1	1	1	2	1
Duplicate?			Realised	-	-	-	-	-	-	duplicate	-	-	-	duplicate	-
Depth (m)		CCME Guideline	Detection	7	0.5	0.5	1	0.5	1	1	1	3.5	1	1	29
Date Sampled		for the Protection	Limit	18-Aug-12	18-Aug-12	23-Aug-12	21-Aug-12	22-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12	22-Aug-12	22-Aug-12	22-Aug-12
ALS Sample ID	Units	of Freshwater Aquatic Life[a]	RDL	L1197323-6	L1197323-1	L1199564-1	L1198951-2	L1198951-6	L1197323-10	L1197323-11	L1197323-12	L1197323-13	L1198951-3	L1198951-4	L1198951-5
Physical Tests															
Conductivity	µS/cm		2.0	53.4	53.3	66.1	76.7	84.1	49.1	48.9	57.6	57.6	119	118	118
Hardness (as $CaCO_3$)	mg/L		0.50	20.6	20.4	26.1	29.5	33.0	20.9	21.3	22.8	23.1	63.1	60.7	66.3
pH	pH	6.5-9.0	0.10	6.96	6.81	7.26	7.07	7.13	7.30	7.32	7.17	7.16	8.01	8.06	7.88
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		1.0 - 2.0	5.0	5.5	6.4	7.4	6.9	12.1	12.2	8.3	8.5	65.3	65.9	65.1
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		1.0 - 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		1.0 - 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		1.0 - 2.0	5.0	5.5	6.4	7.4	6.9	12.1	12.2	8.3	8.5	65.3	65.9	65.1
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	38	28	43	45	53	33	34	38	40	68	69	70
Turbidity	NTU	dependent on background levels	0.10	0.23	0.22	0.22	0.45	0.37	0.28	0.33	0.36	0.39	0.29	0.25	0.19
Nutrients															
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	<0.0050	<0.0050	0.0061	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0115
Nitrate (as N)	mg/L	2.935[b]	0.0050	<0.0050	<0.0050	0.0314	0.0059	0.0091	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0165
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.125	0.113	0.201	0.131	0.177	0.190	0.200	0.192	0.182	0.143	0.146	0.140
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.0028	0.0025	0.0032	0.0038	0.0037	0.0034	0.0036	0.0039	0.0037	0.0033	0.0029	0.0040
Anions															
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 120; long-term: 640	0.50	3.21	3.25	3.46	6.01	8.32	1.14	1.13	2.62	2.62	0.68	0.67	0.66
Fluoride (F)	mg/L	0.12[b]	0.02	0.027	0.027	0.033	0.036	0.036	0.021	0.021	0.028	0.028	<0.020	<0.020	<0.020
Sulfate (SO_4)	mg/L		0.5	13.4	13.5	16.7	17.7	17.8	9.19	9.21	13.4	13.5	0.66	0.65	0.70
Cyanides															
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon															
Total Organic Carbon	mg/L		0.50	1.24	1.18	2.00	2.12	2.47	2.09	2.13	2.21	2.26	2.71	2.54	2.58
Total Metals															
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0140	0.0112	0.0093	0.0328	0.0117	0.0051	0.0042	0.0076	0.0067	0.0031	0.0031	<0.0030
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000409	0.000424	0.000514	0.000653	0.000588	0.00115	0.00113	0.000988	0.000975	0.000215	0.000216	0.000214
Barium (Ba)	mg/L		0.000050	0.00203	0.00280	0.00287	0.00348	0.00407	0.00272	0.000966	0.00299	0.00229	0.0211	0.0205	0.0211
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	<0.0050	<0.0050	0.0078	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0051
Cadmium (Cd)	mg/L	equation[b,d]	0.000010	<0.000010	<0.000010	<0.000010	0.000011	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	4.73	4.79	6.52	6.97	8.69	4.09	4.09	5.24	5.28	14.6	15.2	15.8
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	<0.00010	<0.00010	<0.00010	0.00015	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt (Co)	mg/L		0.00010	0.00015	0.00015	0.00070	0.00080	0.00027	<0.00010	<0.00010	0.00012	0.00013	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	≥0.002[e]	0.00050	0.00133	0.00131	0.00231	0.00313	0.00236	0.00164	0.00148	0.00202	0.00194	0.00097	0.00107	0.00097
Iron (Fe)	mg/L	0.3	0.010	<0.010	<0.010	0.021	0.043	0.057	0.035	0.034	0.074	0.071	<0.010	<0.010	<0.010
Lead (Pb)	mg/L	≥0.001[f]	0.000050	<0.000050	0.000054	<0.000050	0.000061	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	1.91	1.87	2.28	2.58	2.70	2.81	2.77	2.46	2.46	5.94	6.09	6.14
Manganese (Mn)	mg/L		0.000050	0.00172	0.00156	0.00425	0.00385	0.00407	0.00181	0.00170	0.00300	0.00290	0.00246	0.00250	0.00173
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	<0.000050	0.000076	0.000073	0.000074
Nickel (Ni)	mg/L	≥0.025[g]	0.00010	0.00209	0.00208	0.00532	0.00540	0.00373	0.00140	0.00133	0.00327	0.00314	0.00014	0.00012	0.00014
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.340	0.341	0.415	0.481	0.500	0.354	0.352	0.386	0.370	0.239	0.242	0.249
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.114	0.109	0.255	0.222	0.212	0.374	0.373	0.238	0.228	0.958	0.996	1.17
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.751	0.748	0.904	1.06	1.13	0.601	0.595	0.846	0.820	0.447	0.465	0.474
Strontium (Sr)	mg/L		0.00010 - 0.00020	0.0174	0.0174	0.0244	0.0328	0.0444	0.00846	0.00840	0.0180	0.0180	0.00681	0.00719	0.00721
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

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Appendix 3.2-1. Lake Water Quality Analytical Results, Back River Project, 2012

Area				George	George	George	George	George	George	George	George	George	George	George	George
Location				George Lake Central	George Lake South	Lytle Lake	Occurrence Lake	Sleigh Lake	Dragon Lake	Dragon Lake	Komatic Lake	Komatic Lake	Reference C Lake	Reference C Lake	Reference C Lake
Replicate				1	1	1	1	1	1	2	1	1	1	2	1
Duplicate?				-	-	-	-	-	-	duplicate	-	-	-	duplicate	-
Depth (m)			Realised	7	0.5	0.5	1	0.5	1	1	1	3.5	1	1	29
Date Sampled		CCME Guideline for the Protection	Detection Limit	18-Aug-12	18-Aug-12	23-Aug-12	21-Aug-12	22-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12	22-Aug-12	22-Aug-12	22-Aug-12
ALS Sample ID	Units	of Freshwater Aquatic Life[a]	RDL	L1197323-6	L1197323-1	L1199564-1	L1198951-2	L1198951-6	L1197323-10	L1197323-11	L1197323-12	L1197323-13	L1198951-3	L1198951-4	L1198951-5
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	<0.000010	0.000012	0.000015	0.000011	<0.000010	<0.000010	<0.000010	<0.000010	0.000293	0.000315	0.000304
Vanadium (V)	mg/L		0.000050	0.000068	0.000091	0.000101	0.000222	0.000201	0.000099	0.000098	0.000125	0.000137	0.000228	0.000203	0.000221
Zinc (Zn)	mg/L	0.03	0.0030	<0.0030	0.0038	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals															
Aluminum (Al)	mg/L		0.0030	0.0068	0.0075	0.0043	0.0124	0.0059	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000408	0.000424	0.000430	0.000559	0.000502	0.000918	0.000866	0.000748	0.000702	0.000215	0.000207	0.000188
Barium (Ba)	mg/L		0.000050	0.00217	0.00290	0.00285	0.00329	0.00426	0.00291	0.00103	0.00286	0.00232	0.0218	0.0214	0.0202
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	<0.0050	<0.0050	0.0056	<0.0050	0.0053	<0.0050	<0.0050	<0.0050	<0.0050	0.0056	0.0071	0.0056
Cadmium (Cd)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	5.11	5.00	6.61	7.52	8.86	4.12	4.15	5.17	5.32	15.8	14.8	16.7
Chromium (Cr)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	0.00012	0.00011	<0.00010
Cobalt (Co)	mg/L		0.00010	<0.00010	<0.00010	0.00030	0.00073	0.00021	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L		0.00050	0.00104	0.00109	0.00168	0.00236	0.00187	0.00115	0.00119	0.00156	0.00152	0.00101	0.00083	0.00079
Iron (Fe)	mg/L		0.010	<0.010	<0.010	0.019	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	1.91	1.93	2.33	2.61	2.64	2.59	2.65	2.40	2.38	5.74	5.76	5.98
Manganese (Mn)	mg/L		0.000050	0.000400	0.000543	0.00212	0.00316	0.00345	<0.000050	<0.000050	0.000642	0.000490	<0.000050	<0.000050	<0.000050
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	<0.000050	0.000089	0.000077	0.000069
Nickel (Ni)	mg/L		0.00010	0.00212	0.00219	0.00540	0.00525	0.00367	0.00128	0.00127	0.00301	0.00289	0.00016	0.00016	0.00014
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.361	0.359	0.418	0.479	0.508	0.340	0.345	0.361	0.358	0.242	0.238	0.249
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.103	0.107	0.251	0.193	0.208	0.354	0.354	0.216	0.215	0.978	0.994	1.14
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.778	0.783	0.949	1.07	1.10	0.562	0.567	0.795	0.781	0.461	0.454	0.465
Strontium (Sr)	mg/L		0.00010 - 0.00020	0.0182	0.0181	0.0243	0.0350	0.0452	0.00829	0.00833	0.0173	0.0177	0.00709	0.00704	0.00703
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000320	0.000311	0.000305
Vanadium (V)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000055
Zinc (Zn)	mg/L		0.0030	<0.0030	0.0033	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

** Due to a lab error, dissolved metals data is not available for Propellor Lake samples collected in April*

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, (accessed 2012).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ /1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ /1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ /1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realised detection limit

Appendix 3.2-2

Lake Water Quality Analytical Results of Field Duplicates, Back River Project, 2012

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Appendix 3.2-2. Lake Water Quality Analytical Results of Field Duplicates

Location	Big Lake				Fox Lake				Giraffe Lake North				Goose Lake Central			
Replicate	1	2			1	2			1	2			1	2		
Duplicate	sample	duplicate			sample	duplicate			sample	duplicate			sample	duplicate		
Depth	1	1			1	1			1	1			1	1		
Date Sampled	10-Apr-12	10-Apr-12			10-Apr-12	10-Apr-12			11-Apr-12	11-Apr-12			11-Apr-12	11-Apr-12		
ALS Sample ID	L1133356-3	L1133356-10			L1133356-9	L1133356-4			L1133911-7	L1133911-10			L1133911-1	L1133911-2		
	Sample	Duplicate	5 x DL	RPD_a	Sample	Duplicate	5 x DL	RPD_a	Sample	Duplicate	5 x DL	RPD_a	Sample	Duplicate	5 x DL	RPD_a
Physical Tests																
Conductivity	34.0	35.6	10	4.6	50.1	47.6	10	5.1	72.6	73.1	10	0.7	65.7	61.8	10	6.1
Hardness (as $CaCO_3$)	12.7	12.5	2.5	1.6	21.4	20.6	2.5	3.8	27.7	27.5	2.5	0.7	22.4	22.1	2.5	1.3
pH	6.83	7.68	0.5	11.7	7.10	7.13	0.5	0.4	8.07	8.11	0.5	0.5	6.82	8.05	0.5	16.5
Alkalinity, Bicarbonate (as $CaCO_3$)	7.1	6.7	10	RPD-N/A	12.6	12.4	10	1.6	10.8	10.6	10	1.9	7.4	6.6	10	RPD-N/A
Alkalinity, Carbonate (as $CaCO_3$)	<2.0	<2.0	10	RPD-N/A	<2.0	<2.0	10	RPD-N/A	<2.0	<2.0	10	RPD-N/A	<2.0	<2.0	10	RPD-N/A
Alkalinity, Hydroxide (as $CaCO_3$)	<2.0	<2.0	10	RPD-N/A	<2.0	<2.0	10	RPD-N/A	<2.0	<2.0	10	RPD-N/A	<2.0	<2.0	10	RPD-N/A
Alkalinity, Total (as $CaCO_3$)	7.1	6.7	10	RPD-N/A	12.6	12.4	10	1.6	10.8	10.6	10	1.9	7.4	6.6	10	RPD-N/A
Total Suspended Solids	<3.0	<3.0	15	RPD-N/A	<3.0	<3.0	15	RPD-N/A	<3.0	<3.0	15	RPD-N/A	<3.0	<3.0	15	RPD-N/A
Total Dissolved Solids	29	30	50	RPD-N/A	38	36	50	RPD-N/A	54	50	50	RPD-N/A	48	45	50	RPD-N/A
Turbidity	0.59	0.37	0.5	RPD-N/A	1.21	0.26	0.5	RPD-N/A	0.24	0.29	0.5	RPD-N/A	0.31	0.29	0.5	RPD-N/A
Nutrients																
Ammonia, Total (as N)	0.0257	0.0220	0.025	RPD-N/A	0.0396	0.0384	0.025	3.1	0.0289	0.0292	0.025	1.0	0.0205	0.0220	0.025	RPD-N/A
Nitrate (as N)	0.0176	0.0178	0.025	RPD-N/A	0.0066	0.0065	0.025	RPD-N/A	0.0179	0.0170	0.025	RPD-N/A	0.0109	0.0089	0.025	RPD-N/A
Nitrite (as N)	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A
Total Kjeldahl Nitrogen	<0.050	<0.050	0.25	RPD-N/A	0.143	0.104	0.25	RPD-N/A	0.261	0.274	0.25	4.9	0.266	0.245	0.25	RPD-N/A
Ortho-phosphate (as P)	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A
Total Phosphorus (P)	0.0042	0.0054	0.01	RPD-N/A	0.0043	0.0038	0.01	RPD-N/A	0.0041	0.0030	0.01	RPD-N/A	0.0032	0.0033	0.01	RPD-N/A
Anions																
Bromide (Br)	<0.050	<0.050	0.25	RPD-N/A	<0.050	<0.050	0.25	RPD-N/A	<0.050	<0.050	0.25	RPD-N/A	<0.050	<0.050	0.25	RPD-N/A
Chloride (Cl)	0.93	0.91	2.5	RPD-N/A	1.02	0.88	2.5	RPD-N/A	1.28	1.27	2.5	RPD-N/A	8.44	7.98	2.5	5.6
Fluoride (F)	0.024	0.024	0.1	RPD-N/A	0.033	0.031	0.1	RPD-N/A	0.036	0.036	0.1	RPD-N/A	0.028	0.026	0.1	RPD-N/A
Sulfate (SO_4)	7.27	7.28	2.5	0.1	9.36	8.82	2.5	5.9	19.5	19.4	2.5	0.5	8.93	8.53	2.5	4.6
Cyanides																
Cyanide, Total	<0.0010	0.0013	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	0.0013	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A
Cyanide, Free	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A
Organic / Inorganic Carbon																
Total Organic Carbon	4.47	4.45	2.5	0.4	4.90	4.68	2.5	4.6	6.01	6.45	2.5	7.1	4.87	4.85	2.5	0.4
Total Metals																
Aluminum (Al)	0.0191	0.0170	0.015	11.6	0.0072	0.0065	0.015	RPD-N/A	0.0298	0.0300	0.015	0.7	0.0237	0.0259	0.015	8.9
Antimony (Sb)	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Arsenic (As)	0.000463	0.000440	0.00015	5.1	0.000359	0.000350	0.00015	2.5	0.000304	0.000285	0.00015	6.5	0.000272	0.000243	0.00015	11.3
Barium (Ba)	0.00553	0.00570	0.00025	3.0	0.00629	0.00527	0.00025	17.6	0.00927	0.00952	0.00025	2.7	0.0106	0.0105	0.00025	0.9
Beryllium (Be)	<0.00020	<0.00020	0.001	RPD-N/A	<0.00020	<0.00020	0.001	RPD-N/A	<0.00020	<0.00020	0.001	RPD-N/A	<0.00020	<0.00020	0.001	RPD-N/A
Bismuth (Bi)	<0.00050	<0.00050	0.0025	RPD-N/A	<0.00050	<0.00050	0.0025	RPD-N/A	<0.00050	<0.00050	0.0025	RPD-N/A	<0.00050	<0.00050	0.0025	RPD-N/A
Boron (B)	0.0071	0.0067	0.025	RPD-N/A	0.0070	0.0073	0.025	RPD-N/A	0.0064	0.0066	0.025	RPD-N/A	0.0059	0.0064	0.025	RPD-N/A
Cadmium (Cd)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	0.000016	0.000016	0.00005	RPD-N/A	0.000011	<0.000010	0.00005	RPD-N/A
Calcium (Ca)	2.64	2.66	0.1	0.8	4.61	4.53	0.1	1.8	5.14	5.23	0.1	1.7	5.27	5.21	0.1	1.1
Chromium (Cr)	0.00023	0.00029	0.0005	RPD-N/A	0.00022	0.00017	0.0005	RPD-N/A	0.00027	0.00029	0.0005	RPD-N/A	0.00021	0.00020	0.0005	RPD-N/A
Cobalt (Co)	0.00072	0.00130	0.0005	**57.4**	<0.00010	<0.00010	0.0005	RPD-N/A	0.00068	0.00069	0.0005	1.5	0.00029	0.00031	0.0005	RPD-N/A
Copper (Cu)	0.00203	0.00180	0.0025	RPD-N/A	0.00191	0.00168	0.0025	RPD-N/A	0.00382	0.00388	0.0025	1.6	0.00230	0.00229	0.0025	RPD-N/A
Iron (Fe)	0.061	0.115	0.05	**61.4**	0.015	0.014	0.05	RPD-N/A	0.029	0.028	0.05	RPD-N/A	0.010	<0.010	0.05	RPD-N/A
Lead (Pb)	<0.000050	<0.000050	0.00025	RPD-N/A	0.00986	0.000351	0.00025	**186.3**	<0.000050	<0.000050	0.00025	RPD-N/A	0.000693	0.000400	0.00025	**53.6**
Lithium (Li)	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A
Magnesium (Mg)	1.65	1.58	0.025	4.3	2.52	2.44	0.025	3.2	3.65	3.65	0.025	0.0	2.57	2.54	0.025	1.2
Manganese (Mn)	0.0214	0.0382	0.00025	**56.4**	0.00391	0.00532	0.00025	*30.6*	0.00726	0.00732	0.00025	0.8	0.00428	0.00435	0.00025	1.6
Mercury (Hg)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A
Molybdenum (Mo)	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	0.000053	0.00025	RPD-N/A
Nickel (Ni)	0.00473	0.00460	0.0005	2.8	0.00427	0.00406	0.0005	5.0	0.0159	0.0157	0.0005	1.3	0.00744	0.00745	0.0005	0.1
Phosphorus (P)	<0.30	<0.30	1.5	RPD-N/A	<0.30	<0.30	1.5	RPD-N/A	<0.30	<0.30	1.5	RPD-N/A	<0.30	<0.30	1.5	RPD-N/A
Potassium (K)	0.468	0.450	0.25	3.9	0.647	0.619	0.25	4.4	0.631	0.630	0.25	0.2	0.509	0.502	0.25	1.4
Selenium (Se)	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A
Silicon (Si)	0.590	0.601	0.25	1.8	0.796	0.764	0.25	4.1	1.68	1.71	0.25	1.8	0.968	0.960	0.25	0.8
Silver (Ag)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A
Sodium (Na)	0.943	0.887	0.05	6.1	1.09	1.04	0.05	4.7	1.51	1.53	0.05	1.3	1.13	1.12	0.05	0.9

Appendix 3.2-2. Lake Water Quality Analytical Results of Field Duplicates

Location	Big Lake				Fox Lake				Giraffe Lake North				Goose Lake Central			
Replicate	**1**	**2**			**1**	**2**			**1**	**2**			**1**	**2**		
Duplicate	**sample**	**duplicate**			**sample**	**duplicate**			**sample**	**duplicate**			**sample**	**duplicate**		
Depth	**1**	**1**			**1**	**1**			**1**	**1**			**1**	**1**		
Date Sampled	**10-Apr-12**	**10-Apr-12**			**10-Apr-12**	**10-Apr-12**			**11-Apr-12**	**11-Apr-12**			**11-Apr-12**	**11-Apr-12**		
ALS Sample ID	**L1133356-3**	**L1133356-10**			**L1133356-9**	**L1133356-4**			**L1133911-7**	**L1133911-10**			**L1133911-1**	**L1133911-2**		
	Sample	**Duplicate**	**5 x DL**	**RPD$_a$**	**Sample**	**Duplicate**	**5 x DL**	**RPD$_a$**	**Sample**	**Duplicate**	**5 x DL**	**RPD$_a$**	**Sample**	**Duplicate**	**5 x DL**	**RPD$_a$**
Strontium (Sr)	0.0115	0.0118	0.0005	2.6	0.0151	0.0143	0.0005	5.4	0.0213	0.0216	0.0005	1.4	0.0245	0.0245	0.0005	0.0
Thallium (Tl)	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Tin (Sn)	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A
Titanium (Ti)	<0.010	<0.010	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A
Uranium (U)	0.000014	0.000013	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	0.000020	0.000019	0.00005	RPD-N/A	0.000011	0.000011	0.00005	RPD-N/A
Vanadium (V)	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	0.000061	0.000051	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Zinc (Zn)	0.0037	<0.0030	0.015	RPD-N/A	<0.0030	<0.0030	0.015	RPD-N/A	0.0053	0.0053	0.015	RPD-N/A	0.0032	0.0031	0.015	RPD-N/A
Dissolved Metals																
Aluminum (Al)	0.0151	0.0116	0.015	RPD-N/A	0.0049	0.0044	0.015	RPD-N/A	0.0263	0.0267	0.015	1.5	0.0209	0.0211	0.015	1.0
Antimony (Sb)	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Arsenic (As)	0.000419	0.000370	0.00015	12.4	0.000354	0.000347	0.00015	2.0	0.000329	0.000318	0.00015	3.4	0.000237	0.000254	0.00015	6.9
Barium (Ba)	0.00536	0.00555	0.00025	3.5	0.00607	0.00518	0.00025	15.8	0.00914	0.00915	0.00025	0.1	0.0102	0.0101	0.00025	1.0
Beryllium (Be)	<0.00020	<0.00020	0.001	RPD-N/A	<0.00020	<0.00020	0.001	RPD-N/A	<0.00020	<0.00020	0.001	RPD-N/A	<0.00020	<0.00020	0.001	RPD-N/A
Bismuth (Bi)	<0.00050	<0.00050	0.0025	RPD-N/A	<0.00050	<0.00050	0.0025	RPD-N/A	<0.00050	<0.00050	0.0025	RPD-N/A	<0.00050	<0.00050	0.0025	RPD-N/A
Boron (B)	0.0061	0.0059	0.025	RPD-N/A	0.0061	0.0083	0.025	RPD-N/A	0.0062	0.0060	0.025	RPD-N/A	0.0051	0.0056	0.025	RPD-N/A
Cadmium (Cd)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	0.000012	0.000015	0.00005	RPD-N/A	0.000011	<0.000010	0.00005	RPD-N/A
Calcium (Ca)	2.53	2.51	0.1	0.8	4.52	4.37	0.1	3.4	5.17	5.10	0.1	1.4	4.95	4.86	0.1	1.8
Chromium (Cr)	0.00020	0.00015	0.0005	RPD-N/A	0.00016	0.00014	0.0005	RPD-N/A	0.00022	0.00020	0.0005	RPD-N/A	0.00017	0.00018	0.0005	RPD-N/A
Cobalt (Co)	0.00072	0.00126	0.0005	**54.5**	<0.00010	<0.00010	0.0005	RPD-N/A	0.00053	0.00054	0.0005	1.9	0.00022	0.00022	0.0005	RPD-N/A
Copper (Cu)	0.00171	0.00156	0.0025	RPD-N/A	0.00174	0.00152	0.0025	RPD-N/A	0.00358	0.00356	0.0025	0.6	0.00209	0.00205	0.0025	RPD-N/A
Iron (Fe)	0.019	0.027	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A	0.011	0.012	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A
Lead (Pb)	<0.000050	<0.000050	0.00025	RPD-N/A	0.00485	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	0.000307	0.000210	0.00025	RPD-N/A
Lithium (Li)	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A
Magnesium (Mg)	1.56	1.51	0.025	3.3	2.47	2.36	0.025	4.6	3.59	3.58	0.025	0.3	2.44	2.41	0.025	1.2
Manganese (Mn)	0.0221	0.0386	0.00025	**54.4**	0.000502	0.000169	0.00025	RPD-N/A	0.00481	0.00509	0.00025	5.7	0.00298	0.00309	0.00025	3.6
Mercury (Hg)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A
Molybdenum (Mo)	0.000069	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Nickel (Ni)	0.00460	0.00444	0.0005	3.5	0.00426	0.00399	0.0005	6.5	0.0157	0.0155	0.0005	1.3	0.00710	0.00715	0.0005	0.7
Phosphorus (P)	<0.30	<0.30	1.5	RPD-N/A	<0.30	<0.30	1.5	RPD-N/A	<0.30	<0.30	1.5	RPD-N/A	<0.30	<0.30	1.5	RPD-N/A
Potassium (K)	0.446	0.424	0.25	5.1	0.628	0.606	0.25	3.6	0.616	0.626	0.25	1.6	0.492	0.478	0.25	2.9
Selenium (Se)	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A
Silicon (Si)	0.561	0.581	0.25	3.5	0.779	0.731	0.25	6.4	1.65	1.67	0.25	1.2	0.913	0.901	0.25	1.3
Silver (Ag)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A
Sodium (Na)	0.889	0.836	0.05	6.1	1.07	1.01	0.05	5.8	1.49	1.46	0.05	2.0	1.07	1.06	0.05	0.9
Strontium (Sr)	0.0110	0.0111	0.0005	0.9	0.0148	0.0138	0.0005	7.0	0.0214	0.0214	0.0005	0.0	0.0233	0.0228	0.0005	2.2
Thallium (Tl)	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Tin (Sn)	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A
Titanium (Ti)	<0.010	<0.010	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A
Uranium (U)	0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	0.000018	0.000018	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A
Vanadium (V)	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	0.000051	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Zinc (Zn)	<0.0030	<0.0030	0.015	RPD-N/A	<0.0030	<0.0030	0.015	RPD-N/A	0.0039	0.0039	0.015	RPD-N/A	<0.0030	<0.0030	0.015	RPD-N/A

a) Relative percent difference (RPD).

b) RPD-N/A -Not applicable when the values are less than five times the detection limit.

Italicized values exceed the 20% relative percent difference and are more than five times the detection limit.

Bold values exceed the 50% relative percent difference and are more than five times the detection limit.

Appendix 3.2-2. Lake Water Quality Analytical Results of Field Duplicates

Location	Lower Long Lake				Fold Lake				George Lake Central				Reference C Lake			
Replicate	**1**	**2**			**1**	**2**			**1**	**2**			**1**	**2**		
Duplicate	**sample**	**duplicate**			**sample**	**duplicate**			**sample**	**duplicate**			**sample**	**duplicate**		
Depth	**1**	**1**			**1**	**1**			**5.5**	**5.5**			**5.5**	**5.5**		
Date Sampled	**13-Apr-12**	**13-Apr-12**			**15-Apr-12**	**15-Apr-12**			**13-Apr-12**	**13-Apr-12**			**13-Apr-12**	**13-Apr-12**		
ALS Sample ID	**L1135132-4**	**L1135132-5**			**L1135132-14**	**L1135132-16**			**L1135132-10**	**L1135132-11**			**L1135132-2**	**L1135132-3**		
	Sample	**Duplicate**	**5 x DL**	**RPD_a**	**Sample**	**Duplicate**	**5 x DL**	**RPD_a**	**Sample**	**Duplicate**	**5 x DL**	**RPD_a**	**Sample**	**Duplicate**	**5 x DL**	**RPD_a**
Physical Tests																
Conductivity	53.6	52.0	10	3.0	75.0	71.6	10	4.6	104	103	10	1.0	148	149	0	0.7
Hardness (as $CaCO_3$)	27.2	28.1	2.5	3.3	34.7	31.8	2.5	8.7	45.1	45.1	2.5	0.0	76.0	79.1	0	4.0
pH	8.32	8.25	0.5	0.8	8.28	7.90	0.5	4.7	8.19	8.23	0.5	0.5	8.23	8.27	0	0.5
Alkalinity, Bicarbonate (as $CaCO_3$)	25.7	20.7	**5 and 10**	*21.6*	12.7	12.5	10	1.6	10.9	10.4	10	4.7	77.7	77.6	0	0.1
Alkalinity, Carbonate (as $CaCO_3$)	**<1.0**	**<2.0**	**5 and 10**	RPD-N/A	**<2.0**	**<2.0**	10	RPD-N/A	**<2.0**	**<2.0**	10	RPD-N/A	<2.0	<2.0	0	RPD-N/A
Alkalinity, Hydroxide (as $CaCO_3$)	**<1.0**	**<2.0**	**5 and 10**	RPD-N/A	**<2.0**	**<2.0**	10	RPD-N/A	**<2.0**	**<2.0**	10	RPD-N/A	<2.0	<2.0	0	RPD-N/A
Alkalinity, Total (as $CaCO_3$)	25.7	20.7	**5 and 10**	*21.6*	12.7	12.5	10	1.6	10.9	10.4	10	4.7	77.7	77.6	0	0.1
Total Suspended Solids	**<3.0**	**<3.0**	**15**	RPD-N/A	**<3.0**	**<3.0**	15	RPD-N/A	**<3.0**	**<3.0**	15	RPD-N/A	<3.0	<3.0	0	RPD-N/A
Total Dissolved Solids	32	30	50	RPD-N/A	46	42	50	RPD-N/A	62	62	50	0.0	82	81	0	1.2
Turbidity	0.51	0.63	0.50	*21.1*	0.80	0.23	0.5	RPD-N/A	0.35	0.91	0.5	RPD-N/A	0.14	0.19	0	*30.3*
Nutrients																
Ammonia, Total (as N)	**<0.0050**	**<0.0050**	**0.025**	RPD-N/A	0.0068	0.0063	0.025	RPD-N/A	0.0124	0.0127	0.025	RPD-N/A	0.0122	0.0130	0	6.3
Nitrate (as N)	0.0197	0.0195	0.0250	RPD-N/A	0.0056	0.0075	0.025	RPD-N/A	0.0186	0.0174	0.025	RPD-N/A	0.0075	0.0083	0	10.1
Nitrite (as N)	**<0.0010**	**<0.0010**	**0.005**	RPD-N/A	**<0.0010**	**<0.0010**	0.005	RPD-N/A	**<0.0010**	**<0.0010**	0.005	RPD-N/A	<0.0010	<0.0010	0	RPD-N/A
Total Kjeldahl Nitrogen	0.191	0.207	0.250	RPD-N/A	0.187	0.230	0.25	RPD-N/A	0.179	0.189	0.25	RPD-N/A	0.199	0.203	0	2.0
Ortho-phosphate (as P)	**<0.0010**	**<0.0010**	**0.005**	RPD-N/A	**<0.0010**	**<0.0010**	0.005	RPD-N/A	**<0.0010**	**<0.0010**	0.005	RPD-N/A	<0.0010	<0.0010	0	RPD-N/A
Total Phosphorus (P)	0.0024	0.0027	0.0100	RPD-N/A	0.0050	0.0044	0.01	RPD-N/A	0.0027	0.0024	0.01	RPD-N/A	0.0024	0.0025	0	4.1
Anions																
Bromide (Br)	**<0.050**	**<0.050**	**0.25**	RPD-N/A	**<0.050**	**<0.050**	0.25	RPD-N/A	**<0.050**	**<0.050**	0.25	RPD-N/A	<0.050	<0.050	0	RPD-N/A
Chloride (Cl)	0.61	0.59	2.50	RPD-N/A	1.88	1.80	2.5	RPD-N/A	6.32	6.29	2.5	0.5	0.79	0.79	0	0.0
Fluoride (F)	**<0.020**	**<0.020**	**0.1**	RPD-N/A	0.026	0.025	0.1	RPD-N/A	0.035	0.035	0.1	RPD-N/A	0.020	0.021	0	4.9
Sulfate (SO_4)	4.15	4.10	2.50	1.2	17.9	17.3	2.5	3.4	24.7	24.6	2.5	0.4	0.88	0.88	0	0.0
Cyanides																
Cyanide, Total	**<0.0010**	**<0.0010**	**0.005**	RPD-N/A	**<0.0010**	**<0.0010**	0.005	RPD-N/A	**<0.0010**	**<0.0010**	0.005	RPD-N/A	<0.0010	<0.0010	0	RPD-N/A
Cyanide, Free	**<0.0010**	**<0.0010**	**0.005**	RPD-N/A	**<0.0010**	**<0.0010**	0.005	RPD-N/A	**<0.0010**	**<0.0010**	0.005	RPD-N/A	<0.0010	<0.0010	0	RPD-N/A
Organic / Inorganic Carbon																
Total Organic Carbon	3.23	3.16	2.50	2.2	2.44	2.29	2.5	RPD-N/A	2.28	2.23	2.5	RPD-N/A	3.38	3.47	0	2.6
Total Metals																
Aluminum (Al)	0.0038	0.0030	0.0150	RPD-N/A	**<0.0030**	0.0040	0.015	RPD-N/A	0.0079	0.0084	0.015	RPD-N/A	<0.0030	<0.0030	0	RPD-N/A
Antimony (Sb)	**<0.000050**	**<0.000050**	**0.00025**	RPD-N/A	**<0.000050**	**<0.000050**	0.00025	RPD-N/A	**<0.000050**	**<0.000050**	0.00025	RPD-N/A	<0.000050	<0.000050	0	RPD-N/A
Arsenic (As)	0.000432	0.000439	0.000150	1.6	0.000446	0.000394	0.00015	12.4	0.000489	0.000508	0.00015	3.8	0.000206	0.000207	0	0.5
Barium (Ba)	0.00137	0.00129	0.00025	6.0	0.00170	0.00164	0.00025	3.6	0.00442	0.00453	0.00025	2.5	0.0249	0.0247	0	0.8
Beryllium (Be)	**<0.00020**	**<0.00020**	**0.001**	RPD-N/A	**<0.00020**	**<0.00020**	0.001	RPD-N/A	**<0.00020**	**<0.00020**	0.001	RPD-N/A	<0.00020	<0.00020	0	RPD-N/A
Bismuth (Bi)	**<0.00050**	**<0.00050**	**0.0025**	RPD-N/A	**<0.00050**	**<0.00050**	0.0025	RPD-N/A	**<0.00050**	**<0.00050**	0.0025	RPD-N/A	<0.00050	<0.00050	0	RPD-N/A
Boron (B)	0.0071	0.0070	0.0250	RPD-N/A	0.0075	0.0073	0.025	RPD-N/A	0.0080	0.0075	0.025	RPD-N/A	0.0067	0.0089	0	*28.2*
Cadmium (Cd)	**<0.000010**	**<0.000010**	**0.00005**	RPD-N/A	**<0.000010**	**<0.000010**	0.00005	RPD-N/A	**<0.000010**	0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0	RPD-N/A
Calcium (Ca)	5.45	5.45	0.10	0.0	8.14	7.43	0.1	9.1	12.0	11.8	0.1	1.7	19.2	20.1	0	4.6
Chromium (Cr)	0.00021	0.00011	0.00050	RPD-N/A	0.00011	0.00011	0.0005	RPD-N/A	0.00013	0.00013	0.0005	RPD-N/A	0.00017	0.00012	0	*34.5*
Cobalt (Co)	**<0.00010**	**<0.00010**	**0.0005**	RPD-N/A	**<0.00010**	**<0.00010**	0.0005	RPD-N/A	0.00090	0.00092	0.0005	2.2	<0.00010	<0.00010	0	RPD-N/A
Copper (Cu)	0.00127	0.00134	0.00250	RPD-N/A	0.00136	0.00127	0.0025	RPD-N/A	0.00201	0.00198	0.0025	RPD-N/A	0.00102	0.00090	0	12.5
Iron (Fe)	0.011	**<0.010**	**0.05**	RPD-N/A	**<0.010**	**<0.010**	0.05	RPD-N/A	0.034	0.040	0.05	RPD-N/A	<0.010	<0.010	0	RPD-N/A
Lead (Pb)	**<0.000050**	**<0.000050**	**0.00025**	RPD-N/A	0.000577	0.000235	0.00025	RPD-N/A	0.00226	0.00170	0.00025	*28.3*	<0.000050	<0.000050	0	RPD-N/A
Lithium (Li)	**<0.0050**	**<0.0050**	**0.025**	RPD-N/A	**<0.0050**	**<0.0050**	0.025	RPD-N/A	**<0.0050**	**<0.0050**	0.025	RPD-N/A	<0.0050	<0.0050	0	RPD-N/A
Magnesium (Mg)	2.90	2.92	0.03	0.7	3.27	3.09	0.025	5.7	3.68	3.69	0.025	0.3	7.37	7.44	0	0.9
Manganese (Mn)	0.000576	0.000436	0.000250	*27.7*	0.00114	0.00120	0.00025	5.1	0.0275	0.0299	0.00025	8.4	0.00151	0.00147	0	2.7
Mercury (Hg)	**<0.000010**	**<0.000010**	**0.00005**	RPD-N/A	**<0.000010**	**<0.000010**	0.00005	RPD-N/A	**<0.000010**	**<0.000010**	0.00005	RPD-N/A	<0.000010	<0.000010	0	RPD-N/A
Molybdenum (Mo)	0.000066	0.000053	0.000250	RPD-N/A	0.000055	**<0.000050**	0.00025	RPD-N/A	**<0.000050**	**<0.000050**	0.00025	RPD-N/A	0.000105	0.000094	0	11.1
Nickel (Ni)	0.00064	0.00065	0.00050	1.6	0.00212	0.00206	0.0005	2.9	0.00797	0.00770	0.0005	3.4	0.00016	0.00013	0	*20.7*
Phosphorus (P)	**<0.30**	**<0.30**	**1.5**	RPD-N/A	**<0.30**	**<0.30**	1.5	RPD-N/A	**<0.30**	**<0.30**	1.5	RPD-N/A	<0.30	<0.30	0	RPD-N/A
Potassium (K)	0.346	0.348	0.250	0.6	0.590	0.549	0.25	7.2	0.658	0.650	0.25	1.2	0.296	0.298	0	0.7
Selenium (Se)	**<0.00010**	**<0.00010**	**0.0005**	RPD-N/A	**<0.00010**	**<0.00010**	0.0005	RPD-N/A	**<0.00010**	**<0.00010**	0.0005	RPD-N/A	<0.00010	<0.00010	0	RPD-N/A
Silicon (Si)	0.592	0.596	0.250	0.7	0.274	0.259	0.25	5.6	0.469	0.466	0.25	0.6	1.21	1.21	0	0.0
Silver (Ag)	**<0.000010**	**<0.000010**	**0.00005**	RPD-N/A	**<0.000010**	**<0.000010**	0.00005	RPD-N/A	**<0.000010**	**<0.000010**	0.00005	RPD-N/A	<0.000010	<0.000010	0	RPD-N/A
Sodium (Na)	0.550	0.550	0.050	0.0	1.08	0.994	0.05	8.3	1.39	1.38	0.05	0.7	0.542	0.546	0	0.7

Appendix 3.2-2. Lake Water Quality Analytical Results of Field Duplicates

Location	Lower Long Lake				Fold Lake				George Lake Central				Reference C Lake			
Replicate	**1**	**2**			**1**	**2**			**1**	**2**			**1**	**2**		
Duplicate	**sample**	**duplicate**			**sample**	**duplicate**			**sample**	**duplicate**			**sample**	**duplicate**		
Depth	**1**	**1**			**1**	**1**			**5.5**	**5.5**			**5.5**	**5.5**		
Date Sampled	**13-Apr-12**	**13-Apr-12**			**15-Apr-12**	**15-Apr-12**			**13-Apr-12**	**13-Apr-12**			**13-Apr-12**	**13-Apr-12**		
ALS Sample ID	**L1135132-4**	**L1135132-5**			**L1135132-14**	**L1135132-16**			**L1135132-10**	**L1135132-11**			**L1135132-2**	**L1135132-3**		
	Sample	**Duplicate**	**5 x DL**	**RPD$_a$**	**Sample**	**Duplicate**	**5 x DL**	**RPD$_a$**	**Sample**	**Duplicate**	**5 x DL**	**RPD$_a$**	**Sample**	**Duplicate**	**5 x DL**	**RPD$_a$**
Strontium (Sr)	0.00943	0.00948	0.00050	0.5	0.0267	0.0241	0.0005	10.2	0.0421	0.0419	0.0005	0.5	0.00863	0.00854	0	1.0
Thallium (Tl)	**<0.000050**	**<0.000050**	**0.00025**	RPD-N/A	**<0.000050**	**<0.000050**	0.00025	RPD-N/A	**<0.000050**	**<0.000050**	0.00025	RPD-N/A	<0.000050	<0.000050	0	RPD-N/A
Tin (Sn)	**<0.00010**	**<0.00010**	**0.0005**	RPD-N/A	**<0.00010**	**<0.00010**	0.0005	RPD-N/A	**<0.00010**	**<0.00010**	0.0005	RPD-N/A	<0.00010	<0.00010	0	RPD-N/A
Titanium (Ti)	**<0.010**	**<0.010**	**0.05**	RPD-N/A	**<0.010**	**<0.010**	0.05	RPD-N/A	**<0.010**	**<0.010**	0.05	RPD-N/A	<0.010	<0.010	0	RPD-N/A
Uranium (U)	0.000042	0.000039	0.000050	RPD-N/A	**<0.000010**	**<0.000010**	0.00005	RPD-N/A	**<0.000010**	**<0.000010**	0.00005	RPD-N/A	0.000402	0.000398	0	1.0
Vanadium (V)	**<0.000050**	**<0.000050**	**0.00025**	RPD-N/A	**<0.000050**	**<0.000050**	0.00025	RPD-N/A	**<0.000050**	**<0.000050**	0.00025	RPD-N/A	0.000050	0.000050	0	0.0
Zinc (Zn)	**<0.0030**	**<0.0030**	**0.015**	RPD-N/A	0.0033	0.0032	0.015	RPD-N/A	0.0071	0.0070	0.015	RPD-N/A	<0.0030	<0.0030	0	RPD-N/A
Dissolved Metals																
Aluminum (Al)	**<0.0030**	**<0.0030**	**0.015**	RPD-N/A	**<0.0030**	**<0.0030**	0.015	RPD-N/A	**<0.0030**	**<0.0030**	0.015	RPD-N/A	<0.0030	<0.0030	0	RPD-N/A
Antimony (Sb)	**<0.000050**	**<0.000050**	**0.00025**	RPD-N/A	**<0.000050**	**<0.000050**	0.00025	RPD-N/A	**<0.000050**	**<0.000050**	0.00025	RPD-N/A	<0.000050	<0.000050	0	RPD-N/A
Arsenic (As)	0.000466	0.000449	0.000150	3.7	0.000435	0.000435	0.00015	0.0	0.000380	0.000390	0.00015	2.6	0.000185	0.000198	0	6.8
Barium (Ba)	0.00136	0.00129	0.00025	5.3	0.00177	0.00168	0.00025	5.2	0.00438	0.00487	0.00025	10.6	0.0251	0.0251	0	0.0
Beryllium (Be)	**<0.00020**	**<0.00020**	**0.001**	RPD-N/A	**<0.00020**	**<0.00020**	0.001	RPD-N/A	**<0.00020**	**<0.00020**	0.001	RPD-N/A	<0.00020	<0.00020	0	RPD-N/A
Bismuth (Bi)	**<0.00050**	**<0.00050**	**0.0025**	RPD-N/A	**<0.00050**	**<0.00050**	0.0025	RPD-N/A	**<0.00050**	**<0.00050**	0.0025	RPD-N/A	<0.00050	<0.00050	0	RPD-N/A
Boron (B)	**<0.0050**	**<0.0050**	**0.025**	RPD-N/A	**<0.0050**	**<0.0050**	0.025	RPD-N/A	**<0.0050**	**<0.0050**	0.025	RPD-N/A	<0.0050	<0.0050	0	RPD-N/A
Cadmium (Cd)	**<0.000010**	**<0.000010**	**0.00005**	RPD-N/A	**<0.000010**	**<0.000010**	0.00005	RPD-N/A	0.000011	**<0.000010**	0.00005	RPD-N/A	<0.000010	<0.000010	0	RPD-N/A
Calcium (Ca)	5.11	5.00	0.10	2.2	7.04	6.61	0.1	6.3	9.91	10.0	0.1	0.9	18.6	18.7	0	0.5
Chromium (Cr)	**<0.00010**	**<0.00010**	**0.0005**	RPD-N/A	**<0.00010**	**<0.00010**	0.0005	RPD-N/A	**<0.00010**	**<0.00010**	0.0005	RPD-N/A	<0.00010	<0.00010	0	RPD-N/A
Cobalt (Co)	**<0.00010**	**<0.00010**	**0.0005**	RPD-N/A	**<0.00010**	**<0.00010**	0.0005	RPD-N/A	**<0.00010**	**<0.00010**	0.0005	RPD-N/A	<0.00010	<0.00010	0	RPD-N/A
Copper (Cu)	0.00111	0.00110	0.00250	RPD-N/A	0.00111	0.00106	0.0025	RPD-N/A	0.00160	0.00164	0.0025	RPD-N/A	0.00088	0.00082	0	7.1
Iron (Fe)	**<0.010**	**<0.010**	**0.05**	RPD-N/A	**<0.010**	**<0.010**	0.05	RPD-N/A	**<0.010**	**<0.010**	0.05	RPD-N/A	<0.010	<0.010	0	RPD-N/A
Lead (Pb)	**<0.000050**	**<0.000050**	**0.00025**	RPD-N/A	0.000105	**<0.000050**	0.00025	RPD-N/A	0.000056	**<0.000050**	0.00025	RPD-N/A	<0.000050	<0.000050	0	RPD-N/A
Lithium (Li)	**<0.0050**	**<0.0050**	**0.025**	RPD-N/A	**<0.0050**	**<0.0050**	0.025	RPD-N/A	**<0.0050**	**<0.0050**	0.025	RPD-N/A	<0.0050	<0.0050	0	RPD-N/A
Magnesium (Mg)	2.92	2.89	0.03	1.0	3.19	3.07	0.025	3.8	3.52	3.63	0.025	3.1	7.31	7.39	0	1.1
Manganese (Mn)	0.000098	0.000097	0.000250	RPD-N/A	0.000075	0.000066	0.00025	RPD-N/A	0.00869	0.00954	0.00025	9.3	0.000117	0.000107	0	8.9
Mercury (Hg)	**<0.000010**	**<0.000010**	**0.00005**	RPD-N/A	**<0.000010**	**<0.000010**	0.00005	RPD-N/A	**<0.000010**	**<0.000010**	0.00005	RPD-N/A	<0.000010	<0.000010	0	RPD-N/A
Molybdenum (Mo)	**<0.000050**	0.000053	0.000250	RPD-N/A	**<0.000050**	**<0.000050**	0.00025	RPD-N/A	**<0.000050**	**<0.000050**	0.00025	RPD-N/A	0.000083	0.000089	0	7.0
Nickel (Ni)	0.00065	0.00067	0.00050	3.0	0.00221	0.00203	0.0005	8.5	0.00780	0.00773	0.0005	0.9	0.00016	0.00015	0	6.5
Phosphorus (P)	**<0.30**	**<0.30**	**1.5**	RPD-N/A	**<0.30**	**<0.30**	1.5	RPD-N/A	**<0.30**	**<0.30**	1.5	RPD-N/A	<0.30	<0.30	0	RPD-N/A
Potassium (K)	0.352	0.345	0.250	2.0	0.587	0.550	0.25	6.5	0.636	0.654	0.25	2.8	0.300	0.296	0	1.3
Selenium (Se)	**<0.00010**	**<0.00010**	**0.0005**	RPD-N/A	**<0.00010**	**<0.00010**	0.0005	RPD-N/A	**<0.00010**	**<0.00010**	0.0005	RPD-N/A	<0.00010	<0.00010	0	RPD-N/A
Silicon (Si)	0.594	0.580	0.250	2.4	0.276	0.256	0.25	7.5	0.448	0.465	0.25	3.7	1.19	1.20	0	0.8
Silver (Ag)	**<0.000010**	**<0.000010**	**0.00005**	RPD-N/A	**<0.000010**	**<0.000010**	0.00005	RPD-N/A	**<0.000010**	**<0.000010**	0.00005	RPD-N/A	<0.000010	<0.000010	0	RPD-N/A
Sodium (Na)	0.562	0.544	0.050	3.3	1.05	1.00	0.05	4.9	1.37	1.40	0.05	2.2	0.558	0.551	0	1.3
Strontium (Sr)	0.00919	0.00907	0.00050	1.3	0.0233	0.0216	0.0005	7.6	0.0354	0.0358	0.0005	1.1	0.00828	0.00842	0	1.7
Thallium (Tl)	**<0.000050**	**<0.000050**	**0.00025**	RPD-N/A	**<0.000050**	**<0.000050**	0.00025	RPD-N/A	**<0.000050**	**<0.000050**	0.00025	RPD-N/A	<0.000050	<0.000050	0	RPD-N/A
Tin (Sn)	**<0.00010**	**<0.00010**	**0.0005**	RPD-N/A	**<0.00010**	**<0.00010**	0.0005	RPD-N/A	**<0.00010**	**<0.00010**	0.0005	RPD-N/A	<0.00010	<0.00010	0	RPD-N/A
Titanium (Ti)	**<0.010**	**<0.010**	**0.05**	RPD-N/A	**<0.010**	**<0.010**	0.05	RPD-N/A	**<0.010**	**<0.010**	0.05	RPD-N/A	<0.010	<0.010	0	RPD-N/A
Uranium (U)	0.000028	0.000029	0.000050	RPD-N/A	**<0.000010**	**<0.000010**	0.00005	RPD-N/A	**<0.000010**	**<0.000010**	0.00005	RPD-N/A	0.000381	0.000383	0	0.5
Vanadium (V)	**<0.000050**	**<0.000050**	**0.00025**	RPD-N/A	**<0.000050**	**<0.000050**	0.00025	RPD-N/A	**<0.000050**	**<0.000050**	0.00025	RPD-N/A	<0.000050	<0.000050	0	RPD-N/A
Zinc (Zn)	**<0.0030**	**<0.0030**	**0.015**	RPD-N/A	**<0.0030**	**<0.0030**	0.015	RPD-N/A	0.0054	0.0053	0.015	RPD-N/A	<0.0030	<0.0030	0	RPD-N/A

a) Relative percent difference (RPD).

b) RPD-N/A -Not applicable when the values are less than five times the detection limit.

Italicized values exceed the 20% relative percent difference and are more than five times the detection limit.

Bold values exceed the 50% relative percent difference and are more than five times the detection limit.

Appendix 3.2-2. Lake Water Quality Analytical Results of Field Duplicates

Location	Fox Lake				Giraffe Lake South				Goose Lake Neck				Propellor Lake			
Replicate	**1**	**2**			**1**	**2**			**1**	**2**			**1**	**2**		
Duplicate	**sample**	**duplicate**			**sample**	**duplicate**			**sample**	**duplicate**			**sample**	**duplicate**		
Depth	**1**	**1**			**3.7**	**3.7**			**1**	**1**			**1**	**1**		
Date Sampled	**20-Aug-12**	**20-Aug-12**			**19-Aug-12**	**19-Aug-12**			**14-Aug-12**	**14-Aug-12**			**21-Aug-12**	**21-Aug-12**		
ALS Sample ID	**L1198584-5**	**L1198584-6**			**L1198584-2**	**L1198584-3**			**L1195581-4**	**L1195581-5**			**L1198584-8**	**L1198584-9**		
	Sample	**Duplicate**	**5 x DL**	**RPD_a**	**Sample**	**Duplicate**	**5 x DL**	**RPD_a**	**Sample**	**Duplicate**	**5 x DL**	**RPD_a**	**Sample**	**Duplicate**	**5 x DL**	**RPD_a**
Physical Tests																
Conductivity	18.5	18.3	10	1.1	24.1	24.0	10	0.4	36.1	36.1	10	0.0	19.5	19.3	10	1.0
Hardness (as $CaCO_3$)	7.28	7.41	2.5	1.8	9.34	9.28	2.5	0.6	13.9	14.0	2.5	0.7	7.51	7.76	2.5	3.3
pH	6.85	6.87	0.5	0.3	6.91	6.86	0.5	0.7	6.74	6.61	0.5	1.9	6.77	6.73	0.5	0.6
Alkalinity, Bicarbonate (as $CaCO_3$)	4.9	4.7	10	RPD-N/A	4.1	3.6	10	RPD-N/A	3.5	3.7	10	RPD-N/A	3.0	3.1	10	RPD-N/A
Alkalinity, Carbonate (as $CaCO_3$)	<2.0	<2.0	10	RPD-N/A	<2.0	<2.0	10	RPD-N/A	<2.0	<2.0	10	RPD-N/A	<2.0	<2.0	10	RPD-N/A
Alkalinity, Hydroxide (as $CaCO_3$)	<2.0	<2.0	10	RPD-N/A	<2.0	<2.0	10	RPD-N/A	<2.0	<2.0	10	RPD-N/A	<2.0	<2.0	10	RPD-N/A
Alkalinity, Total (as $CaCO_3$)	4.9	4.7	10	RPD-N/A	4.1	3.6	10	RPD-N/A	3.5	3.7	10	RPD-N/A	3.0	3.1	10	RPD-N/A
Total Suspended Solids	**1.5**	**1.5**	15	RPD-N/A	<3.0	**1.5**	15	RPD-N/A	<3.0	<3.0	15	RPD-N/A	**1.5**	**1.5**	15	RPD-N/A
Total Dissolved Solids	13	15	50	RPD-N/A	18	18	50	RPD-N/A	23	34	50	RPD-N/A	18	15	50	RPD-N/A
Turbidity	0.44	0.40	0.5	RPD-N/A	0.28	0.59	0.5	RPD-N/A	0.41	0.36	0.5	RPD-N/A	0.42	0.31	0.5	RPD-N/A
Nutrients																
Ammonia, Total (as N)	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A
Nitrate (as N)	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	0.0076	0.025	RPD-N/A
Nitrite (as N)	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A
Total Kjeldahl Nitrogen	0.202	0.196	0.25	RPD-N/A	0.202	0.162	0.25	RPD-N/A	0.168	0.151	0.25	RPD-N/A	0.181	0.151	0.25	RPD-N/A
Ortho-phosphate (as P)	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A
Total Phosphorus (P)	0.0034	0.0037	0.01	RPD-N/A	0.0032	0.0030	0.01	RPD-N/A	0.0029	0.0030	0.01	RPD-N/A	0.0036	0.0036	0.01	RPD-N/A
Anions																
Bromide (Br)	<0.050	<0.050	0.25	RPD-N/A	<0.050	<0.050	0.25	RPD-N/A	<0.050	<0.050	0.25	RPD-N/A	<0.050	<0.050	0.25	RPD-N/A
Chloride (Cl)	<0.50	<0.50	2.5	RPD-N/A	0.53	0.56	2.5	RPD-N/A	5.62	5.63	2.5	0.2	1.65	1.61	2.5	RPD-N/A
Fluoride (F)	0.020	<0.020	0.1	RPD-N/A	0.024	0.025	0.1	RPD-N/A	<0.020	<0.020	0.1	RPD-N/A	<0.020	<0.020	0.1	RPD-N/A
Sulfate (SO_4)	3.23	3.22	2.5	0.3	5.79	5.80	2.5	0.2	4.34	4.34	2.5	0.0	2.78	2.80	2.5	0.7
Cyanides																
Cyanide, Total	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A
Cyanide, Free	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A
Organic / Inorganic Carbon																
Total Organic Carbon	2.87	2.68	2.5	6.8	2.89	3.11	2.5	7.3	2.84	2.86	2.5	0.7	3.17	2.92	2.5	8.2
Total Metals																
Aluminum (Al)	0.0137	0.0061	0.015	RPD-N/A	0.0131	0.0178	0.015	RPD-N/A	0.0140	0.0137	0.015	RPD-N/A	0.0171	0.0102	0.015	RPD-N/A
Antimony (Sb)	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Arsenic (As)	0.000208	0.000229	0.00015	9.6	0.000202	0.000221	0.00015	9.0	0.000236	0.000195	0.00015	19.0	0.000148	0.000147	0.00015	RPD-N/A
Barium (Ba)	0.00172	0.00171	0.00025	0.6	0.00311	0.00322	0.00025	3.5	0.00738	0.00694	0.00025	6.1	0.00366	0.00361	0.00025	1.4
Beryllium (Be)	<0.00020	<0.00020	0.001	RPD-N/A	<0.00020	<0.00020	0.001	RPD-N/A	<0.00020	<0.00020	0.001	RPD-N/A	<0.00020	<0.00020	0.001	RPD-N/A
Bismuth (Bi)	<0.00050	<0.00050	0.0025	RPD-N/A	<0.00050	<0.00050	0.0025	RPD-N/A	<0.00050	<0.00050	0.0025	RPD-N/A	<0.00050	<0.00050	0.0025	RPD-N/A
Boron (B)	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A
Cadmium (Cd)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A
Calcium (Ca)	1.47	1.57	0.1	6.6	1.67	1.67	0.1	0.0	3.63	3.49	0.1	3.9	1.72	1.62	0.1	6.0
Chromium (Cr)	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	0.00012	0.0005	RPD-N/A	0.00013	0.00016	0.0005	RPD-N/A	0.00154	<0.00010	0.0005	RPD-N/A
Cobalt (Co)	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	0.00011	0.0005	RPD-N/A	0.00013	0.00013	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A
Copper (Cu)	0.00091	0.00088	0.0025	RPD-N/A	0.00184	0.00205	0.0025	RPD-N/A	0.00505	0.00299	0.0025	**51.2**	0.00102	0.00104	0.0025	RPD-N/A
Iron (Fe)	0.042	0.041	0.05	RPD-N/A	0.051	0.050	0.05	RPD-N/A	0.034	0.033	0.05	RPD-N/A	0.109	0.018	0.05	RPD-N/A
Lead (Pb)	<0.000050	0.000051	0.00025	RPD-N/A	<0.000050	0.000053	0.00025	RPD-N/A	0.000462	<0.000050	0.00025	RPD-N/A	0.000102	0.000065	0.00025	RPD-N/A
Lithium (Li)	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A
Magnesium (Mg)	0.883	0.894	0.025	1.2	1.22	1.32	0.025	7.9	1.40	1.33	0.025	5.1	0.871	0.870	0.025	0.1
Manganese (Mn)	0.00160	0.00151	0.00025	5.8	0.00147	0.00154	0.00025	4.7	0.00286	0.00287	0.00025	0.3	0.00412	0.00281	0.00025	*37.8*
Mercury (Hg)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A
Molybdenum (Mo)	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	0.000194	<0.000050	0.00025	RPD-N/A
Nickel (Ni)	0.00109	0.00112	0.0005	2.7	0.00394	0.00422	0.0005	6.9	0.00363	0.00352	0.0005	3.1	0.00263	0.00185	0.0005	*34.8*
Phosphorus (P)	<0.30	<0.30	1.5	RPD-N/A	<0.30	<0.30	1.5	RPD-N/A	<0.30	<0.30	1.5	RPD-N/A	<0.30	<0.30	1.5	RPD-N/A
Potassium (K)	0.268	0.273	0.25	1.8	0.300	0.327	0.25	8.6	0.394	0.359	0.25	9.3	0.269	0.271	0.25	0.7
Selenium (Se)	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A
Silicon (Si)	0.224	0.209	0.25	RPD-N/A	0.205	0.223	0.25	RPD-N/A	0.249	0.243	0.25	RPD-N/A	0.129	0.126	0.25	RPD-N/A
Silver (Ag)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A
Sodium (Na)	0.441	0.445	0.05	0.9	0.585	0.630	0.05	7.4	0.639	0.613	0.05	4.2	0.474	0.465	0.05	1.9

Appendix 3.2-2. Lake Water Quality Analytical Results of Field Duplicates

Location	Fox Lake				Giraffe Lake South				Goose Lake Neck				Propellor Lake			
Replicate	**1**	**2**			**1**	**2**			**1**	**2**			**1**	**2**		
Duplicate	**sample**	**duplicate**			**sample**	**duplicate**			**sample**	**duplicate**			**sample**	**duplicate**		
Depth	**1**	**1**			**3.7**	**3.7**			**1**	**1**			**1**	**1**		
Date Sampled	**20-Aug-12**	**20-Aug-12**			**19-Aug-12**	**19-Aug-12**			**14-Aug-12**	**14-Aug-12**			**21-Aug-12**	**21-Aug-12**		
ALS Sample ID	**L1198584-5**	**L1198584-6**			**L1198584-2**	**L1198584-3**			**L1195581-4**	**L1195581-5**			**L1198584-8**	**L1198584-9**		
	Sample	**Duplicate**	**5 x DL**	**RPD$_a$**	**Sample**	**Duplicate**	**5 x DL**	**RPD$_a$**	**Sample**	**Duplicate**	**5 x DL**	**RPD$_a$**	**Sample**	**Duplicate**	**5 x DL**	**RPD$_a$**
Strontium (Sr)	0.00486	0.00508	0.001	4.4	0.00712	0.00711	0.001	0.1	0.0208	0.0196	0.001	5.9	0.00812	0.00766	0.0005	5.8
Thallium (Tl)	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Tin (Sn)	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A
Titanium (Ti)	<0.010	<0.010	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A
Uranium (U)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A
Vanadium (V)	0.000066	0.000108	0.00025	RPD-N/A	0.000123	0.000154	0.00025	RPD-N/A	0.000645	0.000461	0.00025	*33.3*	0.000138	0.000119	0.00025	RPD-N/A
Zinc (Zn)	<0.0030	<0.0030	0.015	RPD-N/A	<0.0030	<0.0030	0.015	RPD-N/A	<0.0030	<0.0030	0.015	RPD-N/A	<0.0030	0.0031	0.015	RPD-N/A
Dissolved Metals																
Aluminum (Al)	0.0052	<0.0030	0.015	RPD-N/A	0.0064	0.0093	0.015	RPD-N/A	0.0074	0.0067	0.015	RPD-N/A	0.0112	0.0058	0.015	RPD-N/A
Antimony (Sb)	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Arsenic (As)	0.000207	0.000202	0.00015	2.4	0.000182	0.000178	0.00015	2.2	0.000175	0.000132	0.00015	RPD-N/A	0.000125	0.000118	0.00015	RPD-N/A
Barium (Ba)	0.00174	0.00172	0.00025	1.2	0.00379	0.00307	0.00025	*21.0*	0.00701	0.00671	0.00025	4.4	0.00352	0.00358	0.00025	1.7
Beryllium (Be)	<0.00020	<0.00020	0.001	RPD-N/A	<0.00020	<0.00020	0.001	RPD-N/A	<0.00020	<0.00020	0.001	RPD-N/A	<0.00020	<0.00020	0.001	RPD-N/A
Bismuth (Bi)	<0.00050	<0.00050	0.0025	RPD-N/A	<0.00050	<0.00050	0.0025	RPD-N/A	<0.00050	<0.00050	0.0025	RPD-N/A	<0.00050	<0.00050	0.0025	RPD-N/A
Boron (B)	0.0101	<0.0050	0.025	RPD-N/A	<0.0050	0.0059	0.025	RPD-N/A	<0.0050	0.0056	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A
Cadmium (Cd)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A
Calcium (Ca)	1.44	1.49	0.1	3.4	1.68	1.68	0.1	0.0	3.44	3.44	0.1	0.0	1.57	1.71	0.1	8.5
Chromium (Cr)	0.00029	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A
Cobalt (Co)	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A
Copper (Cu)	0.00064	0.00066	0.0025	RPD-N/A	0.00134	0.00146	0.0025	RPD-N/A	0.00143	0.00132	0.0025	RPD-N/A	0.00068	0.00081	0.0025	RPD-N/A
Iron (Fe)	<0.010	<0.010	0.05	RPD-N/A	0.012	0.012	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A
Lead (Pb)	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Lithium (Li)	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A
Magnesium (Mg)	0.895	0.893	0.025	0.2	1.25	1.23	0.025	1.6	1.28	1.31	0.025	2.3	0.870	0.849	0.025	2.4
Manganese (Mn)	0.000412	0.000200	0.00025	RPD-N/A	0.00119	0.00123	0.00025	3.3	0.00147	0.00115	0.00025	*24.4*	0.000166	0.000216	0.00025	RPD-N/A
Mercury (Hg)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A
Molybdenum (Mo)	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Nickel (Ni)	0.00112	0.00107	0.0005	4.6	0.00399	0.00390	0.0005	2.3	0.00343	0.00348	0.0005	1.4	0.00179	0.00176	0.0005	1.7
Phosphorus (P)	<0.30	<0.30	1.5	RPD-N/A	<0.30	<0.30	1.5	RPD-N/A	<0.30	<0.30	1.5	RPD-N/A	<0.30	<0.30	1.5	RPD-N/A
Potassium (K)	0.277	0.271	0.25	2.2	0.309	0.303	0.25	2.0	0.381	0.356	0.25	6.8	0.271	0.275	0.25	1.5
Selenium (Se)	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A
Silicon (Si)	0.211	0.197	0.25	RPD-N/A	0.193	0.203	0.25	RPD-N/A	0.230	0.226	0.25	RPD-N/A	0.124	0.112	0.25	RPD-N/A
Silver (Ag)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A
Sodium (Na)	0.442	0.439	0.05	0.7	0.592	0.588	0.05	0.7	0.622	0.610	0.05	1.9	0.468	0.460	0.05	1.7
Strontium (Sr)	0.00494	0.00485	0.001	1.8	0.00732	0.00712	0.001	2.8	0.0191	0.0194	0.001	1.6	0.00734	0.00799	0.0005	8.5
Thallium (Tl)	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Tin (Sn)	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A
Titanium (Ti)	<0.010	<0.010	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A
Uranium (U)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A
Vanadium (V)	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	0.000114	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Zinc (Zn)	<0.0030	<0.0030	0.015	RPD-N/A	<0.0030	<0.0030	0.015	RPD-N/A	<0.0030	<0.0030	0.015	RPD-N/A	<0.0030	<0.0030	0.015	RPD-N/A

a) Relative percent difference (RPD).

b) RPD-N/A -Not applicable when the values are less than five times the detection limit.

Italicized values exceed the 20% relative percent difference and are more than five times the detection limit.

Bold values exceed the 50% relative percent difference and are more than five times the detection limit.

Appendix 3.2-2. Lake Water Quality Analytical Results of Field Duplicates

Location	Fold Lake				Dragon Lake				Reference C Lake			
Replicate	**1**	**2**			**1**	**2**			**1**	**2**		
Duplicate	**sample**	**duplicate**			**sample**	**duplicate**			**sample**	**duplicate**		
Depth	**1**	**1**			**1**	**1**			**1**	**1**		
Date Sampled	**19-Aug-12**	**19-Aug-12**			**20-Aug-12**	**20-Aug-12**			**22-Aug-12**	**22-Aug-12**		
ALS Sample ID	**L1197323-7**	**L1197323-8**			**L1197323-10**	**L1197323-11**			**L1198951-3**	**L1198951-4**		
	Sample	**Duplicate**	**5 x DL**	**RPD_a**	**Sample**	**Duplicate**	**5 x DL**	**RPD_a**	**Sample**	**Duplicate**	**5 x DL**	**RPD_a**
Physical Tests												
Conductivity	51.0	47.7	10	6.7	49.1	48.9	10	0.4	119	118	10	0.8
Hardness (as $CaCO_3$)	18.6	19.6	2.5	5.2	20.9	21.3	2.5	1.9	63.1	60.7	2.5	3.9
pH	7.21	7.14	0.5	1.0	7.30	7.32	0.5	0.3	8.01	8.06	0.5	0.6
Alkalinity, Bicarbonate (as $CaCO_3$)	8.2	8.0	10	RPD-N/A	12.1	12.2	10	0.8	65.3	65.9	10	0.9
Alkalinity, Carbonate (as $CaCO_3$)	<2.0	<2.0	10	RPD-N/A	<2.0	<2.0	10	RPD-N/A	<2.0	<2.0	10	RPD-N/A
Alkalinity, Hydroxide (as $CaCO_3$)	<2.0	<2.0	10	RPD-N/A	<2.0	<2.0	10	RPD-N/A	<2.0	<2.0	10	RPD-N/A
Alkalinity, Total (as $CaCO_3$)	8.2	8.0	10	RPD-N/A	12.1	12.2	10	0.8	65.3	65.9	10	0.9
Total Suspended Solids	**1.5**	**1.5**	15	RPD-N/A	**1.5**	**1.5**	15	RPD-N/A	**1.5**	**1.5**	15	RPD-N/A
Total Dissolved Solids	34	30	50	RPD-N/A	33	34	50	RPD-N/A	68	69	50	1.5
Turbidity	0.29	0.27	0.5	RPD-N/A	0.28	0.33	0.5	RPD-N/A	0.29	0.25	0.5	RPD-N/A
Nutrients												
Ammonia, Total (as N)	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A
Nitrate (as N)	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A
Nitrite (as N)	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A
Total Kjeldahl Nitrogen	0.137	0.118	0.25	RPD-N/A	0.190	0.200	0.25	RPD-N/A	0.143	0.146	0.25	RPD-N/A
Ortho-phosphate (as P)	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A
Total Phosphorus (P)	0.0034	0.0036	0.01	RPD-N/A	0.0034	0.0036	0.01	RPD-N/A	0.0033	0.0029	0.01	RPD-N/A
Anions												
Bromide (Br)	<0.050	<0.050	0.25	RPD-N/A	<0.050	<0.050	0.25	RPD-N/A	<0.050	<0.050	0.25	RPD-N/A
Chloride (Cl)	1.36	1.35	2.5	RPD-N/A	1.14	1.13	2.5	RPD-N/A	0.68	0.67	2.5	RPD-N/A
Fluoride (F)	0.020	0.020	0.1	RPD-N/A	0.021	0.021	0.1	RPD-N/A	<0.020	<0.020	0.1	RPD-N/A
Sulfate (SO_4)	11.3	11.3	2.5	0.0	9.19	9.21	2.5	0.2	0.66	0.65	2.5	RPD-N/A
Cyanides												
Cyanide, Total	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A
Cyanide, Free	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A	<0.0010	<0.0010	0.005	RPD-N/A
Organic / Inorganic Carbon												
Total Organic Carbon	1.37	1.40	2.5	RPD-N/A	2.09	2.13	2.5	RPD-N/A	2.71	2.54	2.5	6.5
Total Metals												
Aluminum (Al)	0.0048	0.0037	0.015	RPD-N/A	0.0051	0.0042	0.015	RPD-N/A	0.0031	0.0031	0.015	RPD-N/A
Antimony (Sb)	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Arsenic (As)	0.000535	0.000495	0.00015	7.8	0.00115	0.00113	0.00015	1.8	0.000215	0.000216	0.00015	0.5
Barium (Ba)	0.00145	0.00180	0.00025	*21.5*	0.00272	0.000966	0.00025	**95.2**	0.0211	0.0205	0.00025	2.9
Beryllium (Be)	<0.00020	<0.00020	0.001	RPD-N/A	<0.00020	<0.00020	0.001	RPD-N/A	<0.00020	<0.00020	0.001	RPD-N/A
Bismuth (Bi)	<0.00050	<0.00050	0.0025	RPD-N/A	<0.00050	<0.00050	0.0025	RPD-N/A	<0.00050	<0.00050	0.0025	RPD-N/A
Boron (B)	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A
Cadmium (Cd)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A
Calcium (Ca)	4.24	3.98	0.1	6.3	4.09	4.09	0.1	0.0	14.6	15.2	0.1	4.0
Chromium (Cr)	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A
Cobalt (Co)	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A
Copper (Cu)	0.00113	0.00107	0.0025	RPD-N/A	0.00164	0.00148	0.0025	RPD-N/A	0.00097	0.00107	0.0025	RPD-N/A
Iron (Fe)	0.018	0.017	0.05	RPD-N/A	0.035	0.034	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A
Lead (Pb)	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Lithium (Li)	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A
Magnesium (Mg)	2.05	1.85	0.025	10.3	2.81	2.77	0.025	1.4	5.94	6.09	0.025	2.5
Manganese (Mn)	0.00232	0.00208	0.00025	10.9	0.00181	0.00170	0.00025	6.3	0.00246	0.00250	0.00025	1.6
Mercury (Hg)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A
Molybdenum (Mo)	<0.000050	<0.000050	0.00025	RPD-N/A	0.000050	<0.000050	0.00025	RPD-N/A	0.000076	0.000073	0.00025	RPD-N/A
Nickel (Ni)	0.00102	0.00093	0.0005	9.2	0.00140	0.00133	0.0005	5.1	0.00014	0.00012	0.0005	RPD-N/A
Phosphorus (P)	<0.30	<0.30	1.5	RPD-N/A	<0.30	<0.30	1.5	RPD-N/A	<0.30	<0.30	1.5	RPD-N/A
Potassium (K)	0.374	0.349	0.25	6.9	0.354	0.352	0.25	0.6	0.239	0.242	0.25	RPD-N/A
Selenium (Se)	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A
Silicon (Si)	0.117	0.114	0.25	RPD-N/A	0.374	0.373	0.25	0.3	0.958	0.996	0.25	3.9
Silver (Ag)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A
Sodium (Na)	0.736	0.676	0.05	8.5	0.601	0.595	0.05	1.0	0.447	0.465	0.05	3.9

Appendix 3.2-2. Lake Water Quality Analytical Results of Field Duplicates

Location	Fold Lake				Dragon Lake				Reference C Lake			
Replicate	**1**	**2**			**1**	**2**			**1**	**2**		
Duplicate	**sample**	**duplicate**			**sample**	**duplicate**			**sample**	**duplicate**		
Depth	**1**	**1**			**1**	**1**			**1**	**1**		
Date Sampled	**19-Aug-12**	**19-Aug-12**			**20-Aug-12**	**20-Aug-12**			**22-Aug-12**	**22-Aug-12**		
ALS Sample ID	**L1197323-7**	**L1197323-8**			**L1197323-10**	**L1197323-11**			**L1198951-3**	**L1198951-4**		
	Sample	**Duplicate**	**5 x DL**	**RPD_a**	**Sample**	**Duplicate**	**5 x DL**	**RPD_a**	**Sample**	**Duplicate**	**5 x DL**	**RPD_a**
Strontium (Sr)	0.0144	0.0134	0.001	7.2	0.00846	0.00840	0.001	0.7	0.00681	0.00719	0.001	5.4
Thallium (Tl)	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Tin (Sn)	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A
Titanium (Ti)	<0.010	<0.010	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A
Uranium (U)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	0.000293	0.000315	0.00005	7.2
Vanadium (V)	0.000076	0.000084	0.00025	RPD-N/A	0.000099	0.000098	0.00025	RPD-N/A	0.000228	0.000203	0.00025	RPD-N/A
Zinc (Zn)	<0.0030	<0.0030	0.015	RPD-N/A	<0.0030	<0.0030	0.015	RPD-N/A	<0.0030	<0.0030	0.015	RPD-N/A
Dissolved Metals												
Aluminum (Al)	<0.0030	<0.0030	0.015	RPD-N/A	<0.0030	<0.0030	0.015	RPD-N/A	<0.0030	<0.0030	0.015	RPD-N/A
Antimony (Sb)	<0.000050	0.000114	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Arsenic (As)	0.000460	0.000468	0.00015	1.7	0.000918	0.000866	0.00015	5.8	0.000215	0.000207	0.00015	3.8
Barium (Ba)	0.00135	0.00148	0.00025	9.2	0.00291	0.00103	0.00025	**95.4**	0.0218	0.0214	0.00025	1.9
Beryllium (Be)	<0.00020	<0.00020	0.001	RPD-N/A	<0.00020	<0.00020	0.001	RPD-N/A	<0.00020	<0.00020	0.001	RPD-N/A
Bismuth (Bi)	<0.00050	<0.00050	0.0025	RPD-N/A	<0.00050	<0.00050	0.0025	RPD-N/A	<0.00050	<0.00050	0.0025	RPD-N/A
Boron (B)	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A	0.0056	0.0071	0.025	RPD-N/A
Cadmium (Cd)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A
Calcium (Ca)	4.20	4.50	0.1	6.9	4.12	4.15	0.1	0.7	15.8	14.8	0.1	6.5
Chromium (Cr)	<0.00010	0.00014	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	0.00012	0.00011	0.0005	RPD-N/A
Cobalt (Co)	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A
Copper (Cu)	0.00082	0.00082	0.0025	RPD-N/A	0.00115	0.00119	0.0025	RPD-N/A	0.00101	0.00083	0.0025	RPD-N/A
Iron (Fe)	<0.010	<0.010	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A
Lead (Pb)	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Lithium (Li)	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A	<0.0050	<0.0050	0.025	RPD-N/A
Magnesium (Mg)	1.98	2.03	0.025	2.5	2.59	2.65	0.025	2.3	5.74	5.76	0.025	0.3
Manganese (Mn)	0.000236	0.000178	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Mercury (Hg)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A
Molybdenum (Mo)	<0.000050	0.000128	0.00025	RPD-N/A	0.000050	<0.000050	0.00025	RPD-N/A	0.000089	0.000077	0.00025	RPD-N/A
Nickel (Ni)	0.00098	0.00103	0.0005	5.0	0.00128	0.00127	0.0005	0.8	0.00016	0.00016	0.0005	RPD-N/A
Phosphorus (P)	<0.30	<0.30	1.5	RPD-N/A	<0.30	<0.30	1.5	RPD-N/A	<0.30	<0.30	1.5	RPD-N/A
Potassium (K)	0.370	0.391	0.25	5.5	0.340	0.345	0.25	1.5	0.242	0.238	0.25	RPD-N/A
Selenium (Se)	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A
Silicon (Si)	0.110	0.108	0.25	RPD-N/A	0.354	0.354	0.25	0.0	0.978	0.994	0.25	1.6
Silver (Ag)	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A
Sodium (Na)	0.707	0.701	0.05	0.9	0.562	0.567	0.05	0.9	0.461	0.454	0.05	1.5
Strontium (Sr)	0.0139	0.0147	0.001	5.6	0.00829	0.00833	0.001	0.5	0.00709	0.00704	0.001	0.7
Thallium (Tl)	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Tin (Sn)	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A	<0.00010	<0.00010	0.0005	RPD-N/A
Titanium (Ti)	<0.010	<0.010	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A	<0.010	<0.010	0.05	RPD-N/A
Uranium (U)	<0.000010	0.000021	0.00005	RPD-N/A	<0.000010	<0.000010	0.00005	RPD-N/A	0.000320	0.000311	0.00005	2.9
Vanadium (V)	<0.000050	0.000068	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A	<0.000050	<0.000050	0.00025	RPD-N/A
Zinc (Zn)	<0.0030	<0.0030	0.015	RPD-N/A	<0.0030	<0.0030	0.015	RPD-N/A	<0.0030	<0.0030	0.015	RPD-N/A

a) Relative percent difference (RPD).

b) RPD-N/A -Not applicable when the values are less than five times the detection limit.

Italicized values exceed the 20% relative percent difference and are more than five times the detection limit.

Bold values exceed the 50% relative percent difference and are more than five times the detection limit.

Appendix 3.2-3

Lake Water Quality QA/QC Results, Back River Project, 2012

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Appendix 3.2-3. Lake Water Quality QA/QC Results, Back River Project, 2012

Area			Realised	Goose	Goose	Goose	George	George	George	Goose	Goose	Goose	George	George	George
Blank Type		CCME Guideline	Detection	Equipment	Field	Travel	Equipment	Field	Travel	Equipment	Field	Travel	Equipment	Field	Travel
Date Sampled		for the Protection	Limit	10-Apr-12	11-Apr-12	10-Apr-12	10-Apr-12	13-Apr-12	13-Apr-12	14-Aug-12	14-Aug-12	14-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12
ALS Sample ID	Units	of Freshwater Aquatic Life[a]	(RDL)	L1133356-1	L1133911-4	L1133356-7	L1133356-2	L1135132-12	L1135132-8	L1195581-1	L1195581-2	L1195581-3	L1197323-3	L1197323-2	L1197323-4
Physical Tests															
Conductivity	µS/cm		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	3.1	<2.0	<2.0	<2.0	<2.0	<2.0
Hardness (as $CaCO_3$)	mg/L		0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	-	-	<0.50	<0.50	<0.50
pH	pH	6.5-9.0	0.10	5.63	5.65	5.61	5.61	5.79	5.78	5.78	6.06	5.64	6.16	5.75	5.73
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		1.0 - 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		1.0 - 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		1.0 - 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		1.0 - 2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Turbidity	NTU	dependent on background levels	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nutrients															
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0086	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate (as N)	mg/L	2.935[b]	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0463	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Anions															
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 120; long-term: 640	0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.71	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride (F)	mg/L	0.12[b]	0.02	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Sulfate (SO_4)	mg/L		0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Cyanides															
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon															
Total Organic Carbon	mg/L		0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Metals															
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0941	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	<0.000030	<0.000030	<0.000030	<0.000030	<0.000030	<0.000030	<0.000030	<0.000030	<0.000030	<0.000030	<0.000030	<0.000030
Barium (Ba)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	0.000176	<0.000050	<0.000050	0.000060	<0.000050	<0.000050	0.000719	<0.000050	<0.000050
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cadmium (Cd)	mg/L	equation[b,d]	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt (Co)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	≥0.002[e]	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)	mg/L	0.3	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead (Pb)	mg/L	≥0.001[f]	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000575	<0.000050	<0.000050	0.000057	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Manganese (Mn)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000282	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	≥0.025[g]	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00018	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

Appendix 3.2-3. Lake Water Quality QA/QC Results, Back River Project, 2012

Area Blank Type Date Sampled ALS Sample ID	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection Limit (RDL)	Goose Equipment 10-Apr-12 L1133356-1	Goose Field 11-Apr-12 L1133911-4	Goose Travel 10-Apr-12 L1133356-7	George Equipment 10-Apr-12 L1133356-2	George Field 13-Apr-12 L1135132-12	George Travel 13-Apr-12 L1135132-8	Goose Equipment 14-Aug-12 L1195581-1	Goose Field 14-Aug-12 L1195581-2	Goose Travel 14-Aug-12 L1195581-3	George Equipment 18-Aug-12 L1197323-3	George Field 18-Aug-12 L1197323-2	George Travel 18-Aug-12 L1197323-4
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.017	<0.010	<0.010	<0.010	<0.010	<0.010
Strontium (Sr)	mg/L		0.00010 -	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Zinc (Zn)	mg/L	0.03	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, (accessed 2012).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(hardness)]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(hardness)]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(hardness)]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(hardness)]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realised detection limit

Appendix 3.3-1

Stream Water Quality Analytical Results, Back River Project, 2012

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Appendix 3.3-1. Stream Water Quality Analytical Results, Back River, 2012

Area				Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location				Moby OF	Moby OF	Gander IF	Gander IF	Gander US	Gander US	Pond 19 OF	Pond 19 OF	Chair OF	Chair OF
Replicate				1	2	1	2	1	2	1	2	1	2
Date Sampled				12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12
ALS Sample ID #	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection Limit (RDL)	L1162486-1	L1162486-2	L1162486-3	L1162486-4	L1162486-5	L1162486-6	L1162486-9	L1162486-10	L1162486-7	L1162486-8
Physical Tests	µS/cm												
Conductivity			2.0	20.9	20.4	20.1	20.0	20.2	20.2	25.3	25.4	16.7	16.6
Hardness (as $CaCO_3$)	mg/L		0.50	8.09	8.38	7.72	8.11	7.92	7.93	11.2	11.1	6.96	7.03
pH	pH	6.5-9.0	0.10	6.79	6.67	6.83	6.82	6.80	6.80	6.98	7.00	5.73	6.47
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	2.9	3.1	3.9	3.9	4.0	4.2	6.6	6.3	4.0	4.3
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	2.9	3.1	3.9	3.9	4.0	4.2	6.6	6.3	4.0	4.3
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	4.7	<3.0	3.3	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	19	18	21	17	19	19	23	23	18	23
Turbidity	NTU	dependent on background levels	0.10	0.67	0.67	1.76	1.77	1.22	1.35	0.29	0.31	0.53	0.63
Nutrients													
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate (as N)	mg/L	2.935[b]	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.135	0.137	0.187	0.159	0.163	0.174	0.155	0.165	0.178	0.170
Ortho-phosphate (as P)	mg/L		0.001	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.0033	0.0034	0.0061	0.0065	0.0077	0.0072	0.0029	0.0032	0.0053	0.0056
Anions													
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 120; long-term: 640	0.50	<0.50	<0.50	0.52	<0.50	0.52	0.52	<0.50	<0.50	<0.50	<0.50
Fluoride (F)	mg/L	0.12[b]	0.02	0.024	0.024	<0.020	<0.020	<0.020	<0.020	0.025	0.023	<0.020	<0.020
Sulfate (SO_4)	mg/L		0.5	5.86	5.86	4.65	4.66	4.83	4.87	5.23	5.24	3.10	3.09
Cyanides													
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon													
Total Organic Carbon	mg/L		0.50	3.19	3.34	3.54	3.54	3.46	3.41	3.97	4.01	3.93	3.95
Total Metals													
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0742	0.0686	0.0576	0.0547	0.0526	0.0468	0.0429	0.0384	0.0433	0.0425
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000249	0.000232	0.000345	0.000334	0.000333	0.000320	0.000317	0.000294	0.000307	0.000296
Barium (Ba)	mg/L		0.000050	0.00372	0.00366	0.00422	0.00404	0.00400	0.00392	0.00309	0.00308	0.00324	0.00315
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	0.0066	0.0059	0.0077	0.0067	0.0066	0.0063	0.0071	0.0067	0.0079	0.0061
Cadmium (Cd)	mg/L	equation[b,d]	0.000010	0.000015	0.000013	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	1.80	1.64	1.59	1.57	1.57	1.59	2.27	2.06	1.29	1.22
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00023	0.00024	0.00026	0.00025	0.00024	0.00022	0.00022	0.00021	0.00018	0.00019
Cobalt (Co)	mg/L		0.00010	0.00117	0.00119	0.00044	0.00046	0.00033	0.00032	0.00012	0.00012	0.00013	0.00013
Copper (Cu)	mg/L	≥0.002[e]	0.0005 - 0.0015	0.00301	0.00302	0.00161	0.00166	0.00146	0.00146	0.00254	0.00251	0.00162	0.00158
Iron (Fe)	mg/L	0.3	0.010	0.092	0.087	0.124	0.118	0.113	0.104	0.044	0.041	0.083	0.084
Lead (Pb)	mg/L	≥0.001[f]	0.000050	<0.000050	<0.000050	0.000074	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	0.926	0.914	1.03	1.01	1.07	1.08	1.35	1.32	1.01	0.981
Manganese (Mn)	mg/L		0.000050	0.00307	0.00323	0.00664	0.00664	0.00621	0.00635	0.000399	0.000417	0.00158	0.00157
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	≥0.025[g]	0.00010	0.0157	0.0158	0.00584	0.00588	0.00517	0.00514	0.00536	0.00523	0.00297	0.00287
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.214	0.218	0.312	0.304	0.313	0.317	0.311	0.300	0.294	0.278
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.589	0.582	0.422	0.413	0.404	0.395	0.452	0.447	0.328	0.338
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.472	0.464	0.573	0.566	0.589	0.590	0.458	0.455	0.468	0.457

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River, 2012

Area				Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location				Moby OF	Moby OF	Gander IF	Gander IF	Gander US	Gander US	Pond 19 OF	Pond 19 OF	Chair OF	Chair OF
Replicate				1	2	1	2	1	2	1	2	1	2
Date Sampled				12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12
ALS Sample ID #	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection Limit (RDL)	L1162486-1	L1162486-2	L1162486-3	L1162486-4	L1162486-5	L1162486-6	L1162486-9	L1162486-10	L1162486-7	L1162486-8
Strontium (Sr)	mg/L		0.00020	0.00738	0.00677	0.00702	0.00688	0.00695	0.00708	0.00726	0.00662	0.00522	0.00495
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	0.000030	0.000026	0.000015	0.000015	0.000013	0.000012	0.000012	0.000011	0.000015	0.000014
Vanadium (V)	mg/L		0.000050	0.000152	0.000154	0.000181	0.000179	0.000174	0.000153	<0.000050	0.000086	0.000166	0.000147
Zinc (Zn)	mg/L	0.03	0.0030	0.0054	0.0055	0.0032	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals													
Aluminum (Al)	mg/L		0.0030	0.0467	0.0457	0.0176	0.0225	0.0152	0.0166	0.0363	0.0374	0.0270	0.0272
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000205	0.000194	0.000265	0.000284	0.000285	0.000264	0.000276	0.000299	0.000249	0.000274
Barium (Ba)	mg/L		0.000050	0.00344	0.00335	0.00362	0.00374	0.00352	0.00351	0.00306	0.00308	0.00294	0.00303
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	0.0055	0.0050	0.0073	0.0060	0.0062	0.0062	0.0085	0.0074	0.0069	0.0059
Cadmium (Cd)	mg/L		0.000010	0.000015	0.000016	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	1.75	1.88	1.49	1.63	1.50	1.50	2.28	2.24	1.24	1.25
Chromium (Cr)	mg/L		0.00010	0.00016	0.00017	0.00018	0.00013	0.00012	<0.00010	0.00017	0.00019	0.00015	0.00015
Cobalt (Co)	mg/L		0.00010	0.00111	0.00112	0.00026	0.00039	0.00017	0.00017	0.00012	0.00012	<0.00010	<0.00010
Copper (Cu)	mg/L		0.00050	0.00264	0.00268	0.00138	0.00145	0.00120	0.00122	0.00243	0.00237	0.00135	0.00137
Iron (Fe)	mg/L		0.010	0.031	0.033	0.019	0.054	0.013	0.014	0.033	0.032	0.028	0.027
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	0.903	0.897	0.972	0.980	1.01	1.02	1.35	1.34	0.939	0.950
Manganese (Mn)	mg/L		0.000050	0.00286	0.00314	0.00412	0.00602	0.00382	0.00381	0.000411	0.000375	0.000990	0.00104
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.0148	0.0148	0.00532	0.00540	0.00462	0.00465	0.00529	0.00525	0.00279	0.00272
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.218	0.215	0.296	0.292	0.296	0.304	0.323	0.312	0.275	0.282
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.546	0.545	0.327	0.328	0.316	0.319	0.459	0.447	0.297	0.304
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.456	0.452	0.548	0.542	0.555	0.560	0.480	0.458	0.443	0.442
Strontium (Sr)	mg/L		0.00020	0.00716	0.00785	0.00655	0.00658	0.00656	0.00650	0.00722	0.00712	0.00494	0.00508
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	0.000024	0.000026	0.000010	0.000011	<0.000010	<0.000010	0.000011	0.000011	0.000012	0.000012
Vanadium (V)	mg/L		0.000050	0.000081	0.000081	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000068	0.000080
Zinc (Zn)	mg/L		0.0030	0.0045	0.0051	<0.0030	0.0044	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Note Echo OF was dry during August sampling.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, (accessed 2012).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realised detection limit

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River, 2012

Area				Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location				Llama OF	Llama OF	Echo OF	Echo OF	Giraffe OF	Giraffe OF	Wolf OF	Wolf OF	Goose OF	Goose OF
Replicate				1	2	1	2	1	2	1	2	1	2
Date Sampled				12-Jun-12	12-Jun-12	13-Jun-12	13-Jun-12	13-Jun-12	13-Jun-12	12-Jun-12	12-Jun-12	13-Jun-12	13-Jun-12
ALS Sample ID #	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection (RDL)	L1162486-11	L1162486-12	L1162486-21	L1162486-22	L1162486-23	L1162486-24	L1162486-17	L1162486-18	L1162486-25	L1162486-26
Physical Tests	µS/cm												
Conductivity			2.0	41.4	40.7	28.7	28.8	17.6	17.5	15.9	16.0	25.6	25.5
Hardness (as $CaCO_3$)	mg/L		0.50	16.2	16.4	11.3	11.7	6.89	6.96	6.68	6.68	10.1	10.1
pH	pH	6.5-9.0	0.10	6.78	6.76	5.90	6.10	6.62	6.67	6.51	6.51	6.70	6.74
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	4.1	3.7	3.2	2.9	3.0	3.1	3.6	4.1	3.9	3.9
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	4.1	3.7	3.2	2.9	3.0	3.1	3.6	4.1	3.9	3.9
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	41	37	37	40	17	11	21	21	29	26
Turbidity	NTU	dependent on background levels	0.10	0.20	0.17	0.26	0.27	0.43	0.39	0.26	0.25	0.57	0.46
Nutrients													
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	<0.0050	<0.0050	0.0640	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate (as N)	mg/L	2.935[b]	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.132	0.146	0.285	0.299	0.135	0.146	0.168	0.162	0.200	0.216
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	0.0016	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.0025	0.0023	0.0033	0.0033	0.0049	0.0046	0.0044	0.0041	0.0070	0.0078
Anions													
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 120; long-term: 640	0.50	7.46	7.31	3.92	3.92	<0.50	<0.50	<0.50	<0.50	2.33	2.33
Fluoride (F)	mg/L	0.12[b]	0.02	<0.020	<0.020	0.026	0.027	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Sulfate (SO_4)	mg/L		0.5	3.62	3.64	3.42	3.43	4.39	4.40	3.21	3.16	4.30	4.30
Cyanides													
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon													
Total Organic Carbon	mg/L		0.50	3.32	3.30	9.65	9.65	3.51	3.49	3.77	3.75	4.38	4.37
Total Metals													
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0325	0.0363	0.142	0.131	0.0382	0.0373	0.0219	0.0225	0.0330	0.0352
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000200	0.000196	0.000418	0.000373	0.000167	0.000178	0.000175	0.000162	0.000215	0.000178
Barium (Ba)	mg/L		0.000050	0.00873	0.00901	0.0123	0.0119	0.00300	0.00306	0.00367	0.00369	0.00546	0.00551
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	<0.0050	0.0080	0.0075	0.0071	0.0069	0.0065	0.0077	0.0088	0.0069	0.0075
Cadmium (Cd)	mg/L	equation[b,d]	0.000010	0.000016	0.000014	0.000016	0.000015	<0.000010	0.000011	<0.000010	<0.000010	<0.000010	0.000013
Calcium (Ca)	mg/L		0.020	4.09	4.19	2.91	2.85	1.30	1.33	1.35	1.37	2.27	2.30
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00013	0.00020	0.00048	0.00055	0.00016	0.00016	0.00026	0.00018	0.00020	0.00029
Cobalt (Co)	mg/L		0.00010	0.00049	0.00050	0.00105	0.00100	0.00048	0.00051	<0.00010	<0.00010	0.00060	0.00060
Copper (Cu)	mg/L	≥0.002[e]	0.0005 - 0.0015	0.00205	0.00205	0.00248	0.00231	0.00184	0.00194	0.00115	0.00115	0.00157	0.00156
Iron (Fe)	mg/L	0.3	0.010	0.015	0.016	0.142	0.144	0.050	0.052	0.048	0.050	0.082	0.082
Lead (Pb)	mg/L	≥0.001[f]	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000073
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	1.48	1.49	1.22	1.18	0.874	0.920	0.810	0.808	1.11	1.10
Manganese (Mn)	mg/L		0.000050	0.00459	0.00486	0.00431	0.00395	0.00448	0.00468	0.000767	0.000725	0.0119	0.0116
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	≥0.025[g]	0.00010	0.00504	0.00517	0.00464	0.00429	0.00691	0.00707	0.00274	0.00275	0.00534	0.00535
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.399	0.409	0.069	0.078	0.228	0.238	0.244	0.240	0.345	0.333
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.521	0.525	0.800	0.804	0.377	0.392	0.269	0.260	0.416	0.421
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.664	0.667	0.853	0.836	0.420	0.438	0.433	0.435	0.554	0.543

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River, 2012

Area				Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location				Llama OF	Llama OF	Echo OF	Echo OF	Giraffe OF	Giraffe OF	Wolf OF	Wolf OF	Goose OF	Goose OF
Replicate				1	2	1	2	1	2	1	2	1	2
Date Sampled				12-Jun-12	12-Jun-12	13-Jun-12	13-Jun-12	13-Jun-12	13-Jun-12	12-Jun-12	12-Jun-12	13-Jun-12	13-Jun-12
ALS Sample ID #	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection (RDL)	L1162486-11	L1162486-12	L1162486-21	L1162486-22	L1162486-23	L1162486-24	L1162486-17	L1162486-18	L1162486-25	L1162486-26
Strontium (Sr)	mg/L		0.00020	0.0234	0.0238	0.0126	0.0121	0.00562	0.00570	0.00575	0.00584	0.0124	0.0125
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000014	0.000016	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	0.000085	0.000078	0.000190	0.000224	0.000078	0.000075	0.000104	0.000108	0.000085	0.000097
Zinc (Zn)	mg/L	0.03	0.0030	<0.0030	<0.0030	0.0033	0.0035	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals													
Aluminum (Al)	mg/L		0.0030	0.0293	0.0317	0.126	0.131	0.0351	0.0329	0.0180	0.0180	0.0260	0.0277
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000186	0.000180	0.000340	0.000378	0.000160	0.000144	0.000159	0.000159	0.000177	0.000166
Barium (Ba)	mg/L		0.000050	0.00864	0.00873	0.0113	0.0118	0.00298	0.00297	0.00368	0.00358	0.00542	0.00534
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	0.0063	0.0061	0.0083	0.0070	0.0080	0.0057	0.0074	0.0078	0.0079	0.0080
Cadmium (Cd)	mg/L		0.000010	0.000015	0.000017	0.000016	0.000012	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	4.11	4.17	2.68	2.76	1.30	1.30	1.36	1.35	2.24	2.25
Chromium (Cr)	mg/L		0.00010	0.00016	0.00013	0.00044	0.00041	0.00015	0.00014	0.00015	0.00016	0.00015	0.00017
Cobalt (Co)	mg/L		0.00010	0.00047	0.00050	0.00101	0.00097	0.00043	0.00047	<0.00010	<0.00010	0.00042	0.00040
Copper (Cu)	mg/L		0.00050	0.00186	0.00186	0.00223	0.00237	0.00176	0.00178	0.00107	0.00105	0.00142	0.00138
Iron (Fe)	mg/L		0.010	<0.010	<0.010	0.074	0.086	0.024	0.011	0.020	0.022	0.021	0.023
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	1.44	1.45	1.11	1.16	0.882	0.901	0.800	0.807	1.10	1.09
Manganese (Mn)	mg/L		0.000050	0.00444	0.00474	0.00383	0.00413	0.00398	0.00396	0.000487	0.000560	0.00915	0.00870
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.00495	0.00505	0.00429	0.00448	0.00670	0.00681	0.00268	0.00270	0.00519	0.00517
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.394	0.399	0.071	0.075	0.233	0.236	0.247	0.245	0.345	0.334
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.507	0.517	0.788	0.785	0.370	0.368	0.244	0.253	0.389	0.411
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.643	0.651	0.869	0.824	0.420	0.431	0.430	0.424	0.542	0.535
Strontium (Sr)	mg/L		0.00020	0.0232	0.0232	0.0114	0.0118	0.00557	0.00556	0.00559	0.00558	0.0121	0.0121
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000013	0.000013	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	<0.000050	<0.000050	0.000125	0.000138	<0.000050	<0.000050	0.000051	<0.000050	<0.000050	<0.000050
Zinc (Zn)	mg/L		0.0030	<0.0030	<0.0030	0.0037	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Note Echo OF was dry during August sampling.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, (accessed 2012).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realised detection limit

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River, 2012

Area				Goose	Goose	Goose	Goose	George	George	George	George	George	George
Location				Propellor OF	Propellor OF	Reference B OF	Reference B OF	George OF	George OF	Sleigh OF	Sleigh OF	Dragon OF	Dragon OF
Replicate				1	2	1	2	1	2	1	2	1	2
Date Sampled				12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	13-Jun-12	13-Jun-12	13-Jun-12	13-Jun-12	13-Jun-12	13-Jun-12
ALS Sample ID #	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection (RDL)	L1162486-15	L1162486-16	L1162486-13	L1162486-14	L1162486-29	L1162486-30	L1162486-35	L1162486-36	L1162486-33	L1162486-34
Physical Tests	µS/cm												
Conductivity			2.0	24.7	24.6	11.0	11.0	42.0	41.9	24.1	24.2	53.7	53.7
Hardness (as $CaCO_3$)	mg/L		0.50	10.0	10.1	5.05	5.00	16.2	16.5	9.48	9.52	23.6	23.8
pH	pH	6.5-9.0	0.10	6.87	6.91	6.50	6.81	6.99	6.99	6.77	6.74	7.40	7.41
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	4.9	4.9	4.7	4.6	5.3	5.4	3.2	3.3	14.3	14.0
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	4.9	4.9	4.7	4.6	5.3	5.4	3.2	3.3	14.3	14.0
Total Suspended Solids	mg/L	dependent on background levels	3.0	3.3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	22	21	13	11	29	21	20	18	28	38
Turbidity	NTU	dependent on background levels	0.10	0.28	0.34	0.37	0.52	0.38	0.25	0.51	0.38	0.41	0.36
Nutrients													
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate (as N)	mg/L	2.935[b]	0.0050	0.0203	0.0226	<0.0050	<0.0050	<0.0050	<0.0050	0.0062	0.0058	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.188	0.185	0.200	0.223	0.118	0.113	0.125	0.126	0.178	0.190
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.0041	0.0040	0.0062	0.0065	0.0030	0.0034	0.0038	0.0040	0.0041	0.0039
Anions													
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 120; long-term: 640	0.50	1.88	1.88	<0.50	<0.50	2.35	2.34	1.30	1.32	1.13	1.13
Fluoride (F)	mg/L	0.12[b]	0.02	<0.020	<0.020	<0.020	<0.020	0.022	0.022	<0.020	<0.020	<0.020	<0.020
Sulfate (SO_4)	mg/L		0.5	3.80	3.79	0.97	0.96	10.3	10.3	6.08	6.05	10.4	10.4
Cyanides													
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon													
Total Organic Carbon	mg/L		0.50	4.01	3.98	3.95	3.94	2.07	2.02	2.16	2.18	2.92	2.97
Total Metals													
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0177	0.0220	0.0207	0.0229	0.0236	0.0234	0.0383	0.0361	0.0143	0.0124
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000174	0.000171	0.000105	0.000115	0.000447	0.000444	0.000434	0.000420	0.000596	0.000604
Barium (Ba)	mg/L		0.000050	0.00520	0.00528	0.00380	0.00396	0.00242	0.00239	0.00178	0.00186	0.00144	0.00152
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	0.0078	0.0082	0.0073	0.0066	0.0073	0.0070	0.0077	0.0072	0.0080	0.0072
Cadmium (Cd)	mg/L	equation[b,d]	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000016	0.000013	0.000011	0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	2.16	2.17	1.02	0.952	4.10	4.09	2.44	2.45	4.82	4.84
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00015	0.00020	0.00020	0.00019	0.00012	0.00012	0.00012	0.00016	0.00011	<0.00010
Cobalt (Co)	mg/L		0.00010	0.00016	0.00016	<0.00010	<0.00010	0.00142	0.00144	0.00062	0.00062	0.00054	0.00054
Copper (Cu)	mg/L	≥0.002[e]	0.0005 - 0.0015	0.00121	0.00117	0.00074	0.00074	0.00199	0.00196	0.00246	0.00251	0.00180	0.00176
Iron (Fe)	mg/L	0.3	0.010	0.039	0.040	0.167	0.135	0.049	0.045	0.056	0.057	0.046	0.044
Lead (Pb)	mg/L	≥0.001[f]	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	1.17	1.17	0.627	0.636	1.50	1.51	0.885	0.888	2.99	3.01
Manganese (Mn)	mg/L		0.000050	0.00676	0.00666	0.00207	0.00207	0.00954	0.00950	0.00878	0.00880	0.00621	0.00631
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	≥0.025[g]	0.00010	0.00317	0.00315	0.00127	0.00123	0.00621	0.00627	0.00669	0.00663	0.00401	0.00406
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.356	0.360	0.204	0.213	0.261	0.268	0.213	0.209	0.375	0.374
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.344	0.343	0.202	0.202	0.224	0.226	0.220	0.219	0.323	0.326
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.634	0.636	0.345	0.351	0.636	0.633	0.421	0.416	0.618	0.623

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River, 2012

Area				Goose	Goose	Goose	Goose	George	George	George	George	George	George
Location				Propellor OF	Propellor OF	Reference B OF	Reference B OF	George OF	George OF	Sleigh OF	Sleigh OF	Dragon OF	Dragon OF
Replicate				1	2	1	2	1	2	1	2	1	2
Date Sampled				12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	13-Jun-12	13-Jun-12	13-Jun-12	13-Jun-12	13-Jun-12	13-Jun-12
ALS Sample ID #	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection (RDL)	L1162486-15	L1162486-16	L1162486-13	L1162486-14	L1162486-29	L1162486-30	L1162486-35	L1162486-36	L1162486-33	L1162486-34
Strontium (Sr)	mg/L		0.00020	0.0101	0.0102	0.00374	0.00352	0.0160	0.0157	0.0101	0.0100	0.0100	0.00998
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000013	0.000013	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	0.000074	0.000070	0.000096	0.000097	0.000064	0.000070	0.000073	0.000090	0.000083	0.000075
Zinc (Zn)	mg/L	0.03	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0047	0.0051	0.0040	0.0038	<0.0030	<0.0030
Dissolved Metals													
Aluminum (Al)	mg/L		0.0030	0.0124	0.0172	0.0172	0.0176	0.0158	0.0149	0.0229	0.0266	0.0080	0.0089
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000154	0.000155	0.000107	0.000085	0.000396	0.000398	0.000355	0.000364	0.000531	0.000561
Barium (Ba)	mg/L		0.000050	0.00515	0.00527	0.00387	0.00378	0.00235	0.00241	0.00172	0.00174	0.00141	0.00136
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	0.0070	0.0066	0.0067	0.0073	0.0059	0.0066	0.0071	0.0067	0.0061	0.0074
Cadmium (Cd)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	0.000013	0.000011	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	2.12	2.14	0.998	0.989	4.06	4.13	2.38	2.35	4.72	4.75
Chromium (Cr)	mg/L		0.00010	0.00017	0.00013	0.00014	0.00016	<0.00010	0.00011	<0.00010	0.00013	<0.00010	<0.00010
Cobalt (Co)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00130	0.00118	0.00055	0.00057	0.00040	0.00039
Copper (Cu)	mg/L		0.00050	0.00112	0.00110	0.00069	0.00067	0.00171	0.00172	0.00214	0.00220	0.00151	0.00150
Iron (Fe)	mg/L		0.010	<0.010	0.028	0.073	0.073	<0.010	<0.010	<0.010	<0.010	0.012	0.010
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	1.14	1.16	0.620	0.616	1.48	1.49	0.862	0.884	2.86	2.90
Manganese (Mn)	mg/L		0.000050	0.00262	0.00429	0.000703	0.000715	0.00830	0.00807	0.00805	0.00826	0.00454	0.00449
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.00301	0.00306	0.00123	0.00122	0.00601	0.00610	0.00635	0.00648	0.00382	0.00376
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.358	0.359	0.212	0.211	0.262	0.271	0.210	0.214	0.367	0.361
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.326	0.326	0.190	0.198	0.217	0.222	0.208	0.209	0.307	0.305
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.615	0.625	0.341	0.343	0.617	0.622	0.409	0.428	0.593	0.593
Strontium (Sr)	mg/L		0.00020	0.00974	0.00987	0.00363	0.00360	0.0156	0.0157	0.00967	0.00958	0.00969	0.00966
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000011	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	<0.000050	<0.000050	0.000051	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Zinc (Zn)	mg/L		0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0040	0.0040	0.0034	0.0035	<0.0030	<0.0030

Note Echo OF was dry during August sampling.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, (accessed 2012).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realised detection limit

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River, 2012

Area				George	George	George	George	Goose	Goose	Goose	Goose	Goose	Goose
Location				Komatic IF	Komatic IF	Reference C OF	Reference C OF	Moby OF	Moby OF	Gander IF	Gander IF	Gander US	Gander US
Replicate				1	2	1	2	1	2	1	2	1	2
Date Sampled				13-Jun-12	13-Jun-12	13-Jun-12	13-Jun-12	12-Aug-12	12-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12
ALS Sample ID #	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection (RDL)	L1162486-31	L1162486-32	L1162486-27	L1162486-28	L1193094-1	L1193094-2	L1192523-5	L1192523-6	L1192523-7	L1192523-8
Physical Tests	µS/cm												
Conductivity			2.0	34.1	34.2	46.8	46.9	54.4	54.4	28.0	28.1	23.6	23.5
Hardness (as $CaCO_3$)	mg/L		0.50	14.4	14.4	24.8	24.7	20.6	20.6	10.6	10.3	8.89	8.57
pH	pH	6.5-9.0	0.10	7.13	7.11	7.68	7.72	6.86	6.86	7.00	7.00	6.99	6.99
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	7.0	7.8	26.0	25.9	4.4	4.5	4.6	4.7	4.4	4.6
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	7.0	7.8	26.0	25.9	4.4	4.5	4.6	4.7	4.4	4.6
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	3.5	<3.0	<3.0
Total Dissolved Solids	mg/L		10	27	25	27	29	44	46	23	20	17	20
Turbidity	NTU	dependent on background levels	0.10	0.69	0.69	0.21	0.20	0.79	0.75	1.01	0.85	0.51	0.54
Nutrients													
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0077	0.0071	0.0058	0.0058	<0.0050	0.0050
Nitrate (as N)	mg/L	2.935[b]	0.0050	<0.0050	<0.0050	0.0059	<0.0050	0.110	0.109	0.0157	0.0167	0.0083	0.0079
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.149	0.163	0.123	0.118	0.208	0.188	0.211	0.218	0.210	0.201
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.0047	0.0049	0.0031	0.0046	0.0046	0.0044	0.0054	0.0059	0.0047	0.0041
Anions													
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 120; long-term: 640	0.50	1.11	1.12	<0.50	<0.50	<0.50	<0.50	0.51	0.50	0.52	0.52
Fluoride (F)	mg/L	0.12[b]	0.02	<0.020	<0.020	<0.020	<0.020	0.037	0.038	0.023	0.024	0.022	0.022
Sulfate (SO_4)	mg/L		0.5	7.41	7.41	<0.50	<0.50	17.6	17.7	6.74	6.73	5.17	5.17
Cyanides													
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon													
Total Organic Carbon	mg/L		0.50	2.68	2.70	2.45	2.42	3.23	3.23	2.72	2.59	2.54	2.54
Total Metals													
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0341	0.0328	0.0049	0.0039	0.0589	0.0573	0.0218	0.0212	0.0085	0.0094
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000691	0.000707	0.000101	0.000109	0.000544	0.000519	0.000470	0.000476	0.000404	0.000454
Barium (Ba)	mg/L		0.000050	0.00172	0.00173	0.00983	0.00989	0.00954	0.00957	0.00416	0.00416	0.00329	0.00352
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	0.0069	0.0076	0.0075	0.0069	0.0080	0.0057	<0.0050	<0.0050	<0.0050	0.0060
Cadmium (Cd)	mg/L	equation[b,d]	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000041	0.000041	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	3.21	3.13	5.96	5.99	4.67	4.64	2.17	2.16	1.46	1.78
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00016	0.00018	0.00010	0.00010	0.00029	0.00053	0.00022	0.00030	0.00020	0.00017
Cobalt (Co)	mg/L		0.00010	0.00047	0.00046	<0.00010	<0.00010	0.00604	0.00606	0.00059	0.00059	<0.00010	0.00012
Copper (Cu)	mg/L	≥0.002[e]	0.0005 - 0.0015	0.00213	0.00207	0.00059	0.00063	0.00385	0.00375	0.00166	0.00162	0.00138	0.00187
Iron (Fe)	mg/L	0.3	0.010	0.068	0.065	0.014	0.013	0.378	0.391	0.137	0.139	0.087	0.087
Lead (Pb)	mg/L	≥0.001[f]	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000062	0.000052	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	1.64	1.61	2.46	2.48	2.18	2.18	1.24	1.25	1.12	1.19
Manganese (Mn)	mg/L		0.000050	0.00359	0.00342	0.00179	0.00192	0.0208	0.0213	0.00317	0.00297	0.00195	0.00213
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	≥0.025[g]	0.00010	0.00537	0.00517	<0.00010	0.00010	0.0394	0.0394	0.00706	0.00694	0.00267	0.00276
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.260	0.271	0.116	0.122	0.318	0.294	0.307	0.307	0.308	0.312
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.273	0.263	0.375	0.374	1.88	1.89	0.297	0.306	0.106	0.111
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.498	0.488	0.214	0.214	1.11	1.09	0.639	0.654	0.595	0.615

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River, 2012

Area				George	George	George	George	Goose	Goose	Goose	Goose	Goose	Goose
Location				Komatic IF	Komatic IF	Reference C OF	Reference C OF	Moby OF	Moby OF	Gander IF	Gander IF	Gander US	Gander US
Replicate				1	2	1	2	1	2	1	2	1	2
Date Sampled				13-Jun-12	13-Jun-12	13-Jun-12	13-Jun-12	12-Aug-12	12-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12
ALS Sample ID #	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection (RDL)	L1162486-31	L1162486-32	L1162486-27	L1162486-28	L1193094-1	L1193094-2	L1192523-5	L1192523-6	L1192523-7	L1192523-8
Strontium (Sr)	mg/L		0.00020	0.00972	0.00937	0.00278	0.00276	0.0209	0.0208	0.00968	0.00971	0.00672	0.00821
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	0.000013	0.000011	0.000061	0.000062	0.000027	0.000028	0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	0.000173	0.000175	0.000066	0.000069	0.000269	0.000256	0.000248	0.000236	0.000183	0.000213
Zinc (Zn)	mg/L	0.03	0.0030	0.0035	0.0032	<0.0030	<0.0030	0.0102	0.0101	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals													
Aluminum (Al)	mg/L		0.0030	0.0178	0.0178	<0.0030	<0.0030	0.0358	0.0369	0.0068	0.0053	0.0031	0.0033
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000642	0.000623	0.000078	0.000091	0.000416	0.000472	0.000399	0.000348	0.000372	0.000345
Barium (Ba)	mg/L		0.000050	0.00165	0.00163	0.00995	0.00974	0.00956	0.00944	0.00411	0.00380	0.00337	0.00320
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	0.0059	<0.0050	0.0061	0.0066	<0.0050	<0.0050	<0.0050	<0.0050	0.0056	<0.0050
Cadmium (Cd)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000037	0.000038	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	3.15	3.16	5.92	5.86	4.69	4.63	2.18	2.19	1.71	1.59
Chromium (Cr)	mg/L		0.00010	0.00012	0.00010	<0.00010	<0.00010	0.00022	0.00023	0.00014	<0.00010	0.00011	<0.00010
Cobalt (Co)	mg/L		0.00010	0.00040	0.00040	<0.00010	<0.00010	0.00569	0.00585	0.00048	0.00043	<0.00010	<0.00010
Copper (Cu)	mg/L		0.00050	0.00177	0.00177	0.00057	0.00058	0.00304	0.00310	0.00197	0.00124	0.00109	0.00117
Iron (Fe)	mg/L		0.010	0.016	0.014	<0.010	<0.010	0.203	0.209	0.050	0.052	0.029	0.026
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	1.58	1.59	2.44	2.44	2.16	2.18	1.26	1.17	1.12	1.12
Manganese (Mn)	mg/L		0.000050	0.00298	0.00306	0.000077	0.000111	0.0189	0.0196	0.00214	0.00191	0.00127	0.00111
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.00499	0.00499	0.00013	0.00011	0.0386	0.0388	0.00679	0.00635	0.00261	0.00252
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.258	0.255	0.116	0.124	0.298	0.294	0.312	0.283	0.307	0.302
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.247	0.247	0.361	0.375	1.86	1.84	0.278	0.277	0.096	0.098
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.478	0.477	0.213	0.210	1.08	1.10	0.648	0.602	0.596	0.593
Strontium (Sr)	mg/L		0.00020	0.00938	0.00936	0.00271	0.00271	0.0206	0.0206	0.00963	0.00964	0.00776	0.00717
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	<0.000010	0.000058	0.000056	0.000022	0.000022	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	0.000099	0.000094	<0.000050	<0.000050	0.000118	0.000107	0.000067	0.000050	0.000060	<0.000050
Zinc (Zn)	mg/L		0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0092	0.0098	<0.0030	<0.0030	<0.0030	<0.0030

Note Echo OF was dry during August sampling.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, (accessed 2012).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realised detection limit

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River, 2012

Area				Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location				Pond 19 OF	Pond 19 OF	Chair OF	Chair OF	Llama OF	Llama OF	Giraffe OF	Giraffe OF	Wolf OF	Wolf OF
Replicate				1	2	1	2	1	2	1	2	1	2
Date Sampled				13-Aug-12	13-Aug-12	12-Aug-12	12-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	7-Aug-12	7-Aug-12
ALS Sample ID #	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection (RDL)	L1193081-1	L1193081-2	L1193094-3	L1193094-4	L1191588-1	L1191588-2	L1191588-3	L1191588-4	L1190634-1	L1190634-2
Physical Tests	µS/cm												
Conductivity			2.0	70.3	69.7	30.6	30.6	176	173	24.3	24.2	24.2	23.7
Hardness (as $CaCO_3$)	mg/L		0.50	30.4	29.2	12.6	12.6	67.0	66.0	9.40	9.28	9.48	9.51
pH	pH	6.5-9.0	0.10	7.36	7.30	7.16	7.16	7.00	6.79	6.91	6.89	7.19	7.18
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	15.6	15.2	8.9	9.2	4.8	5.3	4.3	3.7	6.9	6.7
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	15.6	15.2	8.9	9.2	4.8	5.3	4.3	3.7	6.9	6.7
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	6.3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	52	50	23	23	124	117	22	18	20	21
Turbidity	NTU	dependent on background levels	0.10	0.83	0.74	1.15	1.23	0.15	0.16	0.30	0.27	0.53	0.52
Nutrients													
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	<0.0050	<0.0050	0.0076	0.0072	0.0070	0.0066	0.0082	0.0096	0.0091	0.0083
Nitrate (as N)	mg/L	2.935[b]	0.0050	0.153	0.153	<0.0050	<0.0050	0.471	0.471	0.0176	0.0176	0.0401	0.0453
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.218	0.236	0.367	0.433	0.087	0.105	0.168	0.172	0.223	0.221
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.0054	0.0044	0.0139	0.0135	<0.0020	0.0021	0.0035	0.0037	0.0046	0.0044
Anions													
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	0.343	0.350	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 120; long-term: 640	0.50	0.75	0.75	0.69	0.69	40.9	41.1	0.54	0.54	0.83	0.83
Fluoride (F)	mg/L	0.12[b]	0.02	0.026	0.026	0.026	0.025	<0.020	<0.020	0.023	0.023	0.020	0.020
Sulfate (SO_4)	mg/L		0.5	15.2	15.1	4.17	4.17	7.12	7.16	6.03	6.02	3.62	3.62
Cyanides													
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon													
Total Organic Carbon	mg/L		0.50	4.25	4.10	4.11	4.38	1.80	1.90	3.02	3.11	3.27	3.10
Total Metals													
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0405	0.0399	0.0361	0.0348	0.0190	0.0218	0.0122	0.0136	0.0125	0.0136
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000579	0.000543	0.00139	0.00141	0.000204	0.000207	0.000218	0.000205	0.000237	0.000260
Barium (Ba)	mg/L		0.000050	0.00798	0.00823	0.00435	0.00444	0.0343	0.0343	0.00343	0.00356	0.00437	0.00461
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	0.0073	0.0057	0.0055	<0.0050	0.0067	0.0076	<0.0050	0.0053	0.0053	<0.0050
Cadmium (Cd)	mg/L	equation[b,d]	0.000010	0.000016	0.000016	<0.000010	<0.000010	0.000087	0.000091	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	6.79	6.69	2.09	2.15	17.4	17.1	1.73	1.76	1.89	1.99
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00029	0.00034	0.00028	0.00040	0.00011	0.00015	0.00011	<0.00010	0.00013	0.00014
Cobalt (Co)	mg/L		0.00010	0.00022	0.00020	0.00062	0.00062	0.00170	0.00178	0.00012	0.00012	<0.00010	0.00010
Copper (Cu)	mg/L	≥0.002[e]	0.0005 - 0.0015	0.00396	0.00394	0.00201	0.00199	0.00180	0.00154	0.00196	0.00200	0.00153	0.00135
Iron (Fe)	mg/L	0.3	0.010	0.207	0.201	0.500	0.492	<0.010	0.017	0.060	0.061	0.218	0.228
Lead (Pb)	mg/L	≥0.001[f]	0.000050	<0.000050	<0.000050	<0.000050	0.000058	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	3.14	3.16	1.65	1.69	5.48	5.65	1.25	1.29	1.13	1.19
Manganese (Mn)	mg/L		0.000050	0.00244	0.00249	0.0114	0.0114	0.0121	0.0126	0.00223	0.00240	0.00210	0.00225
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	≥0.025[g]	0.00010	0.00985	0.00979	0.00313	0.00319	0.0189	0.0193	0.00428	0.00438	0.00177	0.00194
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.462	0.449	0.374	0.380	0.809	0.831	0.326	0.332	0.301	0.315
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	2.02	1.97	0.242	0.239	1.41	1.47	0.255	0.249	0.265	0.266
Silver (Ag)	mg/L	0.0001	0.000010	0.000012	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	1.11	1.09	0.724	0.739	1.45	1.58	0.579	0.603	0.576	0.598

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River, 2012

Area				Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location				Pond 19 OF	Pond 19 OF	Chair OF	Chair OF	Llama OF	Llama OF	Giraffe OF	Giraffe OF	Wolf OF	Wolf OF
Replicate				1	2	1	2	1	2	1	2	1	2
Date Sampled				13-Aug-12	13-Aug-12	12-Aug-12	12-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	7-Aug-12	7-Aug-12
ALS Sample ID #	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection (RDL)	L1193081-1	L1193081-2	L1193094-3	L1193094-4	L1191588-1	L1191588-2	L1191588-3	L1191588-4	L1190634-1	L1190634-2
Strontium (Sr)	mg/L		0.00020	0.0215	0.0215	0.00897	0.00903	0.0973	0.101	0.00761	0.00777	0.00838	0.00875
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	0.000023	0.000022	0.000016	0.000016	<0.000010	<0.000010	0.000012	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	0.000197	0.000203	0.000376	0.000368	0.000156	0.000226	0.000175	0.000173	0.000208	0.000215
Zinc (Zn)	mg/L	0.03	0.0030	0.0030	<0.0030	<0.0030	<0.0030	0.0099	0.0118	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals													
Aluminum (Al)	mg/L		0.0030	0.0282	0.0250	0.0107	0.0102	0.0123	0.0121	0.0068	0.0060	0.0052	0.0059
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000476	0.000434	0.00113	0.00117	0.000152	0.000161	0.000180	0.000173	0.000197	0.000195
Barium (Ba)	mg/L		0.000050	0.00815	0.00820	0.00441	0.00465	0.0339	0.0338	0.00337	0.00348	0.00443	0.00438
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0052	<0.0050	<0.0050	<0.0050	<0.0050
Cadmium (Cd)	mg/L		0.000010	0.000016	0.000012	<0.000010	<0.000010	0.000090	0.000091	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	6.82	6.53	2.19	2.17	17.7	17.1	1.68	1.65	1.92	1.92
Chromium (Cr)	mg/L		0.00010	0.00019	0.00023	0.00014	0.00014	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt (Co)	mg/L		0.00010	0.00019	0.00017	0.00021	0.00017	0.00174	0.00170	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L		0.00050	0.00304	0.00305	0.00149	0.00145	0.00114	0.00115	0.00199	0.00161	0.00100	0.00103
Iron (Fe)	mg/L		0.010	0.099	0.095	0.143	0.137	<0.010	<0.010	0.014	0.014	0.094	0.088
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	3.26	3.13	1.73	1.74	5.57	5.64	1.26	1.25	1.14	1.14
Manganese (Mn)	mg/L		0.000050	0.00180	0.00185	0.00572	0.00478	0.0123	0.0120	0.00180	0.00174	0.000781	0.000967
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.00985	0.00967	0.00305	0.00306	0.0189	0.0188	0.00416	0.00420	0.00175	0.00174
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.469	0.453	0.387	0.403	0.822	0.823	0.323	0.322	0.308	0.305
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	2.00	1.96	0.223	0.217	1.47	1.44	0.234	0.234	0.255	0.254
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	1.12	1.10	0.753	0.768	1.53	1.43	0.582	0.592	0.576	0.574
Strontium (Sr)	mg/L		0.00020	0.0207	0.0210	0.00923	0.00906	0.0986	0.0953	0.00720	0.00699	0.00830	0.00825
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	0.000018	0.000018	0.000011	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	0.000062	0.000070	0.000099	0.000092	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Zinc (Zn)	mg/L		0.0030	0.0042	<0.0030	<0.0030	<0.0030	0.0096	0.0098	<0.0030	<0.0030	<0.0030	<0.0030

Note Echo OF was dry during August sampling.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, (accessed 2012).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realised detection limit

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River, 2012

Area				Goose	Goose	Goose	Goose	Goose	Goose	George	George	George	George
Location				Goose OF	Goose OF	Propellor OF	Propellor OF	Reference B OF	Reference B OF	George OF	George OF	Sleigh OF	Sleigh OF
Replicate				1	2	1	2	1	2	1	2	1	2
Date Sampled				7-Aug-12	7-Aug-12	9-Aug-12	9-Aug-12	10-Aug-12	10-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12
ALS Sample ID #	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection (RDL)	L1190634-3	L1190634-4	L1192523-1	L1192523-2	L1192523-3	L1192523-4	L1190226-5	L1190219-1	L1190226-3	L1190226-4
Physical Tests	µS/cm												
Conductivity			2.0	30.9	31.2	21.3	21.3	20.5	20.4	53.5	54.3	75.8	75.0
Hardness (as $CaCO_3$)	mg/L		0.50	11.6	11.2	8.04	7.59	8.32	8.64	20.9	21.1	30.2	29.5
pH	pH	6.5-9.0	0.10	6.81	6.79	6.81	6.81	7.14	7.16	7.13	7.21	7.20	7.18
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	3.3	3.2	3.9	3.6	7.1	6.6	6.2	6.6	6.8	7.0
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	3.3	3.2	3.9	3.6	7.1	6.6	6.2	6.6	6.8	7.0
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	3.3	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	26	24	17	16	16	24	35	37	56	49
Turbidity	NTU	dependent on background levels	0.10	0.34	0.39	0.28	0.25	0.77	0.62	0.46	0.52	0.50	0.44
Nutrients													
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	0.0055	0.0068	0.0054	0.0054	0.0115	0.0118	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate (as N)	mg/L	2.935[b]	0.0050	<0.0050	<0.0050	0.112	0.114	0.0119	<0.0050	<0.0050	<0.0050	0.0111	0.0106
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.206	0.181	0.144	0.151	0.274	0.267	0.149	0.142	0.186	0.195
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.0033	0.0033	0.0031	0.0035	0.0066	0.0047	0.0040	0.0038	0.0046	0.0037
Anions													
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 120; long-term: 640	0.50	4.30	4.31	1.58	1.57	<0.50	<0.50	3.27	3.27	6.13	6.01
Fluoride (F)	mg/L	0.12[b]	0.02	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.028	0.028	0.038	0.037
Sulfate (SO_4)	mg/L		0.5	4.32	4.32	2.89	2.89	2.16	2.17	13.4	13.5	18.2	18.2
Cyanides													
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon													
Total Organic Carbon	mg/L		0.50	3.39	3.20	2.43	2.25	2.88	2.79	1.98	2.01	2.65	2.70
Total Metals													
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0175	0.0115	0.0074	0.0077	0.0062	0.0060	0.0087	0.0095	0.0140	0.0131
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000227	0.000205	0.000146	0.000158	0.000261	0.000256	0.000568	0.000584	0.000773	0.000761
Barium (Ba)	mg/L		0.000050	0.00548	0.00504	0.00423	0.00429	0.00406	0.00401	0.00223	0.00238	0.00330	0.00326
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	<0.0050	<0.0050	0.0068	0.0066	<0.0050	0.0054	<0.0050	<0.0050	0.0057	<0.0050
Cadmium (Cd)	mg/L	equation[b,d]	0.000010	0.000014	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	2.64	2.65	1.71	1.76	1.58	1.58	5.16	5.49	7.71	7.52
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00012	0.00011	0.00020	0.00014	0.00015	0.00012	<0.00010	0.00027	<0.00010	0.00011
Cobalt (Co)	mg/L		0.00010	0.00027	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	0.00050	0.00054	0.00039	0.00036
Copper (Cu)	mg/L	≥0.002[e]	0.0005 - 0.0015	0.00147	0.00162	0.00122	0.00106	0.00076	0.00074	0.00151	0.00170	0.00249	0.00242
Iron (Fe)	mg/L	0.3	0.010	0.167	0.068	0.016	0.019	0.218	0.216	0.079	0.082	0.089	0.085
Lead (Pb)	mg/L	≥0.001[f]	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	1.19	1.23	0.893	0.897	1.14	1.13	1.94	1.97	2.71	2.64
Manganese (Mn)	mg/L		0.000050	0.00624	0.00342	0.00206	0.00193	0.00402	0.00389	0.00787	0.00870	0.00572	0.00559
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	≥0.025[g]	0.00010	0.00263	0.00228	0.00159	0.00168	0.00085	0.00082	0.00312	0.00331	0.00346	0.00342
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.342	0.332	0.296	0.298	0.316	0.320	0.357	0.372	0.501	0.497
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.214	0.202	0.178	0.184	0.199	0.201	0.165	0.176	0.226	0.223
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.614	0.588	0.458	0.467	0.492	0.491	0.817	0.769	1.11	1.09

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River, 2012

Area				Goose	Goose	Goose	Goose	Goose	Goose	George	George	George	George
Location				Goose OF	Goose OF	Goose	Goose	Goose	Goose	George OF	George OF	Sleigh OF	Sleigh OF
Replicate				1	2	Propellor OF 1	Propellor OF 2	Reference B OF 1	Reference B OF 2	1	2	1	2
Date Sampled				7-Aug-12	7-Aug-12	9-Aug-12	9-Aug-12	10-Aug-12	10-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12
ALS Sample ID #	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection (RDL)	L1190634-3	L1190634-4	L1192523-1	L1192523-2	L1192523-3	L1192523-4	L1190226-5	L1190219-1	L1190226-3	L1190226-4
Strontium (Sr)	mg/L		0.00020	0.0148	0.0148	0.00850	0.00855	0.00602	0.00599	0.0199	0.0203	0.0355	0.0343
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	0.000235	0.000217	0.000090	0.000105	0.000112	0.000127	0.000120	0.000114	0.000151	0.000151
Zinc (Zn)	mg/L	0.03	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals													
Aluminum (Al)	mg/L		0.0030	0.0047	0.0058	0.0045	0.0043	<0.0030	<0.0030	<0.0030	<0.0030	0.0053	0.0047
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000177	0.000151	0.000131	0.000108	0.000215	0.000217	0.000411	0.000420	0.000553	0.000541
Barium (Ba)	mg/L		0.000050	0.00489	0.00452	0.00420	0.00416	0.00369	0.00419	0.00210	0.00225	0.00333	0.00334
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0052	<0.0050	<0.0050	<0.0050
Cadmium (Cd)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	2.61	2.64	1.74	1.58	1.49	1.55	5.17	5.29	7.66	7.59
Chromium (Cr)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	0.00011	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt (Co)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00024	0.00022	0.00019	0.00020
Copper (Cu)	mg/L		0.00050	0.00109	0.00094	0.00087	0.00089	0.00055	0.00052	0.00109	0.00119	0.00198	0.00192
Iron (Fe)	mg/L		0.010	0.013	0.015	<0.010	<0.010	0.063	0.062	<0.010	<0.010	0.013	0.014
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	1.24	1.12	0.896	0.887	1.12	1.16	1.95	1.92	2.69	2.57
Manganese (Mn)	mg/L		0.000050	0.00157	0.00194	0.000888	0.000784	0.00102	0.00121	0.00514	0.00516	0.00352	0.00381
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.00225	0.00199	0.00161	0.00160	0.00080	0.00073	0.00291	0.00299	0.00343	0.00340
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.325	0.293	0.298	0.300	0.315	0.312	0.352	0.353	0.506	0.491
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.187	0.185	0.173	0.172	0.184	0.182	0.152	0.148	0.207	0.212
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.585	0.525	0.461	0.462	0.481	0.492	0.786	0.750	1.12	1.06
Strontium (Sr)	mg/L		0.00020	0.0139	0.0146	0.00841	0.00766	0.00566	0.00573	0.0188	0.0193	0.0353	0.0337
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Zinc (Zn)	mg/L		0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Note Echo OF was dry during August sampling.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, (accessed 2012).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realised detection limit

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River, 2012

Area				George	George	George	George	George	George	Goose	Goose	Goose	Goose
Location				Dragon OF	Dragon OF	Komatic IF	Komatic IF	Reference C OF	Reference C OF	Moby OF	Moby OF	Gander IF	Gander IF
Replicate				1	2	1	2	1	2	1	2	1	2
Date Sampled				5-Aug-12	5-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	18-Sep-12	18-Sep-12	18-Sep-12	18-Sep-12
ALS Sample ID #	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection (RDL)	L1190226-1	L1190226-2	L1190219-2	L1190219-3	L1190219-4	L1190219-5	L1212310-5	L1212310-6	L1212310-7	L1212310-8
Physical Tests	µS/cm												
Conductivity			2.0	46.5	45.9	76.5	69.7	114	115	72.5	72.6	41.8	41.3
Hardness (as $CaCO_3$)	mg/L		0.50	20.1	20.7	28.7	28.3	63.1	62.8	28.1	27.3	16.3	16.1
pH	pH	6.5-9.0	0.10	7.48	7.47	7.47	7.31	8.16	8.16	6.58	6.55	6.86	6.87
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	11.6	11.7	9.3	9.0	68.6	68.0	3.4	3.3	4.8	4.7
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	11.6	11.7	9.3	9.0	68.6	68.0	3.4	3.3	4.8	4.7
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	5.7	10.3	<3.0	<3.0	<3.0	<3.0	<3.0	4.3
Total Dissolved Solids	mg/L		10	37	34	53	51	72	67	56	56	29	33
Turbidity	NTU	dependent on background levels	0.10	0.40	0.73	2.52	2.75	0.28	0.26	0.67	0.93	1.10	1.31
Nutrients													
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0063	<0.0050	<0.0050
Nitrate (as N)	mg/L	2.935[b]	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.113	0.113	0.0364	0.0369
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.234	0.242	0.260	0.249	0.171	0.180	0.154	0.159	0.170	0.179
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.0042	0.0044	0.0100	0.0108	0.0023	0.0023	0.0032	0.0035	0.0061	0.0074
Anions													
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 120; long-term: 640	0.50	1.11	1.12	4.31	4.31	0.66	0.67	0.63	0.63	0.64	0.64
Fluoride (F)	mg/L	0.12[b]	0.02	0.021	0.022	0.035	0.035	<0.020	<0.020	0.037	0.037	0.024	0.025
Sulfate (SO_4)	mg/L		0.5	9.20	9.19	17.3	17.4	0.68	0.68	28.2	28.4	13.4	13.5
Cyanides													
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon													
Total Organic Carbon	mg/L		0.50	3.68	3.68	3.62	3.71	3.86	3.54	3.46	3.47	3.53	3.62
Total Metals													
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0081	0.0088	0.0936	0.0806	<0.0030	<0.0030	0.0668	0.0657	0.0476	0.0658
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.00128	0.00138	0.00146	0.00146	0.000243	0.000227	0.000263	0.000233	0.000418	0.000386
Barium (Ba)	mg/L		0.000050	0.000645	0.000704	0.00294	0.00287	0.0225	0.0224	0.0112	0.0109	0.00703	0.00647
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0077	0.0072	0.0070	0.0065
Cadmium (Cd)	mg/L	equation[b,d]	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000064	0.000061	0.000021	0.000017
Calcium (Ca)	mg/L		0.020	4.07	4.28	7.14	7.21	16.2	16.1	6.50	6.28	3.46	3.54
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	<0.00010	<0.00010	0.00034	0.00032	<0.00010	<0.00010	0.00033	0.00035	0.00041	0.00038
Cobalt (Co)	mg/L		0.00010	0.00018	0.00019	0.00046	0.00047	<0.00010	<0.00010	0.0108	0.0102	0.00275	0.00252
Copper (Cu)	mg/L	≥0.002[e]	0.0005 - 0.0015	0.00175	0.00178	0.00309	0.00321	0.00098	0.00101	0.00395	0.00339	0.00340	0.00197
Iron (Fe)	mg/L	0.3	0.010	0.079	0.078	0.283	0.263	<0.010	0.011	0.184	0.175	0.171	0.226
Lead (Pb)	mg/L	≥0.001[f]	0.000050	<0.000050	<0.000050	0.000072	0.000080	<0.000050	<0.000050	0.000065	<0.000050	0.000262	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	2.51	2.64	2.85	2.88	6.21	6.24	3.11	2.99	2.07	1.87
Manganese (Mn)	mg/L		0.000050	0.00281	0.00289	0.00547	0.00523	0.00266	0.00273	0.0428	0.0412	0.0114	0.0104
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	0.000056	0.000072	0.000069	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	≥0.025[g]	0.00010	0.00140	0.00148	0.00435	0.00433	<0.00010	<0.00010	0.0568	0.0539	0.0184	0.0165
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.342	0.364	0.481	0.481	0.245	0.248	0.373	0.360	0.376	0.355
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.342	0.355	0.224	0.222	1.02	1.00	2.80	2.71	0.950	1.05
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.550	0.587	1.07	1.10	0.468	0.463	1.31	1.26	0.993	0.911

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River, 2012

Area				George	George	George	George	George	George	Goose	Goose	Goose	Goose
Location				Dragon OF	Dragon OF	Komatic IF	Komatic IF	Reference C OF	Reference C OF	Moby OF	Moby OF	Gander IF	Gander IF
Replicate				1	2	1	2	1	2	1	2	1	2
Date Sampled				5-Aug-12	5-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	18-Sep-12	18-Sep-12	18-Sep-12	18-Sep-12
ALS Sample ID #	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection (RDL)	L1190226-1	L1190226-2	L1190219-2	L1190219-3	L1190219-4	L1190219-5	L1212310-5	L1212310-6	L1212310-7	L1212310-8
Strontium (Sr)	mg/L		0.00020	0.00859	0.00902	0.0273	0.0293	0.00749	0.00744	0.0279	0.0272	0.0148	0.0153
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	<0.000010	0.000015	0.000016	0.000311	0.000303	0.000027	0.000025	0.000015	0.000015
Vanadium (V)	mg/L		0.000050	0.000142	0.000140	0.000359	0.000346	0.000138	0.000133	0.000217	0.000197	0.000333	0.000339
Zinc (Zn)	mg/L	0.03	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0180	0.0161	0.0083	0.0064
Dissolved Metals													
Aluminum (Al)	mg/L		0.0030	0.0033	0.0033	0.0066	0.0071	<0.0030	<0.0030	0.0403	0.0397	0.0097	0.0107
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000983	0.00100	0.000887	0.000930	0.000217	0.000212	0.000197	0.000193	0.000281	0.000310
Barium (Ba)	mg/L		0.000050	0.000573	0.000714	0.00272	0.00255	0.0210	0.0209	0.0109	0.0106	0.00600	0.00606
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0066	0.0063	0.0061	0.0057
Cadmium (Cd)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000064	0.000061	0.000015	0.000015
Calcium (Ca)	mg/L		0.020	4.11	4.23	7.06	6.87	15.3	15.3	6.34	6.15	3.51	3.46
Chromium (Cr)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	0.00012	<0.00010	<0.00010	0.00030	0.00022	0.00021	0.00018
Cobalt (Co)	mg/L		0.00010	<0.00010	<0.00010	0.00028	0.00029	<0.00010	<0.00010	0.0102	0.00992	0.00234	0.00228
Copper (Cu)	mg/L		0.00050	0.00137	0.00139	0.00203	0.00207	0.00083	0.00083	0.00290	0.00280	0.00136	0.00133
Iron (Fe)	mg/L		0.010	0.015	0.013	0.043	0.039	<0.010	<0.010	0.089	0.093	0.043	0.050
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	2.40	2.46	2.68	2.72	6.02	6.00	2.99	2.90	1.83	1.81
Manganese (Mn)	mg/L		0.000050	0.000172	0.000214	0.00314	0.00329	0.000057	0.000074	0.0411	0.0404	0.00941	0.00932
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000065	0.000059	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.00132	0.00131	0.00373	0.00384	<0.00010	<0.00010	0.0536	0.0522	0.0155	0.0153
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.341	0.346	0.448	0.459	0.241	0.233	0.358	0.349	0.326	0.321
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.326	0.329	0.087	0.080	0.972	0.977	2.66	2.70	0.911	0.936
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.554	0.552	1.01	1.05	0.452	0.451	1.26	1.22	0.881	0.883
Strontium (Sr)	mg/L		0.00020	0.00851	0.00879	0.0269	0.0271	0.00694	0.00696	0.0270	0.0263	0.0147	0.0147
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	<0.000010	0.000012	<0.000010	0.000297	0.000294	0.000025	0.000022	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	<0.000050	<0.000050	0.000052	0.000069	0.000050	0.000051	<0.000050	0.000058	0.000063	0.000062
Zinc (Zn)	mg/L		0.0030	<0.0030	0.0032	<0.0030	<0.0030	<0.0030	<0.0030	0.0161	0.0148	0.0048	0.0045

Note Echo OF was dry during August sampling.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, (accessed 2012).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ /1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ /1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ /1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realised detection limit

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River, 2012

Area				Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location				Gander US	Gander US	Pond 19 OF	Pond 19 OF	Chair OF	Chair OF	Llama OF	Llama OF	Echo OF	Echo OF
Replicate				1	2	1	2	1	2	1	2	1	2
Date Sampled				18-Sep-12	18-Sep-12	18-Sep-12	18-Sep-12	18-Sep-12	18-Sep-12	18-Sep-12	18-Sep-12	18-Sep-12	18-Sep-12
ALS Sample ID #	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection (RDL)	L1212310-9	L1212310-10	L1212310-3	L1212310-4	L1212310-11	L1212310-12	L1212310-13	L1212310-14	L1212310-15	L1212310-16
Physical Tests	µS/cm												
Conductivity			2.0	29.3	29.5	108	109	59.8	60.0	335	336	116	116
Hardness (as $CaCO_3$)	mg/L		0.50	11.5	11.4	47.2	47.1	24.0	23.7	132	132	42.6	44.0
pH	pH	6.5-9.0	0.10	6.90	6.90	7.17	7.18	6.95	6.96	6.60	6.66	5.85	6.10
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	5.0	4.9	15.4	14.9	6.8	6.7	5.7	5.8	2.3	2.1
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	5.0	4.9	15.4	14.9	6.8	6.7	5.7	5.8	2.3	2.1
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	22	23	84	86	46	46	314	284	87	90
Turbidity	NTU	dependent on background levels	0.10	0.90	0.84	0.45	0.37	0.84	1.07	0.25	0.24	0.26	0.20
Nutrients													
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate (as N)	mg/L	2.935[b]	0.0050	0.0098	0.0067	0.122	0.121	0.0522	0.0501	0.608	0.609	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.174	0.179	0.194	0.190	0.208	0.216	0.138	0.135	0.264	0.274
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.0066	0.0058	0.0030	0.0023	0.0073	0.0060	<0.0020	<0.0020	0.0033	0.0032
Anions													
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.621	0.634	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 120; long-term: 640	0.50	0.64	0.63	1.47	1.47	1.08	1.07	87.7	87.9	18.3	18.1
Fluoride (F)	mg/L	0.12[b]	0.02	0.021	0.021	0.022	0.024	<0.020	<0.020	<0.020	<0.020	0.020	0.020
Sulfate (SO_4)	mg/L		0.5	8.08	8.03	35.3	35.4	19.7	19.6	17.5	17.4	23.2	23.0
Cyanides													
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon													
Total Organic Carbon	mg/L		0.50	3.29	3.31	4.95	4.99	4.36	4.50	2.49	2.27	6.44	6.81
Total Metals													
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0212	0.0215	0.0223	0.0231	0.0426	0.0363	0.0243	0.0229	0.0881	0.0867
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000410	0.000384	0.000362	0.000376	0.000588	0.000605	0.000174	0.000178	0.000239	0.000217
Barium (Ba)	mg/L		0.000050	0.00441	0.00460	0.00959	0.00951	0.00798	0.00826	0.0551	0.0558	0.0415	0.0410
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	0.0064	0.0062	0.0068	0.0068	0.0060	0.0061	0.0088	0.0092	0.0062	0.0066
Cadmium (Cd)	mg/L	equation[b,d]	0.000010	<0.000010	<0.000010	0.000016	0.000013	<0.000010	<0.000010	0.000209	0.000216	0.000054	0.000052
Calcium (Ca)	mg/L		0.020	2.38	2.41	9.45	9.62	3.93	4.09	32.4	32.7	10.5	10.3
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00027	0.00029	0.00033	0.00031	0.00036	0.00037	0.00019	0.00020	0.00049	0.00050
Cobalt (Co)	mg/L		0.00010	0.00018	0.00020	0.00028	0.00028	0.00062	0.00062	0.00598	0.00616	0.00464	0.00461
Copper (Cu)	mg/L	≥0.002[e]	0.0005 - 0.0015	0.00176	0.00146	0.00251	0.00273	0.00152	0.00166	0.00176	0.00177	0.00180	0.00159
Iron (Fe)	mg/L	0.3	0.010	0.126	0.125	0.071	0.072	0.315	0.298	0.012	<0.010	0.070	0.075
Lead (Pb)	mg/L	≥0.001[f]	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000054	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	1.45	1.43	5.74	5.55	3.35	3.40	12.2	12.6	4.47	4.40
Manganese (Mn)	mg/L		0.000050	0.00247	0.00257	0.00282	0.00286	0.00683	0.00663	0.0467	0.0475	0.0380	0.0374
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	≥0.025[g]	0.00010	0.00362	0.00361	0.00975	0.00949	0.00418	0.00474	0.0461	0.0470	0.00806	0.00800
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.330	0.347	0.680	0.667	0.441	0.439	1.03	1.04	0.244	0.240
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.310	0.305	2.61	2.50	1.45	1.44	2.12	2.10	3.90	3.86
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.759	0.765	1.50	1.47	1.13	1.15	2.21	2.24	1.73	1.68

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River, 2012

Area				Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location				Gander US	Gander US	Pond 19 OF	Pond 19 OF	Chair OF	Chair OF	Llama OF	Llama OF	Echo OF	Echo OF
Replicate				1	2	1	2	1	2	1	2	1	2
Date Sampled				18-Sep-12	18-Sep-12	18-Sep-12	18-Sep-12	18-Sep-12	18-Sep-12	18-Sep-12	18-Sep-12	18-Sep-12	18-Sep-12
ALS Sample ID #	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection (RDL)	L1212310-9	L1212310-10	L1212310-3	L1212310-4	L1212310-11	L1212310-12	L1212310-13	L1212310-14	L1212310-15	L1212310-16
Strontium (Sr)	mg/L		0.00020	0.0106	0.0105	0.0289	0.0298	0.0161	0.0169	0.159	0.161	0.0439	0.0438
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	<0.000010	0.000013	0.000013	0.000011	0.000012	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	0.000289	0.000258	0.000146	0.000150	0.000309	0.000278	0.000114	0.000127	0.000220	0.000229
Zinc (Zn)	mg/L	0.03	0.0030	<0.0030	0.0040	0.0035	0.0039	0.0032	0.0034	0.0233	0.0239	0.0082	0.0083
Dissolved Metals													
Aluminum (Al)	mg/L		0.0030	0.0038	0.0038	0.0158	0.0158	0.0139	0.0131	0.0204	0.0191	0.0849	0.0835
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000299	0.000259	0.000306	0.000307	0.000461	0.000394	0.000123	0.000152	0.000184	0.000199
Barium (Ba)	mg/L		0.000050	0.00412	0.00410	0.00962	0.00945	0.00785	0.00785	0.0561	0.0563	0.0415	0.0421
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	0.0062	0.0051	0.0061	0.0072	0.0060	0.0062	0.0081	0.0089	<0.0050	0.0054
Cadmium (Cd)	mg/L		0.000010	<0.000010	<0.000010	0.000011	0.000012	<0.000010	<0.000010	0.000210	0.000221	0.000051	0.000050
Calcium (Ca)	mg/L		0.020	2.28	2.28	9.64	9.71	4.01	3.94	33.0	32.6	9.77	10.3
Chromium (Cr)	mg/L		0.00010	0.00020	0.00014	0.00021	0.00026	0.00028	0.00034	0.00016	0.00018	0.00035	0.00034
Cobalt (Co)	mg/L		0.00010	0.00012	0.00011	0.00026	0.00027	0.00050	0.00052	0.00603	0.00602	0.00459	0.00458
Copper (Cu)	mg/L		0.00050	0.00102	0.00100	0.00218	0.00217	0.00124	0.00121	0.00150	0.00151	0.00143	0.00144
Iron (Fe)	mg/L		0.010	0.021	0.020	0.036	0.043	0.092	0.093	<0.010	<0.010	0.055	0.056
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	1.40	1.38	5.63	5.55	3.39	3.36	12.1	12.3	4.42	4.43
Manganese (Mn)	mg/L		0.000050	0.00132	0.00147	0.00269	0.00266	0.00555	0.00552	0.0471	0.0463	0.0377	0.0376
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.00335	0.00337	0.00942	0.00946	0.00390	0.00393	0.0460	0.0455	0.00791	0.00797
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.314	0.315	0.665	0.666	0.443	0.437	1.04	1.04	0.241	0.245
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.255	0.255	2.50	2.58	1.33	1.35	2.10	2.09	3.89	3.82
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.730	0.722	1.46	1.47	1.14	1.13	2.23	2.22	1.70	1.70
Strontium (Sr)	mg/L		0.00020	0.0100	0.0101	0.0294	0.0294	0.0161	0.0160	0.162	0.157	0.0407	0.0431
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	<0.000010	0.000012	0.000011	<0.000010	<0.000010	<0.000010	0.000011	<0.000010	<0.000010
Vanadium (V)	mg/L		0.000050	0.000053	<0.000050	0.000057	<0.000050	0.000093	0.000074	<0.000050	<0.000050	0.000144	0.000121
Zinc (Zn)	mg/L		0.0030	<0.0030	<0.0030	<0.0030	0.0035	0.0034	<0.0030	0.0238	0.0227	0.0073	0.0076

Note Echo OF was dry during August sampling.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, (accessed 2012).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realised detection limit

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River, 2012

Area				Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location				Giraffe OF	Giraffe OF	Wolf OF	Wolf OF	Goose OF	Goose OF	Propellor OF	Propellor OF	Reference B OF	Reference B OF
Replicate				1	2	1	2	1	2	1	2	1	2
Date Sampled				19-Sep-12	19-Sep-12	18-Sep-12	18-Sep-12	19-Sep-12	19-Sep-12	17-Sep-12	17-Sep-12	17-Sep-12	17-Sep-12
ALS Sample ID #	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection (RDL)	L1212370-1	L1212370-2	L1212310-1	L1212310-2	L1212370-3	L1212370-4	L1211487-3	L1211487-4	L1211487-5	L1211487-6
Physical Tests	µS/cm												
Conductivity			2.0	27.8	27.5	29.1	28.6	32.0	32.2	19.3	19.4	28.9	29.1
Hardness (as $CaCO_3$)	mg/L		0.50	10.8	10.7	12.0	11.9	12.4	12.3	7.96	8.01	13.0	12.9
pH	pH	6.5-9.0	0.10	6.91	6.86	7.02	6.98	6.85	6.79	6.69	6.76	7.06	7.02
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	4.5	4.8	6.3	5.5	3.5	3.5	3.8	3.9	10.7	10.9
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	4.5	4.8	6.3	5.5	3.5	3.5	3.8	3.9	10.7	10.9
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	20	20	23	21	19	<10	16	17	37	30
Turbidity	NTU	dependent on background levels	0.10	0.62	0.35	0.64	0.78	0.56	0.37	0.52	0.38	2.15	2.10
Nutrients													
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0488	0.0489
Nitrate (as N)	mg/L	2.935[b]	0.0050	0.0062	0.0068	0.0432	0.0420	<0.0050	<0.0050	0.0671	0.0675	0.0162	0.0192
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.156	0.152	0.176	0.183	0.155	0.160	0.120	0.122	0.558	0.683
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.0032	0.0029	0.0035	0.0031	0.0035	0.0033	0.0035	0.0028	0.0139	0.0128
Anions													
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 120; long-term: 640	0.50	0.59	0.59	1.27	1.26	4.56	4.53	1.67	1.67	0.72	0.72
Fluoride (F)	mg/L	0.12[b]	0.02	0.024	0.023	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.021	0.022
Sulfate (SO_4)	mg/L		0.5	7.28	7.19	5.98	6.04	4.47	4.42	3.46	3.49	3.06	3.06
Cyanides													
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon													
Total Organic Carbon	mg/L		0.50	3.37	3.40	3.86	3.82	3.45	3.37	2.42	2.65	7.89	7.90
Total Metals													
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0109	0.0101	0.0157	0.0161	0.0063	0.0060	0.0088	0.0085	0.0534	0.0544
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000193	0.000202	0.000202	0.000179	0.000160	0.000188	0.000133	0.000142	0.000402	0.000398
Barium (Ba)	mg/L		0.000050	0.00330	0.00334	0.00519	0.00528	0.00480	0.00485	0.00365	0.00361	0.00850	0.00851
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	0.0069	0.0070	0.0061	0.0062	0.0063	0.0060	0.0065	0.0066	0.0065	0.0068
Cadmium (Cd)	mg/L	equation[b,d]	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	1.92	1.95	2.36	2.42	2.82	2.85	1.69	1.66	2.47	2.44
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00017	0.00021	0.00029	0.00027	0.00018	0.00018	0.00019	0.00019	0.00070	0.00071
Cobalt (Co)	mg/L		0.00010	0.00011	0.00011	0.00013	0.00014	<0.00010	<0.00010	<0.00010	<0.00010	0.00030	0.00029
Copper (Cu)	mg/L	≥0.002[e]	0.0005 - 0.0015	0.00209	0.00173	0.00105	0.00115	0.00119	0.00129	<0.0015	<0.0015	<0.0015	<0.0015
Iron (Fe)	mg/L	0.3	0.010	0.060	0.060	0.128	0.128	0.036	0.036	0.018	0.024	1.19	1.18
Lead (Pb)	mg/L	≥0.001[f]	0.000050	0.000056	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	1.51	1.50	1.47	1.47	1.35	1.37	0.966	0.955	1.70	1.70
Manganese (Mn)	mg/L		0.000050	0.00210	0.00203	0.00248	0.00260	0.00190	0.00197	0.00139	0.00144	0.00364	0.00354
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	0.000072	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	≥0.025[g]	0.00010	0.00399	0.00406	0.00227	0.00223	0.00224	0.00228	0.00162	0.00167	0.00270	0.00268
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.333	0.330	0.281	0.281	0.324	0.332	0.263	0.263	0.307	0.298
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.307	0.312	0.788	0.795	0.173	0.177	0.195	0.194	0.637	0.635
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000017	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.663	0.656	0.704	0.697	0.626	0.642	0.491	0.486	0.934	0.941

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River, 2012

Area				Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location				Giraffe OF	Giraffe OF	Wolf OF	Wolf OF	Goose OF	Goose OF	Propellor OF	Propellor OF	Reference B OF	Reference B OF
Replicate				1	2	1	2	1	2	1	2	1	2
Date Sampled				19-Sep-12	19-Sep-12	18-Sep-12	18-Sep-12	19-Sep-12	19-Sep-12	17-Sep-12	17-Sep-12	17-Sep-12	17-Sep-12
ALS Sample ID #	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection (RDL)	L1212370-1	L1212370-2	L1212310-1	L1212310-2	L1212370-3	L1212370-4	L1211487-3	L1211487-4	L1211487-5	L1211487-6
Strontium (Sr)	mg/L		0.00020	0.00808	0.00821	0.00991	0.0101	0.0150	0.0151	0.00773	0.00759	0.00904	0.00906
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000015	0.000016
Vanadium (V)	mg/L		0.000050	0.000129	0.000154	0.000169	0.000160	0.000118	0.000109	0.000092	0.000097	0.000647	0.000652
Zinc (Zn)	mg/L	0.03	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0040
Dissolved Metals													
Aluminum (Al)	mg/L		0.0030	0.0049	0.0044	0.0091	0.0092	<0.0030	0.0045	0.0044	0.0048	0.0332	0.0330
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000147	0.000165	0.000150	0.000169	0.000170	0.000136	0.000103	0.000086	0.000329	0.000322
Barium (Ba)	mg/L		0.000050	0.00323	0.00322	0.00509	0.00521	0.00466	0.00473	0.00348	0.00347	0.00803	0.00795
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	0.0063	0.0064	0.0056	0.0059	0.0070	0.0055	<0.0050	0.0068	0.0063	0.0063
Cadmium (Cd)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	1.86	1.90	2.35	2.38	2.75	2.71	1.64	1.65	2.42	2.43
Chromium (Cr)	mg/L		0.00010	0.00011	0.00019	0.00021	0.00021	0.00022	0.00014	<0.00010	0.00017	0.00060	0.00052
Cobalt (Co)	mg/L		0.00010	<0.00010	<0.00010	0.00012	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	0.00026	0.00024
Copper (Cu)	mg/L		0.00050	0.00133	0.00134	0.00085	0.00083	0.00092	0.00097	0.00075	0.00076	0.00098	0.00096
Iron (Fe)	mg/L		0.010	0.011	<0.010	0.062	0.062	<0.010	<0.010	<0.010	<0.010	0.712	0.711
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	1.49	1.45	1.48	1.46	1.35	1.34	0.939	0.943	1.68	1.65
Manganese (Mn)	mg/L		0.000050	0.00153	0.00154	0.00245	0.00236	0.00106	0.00112	0.000206	0.000684	0.00326	0.00311
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.00386	0.00378	0.00215	0.00220	0.00220	0.00225	0.00159	0.00154	0.00254	0.00254
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.327	0.323	0.286	0.282	0.328	0.320	0.250	0.257	0.292	0.290
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.296	0.288	0.762	0.774	0.159	0.160	0.182	0.182	0.587	0.585
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.655	0.635	0.702	0.694	0.627	0.623	0.472	0.475	0.914	0.905
Strontium (Sr)	mg/L		0.00020	0.00767	0.00787	0.00970	0.00982	0.0145	0.0142	0.00738	0.00735	0.00870	0.00873
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000013	0.000012
Vanadium (V)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000365	0.000376
Zinc (Zn)	mg/L		0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Note Echo OF was dry during August sampling.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, (accessed 2012).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realised detection limit

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River, 2012

Area				George	George	George	George	George	George	George	George	George	George
Location				George OF	George OF	Sleigh OF	Sleigh OF	Dragon OF	Dragon OF	Komatic IF	Komatic IF	Reference C OF	Reference C OF
Replicate				1	2	1	2	1	2	1	2	1	2
Date Sampled				19-Sep-12	19-Sep-12	19-Sep-12	19-Sep-12	19-Sep-12	19-Sep-12	19-Sep-12	19-Sep-12	19-Sep-12	19-Sep-12
ALS Sample ID #	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection (RDL)	L1212370-5	L1212370-6	L1212370-7	L1212370-8	L1212370-9	L1212370-10	L1212370-11	L1212370-12	L1212370-15	L1212370-16
Physical Tests	µS/cm												
Conductivity			2.0	69.2	69.4	106	106	60.9	61.1	121	122	118	118
Hardness (as $CaCO_3$)	mg/L		0.50	28.0	28.3	42.2	42.4	26.4	26.7	51.0	51.3	62.8	63.6
pH	pH	6.5-9.0	0.10	7.09	7.03	7.07	7.12	7.43	7.43	7.31	7.36	8.13	8.14
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	5.8	5.4	6.9	6.9	12.6	12.5	11.5	11.7	67.0	66.5
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	5.8	5.4	6.9	6.9	12.6	12.5	11.5	11.7	67.0	66.5
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	40	33	64	60	44	38	86	88	64	66
Turbidity	NTU	dependent on background levels	0.10	0.67	0.29	0.43	0.75	0.36	0.80	0.63	0.88	0.38	0.24
Nutrients													
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate (as N)	mg/L	2.935[b]	0.0050	0.0097	0.0110	0.0334	0.0337	<0.0050	<0.0050	0.0219	0.0227	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.145	0.143	0.183	0.178	0.202	0.209	0.222	0.214	0.164	0.159
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.0023	0.0022	0.0036	0.0041	0.0049	0.0042	0.0074	0.0043	0.0027	0.0025
Anions													
Bromide (Br)	mg/L		0.050	<0.050	<0.050	0.084	0.068	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 120; long-term: 640	0.50	2.88	2.86	10.7	10.6	1.20	1.19	4.53	4.52	0.68	0.68
Fluoride (F)	mg/L	0.12[b]	0.02	0.028	0.028	0.034	0.034	0.022	0.021	0.027	0.027	<0.020	<0.020
Sulfate (SO_4)	mg/L		0.5	21.7	21.6	25.9	25.7	14.6	14.5	37.8	37.6	0.71	0.70
Cyanides													
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon													
Total Organic Carbon	mg/L		0.50	2.57	2.59	3.09	3.27	3.78	5.35	4.78	4.73	6.94	5.15
Total Metals													
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0190	0.0211	0.0220	0.0219	0.0064	0.0096	0.0283	0.0274	<0.0030	<0.0030
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000453	0.000411	0.000541	0.000476	0.000962	0.00109	0.00107	0.00100	0.000228	0.000203
Barium (Ba)	mg/L		0.000050	0.00275	0.00267	0.00494	0.00490	0.00103	0.00106	0.00406	0.00403	0.0186	0.0189
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	0.0059	0.0063	0.0072	0.0069	0.0056	0.0056	0.0064	0.0065	0.0056	<0.0050
Cadmium (Cd)	mg/L	equation[b,d]	0.000010	0.000013	0.000013	0.000021	0.000019	<0.000010	<0.000010	0.000017	0.000019	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	7.09	6.83	10.9	11.0	5.21	5.19	11.0	11.0	14.3	15.1
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00013	0.00017	0.00020	0.00020	0.00018	0.00020	0.00027	0.00029	0.00013	<0.00010
Cobalt (Co)	mg/L		0.00010	0.00190	0.00200	0.00164	0.00166	0.00102	0.00118	0.00270	0.00267	<0.00010	<0.00010
Copper (Cu)	mg/L	≥0.002[e]	0.0005 - 0.0015	0.00190	0.00180	0.00270	0.00286	0.00174	0.00182	0.00314	0.00317	0.00095	0.00096
Iron (Fe)	mg/L	0.3	0.010	0.064	0.066	0.088	0.089	0.063	0.109	0.193	0.197	<0.010	<0.010
Lead (Pb)	mg/L	≥0.001[f]	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	2.68	2.63	3.75	3.79	3.47	3.34	5.97	6.08	6.32	6.33
Manganese (Mn)	mg/L		0.000050	0.00737	0.00820	0.0189	0.0187	0.00260	0.00452	0.0125	0.0129	0.00226	0.00256
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	≥0.025[g]	0.00010	0.00815	0.00811	0.00881	0.00889	0.00460	0.00463	0.0146	0.0144	0.00011	<0.00010
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.370	0.346	0.555	0.559	0.375	0.365	0.532	0.547	0.239	0.239
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.573	0.554	0.549	0.552	0.507	0.510	1.15	1.18	1.02	1.02
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.973	0.948	1.32	1.33	0.661	0.645	1.20	1.21	0.456	0.460

Appendix 3.3-1. Stream Water Quality Analytical Results, Back River, 2012

Area				George	George	George	George	George	George	George	George	George	George
Location				George OF	George OF	Sleigh OF	Sleigh OF	Dragon OF	Dragon OF	Komatic IF	Komatic IF	Reference C OF	Reference C OF
Replicate				1	2	1	2	1	2	1	2	1	2
Date Sampled				19-Sep-12	19-Sep-12	19-Sep-12	19-Sep-12	19-Sep-12	19-Sep-12	19-Sep-12	19-Sep-12	19-Sep-12	19-Sep-12
ALS Sample ID #	Units	CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Realised Detection (RDL)	L1212370-5	L1212370-6	L1212370-7	L1212370-8	L1212370-9	L1212370-10	L1212370-11	L1212370-12	L1212370-15	L1212370-16
Strontium (Sr)	mg/L		0.00020	0.0254	0.0247	0.0573	0.0580	0.0109	0.0109	0.0345	0.0347	0.00667	0.00701
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	0.000022	0.000027	0.000318	0.000338
Vanadium (V)	mg/L		0.000050	0.000120	0.000124	0.000138	0.000143	0.000110	0.000120	0.000206	0.000204	0.000110	0.000139
Zinc (Zn)	mg/L	0.03	0.0030	0.0058	0.0056	0.0050	0.0054	0.0032	0.0034	0.0067	0.0075	<0.0030	<0.0030
Dissolved Metals													
Aluminum (Al)	mg/L		0.0030	0.0084	0.0098	0.0089	0.0090	<0.0030	<0.0030	0.0147	0.0141	<0.0030	<0.0030
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000351	0.000293	0.000369	0.000408	0.000735	0.000758	0.000764	0.000711	0.000217	0.000200
Barium (Ba)	mg/L		0.000050	0.00272	0.00272	0.00472	0.00466	0.000996	0.000996	0.00397	0.00384	0.0188	0.0191
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	0.0064	0.0065	0.0070	0.0069	0.0058	0.0059	0.0062	0.0066	0.0061	0.0066
Cadmium (Cd)	mg/L		0.000010	0.000010	0.000012	0.000020	0.000017	<0.000010	<0.000010	0.000016	0.000015	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	6.90	6.98	10.9	10.8	5.04	5.11	10.7	10.8	14.8	15.0
Chromium (Cr)	mg/L		0.00010	0.00015	0.00014	0.00011	<0.00010	0.00020	<0.00010	0.00032	0.00020	0.00013	0.00012
Cobalt (Co)	mg/L		0.00010	0.00169	0.00173	0.00154	0.00153	0.00082	0.00074	0.00256	0.00247	<0.00010	<0.00010
Copper (Cu)	mg/L		0.00050	0.00138	0.00141	0.00202	0.00201	0.00130	0.00136	0.00243	0.00236	0.00071	0.00077
Iron (Fe)	mg/L		0.010	0.017	0.019	0.021	0.020	0.014	0.013	0.114	0.110	<0.010	<0.010
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	2.61	2.63	3.66	3.71	3.36	3.38	5.89	5.92	6.26	6.36
Manganese (Mn)	mg/L		0.000050	0.00600	0.00615	0.0180	0.0177	0.00143	0.00126	0.0120	0.0120	0.000068	<0.000050
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000051	0.000080
Nickel (Ni)	mg/L		0.00010	0.00777	0.00799	0.00849	0.00858	0.00435	0.00429	0.0141	0.0137	0.00015	0.00012
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.350	0.350	0.543	0.554	0.365	0.379	0.520	0.522	0.234	0.241
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.535	0.542	0.515	0.518	0.496	0.494	1.13	1.14	1.02	1.02
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.946	0.942	1.29	1.30	0.641	0.651	1.17	1.18	0.454	0.461
Strontium (Sr)	mg/L		0.00020	0.0241	0.0245	0.0558	0.0560	0.0105	0.0105	0.0334	0.0336	0.00677	0.00684
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000017	0.000018	0.000329	0.000331
Vanadium (V)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000061	0.000070	<0.000050	<0.000050
Zinc (Zn)	mg/L		0.0030	0.0047	0.0046	0.0043	0.0036	<0.0030	<0.0030	0.0055	0.0049	<0.0030	<0.0030

Note Echo OF was dry during August sampling.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment, (accessed 2012).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultraoligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Mesoeutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hypereutrophic.

d) Guideline is hardness-dependent: cadmium guideline (mg/L) = $10^{\{0.86[\log(\text{hardness})]-3.2\}}$ / 1000.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness.

h) RDL = Realised detection limit

Appendix 3.3-2

Stream Water Quality Analytical Results of Field Duplicates, Back River Project, 2012

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Appendix 3.3-2. Stream Water Quality Analytical Results of Field Duplicates, Back River, 2012

Location		Moby OF	Gander IF	Gander US	Pond 19 OF	Chair OF	Llama OF	Echo OF	Giraffe OF	Wolf OF	Goose OF	Propellor OF	Reference B OF
Depth	Realised	12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	13-Jun-12	13-Jun-12	12-Jun-12	13-Jun-12	12-Jun-12	12-Jun-12
	Detection	L1162486-1	L1162486-3	L1162486-5	L1162486-9	L1162486-7	L1162486-11	L1162486-21	L1162486-23	L1162486-17	L1162486-25	L1162486-15	L1162486-13
ALS Sample ID	Limit	L1162486-2	L1162486-4	L1162486-6	L1162486-10	L1162486-8	L1162486-12	L1162486-22	L1162486-24	L1162486-18	L1162486-26	L1162486-16	L1162486-14
	(RDL)	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a
Physical Tests													
Conductivity	2.0	2.4	0.5	0.0	0.4	0.6	1.7	0.3	0.6	0.6	0.4	0.4	0.0
Hardness (as $CaCO_3$)	0.50	3.5	4.9	0.1	0.9	1.0	1.2	3.5	1.0	0.0	0.0	1.0	1.0
pH	0.10	1.8	0.1	0.0	0.3	12.1	0.3	3.3	0.8	0.0	0.6	0.6	4.7
Alkalinity, Bicarbonate (as $CaCO_3$)	2.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Alkalinity, Carbonate (as $CaCO_3$)	2.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Alkalinity, Hydroxide (as $CaCO_3$)	2.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Alkalinity, Total (as $CaCO_3$)	2.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Total Suspended Solids	3.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Total Dissolved Solids	10	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Turbidity	0.10	0.0	0.6	10.1	RPD-N/A	17.2	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Nutrients													
Ammonia, Total (as N)	0.0050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Nitrate (as N)	0.0050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Nitrite (as N)	0.001	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Total Kjeldahl Nitrogen	0.05	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	4.8	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Ortho-phosphate (as P)	0.001	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Total Phosphorus (P)	0.002	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Anions													
Bromide (Br)	0.050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Chloride (Cl)	0.50	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	2.0	0.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Fluoride (F)	0.02	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Sulfate (SO_4)	0.5	0.0	0.2	0.8	0.2	0.3	0.6	0.3	0.2	1.6	0.0	0.3	RPD-N/A
Cyanides													
Cyanide, Total	0.0010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Cyanide, Free	0.0010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Organic / Inorganic Carbon													
Total Organic Carbon	0.50	4.6	0.0	1.5	1.0	0.5	0.6	0.0	0.6	0.5	0.2	0.8	0.3
Total Metals													
Aluminum (Al)	0.0030	7.8	5.2	11.7	11.1	1.9	11.0	8.1	2.4	2.7	6.5	21.7	10.1
Antimony (Sb)	0.00005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Arsenic (As)	0.000030	7.1	3.2	4.0	7.5	3.6	2.0	11.4	6.4	7.7	18.8	1.7	RPD-N/A
Barium (Ba)	0.000050	1.6	4.4	2.0	0.3	2.8	3.2	3.3	2.0	0.5	0.9	1.5	4.1
Beryllium (Be)	0.00020	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Bismuth (Bi)	0.00050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Boron (B)	0.005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Cadmium (Cd)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Calcium (Ca)	0.020	9.3	1.3	1.3	9.7	5.6	2.4	2.1	2.3	1.5	1.3	0.5	6.9
Chromium (Cr)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Cobalt (Co)	0.00010	1.7	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	4.9	RPD-N/A	RPD-N/A	0.0	RPD-N/A	RPD-N/A
Copper (Cu)	0.0005 - 0.0015	0.3	RPD-N/A	RPD-N/A	1.2	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Iron (Fe)	0.010	5.6	5.0	8.3	RPD-N/A	1.2	RPD-N/A	1.4	RPD-N/A	RPD-N/A	0.0	RPD-N/A	21.2
Lead (Pb)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Lithium (Li)	0.0050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Magnesium (Mg)	0.0050	1.3	2.0	0.9	2.2	2.9	0.7	3.3	5.1	0.2	0.9	0.0	1.4
Manganese (Mn)	0.000050	5.1	0.0	2.2	4.4	0.6	5.7	8.7	4.4	5.6	2.6	1.5	0.0
Mercury (Hg)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Molybdenum (Mo)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Nickel (Ni)	0.00010	0.6	0.7	0.6	2.5	3.4	2.5	7.8	2.3	0.4	0.2	0.6	3.2
Phosphorus (P)	0.30	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Potassium (K)	0.050	RPD-N/A	2.6	1.3	3.6	5.6	2.5	RPD-N/A	RPD-N/A	RPD-N/A	3.5	1.1	RPD-N/A
Selenium (Se)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Silicon (Si)	0.050	1.2	2.2	2.3	1.1	3.0	0.8	0.5	3.9	3.4	1.2	0.3	RPD-N/A
Silver (Ag)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Sodium (Na)	0.010	1.7	1.2	0.2	0.7	2.4	0.5	2.0	4.2	0.5	2.0	0.3	1.7

Appendix 3.3-2. Stream Water Quality Analytical Results of Field Duplicates, Back River, 2012

Location		Moby OF	Gander IF	Gander US	Pond 19 OF	Chair OF	Llama OF	Echo OF	Giraffe OF	Wolf OF	Goose OF	Propellor OF	Reference B OF
Depth	Realised	12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	13-Jun-12	13-Jun-12	12-Jun-12	13-Jun-12	12-Jun-12	12-Jun-12
	Detection	L1162486-1	L1162486-3	L1162486-5	L1162486-9	L1162486-7	L1162486-11	L1162486-21	L1162486-23	L1162486-17	L1162486-25	L1162486-15	L1162486-13
ALS Sample ID	Limit	L1162486-2	L1162486-4	L1162486-6	L1162486-10	L1162486-8	L1162486-12	L1162486-22	L1162486-24	L1162486-18	L1162486-26	L1162486-16	L1162486-14
	(RDL)	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a
Strontium (Sr)	0.00020	8.6	2.0	1.9	9.2	5.3	1.7	4.0	1.4	1.6	0.8	1.0	6.1
Thallium (Tl)	0.00005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Tin (Sn)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Titanium (Ti)	0.010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Uranium (U)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Vanadium (V)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Zinc (Zn)	0.0030	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Dissolved Metals													
Aluminum (Al)	0.0030	2.2	24.4	8.8	3.0	0.7	7.9	3.9	6.5	0.0	6.3	RPD-N/A	2.3
Antimony (Sb)	0.00005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Arsenic (As)	0.000030	5.5	6.9	7.7	8.0	9.6	3.3	10.6	RPD-N/A	0.0	6.4	0.6	RPD-N/A
Barium (Ba)	0.000050	2.7	3.3	0.3	0.7	3.0	1.0	4.3	0.3	2.8	1.5	2.3	2.4
Beryllium (Be)	0.00020	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Bismuth (Bi)	0.00050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Boron (B)	0.005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Cadmium (Cd)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Calcium (Ca)	0.020	7.2	9.0	0.0	1.8	0.8	1.4	2.9	0.0	0.7	0.4	0.9	0.9
Chromium (Cr)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Cobalt (Co)	0.00010	0.9	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	4.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Copper (Cu)	0.00050	1.5	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Iron (Fe)	0.010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	15.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	0.0
Lead (Pb)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Lithium (Li)	0.0050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Magnesium (Mg)	0.0050	0.7	0.8	1.0	0.7	1.2	0.7	4.4	2.1	0.9	0.9	1.7	0.6
Manganese (Mn)	0.000050	9.3	37.5	0.3	9.2	4.9	6.5	7.5	0.5	13.9	5.0	48.3	1.7
Mercury (Hg)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Molybdenum (Mo)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Nickel (Ni)	0.00010	0.0	1.5	0.6	0.8	2.5	2.0	4.3	1.6	0.7	0.4	1.6	0.8
Phosphorus (P)	0.30	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Potassium (K)	0.050	RPD-N/A	1.4	2.7	3.5	2.5	1.3	RPD-N/A	RPD-N/A	RPD-N/A	3.2	0.3	RPD-N/A
Selenium (Se)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Silicon (Si)	0.050	0.2	0.3	0.9	2.6	2.3	2.0	0.4	0.5	RPD-N/A	5.5	0.0	RPD-N/A
Silver (Ag)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Sodium (Na)	0.010	0.9	1.1	0.9	4.7	0.2	1.2	5.3	2.6	1.4	1.3	1.6	0.6
Strontium (Sr)	0.00020	9.2	0.5	0.9	1.4	2.8	0.0	3.4	0.2	0.2	0.0	1.3	0.8
Thallium (Tl)	0.00005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Tin (Sn)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Titanium (Ti)	0.010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Uranium (U)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Vanadium (V)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Zinc (Zn)	0.0030	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A

a) Relative percent difference (RPD).

b) RPD-N/A Not applicable when the values are less than five times the detection limit.

Italicized values exceed the 20% relative percent difference and are more than five times the detection limit.

Bold values exceed the 50% relative percent difference and are more than five times the detection limit.

Appendix 3.3-2. Stream Water Quality Analytical Results of Field Duplicates, Back River, 2012

Location		George OF	Sleigh OF	Dragon OF	Komatic IF	Reference C OF	Moby OF	Gander IF	Gander US	Pond 19 OF	Chair OF	Llama OF	Giraffe OF	Wolf OF
Depth	Realised	13-Jun-12	13-Jun-12	13-Jun-12	13-Jun-12	13-Jun-12	12-Aug-12	11-Aug-12	11-Aug-12	13-Aug-12	12-Aug-12	8-Aug-12	8-Aug-12	7-Aug-12
	Detection	L1162486-29	L1162486-35	L1162486-33	L1162486-31	L1162486-27	L1193094-1	L1192523-5	L1192523-7	L1193081-1	L1193094-3	L1191588-1	L1191588-3	L1190634-1
ALS Sample ID	Limit	L1162486-30	L1162486-36	L1162486-34	L1162486-32	L1162486-28	L1193094-2	L1192523-6	L1192523-8	L1193081-2	L1193094-4	L1191588-2	L1191588-4	L1190634-2
	(RDL)	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a
Physical Tests														
Conductivity	2.0	0.2	0.4	0.0	0.3	0.2	0.0	0.4	0.4	0.9	0.0	1.7	0.4	2.1
Hardness (as $CaCO_3$)	0.50	1.8	0.4	0.8	0.0	0.4	0.0	2.9	3.7	4.0	0.0	1.5	1.3	0.3
pH	0.10	0.0	0.4	0.1	0.3	0.5	0.0	0.0	0.0	0.8	0.0	3.0	0.3	0.1
Alkalinity, Bicarbonate (as $CaCO_3$)	2.0	RPD-N/A	RPD-N/A	2.1	RPD-N/A	0.4	RPD-N/A	RPD-N/A	RPD-N/A	2.6	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Alkalinity, Carbonate (as $CaCO_3$)	2.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Alkalinity, Hydroxide (as $CaCO_3$)	2.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Alkalinity, Total (as $CaCO_3$)	2.0	RPD-N/A	RPD-N/A	2.1	RPD-N/A	0.4	RPD-N/A	RPD-N/A	RPD-N/A	2.6	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Total Suspended Solids	3.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Total Dissolved Solids	10	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	5.8	RPD-N/A	RPD-N/A
Turbidity	0.10	RPD-N/A	RPD-N/A	RPD-N/A	0.0	RPD-N/A	5.2	17.2	5.7	11.5	6.7	RPD-N/A	RPD-N/A	1.9
Nutrients														
Ammonia, Total (as N)	0.0050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Nitrate (as N)	0.0050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	0.9	RPD-N/A	RPD-N/A	0.0	RPD-N/A	0.0	RPD-N/A	12.2
Nitrite (as N)	0.001	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Total Kjeldahl Nitrogen	0.05	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	16.5	RPD-N/A	RPD-N/A	RPD-N/A
Ortho-phosphate (as P)	0.001	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Total Phosphorus (P)	0.002	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	2.9	RPD-N/A	RPD-N/A	RPD-N/A
Anions														
Bromide (Br)	0.050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	2.0	RPD-N/A	RPD-N/A
Chloride (Cl)	0.50	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	0.5	RPD-N/A	RPD-N/A
Fluoride (F)	0.02	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Sulfate (SO_4)	0.5	0.0	0.5	0.0	0.0	RPD-N/A	0.6	0.1	0.0	0.7	0.0	0.6	0.2	0.0
Cyanides														
Cyanide, Total	0.0010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Cyanide, Free	0.0010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Organic / Inorganic Carbon														
Total Organic Carbon	0.50	RPD-N/A	RPD-N/A	1.7	0.7	RPD-N/A	0.0	4.9	0.0	3.6	6.4	RPD-N/A	2.9	5.3
Total Metals														
Aluminum (Al)	0.0030	0.9	5.9	RPD-N/A	3.9	RPD-N/A	2.8	2.8	RPD-N/A	1.5	3.7	13.7	RPD-N/A	RPD-N/A
Antimony (Sb)	0.00005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Arsenic (As)	0.000030	0.7	3.3	1.3	2.3	RPD-N/A	4.7	1.3	11.7	6.4	1.4	1.5	6.1	9.3
Barium (Ba)	0.000050	1.2	4.4	5.4	0.6	0.6	0.3	0.0	6.8	3.1	2.0	0.0	3.7	5.3
Beryllium (Be)	0.00020	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Bismuth (Bi)	0.00050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Boron (B)	0.005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Cadmium (Cd)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	4.5	RPD-N/A	RPD-N/A
Calcium (Ca)	0.020	0.2	0.4	0.4	2.5	0.5	0.6	0.5	19.8	1.5	2.8	1.7	1.7	5.2
Chromium (Cr)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Cobalt (Co)	0.00010	1.4	0.0	0.0	RPD-N/A	RPD-N/A	0.3	0.0	RPD-N/A	RPD-N/A	0.0	4.6	RPD-N/A	RPD-N/A
Copper (Cu)	0.0005 - 0.0015	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	2.6	RPD-N/A	RPD-N/A	0.5	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Iron (Fe)	0.010	RPD-N/A	1.8	RPD-N/A	4.5	RPD-N/A	3.4	1.4	0.0	2.9	1.6	RPD-N/A	1.7	4.5
Lead (Pb)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Lithium (Li)	0.0050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Magnesium (Mg)	0.0050	0.7	0.3	0.7	1.8	0.8	0.0	0.8	6.1	0.6	2.4	3.1	3.1	5.2
Manganese (Mn)	0.000050	0.4	0.2	1.6	4.9	7.0	2.4	6.5	8.8	2.0	0.0	4.0	7.3	6.9
Mercury (Hg)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Molybdenum (Mo)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Nickel (Ni)	0.00010	1.0	0.9	1.2	3.8	RPD-N/A	0.0	1.7	3.3	0.6	1.9	2.1	2.3	9.2
Phosphorus (P)	0.30	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Potassium (K)	0.050	2.6	RPD-N/A	0.3	4.1	RPD-N/A	7.8	0.0	1.3	2.9	1.6	2.7	1.8	4.5
Selenium (Se)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Silicon (Si)	0.050	RPD-N/A	RPD-N/A	0.9	3.7	0.3	0.5	3.0	RPD-N/A	2.5	RPD-N/A	4.2	RPD-N/A	0.4
Silver (Ag)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Sodium (Na)	0.010	0.5	1.2	0.8	2.0	0.0	1.8	2.3	3.3	1.8	2.1	8.6	4.1	3.7

Appendix 3.3-2. Stream Water Quality Analytical Results of Field Duplicates, Back River, 2012

Location		George OF	Sleigh OF	Dragon OF	Komatic IF	Reference C OF	Moby OF	Gander IF	Gander US	Pond 19 OF	Chair OF	Llama OF	Giraffe OF	Wolf OF
Depth	Realised	13-Jun-12	13-Jun-12	13-Jun-12	13-Jun-12	13-Jun-12	12-Aug-12	11-Aug-12	11-Aug-12	13-Aug-12	12-Aug-12	8-Aug-12	8-Aug-12	7-Aug-12
	Detection	L1162486-29	L1162486-35	L1162486-33	L1162486-31	L1162486-27	L1193094-1	L1192523-5	L1192523-7	L1193081-1	L1193094-3	L1191588-1	L1191588-3	L1190634-1
ALS Sample ID	Limit	L1162486-30	L1162486-36	L1162486-34	L1162486-32	L1162486-28	L1193094-2	L1192523-6	L1192523-8	L1193081-2	L1193094-4	L1191588-2	L1191588-4	L1190634-2
	(RDL)	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a
Strontium (Sr)	0.00020	1.9	1.0	0.2	3.7	0.7	0.5	0.3	20.0	0.0	0.7	3.7	2.1	4.3
Thallium (Tl)	0.00005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Tin (Sn)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Titanium (Ti)	0.010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Uranium (U)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	1.6	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Vanadium (V)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	5.0	RPD-N/A	RPD-N/A	RPD-N/A	2.2	RPD-N/A	RPD-N/A	RPD-N/A
Zinc (Zn)	0.0030	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Dissolved Metals														
Aluminum (Al)	0.0030	RPD-N/A	14.9	RPD-N/A	0.0	RPD-N/A	3.0	RPD-N/A	RPD-N/A	12.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Antimony (Sb)	0.00005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Arsenic (As)	0.000030	0.5	2.5	5.5	3.0	RPD-N/A	12.6	13.7	7.5	9.2	3.5	5.8	4.0	1.0
Barium (Ba)	0.000050	2.5	1.2	3.6	1.2	2.1	1.3	7.8	5.2	0.6	5.3	0.3	3.2	1.1
Beryllium (Be)	0.00020	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Bismuth (Bi)	0.00050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Boron (B)	0.005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Cadmium (Cd)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	1.1	RPD-N/A	RPD-N/A
Calcium (Ca)	0.020	1.7	1.3	0.6	0.3	1.0	1.3	0.5	7.3	4.3	0.9	3.4	1.8	0.0
Chromium (Cr)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Cobalt (Co)	0.00010	9.7	3.6	RPD-N/A	RPD-N/A	RPD-N/A	2.8	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	2.3	RPD-N/A	RPD-N/A
Copper (Cu)	0.00050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	2.0	RPD-N/A	RPD-N/A	0.3	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Iron (Fe)	0.010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	2.9	RPD-N/A	RPD-N/A	4.1	4.3	RPD-N/A	RPD-N/A	6.6
Lead (Pb)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Lithium (Li)	0.0050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Magnesium (Mg)	0.0050	0.7	2.5	1.4	0.6	0.0	0.9	7.4	0.0	4.1	0.6	1.2	0.8	0.0
Manganese (Mn)	0.000050	2.8	2.6	1.1	2.6	RPD-N/A	3.6	11.4	13.4	2.7	17.9	2.5	3.4	21.3
Mercury (Hg)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Molybdenum (Mo)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Nickel (Ni)	0.00010	1.5	2.0	1.6	0.0	RPD-N/A	0.5	6.7	3.5	1.8	0.3	0.5	1.0	0.6
Phosphorus (P)	0.30	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Potassium (K)	0.050	3.4	RPD-N/A	1.6	1.2	RPD-N/A	1.4	9.7	1.6	3.5	4.1	0.1	0.3	1.0
Selenium (Se)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Silicon (Si)	0.050	RPD-N/A	RPD-N/A	0.7	RPD-N/A	3.8	1.1	0.4	RPD-N/A	2.0	RPD-N/A	2.1	RPD-N/A	0.4
Silver (Ag)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Sodium (Na)	0.010	0.8	4.5	0.0	0.2	1.4	1.8	7.4	0.5	1.8	2.0	6.8	1.7	0.3
Strontium (Sr)	0.00020	0.6	0.9	0.3	0.2	0.0	0.0	0.1	7.9	1.4	1.9	3.4	3.0	0.6
Thallium (Tl)	0.00005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Tin (Sn)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Titanium (Ti)	0.010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Uranium (U)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	3.5	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Vanadium (V)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Zinc (Zn)	0.0030	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A

a) Relative percent difference (RPD).

b) RPD-N/A Not applicable when the values are less than five times the detection limit.

Italicized values exceed the 20% relative percent difference and are more than five times the detection limit.

Bold values exceed the 50% relative percent difference and are more than five times the detection limit.

Appendix 3.3-2. Stream Water Quality Analytical Results of Field Duplicates, Back River, 2012

Location		Goose OF	Propellor OF	Reference B OF	George OF	Sleigh OF	Dragon OF	Komatic IF	Reference C OF	Moby OF	Gander IF	Gander US	Pond 19 OF	Chair OF
Depth	Realised	7-Aug-12	9-Aug-12	10-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	6-Aug-12	6-Aug-12	18-Sep-12	18-Sep-12	18-Sep-12	18-Sep-12	18-Sep-12
	Detection	L1190634-3	L1192523-1	L1192523-3	L1190226-5	L1190226-3	L1190226-1	L1190219-2	L1190219-4	L1212310-5	L1212310-7	L1212310-9	L1212310-3	L1212310-11
ALS Sample ID	Limit	L1190634-4	L1192523-2	L1192523-4	L1190219-1	L1190226-4	L1190226-2	L1190219-3	L1190219-5	L1212310-6	L1212310-8	L1212310-10	L1212310-4	L1212310-12
	(RDL)	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a
Physical Tests														
Conductivity	2.0	1.0	0.0	0.5	1.5	1.1	1.3	9.3	0.9	0.1	1.2	0.7	0.9	0.3
Hardness (as $CaCO_3$)	0.50	3.5	5.8	3.8	1.0	2.3	2.9	1.4	0.5	2.9	1.2	0.9	0.2	1.3
pH	0.10	0.3	0.0	0.3	1.1	0.3	0.1	2.2	0.0	0.5	0.1	0.0	0.1	0.1
Alkalinity, Bicarbonate (as $CaCO_3$)	2.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	0.9	RPD-N/A	0.9	RPD-N/A	RPD-N/A	RPD-N/A	3.3	RPD-N/A
Alkalinity, Carbonate (as $CaCO_3$)	2.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Alkalinity, Hydroxide (as $CaCO_3$)	2.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Alkalinity, Total (as $CaCO_3$)	2.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	0.9	RPD-N/A	0.9	RPD-N/A	RPD-N/A	RPD-N/A	3.3	RPD-N/A
Total Suspended Solids	3.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Total Dissolved Solids	10	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	3.8	7.2	0.0	RPD-N/A	RPD-N/A	2.4	RPD-N/A
Turbidity	0.10	RPD-N/A	RPD-N/A	21.6	RPD-N/A	RPD-N/A	RPD-N/A	8.7	RPD-N/A	32.5	17.4	6.9	RPD-N/A	24.1
Nutrients														
Ammonia, Total (as N)	0.0050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Nitrate (as N)	0.0050	RPD-N/A	1.8	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	0.0	1.4	RPD-N/A	0.8	4.1
Nitrite (as N)	0.001	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Total Kjeldahl Nitrogen	0.05	RPD-N/A	RPD-N/A	2.6	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Ortho-phosphate (as P)	0.001	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Total Phosphorus (P)	0.002	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Anions														
Bromide (Br)	0.050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Chloride (Cl)	0.50	0.2	RPD-N/A	RPD-N/A	0.0	2.0	RPD-N/A	0.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Fluoride (F)	0.02	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Sulfate (SO_4)	0.5	0.0	0.0	RPD-N/A	0.7	0.0	0.1	0.6	RPD-N/A	0.7	0.7	0.6	0.3	0.5
Cyanides														
Cyanide, Total	0.0010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Cyanide, Free	0.0010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Organic / Inorganic Carbon														
Total Organic Carbon	0.50	5.8	RPD-N/A	3.2	RPD-N/A	1.9	0.0	2.5	8.6	0.3	2.5	0.6	0.8	3.2
Total Metals														
Aluminum (Al)	0.0030	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	14.9	RPD-N/A	1.7	32.1	1.4	3.5	16.0
Antimony (Sb)	0.00005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Arsenic (As)	0.000030	10.2	RPD-N/A	1.9	2.8	1.6	7.5	0.0	6.8	12.1	8.0	6.5	3.8	2.8
Barium (Ba)	0.000050	8.4	1.4	1.2	6.5	1.2	8.7	2.4	0.4	2.7	8.3	4.2	0.8	3.4
Beryllium (Be)	0.00020	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Bismuth (Bi)	0.00050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Boron (B)	0.005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Cadmium (Cd)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	4.8	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Calcium (Ca)	0.020	0.4	2.9	0.0	6.2	2.5	5.0	1.0	0.6	3.4	2.3	1.3	1.8	4.0
Chromium (Cr)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Cobalt (Co)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	5.7	8.7	RPD-N/A	RPD-N/A	0.0
Copper (Cu)	0.0005 - 0.0015	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	0.0025	RPD-N/A	3.8	RPD-N/A	15.3	RPD-N/A	RPD-N/A	8.4	RPD-N/A
Iron (Fe)	0.010	84.3	RPD-N/A	0.9	3.7	4.6	1.3	7.3	RPD-N/A	5.0	27.7	0.8	1.4	5.5
Lead (Pb)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Lithium (Li)	0.0050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Magnesium (Mg)	0.0050	3.3	0.4	0.9	1.5	2.6	5.0	1.0	0.5	3.9	10.2	1.4	3.4	1.5
Manganese (Mn)	0.000050	58.4	6.5	3.3	10.0	2.3	2.8	4.5	2.6	3.8	9.2	4.0	1.4	3.0
Mercury (Hg)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Molybdenum (Mo)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Nickel (Ni)	0.00010	14.3	5.5	3.6	5.9	1.2	5.6	0.5	RPD-N/A	5.2	10.9	0.3	2.7	12.6
Phosphorus (P)	0.30	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Potassium (K)	0.050	3.0	0.7	1.3	4.1	0.8	6.2	0.0	RPD-N/A	3.5	5.7	5.0	1.9	0.5
Selenium (Se)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Silicon (Si)	0.050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	3.7	RPD-N/A	2.0	3.3	10.0	1.6	4.3	0.7
Silver (Ag)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Sodium (Na)	0.010	4.3	1.9	0.2	6.1	1.8	6.5	2.8	1.1	3.9	8.6	0.8	2.0	1.8

Appendix 3.3-2. Stream Water Quality Analytical Results of Field Duplicates, Back River, 2012

Location		Goose OF	Propellor OF	Reference B OF	George OF	Sleigh OF	Dragon OF	Komatic IF	Reference C OF	Moby OF	Gander IF	Gander US	Pond 19 OF	Chair OF
Depth	Realised	7-Aug-12	9-Aug-12	10-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	6-Aug-12	6-Aug-12	18-Sep-12	18-Sep-12	18-Sep-12	18-Sep-12	18-Sep-12
	Detection	L1190634-3	L1192523-1	L1192523-3	L1190226-5	L1190226-3	L1190226-1	L1190219-2	L1190219-4	L1212310-5	L1212310-7	L1212310-9	L1212310-3	L1212310-11
ALS Sample ID	Limit	L1190634-4	L1192523-2	L1192523-4	L1190219-1	L1190226-4	L1190226-2	L1190219-3	L1190219-5	L1212310-6	L1212310-8	L1212310-10	L1212310-4	L1212310-12
	(RDL)	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a
Strontium (Sr)	0.00020	0.0	0.6	0.5	2.0	3.4	4.9	7.1	0.7	2.5	3.3	0.9	3.1	4.8
Thallium (Tl)	0.00005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Tin (Sn)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Titanium (Ti)	0.010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Uranium (U)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	2.6	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Vanadium (V)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	3.7	RPD-N/A	RPD-N/A	1.8	11.3	RPD-N/A	10.6
Zinc (Zn)	0.0030	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	11.1	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Dissolved Metals														
Aluminum (Al)	0.0030	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	1.5	RPD-N/A	RPD-N/A	0.0	RPD-N/A
Antimony (Sb)	0.00005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Arsenic (As)	0.000030	15.9	RPD-N/A	0.9	2.2	2.2	1.7	4.7	2.3	2.1	9.8	14.3	0.3	15.7
Barium (Ba)	0.000050	7.9	1.0	12.7	6.9	0.3	21.9	6.5	0.5	2.8	1.0	0.5	1.8	0.0
Beryllium (Be)	0.00020	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Bismuth (Bi)	0.00050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Boron (B)	0.005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Cadmium (Cd)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	4.8	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Calcium (Ca)	0.020	1.1	9.6	3.9	2.3	0.9	2.9	2.7	0.0	3.0	1.4	0.0	0.7	1.8
Chromium (Cr)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Cobalt (Co)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	2.8	2.6	RPD-N/A	RPD-N/A	RPD-N/A
Copper (Cu)	0.00050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	3.5	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Iron (Fe)	0.010	RPD-N/A	RPD-N/A	1.6	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	4.4	RPD-N/A	RPD-N/A	RPD-N/A	1.1
Lead (Pb)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Lithium (Li)	0.0050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Magnesium (Mg)	0.0050	10.2	1.0	3.5	1.6	4.6	2.5	1.5	0.3	3.1	1.1	1.4	1.4	0.9
Manganese (Mn)	0.000050	21.1	12.4	17.0	0.4	7.9	RPD-N/A	4.7	RPD-N/A	1.7	1.0	10.8	1.1	0.5
Mercury (Hg)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Molybdenum (Mo)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Nickel (Ni)	0.00010	12.3	0.6	9.2	2.7	0.9	0.8	2.9	RPD-N/A	2.6	1.3	0.6	0.4	0.8
Phosphorus (P)	0.30	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Potassium (K)	0.050	10.4	0.7	1.0	0.3	3.0	1.5	2.4	RPD-N/A	2.5	1.5	0.3	0.2	1.4
Selenium (Se)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Silicon (Si)	0.050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	0.9	RPD-N/A	0.5	1.5	2.7	0.0	3.1	1.5
Silver (Ag)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Sodium (Na)	0.010	10.8	0.2	2.3	4.7	5.5	0.4	3.9	0.2	3.2	0.2	1.1	0.7	0.9
Strontium (Sr)	0.00020	4.9	9.3	1.2	2.6	4.6	3.2	0.7	0.3	2.6	0.0	1.0	0.0	0.6
Thallium (Tl)	0.00005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Tin (Sn)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Titanium (Ti)	0.010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Uranium (U)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	1.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Vanadium (V)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Zinc (Zn)	0.0030	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A

a) Relative percent difference (RPD).

b) RPD-N/A Not applicable when the values are less than five times the detection limit.

Italicized values exceed the 20% relative percent difference and are more than five times the detection limit.

Bold values exceed the 50% relative percent difference and are more than five times the detection limit.

Appendix 3.3-2. Stream Water Quality Analytical Results of Field Duplicates, Back River, 2012

Location		Llama OF	Echo OF	Giraffe OF	Wolf OF	Goose OF	Propellor OF	Reference B OF	George OF	Sleigh OF	Dragon OF	Komatic IF	Reference C OF
Depth	Realised	18-Sep-12	18-Sep-12	19-Sep-12	18-Sep-12	19-Sep-12	17-Sep-12	17-Sep-12	19-Sep-12	19-Sep-12	19-Sep-12	19-Sep-12	19-Sep-12
	Detection	L1212310-13	L1212310-15	L1212370-1	L1212310-1	L1212370-3	L1211487-3	L1211487-5	L1212370-5	L1212370-7	L1212370-9	L1212370-11	L1212370-15
ALS Sample ID	Limit	L1212310-14	L1212310-16	L1212370-2	L1212310-2	L1212370-4	L1211487-4	L1211487-6	L1212370-6	L1212370-8	L1212370-10	L1212370-12	L1212370-16
	(RDL)	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a
Physical Tests													
Conductivity	2.0	0.3	0.0	1.1	1.7	0.6	0.5	0.7	0.3	0.0	0.3	0.8	0.0
Hardness (as $CaCO_3$)	0.50	0.0	3.2	0.9	0.8	0.8	0.6	0.8	1.1	0.5	1.1	0.6	1.3
pH	0.10	0.9	4.2	0.7	0.6	0.9	1.0	0.6	0.8	0.7	0.0	0.7	0.1
Alkalinity, Bicarbonate (as $CaCO_3$)	2.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	1.9	RPD-N/A	RPD-N/A	0.8	1.7	0.7
Alkalinity, Carbonate (as $CaCO_3$)	2.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Alkalinity, Hydroxide (as $CaCO_3$)	2.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Alkalinity, Total (as $CaCO_3$)	2.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	1.9	RPD-N/A	RPD-N/A	0.8	1.7	0.7
Total Suspended Solids	3.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Total Dissolved Solids	10	10.0	3.4	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	6.5	RPD-N/A	2.3	3.1
Turbidity	0.10	RPD-N/A	RPD-N/A	RPD-N/A	19.7	RPD-N/A	RPD-N/A	2.4	RPD-N/A	RPD-N/A	RPD-N/A	33.1	RPD-N/A
Nutrients													
Ammonia, Total (as N)	0.0050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	0.2	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Nitrate (as N)	0.0050	0.2	RPD-N/A	RPD-N/A	2.8	RPD-N/A	0.6	RPD-N/A	RPD-N/A	0.9	RPD-N/A	RPD-N/A	RPD-N/A
Nitrite (as N)	0.001	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Total Kjeldahl Nitrogen	0.05	RPD-N/A	3.7	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	20.1	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Ortho-phosphate (as P)	0.001	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Total Phosphorus (P)	0.002	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	8.2	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Anions													
Bromide (Br)	0.050	2.1	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Chloride (Cl)	0.50	0.2	1.1	RPD-N/A	RPD-N/A	0.7	RPD-N/A	RPD-N/A	0.7	0.9	RPD-N/A	0.2	RPD-N/A
Fluoride (F)	0.02	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Sulfate (SO_4)	0.5	0.6	0.9	1.2	1.0	1.1	0.9	0.0	0.5	0.8	0.7	0.5	RPD-N/A
Cyanides													
Cyanide, Total	0.0010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Cyanide, Free	0.0010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Organic / Inorganic Carbon													
Total Organic Carbon	0.50	RPD-N/A	5.6	0.9	1.0	2.3	RPD-N/A	0.1	0.8	5.7	34.4	1.1	29.6
Total Metals													
Aluminum (Al)	0.0030	5.9	1.6	RPD-N/A	2.5	RPD-N/A	RPD-N/A	1.9	10.5	0.5	RPD-N/A	3.2	RPD-N/A
Antimony (Sb)	0.00005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Arsenic (As)	0.000030	2.3	9.6	4.6	12.1	16.1	RPD-N/A	1.0	9.7	12.8	12.5	6.8	11.6
Barium (Ba)	0.000050	1.3	1.2	1.2	1.7	1.0	1.1	0.1	3.0	0.8	2.9	0.7	1.6
Beryllium (Be)	0.00020	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Bismuth (Bi)	0.00050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Boron (B)	0.005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Cadmium (Cd)	0.000010	3.3	3.8	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Calcium (Ca)	0.020	0.9	1.9	1.6	2.5	1.1	1.8	1.2	3.7	0.9	0.4	0.0	5.4
Chromium (Cr)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	1.4	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Cobalt (Co)	0.00010	3.0	0.6	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	5.1	1.2	14.5	1.1	RPD-N/A
Copper (Cu)	0.0005 - 0.0015	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	5.8	RPD-N/A	1.0	RPD-N/A
Iron (Fe)	0.010	RPD-N/A	6.9	0.0	0.0	RPD-N/A	RPD-N/A	0.8	3.1	1.1	53.5	2.1	RPD-N/A
Lead (Pb)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Lithium (Li)	0.0050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Magnesium (Mg)	0.0050	3.2	1.6	0.7	0.0	1.5	1.1	0.0	1.9	1.1	3.8	1.8	0.2
Manganese (Mn)	0.000050	1.7	1.6	3.4	4.7	3.6	3.5	2.8	10.7	1.1	53.9	3.1	12.4
Mercury (Hg)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Molybdenum (Mo)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Nickel (Ni)	0.00010	1.9	0.7	1.7	1.8	1.8	3.0	0.7	0.5	0.9	0.7	1.4	RPD-N/A
Phosphorus (P)	0.30	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Potassium (K)	0.050	1.0	RPD-N/A	0.9	0.0	2.4	0.0	3.0	6.7	0.7	2.7	2.8	RPD-N/A
Selenium (Se)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Silicon (Si)	0.050	0.9	1.0	1.6	0.9	RPD-N/A	RPD-N/A	0.3	3.4	0.5	0.6	2.6	0.0
Silver (Ag)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Sodium (Na)	0.010	1.3	2.9	1.1	1.0	2.5	1.0	0.7	2.6	0.8	2.5	0.8	0.9

Appendix 3.3-2. Stream Water Quality Analytical Results of Field Duplicates, Back River, 2012

Location		Llama OF	Echo OF	Giraffe OF	Wolf OF	Goose OF	Propellor OF	Reference B OF	George OF	Sleigh OF	Dragon OF	Komatic IF	Reference C OF
Depth	Realised	18-Sep-12	18-Sep-12	19-Sep-12	18-Sep-12	19-Sep-12	17-Sep-12	17-Sep-12	19-Sep-12	19-Sep-12	19-Sep-12	19-Sep-12	19-Sep-12
	Detection	L1212310-13	L1212310-15	L1212370-1	L1212310-1	L1212370-3	L1211487-3	L1211487-5	L1212370-5	L1212370-7	L1212370-9	L1212370-11	L1212370-15
ALS Sample ID	Limit	L1212310-14	L1212310-16	L1212370-2	L1212310-2	L1212370-4	L1211487-4	L1211487-6	L1212370-6	L1212370-8	L1212370-10	L1212370-12	L1212370-16
	(RDL)	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a	RPD_a
Strontium (Sr)	0.00020	1.3	0.2	1.6	1.9	0.7	1.8	0.2	2.8	1.2	0.0	0.6	5.0
Thallium (Tl)	0.00005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Tin (Sn)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Titanium (Ti)	0.010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Uranium (U)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	6.1
Vanadium (V)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	0.8	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Zinc (Zn)	0.0030	2.5	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Dissolved Metals													
Aluminum (Al)	0.0030	6.6	1.7	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	0.6	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Antimony (Sb)	0.00005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Arsenic (As)	0.000030	RPD-N/A	7.8	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	2.2	18.0	10.0	3.1	7.2	8.2
Barium (Ba)	0.000050	0.4	1.4	0.3	2.3	1.5	0.3	1.0	0.0	1.3	0.0	3.3	1.6
Beryllium (Be)	0.00020	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Bismuth (Bi)	0.00050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Boron (B)	0.005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Cadmium (Cd)	0.000010	5.1	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Calcium (Ca)	0.020	1.2	5.3	2.1	1.3	1.5	0.6	0.4	1.2	0.9	1.4	0.9	1.3
Chromium (Cr)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	14.3	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Cobalt (Co)	0.00010	0.2	0.2	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	2.3	0.7	10.3	3.6	RPD-N/A
Copper (Cu)	0.00050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Iron (Fe)	0.010	RPD-N/A	1.8	RPD-N/A	0.0	RPD-N/A	RPD-N/A	0.1	RPD-N/A	RPD-N/A	RPD-N/A	3.6	RPD-N/A
Lead (Pb)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Lithium (Li)	0.0050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Magnesium (Mg)	0.0050	1.6	0.2	2.7	1.4	0.7	0.4	1.8	0.8	1.4	0.6	0.5	1.6
Manganese (Mn)	0.000050	1.7	0.3	0.7	3.7	5.5	RPD-N/A	4.7	2.5	1.7	12.6	0.0	RPD-N/A
Mercury (Hg)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Molybdenum (Mo)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Nickel (Ni)	0.00010	1.1	0.8	2.1	2.3	2.2	3.2	0.0	2.8	1.1	1.4	2.9	RPD-N/A
Phosphorus (P)	0.30	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Potassium (K)	0.050	0.0	RPD-N/A	1.2	1.4	2.5	RPD-N/A	0.7	0.0	2.0	3.8	0.4	RPD-N/A
Selenium (Se)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Silicon (Si)	0.050	0.5	1.8	2.7	1.6	RPD-N/A	RPD-N/A	0.3	1.3	0.6	0.4	0.9	0.0
Silver (Ag)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Sodium (Na)	0.010	0.4	0.0	3.1	1.1	0.6	0.6	1.0	0.4	0.8	1.5	0.9	1.5
Strontium (Sr)	0.00020	3.1	5.7	2.6	1.2	2.1	0.4	0.3	1.6	0.4	0.0	0.6	1.0
Thallium (Tl)	0.00005	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Tin (Sn)	0.00010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Titanium (Ti)	0.010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Uranium (U)	0.000010	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	0.6
Vanadium (V)	0.000050	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	3.0	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A
Zinc (Zn)	0.0030	4.7	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A	RPD-N/A

a) Relative percent difference (RPD).

b) RPD-N/A Not applicable when the values are less than five times the detection limit.

Italicized values exceed the 20% relative percent difference and are more than five times the detection limit.

Bold values exceed the 50% relative percent difference and are more than five times the detection limit.

Appendix 3.3-3

Stream Water Quality QA/QC Results, Back River Project, 2012

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Appendix 3.3-3. Stream Water Quality QA/QC Results, Back River, 2012

Area		CCME Guideline for the Protection of Freshwater Aquatic Life[a]	Field	Travel	Field	Travel	Field	Travel	Field	Travel	Field	Travel
Blank Type			Goose	Goose	George	George	Goose	Goose	Goose	Goose	George	George
Date Sampled			12-Jun-12	12-Jun-12	13-Jun-12	13-Jun-12	7-Aug-12	7-Aug-12	17-Sep-12	17-Sep-12	19-Sep-12	19-Sep-12
ALS Sample ID	Units		L1162486-19	L1162486-20	L1162486-37	L1162486-38	L1190634-6	L1190634-5	L1211487-2	L1211487-1	L1212370-13	L1212370-14
Physical Tests												
Conductivity	µS/cm		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0
Hardness (as $CaCO_3$)	mg/L		<0.50	<0.50	<0.50	<0.50	-	-	-	-	-	-
pH	pH	6.5-9.0	5.65	6.18	5.71	6.17	5.97	5.87	5.96	-	5.91	5.96
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0
Total Suspended Solids	mg/L	dependent on background levels	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	-	<3.0	<3.0
Total Dissolved Solids	mg/L		<10	<10	<10	<10	<10	<10	<10	-	<10	<10
Turbidity	NTU	dependent on background levels	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10
Nutrients												
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0128	<0.0050	<0.0050
Nitrate (as N)	mg/L	2.935[b]	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	-	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		<0.050	0.058	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Ortho-phosphate (as P)	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	-	<0.0020	<0.0020
Anions												
Bromide (Br)	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	-	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 120; long-term: 640	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	<0.50	<0.50
Fluoride (F)	mg/L	0.12[b]	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-	<0.020	<0.020
Sulfate (SO_4)	mg/L		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	<0.50	<0.50
Cyanides												
Cyanide, Total	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon												
Total Organic Carbon	mg/L		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Metals												
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Antimony (Sb)	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	<0.000030	<0.000030	<0.000030	<0.000030	<0.000030	<0.000030	<0.000030	<0.000030	<0.000030	<0.000030
Barium (Ba)	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Beryllium (Be)	mg/L		<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cadmium (Cd)	mg/L	equation[b,d]	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010

Appendix 3.3-3. Stream Water Quality QA/QC Results, Back River, 2012

Area		CCME Guideline for the Protection of Freshwater	Field	Travel	Field	Travel	Field	Travel	Field	Travel	Field	Travel
Blank Type			Goose	Goose	George	George	Goose	Goose	Goose	Goose	George	George
Date Sampled			12-Jun-12	12-Jun-12	13-Jun-12	13-Jun-12	7-Aug-12	7-Aug-12	17-Sep-12	17-Sep-12	19-Sep-12	19-Sep-12
ALS Sample ID	Units	Aquatic Life[a]	L1162486-19	L1162486-20	L1162486-37	L1162486-38	L1190634-6	L1190634-5	L1211487-2	L1211487-1	L1212370-13	L1212370-14
Calcium (Ca)	mg/L		<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt (Co)	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	≥0.002[e]	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)	mg/L	0.3	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead (Pb)	mg/L	≥0.001[f]	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Manganese (Mn)	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073[d]	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	≥0.025[g]	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Phosphorus (P)	mg/L		<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Selenium (Se)	mg/L	0.001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Silver (Ag)	mg/L	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Strontium (Sr)	mg/L		<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium (Tl)	mg/L	0.0008	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Zinc (Zn)	mg/L	0.03	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Note the September travel blank from the Goose Area could not be analyzed for some parameters due to a handling error.

Appendix 3.4-1

Lake Sediment Quality Analytical Results, Back River Project, August 2012

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Appendix 3.4-1. Lake Sediment Quality Analytical Results, Back River Project, 2012

Area					Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location					Gander	Gander	Gander	Pond 19	Pond 19	Pond 19	Big	Big	Big	Rabbit	Rabbit	Rabbit	Fox	Fox	Fox	Echo	Echo	Echo
Depth (m):					2.4	2.4	2.4	1.4	1.5	1.5	5.0	5.0	5.0	3.6	3.6	3.6	5.8	5.8	5.8	0.6	0.6	0.4
Replicate:		CCME Guidelines for the Protection of Aquatic Life[a]		Realised Detection Limits (RDL[d])	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled:					18-Aug-12	18-Aug-12	18-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	16-Aug-12	16-Aug-12	16-Aug-12	15-Aug-12	15-Aug-12	15-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12	17-Aug-12	17-Aug-12	17-Aug-12
ALS Sample ID:	Units	ISQG[b]	PEL[c]		L1196505-7	L1196505-8	L1196505-9	L1198607-10	L1198607-11	L1198607-12	L1195586-10	L1195586-11	L1195586-12	L1195586-4	L1195586-5	L1195586-6	L1198607-7	L1198607-8	L1198607-9	L1196505-4	L1196505-5	L1196505-6
Physical Tests																						
Moisture	%			0.25	68.1	70.5	70.1	87.9	76.9	89.1	83.9	87.8	87.8	86.1	82.1	81.5	87.8	86.8	85.7	71.3	68.1	84.9
pH	pH			0.10	5.61	5.70	5.42	6.73	6.22	7.13	5.03	5.13	5.05	5.27	5.78	5.76	5.23	5.01	5.20	5.44	5.53	5.29
Particle Size																						
% Gravel (>2 mm)	%			0.10	<0.10	<0.10	<0.10	22.4	11.2	21.8	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
% Sand (2.0 mm - 0.063 mm)	%			0.10	0.78	0.64	0.69	46.6	53.3	40.6	11.0	11.2	10.7	6.96	8.45	11.0	11.3	20.1	18.6	7.88	5.89	8.64
% Silt (0.063 mm - 4 µm)	%			0.10	86.8	84.8	85.1	27.6	34.2	35.2	79.5	80.3	82.1	85.1	84.1	81.6	84.6	75.9	77.7	89.9	89.5	89.6
% Clay (<4 µm)	%			0.10	12.4	14.5	14.2	3.43	1.36	2.43	9.48	8.42	7.26	7.97	7.45	7.36	4.14	3.94	3.72	2.10	4.59	1.72
Texture					Silt	Silt	Silt	Sandy loam	Sandy loam	Sandy loam	Silt	Silt	Silt	Silt	Silt	Silt	Silt	Silt loam	Silt loam	Silt	Silt	Silt
Leachable Nutrients																						
Total Nitrogen by LECO	%			0.020	0.242	0.244	0.077	0.511	0.441	0.484	0.584	0.719	0.718	0.648	0.481	0.469	0.793	0.764	0.711	0.989	0.639	1.12
Plant Available Nutrients																						
Available Ammonium (as N)	mg/kg			1 - 2.4	33.6	17.0	30.2	14.4	11.1	11.5	-	-	-	18.0	8.4	9.4	29.7	23.4	24.7	-	23.0	-
Nitrate and Nitrite (as N)	mg/kg			2 - 6.0	-	-	-	-	<4.0	<4.0	-	-	-	-	-	-	-	<6.0	-	-	-	-
Nitrate (as N)	mg/kg			2 - 6.0	-	-	-	-	<4.0	<4.0	-	-	-	-	-	-	-	<6.0	-	-	-	-
Nitrite (as N)	mg/kg			0.4 - 1.2	-	-	-	-	<0.80	<0.80	-	-	-	-	-	-	-	<1.2	-	-	-	-
Available Phosphate (as P)	mg/kg			2 - 6.0	<4.0	17.9	17.6	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	8.1	9.7	4.1	4.4	5.0	<4.0	<4.0	<4.0
Cyanides																						
Cyanide, Weak Acid Dissociable	mg/kg			0.05	0.074	0.053	0.065	<0.050	<0.050	<0.050	0.138	0.105	0.089	0.119	0.093	0.096	0.123	0.135	0.119	0.091	<0.050	0.121
Cyanide, Total	mg/kg			0.05	0.194	0.180	0.176	0.144	0.067	0.127	0.297	0.350	0.349	0.304	0.236	0.158	0.376	0.404	0.359	0.196	0.136	0.360
Organic / Inorganic Carbon																						
Total Organic Carbon	%			0.10	3.04	2.87	0.70	7.19	6.10	6.76	7.16	8.51	8.61	7.58	5.78	5.49	10.2	9.46	9.04	15.0	9.51	15.2
Metals																						
Aluminum (Al)	mg/kg			50.0 - 100.0	12500	12600	12000	5660	6550	5760	9550	9560	9540	7540	7450	6910	7910	6970	7250	6480	7200	5560
Antimony (Sb)	mg/kg			0.10 - 0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	0.12	0.10	<0.10	0.13	0.16	0.14	0.15	<0.10	<0.10	<0.10
Arsenic (As)	mg/kg	5.9	17	0.050 - 0.10	9.57	9.25	8.50	3.35	3.27	3.83	26.8	29.4	27.6	24.9	15.1	11.6	19.5	16.7	16.7	14.9	10.1	23.4
Barium (Ba)	mg/kg			0.50 - 1.0	84.8	88.2	80.7	57.5	56.0	53.0	36.4	38.7	40.3	50.3	49.4	56.7	35.1	31.3	34.6	56.1	57.9	65.3
Beryllium (Be)	mg/kg			0.20 - 0.40	0.47	0.49	0.45	<0.20	<0.20	<0.20	0.34	0.31	0.31	0.29	0.26	0.23	0.30	0.27	0.26	0.22	0.24	0.21
Bismuth (Bi)	mg/kg			0.2 - 0.4	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg	0.6	3.5	0.050 - 0.10	0.182	0.170	0.167	0.149	0.117	0.126	0.283	0.239	0.290	0.382	0.471	0.516	0.331	0.251	0.290	0.270	0.195	0.216
Calcium (Ca)	mg/kg			50.0 - 100.0	2710	2730	2410	3670	3220	3230	1930	2190	2820	3000	3010	2710	2620	2280	2670	2840	3490	3210
Chromium (Cr)	mg/kg	37.3	90	0.50 - 1.0	41.7	41.5	40.5	18.2	21.5	19.3	30.4	29.1	30.0	26.9	24.7	23.2	23.9	20.7	21.3	27.7	29.6	24.8
Cobalt (Co)	mg/kg			0.10 - 0.20	15.8	16.5	14.6	5.24	5.82	4.97	15.4	17.5	16.9	15.5	13.2	13.0	26.7	21.9	22.3	14.0	13.6	18.5
Copper (Cu)	mg/kg	35.7	197	0.50 - 1.0	34.6	34.8	33.4	30.2	30.7	29.5	74.4	72.8	75.0	86.0	67.1	60.2	87.5	71.3	74.8	48.9	37.2	34.9
Iron (Fe)	mg/kg			50.0 - 100.0	18400	18200	17800	9560	10800	9460	20000	23800	22500	16900	12800	12000	26200	23100	23000	14300	15900	28100
Lead (Pb)	mg/kg	35	91.3	0.50 - 1.0	6.05	6.15	5.77	1.94	2.11	2.02	5.39	5.86	5.94	5.26	4.88	4.72	6.27	5.57	5.90	3.42	3.65	4.04
Lithium (Li)	mg/kg			5.0 - 10.0	21.6	21.7	20.9	11.8	13.5	12.0	13.0	13.0	13.0	10.8	11.2	10.9	8.0	8.1	8.0	7.8	9.7	6.4
Magnesium (Mg)	mg/kg			20.0 - 40.0	6680	6680	6350	4180	4680	4200	4110	3970	4100	4010	3920	3800	2820	2560	2640	2940	3940	2550
Manganese (Mn)	mg/kg			1.0 - 2.0	148	150	136	81.5	94.4	82.1	111	115	117	102	98.4	93.7	111	102	103	92.2	122	147
Mercury (Hg)	mg/kg	0.17	0.486	0.0050- 0.0210	0.0263	0.0256	0.0256	0.0161	0.0123	0.0138	0.0554	0.0676	0.0699	0.0213	0.0176	0.0428	0.0719	0.0646	0.0682	0.0356	0.0312	0.0433
Molybdenum (Mo)	mg/kg			0.50 - 1.0	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	1.39	1.24	1.23	1.52	1.27	0.92	0.87	0.73	0.79	0.52	0.51	0.62
Nickel (Ni)	mg/kg			0.50 - 1.0	68.9	71.3	66.5	61.0	56.2	55.4	59.9	61.2	61.1	106	91.9	91.5	84.2	69.2	71.2	44.9	36.8	43.3
Phosphorus (P)	mg/kg			50.0 - 100.0	697	677	714	438	468	403	575	632	682	552	555	507	721	697	648	492	600	618
Potassium (K)	mg/kg			100.0 - 200.0	1400	1380	1250	670	720	610	640	670	700	920	950	920	480	460	470	520	740	540
Selenium (Se)	mg/kg			0.20 - 0.40	0.22	<0.20	0.20	<0.20	<0.20	<0.20	0.48	0.47	0.43	0.66	0.48	0.41	0.61	0.52	0.56	0.36	0.26	0.30
Silver (Ag)	mg/kg			0.10 - 0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.18	0.17	0.17	<0.15	<0.10	<0.10	0.23	0.18	0.19	<0.10	<0.10	<0.10
Sodium (Na)	mg/kg			100.0 - 200.0	170	170	150	110	<100	<100	<100	100	110	150	150	130	<100	<100	<100	140	200	140
Strontium (Sr)	mg/kg			0.50 - 1.0	37.0	36.2	30.4	15.6	11.5	13.8	10.1	11.3	12.2	16.1	15.4	13.5	10.1	9.28	10.0	14.1	17.0	16.8
Sulphur (S)	mg/kg			500	1700	1400	500	2700	2800	3100	3300	3200	3700	7200	5900	5500	4200	3600	3700	3400	2700	3000
Thallium (Tl)	mg/kg			0.050 - 0.10	0.131	0.133	0.118	<0.050	0.062	<0.050	0.087	0.090	0.084	0.116	0.140	0.134	0.074	0.063	0.068	0.091	0.077	0.066
Tin (Sn)	mg/kg			2.0 - 4.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg			1.0 - 2.0	719	693	611	255	306	229	244	241	243	376	389	412	177	179	185	330	432	291
Uranium (U)	mg/kg			0.050 - 0.10	1.28	1.30	1.23	0.337	0.419	0.380	1.53	1.50	1.52	1.50	1.36	1.05	0.873	0.721	0.749	0.809	0.733	0.619
Vanadium (V)	mg/kg			0.20 - 0.40	39.8	39.8	37.7	13.7	17.0	13.8	29.4	28.9	29.1	33.5	30.9	28.3	27.3	24.1	25.5	37.9	38.5	35.0
Zinc (Zn)	mg/kg	123	315	1.0 - 2.0	71.1	71.0	68.2	52.1	44.9	46.8	64.3	62.1	62.7	75.1	85.8	101	64.2	52.5	55.4	56.6	51.2	49.6

Notes: Nutrient data could not be analyzed for some samples due to insufficient volume.

a) Canadian sediment quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment (accessed 2012)

b) ISQG = Interim Sediment Quality Guideline

c) PEL = Probable Effects Level

Appendix 3.4-1. Lake Sediment Quality Analytical Results, Back River Project, 2012

Area					Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location					Rascal	Rascal	Rascal	Giraffe North	Giraffe North	Giraffe North	Giraffe South	Giraffe South	Giraffe South	Goose Neck	Goose Neck	Goose Neck	Goose Central	Goose Central	Goose Central	Goose Tail	Goose Tail	Goose Tail
Depth (m):					2.8	2.8	2.8	3.7	3.7	3.7	7.3	7.3	7.3	3.0	3.0	3.0	4.5	4.5	4.5	2.8	2.8	2.8
Replicate:		CCME Guidelines for the Protection of Aquatic Life[a]		Realised Detection Limits	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled:					15-Aug-12	15-Aug-12	15-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	14-Aug-12	14-Aug-12	14-Aug-12	17-Aug-12	17-Aug-12	17-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12
ALS Sample ID:	Units	ISQG[b]	PEL[c]	(RDL[d])	L1195586-7	L1195586-8	L1195586-9	L1198607-4	L1198607-5	L1198607-6	L1198607-1	L1198607-2	L1198607-3	L1195586-1	L1195586-2	L1195586-3	L1196505-1	L1196505-2	L1196505-3	L1196505-10	L1196499-5	L1196499-6
Physical Tests																						
Moisture	%			0.25	80.9	83.8	83.3	88.8	88.8	87.3	72.7	76.8	71.6	85.2	87.8	87.1	86.0	86.0	86.5	64.4	55.7	63.9
pH	pH			0.10	5.73	5.87	5.86	5.70	5.58	5.63	5.49	5.45	5.55	5.85	6.02	5.60	6.01	6.07	5.91	5.98	5.91	6.21
Particle Size																						
% Gravel (>2 mm)	%			0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	2.11	1.52	11.7	0.26	<0.10	<0.10	0.52	<0.10	<0.10	<0.10	<0.10	1.73
% Sand (2.0 mm - 0.063 mm)	%			0.10	49.7	44.1	48.6	5.90	4.09	2.60	63.1	52.4	44.2	10.9	7.19	4.01	5.16	6.40	6.47	55.0	73.5	64.5
% Silt (0.063 mm - 4 µm)	%			0.10	45.9	50.8	46.9	82.5	83.6	87.2	33.2	44.0	40.9	79.7	80.3	84.9	83.8	85.8	87.0	43.5	24.4	31.6
% Clay (<4 µm)	%			0.10	4.34	5.11	4.52	11.6	12.3	10.2	1.60	2.10	3.28	9.17	12.5	11.1	10.5	7.76	6.49	1.54	2.09	2.12
Texture					Sandy loam	Sandy loam	Sandy loam	Silt	Silt	Silt	Sandy loam	Sandy loam	Sandy loam	Silt	Silt	Silt	Silt	Silt	Silt	Sandy loam	Loamy sand	Sandy loam
Leachable Nutrients																						
Total Nitrogen by LECO	%			0.020	0.481	0.533	0.464	0.865	0.851	0.896	0.184	0.287	0.300	0.637	0.668	0.771	0.536	0.542	0.639	0.174	0.097	0.125
Plant Available Nutrients																						
Available Ammonium (as N)	mg/kg			1 - 2.4	6.1	7.7	8.8	20.4	14.5	18.1	11.0	15.6	5.4	26.1	18.2	52.8	-	-	-	5.5	2.7	5.5
Nitrate and Nitrite (as N)	mg/kg			2 - 6.0	-	-	-	<4.0	<6.0	-	<2.0	<2.0	<2.0	-	-	-	-	-	-	-	-	-
Nitrate (as N)	mg/kg			2 - 6.0	-	-	-	<4.0	<6.0	-	<2.0	<2.0	<2.0	-	-	-	-	-	-	-	-	-
Nitrite (as N)	mg/kg			0.4 - 1.2	-	-	-	<0.80	<1.2	-	<0.40	<0.40	<0.40	-	-	-	-	-	-	-	-	-
Available Phosphate (as P)	mg/kg			2 - 6.0	<4.0	4.7	4.4	5.0	5.0	6.5	3.1	<2.0	4.0	7.0	8.8	16.2	8.3	8.3	9.0	4.4	<4.0	6.7
Cyanides																						
Cyanide, Weak Acid Dissociable	mg/kg			0.05	0.057	0.067	0.071	0.138	0.142	0.127	0.052	0.121	0.054	0.085	0.094	0.173	<0.050	<0.050	0.141	<0.050	<0.050	<0.050
Cyanide, Total	mg/kg			0.05	0.123	0.151	0.137	0.453	0.411	0.403	0.191	0.244	0.217	0.304	0.378	0.468	0.292	0.310	0.346	0.094	0.070	0.086
Organic / Inorganic Carbon																						
Total Organic Carbon	%			0.10	5.67	6.49	5.53	11.3	11.6	12.1	3.09	4.41	4.78	7.61	8.05	9.40	6.15	6.41	7.25	1.94	1.00	1.42
Metals																						
Aluminum (Al)	mg/kg			50.0 - 100.0	3860	4110	3640	10600	11000	8700	6350	6390	7160	9620	11500	11300	10600	10500	9620	6290	4510	4750
Antimony (Sb)	mg/kg			0.10 - 0.20	<0.10	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	<0.10	0.13	0.14	<0.20	<0.10	0.11	<0.10	<0.10	<0.10	<0.10
Arsenic (As)	mg/kg	5.9	17	0.050 - 0.10	3.61	3.42	3.15	12.2	14.1	10.9	8.76	11.5	12.9	29.1	17.1	30.2	11.5	10.7	12.1	5.41	4.33	3.35
Barium (Ba)	mg/kg			0.50 - 1.0	30.8	31.8	27.5	54.6	58.1	47.5	29.8	29.3	34.1	58.9	73.3	65.5	64.2	63.7	62.1	43.0	22.0	31.5
Beryllium (Be)	mg/kg			0.20 - 0.40	<0.20	<0.20	<0.20	0.64	0.71	0.54	0.33	0.35	0.43	0.54	0.66	0.65	0.55	0.53	0.46	0.27	<0.20	<0.20
Bismuth (Bi)	mg/kg			0.2 - 0.4	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.40	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg	0.6	3.5	0.050 - 0.10	0.182	0.156	0.150	0.478	0.581	0.404	0.180	0.181	0.137	0.313	0.385	0.37	0.249	0.289	0.294	0.122	<0.050	0.093
Calcium (Ca)	mg/kg			50.0 - 100.0	1680	1830	1760	3370	3090	2620	1780	1860	1900	2570	3210	2760	3050	2690	2890	2230	1270	1550
Chromium (Cr)	mg/kg	37.3	90	0.50 - 1.0	12.4	13.0	11.4	24.4	25.5	20.6	16.1	15.2	19.5	27.3	33.2	32.9	29.3	29.6	26.9	18.3	12.2	13.7
Cobalt (Co)	mg/kg			0.10 - 0.20	3.32	3.53	3.10	15.3	16.0	13.1	12.4	13.5	17.2	36.5	21.9	33.4	14.1	15.6	14.3	7.89	4.34	5.89
Copper (Cu)	mg/kg	35.7	197	0.50 - 1.0	36.6	38.3	34.1	115	122	97.0	41.5	41.8	59.8	77.3	95.2	97.0	84.9	86.8	80.1	38.4	19.3	23.2
Iron (Fe)	mg/kg			50.0 - 100.0	7320	7510	6420	14700	14900	11900	14400	15500	32000	35200	23900	31400	22800	20700	24600	8880	7660	7500
Lead (Pb)	mg/kg	35	91.3	0.50 - 1.0	2.88	3.00	2.61	5.00	5.11	4.43	2.80	2.83	3.18	5.51	6.63	6.4	5.39	5.44	5.29	3.41	1.99	2.32
Lithium (Li)	mg/kg			5.0 - 10.0	5.5	5.8	5.3	10.1	10.2	7.8	9.7	9.5	8.9	10.5	12.7	12	11.0	11.0	9.6	9.9	7.5	7.6
Magnesium (Mg)	mg/kg			20.0 - 40.0	1630	1710	1530	2850	2950	2270	2870	2690	2850	2990	3700	3780	3220	3270	2970	2700	1950	2140
Manganese (Mn)	mg/kg			1.0 - 2.0	42.8	44.6	38.5	69.2	71.3	55.3	76.3	74.7	92.8	436	178	150	135	163	161	77.1	62.4	64.3
Mercury (Hg)	mg/kg	0.17	0.486	0.0050- 0.0210	0.0415	0.0439	0.0389	0.0909	0.0889	0.0816	0.0384	0.0499	0.0436	0.0715	0.079	0.079	0.0722	0.0694	0.0795	0.0248	0.0139	0.0226
Molybdenum (Mo)	mg/kg			0.50 - 1.0	<0.50	<0.50	<0.50	0.90	1.02	0.74	<0.50	<0.50	0.56	1.18	1.35	1.5	1.02	0.96	0.98	<0.50	<0.50	<0.50
Nickel (Ni)	mg/kg			0.50 - 1.0	30.6	33.4	30.0	121	127	108	58.4	57.4	67.1	74.1	76.2	97.6	58.6	58.6	54.3	35.7	17.8	23.2
Phosphorus (P)	mg/kg			50.0 - 100.0	315	314	309	599	579	502	485	512	585	609	750	850	615	610	647	550	326	358
Potassium (K)	mg/kg			100.0 - 200.0	320	330	290	630	660	510	470	440	450	630	850	1000	670	660	660	620	390	430
Selenium (Se)	mg/kg			0.20 - 0.40	0.24	0.25	0.22	0.57	0.65	0.48	0.22	0.25	0.29	0.49	0.50	0.59	0.48	0.49	0.45	0.22	<0.20	<0.20
Silver (Ag)	mg/kg			0.10 - 0.20	<0.10	<0.10	<0.10	0.26	0.28	0.23	0.11	0.11	0.15	0.15	0.17	<0.20	0.18	0.18	0.19	<0.10	<0.10	<0.10
Sodium (Na)	mg/kg			100.0 - 200.0	<100	<100	<100	120	100	<100	<100	<100	<100	<100	130	<200	110	110	120	<100	<100	<100
Strontium (Sr)	mg/kg			0.50 - 1.0	9.90	10.7	9.81	18.3	18.6	15.5	8.95	8.85	9.89	15.8	19.8	20.0	19.0	17.7	18.6	13.0	7.50	8.74
Sulphur (S)	mg/kg			500	2200	2500	2000	4700	5200	5400	3000	2500	2300	2700	3000	3600	2600	2600	2700	1100	900	1100
Thallium (Tl)	mg/kg			0.050 - 0.10	<0.050	<0.050	<0.050	0.090	0.106	0.076	0.061	0.061	<0.050	0.091	0.099	0.10	0.074	0.077	0.075	<0.050	<0.050	<0.050
Tin (Sn)	mg/kg			2.0 - 4.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<4.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg			1.0 - 2.0	157	161	139	212	215	174	241	224	264	210	331	405	242	241	230	289	216	232
Uranium (U)	mg/kg			0.050 - 0.10	0.455	0.511	0.443	1.98	2.13	1.70	0.781	0.745	1.00	1.50	1.73	1.89	1.44	1.43	1.32	0.936	0.550	0.572
Vanadium (V)	mg/kg			0.20 - 0.40	13.2	13.5	12.1	24.5	26.0	20.8	21.1	20.5	23.7	29.0	35.5	36.2	31.5	31.1	29.1	19.6	14.9	15.7
Zinc (Zn)	mg/kg	123	315	1.0 - 2.0	40.2	33.9	32.1	90.5	109	80.5	45.1	41.6	61.6	84.1	98.6	106	67.6	69.8	64.5	43.2	24.4	30.9

Notes: Nutrient data could not be analyzed for some samples due to insufficient volume.

a) Canadian sediment quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment (accessed 2012)

b) ISQG = Interim Sediment Quality Guideline

c) PEL = Probable Effects Level

Appendix 3.4-1. Lake Sediment Quality Analytical Results, Back River Project, 2012

Area					George	George	George	George	George	George	George	George	George	George	George	George	George	George	George	George	George
Location					Lower Long	Fold	Fold	Fold	Central	Central	Central	South	South	South	Lytle	Lytle	Lytle	Occurrence	Occurrence	Occurrence	Sleigh	Sleigh	Sleigh
Depth (m):					5.2	9.8	9.8	9.8	14.5	14.5	14.5	1.6	1.6	1.6	1.4	1.4	1.4	1.4	1.4	1.4	1.2	1.2	1.2
Replicate:					3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled:		CCME Guidelines for the Protection of Aquatic Life[a]		Realised Detection Limits	21-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	23-Aug-12	23-Aug-12	23-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	22-Aug-12	22-Aug-12	22-Aug-12
ALS Sample ID:	Units	ISQG[b]	PEL[c]	(RDL[d])	L1199578-3	L1197332-7	L1197332-8	L1197332-9	L1197332-4	L1197332-5	L1197332-6	L1197332-1	L1197332-2	L1197332-3	L1199578-16	L1199578-17	L1199578-18	L1199578-7	L1199578-8	L1199578-9	L1199578-13	L1199578-14	L1199578-15
Physical Tests																							
Moisture	%			0.25	89.0	61.7	65.6	74.3	29.9	40.0	41.8	26.8	24.2	27.3	48.4	47.7	52.1	59.4	54.1	55.9	25.5	17.2	21.9
pH	pH			0.10	6.37	6.14	5.82	5.74	6.83	6.44	6.11	6.84	6.71	6.87	6.22	6.08	6.32	6.09	6.02	6.07	6.22	5.91	6.20
Particle Size																							
% Gravel (>2 mm)	%			0.10	<0.10	<0.10	<0.10	<0.10	0.78	0.72	<0.10	3.12	4.60	5.39	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.58	0.35	0.85
% Sand (2.0 mm - 0.063 mm)	%			0.10	1.34	4.60	3.25	7.62	80.9	76.3	78.2	95.9	94.4	93.7	0.31	0.23	0.22	0.43	0.17	0.28	80.1	72.5	85.3
% Silt (0.063 mm - 4 µm)	%			0.10	83.5	85.4	86.9	83.7	17.3	21.7	20.7	0.72	0.74	0.64	87.5	85.4	87.2	80.5	80.1	78.4	18.5	26.5	12.8
% Clay (<4 µm)	%			0.10	15.2	9.98	9.84	8.71	0.97	1.29	1.08	0.28	0.24	0.26	12.2	14.4	12.6	19.1	19.8	21.3	0.85	0.62	1.07
Texture					Silt	Silt	Silt	Silt	Sand	Loamy sand	Loamy sand	Sand	Sand	Sand	Silt	Silt	Silt	Silt	Silt	Silt	Loamy sand	Loamy sand	Sand
Leachable Nutrients																							
Total Nitrogen by LECO	%			0.020	0.616	0.194	0.212	0.294	0.044	0.049	0.048	0.024	0.021	0.024	0.187	0.170	0.197	0.197	0.230	0.200	0.024	0.024	0.020
Plant Available Nutrients																							
Available Ammonium (as N)	mg/kg			1 - 2.4	6.5	5.5	9.8	9.2	3.0	3.6	2.7	1.2	<1.0	1.0	12.4	10.9	13.2	3.5	5.5	3.7	<1.0	<1.0	<1.0
Nitrate and Nitrite (as N)	mg/kg			2 - 6.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<2.0	<2.0	<2.0	<2.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<2.0	<2.0	<2.0
Nitrate (as N)	mg/kg			2 - 6.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<2.0	<2.0	<2.0	<2.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<2.0	<2.0	<2.0
Nitrite (as N)	mg/kg			0.4 - 1.2	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.40	<0.40	<0.40	<0.40	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.40	<0.40	<0.40
Available Phosphate (as P)	mg/kg			2 - 6.0	10.7	36.2	13.0	10.6	<2.0	<2.0	8.2	<2.0	<2.0	<2.0	4.5	<4.0	4.4	8.8	8.1	11.2	<2.0	<2.0	<2.0
Cyanides																							
Cyanide, Weak Acid Dissociable	mg/kg			0.05	0.077	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.085	0.095	0.126	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Cyanide, Total	mg/kg			0.05	0.185	0.126	0.137	0.166	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.139	0.220	0.131	0.077	0.083	0.075	<0.050	<0.050	<0.050
Organic / Inorganic Carbon																							
Total Organic Carbon	%			0.10	7.85	1.81	2.07	3.04	0.37	0.48	0.46	0.20	0.18	0.20	2.37	2.14	2.47	2.07	2.53	2.18	0.22	0.23	0.18
Metals																							
Aluminum (Al)	mg/kg			50.0 - 100.0	13100	11700	11300	10500	8130	8540	8420	15900	14000	14500	17400	17400	17700	32300	34000	33500	10200	7730	10600
Antimony (Sb)	mg/kg			0.10 - 0.20	0.27	0.16	0.19	0.27	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	<0.10	0.11	<0.10	0.17	<0.10	0.16
Arsenic (As)	mg/kg	5.9	17	0.050 - 0.10	28.9	38.7	263	542	33.7	31.8	55.6	20.0	16.7	17.8	40.2	38.6	51.0	55.1	53.8	48.8	12.3	13.7	15.7
Barium (Ba)	mg/kg			0.50 - 1.0	47.0	57.1	76.7	97.3	15.0	19.9	41.5	11.0	10.2	9.45	58.6	56.7	59.9	143	145	144	13.0	11.4	13.7
Beryllium (Be)	mg/kg			0.20 - 0.40	0.71	0.33	0.33	0.37	<0.20	0.21	0.22	0.24	0.23	0.21	0.50	0.54	0.56	0.97	1.06	1.07	<0.20	<0.20	<0.20
Bismuth (Bi)	mg/kg			0.2 - 0.4	0.35	<0.20	0.20	0.22	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.21	0.21	0.22	0.38	0.39	0.38	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg	0.6	3.5	0.050 - 0.10	0.587	0.292	0.341	0.467	0.123	0.157	0.203	<0.050	<0.050	<0.050	0.212	0.178	0.234	0.272	0.326	0.289	<0.050	<0.050	<0.050
Calcium (Ca)	mg/kg			50.0 - 100.0	2480	2310	2050	2260	586	635	643	878	886	805	2290	2230	2310	3160	3330	3410	1330	1270	1340
Chromium (Cr)	mg/kg	37.3	90	0.50 - 1.0	38.9	41.0	40.0	36.2	30.4	30.0	30.1	62.0	54.5	55.2	64.7	64.9	66.0	121	125	124	37.0	29.5	40.0
Cobalt (Co)	mg/kg			0.10 - 0.20	10.7	18.3	30.2	49.4	54.1	58.9	104	14.5	14.5	14.1	46.6	42.4	49.6	51.1	53.5	52.1	7.87	6.17	7.21
Copper (Cu)	mg/kg	35.7	197	0.50 - 1.0	108	62.2	78.0	101	23.0	33.0	34.5	14.3	13.3	12.7	45.2	46.4	48.3	111	111	112	18.3	15.8	17.8
Iron (Fe)	mg/kg			50.0 - 100.0	20500	22100	42700	86600	18800	18000	24900	27800	24800	25100	29700	30100	32700	48700	49200	49200	17800	14700	18600
Lead (Pb)	mg/kg	35	91.3	0.50 - 1.0	8.76	5.92	6.20	6.72	1.80	2.23	2.38	1.68	1.70	1.76	7.15	7.11	7.26	12.1	12.0	11.7	3.20	2.65	3.31
Lithium (Li)	mg/kg			5.0 - 10.0	18.6	21.2	19.7	17.7	18.4	18.9	18.1	38.4	35.1	36.7	34.6	34.8	35.5	66.4	66.2	68.8	23.7	17.2	25.5
Magnesium (Mg)	mg/kg			20.0 - 40.0	6070	7390	7070	6180	5660	5670	5680	11800	10400	10700	11000	11100	11500	20000	20700	20800	7080	5680	7270
Manganese (Mn)	mg/kg			1.0 - 2.0	171	542	1910	1530	1870	1740	4000	339	331	320	299	296	310	497	509	507	176	137	182
Mercury (Hg)	mg/kg	0.17	0.486	0.0050- 0.0210	0.0488	0.0305	0.0333	0.0492	<0.0050	0.0078	0.0084	<0.0050	<0.0050	<0.0050	0.0150	0.0136	0.0140	0.0191	0.0215	0.0219	<0.0050	<0.0050	<0.0050
Molybdenum (Mo)	mg/kg			0.50 - 1.0	2.01	1.54	2.24	3.91	0.69	0.68	0.99	<0.50	<0.50	<0.50	0.70	0.72	0.73	0.89	0.93	0.94	0.51	<0.50	0.65
Nickel (Ni)	mg/kg			0.50 - 1.0	47.9	57.2	66.8	72.3	53.6	64.5	70.5	50.8	46.9	47.5	93.7	85.1	102	130	142	136	26.4	20.7	25.2
Phosphorus (P)	mg/kg			50.0 - 100.0	560	658	1250	2040	206	254	286	255	248	237	489	467	457	481	514	453	367	343	346
Potassium (K)	mg/kg			100.0 - 200.0	850	1040	990	870	260	320	340	510	420	400	1190	1170	1150	2740	3050	2970	400	330	440
Selenium (Se)	mg/kg			0.20 - 0.40	0.56	0.26	0.40	0.62	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.26	0.30	0.30	<0.20	<0.20	<0.20
Silver (Ag)	mg/kg			0.10 - 0.20	0.23	0.14	0.16	0.17	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.14	0.13	0.17	0.20	0.23	0.21	0.24	<0.20	0.11
Sodium (Na)	mg/kg			100.0 - 200.0	<100	130	130	110	<100	<100	<100	<100	<100	<100	150	140	130	190	210	220	<100	<100	<100
Strontium (Sr)	mg/kg			0.50 - 1.0	8.86	10.6	11.5	12.2	3.17	3.66	4.87	3.87	3.77	3.57	11.9	11.3	12.0	19.3	20.8	21.4	5.33	5.15	5.34
Sulphur (S)	mg/kg			500	3300	1200	1400	1400	<500	<500	<500	<500	<500	<500	2200	1700	2100	1300	1400	1400	<500	<500	<500
Thallium (Tl)	mg/kg			0.050 - 0.10	0.067	0.100	0.113	0.189	<0.050	0.053	0.073	<0.050	<0.050	<0.050	0.101	0.098	0.105	0.210	0.212	0.209	<0.050	<0.050	<0.050
Tin (Sn)	mg/kg			2.0 - 4.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg			1.0 - 2.0	174	405	377	290	184	196	187	328	350	296	643	643	625	1180	1280	1300	304	283	310
Uranium (U)	mg/kg			0.050 - 0.10	2.84	1.12	1.23	1.30	0.446	0.476	0.511	0.483	0.473	0.470	1.10	1.10	1.13	1.91	2.16	2.10	0.600	0.518	0.558
Vanadium (V)	mg/kg			0.20 - 0.40	29.5	30.6	30.8	28.9	17.0	17.7	17.8	31.2	29.2	29.1	43.1	44.1	44.4	83.5	88.0	87.2	22.6	18.8	22.7
Zinc (Zn)	mg/kg	123	315	1.0 - 2.0	75.8	82.8	94.3	116	52.1	64.7	69.7	66.7	59.9	61.8	146	142	156	252	267	265	39.1	30.5	38.4

Notes: Nutrient data could not be analyzed for some samples due to insufficient volume.

a) Canadian sediment quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment (accessed 2012)

b) ISQG = Interim Sediment Quality Guideline

c) PEL = Probable Effects Level

Appendix 3.4-1. Lake Sediment Quality Analytical Results, Back River Project, 2012

Area					George	George	George	George	George	George	George	George	George
Location					Dragon	Dragon	Dragon	Komatic	Komatic	Komatic	Reference C	Reference C	Reference C
Depth (m):					3.4	3.4	3.4	7.0	7.0	7.0	35	35	35
Replicate:		CCME Guidelines for the		Realised	1	2	3	1	2	3	1	2	3
Date Sampled:		Protection of Aquatic Life[a]		Detection Limits	20-Aug-12	20-Aug-12	20-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	22-Aug-12	22-Aug-12	22-Aug-12
ALS Sample ID:	Units	ISQG[b]	PEL[c]	(RDL[d])	L1197332-10	L1197332-11	L1197332-12	L1199578-4	L1199578-5	L1199578-6	L1199578-10	L1199578-11	L1199578-12
Physical Tests													
Moisture	%			0.25	72.0	75.1	79.9	81.2	80.1	81.2	85.0	82.3	84.9
pH	pH			0.10	6.64	6.77	6.71	6.22	6.12	6.04	6.45	6.59	6.31
Particle Size													
% Gravel (>2 mm)	%			0.10	2.43	11.6	26.4	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
% Sand (2.0 mm - 0.063 mm)	%			0.10	13.2	23.4	12.5	2.08	2.54	2.42	0.94	1.80	1.61
% Silt (0.063 mm - 4 µm)	%			0.10	72.0	60.0	54.8	85.2	86.7	85.9	86.5	87.2	86.3
% Clay (<4 µm)	%			0.10	12.4	5.05	6.31	12.7	10.8	11.7	12.6	11.0	12.1
Texture					Silt loam / Silt	Silt loam	Silt loam	Silt	Silt	Silt	Silt	Silt	Silt
Leachable Nutrients													
Total Nitrogen by LECO	%			0.020	0.287	0.307	0.420	0.514	0.506	0.534	0.663	0.505	0.697
Plant Available Nutrients													
Available Ammonium (as N)	mg/kg			1 - 2.4	12.8	11.6	18.9	20.9	23.3	19.2	5.3	4.6	7.6
Nitrate and Nitrite (as N)	mg/kg			2 - 6.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Nitrate (as N)	mg/kg			2 - 6.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Nitrite (as N)	mg/kg			0.4 - 1.2	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80
Available Phosphate (as P)	mg/kg			2 - 6.0	4.7	3.3	3.1	<4.0	<4.0	<4.0	6.6	54.8	9.1
Cyanides													
Cyanide, Weak Acid Dissociable	mg/kg			0.05	0.081	<0.050	<0.050	0.092	0.110	0.080	<0.050	<0.050	<0.050
Cyanide, Total	mg/kg			0.05	0.138	0.094	0.119	0.281	0.274	0.273	0.153	0.100	0.124
Organic / Inorganic Carbon													
Total Organic Carbon	%			0.10	3.41	3.72	5.11	5.88	5.79	5.99	6.57	5.11	7.14
Metals													
Aluminum (Al)	mg/kg			50.0 - 100.0	15200	10800	10900	14500	15100	15200	10200	10900	10200
Antimony (Sb)	mg/kg			0.10 - 0.20	0.30	0.40	0.39	0.24	0.24	0.24	0.29	0.26	0.30
Arsenic (As)	mg/kg	5.9	17	0.050 - 0.10	52.2	82.4	57.3	345	298	391	14.2	4.35	14.9
Barium (Ba)	mg/kg			0.50 - 1.0	63.1	42.2	48.2	73.6	68.9	73.8	236	140	332
Beryllium (Be)	mg/kg			0.20 - 0.40	0.34	0.38	0.40	0.61	0.62	0.59	0.69	0.74	0.70
Bismuth (Bi)	mg/kg			0.2 - 0.4	0.20	<0.20	<0.20	0.32	0.35	0.34	0.37	0.36	0.38
Cadmium (Cd)	mg/kg	0.6	3.5	0.050 - 0.10	0.377	0.432	0.472	0.664	0.735	0.673	0.403	0.359	0.533
Calcium (Ca)	mg/kg			50.0 - 100.0	2890	2560	2640	2980	3320	3300	4180	3590	4260
Chromium (Cr)	mg/kg	37.3	90	0.50 - 1.0	50.7	36.2	36.4	51.2	53.0	53.4	26.3	28.2	25.8
Cobalt (Co)	mg/kg			0.10 - 0.20	29.9	23.2	24.6	65.7	55.0	62.2	10.5	6.48	11.0
Copper (Cu)	mg/kg	35.7	197	0.50 - 1.0	71.1	92.3	107	126	135	135	91.3	103	97.6
Iron (Fe)	mg/kg			50.0 - 100.0	25400	22400	22200	65800	59800	69500	24200	15100	23200
Lead (Pb)	mg/kg	35	91.3	0.50 - 1.0	6.52	6.27	6.91	10.2	9.26	9.12	6.39	4.46	6.70
Lithium (Li)	mg/kg			5.0 - 10.0	30.9	20.4	20.2	25.5	26.4	25.7	16.5	17.3	16.5
Magnesium (Mg)	mg/kg			20.0 - 40.0	9210	6270	6270	7610	7960	7900	6130	6210	5910
Manganese (Mn)	mg/kg			1.0 - 2.0	226	192	190	1390	700	1100	1270	283	2400
Mercury (Hg)	mg/kg	0.17	0.486	0.0050- 0.0210	0.0188	0.0228	0.0281	0.0660	0.0736	0.0690	0.0951	0.0556	0.102
Molybdenum (Mo)	mg/kg			0.50 - 1.0	1.80	2.20	2.10	3.41	3.31	3.40	0.75	<0.50	0.92
Nickel (Ni)	mg/kg			0.50 - 1.0	121	94.0	99.0	156	144	146	25.5	22.9	27.0
Phosphorus (P)	mg/kg			50.0 - 100.0	520	480	501	797	826	826	855	785	845
Potassium (K)	mg/kg			100.0 - 200.0	1520	730	760	770	800	870	890	1000	1030
Selenium (Se)	mg/kg			0.20 - 0.40	0.38	0.35	0.38	0.70	0.73	0.77	0.94	1.02	1.02
Silver (Ag)	mg/kg			0.10 - 0.20	0.11	0.14	0.16	0.27	0.29	0.28	0.15	0.15	0.15
Sodium (Na)	mg/kg			100.0 - 200.0	130	<100	110	150	120	130	110	110	120
Strontium (Sr)	mg/kg			0.50 - 1.0	11.3	8.49	8.58	14.8	15.7	15.9	6.77	7.16	7.35
Sulphur (S)	mg/kg			500	4800	2000	3000	3600	3300	2600	2000	1700	2100
Thallium (Tl)	mg/kg			0.050 - 0.10	0.141	0.108	0.106	0.130	0.128	0.130	0.085	0.069	0.100
Tin (Sn)	mg/kg			2.0 - 4.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg			1.0 - 2.0	566	302	272	340	349	372	173	209	189
Uranium (U)	mg/kg			0.050 - 0.10	1.42	1.28	1.38	1.82	1.86	1.85	6.28	7.08	6.58
Vanadium (V)	mg/kg			0.20 - 0.40	37.1	29.5	28.3	40.1	42.1	42.4	28.7	28.3	29.7
Zinc (Zn)	mg/kg	123	315	1.0 - 2.0	102	130	143	175	178	176	64.8	55.9	68.6

Notes: Nutrient data could not be analyzed for some samples due to insufficient volume.

a) Canadian sediment quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment (accessed 2012)

b) ISQG = Interim Sediment Quality Guideline

c) PEL = Probable Effects Level

Appendix 3.5-1

Stream Sediment Quality Analytical Results, Back River Project, August 2012

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Appendix 3.5-1. Stream Sediment Quality Analytical Results, Back River Project, 2012

Area				Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location				Moby OF	Moby OF	Moby OF	Gander IF	Gander IF	Gander IF	Gander US	Gander US	Gander US	Pond 19 OF	Pond 19 OF	Pond 19 OF
Replicate:				1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled:				12-Aug-12	12-Aug-12	12-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	13-Aug-12	13-Aug-12	13-Aug-12
ALS Sample ID:		CCME Guidelines for the Protection of Aquatic Life[a]		Realised Detection Limits (RDL)	MN-01-OF 1	MN-01-OF 2	MN-01-OF 3	MN-02-0F 1	MN-02-0F 2	MN-02-0F 3	MN-02-US 1	MN-02-US 2	MN-02-US 3	POND 19 OF 1	POND 19 OF 2	POND 19 OF 3
ALS Sample ID #:	Units	ISQG[b]	PEL[c]		L1193089-1	L1193089-2	L1193089-3	L1192524-7	L1192524-8	L1192524-9	L1192524-10	L1192524-11	L1192524-12	L1193085-1	L1193085-2	L1193085-3
Physical Tests																
Moisture	%			0.25	13.7	22.4	20.1	14.6	21.6	20.3	11.9	4.23	16.2	21.4	30.7	16.7
pH	pH			0.10	5.71	6.05	5.61	6.11	5.82	5.55	6.47	6.50	6.42	6.07	6.00	6.55
Particle Size																
% Gravel (>2 mm)	%			0.10	22.1	17.7	9.73	4.93	0.35	1.12	42.8	29.9	30.0	19.5	39.9	21.0
% Sand (2.0 mm - 0.063 mm)	%			0.10	67.6	75.1	76.9	91.5	91.6	90.7	56.6	69.6	69.1	66.6	50.9	67.6
% Silt (0.063 mm - 4 µm)	%			0.10	9.90	7.00	12.9	2.82	6.70	6.73	<0.10	0.17	0.36	13.2	8.48	10.6
% Clay (<4 µm)	%			0.10	0.40	0.22	0.44	0.77	1.38	1.42	0.53	0.37	0.59	0.75	0.70	0.84
Texture					Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Loamy sand	Sand / Loamy	Sand
Leachable Nutrients																
Total Nitrogen by LECO	%			0.020	0.022	<0.020	0.020	<0.020	0.022	<0.020	<0.020	<0.020	<0.020	0.045	0.031	0.044
Plant Available Nutrients																
Available Ammonium (as N)	mg/kg			1 - 4.0	1.7	1.1	1.3	3.9	4.2	4.3	<1.6	<1.0	1.2	2.4	2.0	1.7
Nitrate and Nitrite (as N)	mg/kg			0.5 - 6.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.50	<0.50	<0.50
Nitrate (as N)	mg/kg			0.5 - 6.1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.50	<0.50	<0.50
Nitrite (as N)	mg/kg			0.4 - 1.2	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.50	<0.50	<0.50
Available Phosphate (as P)	mg/kg			2 - 8.0	<2.0	2.3	<2.0	<2.0	2.4	2.3	<4.0	<2.0	<2.0	<2.0	<2.0	<2.0
Cyanides																
Cyanide, Weak Acid Dissociable	mg/kg			0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Cyanide, Total	mg/kg			0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Organic / Inorganic Carbon																
Total Organic Carbon	%			0.10	0.39	0.19	0.28	0.23	0.39	0.28	<0.10	<0.10	0.16	0.64	0.42	0.62
Metals																
Aluminum (Al)	mg/kg			50	4520	6480	3970	4750	3770	4510	6180	6920	6070	7830	9660	9780
Antimony (Sb)	mg/kg			0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Arsenic (As)	mg/kg	5.9	17	0.050	3.61	5.02	3.23	4.23	3.65	3.18	8.89	7.75	8.79	2.70	3.23	2.82
Barium (Ba)	mg/kg			0.50	17.1	15.3	16.8	15.6	15.5	17.7	24.0	21.5	19.2	24.4	16.6	19.9
Beryllium (Be)	mg/kg			0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Bismuth (Bi)	mg/kg			0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg	0.6	3.5	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Calcium (Ca)	mg/kg			50	1340	882	1250	812	980	824	1300	1430	928	1300	1350	1260
Chromium (Cr)	mg/kg	37.3	90	0.50	13.9	21.5	12.4	14.9	11.5	14.4	20.7	22.9	21.0	27.8	32.1	31.2
Cobalt (Co)	mg/kg			0.10	3.38	4.21	2.97	3.23	3.06	3.30	6.10	5.34	6.44	4.26	5.14	4.96
Copper (Cu)	mg/kg	35.7	197	0.50	5.74	5.39	5.32	4.45	4.65	4.86	6.65	5.42	7.40	10.9	8.45	10.8
Iron (Fe)	mg/kg			50	8230	11800	6910	8670	6850	7680	12400	12900	11800	12100	15800	15000
Lead (Pb)	mg/kg	35	91.3	0.50	1.63	1.16	1.71	1.06	1.32	1.19	1.90	1.40	1.47	1.79	1.63	2.11
Lithium (Li)	mg/kg			5.0	9.6	14.9	8.3	11.1	8.4	10.7	14.4	15.3	14.8	17.1	21.2	22.5
Magnesium (Mg)	mg/kg			20	3050	4890	2580	3460	2470	3140	4660	5190	4790	5870	7430	6890
Manganese (Mn)	mg/kg			1.0	80.8	109	69.3	68.6	56.1	64.0	122	129	128	126	161	154
Mercury (Hg)	mg/kg	0.17	0.486	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0066	<0.0050	0.0068
Molybdenum (Mo)	mg/kg			0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Nickel (Ni)	mg/kg			0.50	12.4	15.6	12.7	11.1	9.90	11.4	13.8	13.5	13.9	20.9	20.9	20.9
Phosphorus (P)	mg/kg			50	384	270	360	238	245	217	300	359	297	244	273	274
Potassium (K)	mg/kg			100	340	270	250	380	290	320	680	650	460	470	400	360

Appendix 3.5-1. Stream Sediment Quality Analytical Results, Back River Project, 2012

Area					Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location					Moby OF	Moby OF	Moby OF	Gander IF	Gander IF	Gander IF	Gander US	Gander US	Gander US	Pond 19 OF	Pond 19 OF	Pond 19 OF
Replicate:					1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled:					12-Aug-12	12-Aug-12	12-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	13-Aug-12	13-Aug-12	13-Aug-12
ALS Sample ID:		CCME Guidelines for the Protection of Aquatic Life[a]		Realised Detection Limits (RDL)	MN-01-OF 1	MN-01-OF 2	MN-01-OF 3	MN-02-0F 1	MN-02-0F 2	MN-02-0F 3	MN-02-US 1	MN-02-US 2	MN-02-US 3	POND 19 OF 1	POND 19 OF 2	POND 19 OF 3
ALS Sample ID #:	Units	ISQG[b]	PEL[c]		L1193089-1	L1193089-2	L1193089-3	L1192524-7	L1192524-8	L1192524-9	L1192524-10	L1192524-11	L1192524-12	L1193085-1	L1193085-2	L1193085-3
Selenium (Se)	mg/kg			0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Silver (Ag)	mg/kg			0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	mg/kg			100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Strontium (Sr)	mg/kg			0.50	5.45	3.96	5.75	3.66	4.66	4.17	5.67	5.43	4.02	4.87	5.70	4.89
Sulphur (S)	mg/kg			500	<500	<500	<500	<500	<500	<500	<500	<500	<500	700	600	700
Thallium (Tl)	mg/kg			0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Tin (Sn)	mg/kg			2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg			1.0	258	150	243	181	194	192	298	260	193	413	371	299
Uranium (U)	mg/kg			0.050	0.438	0.317	0.510	0.216	0.259	0.242	0.398	0.304	0.319	0.381	0.393	0.368
Vanadium (V)	mg/kg			0.20	15.2	15.9	12.7	12.4	11.6	12.3	18.9	18.5	17.2	19.9	24.4	20.3
Zinc (Zn)	mg/kg	123	315	1.0	18.3	24.1	16.2	17.8	15.3	17.2	23.5	24.9	23.4	30.0		34.5

Note Echo OF was dry during August sampling.

Nutrient data could not be analyzed for some samples due to insufficient volume.

Depths are the mean of the two grabs in each replicate.

a) Canadian sediment quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment (accessed 2012)

b) ISQG = Interim Sediment Quality Guideline

c) PEL = Probable Effects Level

d) Realised Detection Limits

Appendix 3.5-1. Stream Sediment Quality Analytical Results, Back River Project, 2012

Area				Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location				Chair OF	Chair OF	Chair OF	Giraffe OF	Giraffe OF	Giraffe OF	Wolf OF	Wolf OF	Wolf OF	Goose OF	Goose OF	Goose OF
Replicate:				1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled:		CCME Guidelines for the Protection of Aquatic Life[a]		13-Aug-12	13-Aug-12	13-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12
ALS Sample ID:			Realised Detection Limits (RDL)	CHAIR OF 1	CHAIR OF 2	CHAIR OF 3	GIRAFFE OF 1	GIRAFFE OF 2	GIRAFFE OF 3	WOLF OF 1	WOLF OF 2	WOLF OF 3	GOOSE OF 1	GOOSE OF 2	GOOSE OF 3
ALS Sample ID #:	Units	ISQG[b] PEL[c]		L1193085-4	L1193085-5	L1193085-6	L1191592-1	L1191592-2	L1191592-3	L1190642-1	L1190642-2	L1190642-3	L1190642-4	L1190642-5	L1190642-6
Physical Tests															
Moisture	%		0.25	17.4	12.5	14.6	17.2	19.9	19.1	38.0	34.7	18.8	13.4	14.1	15.4
pH	pH		0.10	6.44	6.25	5.65	5.70	6.34	6.32	5.78	5.94	6.42	6.21	6.50	6.60
Particle Size															
% Gravel (>2 mm)	%		0.10	31.0	36.7	35.3	42.8	41.0	23.8	11.1	4.39	23.7	43.1	52.6	63.7
% Sand (2.0 mm - 0.063 mm)	%		0.10	60.3	55.8	53.1	52.8	56.3	72.8	76.1	84.6	74.2	49.2	45.7	34.6
% Silt (0.063 mm - 4 µm)	%		0.10	8.09	6.98	10.8	3.97	2.36	2.94	12.2	10.7	2.09	7.37	1.62	1.64
% Clay (<4 µm)	%		0.10	0.55	0.54	0.82	0.45	0.35	0.53	0.64	0.26	<0.10	0.37	0.10	<0.10
Texture				Sand	Sand	Loamy sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand
Leachable Nutrients															
Total Nitrogen by LECO	%		0.020	<0.020	0.021	0.035	<0.020	0.026	<0.020	0.087	0.072	0.030	0.025	<0.020	<0.020
Plant Available Nutrients															
Available Ammonium (as N)	mg/kg		1 - 4.0	1.9	1.4	2.1	1.8	1.1	<1.0	3.0	3.1	1.5	1.1	1.6	1.8
Nitrate and Nitrite (as N)	mg/kg		0.5 - 6.0	<0.50	<0.50	<0.50	<2.0	<2.0	<2.0	<2.0	<4.0	<2.0	<4.0	<4.0	<4.0
Nitrate (as N)	mg/kg		0.5 - 6.1	<0.50	<0.50	<0.50	<2.0	<2.0	<2.0	<2.0	<4.0	<2.0	<4.0	<4.0	<4.0
Nitrite (as N)	mg/kg		0.4 - 1.2	<0.50	<0.50	<0.50	<0.40	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80	<0.80	<0.80
Available Phosphate (as P)	mg/kg		2 - 8.0	<2.0	<2.0	<2.0	2.0	<2.0	2.8	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Cyanides															
Cyanide, Weak Acid Dissociable	mg/kg		0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Cyanide, Total	mg/kg		0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.069	<0.050	<0.050	<0.050	<0.050	<0.050
Organic / Inorganic Carbon															
Total Organic Carbon	%		0.10	0.17	0.27	0.52	0.10	0.29	0.19	1.39	1.10	0.29	0.34	<0.10	<0.10
Metals															
Aluminum (Al)	mg/kg		50	12800	12100	9850	7740	9380	9060	2990	3020	2400	4240	4500	7190
Antimony (Sb)	mg/kg		0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Arsenic (As)	mg/kg	5.9 17	0.050	14.5	17.0	9.98	6.33	3.72	7.45	1.58	1.75	1.39	2.84	2.17	3.87
Barium (Ba)	mg/kg		0.50	16.0	23.4	17.6	34.4	21.5	19.6	14.6	15.7	11.9	18.4	17.3	23.3
Beryllium (Be)	mg/kg		0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Bismuth (Bi)	mg/kg		0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg	0.6 3.5	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.055
Calcium (Ca)	mg/kg		50	1400	1280	1240	1740	1360	1130	979	966	917	1360	1140	1600
Chromium (Cr)	mg/kg	37.3 90	0.50	42.8	41.3	32.3	26.9	29.1	31.5	7.44	7.48	5.68	12.7	13.0	20.6
Cobalt (Co)	mg/kg		0.10	6.22	5.73	4.57	9.52	6.49	13.5	1.89	1.97	1.60	4.59	5.03	17.2
Copper (Cu)	mg/kg	35.7 197	0.50	7.88	8.56	12.5	18.6	8.98	10.6	5.32	4.18	3.23	6.25	4.84	8.56
Iron (Fe)	mg/kg		50	21600	22100	17300	15100	16500	16800	5290	5550	4650	8420	8800	14400
Lead (Pb)	mg/kg	35 91.3	0.50	2.80	2.68	2.27	3.08	2.45	2.35	1.11	1.07	1.11	1.70	1.30	1.90
Lithium (Li)	mg/kg		5.0	32.0	31.5	24.5	15.5	20.9	20.6	5.3	6.0	<5.0	8.1	9.1	15.8
Magnesium (Mg)	mg/kg		20	9340	8980	7050	5990	7400	7040	1730	1830	1440	2630	3310	5840
Manganese (Mn)	mg/kg		1.0	210	200	153	129	167	209	44.3	48.5	37.8	100	121	373
Mercury (Hg)	mg/kg	0.17 0.486	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Molybdenum (Mo)	mg/kg		0.50	0.78	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Nickel (Ni)	mg/kg		0.50	23.1	21.7	19.3	22.7	21.4	26.0	7.12	7.02	5.46	9.54	10.8	18.3
Phosphorus (P)	mg/kg		50	406	429	362	488	363	342	258	241	267	311	257	425
Potassium (K)	mg/kg		100	380	450	370	900	660	630	190	200	170	350	400	680

Appendix 3.5-1. Stream Sediment Quality Analytical Results, Back River Project, 2012

Area					Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location					Chair OF	Chair OF	Chair OF	Giraffe OF	Giraffe OF	Giraffe OF	Wolf OF	Wolf OF	Wolf OF	Goose OF	Goose OF	Goose OF
Replicate:					1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled:					13-Aug-12	13-Aug-12	13-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12
		CCME Guidelines for the Protection of Aquatic Life[a]		Realised Detection Limits (RDL)												
ALS Sample ID:					CHAIR OF 1	CHAIR OF 2	CHAIR OF 3	GIRAFFE OF 1	GIRAFFE OF 2	GIRAFFE OF 3	WOLF OF 1	WOLF OF 2	WOLF OF 3	GOOSE OF 1	GOOSE OF 2	GOOSE OF 3
ALS Sample ID #:	Units	ISQG[b]	PEL[c]		L1193085-4	L1193085-5	L1193085-6	L1191592-1	L1191592-2	L1191592-3	L1190642-1	L1190642-2	L1190642-3	L1190642-4	L1190642-5	L1190642-6
Selenium (Se)	mg/kg			0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Silver (Ag)	mg/kg			0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	mg/kg			100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Strontium (Sr)	mg/kg			0.50	3.90	5.78	4.80	6.07	4.78	3.98	5.65	5.59	4.54	5.86	5.04	5.39
Sulphur (S)	mg/kg			500	<500	<500	<500	600	600	<500	700	<500	700	600	600	<500
Thallium (Tl)	mg/kg			0.050	<0.050	<0.050	<0.050	0.056	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Tin (Sn)	mg/kg			2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg			1.0	400	336	311	406	315	277	189	187	149	291	241	314
Uranium (U)	mg/kg			0.050	0.658	0.426	0.517	0.555	0.334	0.371	0.242	0.205	0.250	0.359	0.263	0.313
Vanadium (V)	mg/kg			0.20	27.8	31.3	25.0	29.2	27.7	25.7	10.0	10.5	8.18	18.0	15.6	25.6
Zinc (Zn)	mg/kg	123	315	1.0	42.4	40.4	33.1	29.8	33.6	33.7	11.0	11.2	9.7	13.5	15.5	23.6

Note Echo OF was dry during August sampling.

Nutrient data could not be analyzed for some samples due to insufficient volume.

Depths are the mean of the two grabs in each replicate.

a) Canadian sediment quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment (accessed 2012)

b) ISQG = Interim Sediment Quality Guideline

c) PEL = Probable Effects Level

d) Realised Detection Limits

Appendix 3.5-1. Stream Sediment Quality Analytical Results, Back River Project, 2012

Area				Goose	Goose	Goose	Goose	Goose	Goose	George	George	George	George	George
Location				Propellor OF	Propellor OF	Propellor OF	Reference B OF	Reference B OF	Reference B OF	George OF	George OF	George OF	Sleigh OF	Sleigh OF
Replicate:				1	2	3	1	2	3	1	2	3	1	2
Date Sampled:				9-Aug-12	9-Aug-12	9-Aug-12	10-Aug-12	10-Aug-12	10-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12
ALS Sample ID:		CCME Guidelines for the Protection of Aquatic Life[a]		PROPELLOR OF 1	PROPELLOR OF 2	PROPELLOR OF 3	REF B OF 1	REF B OF 2	REF B OF 3	GEORGE LAKE OF-1	GEORGE LAKE OF-2	GEORGE LAKE OF-3	SLEIGH LAKE OF-1	SLEIGH LAKE OF-2
ALS Sample ID #:	Units	ISQG[b]	PEL[c]	Realised Detection Limits (RDL)	L1192524-1	L1192524-2	L1192524-3	L1192524-4	L1192524-5	L1192524-6	L1190254-1	L1190254-2	L1190254-3	L1190254-4	L1190254-5
Physical Tests															
Moisture	%			0.25	9.43	16.2	14.6	49.3	16.7	64.2	82.1	79.7	85.0	20.5	18.4
pH	pH			0.10	7.21	5.72	6.23	5.59	6.12	5.35	6.13	6.50	6.64	6.86	6.85
Particle Size															
% Gravel (>2 mm)	%			0.10	72.7	74.5	41.8	11.4	10.6	16.8	2.69	0.18	1.31	28.2	25.0
% Sand (2.0 mm - 0.063 mm)	%			0.10	24.0	19.7	47.0	69.0	80.0	65.7	22.8	15.8	21.3	67.5	69.5
% Silt (0.063 mm - 4 µm)	%			0.10	2.41	4.63	9.62	18.4	8.05	15.9	62.0	69.6	66.0	3.56	4.82
% Clay (<4 µm)	%			0.10	0.85	1.21	1.58	1.14	1.35	1.58	12.6	14.5	11.4	0.71	0.66
Texture					Sand	Loamy sand	Loamy sand	Loamy sand	Sand	Loamy sand	Silt loam	Silt loam	Silt loam	Sand	Sand
Leachable Nutrients															
Total Nitrogen by LECO	%			0.020	0.042	0.046	0.021	0.132	0.051	0.293	0.913	0.952	1.13	0.020	0.022
Plant Available Nutrients															
Available Ammonium (as N)	mg/kg			1 - 4.0	2.7	-	2.2	4.5	3.1	14.1	31.2	19.3	32.8	2.0	1.7
Nitrate and Nitrite (as N)	mg/kg			0.5 - 6.0	<2.0	-	<2.0	<2.0	<2.0	<2.0	<6.0	<6.0	<6.0	<2.0	<2.0
Nitrate (as N)	mg/kg			0.5 - 6.1	<2.0	-	<2.0	<2.0	<2.0	<2.0	<6.0	<6.0	<6.0	<2.0	<2.0
Nitrite (as N)	mg/kg			0.4 - 1.2	<0.40	-	<0.40	<0.40	<0.40	<0.40	<1.2	<1.2	<1.2	<0.40	<0.40
Available Phosphate (as P)	mg/kg			2 - 8.0	2.2	-	<6.0	<2.0	<4.0	<8.0	10.0	7.8	2.1	2.1	<2.0
Cyanides															
Cyanide, Weak Acid Dissociable	mg/kg			0.05	<0.050	<0.050	<0.050	<0.050	<0.050	0.064	0.266	0.142	0.203	<0.050	<0.050
Cyanide, Total	mg/kg			0.05	<0.050	<0.050	<0.050	0.062	<0.050	0.171	0.553	0.337	0.516	<0.050	<0.050
Organic / Inorganic Carbon															
Total Organic Carbon	%			0.10	0.54	0.60	0.30	1.97	0.80	4.54	10.8	11.3	12.3	0.29	0.34
Metals															
Aluminum (Al)	mg/kg			50	17400	18300	23700	3550	4570	3380	12500	11100	10900	15300	17100
Antimony (Sb)	mg/kg			0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.23	<0.10	0.15	<0.10	<0.10
Arsenic (As)	mg/kg	5.9	17	0.050	23.9	27.5	23.9	3.10	2.37	2.18	46.8	28.2	96.6	8.04	8.68
Barium (Ba)	mg/kg			0.50	13.5	91.7	8.06	29.0	15.9	16.1	33.9	26.1	27.0	10.1	8.56
Beryllium (Be)	mg/kg			0.20	0.32	0.49	0.35	<0.20	<0.20	<0.20	0.64	0.57	0.70	<0.20	<0.20
Bismuth (Bi)	mg/kg			0.20	0.27	0.27	0.29	<0.20	<0.20	<0.20	0.24	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg	0.6	3.5	0.050	<0.050	0.209	<0.050	<0.050	<0.050	<0.050	0.263	0.155	0.255	<0.050	<0.050
Calcium (Ca)	mg/kg			50	1130	1380	1070	1270	1410	907	2730	2520	2790	1210	1190
Chromium (Cr)	mg/kg	37.3	90	0.50	52.9	54.3	75.3	10.7	12.8	12.0	36.6	33.8	30.0	58.7	62.8
Cobalt (Co)	mg/kg			0.10	15.0	51.2	16.6	4.18	2.54	2.41	78.4	37.6	172	9.57	11.5
Copper (Cu)	mg/kg	35.7	197	0.50	8.72	36.2	19.4	9.12	6.38	8.80	102	91.2	122	12.0	11.5
Iron (Fe)	mg/kg			50	33800	37200	45400	7780	8570	7880	22000	17200	28300	25300	28000
Lead (Pb)	mg/kg	35	91.3	0.50	4.07	11.4	4.62	1.78	1.21	1.47	10.5	7.25	8.41	2.43	2.43
Lithium (Li)	mg/kg			5.0	37.1	41.1	54.1	6.6	9.4	6.4	18.1	16.3	13.7	36.4	41.9
Magnesium (Mg)	mg/kg			20	13800	13600	18500	2290	3000	1940	6040	5340	4550	11500	12900
Manganese (Mn)	mg/kg			1.0	487	6960	643	66.8	74.5	40.3	407	252	1250	300	345
Mercury (Hg)	mg/kg	0.17	0.486	0.0050	<0.0050	0.0060	<0.0050	<0.0050	<0.0050	0.0063	0.0501	0.0484	0.0702	<0.0050	<0.0050
Molybdenum (Mo)	mg/kg			0.50	0.93	1.14	1.47	<0.50	<0.50	<0.50	0.79	0.59	1.09	<0.50	<0.50
Nickel (Ni)	mg/kg			0.50	30.5	81.0	50.5	11.8	8.52	9.52	83.3	62.6	84.7	38.6	42.6
Phosphorus (P)	mg/kg			50	602	654	626	285	420	232	913	787	929	405	386
Potassium (K)	mg/kg			100	320	660	130	460	190	200	500	480	490	340	310

Appendix 3.5-1. Stream Sediment Quality Analytical Results, Back River Project, 2012

Area					Goose	Goose	Goose	Goose	Goose	Goose	George	George	George	George	George
Location					Propellor OF	Propellor OF	Propellor OF	Reference B OF	Reference B OF	Reference B OF	George OF	George OF	George OF	Sleigh OF	Sleigh OF
Replicate:					1	2	3	1	2	3	1	2	3	1	2
Date Sampled:					9-Aug-12	9-Aug-12	9-Aug-12	10-Aug-12	10-Aug-12	10-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12
ALS Sample ID:		CCME Guidelines for the Protection of Aquatic Life[a]		Realised Detection Limits (RDL)	PROPELLOR OF 1	PROPELLOR OF 2	PROPELLOR OF 3	REF B OF 1	REF B OF 2	REF B OF 3	GEORGE LAKE OF-1	GEORGE LAKE OF-2	GEORGE LAKE OF-3	SLEIGH LAKE OF-1	SLEIGH LAKE OF-2
ALS Sample ID #:	Units	ISQG[b]	PEL[c]		L1192524-1	L1192524-2	L1192524-3	L1192524-4	L1192524-5	L1192524-6	L1190254-1	L1190254-2	L1190254-3	L1190254-4	L1190254-5
Selenium (Se)	mg/kg			0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.78	0.63	1.21	<0.20	<0.20
Silver (Ag)	mg/kg			0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.12	0.12	0.14	<0.10	<0.10
Sodium (Na)	mg/kg			100	<100	<100	<100	<100	<100	<100	<100	<100	160	<100	<100
Strontium (Sr)	mg/kg			0.50	4.70	7.16	2.42	5.96	8.65	4.95	13.7	12.5	12.6	4.50	4.26
Sulphur (S)	mg/kg			500	<500	<500	<500	800	<500	1100	3300	3300	2900	<500	<500
Thallium (Tl)	mg/kg			0.050	<0.050	0.089	<0.050	<0.050	<0.050	<0.050	0.082	0.064	0.109	<0.050	<0.050
Tin (Sn)	mg/kg			2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg			1.0	86.1	269	79.1	262	201	196	201	187	132	233	249
Uranium (U)	mg/kg			0.050	0.682	0.865	0.974	0.340	0.237	0.280	1.49	1.34	1.48	0.538	0.492
Vanadium (V)	mg/kg			0.20	25.8	41.6	32.9	19.0	16.1	24.5	22.4	19.1	20.0	30.4	30.7
Zinc (Zn)	mg/kg	123	315	1.0	60.1	86.7	78.7	19.8	12.2	15.6	101	78.1	98.5	52.0	56.9

Note Echo OF was dry during August sampling.

Nutrient data could not be analyzed for some samples due to insufficient volume.

Depths are the mean of the two grabs in each replicate.

a) Canadian sediment quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment (accessed 2012)

b) ISQG = Interim Sediment Quality Guideline

c) PEL = Probable Effects Level

d) Realised Detection Limits

Appendix 3.5-1. Stream Sediment Quality Analytical Results, Back River Project, 2012

Area				George	George	George	George	George	George	George	George	George	George
Location				Sleigh OF	Dragon OF	Dragon OF	Dragon OF	Komatic OF	Komatic OF	Komatic OF	Reference C OF	Reference C OF	Reference C OF
Replicate:				3	1	2	3	1	2	3	1	2	3
Date Sampled:				5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12
ALS Sample ID:		CCME Guidelines for the Protection of Aquatic Life[a]		Realised Detection Limits (RDL)	SLEIGH LAKE OF-3	DRAGON LAKE OF-1	DRAGON LAKE OF-2	DRAGON LAKE OF-3	KOMATIC LAKE OF-1	KOMATIC LAKE OF-2	KOMATIC LAKE OF-3	REFERENCE LAKE C OF-1	REFERENCE LAKE C OF-2	REFERENCE LAKE C OF-3
ALS Sample ID #:	Units	ISQG[b]	PEL[c]		L1190254-6	L1190254-7	L1190254-8	L1190254-9	L1190254-10	L1190254-11	L1190254-12	L1190254-13	L1190254-14	L1190254-15
Physical Tests														
Moisture	%			0.25	19.9	40.4	22.0	29.1	16.4	16.4	15.9	38.6	25.1	31.1
pH	pH			0.10	6.72	6.63	6.72	6.80	6.48	6.69	6.71	7.28	6.98	7.17
Particle Size														
% Gravel (>2 mm)	%			0.10	28.8	38.6	33.9	48.1	<0.10	<0.10	<0.10	68.3	57.1	66.0
% Sand (2.0 mm - 0.063 mm)	%			0.10	66.7	45.5	52.7	40.4	96.8	97.7	98.3	23.0	35.0	28.2
% Silt (0.063 mm - 4 µm)	%			0.10	3.79	14.5	12.1	10.4	2.68	1.87	1.34	8.10	7.08	5.01
% Clay (<4 µm)	%			0.10	0.68	1.50	1.34	1.11	0.50	0.47	0.41	0.66	0.81	0.85
Texture					Sand	Loamy sand	Loamy sand	Loamy sand	Sand	Sand	Sand	Loamy sand	Loamy sand	Loamy sand
Leachable Nutrients														
Total Nitrogen by LECO	%			0.020	0.021	0.046	0.037	0.024	<0.020	<0.020	<0.020	0.182	0.052	0.080
Plant Available Nutrients														
Available Ammonium (as N)	mg/kg			1 - 4.0	1.4	1.8	2.2	2.2	1.2	<1.0	<1.0	1.8	1.4	1.6
Nitrate and Nitrite (as N)	mg/kg			0.5 - 6.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nitrate (as N)	mg/kg			0.5 - 6.1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nitrite (as N)	mg/kg			0.4 - 1.2	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Available Phosphate (as P)	mg/kg			2 - 8.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.4	<2.0	<2.0
Cyanides														
Cyanide, Weak Acid Dissociable	mg/kg			0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Cyanide, Total	mg/kg			0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Organic / Inorganic Carbon														
Total Organic Carbon	%			0.10	0.35	0.64	0.45	0.30	0.19	0.14	0.11	2.71	0.86	1.11
Metals														
Aluminum (Al)	mg/kg			50	14800	14300	14300	16000	11100	16700	13800	6820	6340	8840
Antimony (Sb)	mg/kg			0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	<0.10	0.10
Arsenic (As)	mg/kg	5.9	17	0.050	8.72	31.1	37.6	39.3	7.66	14.9	9.72	1.66	1.39	3.56
Barium (Ba)	mg/kg			0.50	9.33	30.5	22.8	18.8	9.57	11.4	9.78	41.8	37.7	39.5
Beryllium (Be)	mg/kg			0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.30	0.30	0.37
Bismuth (Bi)	mg/kg			0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg	0.6	3.5	0.050	<0.050	0.067	<0.050	<0.050	<0.050	<0.050	<0.050	0.060	<0.050	<0.050
Calcium (Ca)	mg/kg			50	1190	1340	1370	1320	1040	1300	1140	3020	1630	1520
Chromium (Cr)	mg/kg	37.3	90	0.50	52.5	48.9	55.4	55.2	40.7	66.6	52.6	16.2	14.4	22.9
Cobalt (Co)	mg/kg			0.10	8.90	19.9	16.4	15.4	5.63	8.06	6.82	5.04	5.11	7.70
Copper (Cu)	mg/kg	35.7	197	0.50	12.0	18.2	16.7	12.3	7.82	9.85	9.71	9.52	6.38	4.33
Iron (Fe)	mg/kg			50	23600	33200	38000	39200	18400	29300	23600	12900	12200	20100
Lead (Pb)	mg/kg	35	91.3	0.50	2.58	3.00	3.11	2.60	1.64	2.07	1.75	2.06	1.69	1.56
Lithium (Li)	mg/kg			5.0	35.7	27.8	29.1	32.9	25.4	41.5	34.5	12.1	11.2	16.0
Magnesium (Mg)	mg/kg			20	10700	9950	10500	11400	8310	13200	11100	7170	5480	8270
Manganese (Mn)	mg/kg			1.0	280	370	318	347	184	277	231	136	85.4	159
Mercury (Hg)	mg/kg	0.17	0.486	0.0050	<0.0050	0.0054	0.0053	<0.0050	<0.0050	<0.0050	<0.0050	0.0102	<0.0050	<0.0050
Molybdenum (Mo)	mg/kg			0.50	<0.50	<0.50	0.60	0.61	<0.50	0.59	<0.50	<0.50	<0.50	<0.50
Nickel (Ni)	mg/kg			0.50	34.9	38.8	35.6	35.8	26.2	40.9	32.6	13.0	13.0	18.7
Phosphorus (P)	mg/kg			50	344	394	447	479	324	472	390	346	235	321
Potassium (K)	mg/kg			100	300	390	360	380	210	360	260	370	330	490

Appendix 3.5-1. Stream Sediment Quality Analytical Results, Back River Project, 2012

Area					George	George	George	George	George	George	George	George	George	George
Location					Sleigh OF	Dragon OF	Dragon OF	Dragon OF	Komatic OF	Komatic OF	Komatic OF	Reference C OF	Reference C OF	Reference C OF
Replicate:					3	1	2	3	1	2	3	1	2	3
Date Sampled:					5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12
ALS Sample ID:		CCME Guidelines for the Protection of Aquatic Life[a]		Realised Detection Limits (RDL)	SLEIGH LAKE OF-3	DRAGON LAKE OF-1	DRAGON LAKE OF-2	DRAGON LAKE OF-3	KOMATIC LAKE OF-1	KOMATIC LAKE OF-2	KOMATIC LAKE OF-3	REFERENCE LAKE C OF-1	REFERENCE LAKE C OF-2	REFERENCE LAKE C OF-3
ALS Sample ID #:	Units	ISQG[b]	PEL[c]		L1190254-6	L1190254-7	L1190254-8	L1190254-9	L1190254-10	L1190254-11	L1190254-12	L1190254-13	L1190254-14	L1190254-15
Selenium (Se)	mg/kg			0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Silver (Ag)	mg/kg			0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	mg/kg			100	<100	<100	<100	<100	<100	<100	<100	<100	110	<100
Strontium (Sr)	mg/kg			0.50	4.62	5.32	5.12	5.05	3.91	4.79	4.35	4.25	4.62	3.20
Sulphur (S)	mg/kg			500	<500	500	<500	<500	<500	<500	<500	<500	<500	<500
Thallium (Tl)	mg/kg			0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Tin (Sn)	mg/kg			2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg			1.0	283	277	261	256	216	200	194	242	316	201
Uranium (U)	mg/kg			0.050	0.422	0.488	0.510	0.444	0.366	0.460	0.410	2.08	0.881	1.11
Vanadium (V)	mg/kg			0.20	27.5	27.5	30.3	31.2	20.2	32.2	25.4	16.3	16.9	19.2
Zinc (Zn)	mg/kg	123	315	1.0	50.1	48.2	49.5	51.0	37.3	54.4	45.2	17.5	13.8	19.5

Note Echo OF was dry during August sampling.

Nutrient data could not be analyzed for some samples due to insufficient volume.

Depths are the mean of the two grabs in each replicate.

a) Canadian sediment quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment (accessed 2012)

b) ISQG = Interim Sediment Quality Guideline

c) PEL = Probable Effects Level

d) Realised Detection Limits

Appendix 3.6-1

Lake Phytoplankton Biomass as Chl *a* Results, Back River Project, 2012

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Appendix 3.6-1. Lake Phytoplankton Biomass as Chl *a* Results, Back River Project, 2012

Area			Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location			Moby	Moby	Moby	Gander	Gander	Gander	Big	Big	Big	Fox	Fox	Fox	Rascal	Rascal	Rascal
Replicate		Realised	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Depth (m)		Detection	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Date Sampled		Limit	10-Apr-2012	10-Apr-2012	10-Apr-2012	10-Apr-2012	10-Apr-2012	10-Apr-2012	10-Apr-2012	10-Apr-2012	10-Apr-2012	10-Apr-2012	10-Apr-2012	10-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012
ALS Sample ID	Units	(RDL)	L1135625-7	L1135625-8	L1135625-9	L1135625-4	L1135625-5	L1135625-6	L1135625-1	L1135625-2	L1135625-3	L1135625-10	L1135625-11	L1135625-12	L1135625-28	L1135625-29	L1135625-30
Plant Pigments																	
Chlorophyll a	ug/L	0.010	0.173	0.279	0.409	0.157	0.117	0.206	0.037	0.066	<0.010	0.181	0.297	0.282	1.03	0.328	0.895
Pheopigments	ug/L	0.010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Area			Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location			Giraffe North	Giraffe North	Giraffe North	Giraffe South	Giraffe South	Giraffe South	Goose Neck	Goose Neck	Goose Neck	Goose Central	Goose Central	Goose Central	Goose Tail	Goose Tail	Goose Tail
Replicate		Realised	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Depth (m)		Detection	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Date Sampled		Limit	11-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012
ALS Sample ID	Units	(RDL)	L1135625-13	L1135625-14	L1135625-15	L1135625-16	L1135625-17	L1135625-18	L1135625-25	L1135625-26	L1135625-27	L1135625-22	L1135625-23	L1135625-24	L1135625-19	L1135625-20	L1135625-21
Plant Pigments																	
Chlorophyll a	ug/L	0.010	0.134	0.139	0.201	0.104	0.06	0.142	0.122	0.163	0.195	0.35	0.324	0.389	0.107	0.187	0.053
Pheopigments	ug/L	0.010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Area			Goose	Goose	Goose	George	George	George	George	George	George	George	George	George	George	George	George
Location			Propellor	Propellor	Propellor	Lower Long	Lower Long	Lower Long	Fold	Fold	Fold	George Central	George Central	George Central	Dragon	Dragon	Dragon
Replicate		Realised	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Depth (m)		Detection	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Date Sampled		Limit	12-Apr-2012	12-Apr-2012	12-Apr-2012	13-Apr-2012	13-Apr-2012	13-Apr-2012	15-Apr-2012	15-Apr-2012	15-Apr-2012	13-Apr-2012	13-Apr-2012	13-Apr-2012	15-Apr-2012	15-Apr-2012	15-Apr-2012
ALS Sample ID	Units	(RDL)	L1135625-31	L1135625-32	L1135625-33	L1135623-4	L1135623-5	L1135623-6	L1135623-16	L1135623-17	L1135623-18	L1135623-10	L1135623-11	L1135623-12	L1135623-13	L1135623-14	L1135623-15
Plant Pigments																	
Chlorophyll a	ug/L	0.010	0.111	0.06	0.063	0.844	0.558	0.979	0.699	2.26	0.504	0.094	0.188	0.099	0.826	1.55	1.45
Pheopigments	ug/L	0.010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Area			George	George	George	George	George	George
Location			Komatic	Komatic	Komatic	Reference C	Reference C	Reference C
Replicate		Realised	1	2	3	1	2	3
Depth (m)		Detection	1	1	1	1	1	1
Date Sampled		Limit	13-Apr-2012	13-Apr-2012	13-Apr-2012	13-Apr-2012	13-Apr-2012	13-Apr-2012
ALS Sample ID	Units	(RDL)	L1135623-7	L1135623-8	L1135623-9	L1135623-1	L1135623-2	L1135623-3
Plant Pigments								
Chlorophyll a	ug/L	0.010	2.24	2.13	0.758	0.262	0.139	0.325
Pheopigments	ug/L	0.010	-	-	-	-	-	-

Appendix 3.6-1. Lake Phytoplankton Biomass as Chl *a* Results, Back River Project, 2012

Area			Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location			Gander	Gander	Gander	Big	Big	Big	Rabbit	Rabbit	Rabbit	Fox	Fox	Fox
Replicate		Realised	1	2	3	1	2	3	1	2	3	1	2	3
Depth (m)		Detection	1	1	1	1	1	1	1	1	1	1	1	1
Date Sampled		Limit	18-Aug-12	18-Aug-12	18-Aug-12	16-Aug-12	16-Aug-12	16-Aug-12	15-Aug-12	15-Aug-12	15-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12
ALS Sample ID	Units	(RDL)	L1199756-13	L1199756-14	L1199756-15	L1199756-7	L1199756-8	L1199756-9	L1199756-4	L1199756-5	L1199756-6	L1199756-19	L1199756-20	L1199756-21
Plant Pigments														
Chlorophyll a	ug/L	0.010	1.04	0.882	0.481	0.472	0.488	0.372	0.135	0.159	0.158	0.334	0.838	0.646
Pheopigments	ug/L	0.010	-	-	-	-	-	-	-	-	-	-	-	-

Area			Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	George	George	George
Location			Giraffe South	Giraffe South	Giraffe South	Goose Neck	Goose Neck	Goose Neck	Goose Central	Goose Central	Goose Central	Lower Long	Lower Long	Lower Long
Replicate		Realised	1	2	3	1	2	3	1	2	3	1	2	3
Depth (m)		Detection	1	1	1	1	1	1	1	1	1	1	1	1
Date Sampled		Limit	19-Aug-12	19-Aug-12	19-Aug-12	14-Aug-12	14-Aug-12	14-Aug-12	17-Aug-12	17-Aug-12	17-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12
ALS Sample ID	Units	(RDL)	L1199756-16	L1199756-17	L1199756-18	L1199756-1	L1199756-2	L1199756-3	L1199756-10	L1199756-11	L1199756-12	L1200353-13	L1200353-14	L1200353-15
Plant Pigments														
Chlorophyll a	ug/L	0.010	0.253	0.437	0.460	0.536	0.193	0.236	0.299	0.339	0.231	0.819	0.873	0.593
Pheopigments	ug/L	0.010	-	-	-	-	-	-	-	-	-	0.490	0.030	0.800

Area			George	George	George	George	George	George	George	George	George	George	George	George
Location			Fold	Fold	Fold	George Central	George Central	George Central	Lytle	Lytle	Lytle	Occurrence	Occurrence	Occurrence
Replicate		Realised	1	2	3	1	2	3	1	2	3	1	2	3
Depth (m)		Detection	1	1	1	1	1	1	1	1	1	1	1	1
Date Sampled		Limit	19-Aug-12	19-Aug-12	19-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	23-Aug-12	23-Aug-12	23-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12
ALS Sample ID	Units	(RDL)	L1200353-4	L1200353-5	L1200353-6	L1200353-1	L1200353-2	L1200353-3	L1200353-25	L1200353-26	L1200353-27	L1200353-16	L1200353-17	L1200353-18
Plant Pigments														
Chlorophyll a	ug/L	0.010	0.303	0.180	0.143	0.291	0.103	0.213	0.067	0.257	0.085	0.394	0.164	0.071
Pheopigments	ug/L	0.010	0.220	0.090	0.290	0.160	0.200	0.030	0.200	0.070	0.170	0.150	0.170	0.120

Area			George	George	George	George	George	George	George	George	George	George	George	George
Location			Sleigh	Sleigh	Sleigh	Dragon	Dragon	Dragon	Komatic	Komatic	Komatic	Reference C	Reference C	Reference C
Replicate		Realised	1	2	3	1	2	3	1	2	3	1	2	3
Depth (m)		Detection	1	1	1	1	1	1	1	1	1	1	1	1
Date Sampled		Limit	22-Aug-12	22-Aug-12	22-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12	22-Aug-12	22-Aug-12	22-Aug-12
ALS Sample ID	Units	(RDL)	L1200353-22	L1200353-23	L1200353-24	L1200353-7	L1200353-8	L1200353-9	L1200353-10	L1200353-11	L1200353-12	L1200353-19	L1200353-20	L1200353-21
Plant Pigments														
Chlorophyll a	ug/L	0.010	0.339	0.301	0.136	0.679	0.633	0.111	0.469	0.663	0.374	0.125	0.590	0.509
Pheopigments	ug/L	0.010	0.090	0.100	0.160	0.340	0.960	0.100	0.180	0.500	0.890	0.360	0.570	0.200

Appendix 3.6-2

Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

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Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification				Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
				Lake	Moby	Gander	Big	Fox	Rascal	Giraffe North	Giraffe South	Goose Neck	Goose Central
				Replicate	1	1	1	1	1	1	1	1	1
				Lab Duplicate	no	no	no	no	no	no	no	no	no
				Date Sampled	10-Apr-2012	10-Apr-2012	10-Apr-2012	10-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012
				Sample ID	6138.4-7	6138.4-10	6138.4-9	6138.4-8	6138.4-2	6138.4-3	6138.4-11	6138.4-4	6138.4-5
Class	**Order**	**Family**	**Genus**	**Final Designation**									
Bacillariophyceae	Centrales	Stephanodiscaceae	*Cyclotella*	*Cyclotella* sp.	1.99			0.21		2.47		2.51	0.37
				Cyclotella sp. < 6µm									
				Cyclotella sp. 6-10 µm									
			Stephanodiscus	*Stephanodiscus* sp.									
	Pennales	Achnanthaceae	*Achnanthes*	*Achnanthes* sp.									
		Achnanthidiaceae	*Achnanthidium*	*Achnanthidium* sp.									
		Amphipleuraceae	*Frustulia*	*Frustulia* sp.								1.00	
		Bacillariaceae	*Nitzschia*	*Nitzschia* sp.	0.33	0.11	0.11	0.41					0.37
				Nitzschia spp.									
		Catenulaceae	*Amphora*	*Amphora* sp.									
		Cymbellaceae	*Cymbella*	*Cymbella* sp.		0.22						0.13	
		Diploneidaceae	*Diploneis*	*Diploneis* sp.									
		Eunotiaceae	*Eunotia*	*Eunotia* sp.									
		Fragilariaceae	*Fragilaria*	*Fragilaria* sp.								6.03	
			Synedra	*Synedra* sp.						0.31			
		Naviculaceae	*Navicula*	*Navicula* sp.		0.45			1.77				
		Pinnulariaceae	*Caloneis*	*Caloneis* sp.		0.34							
			Pinnularia	*Pinnularia biceps*		0.22						0.75	
				Pinnularia sp.	0.33	0.56	0.11				0.17	1.38	
		Pleurosigmataceae	*Pleurosigma*	*Pleurosigma* sp.									
		Rhopalodiaceae	*Epithemia*	*Epithemia* sp.									
		Stauroneidaceae	*Stauroneis*	*Stauroneis* sp.		0.22						1.13	
		Surirellaceae	*Surirella*	*Surirella* sp.								0.13	
		Tabellariaceae	*Tabellaria*	*Tabellaria fenestrata*									
				Tabellaria flocculosa									
				Tabellaria sp.		2.02		0.82			1.36	1.00	
Chlorodendrophyceae	Chlorodendrales	Chlorodendraceae	*Tetraselmis*	*Tetraselmis* sp.									
Chlorophyceae	Chlorococcales	Chlorococcaceae	*Tetraedron*	*Tetraedron caudatum*									
				Tetraedron minimum									
				Tetraedron sp.						0.15			
		Hydrodictyaceae	*Pediastrum*	*Pediastrum* sp.						21.62		2.01	
		Oocystaceae	*Ankistrodesmus*	*Ankistrodesmus* sp.									
			Botryococcus	*Botryococcus* sp.			16.99						
			Closteriopsis	*Closteriopsis acicularis*									
			Monoraphidium	*Monoraphidium arcuatum*									
				Monoraphidium contortum									
				Monoraphidium sp.	79.72	5.95	1.02	17.63	2.66	7.26	6.28	2.51	7.80
				Monoraphidium tortile									
			Oocystis	*Oocystis* sp.		0.11	0.11			1.08	0.68		
			Quadrigula	*Quadrigula chodati*									
				Quadrigula closterioides									
		Scenedesmaceae	*Coelastrum*	*Coelastrum* sp.									
			Crucigenia	*Crucigenia* sp.		0.45							
			Crucigeniella	*Crucigeniella rectangularis*								1.51	
			Scenedesmus	*Scenedesmus bijuga*									
				Scenedesmus brasiliensis									
				Scenedesmus sp.	1.33	1.12				1.24	0.68	0.50	
	Sphaeropleales	Characiaceae	*Ankyra*	*Ankyra judayi*									
		Radiococcaceae	*Coenococcus*	*Coenococcus fottii*									
	Tetrasporales	Coccomyxaceae	*Elakatothrix*	*Elakatothrix gelatinosa*									
				Elakatothrix sp.	2.33			0.82		4.32	0.34		
		Palmellaceae	*Gloeocystis*	*Gloeocystis gigas*									
			Sphaerocystis	*Sphaerocystis planctonica*	1.33	0.90	0.23			13.44		2.76	3.71
				Sphaerocystis sp.									

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification													
Class	Order	Family	Genus	Final Designation									
Area					Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Lake					Moby	Gander	Big	Fox	Rascal	Giraffe North	Giraffe South	Goose Neck	Goose Central
Replicate					1	1	1	1	1	1	1	1	1
Lab Duplicate					no	no	no	no	no	no	no	no	no
Date Sampled					10-Apr-2012	10-Apr-2012	10-Apr-2012	10-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012
Sample ID					6138.4-7	6138.4-10	6138.4-9	6138.4-8	6138.4-2	6138.4-3	6138.4-11	6138.4-4	6138.4-5
	Volvocales	Chlamydomonadaceae	*Carteria*	*Carteria* sp.			0.23		3.54	0.77		1.26	
			Chlamydomonas	*Chlamydomonas* sp.									
	Zygnematales	Desmidiaceae	*Closterium*	*Closterium* sp.									
			Cosmarium	*Cosmarium* sp.						0.77		0.25	
			Euastrum	*Euastrum* sp.		0.11							
			Spondylosium	*Spondylosium* sp.									
			Staurastrum	*Staurastrum* sp.						0.15			0.37
			Staurodesmus	*Staurodesmus* sp.	0.33			0.21			0.17		
			Teilingia	*Teilingia granulata*	1.33	0.11		0.21			0.17	0.25	
			Xanthidium	*Xanthidium* sp.		0.11							
		Mesotaeniaceae	*Gonatozygon*	*Gonatozygon* sp.									
		Zygnemataceae	*Mougeotia*	*Mougeotia* sp.	0.33	0.34	0.45	1.03			0.68	0.13	0.37
Chrysophyceae	Chromulinales	Chromulinaceae	*Chromulina*	*Chromulina* sp.									
			Kephyrion	*Kephyrion* sp.									
		Chrysocapsaceae	*Chrysocapsa*	*Chrysocapsa planktonica*									
				Chrysocapsa sp.									
	Chrysomonadales	Dinobryaceae	*Chrysococcus*	*Chrysococcus* sp.									
			Chrysolykos	*Chrysolykos planctonicus*									
			Dinobryon	*Dinobryon bavaricum*									
				Dinobryon divergens									
				Dinobryon sertularia									
				Dinobryon sociale									
				Dinobryon sp.	1.66	0.45	0.11	0.82	3.54			0.25	0.37
		Synuraceae	*Mallomonas*	*Mallomonas* sp.									
			Synura	*Synura* sp.									
	Hibberdiales	Stylococcaceae	*Diceras*	*Diceras* sp.									
	Ochromonadales	Ochromonadaceae	*Ochromonas*	*Ochromonas* sp.									
	Prymnesiales	Prymnesiaceae	*Chrysochromulina*	*Chrysochromulina parva*									
Cryptophyceae	Cryptomonadales	Cryptomonadaceae	*Cryptomonas*	*Cryptomonas* sp.	13.62	17.29	3.29	35.88	73.47	7.11	13.07	11.68	40.83
				Cryptomonas spp.									
			Komma	*Komma caudata*	1.99	1.23	1.47	5.33	189.44	23.48	29.70	11.05	63.10
	Pyrenomonadales	Pyrenomonadaceae	*Rhodomonas*	*Rhodomonas lacustris var. nannoplanctica*									
Cyanophyceae	Synechococcales	Synechococcaceae	*Cyanodictyon*	*Cyanodictyon* sp.									
Dinophyceae	Dinophysales	Amphisoleniaceae	*Dinophysis*	*Dinophysis* sp.							0.17		
	Gymnodiniales	Gymondiniaceae	*Gymnodinium*	*Gymnodinium* sp.									
	Peridiniales	Peridiniaceae	*Glenodinium*	*Glenodinium* sp.									
			Peridinium	*Peridinium* sp.	0.33	1.23	0.11	0.41	0.89	1.70	1.02	0.38	1.11
Euglenophyceae	Euglenales	Euglenaceae	*Euglena*	*Euglena* sp.		0.56			0.89				
			Lepocinclis	*Lepocinclis* sp.		2.13							
			Phacus	*Phacus* sp.									
			Trachelomonas	*Trachelomonas* sp.									
Myxophyceae	Chroococcales	Chroococcaceae	*Chroococcus*	*Chroococcus limneticus*									
				Chroococcus minimus									
				Chroococcus prescottii									
				Chroococcus sp.									
		Merismopediaceae	*Aphanocapsa*	*Aphanocapsa conferta*									
				Aphanocapsa holsatica									
				Aphanocapsa incerta									
				Aphanocapsa sp.									
			Coelomoron	*Coelomoron* sp.									
			Coelosphaerium	*Coelosphaerium* sp.									
			Merismopedia	*Merismopedia* sp.						7.41			
				Merismopedia tenuissima									
			Snowella	*Snowella lacustris*									

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification				Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
				Lake	Moby	Gander	Big	Fox	Rascal	Giraffe North	Giraffe South	Goose Neck	Goose Central
				Replicate	1	1	1	1	1	1	1	1	1
				Lab Duplicate	no	no	no	no	no	no	no	no	no
				Date Sampled	10-Apr-2012	10-Apr-2012	10-Apr-2012	10-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012	11-Apr-2012
				Sample ID	6138.4-7	6138.4-10	6138.4-9	6138.4-8	6138.4-2	6138.4-3	6138.4-11	6138.4-4	6138.4-5
Class	**Order**	**Family**	**Genus**	**Final Designation**									
			Woronichinia	*Woronichinia compacta*									
		Microcystaceae	*Gloeocapsa*	*Gloeocapsa* sp.									
			Microcystis	*Microcystis aeruginosa*									
		Synechococcaceae	*Aphanothece*	*Aphanothece minutissima*									
				Aphanothece sp.									
			Rhabdoderma	*Rhabdoderma lineare*									
			Synechococcus	*Synechococcus* sp.								1.00	
	Nostocales	Nostocaceae	*Anabaena*	*Anabaena* sp.	7.97	0.90						0.50	
			Nostoc	*Nostoc* sp.									
	Oscillatoriales	Oscillatoriaceae	*Oscillatoria*	*Oscillatoria* sp.		35.47							
		Pseudanabaenaceae	*Leptolyngbya*	*Leptolyngbya* sp.				6.97					
			Planktolyngbya	*Planktolyngbya limnetica*									
			Pseudanabaena	*Pseudanabaena galeata*									
				Pseudanabaena sp.		2.69							
Trebouxiophyceae	Prasiolales	Koliellaceae	*Koliella*	*Koliella longiseta*									
Xanthophyceae	Heterococcales	Sciadaceae	*Centritractus*	*Centritractus* sp.									
	Mischococcales	Characiopsidaceae	*Characiopsis*	*Characiopsis* sp.			0.11						
Undetermined	Undetermined	Katablepharidaceae	*Katablepharis*	*Katablepharis ovalis*									
		Undetermined	Undetermined	unknown Chlorophyte coccoid		0.11							
				Total	**114.92**	**75.44**	**24.36**	**70.74**	**276.19**	**93.30**	**54.49**	**50.09**	**118.41**

Note: George Central Rep 3 (ID 6141.4-9) contained too much detritus and silt for taxonomists to enumerate.

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification				Area	Goose	Goose	Goose	George	George	George	George	George	George
				Lake	Goose Tail	Goose Tail	Propellor	Lower Long	Fold	George Central	Dragon	Komatic	Reference C
				Replicate	1	1 DUP	1	1	1	1	1	1	1
				Lab Duplicate	no	yes	no	no	no	no	no	no	no
				Date Sampled	11-Apr-2012	11-Apr-2012	12-Apr-2012	13-Apr-2012	15-Apr-2012	13-Apr-2012	15-Aug-2012	13-Apr-2012	13-Apr-2012
				Sample ID	6138.4-6	6138.4-6-DUP	6138.4-1	6141.4-3	6141.4-5	6141.4-1	6141.4-6	6141.4-4	6141.4-2
Class	**Order**	**Family**	**Genus**	**Final Designation**									
Bacillariophyceae	Centrales	Stephanodiscaceae	*Cyclotella*	*Cyclotella* sp.	1.07	0.86		2.00			6.00	0.50	1.00
				Cyclotella sp. < 6µm					51.00	1.00	40.80	586.50	
				Cyclotella sp. 6-10 µm									0.50
			Stephanodiscus	*Stephanodiscus* sp.									
	Pennales	Achnanthaceae	*Achnanthes*	*Achnanthes* sp.	0.21	0.21							
		Achnanthidiaceae	*Achnanthidium*	*Achnanthidium* sp.									
		Amphipleuraceae	*Frustulia*	*Frustulia* sp.									
		Bacillariaceae	*Nitzschia*	*Nitzschia* sp.	0.43	0.86							
				Nitzschia spp.									
		Catenulaceae	*Amphora*	*Amphora* sp.									
		Cymbellaceae	*Cymbella*	*Cymbella* sp.									
		Diploneidaceae	*Diploneis*	*Diploneis* sp.									
		Eunotiaceae	*Eunotia*	*Eunotia* sp.									
		Fragilariaceae	*Fragilaria*	*Fragilaria* sp.									
			Synedra	*Synedra* sp.				2.50			7.50		
		Naviculaceae	*Navicula*	*Navicula* sp.			0.45						
		Pinnulariaceae	*Caloneis*	*Caloneis* sp.									
			Pinnularia	*Pinnularia biceps*									
				Pinnularia sp.									
		Pleurosigmataceae	*Pleurosigma*	*Pleurosigma* sp.									
		Rhopalodiaceae	*Epithemia*	*Epithemia* sp.			0.11						
		Stauroneidaceae	*Stauroneis*	*Stauroneis* sp.									
		Surirellaceae	*Surirella*	*Surirella* sp.									
		Tabellariaceae	*Tabellaria*	*Tabellaria fenestrata*									
				Tabellaria flocculosa									
				Tabellaria sp.			1.81						
Chlorodendrophyceae	Chlorodendrales	Chlorodendraceae	*Tetraselmis*	*Tetraselmis* sp.									
Chlorophyceae	Chlorococcales	Chlorococcaceae	*Tetraedron*	*Tetraedron caudatum*									
				Tetraedron minimum									
				Tetraedron sp.			0.34				5.00	35.70	
		Hydrodictyaceae	*Pediastrum*	*Pediastrum* sp.		11.16							
		Oocystaceae	*Ankistrodesmus*	*Ankistrodesmus* sp.									
			Botryococcus	*Botryococcus* sp.									
			Closteriopsis	*Closteriopsis acicularis*									2.50
			Monoraphidium	*Monoraphidium arcuatum*									
				Monoraphidium contortum									
				Monoraphidium sp.	2.58	2.79	7.12	5.00					
				Monoraphidium tortile									
			Oocystis	*Oocystis* sp.									
			Quadrigula	*Quadrigula chodati*									
				Quadrigula closterioides									
		Scenedesmaceae	*Coelastrum*	*Coelastrum* sp.							8.00		
			Crucigenia	*Crucigenia* sp.	0.86	0.86							
			Crucigeniella	*Crucigeniella rectangularis*	2.15								
			Scenedesmus	*Scenedesmus bijuga*							2.00	6.00	4.00
				Scenedesmus brasiliensis									
				Scenedesmus sp.	0.86	0.86							
	Sphaeropleales	Characiaceae	*Ankyra*	*Ankyra judayi*									
		Radiococcaceae	*Coenococcus*	*Coenococcus fottii*				8.00	36.00				
	Tetrasporales	Coccomyxaceae	*Elakatothrix*	*Elakatothrix gelatinosa*									
				Elakatothrix sp.	1.72	0.86							
		Palmellaceae	*Gloeocystis*	*Gloeocystis gigas*									
			Sphaerocystis	*Sphaerocystis planctonica*	1.29	2.58							
				Sphaerocystis sp.									

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification														
Class	Order	Family	Genus	Final Designation	Goose	Goose	Goose	George	George	George	George	George	George
				Area	Goose	Goose	Goose	George	George	George	George	George	George
				Lake	Goose Tail	Goose Tail	Propellor	Lower Long	Fold	George Central	Dragon	Komatic	Reference C
				Replicate	1	1 DUP	1	1	1	1	1	1	1
				Lab Duplicate	no	yes	no	no	no	no	no	no	no
				Date Sampled	11-Apr-2012	11-Apr-2012	12-Apr-2012	13-Apr-2012	15-Apr-2012	13-Apr-2012	15-Aug-2012	13-Apr-2012	13-Apr-2012
				Sample ID	6138.4-6	6138.4-6-DUP	6138.4-1	6141.4-3	6141.4-5	6141.4-1	6141.4-6	6141.4-4	6141.4-2
	Volvocales	Chlamydomonadaceae	*Carteria*	*Carteria* sp.	0.64	0.64							
			Chlamydomonas	*Chlamydomonas* sp.						1.00			
	Zygnematales	Desmidiaceae	*Closterium*	*Closterium* sp.					2.00		0.50		
			Cosmarium	*Cosmarium* sp.			0.11						
			Euastrum	*Euastrum* sp.									
			Spondylosium	*Spondylosium* sp.									
			Staurastrum	*Staurastrum* sp.									
			Staurodesmus	*Staurodesmus* sp.			0.23						
			Teilingia	*Teilingia granulata*	0.21	0.21							
			Xanthidium	*Xanthidium* sp.									
		Mesotaeniaceae	*Gonatozygon*	*Gonatozygon* sp.									
		Zygnemataceae	*Mougeotia*	*Mougeotia* sp.									
Chrysophyceae	Chromulinales	Chromulinaceae	*Chromulina*	*Chromulina* sp.									
			Kephyrion	*Kephyrion* sp.							5.10		
		Chrysocapsaceae	*Chrysocapsa*	*Chrysocapsa planktonica*									
				Chrysocapsa sp.									
	Chrysomonadales	Dinobryaceae	*Chrysococcus*	*Chrysococcus* sp.									
			Chrysolykos	*Chrysolykos planctonicus*									
			Dinobryon	*Dinobryon bavaricum*									
				Dinobryon divergens									
				Dinobryon sertularia					9.00		2.50		
				Dinobryon sociale				3.50				1.50	
				Dinobryon sp.	0.21	0.43		3.50					
		Synuraceae	*Mallomonas*	*Mallomonas* sp.									
			Synura	*Synu* ra sp.									
	Hibberdiales	Stylococcaceae	*Diceras*	*Diceras* sp.									
	Ochromonadales	Ochromonadaceae	*Ochromonas*	*Ochromonas* sp.									
	Prymnesiales	Prymnesiaceae	*Chrysochromulina*	*Chrysochromulina parva*				44.00	107.10	5.10	173.40	132.60	10.20
Cryptophyceae	Cryptomonadales	Cryptomonadaceae	*Cryptomonas*	*Cryptomonas* sp.	33.69	34.12	7.46						
				Cryptomonas spp.				5.50	51.00		44.00	114.00	1.50
			Komma	*Komma caudata*	22.75	22.53	15.83						
	Pyrenomonadales	Pyrenomonadaceae	*Rhodomonas*	*Rhodomonas lacustris var. nannoplanctica*				132.00	122.00	1.00	180.00	79.00	37.00
Cyanophyceae	Synechococcales	Synechococcaceae	*Cyanodictyon*	*Cyanodictyon* sp.									
Dinophyceae	Dinophysales	Amphisoleniaceae	*Dinophysis*	*Dinophysis* sp.									
	Gymnodiniales	Gymondiniaceae	*Gymnodinium*	*Gymnodinium* sp.				2.50			4.00	40.00	1.00
	Peridiniales	Peridiniaceae	*Glenodinium*	*Glenodinium* sp.									
			Peridinium	*Peridinium* sp.	1.50	1.50		0.50					
Euglenophyceae	Euglenales	Euglenaceae	*Euglena*	*Euglena* sp.			0.23						
			Lepocinclis	*Lepocinclis* sp.									
			Phacus	*Phacus* sp.									
			Trachelomonas	*Trachelomonas* sp.									
Myxophyceae	Chroococcales	Chroococcaceae	*Chroococcus*	*Chroococcus limneticus*									
				Chroococcus minimus									
				Chroococcus prescottii									
				Chroococcus sp.									
		Merismopediaceae	*Aphanocapsa*	*Aphanocapsa conferta*									
				Aphanocapsa holsatica									
				Aphanocapsa incerta									
				Aphanocapsa sp.									
			Coelomoron	*Coelomoron* sp.									
			Coelosphaerium	*Coelosphaerium* sp.									
			Merismopedia	*Merismopedia* sp.									
				Merismopedia tenuissima									
			Snowella	*Snowella lacustris*									

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification				Area	Goose	Goose	Goose	George	George	George	George	George	George
				Lake	Goose Tail	Goose Tail	Propellor	Lower Long	Fold	George Central	Dragon	Komatic	Reference C
				Replicate	1	1 DUP	1	1	1	1	1	1	1
				Lab Duplicate	no	yes	no	no	no	no	no	no	no
				Date Sampled	11-Apr-2012	11-Apr-2012	12-Apr-2012	13-Apr-2012	15-Apr-2012	13-Apr-2012	15-Aug-2012	13-Apr-2012	13-Apr-2012
Class	Order	Family	Genus	Sample ID	6138.4-6	6138.4-6-DUP	6138.4-1	6141.4-3	6141.4-5	6141.4-1	6141.4-6	6141.4-4	6141.4-2
			Woronichinia	*Woronichinia compacta*									
		Microcystaceae	*Gloeocapsa*	*Gloeocapsa* sp.									
			Microcystis	*Microcystis aeruginosa*									
		Synechococcaceae	*Aphanothece*	*Aphanothece minutissima*									
				Aphanothece sp.			129.83						
			Rhabdoderma	*Rhabdoderma lineare*									
			Synechococcus	*Synechococcus* sp.									
	Nostocales	Nostocaceae	*Anabaena*	*Anabaena* sp.									
			Nostoc	*Nostoc* sp.									
	Oscillatoriales	Oscillatoriaceae	*Oscillatoria*	*Oscillatoria* sp.									
		Pseudanabaenaceae	*Leptolyngbya*	*Leptolyngbya* sp.			5.65						
			Planktolyngbya	*Planktolyngbya limnetica*				480.00					768.00
			Pseudanabaena	*Pseudanabaena galeata*									
				Pseudanabaena sp.									
Trebouxiophyceae	Prasiolales	Koliellaceae	*Koliella*	*Koliella longiseta*									
Xanthophyceae	Heterococcales	Sciadaceae	*Centritractus*	*Centritractus* sp.									
	Mischococcales	Characiopsidaceae	*Characiopsis*	*Characiopsis* sp.									
Undetermined	Undetermined	Katablepharidaceae	*Katablepharis*	*Katablepharis ovalis*									
		Undetermined	Undetermined	unknown Chlorophyte coccoid									
				Total	**70.17**	**80.47**	**169.19**	**689.00**	**342.10**	**44.10**	**478.80**	**995.80**	**825.70**

Note: George Central Rep 3 (ID 6141.4-9) contained too much detritus and silt for taxonomists to enumerate.

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL				Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
				Lake	Gander	Gander	Gander	Big	Big	Big	Rabbit	Rabbit	Rabbit	Rabbit
				Replicate	1	2	3	1	2	3	1	2	2-DUP	3
				Lab Duplicate	no	no	no	no	no	no	no	no	no	yes
				Date Sampled	18-Aug-2012	18-Aug-2012	18-Aug-2012	16-Aug-2012	16-Aug-2012	16-Aug-2012	15-Aug-2012	15-Aug-2012	15-Aug-2012	15-Aug-2012
Taxonomic Classification				Sample ID	6138.5-13	6138.5-14	6138.5-15	6138.5-7	6138.5-8	6138.5-9	6138.5-4	6138.5-5	6138.5-6	6138.5-5_DUP
Class	**Order**	**Family**	**Genus**	**Final Designation**										
Bacillariophyceae	Centrales	Stephanodiscaceae	*Cyclotella*	*Cyclotella* sp.	0.88			0.96	8.56	5.64		1.33	7.59	4.99
				Cyclotella sp. < 6µm										
				Cyclotella sp. 6-10 µm										
			Stephanodiscus	*Stephanodiscus* sp.										
	Pennales	Achnanthaceae	*Achnanthes*	*Achnanthes* sp.	1.77	1.00	1.92	0.96				0.67	0.63	1.66
		Achnanthidiaceae	*Achnanthidium*	*Achnanthidium* sp.										
		Amphipleuraceae	*Frustulia*	*Frustulia* sp.				0.96						0.83
		Bacillariaceae	*Nitzschia*	*Nitzschia* sp.	5.30	8.03	8.65	0.96	1.22	1.41				0.83
				Nitzschia spp.										
		Catenulaceae	*Amphora*	*Amphora* sp.										
		Cymbellaceae	*Cymbella*	*Cymbella* sp.	0.88									
		Diploneidaceae	*Diploneis*	*Diploneis* sp.										
		Eunotiaceae	*Eunotia*	*Eunotia* sp.				1.91						
		Fragilariaceae	*Fragilaria*	*Fragilaria* sp.		6.02	4.80							
			Synedra	*Synedra* sp.										
		Naviculaceae	*Navicula*	*Navicula* sp.	1.77	2.01	1.92	0.96	1.22	0.71		2.66	1.90	
		Pinnulariaceae	*Caloneis*	*Caloneis* sp.										
			Pinnularia	*Pinnularia biceps*	0.88			0.96						
				Pinnularia sp.	0.88	1.00								
		Pleurosigmataceae	*Pleurosigma*	*Pleurosigma* sp.										
		Rhopalodiaceae	*Epithemia*	*Epithemia* sp.										
		Stauroneidaceae	*Stauroneis*	*Stauroneis* sp.			0.96							
		Surirellaceae	*Surirella*	*Surirella* sp.										
		Tabellariaceae	*Tabellaria*	*Tabellaria fenestrata*			17.29							
				Tabellaria flocculosa										
				Tabellaria sp.	47.69	32.12	23.06	5.74	39.15	97.35	6.80	15.97	18.97	3.32
Chlorodendrophyceae	Chlorodendrales	Chlorodendraceae	*Tetraselmis*	*Tetraselmis* sp.					0.61					
Chlorophyceae	Chlorococcales	Chlorococcaceae	*Tetraedron*	*Tetraedron caudatum*					0.61					
				Tetraedron minimum										
				Tetraedron sp.	2.65	2.01		1.91	0.61	0.71				
		Hydrodictyaceae	*Pediastrum*	*Pediastrum* sp.	42.39	52.19	11.53							
		Oocystaceae	*Ankistrodesmus*	*Ankistrodesmus* sp.			8.65							
			Botryococcus	*Botryococcus* sp.				53.62						
			Closteriopsis	*Closteriopsis acicularis*										
			Monoraphidium	*Monoraphidium arcuatum*										
				Monoraphidium contortum										
				Monoraphidium sp.	110.40	103.38	104.72	61.28	23.25	40.21	110.52	83.20	75.88	108.03
				Monoraphidium tortile										
			Oocystis	*Oocystis* sp.	8.83	14.05	10.57	61.28	24.47	26.10	5.95	7.32	6.32	9.97
			Quadrigula	*Quadrigula chodati*										
				Quadrigula closterioides										
		Scenedesmaceae	*Coelastrum*	*Coelastrum* sp.										
			Crucigenia	*Crucigenia* sp.			34.59	3.83	2.45	2.82				
			Crucigeniella	*Crucigeniella rectangularis*										
			Scenedesmus	*Scenedesmus bijuga*										
				Scenedesmus brasiliensis										
				Scenedesmus sp.	3.53	4.01				2.82				
	Sphaeropleales	Characiaceae	*Ankyra*	*Ankyra judayi*										
		Radiococcaceae	*Coenococcus*	*Coenococcus fottii*										
	Tetrasporales	Coccomyxaceae	*Elakatothrix*	*Elakatothrix gelatinosa*										
				Elakatothrix sp.	50.34	64.23	64.37	255.65	184.13	200.35	68.01	46.59	49.32	63.99
		Palmellaceae	*Gloeocystis*	*Gloeocystis gigas*										
			Sphaerocystis	*Sphaerocystis planctonica*	25.61	17.06		19.15	39.15	28.22	35.71	10.65	0.63	8.31
				Sphaerocystis sp.										

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification														
				Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
				Lake	Gander	Gander	Gander	Big	Big	Big	Rabbit	Rabbit	Rabbit	Rabbit
				Replicate	1	2	3	1	2	3	1	2	2-DUP	3
				Lab Duplicate	no	no	no	no	no	no	no	no	no	yes
				Date Sampled	18-Aug-2012	18-Aug-2012	18-Aug-2012	16-Aug-2012	16-Aug-2012	16-Aug-2012	15-Aug-2012	15-Aug-2012	15-Aug-2012	15-Aug-2012
				Sample ID	6138.5-13	6138.5-14	6138.5-15	6138.5-7	6138.5-8	6138.5-9	6138.5-4	6138.5-5	6138.5-6	6138.5-5_DUP
Class	**Order**	**Family**	**Genus**	**Final Designation**										
	Volvocales	Chlamydomonadaceae	*Carteria*	*Carteria* sp.										
			Chlamydomonas	*Chlamydomonas* sp.	0.88	3.01	0.96							
	Zygnematales	Desmidiaceae	*Closterium*	*Closterium* sp.										
			Cosmarium	*Cosmarium* sp.	1.77	2.01								0.83
			Euastrum	*Euastrum* sp.	1.77			0.96				1.33	0.63	
			Spondylosium	*Spondylosium* sp.										
			Staurastrum	*Staurastrum* sp.			0.96	0.96	1.22					0.83
			Staurodesmus	*Staurodesmus* sp.	0.88	1.00	0.96		1.84	0.71				
			Teilingia	*Teilingia granulata*	5.30	1.00		12.45	8.56	9.88				
			Xanthidium	*Xanthidium* sp.		1.00								
		Mesotaeniaceae	*Gonatozygon*	*Gonatozygon* sp.										
		Zygnemataceae	*Mougeotia*	*Mougeotia* sp.		2.01	0.96	10.53	7.95	5.64	1.70	1.33	0.63	3.32
Chrysophyceae	Chromulinales	Chromulinaceae	*Chromulina*	*Chromulina* sp.										
			Kephyrion	*Kephyrion* sp.										
		Chrysocapsaceae	*Chrysocapsa*	*Chrysocapsa planktonica*										
				Chrysocapsa sp.										
	Chrysomonadales	Dinobryaceae	*Chrysococcus*	*Chrysococcus* sp.										
			Chrysolykos	*Chrysolykos planctonicus*										
			Dinobryon	*Dinobryon bavaricum*										
				Dinobryon divergens										
				Dinobryon sertularia										
				Dinobryon sociale										
				Dinobryon sp.	3.53	32.12	20.18	0.96	2.45		0.85	2.00	1.90	1.66
		Synuraceae	*Mallomonas*	*Mallomonas* sp.	1.77	1.00	0.96			0.71	0.85			
			Synura	*Synu* ra sp.										
	Hibberdiales	Stylococcaceae	*Diceras*	*Diceras* sp.										
	Ochromonadales	Ochromonadaceae	*Ochromonas*	*Ochromonas* sp.										
	Prymnesiales	Prymnesiaceae	*Chrysochromulina*	*Chrysochromulina parva*										
Cryptophyceae	Cryptomonadales	Cryptomonadaceae	*Cryptomonas*	*Cryptomonas* sp.	7.95	9.03	9.61	3.83	5.51	2.82	85.87	65.23	66.39	80.61
				Cryptomonas spp.										
			Komma	*Komma caudata*										
	Pyrenomonadales	Pyrenomonadaceae	*Rhodomonas*	*Rhodomonas lacustris var. nannoplanctica*										
Cyanophyceae	Synechococcales	Synechococcaceae	*Cyanodictyon*	*Cyanodictyon* sp.										
Dinophyceae	Dinophysales	Amphisoleniaceae	*Dinophysis*	*Dinophysis* sp.										
	Gymnodiniales	Gymondiniaceae	*Gymnodinium*	*Gymnodinium* sp.										
	Peridiniales	Peridiniaceae	*Glenodinium*	*Glenodinium* sp.										
			Peridinium	*Peridinium* sp.	44.16	39.14	42.27	0.96	1.22	1.41	1.70	0.67	1.26	1.66
Euglenophyceae	Euglenales	Euglenaceae	*Euglena*	*Euglena* sp.										
			Lepocinclis	*Lepocinclis* sp.										
			Phacus	*Phacus* sp.	0.88		0.96	0.96	0.61					
			Trachelomonas	*Trachelomonas* sp.	0.88					0.71				
Myxophyceae	Chroococcales	Chroococcaceae	*Chroococcus*	*Chroococcus limneticus*										
				Chroococcus minimus										
				Chroococcus prescottii										
				Chroococcus sp.		4.01		15.32	29.36					
		Merismopediaceae	*Aphanocapsa*	*Aphanocapsa conferta*										
				Aphanocapsa holsatica										
				Aphanocapsa incerta										
				Aphanocapsa sp.				99.58	14.68	22.57		31.95	30.35	
			Coelomoron	*Coelomoron* sp.										
			Coelosphaerium	*Coelosphaerium* sp.				49.79	217.16	67.72	27.21	31.95	60.70	46.54
			Merismopedia	*Merismopedia* sp.	91.86	136.50	53.80	53.62	9.79	98.77	54.41			26.59
				Merismopedia tenuissima										
			Snowella	*Snowella lacustris*										

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification				Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
				Lake	Gander	Gander	Gander	Big	Big	Big	Rabbit	Rabbit	Rabbit	Rabbit
				Replicate	1	2	3	1	2	3	1	2	2-DUP	3
				Lab Duplicate	no	no	no	no	no	no	no	no	no	yes
				Date Sampled	18-Aug-2012	18-Aug-2012	18-Aug-2012	16-Aug-2012	16-Aug-2012	16-Aug-2012	15-Aug-2012	15-Aug-2012	15-Aug-2012	15-Aug-2012
Class	Order	Family	Genus	Sample ID / Final Designation	6138.5-13	6138.5-14	6138.5-15	6138.5-7	6138.5-8	6138.5-9	6138.5-4	6138.5-5	6138.5-6	6138.5-5_DUP
			Woronichinia	*Woronichinia compacta*										
		Microcystaceae	*Gloeocapsa*	*Gloeocapsa* sp.										
			Microcystis	*Microcystis aeruginosa*								332.79	303.51	415.52
		Synechococcaceae	*Aphanothece*	*Aphanothece minutissima*										
				Aphanothece sp.							51.01			
			Rhabdoderma	*Rhabdoderma lineare*										
			Synechococcus	*Synechococcus* sp.										
	Nostocales	Nostocaceae	*Anabaena*	*Anabaena* sp.	298.53	208.76	276.70	57.45	63.01	53.62	6.80	7.99	5.69	10.80
			Nostoc	*Nostoc* sp.						84.66	35.71			
	Oscillatoriales	Oscillatoriaceae	*Oscillatoria*	*Oscillatoria* sp.		58.21								
		Pseudanabaenaceae	*Leptolyngbya*	*Leptolyngbya* sp.	88.32		125.86	1339.54	916.36	1193.65	737.09	260.91	281.38	624.94
			Planktolyngbya	*Planktolyngbya limnetica*										
			Pseudanabaena	*Pseudanabaena galeata*										
				Pseudanabaena sp.		80.29	47.08		19.58	8.47	52.71	10.65	10.75	41.55
Trebouxiophyceae	Prasiolales	Koliellaceae	*Koliella*	*Koliella longiseta*										
Xanthophyceae	Heterococcales	Sciadaceae	*Centritractus*	*Centritractus* sp.				0.96	0.61					
	Mischococcales	Characiopsidaceae	*Characiopsis*	*Characiopsis* sp.										
Undetermined	Undetermined	Katablepharidaceae	*Katablepharis*	*Katablepharis ovalis*										
		Undetermined	Undetermined	unknown Chlorophyte coccoid										
				Total	**852.31**	**886.23**	**874.31**	**2117.98**	**1625.35**	**1957.67**	**1282.89**	**915.18**	**924.43**	**1456.80**

Note: George Central Rep 3 (ID 6141.4-9) contained too much detritus and silt for taxonomists to enumerate.

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification				Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
				Lake	Fox	Fox	Fox	Giraffe South	Giraffe South	Giraffe South	Goose Neck	Goose Neck	Goose Neck
				Replicate	1	2	3	1	2	3	1	2	3
				Lab Duplicate	no	no	no	no	no	no	no	no	no
				Date Sampled	20-Aug-2012	20-Aug-2012	20-Aug-2012	19-Aug-2012	19-Aug-2012	19-Aug-2012	14-Aug-2012	14-Aug-2012	14-Aug-2012
				Sample ID	6138.5-19	6138.5-20	6138.5-21	6138.5-16	6138.5-17	6138.5-18	6138.5-1	6138.5-2	6138.5-3
Class	**Order**	**Family**	**Genus**	**Final Designation**									
Bacillariophyceae	Centrales	Stephanodiscaceae	*Cyclotella*	*Cyclotella* sp.	1.14	1.04				0.81	13.69	11.95	17.46
				Cyclotella sp. < 6µm									
				Cyclotella sp. 6-10 µm									
			Stephanodiscus	*Stephanodiscus* sp.									
	Pennales	Achnanthaceae	*Achnanthes*	*Achnanthes* sp.	1.14			0.70	0.94				
		Achnanthidiaceae	*Achnanthidium*	*Achnanthidium* sp.									
		Amphipleuraceae	*Frustulia*	*Frustulia* sp.									
		Bacillariaceae	*Nitzschia*	*Nitzschia* sp.	2.27	2.08	3.91	0.70	0.94	0.81	3.99	1.56	1.40
				Nitzschia spp.									
		Catenulaceae	*Amphora*	*Amphora* sp.									
		Cymbellaceae	*Cymbella*	*Cymbella* sp.									
		Diploneidaceae	*Diploneis*	*Diploneis* sp.									
		Eunotiaceae	*Eunotia*	*Eunotia* sp.		1.04				1.63			
		Fragilariaceae	*Fragilaria*	*Fragilaria* sp.									
			Synedra	*Synedra* sp.									
		Naviculaceae	*Navicula*	*Navicula* sp.	3.41	1.04	3.13		1.88	1.63	1.14	1.56	2.79
		Pinnulariaceae	*Caloneis*	*Caloneis* sp.									
			Pinnularia	*Pinnularia biceps*	1.14								0.70
				Pinnularia sp.		1.04		0.70					
		Pleurosigmataceae	*Pleurosigma*	*Pleurosigma* sp.								0.52	0.70
		Rhopalodiaceae	*Epithemia*	*Epithemia* sp.									
		Stauroneidaceae	*Stauroneis*	*Stauroneis* sp.			0.78						
		Surirellaceae	*Surirella*	*Surirella* sp.									
		Tabellariaceae	*Tabellaria*	*Tabellaria fenestrata*	3.41								
				Tabellaria flocculosa									
				Tabellaria sp.	38.61	109.07	101.77		16.91	58.53	141.48	178.78	166.25
Chlorodendrophyceae	Chlorodendrales	Chlorodendraceae	*Tetraselmis*	*Tetraselmis* sp.									
Chlorophyceae	Chlorococcales	Chlorococcaceae	*Tetraedron*	*Tetraedron caudatum*									
				Tetraedron minimum									
				Tetraedron sp.	1.14		0.78		0.94	0.81	0.57	0.52	
		Hydrodictyaceae	*Pediastrum*	*Pediastrum* sp.									
		Oocystaceae	*Ankistrodesmus*	*Ankistrodesmus* sp.					1.88				
			Botryococcus	*Botryococcus* sp.							11.41		
			Closteriopsis	*Closteriopsis acicularis*									
			Monoraphidium	*Monoraphidium arcuatum*									
				Monoraphidium contortum									
				Monoraphidium sp.	228.25	186.98	109.60	134.19	170.98	116.25	49.06	46.77	47.50
				Monoraphidium tortile									
			Oocystis	*Oocystis* sp.	2.27	9.35	3.13	5.62	5.64	7.32	19.40	25.99	40.52
			Quadrigula	*Quadrigula chodati*									
				Quadrigula closterioides									
		Scenedesmaceae	*Coelastrum*	*Coelastrum* sp.									
			Crucigenia	*Crucigenia* sp.									
			Crucigeniella	*Crucigeniella rectangularis*			72.02	12.65	93.00	22.76			
			Scenedesmus	*Scenedesmus bijuga*									
				Scenedesmus brasiliensis									
				Scenedesmus sp.			3.13						
	Sphaeropleales	Characiaceae	*Ankyra*	*Ankyra judayi*									
		Radiococcaceae	*Coenococcus*	*Coenococcus fottii*									
	Tetrasporales	Coccomyxaceae	*Elakatothrix*	*Elakatothrix gelatinosa*									
				Elakatothrix sp.	11.36	16.62	14.09	131.38	121.19	121.95	63.33	60.29	64.97
		Palmellaceae	*Gloeocystis*	*Gloeocystis gigas*									
			Sphaerocystis	*Sphaerocystis planctonica*		8.31	3.13	11.24	7.52		36.51	21.31	27.94
				Sphaerocystis sp.						4.88			

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification													
				Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
				Lake	Fox	Fox	Fox	Giraffe South	Giraffe South	Giraffe South	Goose Neck	Goose Neck	Goose Neck
				Replicate	1	2	3	1	2	3	1	2	3
				Lab Duplicate	no	no	no	no	no	no	no	no	no
				Date Sampled	20-Aug-2012	20-Aug-2012	20-Aug-2012	19-Aug-2012	19-Aug-2012	19-Aug-2012	14-Aug-2012	14-Aug-2012	14-Aug-2012
				Sample ID	6138.5-19	6138.5-20	6138.5-21	6138.5-16	6138.5-17	6138.5-18	6138.5-1	6138.5-2	6138.5-3
Class	**Order**	**Family**	**Genus**	**Final Designation**									
	Volvocales	Chlamydomonadaceae	*Carteria*	*Carteria* sp.									
			Chlamydomonas	*Chlamydomonas* sp.		1.04		0.70		0.81			
	Zygnematales	Desmidiaceae	*Closterium*	*Closterium* sp.									
			Cosmarium	*Cosmarium* sp.	1.14		0.78		0.94		0.57		
			Euastrum	*Euastrum* sp.					0.94			0.52	0.70
			Spondylosium	*Spondylosium* sp.									
			Staurastrum	*Staurastrum* sp.							0.57		0.70
			Staurodesmus	*Staurodesmus* sp.	1.14	2.08	1.57		0.94		0.57	1.04	2.10
			Teilingia	*Teilingia granulata*	2.27	7.27	5.48	3.51	2.82	4.06	4.56	1.56	4.89
			Xanthidium	*Xanthidium* sp.	1.14				0.94	0.81			0.70
		Mesotaeniaceae	*Gonatozygon*	*Gonatozygon* sp.	1.14								
		Zygnemataceae	*Mougeotia*	*Mougeotia* sp.	1.14	1.04			0.94	0.81	0.57		2.79
Chrysophyceae	Chromulinales	Chromulinaceae	*Chromulina*	*Chromulina* sp.									
			Kephyrion	*Kephyrion* sp.									
		Chrysocapsaceae	*Chrysocapsa*	*Chrysocapsa planktonica*									
				Chrysocapsa sp.									
	Chrysomonadales	Dinobryaceae	*Chrysococcus*	*Chrysococcus* sp.									
			Chrysolykos	*Chrysolykos planctonicus*									
			Dinobryon	*Dinobryon bavaricum*									
				Dinobryon divergens									
				Dinobryon sertularia									
				Dinobryon sociale									
				Dinobryon sp.	42.02	50.90	54.02	3.51	4.70	8.13	3.42	4.16	1.40
		Synuraceae	*Mallomonas*	*Mallomonas* sp.	1.14	1.04	1.57	2.81	0.94	3.25	1.14	1.04	4.19
			Synura	*Synu* ra sp.									
	Hibberdiales	Stylococcaceae	*Diceras*	*Diceras* sp.									
	Ochromonadales	Ochromonadaceae	*Ochromonas*	*Ochromonas* sp.									
	Prymnesiales	Prymnesiaceae	*Chrysochromulina*	*Chrysochromulina parva*									
Cryptophyceae	Cryptomonadales	Cryptomonadaceae	*Cryptomonas*	*Cryptomonas* sp.	32.93	45.71	31.31	14.05	6.58	17.07	43.93	31.18	47.50
				Cryptomonas spp.									
			Komma	*Komma caudata*	1.14			0.70	0.94	1.63	1.71	4.16	4.89
	Pyrenomonadales	Pyrenomonadaceae	*Rhodomonas*	*Rhodomonas lacustris var. nannoplanctica*									
Cyanophyceae	Synechococcales	Synechococcaceae	*Cyanodictyon*	*Cyanodictyon* sp.									
Dinophyceae	Dinophysales	Amphisoleniaceae	*Dinophysis*	*Dinophysis* sp.									
	Gymnodiniales	Gymondiniaceae	*Gymnodinium*	*Gymnodinium* sp.									
	Peridiniales	Peridiniaceae	*Glenodinium*	*Glenodinium* sp.									
			Peridinium	*Peridinium* sp.	7.95	3.12	7.83		2.82	0.81	2.85	2.08	0.70
Euglenophyceae	Euglenales	Euglenaceae	*Euglena*	*Euglena* sp.									
			Lepocinclis	*Lepocinclis* sp.									
			Phacus	*Phacus* sp.	1.14			0.70	0.94		1.71	1.04	1.40
			Trachelomonas	*Trachelomonas* sp.							0.57		0.70
Myxophyceae	Chroococcales	Chroococcaceae	*Chroococcus*	*Chroococcus limneticus*									
				Chroococcus minimus									
				Chroococcus prescottii									
				Chroococcus sp.		8.31		5.62	1.88	29.27			5.59
		Merismopediaceae	*Aphanocapsa*	*Aphanocapsa conferta*									
				Aphanocapsa holsatica									
				Aphanocapsa incerta									
				Aphanocapsa sp.	9.08								
			Coelomoron	*Coelomoron* sp.									
			Coelosphaerium	*Coelosphaerium* sp.	18.17	45.71		191.10	266.80	243.89	36.51	16.63	33.53
			Merismopedia	*Merismopedia* sp.			75.15	562.05	232.98	347.14	241.89	93.55	69.85
				Merismopedia tenuissima									
			Snowella	*Snowella lacustris*									

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification				Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
				Lake	Fox	Fox	Fox	Giraffe South	Giraffe South	Giraffe South	Goose Neck	Goose Neck	Goose Neck
				Replicate	1	2	3	1	2	3	1	2	3
				Lab Duplicate	no	no	no	no	no	no	no	no	no
				Date Sampled	20-Aug-2012	20-Aug-2012	20-Aug-2012	19-Aug-2012	19-Aug-2012	19-Aug-2012	14-Aug-2012	14-Aug-2012	14-Aug-2012
Class	Order	Family	Genus	Sample ID / Final Designation	6138.5-19	6138.5-20	6138.5-21	6138.5-16	6138.5-17	6138.5-18	6138.5-1	6138.5-2	6138.5-3
			Woronichinia	*Woronichinia compacta*									
		Microcystaceae	*Gloeocapsa*	*Gloeocapsa* sp.									
			Microcystis	*Microcystis aeruginosa*									
		Synechococcaceae	*Aphanothece*	*Aphanothece minutissima*									
				Aphanothece sp.								50.93	75.44
			Rhabdoderma	*Rhabdoderma lineare*									
			Synechococcus	*Synechococcus* sp.									
	Nostocales	Nostocaceae	*Anabaena*	*Anabaena* sp.	43.15	9.35	38.36	6.32	11.27	46.34	5.71	4.68	12.57
			Nostoc	*Nostoc* sp.									
	Oscillatoriales	Oscillatoriaceae	*Oscillatoria*	*Oscillatoria* sp.									
		Pseudanabaenaceae	*Leptolyngbya*	*Leptolyngbya* sp.				288.05	146.55	595.90	90.71	219.84	412.14
			Planktolyngbya	*Planktolyngbya limnetica*									
			Pseudanabaena	*Pseudanabaena galeata*									
				Pseudanabaena sp.									
Trebouxiophyceae	Prasiolales	Koliellaceae	*Koliella*	*Koliella longiseta*									
Xanthophyceae	Heterococcales	Sciadaceae	*Centritractus*	*Centritractus* sp.				1.41	0.94	1.63	1.71	1.04	
	Mischococcales	Characiopsidaceae	*Characiopsis*	*Characiopsis* sp.									
Undetermined	Undetermined	Katablepharidaceae	*Katablepharis*	*Katablepharis ovalis*									
		Undetermined	Undetermined	unknown Chlorophyte coccoid									
				Total	**458.77**	**512.12**	**531.56**	**1377.73**	**1106.65**	**1638.94**	**779.31**	**782.68**	**1052.02**

Note: George Central Rep 3 (ID 6141.4-9) contained too much detritus and silt for taxonomists to enumerate.

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification				Area	Goose	Goose	Goose	Goose	George	George	George	George	George	George
				Lake	Goose Central	Goose Central	Goose Central	Goose Central	Lower Long	Lower Long	Lower Long	Fold	Fold	Fold
				Replicate	1	2	2 DUP	3	1	2	3	1	2	3
				Lab Duplicate	no	no	yes	no	no	no	no	no	no	no
				Date Sampled	17-Aug-2012	17-Aug-2012	17-Aug-2012	17-Aug-2012	21-Aug-2012	21-Aug-2012	21-Aug-2012	19-Aug-2012	19-Aug-2012	19-Aug-2012
Class	Order	Family	Genus	Sample ID / Final Designation	6138.5-10	6138.5-11	6138.5-11_DUP	6138.5-12	6141.4-19	6141.4-20	6141.4-21	6141.4-10	6141.4-11	6141.4-12
Bacillariophyceae	Centrales	Stephanodiscaceae	*Cyclotella*	*Cyclotella* sp.	8.58	8.32	2.90	3.40				14.00	31.00	32.00
				Cyclotella sp. < 6µm					2.00	9.00	43.00	51.00		102.00
				Cyclotella sp. 6-10 µm										
			Stephanodiscus	*Stephanodiscus* sp.										0.50
	Pennales	Achnanthaceae	*Achnanthes*	*Achnanthes* sp.										
		Achnanthidiaceae	*Achnanthidium*	*Achnanthidium* sp.					4.00		6.00		61.20	22.00
		Amphipleuraceae	*Frustulia*	*Frustulia* sp.		0.59	0.58							
		Bacillariaceae	*Nitzschia*	*Nitzschia* sp.	4.57	5.95	5.22	8.17						
				Nitzschia spp.										
		Catenulaceae	*Amphora*	*Amphora* sp.								30.00	30.00	66.00
		Cymbellaceae	*Cymbella*	*Cymbella* sp.				0.68						
		Diploneidaceae	*Diploneis*	*Diploneis* sp.	0.57									
		Eunotiaceae	*Eunotia*	*Eunotia* sp.										
		Fragilariaceae	*Fragilaria*	*Fragilaria* sp.		3.57	1.16	25.87						
			Synedra	*Synedra* sp.					1.50	0.50	1.00		0.50	
		Naviculaceae	*Navicula*	*Navicula* sp.	1.14			2.04						
		Pinnulariaceae	*Caloneis*	*Caloneis* sp.										
			Pinnularia	*Pinnularia biceps*										
				Pinnularia sp.	0.57									
		Pleurosigmataceae	*Pleurosigma*	*Pleurosigma* sp.										
		Rhopalodiaceae	*Epithemia*	*Epithemia* sp.										
		Stauroneidaceae	*Stauroneis*	*Stauroneis* sp.										
		Surirellaceae	*Surirella*	*Surirella* sp.										
		Tabellariaceae	*Tabellaria*	*Tabellaria fenestrata*										
				Tabellaria flocculosa					5.00					
				Tabellaria sp.	456.22	160.54	255.15	397.54						
Chlorodendrophyceae	Chlorodendrales	Chlorodendraceae	*Tetraselmis*	*Tetraselmis* sp.				0.68						
Chlorophyceae	Chlorococcales	Chlorococcaceae	*Tetraedron*	*Tetraedron caudatum*										
				Tetraedron minimum										
				Tetraedron sp.					12.00	20.40	2.00			
		Hydrodictyaceae	*Pediastrum*	*Pediastrum* sp.										
		Oocystaceae	*Ankistrodesmus*	*Ankistrodesmus* sp.										
			Botryococcus	*Botryococcus* sp.										
			Closteriopsis	*Closteriopsis acicularis*					7.00	3.00	3.00			
			Monoraphidium	*Monoraphidium arcuatum*										
				Monoraphidium contortum										
				Monoraphidium sp.	38.30	42.81	40.59	38.12						
				Monoraphidium tortile										
			Oocystis	*Oocystis* sp.	31.44	24.97	23.20	25.87					13.00	
			Quadrigula	*Quadrigula chodati*							0.50			
				Quadrigula closterioides					15.50	42.00	14.50			
		Scenedesmaceae	*Coelastrum*	*Coelastrum* sp.										
			Crucigenia	*Crucigenia* sp.										
			Crucigeniella	*Crucigeniella rectangularis*										
			Scenedesmus	*Scenedesmus bijuga*							4.00		2.00	
				Scenedesmus brasiliensis										
				Scenedesmus sp.										
	Sphaeropleales	Characiaceae	*Ankyra*	*Ankyra judayi*										
		Radiococcaceae	*Coenococcus*	*Coenococcus fottii*										
	Tetrasporales	Coccomyxaceae	*Elakatothrix*	*Elakatothrix gelatinosa*					4.00	16.00	4.00	28.00	35.00	74.00
				Elakatothrix sp.	81.18	101.67	95.68	113.00						
		Palmellaceae	*Gloeocystis*	*Gloeocystis gigas*										8.00
			Sphaerocystis	*Sphaerocystis planctonica*	7.43	11.89	9.28	1.36						
				Sphaerocystis sp.										

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification																
Class	Order	Family	Genus	Final Designation	Area	Goose	Goose	Goose	Goose	George	George	George	George	George	George
					Lake	Goose Central	Goose Central	Goose Central	Goose Central	Lower Long	Lower Long	Lower Long	Fold	Fold	Fold
					Replicate	1	2	2 DUP	3	1	2	3	1	2	3
					Lab Duplicate	no	no	yes	no	no	no	no	no	no	no
					Date Sampled	17-Aug-2012	17-Aug-2012	17-Aug-2012	17-Aug-2012	21-Aug-2012	21-Aug-2012	21-Aug-2012	19-Aug-2012	19-Aug-2012	19-Aug-2012
					Sample ID	6138.5-10	6138.5-11	6138.5-11_DUP	6138.5-12	6141.4-19	6141.4-20	6141.4-21	6141.4-10	6141.4-11	6141.4-12
	Volvocales	Chlamydomonadaceae	*Carteria*	*Carteria* sp.											
			Chlamydomonas	*Chlamydomonas* sp.		0.59	0.58								
	Zygnematales	Desmidiaceae	*Closterium*	*Closterium* sp.											
			Cosmarium	*Cosmarium* sp.					0.50	2.00	3.00				
			Euastrum	*Euastrum* sp.		0.59	0.58	0.68							
			Spondylosium	*Spondylosium* sp.											
			Staurastrum	*Staurastrum* sp.	0.57			0.68							
			Staurodesmus	*Staurodesmus* sp.	0.57	0.59	1.74	3.40		0.50					
			Teilingia	*Teilingia granulata*	4.00	8.32	2.32	3.40							
			Xanthidium	*Xanthidium* sp.		0.59	0.58	1.36							
		Mesotaeniaceae	*Gonatozygon*	*Gonatozygon* sp.				0.68							
		Zygnemataceae	*Mougeotia*	*Mougeotia* sp.	1.14			2.04							
Chrysophyceae	Chromulinales	Chromulinaceae	*Chromulina*	*Chromulina* sp.								112.20	51.00	15.30	
			Kephyrion	*Kephyrion* sp.								30.60	20.40	76.50	
		Chrysocapsaceae	*Chrysocapsa*	*Chrysocapsa planktonica*					52.00	5.50					
				Chrysocapsa sp.					16.00	16.00	105.00				
	Chrysomonadales	Dinobryaceae	*Chrysococcus*	*Chrysococcus* sp.											
			Chrysolykos	*Chrysolykos planctonicus*											
			Dinobryon	*Dinobryon bavaricum*						1.00					
				Dinobryon divergens								224.00	154.50	189.00	
				Dinobryon sertularia											
				Dinobryon sociale					1.00		3.50				
				Dinobryon sp.	7.43	5.95	5.80	7.49							
		Synuraceae	*Mallomonas*	*Mallomonas* sp.	3.43	4.16	4.06	4.76							
			Synura	*Synu* ra sp.							8.50				
	Hibberdiales	Stylococcaceae	*Diceras*	*Diceras* sp.											5.10
	Ochromonadales	Ochromonadaceae	*Ochromonas*	*Ochromonas* sp.					61.20	13.00	69.00	8.00	8.00	18.00	
	Prymnesiales	Prymnesiaceae	*Chrysochromulina*	*Chrysochromulina parva*					20.40	51.00		20.40	10.20		
Cryptophyceae	Cryptomonadales	Cryptomonadaceae	*Cryptomonas*	*Cryptomonas* sp.	5.15	13.68	12.76	16.34							
				Cryptomonas spp.					5.00	1.50	4.00	14.00	2.00	0.50	
			Komma	*Komma caudata*				0.68							
	Pyrenomonadales	Pyrenomonadaceae	*Rhodomonas*	*Rhodomonas lacustris var. nannoplanctica*					13.00	8.00		14.00	9.00	22.00	
Cyanophyceae	Synechococcales	Synechococcaceae	*Cyanodictyon*	*Cyanodictyon* sp.											4400.00
Dinophyceae	Dinophysales	Amphisoleniaceae	*Dinophysis*	*Dinophysis* sp.											
	Gymnodiniales	Gymondiniaceae	*Gymnodinium*	*Gymnodinium* sp.					7.00	1.50	7.00	8.00	1.00		
	Peridiniales	Peridiniaceae	*Glenodinium*	*Glenodinium* sp.											
			Peridinium	*Peridinium* sp.	1.14	1.19	1.74	2.72							
Euglenophyceae	Euglenales	Euglenaceae	*Euglena*	*Euglena* sp.											
			Lepocinclis	*Lepocinclis* sp.											
			Phacus	*Phacus* sp.	2.86	0.59	1.16	2.04							
			Trachelomonas	*Trachelomonas* sp.		0.59	0.58								
Myxophyceae	Chroococcales	Chroococcaceae	*Chroococcus*	*Chroococcus limneticus*					32.00	16.00					
				Chroococcus minimus											
				Chroococcus prescottii											
				Chroococcus sp.	19.44	9.51	9.28	5.45							
		Merismopediaceae	*Aphanocapsa*	*Aphanocapsa conferta*					794.50	130.00					
				Aphanocapsa holsatica								1000.00	1100.00		
				Aphanocapsa incerta								3060.00	500.00		
				Aphanocapsa sp.		35.67	0.58				158.10		45.90	35.70	
			Coelomoron	*Coelomoron* sp.											
			Coelosphaerium	*Coelosphaerium* sp.	80.04	158.16	208.76	49.01							
			Merismopedia	*Merismopedia* sp.	187.52	107.02	115.98	182.43							
				Merismopedia tenuissima							48.00				
			Snowella	*Snowella lacustris*					8.00	64.00	32.00				

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification				Area	Goose	Goose	Goose	Goose	George	George	George	George	George	George
				Lake	Goose Central	Goose Central	Goose Central	Goose Central	Lower Long	Lower Long	Lower Long	Fold	Fold	Fold
				Replicate	1	2	2 DUP	3	1	2	3	1	2	3
				Lab Duplicate	no	no	yes	no	no	no	no	no	no	no
				Date Sampled	17-Aug-2012	17-Aug-2012	17-Aug-2012	17-Aug-2012	21-Aug-2012	21-Aug-2012	21-Aug-2012	19-Aug-2012	19-Aug-2012	19-Aug-2012
Class	Order	Family	Genus	Sample ID / Final Designation	6138.5-10	6138.5-11	6138.5-11_DUP	6138.5-12	6141.4-19	6141.4-20	6141.4-21	6141.4-10	6141.4-11	6141.4-12
			Woronichinia	*Woronichinia compacta*							72.00			
		Microcystaceae	*Gloeocapsa*	*Gloeocapsa* sp.										
			Microcystis	*Microcystis aeruginosa*										
		Synechococcaceae	*Aphanothece*	*Aphanothece minutissima*										
				Aphanothece sp.										
			Rhabdoderma	*Rhabdoderma lineare*							7.00			
			Synechococcus	*Synechococcus* sp.					45.90					
	Nostocales	Nostocaceae	*Anabaena*	*Anabaena* sp.	8.58	29.13	12.76	29.27						
			Nostoc	*Nostoc* sp.										
	Oscillatoriales	Oscillatoriaceae	*Oscillatoria*	*Oscillatoria* sp.		10.70	9.86							
		Pseudanabaenaceae	*Leptolyngbya*	*Leptolyngbya* sp.	772.95	581.49	507.99	524.83						
			Planktolyngbya	*Planktolyngbya limnetica*										
			Pseudanabaena	*Pseudanabaena galeata*										
				Pseudanabaena sp.	21.15	8.32	12.76	21.78						
Trebouxiophyceae	Prasiolales	Koliellaceae	*Koliella*	*Koliella longiseta*										
Xanthophyceae	Heterococcales	Sciadaceae	*Centritractus*	*Centritractus* sp.		0.59	0.58							
	Mischococcales	Characiopsidaceae	*Characiopsis*	*Characiopsis* sp.										
Undetermined	Undetermined	Katablepharidaceae	*Katablepharis*	*Katablepharis ovalis*										
		Undetermined	Undetermined	unknown Chlorophyte coccoid										
				Total	**1745.99**	**1337.79**	**1344.19**	**1475.79**	**1107.50**	**400.90**	**595.10**	**4614.20**	**2074.70**	**5066.60**

Note: George Central Rep 3 (ID 6141.4-9) contained too much detritus and silt for taxonomists to enumerate.

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification				Area	George	George	George	George	George	George	George	George	George
				Lake	George Central	George Central	Lytle	Lytle	Lytle	Lytle	Occurrence	Occurrence	Occurrence
				Replicate	1	2	1	2	2 DUP	3	1	2	3
				Lab Duplicate	no	no	no	no	yes	no	no	no	no
				Date Sampled	18-Aug-2012	18-Aug-2012	23-Aug-2012	23-Aug-2012	23-Aug-2012	23-Aug-2012	21-Aug-2012	21-Aug-2012	21-Aug-2012
				Sample ID	6141.4-7	6141.4-8	6141.4-31	6141.4-32	6141.4-32_DUP	6141.4-33	6141.4-22	6141.4-23	6141.4-24
Class	**Order**	**Family**	**Genus**	**Final Designation**									
Bacillariophyceae	Centrales	Stephanodiscaceae	*Cyclotella*	*Cyclotella* sp.	96.00								
				Cyclotella sp. < 6µm	30.60	164.00							3.00
				Cyclotella sp. 6-10 µm									
			Stephanodiscus	*Stephanodiscus* sp.									
	Pennales	Achnanthaceae	*Achnanthes*	*Achnanthes* sp.									
		Achnanthidiaceae	*Achnanthidium*	*Achnanthidium* sp.		2.00	5.00	3.00	4.00			5.10	
		Amphipleuraceae	*Frustulia*	*Frustulia* sp.									
		Bacillariaceae	*Nitzschia*	*Nitzschia* sp.									
				Nitzschia spp.									
		Catenulaceae	*Amphora*	*Amphora* sp.		10.00							
		Cymbellaceae	*Cymbella*	*Cymbella* sp.							2.00		
		Diploneidaceae	*Diploneis*	*Diploneis* sp.									
		Eunotiaceae	*Eunotia*	*Eunotia* sp.									
		Fragilariaceae	*Fragilaria*	*Fragilaria* sp.									
			Synedra	*Synedra* sp.	1.50	2.50				0.50			
		Naviculaceae	*Navicula*	*Navicula* sp.						2.00			
		Pinnulariaceae	*Caloneis*	*Caloneis* sp.									
			Pinnularia	*Pinnularia biceps*									
				Pinnularia sp.									
		Pleurosigmataceae	*Pleurosigma*	*Pleurosigma* sp.									
		Rhopalodiaceae	*Epithemia*	*Epithemia* sp.									
		Stauroneidaceae	*Stauroneis*	*Stauroneis* sp.									
		Surirellaceae	*Surirella*	*Surirella* sp.									
		Tabellariaceae	*Tabellaria*	*Tabellaria fenestrata*									
				Tabellaria flocculosa							4.00		1.00
				Tabellaria sp.									
Chlorodendrophyceae	Chlorodendrales	Chlorodendraceae	*Tetraselmis*	*Tetraselmis* sp.									
Chlorophyceae	Chlorococcales	Chlorococcaceae	*Tetraedron*	*Tetraedron caudatum*									
				Tetraedron minimum									
				Tetraedron sp.	16.00	20.00	3.00	3.00	3.00				
		Hydrodictyaceae	*Pediastrum*	*Pediastrum* sp.									
		Oocystaceae	*Ankistrodesmus*	*Ankistrodesmus* sp.									
			Botryococcus	*Botryococcus* sp.									
			Closteriopsis	*Closteriopsis acicularis*									
			Monoraphidium	*Monoraphidium arcuatum*									
				Monoraphidium contortum									
				Monoraphidium sp.									
				Monoraphidium tortile	1.00								
			Oocystis	*Oocystis* sp.		1.00							
			Quadrigula	*Quadrigula chodati*									
				Quadrigula closterioides									
		Scenedesmaceae	*Coelastrum*	*Coelastrum* sp.									
			Crucigenia	*Crucigenia* sp.									
			Crucigeniella	*Crucigeniella rectangularis*									
			Scenedesmus	*Scenedesmus bijuga*									
				Scenedesmus brasiliensis			4.00						
				Scenedesmus sp.									
	Sphaeropleales	Characiaceae	*Ankyra*	*Ankyra judayi*	1.00								
		Radiococcaceae	*Coenococcus*	*Coenococcus fottii*									
	Tetrasporales	Coccomyxaceae	*Elakatothrix*	*Elakatothrix gelatinosa*		1.50							
				Elakatothrix sp.									
		Palmellaceae	*Gloeocystis*	*Gloeocystis gigas*						0.50			
			Sphaerocystis	*Sphaerocystis planctonica*									
				Sphaerocystis sp.									

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification				Area	George	George	George	George	George	George	George	George	George
				Lake	George Central	George Central	Lytle	Lytle	Lytle	Lytle	Occurrence	Occurrence	Occurrence
				Replicate	1	2	1	2	2 DUP	3	1	2	3
				Lab Duplicate	no	no	no	no	yes	no	no	no	no
				Date Sampled	18-Aug-2012	18-Aug-2012	23-Aug-2012	23-Aug-2012	23-Aug-2012	23-Aug-2012	21-Aug-2012	21-Aug-2012	21-Aug-2012
				Sample ID	6141.4-7	6141.4-8	6141.4-31	6141.4-32	6141.4-32_DUP	6141.4-33	6141.4-22	6141.4-23	6141.4-24
Class	**Order**	**Family**	**Genus**	**Final Designation**									
	Volvocales	Chlamydomonadaceae	*Carteria*	*Carteria* sp.									
			Chlamydomonas	*Chlamydomonas* sp.									
	Zygnematales	Desmidiaceae	*Closterium*	*Closterium* sp.									
			Cosmarium	*Cosmarium* sp.						2.00			
			Euastrum	*Euastrum* sp.								1.00	
			Spondylosium	*Spondylosium* sp.									
			Staurastrum	*Staurastrum* sp.									
			Staurodesmus	*Staurodesmus* sp.									
			Teilingia	*Teilingia granulata*									
			Xanthidium	*Xanthidium* sp.									
		Mesotaeniaceae	*Gonatozygon*	*Gonatozygon* sp.									
		Zygnemataceae	*Mougeotia*	*Mougeotia* sp.									
Chrysophyceae	Chromulinales	Chromulinaceae	*Chromulina*	*Chromulina* sp.	20.40	45.90							
			Kephyrion	*Kephyrion* sp.		56.10	30.60	20.40	30.60	35.70	15.30	56.10	51.00
		Chrysocapsaceae	*Chrysocapsa*	*Chrysocapsa planktonica*									
				Chrysocapsa sp.									
	Chrysomonadales	Dinobryaceae	*Chrysococcus*	*Chrysococcus* sp.									
			Chrysolykos	*Chrysolykos planctonicus*		5.10							
			Dinobryon	*Dinobryon bavaricum*									
				Dinobryon divergens									
				Dinobryon sertularia	16.50	46.00							
				Dinobryon sociale			2.50	0.50	3.50	4.00			
				Dinobryon sp.									
		Synuraceae	*Mallomonas*	*Mallomonas* sp.									
			Synura	*Synu* ra sp.									
	Hibberdiales	Stylococcaceae	*Diceras*	*Diceras* sp.	1.00	5.00					4.00		
	Ochromonadales	Ochromonadaceae	*Ochromonas*	*Ochromonas* sp.	51.00	52.00					15.30		66.30
	Prymnesiales	Prymnesiaceae	*Chrysochromulina*	*Chrysochromulina parva*	10.20	25.50							10.20
Cryptophyceae	Cryptomonadales	Cryptomonadaceae	*Cryptomonas*	*Cryptomonas* sp.									
				Cryptomonas spp.	1.00	12.00	4.50	9.00	10.50	7.00	9.50	12.00	12.50
			Komma	*Komma caudata*									
	Pyrenomonadales	Pyrenomonadaceae	*Rhodomonas*	*Rhodomonas lacustris var. nannoplanctica*	2.00	5.00	23.00	41.00	44.00	15.00	62.00	54.00	59.00
Cyanophyceae	Synechococcales	Synechococcaceae	*Cyanodictyon*	*Cyanodictyon* sp.									
Dinophyceae	Dinophysales	Amphisoleniaceae	*Dinophysis*	*Dinophysis* sp.									
	Gymnodiniales	Gymondiniaceae	*Gymnodinium*	*Gymnodinium* sp.	3.00	2.50						5.00	0.50
	Peridiniales	Peridiniaceae	*Glenodinium*	*Glenodinium* sp.	1.00		1.00	0.50	0.50	1.00	4.00		
			Peridinium	*Peridinium* sp.									
Euglenophyceae	Euglenales	Euglenaceae	*Euglena*	*Euglena* sp.									
			Lepocinclis	*Lepocinclis* sp.									
			Phacus	*Phacus* sp.									
			Trachelomonas	*Trachelomonas* sp.									
Myxophyceae	Chroococcales	Chroococcaceae	*Chroococcus*	*Chroococcus limneticus*									
				Chroococcus minimus								117.30	
				Chroococcus prescottii						24.00			
				Chroococcus sp.									
		Merismopediaceae	*Aphanocapsa*	*Aphanocapsa conferta*									
				Aphanocapsa holsatica		2399.00							
				Aphanocapsa incerta									
				Aphanocapsa sp.	357.00								
			Coelomoron	*Coelomoron* sp.	100.00								
			Coelosphaerium	*Coelosphaerium* sp.									
			Merismopedia	*Merismopedia* sp.								48.00	16.00
				Merismopedia tenuissima									
			Snowella	*Snowella lacustris*									

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification				Area	George	George	George	George	George	George	George	George	George
				Lake	George Central	George Central	Lytle	Lytle	Lytle	Lytle	Occurrence	Occurrence	Occurrence
				Replicate	1	2	1	2	2 DUP	3	1	2	3
				Lab Duplicate	no	no	no	no	yes	no	no	no	no
				Date Sampled	18-Aug-2012	18-Aug-2012	23-Aug-2012	23-Aug-2012	23-Aug-2012	23-Aug-2012	21-Aug-2012	21-Aug-2012	21-Aug-2012
Class	Order	Family	Genus	Sample ID / Final Designation	6141.4-7	6141.4-8	6141.4-31	6141.4-32	6141.4-32_DUP	6141.4-33	6141.4-22	6141.4-23	6141.4-24
			Woronichinia	*Woronichinia compacta*		98.00							
		Microcystaceae	*Gloeocapsa*	*Gloeocapsa* sp.									
			Microcystis	*Microcystis aeruginosa*									
		Synechococcaceae	*Aphanothece*	*Aphanothece minutissima*	5500.00								
				Aphanothece sp.									
			Rhabdoderma	*Rhabdoderma lineare*									
			Synechococcus	*Synechococcus* sp.	56.10								
	Nostocales	Nostocaceae	*Anabaena*	*Anabaena* sp.									
			Nostoc	*Nostoc* sp.									
	Oscillatoriales	Oscillatoriaceae	*Oscillatoria*	*Oscillatoria* sp.									
		Pseudanabaenaceae	*Leptolyngbya*	*Leptolyngbya* sp.									
			Planktolyngbya	*Planktolyngbya limnetica*									
			Pseudanabaena	*Pseudanabaena galeata*								15.00	6.00
				Pseudanabaena sp.									
Trebouxiophyceae	Prasiolales	Koliellaceae	*Koliella*	*Koliella longiseta*									
Xanthophyceae	Heterococcales	Sciadaceae	*Centritractus*	*Centritractus* sp.									
	Mischococcales	Characiopsidaceae	*Characiopsis*	*Characiopsis* sp.									
Undetermined	Undetermined	Katablepharidaceae	*Katablepharis*	*Katablepharis ovalis*			3.00	3.00	5.00			6.00	11.00
		Undetermined	Undetermined	unknown Chlorophyte coccoid									
				Total	**6265.30**	**2953.10**	**76.60**	**80.40**	**101.10**	**91.70**	**116.10**	**319.50**	**236.50**

Note: George Central Rep 3 (ID 6141.4-9) contained too much detritus and silt for taxonomists to enumerate.

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification															
				Area	George	George	George	George	George	George	George	George	George	George
				Lake	Sleigh	Sleigh	Sleigh	Sleigh	Dragon	Dragon	Dragon	Komatic	Komatic	Komatic
				Replicate	1	1 DUP	2	3	1	2	3	1	2	3
				Lab Duplicate	no	yes	no	no	no	no	no	no	no	no
				Date Sampled	22-Aug-2012	22-Aug-2012	22-Aug-2012	22-Aug-2012	20-Aug-2012	20-Aug-2012	20-Aug-2012	20-Aug-2012	20-Aug-2012	20-Aug-2012
Class	Order	Family	Genus	Sample ID / Final Designation	6141.4-28	6141.4-28_DUP	6141.4-29	6141.4-30	6141.4-13	6141.4-14	6141.4-15	6141.4-16	6141.4-17	6141.4-18
Bacillariophyceae	Centrales	Stephanodiscaceae	*Cyclotella*	*Cyclotella* sp.					26.00					
				Cyclotella sp. < 6µm					153.00	87.00	119.00	12.00	15.00	15.30
				Cyclotella sp. 6-10 µm										
			Stephanodiscus	*Stephanodiscus* sp.										
	Pennales	Achnanthaceae	*Achnanthes*	*Achnanthes* sp.										
		Achnanthidiaceae	*Achnanthidium*	*Achnanthidium* sp.			1.00	3.00			3.00	6.00		
		Amphipleuraceae	*Frustulia*	*Frustulia* sp.										
		Bacillariaceae	*Nitzschia*	*Nitzschia* sp.										
				Nitzschia spp.				1.00						
		Catenulaceae	*Amphora*	*Amphora* sp.										
		Cymbellaceae	*Cymbella*	*Cymbella* sp.										
		Diploneidaceae	*Diploneis*	*Diploneis* sp.										
		Eunotiaceae	*Eunotia*	*Eunotia* sp.							5.00	2.00		
		Fragilariaceae	*Fragilaria*	*Fragilaria* sp.										
			Synedra	*Synedra* sp.					2.50	1.00	3.50		3.00	
		Naviculaceae	*Navicula*	*Navicula* sp.			1.00	2.00		1.00		1.00	1.00	0.50
		Pinnulariaceae	*Caloneis*	*Caloneis* sp.										
			Pinnularia	*Pinnularia biceps*										
				Pinnularia sp.										
		Pleurosigmataceae	*Pleurosigma*	*Pleurosigma* sp.										
		Rhopalodiaceae	*Epithemia*	*Epithemia* sp.										
		Stauroneidaceae	*Stauroneis*	*Stauroneis* sp.										
		Surirellaceae	*Surirella*	*Surirella* sp.										
		Tabellariaceae	*Tabellaria*	*Tabellaria fenestrata*										
				Tabellaria flocculosa				0.50		1.00		1.50	1.50	
				Tabellaria sp.										
Chlorodendrophyceae	Chlorodendrales	Chlorodendraceae	*Tetraselmis*	*Tetraselmis* sp.										
Chlorophyceae	Chlorococcales	Chlorococcaceae	*Tetraedron*	*Tetraedron caudatum*										
				Tetraedron minimum	2.00							5.10		
				Tetraedron sp.		2.00				5.00	4.00			
		Hydrodictyaceae	*Pediastrum*	*Pediastrum* sp.										
		Oocystaceae	*Ankistrodesmus*	*Ankistrodesmus* sp.										
			Botryococcus	*Botryococcus* sp.										
			Closteriopsis	*Closteriopsis acicularis*										
			Monoraphidium	*Monoraphidium arcuatum*							2.00			
				Monoraphidium contortum	1.00									
				Monoraphidium sp.										
				Monoraphidium tortile					9.50	4.00	4.50	1.50		5.10
			Oocystis	*Oocystis* sp.								8.00	18.00	11.00
			Quadrigula	*Quadrigula chodati*										
				Quadrigula closterioides							6.00			17.00
		Scenedesmaceae	*Coelastrum*	*Coelastrum* sp.										
			Crucigenia	*Crucigenia* sp.										
			Crucigeniella	*Crucigeniella rectangularis*										
			Scenedesmus	*Scenedesmus bijuga*										
				Scenedesmus brasiliensis										
				Scenedesmus sp.										
	Sphaeropleales	Characiaceae	*Ankyra*	*Ankyra judayi*										
		Radiococcaceae	*Coenococcus*	*Coenococcus fottii*					250.00	800.00	250.00		44.00	
	Tetrasporales	Coccomyxaceae	*Elakatothrix*	*Elakatothrix gelatinosa*	5.00	6.00	3.00	1.00	3.50	3.50	11.50		13.50	
				Elakatothrix sp.										
		Palmellaceae	*Gloeocystis*	*Gloeocystis gigas*					2.00					2.00
			Sphaerocystis	*Sphaerocystis planctonica*										
				Sphaerocystis sp.										

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification				Area	George	George	George	George	George	George	George	George	George	George
				Lake	Sleigh	Sleigh	Sleigh	Sleigh	Dragon	Dragon	Dragon	Komatic	Komatic	Komatic
				Replicate	1	1 DUP	2	3	1	2	3	1	2	3
				Lab Duplicate	no	yes	no	no	no	no	no	no	no	no
				Date Sampled	22-Aug-2012	22-Aug-2012	22-Aug-2012	22-Aug-2012	20-Aug-2012	20-Aug-2012	20-Aug-2012	20-Aug-2012	20-Aug-2012	20-Aug-2012
				Sample ID	6141.4-28	6141.4-28_DUP	6141.4-29	6141.4-30	6141.4-13	6141.4-14	6141.4-15	6141.4-16	6141.4-17	6141.4-18
Class	**Order**	**Family**	**Genus**	**Final Designation**										
	Volvocales	Chlamydomonadaceae	*Carteria*	*Carteria* sp.										
			Chlamydomonas	*Chlamydomonas* sp.										
	Zygnematales	Desmidiaceae	*Closterium*	*Closterium* sp.										
			Cosmarium	*Cosmarium* sp.						0.50	0.50	1.50		
			Euastrum	*Euastrum* sp.										
			Spondylosium	*Spondylosium* sp.									2.00	
			Staurastrum	*Staurastrum* sp.										
			Staurodesmus	*Staurodesmus* sp.					1.00			1.50	3.00	6.00
			Teilingia	*Teilingia granulata*										
			Xanthidium	*Xanthidium* sp.										
		Mesotaeniaceae	*Gonatozygon*	*Gonatozygon* sp.										
		Zygnemataceae	*Mougeotia*	*Mougeotia* sp.										
Chrysophyceae	Chromulinales	Chromulinaceae	*Chromulina*	*Chromulina* sp.	15.30	20.40	5.10	15.30		25.50				
			Kephyrion	*Kephyrion* sp.	61.20	71.40	51.00	81.60	86.70	45.90	12.00	76.50	86.70	20.40
		Chrysocapsaceae	*Chrysocapsa*	*Chrysocapsa planktonica*									101.00	78.00
				Chrysocapsa sp.										
	Chrysomonadales	Dinobryaceae	*Chrysococcus*	*Chrysococcus* sp.					4.00					
			Chrysolykos	*Chrysolykos planctonicus*										
			Dinobryon	*Dinobryon bavaricum*							1.00	32.00	35.50	17.00
				Dinobryon divergens										
				Dinobryon sertularia								3.00	1.00	4.00
				Dinobryon sociale	5.00	2.00		1.00	3.50		16.00	32.00		
				Dinobryon sp.										
		Synuraceae	*Mallomonas*	*Mallomonas* sp.										
			Synura	*Synu* ra sp.								64.00		
	Hibberdiales	Stylococcaceae	*Diceras*	*Diceras* sp.										
	Ochromonadales	Ochromonadaceae	*Ochromonas*	*Ochromonas* sp.	10.20	35.70	10.20			13.00			11.00	1.00
	Prymnesiales	Prymnesiaceae	*Chrysochromulina*	*Chrysochromulina parva*						40.80	20.40			30.60
Cryptophyceae	Cryptomonadales	Cryptomonadaceae	*Cryptomonas*	*Cryptomonas* sp.										
				Cryptomonas spp.	23.00	26.00	28.00	16.00	10.00	3.00	6.50	1.50	3.00	15.00
			Komma	*Komma caudata*										
	Pyrenomonadales	Pyrenomonadaceae	*Rhodomonas*	*Rhodomonas lacustris var. nannoplanctica*	40.00	46.00	37.00	16.00	15.30	3.00	13.00	4.00	18.00	9.00
Cyanophyceae	Synechococcales	Synechococcaceae	*Cyanodictyon*	*Cyanodictyon* sp.										
Dinophyceae	Dinophysales	Amphisoleniaceae	*Dinophysis*	*Dinophysis* sp.										
	Gymnodiniales	Gymondiniaceae	*Gymnodinium*	*Gymnodinium* sp.			10.20		2.00	1.50	5.50		5.00	3.00
	Peridiniales	Peridiniaceae	*Glenodinium*	*Glenodinium* sp.	0.50	0.50		1.00	2.00		0.50		1.00	
			Peridinium	*Peridinium* sp.									0.50	
Euglenophyceae	Euglenales	Euglenaceae	*Euglena*	*Euglena* sp.										
			Lepocinclis	*Lepocinclis* sp.										
			Phacus	*Phacus* sp.										
			Trachelomonas	*Trachelomonas* sp.										
Myxophyceae	Chroococcales	Chroococcaceae	*Chroococcus*	*Chroococcus limneticus*					12.00		16.50	224.00	4.00	66.00
				Chroococcus minimus				61.20			52.00	204.00	418.20	71.40
				Chroococcus prescottii				16.00						
				Chroococcus sp.										
		Merismopediaceae	*Aphanocapsa*	*Aphanocapsa conferta*								1000.00	900.00	
				Aphanocapsa holsatica									8094.00	4498.00
				Aphanocapsa incerta									400.00	
				Aphanocapsa sp.					51.00					
			Coelomoron	*Coelomoron* sp.										
			Coelosphaerium	*Coelosphaerium* sp.										
			Merismopedia	*Merismopedia* sp.										
				Merismopedia tenuissima										
			Snowella	*Snowella lacustris*										32.00

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification				Area	George	George	George	George	George	George	George	George	George	George
				Lake	Sleigh	Sleigh	Sleigh	Sleigh	Dragon	Dragon	Dragon	Komatic	Komatic	Komatic
				Replicate	1	1 DUP	2	3	1	2	3	1	2	3
				Lab Duplicate	no	yes	no	no	no	no	no	no	no	no
				Date Sampled	22-Aug-2012	22-Aug-2012	22-Aug-2012	22-Aug-2012	20-Aug-2012	20-Aug-2012	20-Aug-2012	20-Aug-2012	20-Aug-2012	20-Aug-2012
				Sample ID	6141.4-28	6141.4-28_DUP	6141.4-29	6141.4-30	6141.4-13	6141.4-14	6141.4-15	6141.4-16	6141.4-17	6141.4-18
Class	**Order**	**Family**	**Genus**	**Final Designation**										
			Woronichinia	*Woronichinia compacta*				64.00						
		Microcystaceae	*Gloeocapsa*	*Gloeocapsa* sp.			8.00							
			Microcystis	*Microcystis aeruginosa*										
		Synechococcaceae	*Aphanothece*	*Aphanothece minutissima*										
				Aphanothece sp.										
			Rhabdoderma	*Rhabdoderma lineare*										
			Synechococcus	*Synechococcus* sp.						10.20		10.20	66.30	15.30
	Nostocales	Nostocaceae	*Anabaena*	*Anabaena* sp.										
			Nostoc	*Nostoc* sp.										
	Oscillatoriales	Oscillatoriaceae	*Oscillatoria*	*Oscillatoria* sp.										
		Pseudanabaenaceae	*Leptolyngbya*	*Leptolyngbya* sp.										
			Planktolyngbya	*Planktolyngbya limnetica*										
			Pseudanabaena	*Pseudanabaena galeata*										
				Pseudanabaena sp.										
Trebouxiophyceae	Prasiolales	Koliellaceae	*Koliella*	*Koliella longiseta*	0.50	1.00								
Xanthophyceae	Heterococcales	Sciadaceae	*Centritractus*	*Centritractus* sp.										
	Mischococcales	Characiopsidaceae	*Characiopsis*	*Characiopsis* sp.										
Undetermined	Undetermined	Katablepharidaceae	*Katablepharis*	*Katablepharis ovalis*	5.00	8.00	6.00							15.30
		Undetermined	Undetermined	unknown Chlorophyte coccoid										
				Total	**168.70**	**219.00**	**160.50**	**279.60**	**634.00**	**1045.90**	**552.40**	**1691.30**	**10246.20**	**4932.90**

Note: George Central Rep 3 (ID 6141.4-9) contained too much detritus and silt for taxonomists to enumerate.

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL				Area	George	George	George	George
				Lake	Reference C	Reference C	Reference C	Reference C
				Replicate	1	1 DUP	2	3
				Lab Duplicate	no	yes	no	no
				Date Sampled	22-Aug-2012	22-Aug-2012	22-Aug-2012	22-Aug-2012
Taxonomic Classification				Sample ID	6141.4-25	6141.4-25_DUP	6141.4-26	6141.4-27
Class	**Order**	**Family**	**Genus**	**Final Designation**				
Bacillariophyceae	Centrales	Stephanodiscaceae	*Cyclotella*	*Cyclotella* sp.				
				Cyclotella sp. < 6µm	57.00	61.00	39.00	147.00
				Cyclotella sp. 6-10 µm				
			Stephanodiscus	*Stephanodiscus* sp.				
	Pennales	Achnanthaceae	*Achnanthes*	*Achnanthes* sp.				
		Achnanthidiaceae	*Achnanthidium*	*Achnanthidium* sp.				2.00
		Amphipleuraceae	*Frustulia*	*Frustulia* sp.				
		Bacillariaceae	*Nitzschia*	*Nitzschia* sp.				
				Nitzschia spp.			0.50	0.50
		Catenulaceae	*Amphora*	*Amphora* sp.				
		Cymbellaceae	*Cymbella*	*Cymbella* sp.				
		Diploneidaceae	*Diploneis*	*Diploneis* sp.				
		Eunotiaceae	*Eunotia*	*Eunotia* sp.				
		Fragilariaceae	*Fragilaria*	*Fragilaria* sp.				
			Synedra	*Synedra* sp.				
		Naviculaceae	*Navicula*	*Navicula* sp.				
		Pinnulariaceae	*Caloneis*	*Caloneis* sp.				
			Pinnularia	*Pinnularia biceps*				
				Pinnularia sp.				
		Pleurosigmataceae	*Pleurosigma*	*Pleurosigma* sp.				
		Rhopalodiaceae	*Epithemia*	*Epithemia* sp.				
		Stauroneidaceae	*Stauroneis*	*Stauroneis* sp.				
		Surirellaceae	*Surirella*	*Surirella* sp.				
		Tabellariaceae	*Tabellaria*	*Tabellaria fenestrata*				
				Tabellaria flocculosa				
				Tabellaria sp.				
Chlorodendrophyceae	Chlorodendrales	Chlorodendraceae	*Tetraselmis*	*Tetraselmis* sp.				
Chlorophyceae	Chlorococcales	Chlorococcaceae	*Tetraedron*	*Tetraedron caudatum*				
				Tetraedron minimum			2.00	
				Tetraedron sp.	11.00	18.00		2.00
		Hydrodictyaceae	*Pediastrum*	*Pediastrum* sp.				
		Oocystaceae	*Ankistrodesmus*	*Ankistrodesmus* sp.				
			Botryococcus	*Botryococcus* sp.				
			Closteriopsis	*Closteriopsis acicularis*				
			Monoraphidium	*Monoraphidium arcuatum*				
				Monoraphidium contortum				
				Monoraphidium sp.				
				Monoraphidium tortile				
			Oocystis	*Oocystis* sp.			5.00	
			Quadrigula	*Quadrigula chodati*				
				Quadrigula closterioides				
		Scenedesmaceae	*Coelastrum*	*Coelastrum* sp.				
			Crucigenia	*Crucigenia* sp.				
			Crucigeniella	*Crucigeniella rectangularis*				
			Scenedesmus	*Scenedesmus bijuga*				
				Scenedesmus brasiliensis				
				Scenedesmus sp.				
	Sphaeropleales	Characiaceae	*Ankyra*	*Ankyra judayi*				
		Radiococcaceae	*Coenococcus*	*Coenococcus fottii*				
	Tetrasporales	Coccomyxaceae	*Elakatothrix*	*Elakatothrix gelatinosa*	4.00	6.00		4.00
				Elakatothrix sp.				
		Palmellaceae	*Gloeocystis*	*Gloeocystis gigas*				
			Sphaerocystis	*Sphaerocystis planctonica*				
				Sphaerocystis sp.				

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL				Area	George	George	George	George
				Lake	Reference C	Reference C	Reference C	Reference C
				Replicate	1	1 DUP	2	3
				Lab Duplicate	no	yes	no	no
				Date Sampled	22-Aug-2012	22-Aug-2012	22-Aug-2012	22-Aug-2012
Taxonomic Classification				Sample ID	6141.4-25	6141.4-25_DUP	6141.4-26	6141.4-27
Class	Order	Family	Genus	Final Designation				
	Volvocales	Chlamydomonadaceae	*Carteria*	*Carteria* sp.				
			Chlamydomonas	*Chlamydomonas* sp.				
	Zygnematales	Desmidiaceae	*Closterium*	*Closterium* sp.				
			Cosmarium	*Cosmarium* sp.	4.00	4.00	3.00	
			Euastrum	*Euastrum* sp.				
			Spondylosium	*Spondylosium* sp.				
			Staurastrum	*Staurastrum* sp.				4.00
			Staurodesmus	*Staurodesmus* sp.				
			Teilingia	*Teilingia granulata*				
			Xanthidium	*Xanthidium* sp.				
		Mesotaeniaceae	*Gonatozygon*	*Gonatozygon* sp.				
		Zygnemataceae	*Mougeotia*	*Mougeotia* sp.				
Chrysophyceae	Chromulinales	Chromulinaceae	*Chromulina*	*Chromulina* sp.				
			Kephyrion	*Kephyrion* sp.				
		Chrysocapsaceae	*Chrysocapsa*	*Chrysocapsa planktonica*				
				Chrysocapsa sp.				
	Chrysomonadales	Dinobryaceae	*Chrysococcus*	*Chrysococcus* sp.				
			Chrysolykos	*Chrysolykos planctonicus*				
			Dinobryon	*Dinobryon bavaricum*	4.50	4.00	8.50	13.00
				Dinobryon divergens				
				Dinobryon sertularia				
				Dinobryon sociale				
				Dinobryon sp.				
		Synuraceae	*Mallomonas*	*Mallomonas* sp.				
			Synura	*Synu* ra sp.				
	Hibberdiales	Stylococcaceae	*Diceras*	*Diceras* sp.			1.00	
	Ochromonadales	Ochromonadaceae	*Ochromonas*	*Ochromonas* sp.				
	Prymnesiales	Prymnesiaceae	*Chrysochromulina*	*Chrysochromulina parva*				
Cryptophyceae	Cryptomonadales	Cryptomonadaceae	*Cryptomonas*	*Cryptomonas* sp.				
				Cryptomonas spp.	2.00	3.00	1.50	2.00
			Komma	*Komma caudata*				
	Pyrenomonadales	Pyrenomonadaceae	*Rhodomonas*	*Rhodomonas lacustris var. nannoplanctica*	7.00	10.00		11.00
Cyanophyceae	Synechococcales	Synechococcaceae	*Cyanodictyon*	*Cyanodictyon* sp.				
Dinophyceae	Dinophysales	Amphisoleniaceae	*Dinophysis*	*Dinophysis* sp.				
	Gymnodiniales	Gymondiniaceae	*Gymnodinium*	*Gymnodinium* sp.			1.50	4.00
	Peridiniales	Peridiniaceae	*Glenodinium*	*Glenodinium* sp.				
			Peridinium	*Peridinium* sp.				
Euglenophyceae	Euglenales	Euglenaceae	*Euglena*	*Euglena* sp.				
			Lepocinclis	*Lepocinclis* sp.				
			Phacus	*Phacus* sp.				
			Trachelomonas	*Trachelomonas* sp.				
Myxophyceae	Chroococcales	Chroococcaceae	*Chroococcus*	*Chroococcus limneticus*				
				Chroococcus minimus				
				Chroococcus prescottii				
				Chroococcus sp.				
		Merismopediaceae	*Aphanocapsa*	*Aphanocapsa conferta*	128.00	120.00		
				Aphanocapsa holsatica				
				Aphanocapsa incerta			192.00	128.00
				Aphanocapsa sp.				
			Coelomoron	*Coelomoron* sp.				
			Coelosphaerium	*Coelosphaerium* sp.				
			Merismopedia	*Merismopedia* sp.				
				Merismopedia tenuissima				
			Snowella	*Snowella lacustris*	32.00	30.00	128.00	

Appendix 3.6-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/mL				Area	George	George	George	George
				Lake	Reference C	Reference C	Reference C	Reference C
				Replicate	1	1 DUP	2	3
				Lab Duplicate	no	yes	no	no
				Date Sampled	22-Aug-2012	22-Aug-2012	22-Aug-2012	22-Aug-2012
Taxonomic Classification				Sample ID	6141.4-25	6141.4-25_DUP	6141.4-26	6141.4-27
Class	Order	Family	Genus	Final Designation				
			Woronichinia	*Woronichinia compacta*				
		Microcystaceae	*Gloeocapsa*	*Gloeocapsa* sp.				
			Microcystis	*Microcystis aeruginosa*				
		Synechococcaceae	*Aphanothece*	*Aphanothece minutissima*				
				Aphanothece sp.				
			Rhabdoderma	*Rhabdoderma lineare*				
			Synechococcus	*Synechococcus* sp.				
	Nostocales	Nostocaceae	*Anabaena*	*Anabaena* sp.				
			Nostoc	*Nostoc* sp.				
	Oscillatoriales	Oscillatoriaceae	*Oscillatoria*	*Oscillatoria* sp.				
		Pseudanabaenaceae	*Leptolyngbya*	*Leptolyngbya* sp.				
			Planktolyngbya	*Planktolyngbya limnetica*	152.00	154.00	117.00	237.50
			Pseudanabaena	*Pseudanabaena galeata*	364.00	42.00		
				Pseudanabaena sp.				
Trebouxiophyceae	Prasiolales	Koliellaceae	*Koliella*	*Koliella longiseta*	2.00	3.00	7.00	6.00
Xanthophyceae	Heterococcales	Sciadaceae	*Centritractus*	*Centritractus* sp.				
	Mischococcales	Characiopsidaceae	*Characiopsis*	*Characiopsis* sp.				
Undetermined	Undetermined	Katablepharidaceae	*Katablepharis*	*Katablepharis ovalis*	4.00	6.00		5.00
		Undetermined	Undetermined	unknown Chlorophyte coccoid				
				Total	**771.50**	**461.00**	**506.00**	**566.00**

Note: George Central Rep 3 (ID 6141.4-9) contained too much detritus and silt for taxonomists to enumerate.

Appendix 3.6-3

Lake Phytoplankton Richness and Diversity Results, Back River Project, 2012

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Appendix 3.6-3. Lake Phytoplankton Richness and Diversity Results, Back River Project, 2012

Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location	Moby	Gander	Gander	Gander	Gander	Big	Big	Big	Big	Rabbit	Rabbit	Rabbit	Fox	Fox	Fox	Fox	Rascal
Replicate	1	1	1	2	3	1	1	2	3	1	2	3	1	1	2	3	1
Date Sampled	10-Apr-12	10-Apr-12	18-Aug-12	18-Aug-12	18-Aug-12	10-Apr-12	16-Aug-12	16-Aug-12	16-Aug-12	15-Aug-12	15-Aug-12	15-Aug-12	10-Apr-12	20-Aug-12	20-Aug-12	20-Aug-12	11-Apr-12
Eco Analysts Sample ID	6138.4-7	6138.4-10	6138.5-13	6138.5-14	6138.5-15	6138.4-9	6138.5-7	6138.5-8	6138.5-9	6138.5-4	6138.5-5	6138.5-6	6138.4-8	6138.5-19	6138.5-20	6138.5-21	6138.4-2
Genus Richness (# genera)	15	26	28	28	25	13	30	27	25	17	19	21	13	25	21	20	8
Simpson's Diversity Index	0.50	0.72	0.82	0.88	0.84	0.49	0.58	0.65	0.61	0.65	0.77	0.72	0.66	0.72	0.79	0.86	0.46

Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location	Giraffe North	Giraffe South	Giraffe South	Giraffe South	Giraffe South	Goose Neck	Goose Neck	Goose Neck	Goose Neck	Goose Central	Goose Central	Goose Central	Goose Central	Goose Tail	Propellor
Replicate	1	1	1	2	3	1	1	2	3	1	1	2	3	1	1
Date Sampled	11-Apr-12	11-Apr-12	19-Aug-12	19-Aug-12	19-Aug-12	11-Apr-12	14-Aug-12	14-Aug-12	14-Aug-12	11-Apr-12	17-Aug-12	17-Aug-12	17-Aug-12	11-Apr-12	12-Apr-12
Eco Analysts Sample ID	6138.4-3	6138.4-11	6138.5-16	6138.5-17	6138.5-18	6138.4-4	6138.5-1	6138.5-2	6138.5-3	6138.4-5	6138.5-10	6138.5-11	6138.5-12	6138.4-6	6138.4-1
Genus Richness (# genera)	16	13	21	29	26	23	27	25	29	10	25	29	30	15	12
Simpson's Diversity Index	0.84	0.63	0.75	0.84	0.79	0.87	0.84	0.84	0.80	0.59	0.72	0.77	0.78	0.66	0.40

Area	George	George	George	George	George	George	George	George	George	George	George	George	George	George	George	George	George
Location	Lower Long	Lower Long	Lower Long	Lower Long	Fold	Fold	Fold	Fold	George Central	George Central	George Central	Lytle	Lytle	Lytle	Occurrence	Occurrence	Occurrence
Replicate	1	1	2	3	1	1	2	3	1	1	2	1	2	3	1	2	3
Date Sampled	13-Apr-12	21-Aug-12	21-Aug-12	21-Aug-12	15-Apr-12	19-Aug-12	19-Aug-12	19-Aug-12	13-Apr-12	18-Aug-12	18-Aug-12	23-Aug-12	23-Aug-12	23-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12
Eco Analysts Sample ID	6141.4-3	6141.4-19	6141.4-20	6141.4-21	6141.4-5	6141.4-10	6141.4-11	6141.4-12	6141.4-1	6141.4-7	6141.4-8	6141.4-31	6141.4-32	6141.4-33	6141.4-22	6141.4-23	6141.4-24
Genus Richness (# genera)	11	20	18	20	6	12	16	15	5	18	19	9	8	10	8	10	11
Simpson's Diversity Index	0.47	0.47	0.83	0.85	0.73	0.22	0.36	0.24	0.32	0.23	0.33	0.74	0.66	0.74	0.67	0.78	0.80

Area	George	George	George	George	George	George	George	George	George	George	George	George	George	George	George
Location	Sleigh	Sleigh	Sleigh	Dragon	Dragon	Dragon	Dragon	Komatic	Komatic	Komatic	Komatic	Reference C	Reference C	Reference C	Reference C
Replicate	1	2	3	1	1	2	3	1	1	2	3	1	1	2	3
Date Sampled	22-Aug-12	22-Aug-12	22-Aug-12	15-Apr-12	20-Aug-12	20-Aug-12	20-Aug-12	13-Apr-12	20-Aug-12	20-Aug-12	20-Aug-12	13-Apr-12	22-Aug-12	22-Aug-12	22-Aug-12
Eco Analysts Sample ID	6141.4-28	6141.4-29	6141.4-30	6141.4-6	6141.4-13	6141.4-14	6141.4-15	6141.4-4	6141.4-16	6141.4-17	6141.4-18	6141.4-2	6141.4-25	6141.4-26	6141.4-27
Genus Richness (# genera)	12	11	13	12	16	17	18	8	18	21	20	8	13	13	14
Simpson's Diversity Index	0.78	0.80	0.78	0.71	0.74	0.40	0.73	0.61	0.58	0.16	0.17	0.13	0.70	0.73	0.70

Note: George Central Rep 3 (ID 6141.4-9) contained too much detritus and silt for taxonomists to enumerate.

Appendix 3.6-4

Lake Phytoplankton Reference Photographs, Back River Project, 2012

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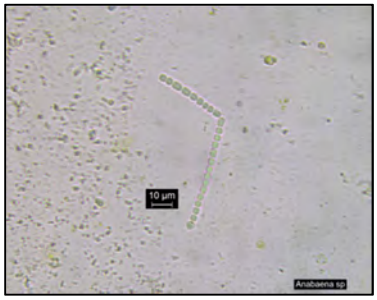
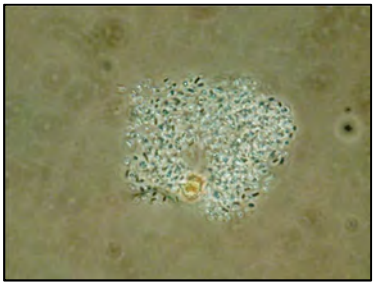
Appendix 3.6-4. Lake Phytoplankton Reference Photographs, Back River Project, 2012

Reference photographs of highly abundant genera are shown below, more information (species names, location, date) on these photographs are available by request. Photographs of less abundant taxa area also available by request.

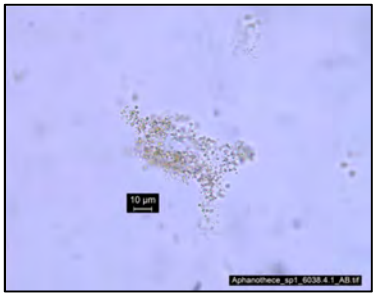
EcoAnalysts, Inc.



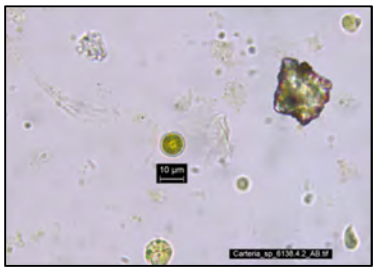
Anabaena (Myxophyceae)



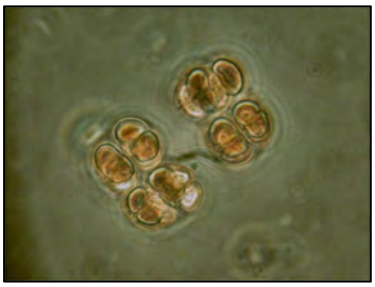
Aphanocapsa (Myxophyceae)



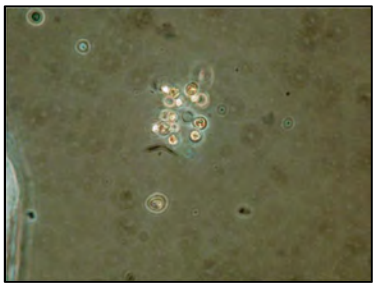
Aphanothece (Myxophyceae)



Carteria (Chlorophyceae)



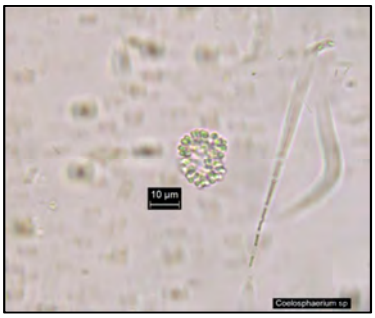
Chroococcus (Myxophyceae)



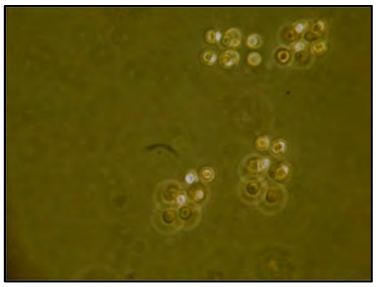
Chrysocapsa (Chrysophyceae)

No picture available

Chrysochromulina (Chrysophyceae)

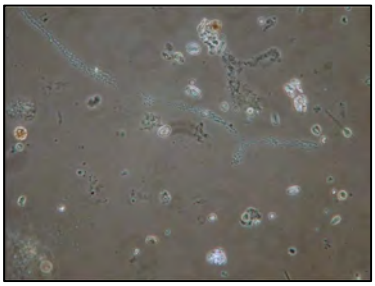


Coelosphaerium (Myxophyceae)

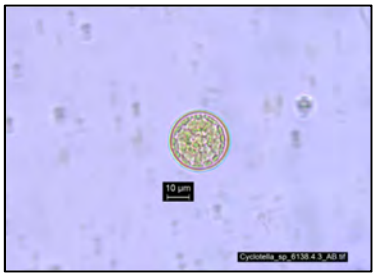


Coenococcus (Chlorophyceae)

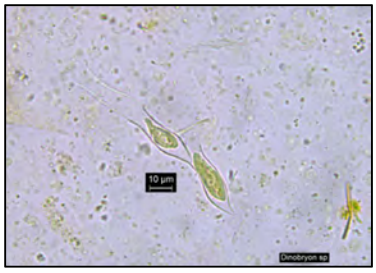
Cryptomonas (Cryptophyceae)



Cyanodictyon (Myxophyceae)

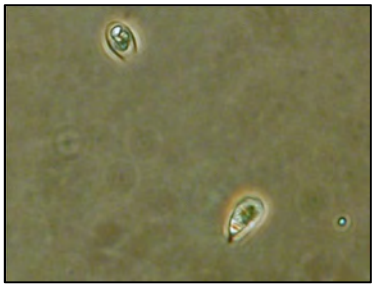


Cyclotella (Bacillariophyceae)



Dinobryon (Chrysophyceae)

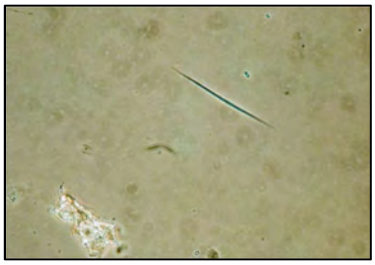
Elakatothrix (Chlorophyceae)



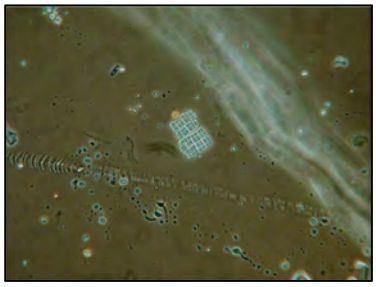
Kephyrion (Chrysophyceae)

Komma (Cryptophyceae)

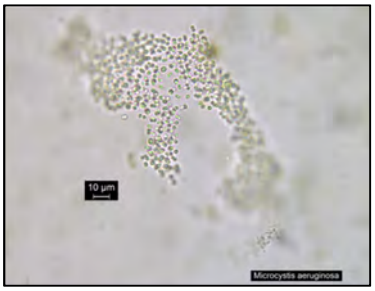
Leptolyngbya (Myxophyceae)



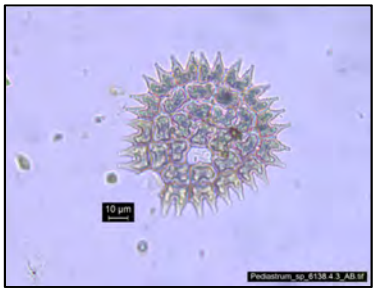
Monoraphidium (Chlorophyceae)



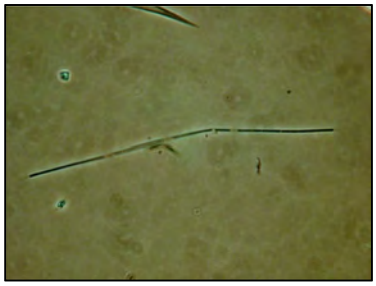
Merismopedia (Myxophyceae)



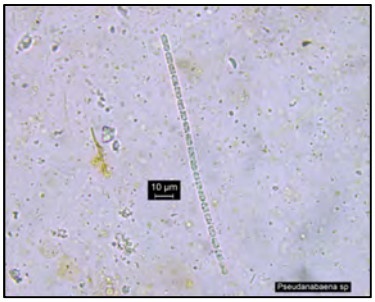
Microcystis (Myxophyceae)



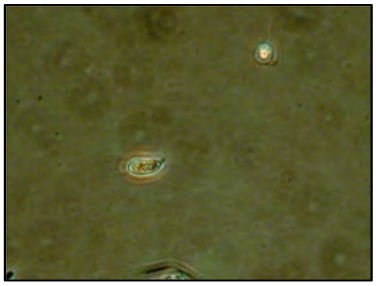
Pediastrum (Chlorophyceae)



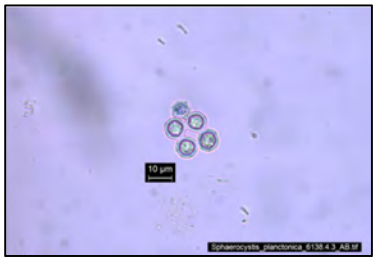
Planktolyngbya (Myxophyceae)



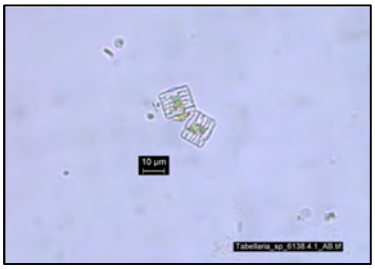
Pseudanabaena (Myxophyceae)



Rhodomonas (Cryptophyceae)



Sphaerocystis (Chlorophyceae)



Tabellaria (Bacillariophyceae)

Appendix 3.6-5

Lake Phytoplankton QA/QC Results, Back River Project, 2012

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Appendix 3.6-5. Lake Phytoplankton QA/QC Results, Back River Project, 2012

Duplication Report

EcoAnalysts, Inc.

6138.4-6	Taxonomic Identification Number (TIN)	Original Count (0.50% counted)	Relative Abundance	Dominance Rank	Duplication Count (0.50% counted)	Relative Abundance	Dominance Rank	Percent Similarity
Cryptomonas sp.	2177	157	51.82%	1	159	51.96%	1	51.82%
Komma caudata	2753	106	34.98%	2	105	34.31%	2	34.31%
Monoraphidium sp.	2250	12	3.96%	3	13	4.25%	3	3.96%
Peridinium sp.	2113	7	2.31%	4	7	2.29%	4	2.29%
Cyclotella sp.	334	5	1.65%	5	4	1.31%	5	1.31%
Nitzschia sp.	1470	2	0.66%		4	1.31%		0.66%
Carteria sp.	2571	3	0.99%		3	0.98%		0.98%
Elakatothrix sp.	2205	3	0.99%		2	0.65%		0.65%
Dinobryon sp.	2095	1	0.33%		2	0.65%		0.33%
Sphaerocystis planctonica	2723	1	0.33%		2	0.65%		0.33%
Achnanthes sp.	3	1	0.33%		1	0.33%		0.33%
Crucigenia sp.	2172	1	0.33%		1	0.33%		0.33%
Scenedesmus sp.	2055	1	0.33%		1	0.33%		0.33%
Teilingia granulata	2759	1	0.33%		1	0.33%		0.33%
Pediastrum sp.	2017	0	0.00%		1	0.33%		0.00%
Crucigeniella rectangularis	3145	2	0.66%		0	0.00%		0.00%
	TOTAL	**303**			**306**			**97.95%**

Appendix 3.6-6

Stream Periphyton Biomass Chl *a* Results, Back River Project, 2012

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Appendix 3.6-6. Stream Periphyton Biomass as Chl *a* Results, Back River Project, 2012

Area			Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location		Realised	Moby OF	Moby OF	Moby OF	Gander IF	Gander IF	Gander IF	Gander US	Gander US	Gander US	Pond 19 OF	Pond 19 OF	Pond 19 OF
Replicate		Detection	1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled		Limit	12-Aug-12	12-Aug-12	12-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	13-Aug-12	13-Aug-12	13-Aug-12
ALS Sample Name			MN-01-OF REP 1	MN-01-OF REP 2	MN-01-OF REP 3	MN-02-OF REP 1	MN-02-OF REP 2	MN-02-OF REP 3	MN-02-US REP 1	MN-02-US REP 2	MN-02-US REP 3	POND 19 OF REP 1	POND 19 OF REP 2	POND 19 OF REP 3
ALS Sample ID	Units	RDL	L1199755-25	L1199755-26	L1199755-27	L1199755-19	L1199755-20	L1199755-21	L1199755-22	L1199755-23	L1199755-24	L1199755-31	L1199755-32	L1199755-33
Area Sampled	cm^2		95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43
Final Volume	L		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Chlorophyll a	ug/L		173	33.1	173	171	42.0	39.3	10.1	40.8	54.1	29.6	40.6	54.0
Chlorophyll a	ug/cm^2		0.91	0.17	0.91	0.90	0.22	0.21	0.05	0.21	0.28	0.16	0.21	0.28
RDL	ug/L	0.04 - 2.2	0.40	0.040	0.40	0.40	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040

Area			Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location		Realised	Chair OF	Chair OF	Chair OF	Llama OF	Llama OF	Llama OF	Giraffe OF	Giraffe OF	Giraffe OF	Wolf OF	Wolf OF	Wolf OF
Replicate		Detection	1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled		Limit	12-Aug-12	12-Aug-12	12-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12
ALS Sample Name			CHAIR OF REP 1	CHAIR OF REP 2	CHAIR OF REP 3	LLAMA OF REP 1	LLAMA OF REP 2	LLAMA OF REP 3	GIRAFFE OF REP 1	GIRAFFE OF REP 2	GIRAFFE OF REP 3	WOLF OF REP 1	WOLF OF REP 2	WOLF OF REP 3
ALS Sample ID	Units	RDL	L1199755-28	L1199755-29	L1199755-30	L1199755-1	L1199755-2	L1199755-3	L1199755-4	L1199755-5	L1199755-6	L1199755-7	L1199755-8	L1199755-9
Area Sampled	cm^2		95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43
Final Volume	L		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Chlorophyll a	ug/L		309	382	361	14.7	15.4	180	59.8	42.7	178	40.8	150	263
Chlorophyll a	ug/cm^2		1.62	2.00	1.89	0.08	0.08	0.94	0.31	0.22	0.93	0.21	0.79	1.38
RDL	ug/L	0.04 - 2.2	0.40	0.40	0.40	0.040	0.040	0.40	0.040	0.040	0.40	0.040	0.40	0.40

Area			Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	George	George	George
Location		Realised	Goose OF	Goose OF	Goose OF	Propellor OF	Propellor OF	Propellor OF	Reference B OF	Reference B OF	Reference B OF	George OF	George OF	George OF
Replicate		Detection	1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled		Limit	9-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	10-Aug-12	10-Aug-12	10-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12
ALS Sample Name			GOOSE OF REP 1	GOOSE OF REP 2	GOOSE OF REP 3	PROPELLOR OF REP 1	PROPELLOR OF REP 2	PROPELLOR OF REP 3	REF B OF REP 1	REF B OF REP 2	REF B OF REP 3	GEORGE LK OF -1	GEORGE LK OF -2	GEORGE LK OF -3
ALS Sample ID	Units	RDL	L1199755-13	L1199755-14	L1199755-15	L1199755-10	L1199755-11	L1199755-12	L1199755-16	L1199755-17	L1199755-18	L1207450-13	L1207450-14	L1207450-15
Area Sampled	cm^2	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43
Final Volume	L		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.174	0.167	0.237
Chlorophyll a	ug/L		223	44.2	34.1	126	168	38.3	200	166	17.3	195	206	415
Chlorophyll a	ug/cm^2		1.17	0.23	0.18	0.66	0.88	0.20	1.05	0.87	0.09	0.36	0.36	1.03
RDL	ug/L	0.04 - 2.2	0.40	0.040	0.040	0.40	0.40	0.040	0.40	0.40	0.040	1.3	1.2	1.3

Area			George	George	George	George	George	George	George	George	George	George	George	George
Location		Realised	Sleigh OF	Sleigh OF	Sleigh OF	Dragon OF	Dragon OF	Dragon OF	Komatic IF*	Komatic IF*	Komatic IF*	Reference C OF	Reference C OF	Reference C OF
Replicate		Detection	1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled		Limit	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12
ALS Sample Name			SLEIGH LK OF -1	SLEIGH LK OF -2	SLEIGH LK OF -3	DRAGON LK OF -1	DRAGON LK OF -2	DRAGON LK OF -3	KONATIC LK OF -1	KONATIC LK OF -2	KONATIC LK OF -3	REF LK C OF -1	REF LK C OF -2	REF LK C OF -3
ALS Sample ID	Units	RDL	L1207450-10	L1207450-11	L1207450-12	L1207450-7	L1207450-8	L1207450-9	L1207450-1	L1207450-2	L1207450-3	L1207450-4	L1207450-5	L1207450-6
Area Sampled	cm^2	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43
Final Volume	L		0.248	0.198	0.203	0.242	0.323	0.299	0.46	0.468	0.456	0.184	0.267	0.275
Chlorophyll a	ug/L		442	449	453	523	1040	337	102	189	160	219	36.3	251
Chlorophyll a	ug/cm^2		1.15	0.93	0.96	1.33	3.52	1.06	0.49	0.93	0.76	0.42	0.10	0.72
RDL	ug/L	0.04 - 2.2	2.2	2.0	1.7	1.4	1.5	1.1	0.28	0.41	0.35	0.87	0.10	1.2

Note Echo OF was dry during August sampling.

**Komatic IF had no rocks so periphyton was collected from sediment surface using modified methods.*

Appendix 3.6-7

Stream Periphyton Density and Taxonomic Results, Back River Project, 2012

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Appendix 3.6-7. Stream Periphyton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/cm^2

Taxonomic Classification				Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
				Stream	Moby OF	Moby OF	Moby OF	Moby OF	Gander IF	Gander IF	Gander IF	Gander US	Gander US	Gander US	Pond 19 OF	Pond 19 OF
				Replicate	1	2	2 Dup	3	1	2	3	1	2	3	1	2
				Lab Duplicate	no	no	yes	no	no	no	no	no	no	no	no	no
				Date Sampled	12-Aug-12	12-Aug-12	12-Aug-12	12-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	13-Aug-12	13-Aug-12
				Sample ID	6138.3-25	6138.3-26	6138.3-26_DUP	6138.3-27	6138.3-19	6138.3-20	6138.3-21	6138.3-22	6138.3-23	6138.3-24	6138.3-31	6138.3-32
Class	Order	Family	Genus	Final Designation												
Bacillariophyceae	**Centrales**	Aulacoseiraceae	*Aulacoseira*	*Aulacoseira* spp.					2631.989974	670.8994052			603.8094647	934.4670287		
		Melosiraceae	*Melosira*	*Melosira* spp.					464.468819	402.5396431						
		Stephanodiscaceae	*Cyclotella*	*Cyclotella meneghiniana*												
				Cyclotella sp.												
				Cyclotella spp.					1083.760578	2146.878097	880.5554693	23.67880254		143.7641583		
		Undetermined	Undetermined	unknown Centric diatom												
	Pennales	Achnanthaceae	*Achnanthes*	*Achnanthes* sp.	8625.849495	445.7803357	425.9678763	8826.757025	9753.845199	4562.115955	3396.428239	47.35760507		1078.231187	34954.42279	4189.847964
			Cocconeis	*Cocconeis* spp.												
		Achnanthidiaceae	*Achnanthidium*	*Achnanthidium* sp.												
		Amphipleuraceae	*Frustulia*	*Frustulia* sp.	1118.165675	594.3737809	709.9464605	526.9705686							1879.270043	1256.954389
				Frustulia spp.							125.7936385					
		Bacillariaceae	*Nitzschia*	*Nitzschia* spp.					9908.668138	7379.893457	6541.269201	390.7002419	1710.793483	1581.405741		
		Cymbellaceae	*Cymbella*	*Cymbella* sp.	638.9518145	148.5934452	141.9892921	526.9705686							751.708017	
				Cymbella spp.					464.468819		754.7618308	106.5546114		143.7641583		
		Encyonema	*Encyonema*	*Encyonema* spp.												
		Eunotiaceae	*Eunotia*	*Eunotia bilunaris*												
				Eunotia sp.				263.4852843		1878.518335	1886.904577	201.2698216	1106.984019	215.6462374		209.4923982
				Eunotia spp.												
		Fragilariaceae	*Diatoma*	*Diatoma* spp.												
			Fragilaria	*Fragilaria* sp.		891.5606714	283.9785842	1317.426422								
				Fragilaria spp.												
			Synedra	*Synedra* sp.											375.8540085	209.4923982
				Synedra spp.												
		Gomphonemataceae	*Gomphonema*	*Gomphonema* sp.												
				Gomphonema spp.												
		Naviculaceae	*Navicula*	*Navicula* sp.												39803.55566
				Navicula spp.	21564.62374	18574.18065	17464.68293	19893.13897	5418.802888	3891.21655	4402.777347	189.4304203	704.4443755	1150.113266	63895.18145	
		Neidiaceae	*Neidium*	*Neidium* spp.												
		Pinnulariaceae	*Caloneis*	*Caloneis* spp.												
			Pinnularia	*Pinnularia* sp.	4472.662701	445.7803357	567.9571684	4479.249833								
				Pinnularia spp.					309.6458793	402.5396431	251.5872769					
		Rhopalodiaceae	*Epithemia*	*Epithemia* spp.												
			Rhopalodia	*Rhopalodia gibba*												
				Rhopalodia spp.												
		Surirellaceae	*Surirella*	*Surirella* spp.												
		Tabellariaceae	*Tabellaria*	*Tabellaria fenestrata*	958.4277217							118.3940127				
				Tabellaria flocculosa	35461.8257	28529.94148	23570.22249	28983.38128	19352.86746	14625.60703	10440.87199	2142.93163	9057.14197	10997.95811	111628.6405	
				Tabellaria sp.												78978.63412
				Tabellaria spp.												
		Undetermined	Undetermined	unknown Pennate diatom												
Chlorophyceae	**Chaetophorales**	Chaetophoraceae	*Gongrosira*	*Gongrosira fluminensis*												
	Chlorococcales	Hydrodictyaceae	*Pediastrum*	*Pediastrum boryanum*					4954.334069							
				Pediastrum sp.						3220.317145						
				Pediastrum tetras												
		Microsporaceae	*Microspora*	*Microspora amoena*												
				Microspora crassior												
		Oocystaceae	*Ankistrodesmus*	*Ankistrodesmus falcatus*				131.7426422	309.6458793	1073.439048	4276.983708		1610.158572	3019.047323		4189.847964
				Ankistrodesmus falcatus var. *acicularis*												
				Ankistrodesmus sp.												1675.939186
			Botryococcus	*Botryococcus braunii*									8050.792862			
			Dictyosphaerium	*Dictyosphaerium ehrenbergianum*									19321.90287			
				Dictyosphaerium pulchellum								378.8608406				
			Oocystis	*Oocystis* cf. *borgei*												
				Oocystis parva												
				Oocystis sp.	958.4277217	891.5606714	1845.860797	395.2279265							4510.248102	3351.878371
		Scenedesmaceae	*Scenedesmus*	*Scenedesmus* sp.	9584.277217	5646.550919	9655.271863	5796.676255	3096.458793	2683.597621	3019.047323		6440.63429	6900.679596	3006.832068	837.9695928
			Tetrastrum	*Tetrastrum staurogeniaeforme*												

Appendix 3.6-7. Stream Periphyton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/cm^2

Taxonomic Classification				Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
				Stream	Moby OF	Moby OF	Moby OF	Moby OF	Gander IF	Gander IF	Gander IF	Gander US	Gander US	Gander US	Pond 19 OF	Pond 19 OF
				Replicate	1	2	2 Dup	3	1	2	3	1	2	3	1	2
				Lab Duplicate	no	no	yes	no	no	no	no	no	no	no	no	no
				Date Sampled	12-Aug-12	12-Aug-12	12-Aug-12	12-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	13-Aug-12	13-Aug-12
Class	Order	Family	Genus	Final Designation	Sample ID	6138.3-25	6138.3-26	6138.3-26_DUP	6138.3-27	6138.3-19	6138.3-20	6138.3-21	6138.3-22	6138.3-23	6138.3-24	6138.3-31	6138.3-32
				Tetrastrum triangulare					619.2917586							
	Oedogoniales	Oedogoniaceae	*Bulbochaete*	*Bulbochaete rectangularis*												
				Bulbochaete sp.								59.19700634	805.0792862	143.7641583		1885.431584
			Oedogonium	*Oedogonium* sp.	2076.593397			658.7132108	1083.760578	670.8994052				646.9387122		837.9695928
				Oedogonium spp.												
	Tetrasporales	Coccomyxaceae	*Elakatothrix*	*Elakatothrix gelatinosa*		2377.495124	1135.914337									
	Ulotrichales	Ulotrichaceae	*Geminella*	*Geminella* sp.												5656.294751
	Volvocales	Chlamydomonadaceae	*Chlamydomonas*	*Chlamydomonas* sp.												
	Zygnematales	Desmidiaceae	*Actinotaenium*	*Actinotaenium diplosporum*												
			Closterium	*Closterium closterioides* var. *intermedium*		148.5934452	141.9892921				125.7936385					
				Closterium costatum		148.5934452	141.9892921									
				Closterium dianae												
				Closterium parvulum		148.5934452	141.9892921									
				Closterium sp.												
				Closterium spp.												
			Cosmarium	*Cosmarium bireme*												
				Cosmarium didymoprotupsum												
				Cosmarium garrolense												
				Cosmarium margaritatum fo. Minor												
				Cosmarium phaseolus	319.4759072	297.1868905	141.9892921	131.7426422				35.5182038				
				Cosmarium regnellii												
				Cosmarium sp.		445.7803357	283.9785842		774.1146983	1073.439048	125.7936385	82.87580888	2012.698216	503.1745539	1127.562026	1466.446787
				Cosmarium subcrenatum							377.3809154	23.67880254	2213.968037	71.88207913		
				Cosmarium subtumidum		148.5934452	141.9892921								375.8540085	
				Cosmarium subtumidum var. *minutum*											375.8540085	
				Cosmarium subundulatum									1408.888751	215.6462374		
				Cosmarium tinctum											375.8540085	
			Desmidium	*Desmidium* sp.												
			Euastrum	*Euastrum binale*												
				Euastrum obesum							125.7936385					
				Euastrum pulchellum		148.5934452	141.9892921		154.8229397	134.179881		35.5182038	100.6349108	575.056633		418.9847964
				Euastrum sp.							251.5872769	23.67880254	100.6349108			
				Euastrum validum				131.7426422		134.179881	377.3809154		402.5396431	143.7641583		
			Micrasterias	*Micrasterias papillifera*												
				Micrasterias sp.							125.7936385					
			Pleurotaenium	*Pleurotaenium ehrenbergii*												
			Staurastrum	*Staurastrum cingulum*												
				Staurastrum crenulatum								11.83940127		71.88207913		209.4923982
				Staurastrum furcigerum												
				Staurastrum furcigerum var. *[furcigerum] f. armiger*												
				Staurastrum margaritaceum												
				Staurastrum setigerum						134.179881				71.88207913		
				Staurastrum sp.					154.8229397	134.179881	377.3809154	11.83940127	100.6349108			
			Staurodesmus	*Staurodesmus dejectus*							251.5872769		301.9047323			
				Staurodesmus extensus	148.5934452	141.9892921										
				Staurodesmus extensus var. *joshuae*								11.83940127				
				Staurodesmus glaber										71.88207913		209.4923982
			Teilingia	*Teilingia granulata*						536.7195242			1509.523662	718.8207913	1503.416034	1466.446787
		Mesotaeniaceae	*Cylindrocystis*	*Cylindrocystis* sp.	445.7803357	425.9678763										209.4923982
		Zygnemataceae	*Mougeotia*	*Mougeotia* sp.						134.179881		59.19700634	905.714197		375.8540085	3980.355566
			Zygnema	*Zygnema* sp.										575.056633	6389.518145	
Chrysophyceae	**Chrysomonadales**	Dinobryaceae	*Dinobryon*	*Dinobryon sertularia*						268.3597621						
				Dinobryon sp.												1047.461991
		Synuraceae	*Mallomonas*	*Mallomonas caudata*												
Cryptophyceae	**Cryptomonadales**	Cryptomonadaceae	*Cryptomonas*	*Cryptomonas* sp.					619.2917586					287.5283165		

Appendix 3.6-7. Stream Periphyton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/cm^2

Taxonomic Classification				Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
				Stream	Moby OF	Moby OF	Moby OF	Moby OF	Gander IF	Gander IF	Gander IF	Gander US	Gander US	Gander US	Pond 19 OF	Pond 19 OF
				Replicate	1	2	2 Dup	3	1	2	3	1	2	3	1	2
				Lab Duplicate	no	no	yes	no	no	no	no	no	no	no	no	no
				Date Sampled	12-Aug-12	12-Aug-12	12-Aug-12	12-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	13-Aug-12	13-Aug-12
				Sample ID	6138.3-25	6138.3-26	6138.3-26_DUP	6138.3-27	6138.3-19	6138.3-20	6138.3-21	6138.3-22	6138.3-23	6138.3-24	6138.3-31	6138.3-32
Class	**Order**	**Family**	**Genus**	**Final Designation**												
Dinophyceae	**Peridiniales**	Oxytoxaceae	*Ceratium*	*Ceratium carolinianum*												
		Peridiniaceae	*Peridinium*	*Peridinium* sp.												
Euglenophyceae	**Euglenales**	Euglenaceae	*Euglena*	*Euglena* sp.						134.179881						
Myxophyceae	**Chroococcales**	Chamaesiphonaceae	*Chamaesiphon*	*Chamaesiphon* spp.												
		Chroococcaceae	*Chroococcus*	*Chroococcus dispersus*												
				Chroococcus minutus	2555.807258									1725.169899		2513.908778
				Chroococcus pallidus												
				Chroococcus sp.												
				Chroococcus turgidus												
	Merismopediaceae	Aphanocapsa	*Aphanocapsa*	*Aphanocapsa delicatissima*												
				Aphanocapsa elachista							6918.650116					
				Aphanocapsa rivularis												5865.787149
			Merismopedia	*Merismopedia glauca*					16720.87748	17175.02477	32203.17145			2300.226532		
				Merismopedia punctata	5111.614516				55736.25828	37972.90633	81262.69045	189.4304203	30995.55252	29040.35997		10055.63511
				Merismopedia spp.												
			Woronichinia	*Woronichinia naegeliana*	95842.77217	188416.4885	196797.1589	17916.99933	35609.27612	45486.97967	118874.9884	520.9336558	27674.60046	43344.89371		13407.51348
		Microcystaceae	*Gloeocapsa*	*Gloeocapsa aeruginosa*												
				Gloeocapsa rupestris												
				Gloeocapsa sanguinea												
				Gloeocapsa sp.						2683.597621			8050.792862			
				Gloeocapsa spp.												
			Microcystis	*Microcystis flosaquae*						48304.75717						
		Synechococcaceae	*Aphanothece*	*Aphanothece smithii*									2012.698216			
			Cyanothece	*Cyanothece aeruginosa*												
	Nostocales	Nostocaceae	*Anabaena*	*Anabaena* sp.					5573.625828		4905.951901	142.0728152		790.7028704		
			Nostoc	*Nostoc linckia*												
				Nostoc paludosum												
				Nostoc sp.							5283.332816					
		Rivulariaceae	*Calothrix*	*Calothrix breviarticulata*												
				Calothrix fusca												
				Calothrix parietina												
				Calothrix sp.	4792.138609	17088.2462	27687.91196		774.1146983	4830.475717			20227.61707	8769.613654	30068.32068	61381.27267
			Dichothrix	*Dichothrix* sp.												
			Gloeotrichia	*Gloeotrichia* sp.									250580.9278	8985.259891		
			Rivularia	*Rivularia haematites*												
		Scytonemataceae	*Scytonema*	*Scytonema mirabile*												
				Scytonema sp.												
	Oscillatoriales	Borziaceae	*Komvophoron*	*Komvophoron* spp.												
		Oscillatoriaceae	*Homoeothrix*	*Homoeothrix janthina*												
			Oscillatoria	*Oscillatoria* sp.	8785.587449	181432.5966	171523.0649	3030.08077					13887.61769		24806.36456	16968.88425
				Oscillatoria ucrainica												
		Phormidiaceae	*Phormidium*	*Phormidium aerugineo-caeruleum*												
				Phormidium sp.												
		Pseudanabaenaceae	*Leptolyngbya*	*Leptolyngbya foveolarum*									11472.37983			
				Leptolyngbya sp.												
				Leptolyngbya tenuis									2213.968037			
			Pseudanabaena	*Pseudanabaena* sp.												
	Stigonematales	Stigonemataceae	*Stigonema*	*Stigonema mamillosum*								5931.540035	61186.02575			9217.66552
				Total	**202867.2011**	**447563.457**	**453513.799**	**93010.30536**	**175569.2136**	**202745.8003**	**287564.2576**	**10738.33695**	**486771.0634**	**125218.5818**	**286400.7545**	**271502.1481**

Note Echo OF was dry during August sampling.

**Komatic IF had no rocks so periphyton was collected from sediment surface using modified methods.*

Appendix 3.6-7. Stream Periphyton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/cm^2

Taxonomic Classification				Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
				Stream	Pond 19 OF	Chair OF	Chair OF	Chair OF	Llama OF	Llama OF	Llama OF	Llama OF	Giraffe OF	Giraffe OF	Giraffe OF
				Replicate	3	1	2	3	1	2	2 Dup	3	1	2	3
				Lab Duplicate	no	no	no	no	no	no	yes	no	no	no	no
				Date Sampled	13-Aug-12	12-Aug-12	12-Aug-12	12-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12
				Sample ID	6138.3-33	6138.3-28	6138.3-29	6138.3-30	6138.3-1	6138.3-2	6138.3-2_DUP	6138.3-3	6138.3-7	6138.3-8	6138.3-9
Class	**Order**	**Family**	**Genus**	**Final Designation**											
Bacillariophyceae	**Centrales**	Aulacoseiraceae	*Aulacoseira*	*Aulacoseira* spp.					563.5555004						
		Melosiraceae	*Melosira*	*Melosira* spp.					2254.222001						
		Stephanodiscaceae	*Cyclotella*	*Cyclotella meneghiniana*											
				Cyclotella sp.	2072.276155										
				Cyclotella spp.											
		Undetermined	Undetermined	unknown Centric diatom											
	Pennales	Achnanthaceae	*Achnanthes*	*Achnanthes* sp.	17268.96796	7357.626955	5508.205297	1047.461991	1207.618929	2817.777502	6279.618433		24152.37859	4919.928971	20126.98216
			Cocconeis	*Cocconeis* spp.											
		Achnanthidiaceae	*Achnanthidium*	*Achnanthidium* sp.											
		Amphipleuraceae	*Frustulia*	*Frustulia* sp.	4144.55231	774.4870478	220.3282119								
				Frustulia spp.											
		Bacillariaceae	*Nitzschia*	*Nitzschia* spp.						1610.158572	1610.158572	268.3597621	15296.50644	36228.56788	61387.29558
		Cymbellaceae	*Cymbella*	*Cymbella* sp.		387.2435239		209.4923982							
				Cymbella spp.									805.0792862	1341.79881	
		Encyonema	*Encyonema*	*Encyonema* spp.											
		Eunotiaceae	*Eunotia*	*Eunotia bilunaris*											
				Eunotia sp.	3453.793592				966.0951435	3622.856788	4508.444003	49914.91575	13686.34787	1341.79881	5031.745539
				Eunotia spp.											
		Fragilariaceae	*Diatoma*	*Diatoma* spp.											
			Fragilaria	*Fragilaria* sp.	8979.863339		1321.969271		966.0951435	1878.518335					
				Fragilaria spp.											
			Synedra	*Synedra* sp.											
				Synedra spp.					483.0475717						
		Gomphonemataceae	*Gomphonema*	*Gomphonema* sp.											
				Gomphonema spp.											
		Naviculaceae	*Navicula*	*Navicula* sp.											
				Navicula spp.	58714.49106	49179.92754	28642.66755	9008.173122			483.0475717		18516.82358	12076.18929	2012.698216
		Neidiaceae	*Neidium*	*Neidium* spp.											
		Pinnulariaceae	*Caloneis*	*Caloneis* spp.											
			Pinnularia	*Pinnularia* sp.	690.7587184										
				Pinnularia spp.					80.50792862						
		Rhopalodiaceae	*Epithemia*	*Epithemia* spp.											
			Rhopalodia	*Rhopalodia gibba*											
				Rhopalodia spp.											
		Surirellaceae	*Surirella*	*Surirella* spp.											
		Tabellariaceae	*Tabellaria*	*Tabellaria fenestrata*	4144.55231						1288.126858				
				Tabellaria flocculosa	138151.7437	127015.8758	90775.2233	64104.67385	23186.28344	5098.83548	3864.380574	34618.40931	187583.4737	64853.60917	157996.8099
				Tabellaria sp.											
				Tabellaria spp.											
		Undetermined	Undetermined	unknown Pennate diatom											
Chlorophyceae	**Chaetophorales**	Chaetophoraceae	*Gongrosira*	*Gongrosira fluminensis*						14893.9668	25440.50545				
	Chlorococcales	Hydrodictyaceae	*Pediastrum*	*Pediastrum boryanum*											
				Pediastrum sp.		2323.461144	1321.969271	1675.939186							
				Pediastrum tetras		1548.974096									
		Microsporaceae	*Microspora*	*Microspora amoena*								16638.30525			
				Microspora crassior						536.7195242					
		Oocystaceae	*Ankistrodesmus*	*Ankistrodesmus falcatus*											
				Ankistrodesmus falcatus var. *acicularis*		9293.844574	5287.877085	20739.74742							
				Ankistrodesmus sp.											
			Botryococcus	*Botryococcus braunii*											
			Dictyosphaerium	*Dictyosphaerium ehrenbergianum*											
				Dictyosphaerium pulchellum											
			Oocystis	*Oocystis* cf. *borgei*											
				Oocystis parva											
				Oocystis sp.	6907.587184	5808.652859	2643.938543	7122.741538							
		Scenedesmaceae	*Scenedesmus*	*Scenedesmus* sp.		85968.06231	50014.5041	54258.53113							
			Tetrastrum	*Tetrastrum staurogeniaeforme*											

Appendix 3.6-7. Stream Periphyton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/cm^2

Taxonomic Classification				Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
				Stream	Pond 19 OF	Chair OF	Chair OF	Chair OF	Llama OF	Llama OF	Llama OF	Llama OF	Giraffe OF	Giraffe OF	Giraffe OF
				Replicate	3	1	2	3	1	2	2 Dup	3	1	2	3
				Lab Duplicate	no	no	no	no	no	no	yes	no	no	no	no
				Date Sampled	13-Aug-12	12-Aug-12	12-Aug-12	12-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12
				Sample ID	6138.3-33	6138.3-28	6138.3-29	6138.3-30	6138.3-1	6138.3-2	6138.3-2_DUP	6138.3-3	6138.3-7	6138.3-8	6138.3-9
Class	**Order**	**Family**	**Genus**	**Final Designation**											
				Tetrastrum triangulare											
	Oedogoniales	Oedogoniaceae	*Bulbochaete*	*Bulbochaete rectangularis*					15215.99851						
				Bulbochaete sp.						73664.75469	76804.56391		19321.90287	13417.9881	68431.73933
			Oedogonium	*Oedogonium* sp.							3059.301288				
				Oedogonium spp.											
	Tetrasporales	Coccomyxaceae	*Elakatothrix*	*Elakatothrix gelatinosa*											
	Ulotrichales	Ulotrichaceae	*Geminella*	*Geminella* sp.	3453.793592										5031.745539
	Volvocales	Chlamydomonadaceae	*Chlamydomonas*	*Chlamydomonas* sp.		387.2435239									
	Zygnematales	Desmidiaceae	*Actinotaenium*	*Actinotaenium diplosporum*	345.3793592										
			Closterium	*Closterium closterioides* var. *intermedium*											
				Closterium costatum			220.3282119								
				Closterium dianae		1161.730572	440.6564238								
				Closterium parvulum			220.3282119	1675.939186							
				Closterium sp.			220.3282119								
				Closterium spp.											
			Cosmarium	*Cosmarium bireme*											
				Cosmarium didymoprotupsum											
				Cosmarium garrolense											
				Cosmarium margaritatum fo. Minor											
				Cosmarium phaseolus			220.3282119	209.4923982							
				Cosmarium regnellii			220.3282119								
				Cosmarium sp.	690.7587184	4259.678763	2643.938543	5237.309955					3220.317145		
				Cosmarium subcrenatum											
				Cosmarium subtumidum			220.3282119								
				Cosmarium subtumidum var. *minutum*											
				Cosmarium subundulatum										447.2662701	4025.396431
				Cosmarium tinctum				209.4923982					805.0792862		
			Desmidium	*Desmidium* sp.											
			Euastrum	*Euastrum binale*	690.7587184										
				Euastrum obesum			220.3282119								
				Euastrum pulchellum		1548.974096									
				Euastrum sp.				628.4771946							
				Euastrum validum			1101.641059	837.9695928							
			Micrasterias	*Micrasterias papillifera*											
				Micrasterias sp.											
			Pleurotaenium	*Pleurotaenium ehrenbergii*											
			Staurastrum	*Staurastrum cingulum*					80.50792862				1610.158572		
				Staurastrum crenulatum				209.4923982	80.50792862						
				Staurastrum furcigerum			660.9846357								
				Staurastrum furcigerum var. *[furcigerum] f. armiger*					80.50792862						
				Staurastrum margaritaceum											
				Staurastrum setigerum											
				Staurastrum sp.	690.7587184	387.2435239		418.9847964							
			Staurodesmus	*Staurodesmus dejectus*									2415.237859		
				Staurodesmus extensus											
				Staurodesmus extensus var. *joshuae*											
				Staurodesmus glaber				1256.954389							
			Teilingia	*Teilingia granulata*	1381.517437	3097.948191	881.3128476	3770.863167					1610.158572		8050.792862
		Mesotaeniaceae	*Cylindrocystis*	*Cylindrocystis* sp.											
		Zygnemataceae	*Mougeotia*	*Mougeotia* sp.	1036.138078	4646.922287	1762.625695	3142.385973			536.7195242		56355.55004	29966.8401	25158.72769
			Zygnema	*Zygnema* sp.							4293.756193				
Chrysophyceae	**Chrysomonadales**	Dinobryaceae	*Dinobryon*	*Dinobryon sertularia*											
				Dinobryon sp.											
		Synuraceae	*Mallomonas*	*Mallomonas caudata*											
Cryptophyceae	**Cryptomonadales**	Cryptomonadaceae	*Cryptomonas*	*Cryptomonas* sp.											

Appendix 3.6-7. Stream Periphyton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/cm^2

Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Stream	Pond 19 OF	Chair OF	Chair OF	Chair OF	Llama OF	Llama OF	Llama OF	Llama OF	Giraffe OF	Giraffe OF	Giraffe OF
Replicate	3	1	2	3	1	2	2 Dup	3	1	2	3
Lab Duplicate	no	no	no	no	no	no	yes	no	no	no	no
Date Sampled	13-Aug-12	12-Aug-12	12-Aug-12	12-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12
Sample ID	6138.3-33	6138.3-28	6138.3-29	6138.3-30	6138.3-1	6138.3-2	6138.3-2_DUP	6138.3-3	6138.3-7	6138.3-8	6138.3-9
Taxonomic Classification											
Class	Order	Family	Genus	Final Designation											
Dinophyceae	Peridiniales	Oxytoxaceae	*Ceratium*	*Ceratium carolinianum*											
		Peridiniaceae	*Peridinium*	*Peridinium* sp.	690.7587184										
Euglenophyceae	Euglenales	Euglenaceae	*Euglena*	*Euglena* sp.											
Myxophyceae	Chroococcales	Chamaesiphonaceae	*Chamaesiphon*	*Chamaesiphon* spp.											
		Chroococcaceae	*Chroococcus*	*Chroococcus dispersus*								12881.26858		7156.260322	
				Chroococcus minutus	5526.069747	4646.922287	881.3128476	1675.939186							20126.98216
				Chroococcus pallidus											
				Chroococcus sp.											
				Chroococcus turgidus											
	Merismopediaceae	Aphanocapsa	*Aphanocapsa*	*Aphanocapsa delicatissima*											
				Aphanocapsa elachista											352222.1877
				Aphanocapsa rivularis	11052.13949										
			Merismopedia	*Merismopedia glauca*		9293.844574							77287.61148		119755.5438
				Merismopedia punctata		21685.63734	20270.19549	53211.06914							
				Merismopedia spp.											
			Woronichinia	*Woronichinia naegeliana*		102232.2903	12338.37987	37708.63167					89363.80077	28625.04129	452857.0985
		Microcystaceae	*Gloeocapsa*	*Gloeocapsa aeruginosa*											
				Gloeocapsa rupestris									9660.951435		
				Gloeocapsa sanguinea											
				Gloeocapsa sp.										894.5325403	12076.18929
				Gloeocapsa spp.											
			Microcystis	*Microcystis flosaquae*											
		Synechococcaceae	*Aphanothece*	*Aphanothece smithii*											
			Cyanothece	*Cyanothece aeruginosa*									805.0792862		
	Nostocales	Nostocaceae	*Anabaena*	*Anabaena* sp.		19362.1762									
			Nostoc	*Nostoc linckia*											
				Nostoc paludosum											
				Nostoc sp.											
		Rivulariaceae	*Calothrix*	*Calothrix breviarticulata*											
				Calothrix fusca											
				Calothrix parietina											
				Calothrix sp.	5526.069747	5808.652859	3304.923178	71436.90778			1127.111001				
			Dichothrix	*Dichothrix* sp.									66821.58076	24152.37859	146926.9697
			Gloeotrichia	*Gloeotrichia* sp.								52598.51337			
			Rivularia	*Rivularia haematites*											
		Scytonemataceae	*Scytonema*	*Scytonema mirabile*											
				Scytonema sp.											
	Oscillatoriales	Borziaceae	*Komvophoron*	*Komvophoron* spp.											
		Oscillatoriaceae	*Homoeothrix*	*Homoeothrix janthina*					151596.4296	35423.48859	6279.618433	146792.7899			
			Oscillatoria	*Oscillatoria* sp.	9325.242698	8519.357526	11677.39523	36451.67728							
				Oscillatoria ucrainica											
		Phormidiaceae	*Phormidium*	*Phormidium aerugineo-caeruleum*											
				Phormidium sp.											
		Pseudanabaenaceae	*Leptolyngbya*	*Leptolyngbya foveolarum*									31398.09216	81849.72743	206301.5671
				Leptolyngbya sp.											
				Leptolyngbya tenuis						5501.375123	5313.523289				
			Pseudanabaena	*Pseudanabaena* sp.											38241.2661
	Stigonematales	Stigonemataceae	*Stigonema*	*Stigonema mamillosum*			8813.128476						91779.03863	125681.8219	218377.7564
				Total	**284937.9713**	**476696.778**	**252055.4744**	**376248.3471**	**196761.3776**	**145048.4514**	**136058.3994**	**318543.0376**	**712495.1683**	**432953.7495**	**1924139.494**

Note Echo OF was dry during August sampling.

**Komatic IF had no rocks so periphyton was collected from sediment surface using modified methods.*

Appendix 3.6-7. Stream Periphyton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/cm^2

Taxonomic Classification				Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose Reference B	Goose Reference B
				Stream	Wolf OF	Wolf OF	Wolf OF	Goose OF	Goose OF	Goose OF	Propellor OF	Propellor OF	Propellor OF	Propellor OF	OF	OF
				Replicate	1	2	3	1	2	3	1	2	2 Dup	3	1	2
				Lab Duplicate	no	no	no	no	no	no	no	no	yes	no	no	no
				Date Sampled	8-Aug-12	8-Aug-12	8-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	10-Aug-12	10-Aug-12
				Sample ID	6138.3-4	6138.3-5	6138.3-6	6138.3-10	6138.3-11	6138.3-12	6138.3-13	6138.3-14	6138.3-14_DUP	6138.3-15	6138.3-16	6138.3-17
Class	**Order**	**Family**	**Genus**	**Final Designation**												
Bacillariophyceae	**Centrales**	Aulacoseiraceae	*Aulacoseira*	*Aulacoseira* spp.								16514.4469		7092.365141		
		Melosiraceae	*Melosira*	*Melosira* spp.			1006.349108									
		Stephanodiscaceae	*Cyclotella*	*Cyclotella meneghiniana*												
				Cyclotella sp.												
				Cyclotella spp.					1252.345556	766.7421774	1341.79881		309.6458793		751.4073338	
		Undetermined	Undetermined	unknown Centric diatom												
	Pennales	Achnanthaceae	*Achnanthes*	*Achnanthes* sp.	3354.497026	8721.692268	17107.93483	7741.146983		4600.453064	4696.295836	2477.167035	928.937638		1502.814668	357.8130161
			Cocconeis	*Cocconeis* spp.												
		Achnanthidiaceae	*Achnanthidium*	*Achnanthidium* sp.												
		Amphipleuraceae	*Frustulia*	*Frustulia* sp.												
				Frustulia spp.												
		Bacillariaceae	*Nitzschia*	*Nitzschia* spp.	9616.224808	14759.78691	7044.443755	14863.00221	7335.16683	16868.3279	12747.0887	4335.042311	774.1146983		2254.222001	2683.597621
		Cymbellaceae	*Cymbella*	*Cymbella* sp.												
				Cymbella spp.			251.5872769	928.937638	894.5325403	4600.453064		412.8611724	309.6458793			
		Encyonema	*Encyonema*	*Encyonema* spp.												
		Eunotiaceae	*Eunotia*	*Eunotia bilunaris*												
				Eunotia sp.	13194.35497	670.8994052	2012.698216	15172.64809	1789.065081	3066.968709	1006.349108	1857.875276	2322.344095		2790.941526	2146.878097
				Eunotia spp.												
		Fragilariaceae	*Diatoma*	*Diatoma* spp.												
			Fragilaria	*Fragilaria* sp.												
				Fragilaria spp.												
			Synedra	*Synedra* sp.												
				Synedra spp.												
		Gomphonemataceae	*Gomphonema*	*Gomphonema* sp.											2790.941526	
				Gomphonema spp.												
		Naviculaceae	*Navicula*	*Navicula* sp.												
				Navicula spp.	4249.029566	4025.396431	5786.50737	5883.271707	1967.971589	11884.50375	6373.544349	5573.625828	4489.86525		966.0951435	2504.691113
		Neidiaceae	*Neidium*	*Neidium* spp.												
		Pinnulariaceae	*Caloneis*	*Caloneis* spp.												
			Pinnularia	*Pinnularia* sp.												
				Pinnularia spp.	447.2662701		503.1745539	1857.875276								
		Rhopalodiaceae	*Epithemia*	*Epithemia* spp.												
			Rhopalodia	*Rhopalodia gibba*												
				Rhopalodia spp.												
		Surirellaceae	*Surirella*	*Surirella* spp.												
		Tabellariaceae	*Tabellaria*	*Tabellaria fenestrata*			1006.349108		536.7195242	16484.95681	5031.745539	825.7223449	1393.406457	13801.35919		
				Tabellaria flocculosa	30414.10637	55349.20093	36228.56788	48304.75717	30235.19986	50604.98371	52665.60331	34061.04673	24771.67035	41979.13421	7514.073338	8229.69937
				Tabellaria sp.												
				Tabellaria spp.												
		Undetermined	Undetermined	unknown Pennate diatom												
Chlorophyceae	**Chaetophorales**	Chaetophoraceae	*Gongrosira*	*Gongrosira fluminensis*												
	Chlorococcales	Hydrodictyaceae	*Pediastrum*	*Pediastrum boryanum*												
				Pediastrum sp.												
				Pediastrum tetras												
		Microsporaceae	*Microspora*	*Microspora amoena*												
				Microspora crassior												
		Oocystaceae	*Ankistrodesmus*	*Ankistrodesmus falcatus*												
				Ankistrodesmus falcatus var. *acicularis*												
				Ankistrodesmus sp.												
			Botryococcus	*Botryococcus braunii*						18401.81226						
			Dictyosphaerium	*Dictyosphaerium ehrenbergianum*			22642.85493									
				Dictyosphaerium pulchellum											30915.04459	
			Oocystis	*Oocystis* cf. *borgei*	1789.065081		251.5872769									
				Oocystis parva												
				Oocystis sp.												
		Scenedesmaceae	*Scenedesmus*	*Scenedesmus* sp.			1006.349108					1651.44469	619.2917586	2300.226532		
			Tetrastrum	*Tetrastrum staurogeniaeforme*			1006.349108									

Appendix 3.6-7. Stream Periphyton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/cm^2

Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose Reference B	Goose Reference B
Stream	Wolf OF	Wolf OF	Wolf OF	Goose OF	Goose OF	Goose OF	Propellor OF	Propellor OF	Propellor OF	Propellor OF	OF	OF
Replicate	1	2	3	1	2	3	1	2	2 Dup	3	1	2
Lab Duplicate	no	no	no	no	no	no	no	no	yes	no	no	no
Date Sampled	8-Aug-12	8-Aug-12	8-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	10-Aug-12	10-Aug-12
Sample ID	6138.3-4	6138.3-5	6138.3-6	6138.3-10	6138.3-11	6138.3-12	6138.3-13	6138.3-14	6138.3-14_DUP	6138.3-15	6138.3-16	6138.3-17
Taxonomic Classification												
Class	Order	Family	Genus	Final Designation												
				Tetrastrum triangulare												
	Oedogoniales	Oedogoniaceae	*Bulbochaete*	*Bulbochaete rectangularis*												
				Bulbochaete sp.		10734.39048	9308.729247	2477.167035	42937.56193	15718.21464	43273.01164	28693.85148	34061.04673	5367.195242	7084.697719	5367.195242
			Oedogonium	*Oedogonium* sp.	2012.698216										23937.69078	15922.67922
				Oedogonium spp.												
	Tetrasporales	Coccomyxaceae	*Elakatothrix*	*Elakatothrix gelatinosa*					357.8130161			412.8611724				
	Ulotrichales	Ulotrichaceae	*Geminella*	*Geminella* sp.								5780.056414		3450.339798		1073.439048
	Volvocales	Chlamydomonadaceae	*Chlamydomonas*	*Chlamydomonas* sp.												
	Zygnematales	Desmidiaceae	*Actinotaenium*	*Actinotaenium diplosporum*						383.3710887				191.6855443		
			Closterium	*Closterium closterioides* var. *intermedium*												
				Closterium costatum												
				Closterium dianae												
				Closterium parvulum		335.4497026										
				Closterium sp.												
				Closterium spp.												
			Cosmarium	*Cosmarium bireme*												
				Cosmarium didymoprotupsum						383.3710887						
				Cosmarium garrolense												
				Cosmarium margaritatum fo. Minor												
				Cosmarium phaseolus					536.7195242		1006.349108			383.3710887		89.45325403
				Cosmarium regnellii												
				Cosmarium sp.	223.6331351						670.8994052		154.8229397			89.45325403
				Cosmarium subcrenatum	1341.79881					383.3710887	335.4497026		154.8229397	575.056633	107.3439048	1073.439048
				Cosmarium subtumidum		1341.79881	251.5872769		178.9065081			206.4305862				357.8130161
				Cosmarium subtumidum var. *minutum*												
				Cosmarium subundulatum		670.8994052		619.2917586						1725.169899		
				Cosmarium tinctum		2348.147918	754.7618308		178.9065081							
			Desmidium	*Desmidium* sp.						6900.679596						
			Euastrum	*Euastrum binale*			251.5872769								107.3439048	89.45325403
				Euastrum obesum												
				Euastrum pulchellum					178.9065081		335.4497026			191.6855443		268.3597621
				Euastrum sp.	223.6331351						335.4497026					
				Euastrum validum	447.2662701		2012.698216		178.9065081	383.3710887					644.063429	
			Micrasterias	*Micrasterias papillifera*		335.4497026										
				Micrasterias sp.												
			Pleurotaenium	*Pleurotaenium ehrenbergii*												
			Staurastrum	*Staurastrum cingulum*			251.5872769			766.7421774						
				Staurastrum crenulatum								412.8611724				
				Staurastrum furcigerum												
				Staurastrum furcigerum var. *[furcigerum] f. armiger*												
				Staurastrum margaritaceum												
				Staurastrum setigerum												
				Staurastrum sp.			251.5872769	309.6458793		383.3710887	2683.597621		309.6458793		644.063429	
			Staurodesmus	*Staurodesmus dejectus*										575.056633		
				Staurodesmus extensus												
				Staurodesmus extensus var. *joshuae*												
				Staurodesmus glaber			1257.936385			383.3710887	335.4497026				107.3439048	
			Teilingia	*Teilingia granulata*				1857.875276			2683.597621					
		Mesotaeniaceae	*Cylindrocystis*	*Cylindrocystis* sp.												
		Zygnemataceae	*Mougeotia*	*Mougeotia* sp.	1118.165675			3096.458793	13954.70763	8434.163951	20797.88156	11972.974	7276.678164	12267.87484	8158.136767	2325.784605
			Zygnema	*Zygnema* sp.				3715.750552		5750.56633			8515.261681	1725.169899	13954.70763	4472.662701
Chrysophyceae	Chrysomonadales	Dinobryaceae	*Dinobryon*	*Dinobryon sertularia*												
				Dinobryon sp.												
		Synuraceae	*Mallomonas*	*Mallomonas caudata*		670.8994052	251.5872769									
Cryptophyceae	Cryptomonadales	Cryptomonadaceae	*Cryptomonas*	*Cryptomonas* sp.												

Appendix 3.6-7. Stream Periphyton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/cm^2

Taxonomic Classification				Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose Reference B	Goose Reference B
				Stream	Wolf OF	Wolf OF	Wolf OF	Goose OF	Goose OF	Goose OF	Propellor OF	Propellor OF	Propellor OF	Propellor OF	OF	OF
				Replicate	1	2	3	1	2	3	1	2	2 Dup	3	1	2
				Lab Duplicate	no	no	no	no	no	no	no	no	yes	no	no	no
				Date Sampled	8-Aug-12	8-Aug-12	8-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	10-Aug-12	10-Aug-12
				Sample ID	6138.3-4	6138.3-5	6138.3-6	6138.3-10	6138.3-11	6138.3-12	6138.3-13	6138.3-14	6138.3-14_DUP	6138.3-15	6138.3-16	6138.3-17
Class	**Order**	**Family**	**Genus**	**Final Designation**												
Dinophyceae	**Peridiniales**	Oxytoxaceae	*Ceratium*	*Ceratium carolinianum*												
		Peridiniaceae	*Peridinium*	*Peridinium* sp.		335.4497026		309.6458793								
Euglenophyceae	**Euglenales**	Euglenaceae	*Euglena*	*Euglena* sp.	223.6331351											
Myxophyceae	**Chroococcales**	Chamaesiphonaceae	*Chamaesiphon*	*Chamaesiphon* spp.												
		Chroococcaceae	*Chroococcus*	*Chroococcus dispersus*	1789.065081	2683.597621		4335.042311								
				Chroococcus minutus		18785.18335		9908.668138		6133.937419		2477.167035				357.8130161
				Chroococcus pallidus												
				Chroococcus sp.												
				Chroococcus turgidus												
	Merismopediaceae	Aphanocapsa	*Aphanocapsa*	*Aphanocapsa delicatissima*												
				Aphanocapsa elachista				235330.8683	64406.3429							
				Aphanocapsa rivularis						30669.68709						
			Merismopedia	*Merismopedia glauca*			34215.86967		2862.504129	12267.87484						
				Merismopedia punctata					178.9065081	18401.81226					21039.40535	21468.78097
				Merismopedia spp.												
			Woronichinia	*Woronichinia naegeliana*	29519.57383	134850.7804	89565.07059	60380.94647	71920.41624	62489.48746	45285.70985				53671.95242	33813.33002
		Microcystaceae	*Gloeocapsa*	*Gloeocapsa aeruginosa*												
				Gloeocapsa rupestris			4025.396431	13934.06457	3041.410637						644.063429	715.6260322
				Gloeocapsa sanguinea												
				Gloeocapsa sp.		6038.094647	4025.396431					412.8611724	4799.51113		1717.502477	
				Gloeocapsa spp.												
			Microcystis	*Microcystis flosaquae*												10734.39048
		Synechococcaceae	*Aphanothece*	*Aphanothece smithii*		20126.98216										
			Cyanothece	*Cyanothece aeruginosa*												
	Nostocales	Nostocaceae	*Anabaena*	*Anabaena* sp.												4830.475717
			Nostoc	*Nostoc linckia*												
				Nostoc paludosum												
				Nostoc sp.					40253.96431	22618.89423					2576.253716	7156.260322
		Rivulariaceae	*Calothrix*	*Calothrix breviarticulata*												
				Calothrix fusca												
				Calothrix parietina												
				Calothrix sp.					10376.57747	41787.44867	32874.07085	39634.67255	36693.0367	17443.38454	33383.9544	45263.34654
			Dichothrix	*Dichothrix* sp.	95938.61494	16437.03543	6038.094647	42731.13135	33097.70399	95842.77217	71115.33695	24358.80917	23068.61801	17826.75562		11002.75025
			Gloeotrichia	*Gloeotrichia* sp.	171973.8809								387057.3492			
			Rivularia	*Rivularia haematites*												
		Scytonemataceae	*Scytonema*	*Scytonema mirabile*												
				Scytonema sp.												
	Oscillatoriales	Borziaceae	*Komvophoron*	*Komvophoron* spp.												
		Oscillatoriaceae	*Homoeothrix*	*Homoeothrix janthina*		63399.99379										
			Oscillatoria	*Oscillatoria* sp.								51194.78538	24616.84741	32394.85699		
				Oscillatoria ucrainica			10818.25291									
		Phormidiaceae	*Phormidium*	*Phormidium aerugineo-caeruleum*												
				Phormidium sp.												
		Pseudanabaenaceae	*Leptolyngbya*	*Leptolyngbya foveolarum*			10566.66563	93203.40968				18785.18335		15909.90018		3667.583415
				Leptolyngbya sp.												
				Leptolyngbya tenuis		6038.094647	14340.47479									
			Pseudanabaena	*Pseudanabaena* sp.		23146.02948	9811.903801	19198.04452								
	Stigonematales	Stigonemataceae	*Stigonema*	*Stigonema mamillosum*				44898.6525	14133.61414				3406.104673	14376.41583		10376.57747
				Total	**367876.5072**	**391805.2526**	**293853.9395**	**631058.3021**	**342784.8694**	**457361.7088**	**305594.6791**	**252051.7458**	**566032.6674**	**189577.0034**	**217264.0634**	**196439.3458**

Note Echo OF was dry during August sampling.

**Komatic IF had no rocks so periphyton was collected from sediment surface using modified methods.*

Appendix 3.6-7. Stream Periphyton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/cm^2

Taxonomic Classification				Area	Goose Reference B	George	George	George	George	George	George	George	George	George	George
				Stream	OF	George OF	George OF	George OF	George OF	Sleigh OF	Sleigh OF	Sleigh OF	Dragon OF	Dragon OF	Dragon OF
				Replicate	3	1	2	3	3 Dup	1	2	3	1	2	3
				Lab Duplicate	no	no	no	no	yes	no	no	no	no	no	no
				Date Sampled	10-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12
				Sample ID	6138.3-18	6141.3-1	6141.3-2	6141.3-3	6141.3-3_DUP	6141.3-4	6141.3-5	6141.3-6	6141.3-7	6141.3-8	6141.3-9
Class	**Order**	**Family**	**Genus**	**Final Designation**											
Bacillariophyceae	**Centrales**	Aulacoseiraceae	*Aulacoseira*	*Aulacoseira* spp.											
		Melosiraceae	*Melosira*	*Melosira* spp.											
		Stephanodiscaceae	*Cyclotella*	*Cyclotella meneghiniana*										459.7007426	398.9469486
				Cyclotella sp.											
				Cyclotella spp.	452.8570985										
		Undetermined	Undetermined	unknown Centric diatom		222.8765829	121.5399339	459.9595102	379.4665959	203.6302408	72.87878752	98.49343942	276.7658716	459.7007426	398.9469486
	Pennales	Achnanthaceae	*Achnanthes*	*Achnanthes* sp.	301.9047323										
			Cocconeis	*Cocconeis* spp.									415.1488075	459.7007426	598.4204229
		Achnanthidiaceae	*Achnanthidium*	*Achnanthidium* sp.		10920.95256	2714.391856	11383.99788	13660.79745	10486.9574	6486.212089	8273.448911	20342.29157	27122.34381	27926.2864
		Amphipleuraceae	*Frustulia*	*Frustulia* sp.											
				Frustulia spp.			40.51331129	114.9898776					830.2976149	5286.558539	
		Bacillariaceae	*Nitzschia*	*Nitzschia* spp.	553.4920093	3491.733132	2552.338611	5289.534367	7083.376457	6414.352585	5247.272701	8864.409548	968.6805508	4137.306683	3391.049063
		Cymbellaceae	*Cymbella*	*Cymbella* sp.											
				Cymbella spp.	100.6349108										
		Encyonema	*Encyonema*	*Encyonema* spp.											
		Eunotiaceae	*Eunotia*	*Eunotia bilunaris*											398.9469486
				Eunotia sp.	1358.571296										
				Eunotia spp.		222.8765829	972.3194709	1379.878531	252.9777306	712.7058428		590.9606365	553.5317433	1379.102228	598.4204229
		Fragilariaceae	*Diatoma*	*Diatoma* spp.											
			Fragilaria	*Fragilaria* sp.											
				Fragilaria spp.		520.0453602	162.0532452	574.9493878		203.6302408		492.4671971	1245.446422	459.7007426	598.4204229
			Synedra	*Synedra* sp.											
				Synedra spp.			283.593179	114.9898776		203.6302408		196.9868788	1660.59523	689.5511138	1795.261269
		Gomphonemataceae	*Gomphonema*	*Gomphonema* sp.											
				Gomphonema spp.											
		Naviculaceae	*Navicula*	*Navicula* sp.											
				Navicula spp.	754.7618308	148.5843886	526.6730468	804.9291429	1011.910922	1527.226806	874.5454502	1181.921273	7887.827342	13561.17191	3391.049063
		Neidiaceae	*Neidium*	*Neidium* spp.											
		Pinnulariaceae	*Caloneis*	*Caloneis* spp.											
			Pinnularia	*Pinnularia* sp.											
				Pinnularia spp.	100.6349108										
		Rhopalodiaceae	*Epithemia*	*Epithemia* spp.										229.8503713	
			Rhopalodia	*Rhopalodia gibba*											
				Rhopalodia spp.											
		Surirellaceae	*Surirella*	*Surirella* spp.											
		Tabellariaceae	*Tabellaria*	*Tabellaria fenestrata*											
				Tabellaria flocculosa	6641.904111	4977.577019	4861.597355	10694.05861	9739.642629	6821.613067	2915.151501	5318.645729	3321.19046	2758.204455	3191.575589
				Tabellaria sp.											
				Tabellaria spp.											
		Undetermined	Undetermined	unknown Pennate diatom		594.3375545	202.5665564	459.9595102	505.9554612	712.7058428	437.2727251	590.9606365	968.6805508	229.8503713	797.8938972
Chlorophyceae	**Chaetophorales**	Chaetophoraceae	*Gongrosira*	*Gongrosira fluminensis*											
	Chlorococcales	Hydrodictyaceae	*Pediastrum*	*Pediastrum boryanum*						3258.083853					
				Pediastrum sp.											
				Pediastrum tetras											
		Microsporaceae	*Microspora*	*Microspora amoena*											
				Microspora crassior											
		Oocystaceae	*Ankistrodesmus*	*Ankistrodesmus falcatus*											
				Ankistrodesmus falcatus var. *acicularis*											
				Ankistrodesmus sp.											
			Botryococcus	*Botryococcus braunii*											
			Dictyosphaerium	*Dictyosphaerium ehrenbergianum*	1610.158572										
				Dictyosphaerium pulchellum	7446.983398										
			Oocystis	*Oocystis* cf. *borgei*											
				Oocystis parva											
				Oocystis sp.											
		Scenedesmaceae	*Scenedesmus*	*Scenedesmus* sp.											
			Tetrastrum	*Tetrastrum staurogeniaeforme*											

Appendix 3.6-7. Stream Periphyton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/cm^2

Area					Goose Reference B	George	George	George	George	George	George	George	George	George	George
Stream					OF	George OF	George OF	George OF	George OF	Sleigh OF	Sleigh OF	Sleigh OF	Dragon OF	Dragon OF	Dragon OF
Replicate					3	1	2	3	3 Dup	1	2	3	1	2	3
Lab Duplicate					no	no	no	no	yes	no	no	no	no	no	no
Date Sampled					10-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12
Taxonomic Classification				Sample ID	6138.3-18	6141.3-1	6141.3-2	6141.3-3	6141.3-3_DUP	6141.3-4	6141.3-5	6141.3-6	6141.3-7	6141.3-8	6141.3-9
Class	Order	Family	Genus	Final Designation											
				Tetrastrum triangulare											
	Oedogoniales	Oedogoniaceae	*Bulbochaete*	*Bulbochaete rectangularis*											
				Bulbochaete sp.	1811.428394		526.6730468	574.9493878	758.9331918			886.4409548	7611.06147	8734.314108	1196.840846
			Oedogonium	*Oedogonium* sp.											
				Oedogonium spp.		222.8765829		574.9493878	632.4443265			393.9737577	1245.446422	1149.251856	997.3673715
	Tetrasporales	Coccomyxaceae	*Elakatothrix*	*Elakatothrix gelatinosa*	402.5396431		81.02662258						276.7658716		
	Ulotrichales	Ulotrichaceae	*Geminella*	*Geminella* sp.											
	Volvocales	Chlamydomonadaceae	*Chlamydomonas*	*Chlamydomonas* sp.											
	Zygnematales	Desmidiaceae	*Actinotaenium*	*Actinotaenium diplosporum*											
			Closterium	*Closterium closterioides* var. *intermedium*	50.31745539										
				Closterium costatum											
				Closterium dianae											
				Closterium parvulum											
				Closterium sp.											
				Closterium spp.											
			Cosmarium	*Cosmarium bireme*								196.9868788		229.8503713	199.4734743
				Cosmarium didymoprotupsum											
				Cosmarium garrolense		148.5843886	81.02662258		126.4888653	203.6302408					
				Cosmarium margaritatum fo. Minor									138.3829358		
				Cosmarium phaseolus				114.9898776					276.7658716		
				Cosmarium regnellii				344.9696327	126.4888653	101.8151204					
				Cosmarium sp.	50.31745539										
				Cosmarium subcrenatum	100.6349108										
				Cosmarium subtumidum											
				Cosmarium subtumidum var. *minutum*											
				Cosmarium subundulatum	50.31745539										
				Cosmarium tinctum											
			Desmidium	*Desmidium* sp.											
			Euastrum	*Euastrum binale*											
				Euastrum obesum	50.31745539										
				Euastrum pulchellum					126.4888653						199.4734743
				Euastrum sp.	50.31745539							98.49343942		229.8503713	
				Euastrum validum											
			Micrasterias	*Micrasterias papillifera*											
				Micrasterias sp.											
			Pleurotaenium	*Pleurotaenium ehrenbergii*											
			Staurastrum	*Staurastrum cingulum*											
				Staurastrum crenulatum											
				Staurastrum furcigerum											
				Staurastrum furcigerum var. *[furcigerum] f. armiger*											
				Staurastrum margaritaceum											398.9469486
				Staurastrum setigerum											
				Staurastrum sp.									276.7658716	229.8503713	
			Staurodesmus	*Staurodesmus dejectus*											
				Staurodesmus extensus											
				Staurodesmus extensus var. *joshuae*											
				Staurodesmus glaber											
			Teilingia	*Teilingia granulata*									4289.871011	459.7007426	
		Mesotaeniaceae	*Cylindrocystis*	*Cylindrocystis* sp.											
		Zygnemataceae	*Mougeotia*	*Mougeotia* sp.	654.1269201	1040.09072	729.2396032	689.9392653	632.4443265	1323.596565			1798.978166	4137.306683	4188.94296
			Zygnema	*Zygnema* sp.		1262.967303	810.2662258	804.9291429					4289.871011	5746.259282	1196.840846
Chrysophyceae	**Chrysomonadales**	Dinobryaceae	*Dinobryon*	*Dinobryon sertularia*											
				Dinobryon sp.											
		Synuraceae	*Mallomonas*	*Mallomonas caudata*											
Cryptophyceae	**Cryptomonadales**	Cryptomonadaceae	*Cryptomonas*	*Cryptomonas* sp.	100.6349108										

Appendix 3.6-7. Stream Periphyton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/cm^2

				Area	Goose Reference B	George	George	George	George	George	George	George	George	George	George
				Stream	OF	George OF	George OF	George OF	George OF	Sleigh OF	Sleigh OF	Sleigh OF	Dragon OF	Dragon OF	Dragon OF
				Replicate	3	1	2	3	3 Dup	1	2	3	1	2	3
				Lab Duplicate	no	no	no	no	yes	no	no	no	no	no	no
				Date Sampled	10-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12
Taxonomic Classification				Sample ID	6138.3-18	6141.3-1	6141.3-2	6141.3-3	6141.3-3_DUP	6141.3-4	6141.3-5	6141.3-6	6141.3-7	6141.3-8	6141.3-9
Class	**Order**	**Family**	**Genus**	**Final Designation**											
Dinophyceae	**Peridiniales**	Oxytoxaceae	*Ceratium*	*Ceratium carolinianum*	50.31745539										
		Peridiniaceae	*Peridinium*	*Peridinium* sp.											
Euglenophyceae	**Euglenales**	Euglenaceae	*Euglena*	*Euglena* sp.											
Myxophyceae	**Chroococcales**	Chamaesiphonaceae	*Chamaesiphon*	*Chamaesiphon* spp.											
		Chroococcaceae	*Chroococcus*	*Chroococcus dispersus*				919.9190204							
				Chroococcus minutus											
				Chroococcus pallidus									276.7658716		
				Chroococcus sp.											398.9469486
				Chroococcus turgidus										919.4014851	
	Merismopediaceae	Aphanocapsa	*Aphanocapsa*	*Aphanocapsa delicatissima*											
				Aphanocapsa elachista					7589.331918						
				Aphanocapsa rivularis	2012.698216								8302.976149		
			Merismopedia	*Merismopedia glauca*	1610.158572										
				Merismopedia punctata	4830.475717										
				Merismopedia spp.						1629.041926	2332.121201	3151.790062	22141.26973		
			Woronichinia	*Woronichinia naegeliana*	22139.68037										
		Microcystaceae	*Gloeocapsa*	*Gloeocapsa aeruginosa*											
				Gloeocapsa rupestris	19321.90287										
				Gloeocapsa sanguinea											
				Gloeocapsa sp.	18164.6014										
				Gloeocapsa spp.											
			Microcystis	*Microcystis flosaquae*											
		Synechococcaceae	*Aphanothece*	*Aphanothece smithii*											
			Cyanothece	*Cyanothece aeruginosa*											
	Nostocales	Nostocaceae	*Anabaena*	*Anabaena* sp.	1912.063305										
			Nostoc	*Nostoc linckia*										18388.0297	
				Nostoc paludosum											
				Nostoc sp.											
		Rivulariaceae	*Calothrix*	*Calothrix breviarticulata*								1772.88191			
				Calothrix fusca			324.1064903	2299.797551	505.9554612	2239.932649	291.5151501	1575.895031		1379.102228	1994.734743
				Calothrix parietina		520.0453602	202.5665564	1724.848163	1644.355249	3868.974575	3206.666651		1660.59523		
				Calothrix sp.	25812.85462	1560.13608	1174.886027	919.9190204	885.4220572	2036.302408	2404.999988	4136.724456		2068.653341	1994.734743
			Dichothrix	*Dichothrix* sp.	9258.411792	18573.04858								50567.08168	
			Gloeotrichia	*Gloeotrichia* sp.											
			Rivularia	*Rivularia haematites*							14575.7575				
		Scytonemataceae	*Scytonema*	*Scytonema mirabile*											
				Scytonema sp.											
	Oscillatoriales	Borziaceae	*Komvophoron*	*Komvophoron* spp.					2656.266171						3590.522537
		Oscillatoriaceae	*Homoeothrix*	*Homoeothrix janthina*											
			Oscillatoria	*Oscillatoria* sp.											
				Oscillatoria ucrainica											
		Phormidiaceae	*Phormidium*	*Phormidium aerugineo-caeruleum*							1457.57575	787.9475154			4388.416435
				Phormidium sp.		3120.272161	1215.399339	4829.574857	3415.199363	5599.831622	5101.515126	2363.842546		1608.952599	6582.624652
		Pseudanabaenaceae	*Leptolyngbya*	*Leptolyngbya foveolarum*											
				Leptolyngbya sp.		3268.85655	4091.84444	25067.79331	22388.52916	14559.56222	12972.42418	11228.25209	1522.212294	13561.17191	19149.45353
				Leptolyngbya tenuis											
			Pseudanabaena	*Pseudanabaena* sp.											
	Stigonematales	Stigonemataceae	*Stigonema*	*Stigonema mamillosum*		23773.50218	2835.93179		18973.3298						
				Total	**127756.0192**	**74589.36308**	**24510.55333**	**70143.82531**	**93095.80487**	**62107.22345**	**58375.9088**	**52201.52289**	**92578.18407**	**166641.5192**	**89962.53691**

Note Echo OF was dry during August sampling.

**Komatic IF had no rocks so periphyton was collected from sediment surface using modified methods.*

Appendix 3.6-7. Stream Periphyton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/cm^2

Taxonomic Classification				Area	George	George	George	George	George	George	George
				Stream	Komatic IF*	Komatic IF*	Komatic IF*	Reference C OF	Reference C OF	Reference C OF	Reference C OF
				Replicate	1	2	3	1	2	2 Dup	3
				Lab Duplicate	no	no	no	no	no	yes	no
				Date Sampled	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12
				Sample ID	6141.3-13	6141.3-14	6141.3-15	6141.3-10	6141.3-11	6141.3-11_DUP	6141.3-12
Class	**Order**	**Family**	**Genus**	**Final Designation**							
Bacillariophyceae	**Centrales**	Aulacoseiraceae	*Aulacoseira*	*Aulacoseira* spp.				98.20232581	1246.875998		
		Melosiraceae	*Melosira*	*Melosira* spp.							
		Stephanodiscaceae	*Cyclotella*	*Cyclotella meneghiniana*							
				Cyclotella sp.							
				Cyclotella spp.							
		Undetermined	Undetermined	unknown Centric diatom	265.4116914	285.4576924	162.2473209	98.20232581	178.1251426		1258.026689
	Pennales	Achnanthaceae	*Achnanthes*	*Achnanthes* sp.							
			Cocconeis	*Cocconeis* spp.			162.2473209				
		Achnanthidiaceae	*Achnanthidium*	*Achnanthidium* sp.	17915.28917	10990.12116	27744.29187	10311.24421	10153.13313	11590.00928	51159.75203
		Amphipleuraceae	*Frustulia*	*Frustulia* sp.							
				Frustulia spp.	265.4116914	428.1865386	162.2473209	589.2139549		190.0001521	1258.026689
		Bacillariaceae	*Nitzschia*	*Nitzschia* spp.	4246.587062	9277.375003	2433.709814	687.4162807	712.5005704	950.0007605	2096.711149
		Cymbellaceae	*Cymbella*	*Cymbella* sp.							
				Cymbella spp.	1327.058457	570.9153848	324.4946418	98.20232581		190.0001521	3354.737838
		Encyonema	*Encyonema*	*Encyonema* spp.	398.1175371	713.644231					
		Eunotiaceae	*Eunotia*	*Eunotia bilunaris*			162.2473209				
				Eunotia sp.							
				Eunotia spp.	4379.292908	3282.763463	811.2366045	589.2139549	890.625713	570.0004563	2096.711149
		Fragilariaceae	*Diatoma*	*Diatoma* spp.							1677.368919
			Fragilaria	*Fragilaria* sp.							
				Fragilaria spp.	398.1175371	428.1865386	162.2473209				1258.026689
			Synedra	*Synedra* sp.							
				Synedra spp.		142.7288462	162.2473209	196.4046516	356.2502852	190.0001521	838.6844595
		Gomphonemataceae	*Gomphonema*	*Gomphonema* sp.							
				Gomphonema spp.					4631.253708	2280.001825	
		Naviculaceae	*Navicula*	*Navicula* sp.							
				Navicula spp.	3981.175371	3996.407694	5354.16159	3928.093032	4809.37885	6080.004867	25579.87602
		Neidiaceae	*Neidium*	*Neidium* spp.	132.7058457	713.644231	811.2366045				
		Pinnulariaceae	*Caloneis*	*Caloneis* spp.	796.2350741	713.644231	162.2473209			190.0001521	
			Pinnularia	*Pinnularia* sp.							
				Pinnularia spp.		285.4576924	648.9892836				
		Rhopalodiaceae	*Epithemia*	*Epithemia* spp.						380.0003042	8386.844595
			Rhopalodia	*Rhopalodia gibba*				196.4046516			
				Rhopalodia spp.				294.6069774			419.3422298
		Surirellaceae	*Surirella*	*Surirella* spp.	265.4116914						
		Tabellariaceae	*Tabellaria*	*Tabellaria fenestrata*							
				Tabellaria flocculosa			5191.914269				
				Tabellaria sp.							
				Tabellaria spp.	4113.881216	4567.323079	486.7419627		534.3754278	2090.001673	5451.448987
		Undetermined	Undetermined	unknown Pennate diatom	663.5292284	999.1019234	973.4839254	491.011629	356.2502852	380.0003042	2516.053379
Chlorophyceae	**Chaetophorales**	Chaetophoraceae	*Gongrosira*	*Gongrosira fluminensis*							
	Chlorococcales	Hydrodictyaceae	*Pediastrum*	*Pediastrum boryanum*							
				Pediastrum sp.							
				Pediastrum tetras							
		Microsporaceae	*Microspora*	*Microspora amoena*							
				Microspora crassior							
		Oocystaceae	*Ankistrodesmus*	*Ankistrodesmus falcatus*							
				Ankistrodesmus falcatus var. *acicularis*							
				Ankistrodesmus sp.							
			Botryococcus	*Botryococcus braunii*							
			Dictyosphaerium	*Dictyosphaerium ehrenbergianum*							
				Dictyosphaerium pulchellum							
			Oocystis	*Oocystis* cf. *borgei*							
				Oocystis parva					712.5005704		
				Oocystis sp.							
		Scenedesmaceae	*Scenedesmus*	*Scenedesmus* sp.							
			Tetrastrum	*Tetrastrum staurogeniaeforme*							

Appendix 3.6-7. Stream Periphyton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/cm^2

Taxonomic Classification				Area	George	George	George	George	George	George	George
				Stream	Komatic IF*	Komatic IF*	Komatic IF*	Reference C OF	Reference C OF	Reference C OF	Reference C OF
				Replicate	1	2	3	1	2	2 Dup	3
				Lab Duplicate	no	no	no	no	no	yes	no
				Date Sampled	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12
				Sample ID	6141.3-13	6141.3-14	6141.3-15	6141.3-10	6141.3-11	6141.3-11_DUP	6141.3-12
Class	**Order**	**Family**	**Genus**	**Final Designation**							
				Tetrastrum triangulare							
	Oedogoniales	Oedogoniaceae	*Bulbochaete*	*Bulbochaete rectangularis*							
				Bulbochaete sp.							
			Oedogonium	*Oedogonium* sp.							
				Oedogonium spp.		1855.475001	811.2366045				
	Tetrasporales	Coccomyxaceae	*Elakatothrix*	*Elakatothrix gelatinosa*							
	Ulotrichales	Ulotrichaceae	*Geminella*	*Geminella* sp.							
	Volvocales	Chlamydomonadaceae	*Chlamydomonas*	*Chlamydomonas* sp.							
	Zygnematales	Desmidiaceae	*Actinotaenium*	*Actinotaenium diplosporum*							
			Closterium	*Closterium closterioides* var. *intermedium*							
				Closterium costatum							
				Closterium dianae							
				Closterium parvulum							
				Closterium sp.							
				Closterium spp.		285.4576924					
			Cosmarium	*Cosmarium bireme*					178.1251426		419.3422298
				Cosmarium didymoprotupsum							
				Cosmarium garrolense							419.3422298
				Cosmarium margaritatum fo. Minor							
				Cosmarium phaseolus							
				Cosmarium regnellii							
				Cosmarium sp.							
				Cosmarium subcrenatum							
				Cosmarium subtumidum							
				Cosmarium subtumidum var. *minutum*							
				Cosmarium subundulatum							
				Cosmarium tinctum							
			Desmidium	*Desmidium* sp.							
			Euastrum	*Euastrum binale*							
				Euastrum obesum							
				Euastrum pulchellum	132.7058457						
				Euastrum sp.							
				Euastrum validum							
			Micrasterias	*Micrasterias papillifera*							
				Micrasterias sp.							
			Pleurotaenium	*Pleurotaenium ehrenbergii*					178.1251426		
			Staurastrum	*Staurastrum cingulum*							
				Staurastrum crenulatum							
				Staurastrum furcigerum							
				Staurastrum furcigerum var. *[furcigerum] f. armiger*							
				Staurastrum margaritaceum	132.7058457						
				Staurastrum setigerum							
				Staurastrum sp.							
			Staurodesmus	*Staurodesmus dejectus*							
				Staurodesmus extensus							
				Staurodesmus extensus var. *joshuae*							
				Staurodesmus glaber							
			Teilingia	*Teilingia granulata*			162.2473209				
		Mesotaeniaceae	*Cylindrocystis*	*Cylindrocystis* sp.							
		Zygnemataceae	*Mougeotia*	*Mougeotia* sp.					178.1251426	570.0004563	
			Zygnema	*Zygnema* sp.							
Chrysophyceae	**Chrysomonadales**	Dinobryaceae	*Dinobryon*	*Dinobryon sertularia*							
				Dinobryon sp.							
		Synuraceae	*Mallomonas*	*Mallomonas caudata*							
Cryptophyceae	**Cryptomonadales**	Cryptomonadaceae	*Cryptomonas*	*Cryptomonas* sp.							

Appendix 3.6-7. Stream Periphyton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in cells/cm^2				Area	George	George	George	George	George	George	George
				Stream	Komatic IF*	Komatic IF*	Komatic IF*	Reference C OF	Reference C OF	Reference C OF	Reference C OF
				Replicate	1	2	3	1	2	2 Dup	3
				Lab Duplicate	no	no	no	no	no	yes	no
				Date Sampled	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12
Taxonomic Classification				Sample ID	6141.3-13	6141.3-14	6141.3-15	6141.3-10	6141.3-11	6141.3-11_DUP	6141.3-12
Class	**Order**	**Family**	**Genus**	**Final Designation**							
Dinophyceae	**Peridiniales**	Oxytoxaceae	*Ceratium*	*Ceratium carolinianum*							
		Peridiniaceae	*Peridinium*	*Peridinium* sp.							
Euglenophyceae	**Euglenales**	Euglenaceae	*Euglena*	*Euglena* sp.							
Myxophyceae	**Chroococcales**	Chamaesiphonaceae	*Chamaesiphon*	*Chamaesiphon* spp.					890.625713		
		Chroococcaceae	*Chroococcus*	*Chroococcus dispersus*		2283.661539	9085.84997	4320.902336	2850.002282	4560.003651	
				Chroococcus minutus							
				Chroococcus pallidus					356.2502852		
				Chroococcus sp.	265.4116914	856.3730772	648.9892836	2356.855819	1425.001141	2280.001825	1677.368919
				Chroococcus turgidus			648.9892836	392.8093032			
	Merismopediaceae	Aphanocapsa	*Aphanocapsa*	*Aphanocapsa delicatissima*				54011.27919	14250.01141		
				Aphanocapsa elachista				19640.46516	10687.50856	13300.01065	50321.06757
				Aphanocapsa rivularis							
			Merismopedia	*Merismopedia glauca*	2123.293531	9134.646157	28555.52848	3142.474426			
				Merismopedia punctata							
				Merismopedia spp.		2283.661539	3893.935702	3142.474426			
			Woronichinia	*Woronichinia naegeliana*							
		Microcystaceae	*Gloeocapsa*	*Gloeocapsa aeruginosa*				12766.30236	13537.51084	17100.01369	6709.475676
				Gloeocapsa rupestris							20967.11149
				Gloeocapsa sanguinea				8052.590716	4987.503993	2280.001825	1677.368919
				Gloeocapsa sp.							
				Gloeocapsa spp.				2553.260471	5700.004563	6840.005476	7548.160136
			Microcystis	*Microcystis flosaquae*							
		Synechococcaceae	*Aphanothece*	*Aphanothece smithii*							
			Cyanothece	*Cyanothece aeruginosa*							
	Nostocales	Nostocaceae	*Anabaena*	*Anabaena* sp.			9410.344612				
			Nostoc	*Nostoc linckia*				49101.1629			
				Nostoc paludosum				191494.5353	60562.54848	57000.04563	
				Nostoc sp.				7856.186065	12468.75998	190.0001521	
		Rivulariaceae	*Calothrix*	*Calothrix breviarticulata*				883.8209323			
				Calothrix fusca					1603.126283	2660.00213	8386.844595
				Calothrix parietina				14730.34887			6290.133447
				Calothrix sp.				1374.832561	3028.127424	3040.002434	3354.737838
			Dichothrix	*Dichothrix* sp.				7856.186065	89062.5713	161500.1293	46127.64527
			Gloeotrichia	*Gloeotrichia* sp.							
			Rivularia	*Rivularia haematites*							
		Scytonemataceae	*Scytonema*	*Scytonema mirabile*				44191.04661	14250.01141	13300.01065	46127.64527
				Scytonema sp.				40262.95358			62901.33447
	Oscillatoriales	Borziaceae	*Komvophoron*	*Komvophoron* spp.	2255.999377	3853.678848				2470.001977	21805.79595
		Oscillatoriaceae	*Homoeothrix*	*Homoeothrix janthina*							
			Oscillatoria	*Oscillatoria* sp.							
				Oscillatoria ucrainica							
		Phormidiaceae	*Phormidium*	*Phormidium aerugineo-caeruleum*					1959.376569	2280.001825	
				Phormidium sp.	796.2350741	1141.83077	486.7419627	1276.630236	3028.127424	2470.001977	4193.422298
		Pseudanabaenaceae	*Leptolyngbya*	*Leptolyngbya foveolarum*							
				Leptolyngbya sp.	4777.410445	15414.71539	7625.624082	9427.423278	42928.15937	57950.04639	45288.96082
				Leptolyngbya tenuis							
			Pseudanabaena	*Pseudanabaena* sp.							
	Stigonematales	Stigonemataceae	*Stigonema*	*Stigonema mamillosum*				11784.2791			
				Total	**49631.98629**	**74504.45772**	**107245.4791**	**508197.0361**	**308690.8721**	**374870.3001**	**441567.3679**

Note Echo OF was dry during August sampling.

**Komatic IF had no rocks so periphyton was collected from sediment surface using modified methods.*

Appendix 3.6-8

Stream Periphyton Richness and Diversity Results, Back River Project, 2012

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Appendix 3.6-8. Stream Periphyton Richness and Diversity Results, Back River Project, 2012

Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location	Moby OF	Moby OF	Moby OF	Gander IF	Gander IF	Gander IF	Gander US	Gander US	Gander US	Pond 19 OF	Pond 19 OF	Pond 19 OF
Replicate	1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled	12-Aug-12	12-Aug-12	12-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	12-Aug-12	12-Aug-12	12-Aug-12
Eco Analysts Sample ID	6138.3-25	6138.3-26	6138.3-27	6138.3-19	6138.3-20	6138.3-21	6138.3-22	6138.3-23	6138.3-24	6138.3-31	6138.3-32	6138.3-33
Genus Richness (# genera)	15	18	16	22	25	22	18	25	25	14	27	21
Simpson's Diversity Index	0.70	0.65	0.77	0.74	0.80	0.66	0.64	0.71	0.79	0.71	0.83	0.66

Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location	Chair OF	Chair OF	Chair OF	Llama OF	Llama OF	Llama OF	Giraffe OF	Giraffe OF	Giraffe OF	Wolf OF	Wolf OF	Wolf OF
Replicate	1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled	12-Aug-12	12-Aug-12	12-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12
Eco Analysts Sample ID	6138.3-28	6138.3-29	6138.3-30	6138.3-1	6138.3-2	6138.3-3	6138.3-7	6138.3-8	6138.3-9	6138.3-4	6138.3-5	6138.3-6
Genus Richness (# genera)	22	21	20	11	10	9	19	15	19	16	19	25
Simpson's Diversity Index	0.83	0.80	0.87	0.38	0.66	0.72	0.86	0.83	0.86	0.69	0.81	0.84

Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	George	George	George
Location	Goose OF	Goose OF	Goose OF	Propellor OF	Propellor OF	Propellor OF	Reference B OF	Reference B OF	Reference B OF	George OF	George OF	George OF
Replicate	1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled	9-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	10-Aug-12	10-Aug-12	10-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12
Eco Analysts Sample ID	6138.3-10	6138.3-11	6138.3-12	6138.3-13	6138.3-14	6138.3-15	6138.3-16	6138.3-17	6138.3-18	6141.3-1	6141.3-2	6141.3-3
Genus Richness (# genera)	22	19	24	16	20	16	21	23	24	15	17	17
Simpson's Diversity Index	0.81	0.87	0.89	0.84	0.88	0.85	0.86	0.88	0.83	0.80	0.88	0.80

Area	George	George	George	George	George	George	George	George	George	George	George	George
Location	Sleigh OF	Sleigh OF	Sleigh OF	Dragon OF	Dragon OF	Dragon OF	Komatic IF*	Komatic IF*	Komatic IF*	Reference C OF	Reference C OF	Reference C OF
Replicate	1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12
Eco Analysts Sample ID	6141.3-4	6141.3-5	6141.3-6	6141.3-7	6141.3-8	6141.3-9	6141.3-13	6141.3-14	6141.3-15	6141.3-10	6141.3-11	6141.3-12
Genus Richness (# genera)	14	9	15	22	25	21	19	20	20	20	22	22
Simpson's Diversity Index	0.86	0.84	0.86	0.86	0.85	0.83	0.82	0.88	0.81	0.71	0.82	0.87

Note Echo OF was dry during August sampling.

**Komatic IF had no rocks so periphyton was collected from sediment surface using modified methods.*

Appendix 3.6-9

Stream Periphyton Reference Photographs, Back River Project, 2012

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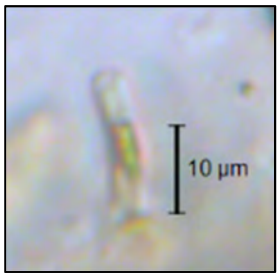
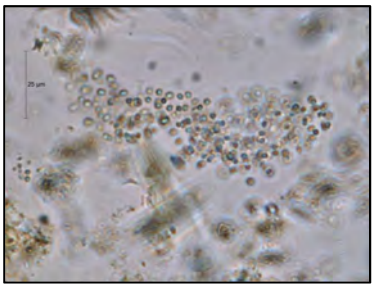
Appendix 3.6-9. Stream Periphyton Reference Photographs, Back River Project, 2012

Reference photographs of highly abundant genera are shown below, more information (species names, location, date) on these photographs are available by request. Photographs of less abundant taxa area also available by request.

EcoAnalysts, Inc.

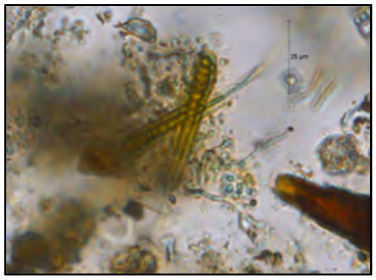


Achnanthidium (Bacillariophyceae)

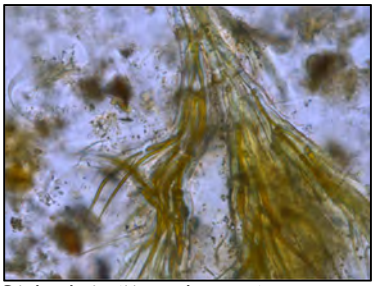


Aphanocapsa (Myxophyceae)

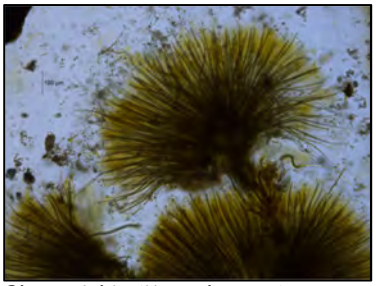
Bulbochaete (Chlorophyceae)



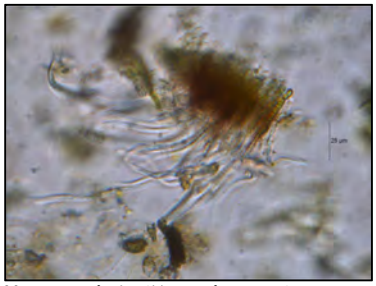
Calothrix (Myxophyceae)



Dichothrix (Myxophyceae)

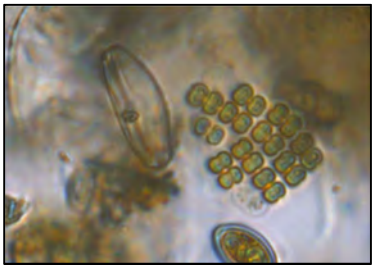


Gloeotrichia (Myxophyceae)

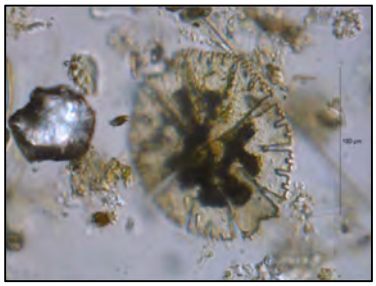


Homoeothrix (Myxophyceae)

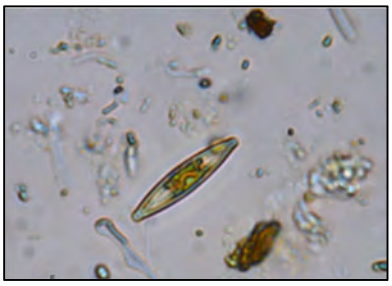
Leptolyngbya (Myxophyceae)



Merismopedia (Myxophyceae)



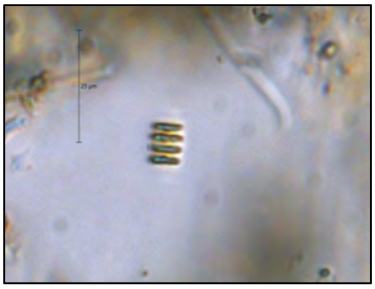
Microcystis (Myxophyceae)



Navicula (Bacillariophyceae)

Nostoc (Myxophyceae)

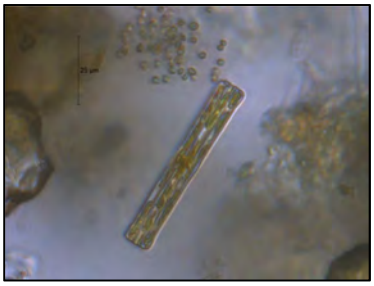
Oscillatoria (Myxophyceae)



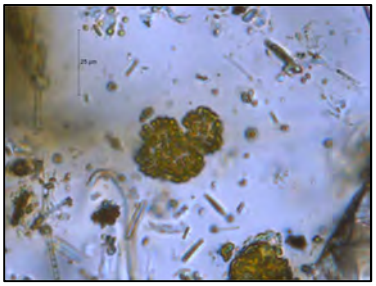
Scenedesmus (Chlorophyceae)

Scytonema (Myxophyceae)

Stigonema (Myxophyceae)



Tabellaria (Bacillariophyceae)



Woronichinia (Myxophyceae)

Appendix 3.6-10

Stream Periphyton QA/QC Results, Back River Project, 2012

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Appendix 3.6-10. Stream Periphyton QA/QC Results, Back River Project, 2012

SoftBody Taxonomy Duplicate Counts

EcoAnalysts, Inc.

6138.3-2_DUP	Taxonomic Identification Number (TIN)	Original Abundance (0.00887% Counted)	Relative Abundance	Dominance Rank	Duplicate Abundance (0.00740% Counted)	Relative Abundance	Dominance Rank	Percent Similarity
Achnanthes sp.	3	21	6.98%	4	39	13.00%	2	6.98%
Bulbochaete sp.	2046	171	56.81%	1	168	56.00%	1	56.00%
Calothrix sp.	2047	0	0.00%		1	0.33%		0.00%
Eunotia sp.	582	17	5.65%	5	28	9.33%	3	5.65%
Fragilaria sp.	654	4	1.33%		0	0.00%		0.00%
Gongrosira fluminensis	3355	13	4.32%		19	6.33%	5	4.32%
Homoeothrix janthina	3038	29	9.63%	3	2	0.67%		0.67%
Leptolyngbya tenuis	3356	4	1.33%		1	0.33%		0.33%
Microspora crassior	3208	1	0.33%		0	0.00%		0.00%
Navicula spp.	959	0	0.00%		3	1.00%		0.00%
Nitzschia spp.	1470	12	3.99%		10	3.33%		3.33%
Oedogonium sp.	2065	0	0.00%		3	1.00%		0.00%
Tabellaria fenestrata	1987	0	0.00%		2	0.67%		0.00%
Tabellaria flocculosa	1988	29	9.63%	2	24	8.00%	4	8.00%
		301			**300**			**85.28%**

6138.3-14_DUP	Taxonomic Identification Number (TIN)	Original Abundance (0.00590% Counted)	Relative Abundance	Dominance Rank	Duplicate Abundance (0.00769% Counted)	Relative Abundance	Dominance Rank	Percent Similarity
Tabellaria flocculosa	1988	96	31.89%	1	120	40.00%	1	31.89%
Achnanthes sp.	3	12	3.99%		6	2.00%		2.00%
Aulacoseira spp.	223	12	3.99%		0	0.00%		0.00%
Bulbochaete sp.	2046	36	11.96%	2	34	11.33%	2	11.33%
Calothrix sp.	2047	22	7.31%	5	5	1.67%		1.67%
Chroococcus minutus	2612	1	0.33%		0	0.00%		0.00%
Cosmarium sp.	2012	0	0.00%		1	0.33%		0.00%
Cosmarium subtumidum	3347	1	0.33%		1	0.33%		0.33%
Cyclotella spp.	334	0	0.00%		2	0.67%		0.00%
Cymbella spp.	379	2	0.66%		2	0.67%		0.66%
Dichothrix sp.	2062	4	1.33%		4	1.33%		1.33%
Elakatothrix gelatinosa	3022	1	0.33%		0	0.00%		0.00%
Eunotia sp.	582	9	2.99%		15	5.00%		2.99%
Geminella sp.	3076	4	1.33%		0	0.00%		0.00%
Gloeocapsa sp.	2049	2	0.66%		3	1.00%		0.66%
Gloeotrichia sp.	2093	0	0.00%		1	0.33%		0.00%
Leptolyngbya foveolarum	3244	9	2.99%		0	0.00%		0.00%

Appendix 3.6-10. Stream Periphyton QA/QC Results, Back River Project, 2012

SoftBody Taxonomy Duplicate Counts

EcoAnalysts, Inc.

6138.3-14_DUP	Taxonomic Identification Number (TIN)	Original Abundance (0.00590% Counted)	Relative Abundance	Dominance Rank	Duplicate Abundance (0.00769% Counted)	Relative Abundance	Dominance Rank	Percent Similarity
Mougeotia sp.	2053	24	7.97%	4	33	11.00%	3	7.97%
Navicula spp.	959	27	8.97%	3	29	9.67%	4	8.97%
Nitzschia spp.	1470	21	6.98%		5	1.67%		1.67%
Oscillatoria sp.	2016	12	3.99%		22	7.33%	5	3.99%
Scenedesmus sp.	2055	2	0.66%		1	0.33%		0.33%
Staurastrum crenulatum	2640	2	0.66%		0	0.00%		0.00%
Staurastrum sp.	2023	0	0.00%		2	0.67%		0.00%
Stigonema mamillosum	3313	0	0.00%		1	0.33%		0.00%
Tabellaria fenestrata	1987	2	0.66%		9	3.00%		0.66%
Zygnema sp.	2027	0	0.00%		4	1.33%		0.00%
		301			**300**			**76.47%**

6138.3-26_DUP	Taxonomic Identification Number (TIN)	Original Abundance (0.00801% Counted)	Relative Abundance	Dominance Rank	Duplicate Abundance (0.00839% Counted)	Relative Abundance	Dominance Rank	Percent Similarity
Navicula spp.	959	125	41.12%	1	123	40.07%	1	40.07%
Achnanthes sp.	3	3	0.99%		3	0.98%		0.98%
Calothrix sp.	2047	6	1.97%		9	2.93%		1.97%
Closterium closterioides var. intermedium	3342	1	0.33%		1	0.33%		0.33%
Closterium costatum	3343	1	0.33%		1	0.33%		0.33%
Closterium parvulum	3344	1	0.33%		1	0.33%		0.33%
Cosmarium phaseolus	3301	2	0.66%		1	0.33%		0.33%
Cosmarium sp.	2012	3	0.99%		2	0.65%		0.65%
Cosmarium subtumidum	3347	1	0.33%		1	0.33%		0.33%
Cylindrocystis sp.	3351	3	0.99%		3	0.98%		0.98%
Cymbella sp.	379	1	0.33%		1	0.33%		0.33%
Elakatothrix gelatinosa	3022	1	0.33%		1	0.33%		0.33%
Euastrum pulchellum	3303	1	0.33%		1	0.33%		0.33%
Fragilaria sp.	654	2	0.66%		1	0.33%		0.33%
Frustulia sp.	728	4	1.32%		5	1.63%		1.32%
Oocystis sp.	2015	4	1.32%		6	1.95%		1.32%
Oscillatoria sp.	2016	88	28.95%	2	89	28.99%	2	28.95%
Pinnularia sp.	1685	3	0.99%		4	1.30%		0.99%
Scenedesmus sp.	2055	13	4.28%	5	15	4.89%	5	4.28%
Staurodesmus extensus	3152	1	0.33%		1	0.33%		0.33%
Tabellaria flocculosa	1988	19	6.25%	4	16	5.21%	4	5.21%
Woronichinia naegeliana	2444	21	6.91%	3	22	7.17%	3	6.91%
		304			**307**			**96.86%**

Appendix 3.6-10. Stream Periphyton QA/QC Results, Back River Project, 2012

SoftBody Taxonomy Duplicate Counts

6141.3-3_DUP	Taxonomic Identification Number (TIN)	Original Abundance (0.00977% Counted)	Relative Abundance	Dominance Rank	Duplicate Abundance (0.00888% Counted)	Relative Abundance	Dominance Rank	Percent Similarity
Achnanthidium sp.	2259	99	32.57%	1	108	35.88%	1	32.57%
Aphanocapsa elachista	3016	0	0.00%		1	0.33%		0.00%
Bulbochaete sp.	2046	2	0.66%		1	0.33%		0.33%
Calothrix fusca	3298	2	0.66%		1	0.33%		0.33%
Calothrix parietina	3110	2	0.66%		3	1.00%		0.66%
Calothrix sp.	2047	3	0.99%		2	0.66%		0.66%
Chroococcus dispersus	2463	1	0.33%		0	0.00%		0.00%
Cosmarium garrolense	2471	0	0.00%		1	0.33%		0.00%
Cosmarium phaseolus	3301	1	0.33%		0	0.00%		0.00%
Cosmarium regnellii	3302	3	0.99%		1	0.33%		0.33%
Euastrum pulchellum	3303	0	0.00%		1	0.33%		0.00%
Eunotia spp.	582	7	2.30%		2	0.66%		0.66%
Fragilaria spp.	654	3	0.99%		0	0.00%		0.00%
Frustulia spp.	728	1	0.33%		0	0.00%		0.00%
Komvophoron spp.	2487	0	0.00%		2	0.66%		0.00%
Leptolyngbya sp.	2105	67	22.04%	2	62	20.60%	2	20.60%
Mougeotia sp.	2053	3	0.99%		4	1.33%		0.99%
Navicula spp.	959	7	2.30%		8	2.66%		2.30%
Nitzschia spp.	1470	46	15.13%	3	56	18.60%	3	15.13%
Oedogonium spp.	2065	1	0.33%		1	0.33%		0.33%
Phormidium sp.	2054	14	4.61%	5	10	3.32%	5	3.32%
Stigonema mamillosum	3313	0	0.00%		1	0.33%		0.00%
Synedra spp.	1930	1	0.33%		0	0.00%		0.00%
Tabellaria flocculosa	1988	32	10.53%	4	29	9.63%	4	9.63%
unknown Centric diatom	-30	4	1.32%		3	1.00%		1.00%
unknown Pennate diatom	-321	4	1.32%		4	1.33%		1.32%
Zygnema sp.	2027	1	0.33%		0	0.00%		0.00%
		304			**301**			**90.17%**

6141.3-11_DUP	TIN	Original Abundance (0.00588% Counted)	Relative Abundance	Dominance Rank	Duplicate Abundance (0.00552% Counted)	Relative Abundance	Dominance Rank	Percent Similarity
Achnanthidium sp.	2259	57	18.69%	2	61	20.20%	2	18.69%
Aphanocapsa delicatissima	2610	1	0.33%		0	0.00%		0.00%
Aphanocapsa elachista	3016	1	0.33%		1	0.33%		0.33%
Aulacoseira spp.	223	2	0.66%		0	0.00%		0.00%

Appendix 3.6-10. Stream Periphyton QA/QC Results, Back River Project, 2012

SoftBody Taxonomy Duplicate Counts

EcoAnalysts, Inc.

6141.3-11_DUP	Taxonomic Identification Number (TIN)	Original Abundance (0.00588% Counted)	Relative Abundance	Dominance Rank	Duplicate Abundance (0.00552% Counted)	Relative Abundance	Dominance Rank	Percent Similarity
Caloneis spp.	251	0	0.00%		1	0.33%		0.00%
Calothrix fusca	3298	2	0.66%		2	0.66%		0.66%
Calothrix sp.	2047	7	2.30%	5	5	1.66%		1.66%
Chamaesiphon spp.	2048	5	1.64%		0	0.00%		0.00%
Chroococcus dispersus	2463	1	0.33%		2	0.66%		0.33%
Chroococcus pallidus	3299	1	0.33%		0	0.00%		0.00%
Chroococcus sp.	2097	3	0.98%		4	1.32%		0.98%
Cosmarium bireme	2996	1	0.33%		0	0.00%		0.00%
Cymbella spp.	379	0	0.00%		1	0.33%		0.00%
Dichothrix sp.	2062	2	0.66%		3	0.99%		0.66%
Epithemia spp.	559	0	0.00%		2	0.66%		0.00%
Eunotia spp.	582	4	1.31%		3	0.99%		0.99%
Frustulia spp.	728	0	0.00%		1	0.33%		0.00%
Gloeocapsa aeruginosa	3304	5	1.64%		7	2.32%	5	1.64%
Gloeocapsa sanguinea	3306	2	0.66%		1	0.33%		0.33%
Gloeocapsa spp.	2049	5	1.64%		6	1.99%		1.64%
Gomphonema spp.	751	26	8.52%	4	12	3.97%	4	3.97%
Komvophoron spp.	2487	0	0.00%		1	0.33%		0.00%
Leptolyngbya sp.	2105	125	40.98%	1	136	45.03%	1	40.98%
Mougeotia sp.	2053	1	0.33%		2	0.66%		0.33%
Navicula spp.	959	27	8.85%	3	32	10.60%	3	8.85%
Nitzschia spp.	1470	4	1.31%		5	1.66%		1.31%
Nostoc paludosum	3308	3	0.98%		2	0.66%		0.66%
Nostoc sp.	2112	3	0.98%		1	0.33%		0.33%
Oocystis parva	2500	1	0.33%		0	0.00%		0.00%
Phormidium aerugineo-caeruleum	3039	2	0.66%		1	0.33%		0.33%
Phormidium sp.	2054	4	1.31%		3	0.99%		0.99%
Pleurotaenium ehrenbergii	3309	1	0.33%		0	0.00%		0.00%
Scytonema mirabile	3311	2	0.66%		1	0.33%		0.33%
Synedra spp.	1930	2	0.66%		1	0.33%		0.33%
Tabellaria spp.	1984	2	0.66%		3	0.99%		0.66%
unknown Centric diatom	-30	1	0.33%		0	0.00%		0.00%
unknown Pennate diatom	-321	2	0.66%		2	0.66%		0.66%
		305			**302**			**87.64%**

Appendix 3.7-1

Lake Zooplankton Density and Taxonomic Results, Back River Project, 2012

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Appendix 3.7-1. Lake Zooplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in zooplankton individuals/m^3

Taxonomic Classification:

					Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
					Lake	Gander	Gander	Gander	Big	Big	Big	Rabbit	Rabbit	Rabbit	Fox	Fox	Fox
					Replicate	1	2	3	1	2	3	1	2	3	1	2	3
					Date Sampled	18-Aug-12	18-Aug-12	18-Aug-12	16-Aug-12	16-Aug-12	16-Aug-12	15-Aug-12	15-Aug-12	15-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12
					Volume Filtered (m^3)	0.606	0.634	0.667	0.539	0.798	0.726	0.543	0.541	0.547	0.648	0.682	0.617
					Tow Type	oblique	oblique	oblique	oblique	oblique	oblique	oblique	oblique	oblique	oblique	oblique	oblique
					Tow Depth (m)	1.5	1.5	1.5	3.7	3.7	3.7	2.5	2.5	2.5	4.8	4.8	4.8
FINE FRACTION:	**Class**	**Order**	**Family**	**Genus**	**Final Designation**												
Crustacea	Branchiopoda	Diplostraca	Chydoridae	*Eurycercus*	*Eurycercus* sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Daphniidae	*Daphnia*	*Daphnia longiremis*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Maxillopoda	Undetermined	Undetermined	Undetermined	Copepoda - nauplii	132.0	394.0	223.9	11029.3	7570.7	6394.5	1274.8	1226.5	3689.1	3129.8	2486.9	6810.1
Diptera-Chironomidae	Insecta	Diptera	Chironomidae	Undetermined	Chironomidae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Organisms	Hydrozoa	Hydroida	Hydridae	*Hydra*	*Hydra* sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rotifera	Monogononta	Collothecacea	Collothecidae	*Collotheca*	*Collotheca* sp.	0.0	0.0	0.0	0.0	0.0	0.0	77.7	44.3	21.3	120.4	200.1	924.2
		Flosculariaceae	Conochilidae	*Conochilus*	*Conochilus unicornis*	32345.7	33493.7	62008.2	15292.8	10228.0	9702.0	139.9	34.5	29.9	1263.9	571.7	972.9
		Ploima	Asplanchnidae	*Asplanchna*	*Asplanchna priodonta*	924.2	985.1	1567.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Brachionidae	*Kellicottia*	*Kellicottia longispina*	23500.1	25415.8	61560.5	11539.1	11030.2	12237.7	2907.2	906.3	806.1	9900.9	5688.4	17998.0
				Keratella	*Keratella cochlearis*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					Keratella serrulata	0.0	0.0	223.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Euchlanidae	*Euchlanis*	*Euchlanis alata*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					Euchlanis sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Synchaetidae	*Synchaeta*	*Synchaeta* sp.	1320.2	1379.2	2014.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Trichotriidae	*Trichotria*	*Trichotria tetractis*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COARSE FRACTION:																	
Crustacea	Branchiopoda	Diplostraca	Bosminidae	*Bosmina*	*Bosmina longirostris*	224.4	761.3	1274.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Eubosmina	*Eubosmina longispina*	0.0	0.0	0.0	59.3	24.4	26.9	0.0	0.0	0.0	0.0	0.0	0.0
			Chydoridae	*Alonella*	*Alonella*	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Chydorus	*Chydorus* sp.	52.8	7.9	10.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Eurycercus	*Eurycercus* sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Undetermined	Chydoridae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Daphniidae	Daphniidae	*Daphnia*	*Daphnia middendorffiana*	0.0	0.0	0.0	148.3	97.7	53.7	0.0	0.0	0.0	185.3	293.3	211.3
					Daphnia longiremis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Holopedidae	*Holpedium*	*Holopedium gibberum*	8.3	14.2	15.0	2402.4	1343.8	1773.0	7988.7	6188.0	4412.2	4137.4	6276.3	1009.5
			Macrothricidae	*Ophryoxus*	*Ophryoxus gracilis*	16.5	3.2	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Maxillopoda	Calanoida	Diaptomidae	*Leptodiaptomus*	*Leptodiaptomus ashlandi*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					Leptodiaptomus pribilofensis	28.1	0.0	18.0	4804.7	4373.6	4110.2	5890.3	5125.9	5261.8	988.0	703.9	399.1
					Leptodiaptomus sicilis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Undetermined	Diaptomidae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Temoridae	*Epischura*	*Epischura lacustris*	6.6	3.2	10.5	207.6	171.0	188.0	0.0	0.0	0.0	61.8	117.3	47.0
					Epischura sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Heterocope	*Heterocope septentrionalis*	0.0	0.0	0.0	29.7	24.4	26.9	147.3	461.8	246.6	432.3	469.3	140.9
			Undetermined	Undetermined	Calanoida - copepodites	0.0	39.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Cyclopoida	Cyclopidae	*Cyclops*	*Cyclops* sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Undetermined	Undetermined	Cyclopoida	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					Cyclopoida - copepodites	104.0	63.0	36.0	2105.8	1734.8	1934.2	0.0	0.0	0.0	9571.7	9795.6	3967.4
		Undetermined	Undetermined	Undetermined	Copepoda - nauplii	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diptera-Chironomidae	Insecta	Diptera	Chironomidae	Undetermined	Chironomidae	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rotifera	Monogononta	Flosculariaceae	Conochilidae	*Conochilus*	*Conochilus unicornis*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					GRAND TOTAL	58664.5	62560.0	128968.9	47619.0	36598.8	36447.1	18425.9	13987.4	14467.0	29791.5	26602.7	32480.2

Note: L/R means organisims were observed in large/rare scans but not observed in subsample enumerated.

Density analyses does not include nauplii; composition, diversity and richness analyses does not include nauplii or copepodites.

Appendix 3.7-1. Lake Zooplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in zooplankton individuals/m^3

Taxonomic Classification:

					Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	George	George	George
					Lake	Giraffe South	Giraffe South	Giraffe South	Goose Neck	Goose Neck	Goose Neck	Goose Central	Goose Central	Goose Central	Lower Long	Lower Long	Lower Long
					Replicate	1	2	3	1	2	3	1	2	3	1	2	3
					Date Sampled	19-Aug-12	19-Aug-12	19-Aug-12	14-Aug-12	14-Aug-12	14-Aug-12	17-Aug-12	17-Aug-12	17-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12
					Volume Filtered (m^3)	0.657	0.503	0.615	0.608	0.728	0.705	0.697	0.545	0.657	1.370	0.741	0.579
					Tow Type	vertical	vertical	vertical	oblique	oblique	oblique	oblique	oblique	oblique	oblique	oblique	oblique
					Tow Depth (m)	6.3	6.3	6.3	2	2	2	3.5	3.5	3.5	3	3	3
FINE FRACTION:	**Class**	**Order**	**Family**	**Genus**	**EcoAnalysts Sample ID**	**6138.6-16**	**6138.6-17**	**6138.6-18**	**6138.6-1**	**6138.6-2**	**6138.6-3**	**6138.6-9**	**6138.6-10**	**6138.6-11**	**6141.5-10**	**6141.5-11**	**6141.5-12**
					Final Designation												
Crustacea	Branchiopoda	Diplostraca	Chydoridae	*Eurycercus*	*Eurycercus* sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Daphniidae	*Daphnia*	*Daphnia longiremis*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Maxillopoda	Undetermined	Undetermined	Undetermined	Copepoda - nauplii	4640.6	4758.7	5369.0	1504.5	1594.4	1170.1	5241.3	5574.8	5401.4	423.5	728.9	966.6
Diptera-Chironomidae	Insecta	Diptera	Chironomidae	Undetermined	Chironomidae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Organisms	Hydrozoa	Hydroida	Hydridae	*Hydra*	*Hydra* sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rotifera	Monogononta	Collothecacea	Collothecidae	*Collotheca*	*Collotheca* sp.	874.9	679.8	518.1	0.0	0.0	0.0	206.9	179.8	76.1	0.0	0.0	0.0
		Flosculariaceae	Conochilidae	*Conochilus*	*Conochilus unicornis*	646.6	793.1	1130.3	3847.7	3518.8	3637.9	5172.3	15915.2	0.0	58.4	566.9	172.6
		Ploima	Asplanchnidae	*Asplanchna*	*Asplanchna priodonta*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Brachionidae	*Kellicottia*	*Kellicottia longispina*	9471.4	9517.4	10267.0	5722.2	5278.2	3382.6	9654.9	10969.8	7683.6	3548.6	7667.2	9976.5
				Keratella	*Keratella cochlearis*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.6	0.0	34.5
					Keratella serrulata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Euchlanidae	*Euchlanis*	*Euchlanis alata*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					Euchlanis sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Synchaetidae	*Synchaeta*	*Synchaeta* sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Trichotriidae	*Trichotria*	*Trichotria tetractis*	0.0	0.0	0.0	24.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COARSE FRACTION:																	
Crustacea	Branchiopoda	Diplostraca	Bosminidae	*Bosmina*	*Bosmina longirostris*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Eubosmina	*Eubosmina longispina*	0.0	0.0	0.0	98.8	26.1	39.7	71.7	91.7	36.5	583.0	949.5	1148.5
			Chydoridae	*Alonella*	*Alonella*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	91.7	0.0	0.0	0.0	0.0
				Chydorus	*Chydorus* sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.8
				Eurycercus	*Eurycercus* sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Undetermined	Chydoridae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Daphniidae	Daphniidae	*Daphnia*	*Daphnia middendorffiana*	0.0	39.7	48.8	0.0	0.0	0.0	0.0	91.7	0.0	55.5	25.7	131.3
					Daphnia longiremis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55.5	77.0	328.1
			Holopedidae	*Holpedium*	*Holopedium gibberum*	1386.5	1191.9	780.7	0.0	0.0	0.0	35.9	91.7	36.5	13.9	51.3	32.8
			Macrothricidae	*Ophryoxus*	*Ophryoxus gracilis*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Maxillopoda	Calanoida	Diaptomidae	*Leptodiaptomus*	*Leptodiaptomus ashlandi*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.9	25.7	32.8
					Leptodiaptomus pribilofensis	8574.5	10926.2	8441.3	11017.0	7839.5	8466.2	10220.4	16508.7	10873.1	180.5	256.6	328.1
					Leptodiaptomus sicilis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	83.3	77.0	98.4
				Undetermined	Diaptomidae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	777.4	461.9	1017.2
			Temoridae	*Epischura*	*Epischura lacustris*	218.9	516.5	292.8	0.0	0.0	159.0	107.6	458.6	145.9	0.0	0.0	0.0
					Epischura sp.	0.0	0.0	0.0	49.4	26.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Heterocope	*Heterocope septentrionalis*	36.5	39.7	48.8	49.4	52.3	79.5	35.9	91.7	36.5	13.9	25.7	32.8
			Undetermined	Undetermined	Calanoida - copepodites	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Cyclopoida	Cyclopidae	*Cyclops*	*Cyclops* sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2540.3	3284.8	5512.8
			Undetermined	Undetermined	Cyclopoida	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					Cyclopoida - copepodites	1094.6	2344.2	1561.4	3606.4	2038.3	2702.8	2295.1	4677.5	3320.3	0.0	0.0	0.0
		Undetermined	Undetermined	Undetermined	Copepoda - nauplii	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diptera-Chironomidae	Insecta	Diptera	Chironomidae	Undetermined	Chironomidae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rotifera	Monogononta	Flosculariaceae	Conochilidae	*Conochilus*	*Conochilus unicornis*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5071.7	0.0	0.0	0.0
					GRAND TOTAL	26944.5	30807.3	28458.1	25920.1	20373.7	19637.8	33042.0	54742.9	32681.6	8362.1	14198.2	19846.1

Note: L/R means organisims were observed in large/rare scans but not observed in subsample enumerated.

Density analyses does not include nauplii; composition, diversity and richness analyses does not include nauplii or copepodites.

Appendix 3.7-1. Lake Zooplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in zooplankton individuals/m^3

Taxonomic Classification:

Area						George	George	George	George	George	George	George	George	George	George	George	George
Lake						Fold	Fold	Fold	George Central	George Central	George Central	Lytle	Lytle	Lytle	Occurrence	Occurrence	Occurrence
Replicate						1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled						19-Aug-12	19-Aug-12	19-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	23-Aug-12	23-Aug-12	23-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12
Volume Filtered (m^3)						0.490	0.572	0.572	0.600	0.581	0.667	0.838	0.967	0.969	0.718	1.425	0.608
Tow Type						vertical	vertical	vertical	vertical	vertical	vertical	horizontal	horizontal	horizontal	horizontal	horizontal	horizontal
Tow Depth (m)						9	9	9	13	13	13	0.5	0.5	0.5	1	1	1
FINE FRACTION:	**Class**	**Order**	**Family**	**Genus**	**Final Designation**	**EcoAnalysts Sample ID**											
						6141.5-4	6141.5-5	6141.5-6	6141.5-1	6141.5-2	6141.5-3	6141.5-25	6141.5-26	6141.5-27	6141.5-16	6141.5-17	6141.5-18
Crustacea	Branchiopoda	Diplostraca	Chydoridae	*Eurycercus*	*Eurycercus* sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Daphniidae	*Daphnia*	*Daphnia longiremis*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Maxillopoda	Undetermined	Undetermined	Undetermined	Copepoda - nauplii	7264.1	7345.7	7275.8	7814.2	0.0	0.0	0.0	0.0	0.0	55.7	40.0	79.0
Diptera-Chironomidae	Insecta	Diptera	Chironomidae	Undetermined	Chironomidae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	L/R	0.0	0.0
Other Organisms	Hydrozoa	Hydroida	Hydridae	*Hydra*	*Hydra* sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rotifera	Monogononta	Collothecacea	Collothecidae	*Collotheca*	*Collotheca* sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Flosculariaceae	Conochilidae	*Conochilus*	*Conochilus unicornis*	9794.3	10843.7	8325.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Ploima	Asplanchnidae	*Asplanchna*	*Asplanchna priodonta*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Brachionidae	*Kellicottia*	*Kellicottia longispina*	11916.4	12662.6	13082.4	3238.5	4209.5	4355.3	3.6	6.2	12.4	23.7	14.0	24.7
				Keratella	*Keratella cochlearis*	163.2	279.8	139.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					Keratella serrulata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Euchlanidae	*Euchlanis*	*Euchlanis alata*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	1.6
					Euchlanis sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0
			Synchaetidae	*Synchaeta*	*Synchaeta* sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Trichotriidae	*Trichotria*	*Trichotria tetractis*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COARSE FRACTION:																	
Crustacea	Branchiopoda	Diplostraca	Bosminidae	*Bosmina*	*Bosmina longirostris*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Eubosmina	*Eubosmina longispina*	1434.7	2596.1	1912.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Chydoridae	*Alonella*	*Alonella*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Chydorus	*Chydorus* sp.	0.0	68.3	68.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Eurycercus	*Eurycercus* sp.	0.0	0.0	0.0	0.0	0.0	0.0	11.9	10.3	10.3	1.4	0.7	0.0
				Undetermined	Chydoridae	0.0	0.0	0.0	0.0	0.0	0.0	11.9	10.3	20.6	0.0	0.7	3.3
		Daphniidae	Daphniidae	*Daphnia*	*Daphnia middendorffiana*	0.0	0.0	0.0	0.0	0.0	22.5	859.5	610.2	474.8	122.6	93.4	200.7
					Daphnia longiremis	7651.8	7925.1	6353.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Holopedidae	*Holpedium*	*Holopedium gibberum*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Macrothricidae	*Ophryoxus*	*Ophryoxus gracilis*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Maxillopoda	Calanoida	Diaptomidae	*Leptodiaptomus*	*Leptodiaptomus ashlandi*	0.0	0.0	0.0	0.0	0.0	0.0	95.5	124.1	92.9	242.3	269.5	467.2
					Leptodiaptomus pribilofensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	104.5	79.3	149.7
					Leptodiaptomus sicilis	1434.7	1434.7	1503.0	0.0	0.0	0.0	47.7	41.4	41.3	41.8	29.5	54.3
				Undetermined	Diaptomidae	8448.8	6695.3	7720.1	9305.3	10384.4	8297.4	0.0	0.0	0.0	34.8	19.7	18.1
			Temoridae	*Epischura*	*Epischura lacustris*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					Epischura sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Heterocope	*Heterocope septentrionalis*	0.0	0.0	0.0	50.0	51.7	22.5	0.0	0.0	10.3	5.6	8.4	4.9
			Undetermined	Undetermined	Calanoida - copepodites	0.0	0.0	0.0	0.0	0.0	0.0	1707.1	1572.1	1569.0	0.0	0.0	0.0
		Cyclopoida	Cyclopidae	*Cyclops*	*Cyclops* sp.	2550.6	888.2	1503.0	0.0	0.0	179.9	0.0	0.0	0.0	0.0	0.0	0.0
			Undetermined	Undetermined	Cyclopoida	0.0	0.0	0.0	1050.6	465.0	0.0	0.0	0.0	0.0	8.4	4.2	9.9
					Cyclopoida - copepodites	17615.0	13254.0	14347.1	0.0	0.0	359.8	59.7	31.0	0.0	0.0	0.0	0.0
		Undetermined	Undetermined	Undetermined	Copepoda - nauplii	0.0	0.0	0.0	0.0	9144.5	6071.3	393.9	320.6	351.0	0.0	0.0	0.0
Diptera-Chironomidae	Insecta	Diptera	Chironomidae	Undetermined	Chironomidae	0.0	0.0	0.0	0.0	0.0	0.0	L/R	L/R	L/R	L/R	L/R	L/R
Rotifera	Monogononta	Flosculariaceae	Conochilidae	*Conochilus*	*Conochilus unicornis*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					GRAND TOTAL	68273.7	63993.5	62231.4	21458.7	24255.0	19308.7	3190.9	2727.4	2583.7	642.0	559.4	1013.4

Note: L/R means organisims were observed in large/rare scans but not observed in subsample enumerated.

Density analyses does not include nauplii; composition, diversity and richness analyses does not include nauplii or copepodites.

Appendix 3.7-1. Lake Zooplankton Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in zooplankton individuals/m^3

Taxonomic Classification:

Area						George	George	George	George	George	George	George	George	George	George
Lake						Sleigh	Sleigh	Sleigh	Dragon	Dragon	Dragon	Komatic	Komatic	Komatic	Reference C
Replicate						1	2	3	1	2	3	1	2	3	1
Date Sampled						22-Aug-12	22-Aug-12	22-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	22-Aug-12
Volume Filtered (m^3)						1.096	1.415	1.058	0.623	1.174	1.138	0.686	0.955	0.693	1.461
Tow Type						horizontal	horizontal	horizontal	oblique	oblique	oblique	vertical	vertical	vertical	vertical
Tow Depth (m)						0.5	0.5	0.5	2	2	2	6	6	6	30
EcoAnalysts Sample ID						6141.5-22	6141.5-23	6141.5-24	6141.5-7	6141.5-8	6141.5-9	6141.5-13	6141.5-14	6141.5-15	6141.5-19
FINE FRACTION:	**Class**	**Order**	**Family**	**Genus**	**Final Designation**										
Crustacea	Branchiopoda	Diplostraca	Chydoridae	*Eurycercus*	*Eurycercus* sp.	0.0	0.0	0.0	0.0	L/R	0.0	0.0	0.0	0.0	0.0
			Daphniidae	*Daphnia*	*Daphnia longiremis*	0.0	0.0	0.0	L/R	L/R	0.0	0.0	0.0	0.0	0.0
	Maxillopoda	Undetermined	Undetermined	Undetermined	Copepoda - nauplii	14.6	26.9	15.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diptera-Chironomidae	Insecta	Diptera	Chironomidae	Undetermined	Chironomidae	L/R	0.0	L/R	L/R	L/R	0.0	0.0	L/R	0.0	0.0
Other Organisms	Hydrozoa	Hydroida	Hydridae	*Hydra*	*Hydra* sp.	L/R	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rotifera	Monogononta	Collothecacea	Collothecidae	*Collotheca*	*Collotheca* sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Flosculariaceae	Conochilidae	*Conochilus*	*Conochilus unicornis*	0.0	0.0	0.0	0.0	0.0	0.0	129.2	162.2	113.6	1536.3
		Ploima	Asplanchnidae	*Asplanchna*	*Asplanchna priodonta*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Brachionidae	*Kellicottia*	*Kellicottia longispina*	184.3	14.1	12.3	1033.7	393.2	1183.5	733.3	889.6	1011.3	1320.6
				Keratella	*Keratella cochlearis*	0.0	0.0	0.0	5.0	2.0	0.0	0.0	0.0	0.0	0.0
					Keratella serrulata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Euchlanidae	*Euchlanis*	*Euchlanis alata*	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					Euchlanis sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Synchaetidae	*Synchaeta*	*Synchaeta* sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Trichotriidae	*Trichotria*	*Trichotria tetractis*	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0
COARSE FRACTION:															
Crustacea	Branchiopoda	Diplostraca	Bosminidae	*Bosmina*	*Bosmina longirostris*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Eubosmina	*Eubosmina longispina*	0.0	0.0	0.0	433.1	486.0	351.5	116.7	31.4	43.3	0.0
			Chydoridae	*Alonella*	*Alonella*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Chydorus	*Chydorus* sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Eurycercus	*Eurycercus* sp.	9.1	0.0	4.7	24.1	0.0	0.0	0.0	0.0	0.0	0.0
				Undetermined	Chydoridae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Daphniidae	Daphniidae	*Daphnia*	*Daphnia middendorffiana*	27.4	4.7	9.5	1251.3	1867.4	2126.9	408.3	628.6	1212.8	0.0
					Daphnia longiremis	0.0	0.0	0.0	0.0	0.0	87.9	58.3	94.3	43.3	0.0
			Holopedidae	*Holpedium*	*Holopedium gibberum*	0.0	0.0	0.0	0.0	0.0	0.0	525.0	534.3	1169.4	0.0
			Macrothricidae	*Ophryoxus*	*Ophryoxus gracilis*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Maxillopoda	Calanoida	Diaptomidae	*Leptodiaptomus*	*Leptodiaptomus ashlandi*	273.7	207.3	269.4	0.0	0.0	0.0	0.0	31.4	0.0	0.0
					Leptodiaptomus pribilofensis	798.3	880.9	949.9	746.0	281.4	703.1	320.8	157.1	606.4	1311.8
					Leptodiaptomus sicilis	41.1	42.4	14.2	0.0	0.0	0.0	0.0	0.0	0.0	532.9
				Undetermined	Diaptomidae	41.1	23.6	42.5	0.0	0.0	0.0	233.3	125.7	0.0	6845.8
			Temoridae	*Epischura*	*Epischura lacustris*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					Epischura sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Heterocope	*Heterocope septentrionalis*	27.4	4.7	14.2	168.4	127.9	123.0	29.2	31.4	86.6	41.0
			Undetermined	Undetermined	Calanoida - copepodites	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Cyclopoida	Cyclopidae	*Cyclops*	*Cyclops* sp.	0.0	0.0	0.0	4114.8	3223.2	2988.2	350.0	282.9	866.3	82.0
			Undetermined	Undetermined	Cyclopoida	13.7	14.1	9.5	0.0	0.0	0.0	0.0	0.0	0.0	7788.6
					Cyclopoida - copepodites	0.0	0.0	0.0	0.0	0.0	0.0	4608.2	5845.9	5630.6	0.0
		Undetermined	Undetermined	Undetermined	Copepoda - nauplii	0.0	0.0	0.0	14317.5	13506.8	11495.6	22020.2	19737.8	21613.0	7091.8
Diptera-Chironomidae	Insecta	Diptera	Chironomidae	Undetermined	Chironomidae	L/R	L/R	0.0	L/R	0.0	0.0	0.0	0.0	0.0	0.0
Rotifera	Monogononta	Flosculariaceae	Conochilidae	*Conochilus*	*Conochilus unicornis*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					GRAND TOTAL	1431.5	1218.7	1341.2	22098.9	19887.9	19059.7	29532.5	28552.7	32396.5	26550.8

Area						George	George	George	George	George	George	George	George	George	George
Lake						Reference C	Reference C	Reference C							
Replicate						2	3								
Date Sampled						22-Aug-12	22-Aug-12								
Volume Filtered (m^3)						1.487	1.753								
Tow Type						vertical	vertical								
Tow Depth (m)						30	30								
EcoAnalysts Sample ID						6141.5-20	6141.5-21								
FINE FRACTION:	**Class**	**Order**	**Family**	**Genus**	**Final Designation**										
Crustacea	Branchiopoda	Diplostraca	Chydoridae	*Eurycercus*	*Eurycercus* sp.	0.0	0.0								
			Daphniidae	*Daphnia*	*Daphnia longiremis*	0.0	0.0								
	Maxillopoda	Undetermined	Undetermined	Undetermined	Copepoda - nauplii	0.0	0.0								
Diptera-Chironomidae	Insecta	Diptera	Chironomidae	Undetermined	Chironomidae	0.0	0.0								
Other Organisms	Hydrozoa	Hydroida	Hydridae	*Hydra*	*Hydra* sp.	0.0	0.0								
Rotifera	Monogononta	Collothecacea	Collothecidae	*Collotheca*	*Collotheca* sp.	0.0	0.0								
		Flosculariaceae	Conochilidae	*Conochilus*	*Conochilus unicornis*	1062.9	0.0								
		Ploima	Asplanchnidae	*Asplanchna*	*Asplanchna priodonta*	0.0	0.0								
			Brachionidae	*Kellicottia*	*Kellicottia longispina*	585.0	493.9								
				Keratella	*Keratella cochlearis*	8.2	1379.3								
					Keratella serrulata	0.0	0.0								
			Euchlanidae	*Euchlanis*	*Euchlanis alata*	0.0	0.0								
					Euchlanis sp.	0.0	0.0								
			Synchaetidae	*Synchaeta*	*Synchaeta* sp.	0.0	0.0								
			Trichotriidae	*Trichotria*	*Trichotria tetractis*	0.0	0.0								
COARSE FRACTION:															
Crustacea	Branchiopoda	Diplostraca	Bosminidae	*Bosmina*	*Bosmina longirostris*	0.0	0.0								
				Eubosmina	*Eubosmina longispina*	0.0	0.0								
			Chydoridae	*Alonella*	*Alonella*	0.0	0.0								
				Chydorus	*Chydorus* sp.	0.0	0.0								
				Eurycercus	*Eurycercus* sp.	0.0	0.0								
				Undetermined	Chydoridae	0.0	0.0								
		Daphniidae	Daphniidae	*Daphnia*	*Daphnia middendorffiana*	0.0	0.0								
					Daphnia longiremis	0.0	0.0								
			Holopedidae	*Holpedium*	*Holopedium gibberum*	0.0	0.0								
			Macrothricidae	*Ophryoxus*	*Ophryoxus gracilis*	0.0	0.0								
	Maxillopoda	Calanoida	Diaptomidae	*Leptodiaptomus*	*Leptodiaptomus ashlandi*	0.0	0.0								
					Leptodiaptomus pribilofensis	1008.5	969.6								
					Leptodiaptomus sicilis	336.2	228.1								
				Undetermined	Diaptomidae	5412.3	4677.0								
			Temoridae	*Epischura*	*Epischura lacustris*	0.0	0.0								
					Epischura sp.	0.0	0.0								
				Heterocope	*Heterocope septentrionalis*	67.2	28.5								
			Undetermined	Undetermined	Calanoida - copepodites	0.0	0.0								
		Cyclopoida	Cyclopidae	*Cyclops*	*Cyclops* sp.	67.2	199.6								
			Undetermined	Undetermined	Cyclopoida	7664.7	5903.2								
					Cyclopoida - copepodites	0.0	0.0								
		Undetermined	Undetermined	Undetermined	Copepoda - nauplii	6051.1	3336.6								
Diptera-Chironomidae	Insecta	Diptera	Chironomidae	Undetermined	Chironomidae	0.0	0.0								
Rotifera	Monogononta	Flosculariaceae	Conochilidae	*Conochilus*	*Conochilus unicornis*	0.0	0.0								
					GRAND TOTAL	22263.4	17215.9								

Note: L/R means organisims were observed in large/rare scans but not observed in subsample enumerated.

Density analyses does not include nauplii; composition, diversity and richness analyses does not include nauplii or copepodites.

Appendix 3.7-2

Lake Zooplankton Richness and Diversity Results, Back River Project, 2012

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Appendix 3.7-2. Lake Zooplankton Richness and Diversity Results, Back River Project, 2012

Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Lake	Gander	Gander	Gander	Big	Big	Big	Rabbit	Rabbit	Rabbit	Fox	Fox	Fox	Giraffe South	Giraffe South	Giraffe South	Goose Neck	Goose Neck	Goose Neck
Replicate	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled	18-Aug-12	18-Aug-12	18-Aug-12	16-Aug-12	16-Aug-12	16-Aug-12	15-Aug-12	15-Aug-12	15-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	14-Aug-12	14-Aug-12	14-Aug-12
Volume Filtered (m^3)	0.606	0.634	0.667	0.539	0.798	0.726	0.543	0.541	0.547	0.648	0.682	0.617	0.657	0.503	0.615	0.608	0.728	0.705
Tow Type	oblique	oblique	oblique	oblique	oblique	oblique	oblique	oblique	oblique	oblique	oblique	oblique	vertical	vertical	vertical	oblique	oblique	oblique
Tow Depth (m)	1.5	1.5	1.5	3.7	3.7	3.7	2.5	2.5	2.5	4.8	4.8	4.8	6.3	6.3	6.3	2	2	2
EcoAnalysts Sample ID	6138.6-13	6138.6-14	6138.6-15	6138.6-7	6138.6-12	6138.6-8	6138.6-4	6138.6-5	6138.6-6	6138.6-19	6138.6-20	6138.6-21	6138.6-16	6138.6-17	6138.6-18	6138.6-1	6138.6-2	6138.6-3
Genus Richness (# genera)	11	9	11	8	8	8	6	6	6	8	8	8	7	8	8	7	6	6
Simpson's Diversity Index	0.53	0.54	0.54	0.67	0.67	0.67	0.64	0.60	0.59	0.60	0.64	0.31	0.63	0.62	0.61	0.61	0.64	0.61

Area	Goose	Goose	Goose	George	George	George	George	George	George	George	George	George	George	George	George	George	George	George
Lake	Goose Central	Goose Central	Goose Central	Lower Long	Lower Long	Lower Long	Fold	Fold	Fold	George Central	George Central	George Central	Lytle	Lytle	Lytle	Occurrence	Occurrence	Occurrence
Replicate	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled	17-Aug-12	17-Aug-12	17-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	23-Aug-12	23-Aug-12	23-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12
Volume Filtered (m^3)	0.697	0.545	0.657	1.370	0.741	0.579	0.490	0.572	0.572	0.600	0.581	0.667	0.838	0.967	0.969	0.718	1.425	0.608
Tow Type	oblique	oblique	oblique	oblique	oblique	oblique	vertical	vertical	vertical	vertical	vertical	vertical	horizontal	horizontal	horizontal	horizontal	horizontal	horizontal
Tow Depth (m)	3.5	3.5	3.5	3	3	3	9	9	9	13	13	13	0.5	0.5	0.5	1	1	1
EcoAnalysts Sample ID	6138.6-9	6138.6-10	6138.6-11	6141.5-10	6141.5-11	6141.5-12	6141.5-4	6141.5-5	6141.5-6	6141.5-1	6141.5-2	6141.5-3	6141.5-25	6141.5-26	6141.5-27	6141.5-16	6141.5-17	6141.5-18
Genus Richness (# genera)	8	10	8	9	8	10	7	8	8	2	2	4	4	5	6	6	5	5
Simpson's Diversity Index	0.65	0.67	0.65	0.62	0.58	0.59	0.75	0.74	0.73	0.03	0.02	0.09	0.27	0.36	0.41	0.44	0.38	0.40

Area	George	George	George	George	George	George	George	George	George	George	George	George
Lake	Sleigh	Sleigh	Sleigh	Dragon	Dragon	Dragon	Komatic	Komatic	Komatic	Reference C	Reference C	Reference C
Replicate	1	2	3	1	2	3	1	2	3	1	2	3
Date Sampled	22-Aug-12	22-Aug-12	22-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	22-Aug-12	22-Aug-12	22-Aug-12
Volume Filtered (m^3)	1.096	1.415	1.058	0.623	1.174	1.138	0.686	0.955	0.693	1.461	1.487	1.753
Tow Type	horizontal	horizontal	horizontal	oblique	oblique	oblique	vertical	vertical	vertical	vertical	vertical	vertical
Tow Depth (m)	0.5	0.5	0.5	2	2	2	6	6	6	30	30	30
EcoAnalysts Sample ID	6141.5-22	6141.5-23	6141.5-24	6141.5-7	6141.5-8	6141.5-9	6141.5-13	6141.5-14	6141.5-15	6141.5-19	6141.5-20	6141.5-21
Genus Richness (# genera)	6	4	5	9	7	6	8	8	8	5	6	5
Simpson's Diversity Index	0.31	0.04	0.06	0.66	0.65	0.72	0.82	0.78	0.81	0.68	0.67	0.67

Diversity and richness data does not include nauplii or copepodites or organisms not identified to the genus level.

Appendix 3.7-3

Lake Zooplankton Reference Photographs, Back River Project, 2012

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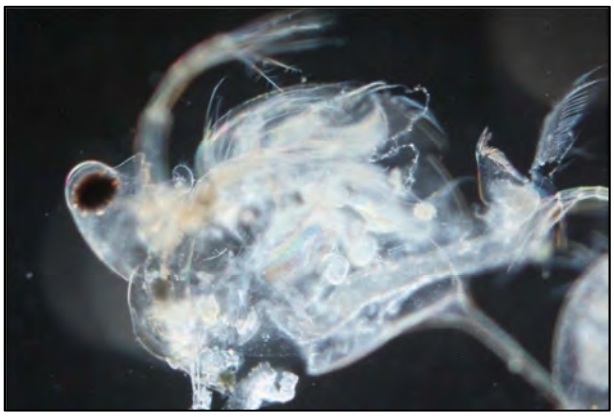
Appendix 3.7-3. Lake Zooplankton Reference Photographs, Back River Project, 2012

Reference photographs of highly abundant genera are shown below, more information (species names, location, date) on these photographs are available by request. Photographs of less abundant taxa area also available by request.

EcoAnalysts, Inc.

Conochilus (Rotifera - Conochilidae)

Cyclops (Crustacea - Cyclopidae)



Daphnia (Crustacea - Daphniidae)

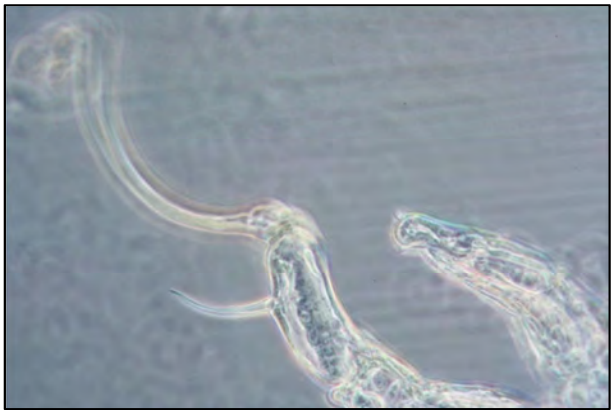
Eubosmina (Crustacea - Bosminidae)

Eurycercus (Crustacea - Chydoridae)

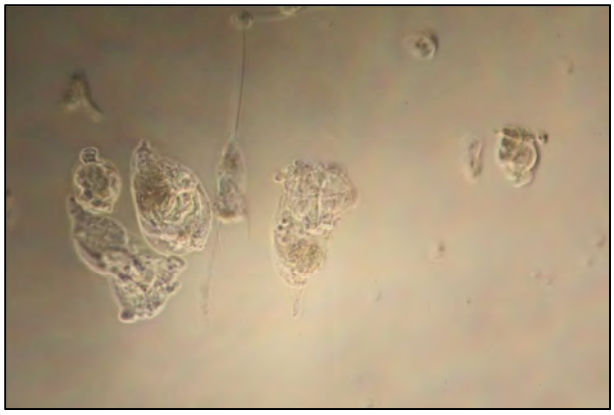
Heterocope (Crustacea - Temoridae)

Holpedium (Crustacea - Holopedidae)

Kellicottia (Rotifera - Brachionidae)



Leptodiaptomus (Crustacea - Diaptomidae)



Synchaeta (Rotifera - Synchaetidae)

Appendix 3.7-4

Lake Zooplankton QA/QC Results, Back River Project, 2012

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EcoAnalysts, Inc.
1420 South Blaine Street, Suite 14
Moscow, Idaho 83843 U.S.A.
(208) 882 - 2588

Taxonomy ID QC Percent Similarity

6141.5-4

Comparison Date: 10/09/2012 02:58:42

Waterbody	Rep
Fold Lake	1

		Original Taxonomist - A Taxonomist					QC Taxonomist - Matthew Hill					
TIN	TAXON	NOTE	AB	L	P	A	AB	L	P	A	NOTE	DIFF.
4158	Conochilus unicornis		120	120	0	0	148	148	0	0		-28
4157	Copepoda - nauplii		89	89	0	0	82	82	0	0		7
4155	Cyclopoida - copepodites		221	221	0	0	204	204	0	0		17
4093	Cyclops		32	32	0	0	24	24	0	0		8
4075	Daphnia longiremis		96	96	0	0	88	88	0	0		8
3089	Diaptomidae		106	106	0	0	124	124	0	0		-18
8168	Eubosmina longispina		15	18	0	0	18	18	0	0		-3
4126	Kellicottia longispina		146	146	0	0	174	174	0	0		-28
4129	Keratella cochlearis		2	2	0	0	1	1	0	0		1
4414	Leptodiaptomus sicilis		16	18	0	0	16	16	0	0		0
			843				879				Difference =	-36
											Percent Similarity =	93.12

EcoAnalysts, Inc.
1420 South Blaine Street, Suite 14
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(208) 882 - 2588

Taxonomy ID QC Percent Similarity

6141.5-17

Comparison Date: 10/09/2012 03:02:54

Waterbody	Rep
Occurance Lake	2

		Original Taxonomist - A Taxonomist					QC Taxonomist - Matthew Hill					
TIN	TAXON	NOTE	AB	L	P	A	AB	L	P	A	NOTE	DIFF.
765	Chironomidae		3	3	0	0	3	3	0	0		0
3318	Chydoridae		1	1	0	0	1	1	0	0		0
4157	Copepoda - nauplii		57	57	0	0	50	50	0	0		7
3298	Cyclopoida		6	6	0	0	0	0	0	0		6
4145	Daphnia middendorffiana		133	133	0	0	133	133	0	0		0
3089	Diaptomidae		28	28	0	0	10	10	0	0		18
4029	Eurycercus		1	1	0	0	1	1	0	0		0
4149	Heterocope septentrionalis		12	12	0	0	10	10	0	0		2
4126	Kellicottia longispina		20	20	0	0	10	10	0	0		10
4412	Leptodiaptomus ashlandi		384	384	0	0	399	399	0	0		-15
4150	Leptodiaptomus pribilofensis		113	113	0	0	154	154	0	0		-41
4414	Leptodiaptomus sicilis		42	42	0	0	45	45	0	0		-3
			800				816				Difference =	-16
											Percent Similarity =	94.09

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Taxonomy ID QC Percent Similarity

6141.5-23

Comparison Date: 10/09/2012 03:08:50

Waterbody	Rep
Sleigh Lake	2

		Original Taxonomist - A Taxonomist					QC Taxonomist - Matthew Hill					
TIN	TAXON	NOTE	AB	L	P	A	AB	L	P	A	NOTE	DIFF.
765	Chironomidae		1	1	0	0	1	1	0	0		0
4157	Copepoda - nauplii		38	38	0	0	26	26	0	0		12
3298	Cyclopoida		3	3	0	0	1	1	0	0		2
4145	Daphnia middendorffiana		1	1	0	0	1	1	0	0		0
3089	Diaptomidae		5	5	0	0	6	6	0	0		-1
4149	Heterocope septentrionalis		1	1	0	0	1	1	0	0		0
4126	Kellicottia longispina		20	20	0	0	14	14	0	0		6
4412	Leptodiaptomus ashlandi		44	44	0	0	50	50	0	0		-6
4150	Leptodiaptomus pribilofensis		187	187	0	0	154	154	0	0		33
4414	Leptodiaptomus sicilis		9	9	0	0	9	9	0	0		0
			309				263				Difference =	46
											Percent Similarity =	93.89

EcoAnalysts, Inc.
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(208) 882 - 2588

Taxonomy ID QC Percent Similarity

6138.6-7

Comparison Date: 10/09/2012 02:53:54

Waterbody	Rep	Comments
Big Lake	1	

		Original Taxonomist - A Taxonomist					QC Taxonomist - Matthew Hill					
TIN	TAXON	NOTE	AB	L	P	A	AB	L	P	A	NOTE	DIFF.
4158	Conochilus unicornis		330	330	0	0	310	310	0	0		20
4157	Copepoda - nauplii		238	238	0	0	238	238	0	0		0
4155	Cyclopoida - copepodites		71	71	0	0	82	82	0	0		-11
4145	Daphnia middendorffiana		5	5	0	0	5	5	0	0		0
4411	Epischura lacustris		7	7	0	0	7	7	0	0		0
8168	Eubosmina longispina		2	2	0	0	2	2	0	0		0
4149	Heterocope septentrionalis		1	1	0	0	1	1	0	0		0
4058	Holopedium gibberum		81	81	0	0	86	86	0	0		-5
4126	Kellicottia longispina		249	249	0	0	240	240	0	0		9
4150	Leptodiaptomus pribilofensis		162	162	0	0	166	166	0	0		-4
			1146				1137				Difference =	9
											Percent Similarity =	97.85

EcoAnalysts, Inc.
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(208) 882 - 2588

Taxonomy ID QC Percent Similarity

6138.6-18

Comparison Date: 10/09/2012 02:55:39

Waterbody	Rep	Comments
Giraffe Lake South - Deep	3	

		Original Taxonomist - A Taxonomist					QC Taxonomist - Matthew Hill					
TIN	TAXON	NOTE	AB	L	P	A	AB	L	P	A	NOTE	DIFF.
4114	Collotheca		11	11	0	0	0	0	0	0		11
4446	Collotheca mutabilis		0	0	0	0	11	11	0	0		-11
4158	Conochilus unicornis		24	24	0	0	24	24	0	0		0
4157	Copepoda - nauplii		114	114	0	0	96	96	0	0		18
4155	Cyclopoida - copepodites		32	32	0	0	34	34	0	0		-2
4145	Daphnia middendorffiana		1	1	0	0	1	1	0	0		0
4411	Epischura lacustris		6	6	0	0	6	6	0	0		0
4149	Heterocope septentrionalis		1	1	0	0	1	1	0	0		0
4058	Holopedium gibberum		16	16	0	0	10	10	0	0		6
4126	Kellicottia longispina		218	218	0	0	238	238	0	0		-20
4150	Leptodiaptomus pribilofensis		173	173	0	0	158	158	0	0		15
			596				579				Difference =	17
											Percent Similarity =	92.91

Appendix 3.7-5

Lake Benthos Density and Taxonomic Results, Back River Project, 2012

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Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
					Lake	Gander	Gander	Gander	Gander	Gander	Pond 19	Pond 19	Pond 19
					Replicate	1	2	3	4	5	1	2	3
					Date Sampled	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6138.2-26	6138.2-27	6138.2-28	6138.2-29	6138.2-30	6138.2-45	6138.2-46	6138.2-47
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**								
Acari	Arachnida	Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.								
			Hygrobatidae	*Hygrobates*	*Hygrobates* sp.								
			Lebertiidae	*Lebertia*	*Lebertia* sp.	53.2		51.4		28.9			
			Oxidae	*Oxus*	*Oxus* sp.								
			Pionidae	Undetermined	Pionidae	17.7							
		Undetermined	Undetermined	Undetermined	Acari								
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae								
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae	35.5	154.1	25.7			72.1	43.3	143.7
		Tubificida	Naididae	*Nais*	*Nais* sp.								24.0
				Specaria	*Specaria josinae*	53.2	51.4	25.7	86.6				
				Vejdovskyella	*Vejdovskyella comata*								
			Tubificidae	*Psammoryctides*	*Psammoryctides californianus*								
				Rhyacodrilus	*Rhyacodrilus coccineus*								
				Undetermined	Tubificidae w/ cap setae	567.9	282.5	487.9	634.8	288.6			143.7
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.	1739.1	1849.0	1926.1	3924.3	3837.7			
				Undetermined	Sphaeriidae	976.0	1027.2	487.9	2164.1	1760.2			
				Sphaerium	*Sphaerium* sp.	17.7	25.7		28.9	28.9			
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Stictotarsus*	*Stictotarsus* sp.								
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera								
	Malacostraca	Amphipoda	Gammaridae	*Gammarus*	*Gammarus* sp.								
	Maxillopoda	Calanoida	Undetermined	Undetermined	Calanoida								
		Cyclopoida	Undetermined	Undetermined	Cyclopoida			25.7					
	Ostracoda	Ostracoda	Undetermined	Undetermined	Ostracoda	53.2						14.4	
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.								24.0
			Empididae	Undetermined	Empididae		25.7			28.9			
			Muscidae	Undetermined	Muscidae						43.3	28.9	71.9
			Tabanidae	*Chrysops*	*Chrysops* sp.								
			Tipulidae	*Tipula*	*Tipula* sp.								
			Undetermined	Undetermined	Diptera								
			Chironomidae	*Abiskomyia*	*Abiskomyia* sp.								
				Ablabesmyia	*Ablabesmyia* (Karelia) sp.	35.5	359.5	179.8	115.4	57.7	14.4	14.4	47.9
				Ablabesmyia	*Ablabesmyia* sp.							202.0	886.2
				Undetermined	Chironomini						14.4		
				Chironomus	*Chironomus* sp.					28.9			
				Cladopelma	*Cladopelma* sp.								
				Cladotanytarsus	*Cladotanytarsus* sp.								
				Corynocera	*Corynocera* sp.								
				Corynoneura	*Corynoneura* sp.								
				Cricotopus	*Cricotopus* sp.	35.5	102.7	282.5	173.1	28.9			24.0
				Cryptochironomus	*Cryptochironomus* sp.	390.4	359.5	359.5	288.6	317.4	14.4		
				Demicryptochironomus	*Demicryptochironomus* sp.								
				Dicrotendipes	*Dicrotendipes fumidus*	816.3	2388.3	693.4	461.7	288.6	14.4	28.9	47.9
				Dicrotendipes	*Dicrotendipes* sp.			128.4		577.1			95.8
				Glyptotendipes	*Glyptotendipes* sp.								
				Heterotanytarsus	*Heterotanytarsus* sp.								
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*	71.0	154.1	179.8	404.0	144.3			
				Hydrobaenus	*Hydrobaenus* sp.								
				Micropsectra	*Micropsectra* sp.								
				Microtendipes	*Microtendipes pedellus gr.*								
				Monodiamesa	*Monodiamesa* sp.								

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2														
Taxonomic Classification:						Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
						Lake	Gander	Gander	Gander	Gander	Gander	Pond 19	Pond 19	Pond 19
						Replicate	1	2	3	4	5	1	2	3
						Date Sampled	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12
						Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
						EcoAnalysts Sample ID	6138.2-26	6138.2-27	6138.2-28	6138.2-29	6138.2-30	6138.2-45	6138.2-46	6138.2-47
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**									
				Undetermined	Orthocladiinae									
				Orthocladius	Orthocladius Complex			25.7						
				Pagastiella	*Pagastiella sp.*									
				Parachironomus	*Parachironomus* sp.		88.7	231.1	205.4	86.6	115.4			
				Paracladius	*Paracladius sp.*									
				Parakiefferiella	*Parakiefferiella* sp.									
				Paratanytarsus	*Paratanytarsus* sp.			102.7				533.8	620.4	2179.5
				Polypedilum	*Polypedilum halterale gr.*		17.7		77.0	144.3	144.3			
				Polypedilum	*Polypedilum scalaenum gr.*									
				Polypedilum	*Polypedilum* sp.									
				Potthastia	*Potthastia longimana gr.*				25.7		28.9			
				Procladius	*Procladius* sp.		319.4	667.7	1104.3	577.1	548.2	86.6	144.3	598.8
				Protanypus	*Protanypus* sp.									
				Psectrocladius	*Psectrocladius* sp.		124.2	487.9	231.1	404.0	202.0	28.9	447.3	910.1
				Pseudosmittia	*Pseudosmittia* sp.									
				Sergentia	*Sergentia* sp.		17.7	51.4	308.2	259.7	173.1			
				Stempellinella	*Stempellinella* sp.									
				Stictochironomus	*Stictochironomus* sp.		124.2	77.0	51.4					
				Undetermined	Tanytarsini							14.4	14.4	
				Tanytarsus	*Tanytarsus* sp.		88.7	462.3	770.4	317.4	259.7		57.7	2275.3
				Thienemannimyia	*Thienemannimyia* gr. sp.									
				Zalutschia	*Zalutschia* sp.		17.7	25.7		28.9		14.4		
Gastropoda	Gastropoda	Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*			205.4	77.0		230.8			
				Valvata	*Valvata* sp.		230.7	51.4		115.4	115.4			
Other Organisms	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda			154.1	179.8			14.4		
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria									
Trichoptera	Insecta	Trichoptera	Hydroptilidae	*Agraylea*	*Agraylea* sp.		35.5				28.9			
			Limnephilidae	*Grensia*	*Grensia praeterita*									
				Undetermined	Limnephilidae									
				Limnephilus	*Limnephilus* sp.								14.4	
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.									
						TOTAL	**5927.2**	**9322.2**	**7884.0**	**10214.7**	**9262.5**	**865.7**	**1630.3**	**7472.4**

Note: Only four replicates were collected at Giraffe South as substrate made it difficult to get complete Ekman grabs.

Nematodes, copepods or cladocerans were excluded from analyses.

Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose
					Lake	Pond 19	Pond 19	Big	Big	Big	Big	Big
					Replicate	4	5	1	2	3	4	5
					Date Sampled	21-Aug-12	21-Aug-12	16-Aug-12	16-Aug-12	16-Aug-12	16-Aug-12	16-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6138.2-48	6138.2-49	6138.2-16	6138.2-17	6138.2-18	6138.2-19	6138.2-20
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**							
Acari	Arachnida	Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.							
			Hygrobatidae	*Hygrobates*	*Hygrobates* sp.							
			Lebertiidae	*Lebertia*	*Lebertia* sp.	14.4				28.9		
			Oxidae	*Oxus*	*Oxus* sp.							
			Pionidae	Undetermined	Pionidae					28.9	28.9	
		Undetermined	Undetermined	Undetermined	Acari							
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae							
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae	72.1	173.1		173.1	86.6	43.3	28.9
		Tubificida	Naididae	*Nais*	*Nais* sp.							
				Specaria	*Specaria josinae*							
				Vejdovskyella	*Vejdovskyella comata*							
			Tubificidae	*Psammoryctides*	*Psammoryctides californianus*							
				Rhyacodrilus	*Rhyacodrilus coccineus*			38.5				
				Undetermined	Tubificidae w/ cap setae	28.9	14.4	154.1	115.4	115.4	57.7	230.8
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.			2388.5	1875.6	1673.6	1500.5	2193.0
				Undetermined	Sphaeriidae			693.4	952.2	735.8	476.1	750.2
				Sphaerium	*Sphaerium* sp.					28.9	43.3	
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Stictotarsus*	*Stictotarsus* sp.							
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera			77.0		14.4		57.7
	Malacostraca	Amphipoda	Gammaridae	*Gammarus*	*Gammarus* sp.							
	Maxillopoda	Calanoida	Undetermined	Undetermined	Calanoida							
		Cyclopoida	Undetermined	Undetermined	Cyclopoida			115.6				57.7
	Ostracoda	Ostracoda	Undetermined	Undetermined	Ostracoda		28.9		86.6		115.4	28.9
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.	14.4						
			Empididae	Undetermined	Empididae							
			Muscidae	Undetermined	Muscidae	144.3	28.9					
			Tabanidae	*Chrysops*	*Chrysops* sp.		28.9					
			Tipulidae	*Tipula*	*Tipula* sp.							
			Undetermined	Undetermined	Diptera							
			Chironomidae	*Abiskomyia*	*Abiskomyia* sp.							
				Ablabesmyia	*Ablabesmyia* (Karelia) sp.	14.4						
				Ablabesmyia	*Ablabesmyia* sp.	129.8	562.7	38.5	28.9	43.3		57.7
				Undetermined	Chironomini							
				Chironomus	*Chironomus* sp.			77.0		14.4		57.7
				Cladopelma	*Cladopelma* sp.			115.6	144.3	129.8	129.8	144.3
				Cladotanytarsus	*Cladotanytarsus* sp.			4931.2	3578.0	1659.2	1644.7	3433.7
				Corynocera	*Corynocera* sp.					14.4		
				Corynoneura	*Corynoneura* sp.							
				Cricotopus	*Cricotopus* sp.	28.9	72.1					
				Cryptochironomus	*Cryptochironomus* sp.			115.6	86.6	14.4	28.9	57.7
				Demicryptochironomus	*Demicryptochironomus* sp.							
				Dicrotendipes	*Dicrotendipes fumidus*	72.1	43.3		86.6	28.9		
				Dicrotendipes	*Dicrotendipes* sp.							
				Glyptotendipes	*Glyptotendipes* sp.							
				Heterotanytarsus	*Heterotanytarsus* sp.					14.4		
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*							
				Hydrobaenus	*Hydrobaenus* sp.							
				Micropsectra	*Micropsectra* sp.							
				Microtendipes	*Microtendipes pedellus gr.*			38.5	86.6	28.9	14.4	57.7
				Monodiamesa	*Monodiamesa* sp.							

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose
					Lake	Pond 19	Pond 19	Big	Big	Big	Big	Big
					Replicate	4	5	1	2	3	4	5
					Date Sampled	21-Aug-12	21-Aug-12	16-Aug-12	16-Aug-12	16-Aug-12	16-Aug-12	16-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6138.2-48	6138.2-49	6138.2-16	6138.2-17	6138.2-18	6138.2-19	6138.2-20
Major Group	Class	Order	Family	Genus	Final Designation							
				Undetermined	Orthocladiinae							
				Orthocladius	Orthocladius Complex							
				Pagastiella	*Pagastiella sp.*							
				Parachironomus	*Parachironomus* sp.			38.5				
				Paracladius	*Paracladius sp.*							
				Parakiefferiella	*Parakiefferiella* sp.							
				Paratanytarsus	*Paratanytarsus* sp.	634.8	1659.2			28.9		
				Polypedilum	*Polypedilum halterale gr.*					57.7	28.9	115.4
				Polypedilum	*Polypedilum scalaenum gr.*							
				Polypedilum	*Polypedilum* sp.				28.9	28.9		57.7
				Potthastia	*Potthastia longimana gr.*							
				Procladius	*Procladius* sp.	288.6	303.0	1078.7	865.7	461.7	360.7	461.7
				Protanypus	*Protanypus* sp.							
				Psectrocladius	*Psectrocladius* sp.	173.1	548.2	115.6	317.4	173.1	115.4	86.6
				Pseudosmittia	*Pseudosmittia* sp.							
				Sergentia	*Sergentia* sp.			38.5	86.6		43.3	
				Stempellinella	*Stempellinella* sp.							
				Stictochironomus	*Stictochironomus* sp.							
				Undetermined	Tanytarsini				86.6	43.3	43.3	
				Tanytarsus	*Tanytarsus* sp.	43.3	591.5	2273.0	779.1	519.4	303.0	1615.9
				Thienemannimyia	*Thienemannimyia* gr. sp.						14.4	
				Zalutschia	*Zalutschia* sp.			423.8	115.4	202.0	303.0	173.1
Gastropoda	Gastropoda	Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*							
				Valvata	*Valvata* sp.							
Other Organisms	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda						14.4	
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria							
Trichoptera	Insecta	Trichoptera	Hydroptilidae	*Agraylea*	*Agraylea* sp.							
			Limnephilidae	*Grensia*	*Grensia praeterita*						14.4	28.9
				Undetermined	Limnephilidae							
				Limnephilus	*Limnephilus* sp.							
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.							
					TOTAL	**1659.2**	**4054.1**	**12751.7**	**9493.3**	**6175.0**	**5323.8**	**9695.3**

Note: Only four replicates were collected at Giraffe South as substrate made it difficult to get complete Ekman grabs.

Nematodes, copepods or cladocerans were excluded from analyses.

Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
					Lake	Rabbit	Rabbit	Rabbit	Rabbit	Rabbit	Fox	Fox	Fox
					Replicate	1	2	3	4	5	1	2	3
					Date Sampled	15-Aug-12	15-Aug-12	15-Aug-12	15-Aug-12	15-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6138.2-6	6138.2-7	6138.2-8	6138.2-9	6138.2-10	6138.2-40	6138.2-41	6138.2-42
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**								
Acari	Arachnida	Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.	14.4							
			Hygrobatidae	*Hygrobates*	*Hygrobates* sp.								
			Lebertiidae	*Lebertia*	*Lebertia* sp.			72.1		14.4		14.4	
			Oxidae	*Oxus*	*Oxus* sp.		14.4	72.1	43.3	43.3			
			Pionidae	Undetermined	Pionidae		14.4	43.3	28.9	28.9	57.7	101.0	72.1
		Undetermined	Undetermined	Undetermined	Acari								
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae								
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae	57.7	14.4	86.6	57.7	72.1	28.9	86.6	14.4
		Tubificida	Naididae	*Nais*	*Nais* sp.								
				Specaria	*Specaria josinae*								
				Vejdovskyella	*Vejdovskyella comata*								
			Tubificidae	*Psammoryctides*	*Psammoryctides californianus*								
				Rhyacodrilus	*Rhyacodrilus coccineus*								
				Undetermined	Tubificidae w/ cap setae		14.4			43.3	303.0	216.4	129.8
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.	173.1	72.1	115.4	101.0	288.6	1745.7	1471.6	1110.9
				Undetermined	Sphaeriidae	86.6	101.0	72.1	259.7	173.1	245.3	303.0	187.6
				Sphaerium	*Sphaerium* sp.	14.4			14.4	14.4	72.1		28.9
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Stictotarsus*	*Stictotarsus* sp.								
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera	72.1	43.3	57.7	202.0	173.1	28.9	14.4	14.4
	Malacostraca	Amphipoda	Gammaridae	*Gammarus*	*Gammarus* sp.								
	Maxillopoda	Calanoida	Undetermined	Undetermined	Calanoida				101.0	14.4			28.9
		Cyclopoida	Undetermined	Undetermined	Cyclopoida	14.4		14.4	14.4	14.4	28.9	43.3	14.4
	Ostracoda	Ostracoda	Undetermined	Undetermined	Ostracoda	692.5	807.9	548.2	1125.3	505.0	101.0	360.7	101.0
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.								
			Empididae	Undetermined	Empididae								
			Muscidae	Undetermined	Muscidae								
			Tabanidae	*Chrysops*	*Chrysops* sp.								
			Tipulidae	*Tipula*	*Tipula* sp.								
			Undetermined	Undetermined	Diptera								
			Chironomidae	*Abiskomyia*	*Abiskomyia* sp.								
				Ablabesmyia	*Ablabesmyia* (Karelia) sp.	129.8	57.7	28.9	158.7	129.8		28.9	
				Ablabesmyia	*Ablabesmyia* sp.	187.6	115.4	101.0	245.3	216.4	14.4	43.3	
				Undetermined	Chironomini			14.4					
				Chironomus	*Chironomus* sp.	28.9	57.7	14.4	72.1	28.9			
				Cladopelma	*Cladopelma* sp.						43.3	28.9	
				Cladotanytarsus	*Cladotanytarsus* sp.		14.4		57.7	14.4	346.3	43.3	72.1
				Corynocera	*Corynocera* sp.		14.4						
				Corynoneura	*Corynoneura* sp.								
				Cricotopus	*Cricotopus* sp.	43.3							
				Cryptochironomus	*Cryptochironomus* sp.			28.9	14.4	43.3	115.4	115.4	86.6
				Demicryptochironomus	*Demicryptochironomus* sp.								
				Dicrotendipes	*Dicrotendipes fumidus*				14.4				
				Dicrotendipes	*Dicrotendipes* sp.								
				Glyptotendipes	*Glyptotendipes* sp.								
				Heterotanytarsus	*Heterotanytarsus* sp.								28.9
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*								
				Hydrobaenus	*Hydrobaenus* sp.								
				Micropsectra	*Micropsectra* sp.								
				Microtendipes	*Microtendipes pedellus gr.*								
				Monodiamesa	*Monodiamesa* sp.								

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
					Lake	Rabbit	Rabbit	Rabbit	Rabbit	Rabbit	Fox	Fox	Fox
					Replicate	1	2	3	4	5	1	2	3
					Date Sampled	15-Aug-12	15-Aug-12	15-Aug-12	15-Aug-12	15-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6138.2-6	6138.2-7	6138.2-8	6138.2-9	6138.2-10	6138.2-40	6138.2-41	6138.2-42
Major Group	Class	Order	Family	Genus	Final Designation								
				Undetermined	Orthocladiinae								
				Orthocladius	Orthocladius Complex								
				Pagastiella	*Pagastiella sp.*	14.4		14.4				43.3	
				Parachironomus	*Parachironomus* sp.								
				Paracladius	*Paracladius sp.*								
				Parakiefferiella	*Parakiefferiella* sp.								
				Paratanytarsus	*Paratanytarsus* sp.	57.7	14.4	28.9		14.4			
				Polypedilum	*Polypedilum halterale gr.*				14.4		173.1	28.9	72.1
				Polypedilum	*Polypedilum scalaenum gr.*								
				Polypedilum	*Polypedilum* sp.								
				Potthastia	*Potthastia longimana gr.*								
				Procladius	*Procladius* sp.	548.2	346.3	360.7	591.5	649.2	331.8	490.5	129.8
				Protanypus	*Protanypus* sp.								
				Psectrocladius	*Psectrocladius* sp.	649.2	230.8	274.1	750.2	1168.6	158.7	245.3	43.3
				Pseudosmittia	*Pseudosmittia* sp.								
				Sergentia	*Sergentia* sp.								
				Stempellinella	*Stempellinella* sp.								
				Stictochironomus	*Stictochironomus* sp.	14.4			14.4				
				Undetermined	Tanytarsini								
				Tanytarsus	*Tanytarsus* sp.	245.3	115.4	259.7	245.3	706.9	115.4		43.3
				Thienemannimyia	*Thienemannimyia* gr. sp.	57.7		14.4	72.1	43.3			
				Zalutschia	*Zalutschia* sp.								
Gastropoda	Gastropoda	Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*								
				Valvata	*Valvata* sp.								
Other Organisms	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda	331.8	173.1	259.7	216.4	173.1		28.9	
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria					28.9		14.4	14.4
Trichoptera	Insecta	Trichoptera	Hydroptilidae	*Agraylea*	*Agraylea* sp.								
			Limnephilidae	*Grensia*	*Grensia praeterita*	14.4	14.4	14.4	43.3				
				Undetermined	Limnephilidae								
				Limnephilus	*Limnephilus* sp.								
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.								
					TOTAL	**3448.2**	**2236.3**	**2496.0**	**4458.1**	**4602.4**	**3909.9**	**3722.3**	**2193.0**

Note: Only four replicates were collected at Giraffe South as substrate made it difficult to get complete Ekman grabs.

Nematodes, copepods or cladocerans were excluded from analyses.

Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose
					Lake	Fox	Fox	Rascal	Rascal	Rascal	Rascal	Rascal
					Replicate	4	5	1	2	3	4	5
					Date Sampled	20-Aug-12	20-Aug-12	15-Aug-12	15-Aug-12	15-Aug-12	8-Aug-12	15-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6138.2-43	6138.2-44	6138.2-11	6138.2-12	6138.2-13	6138.2-14	6138.2-15
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**							
Acari	Arachnida	Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.							
			Hygrobatidae	*Hygrobates*	*Hygrobates* sp.							
			Lebertiidae	*Lebertia*	*Lebertia* sp.					28.9	43.3	14.4
			Oxidae	*Oxus*	*Oxus* sp.							
			Pionidae	Undetermined	Pionidae	28.9	14.4					
		Undetermined	Undetermined	Undetermined	Acari							
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae							
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae	43.3	28.9	43.3	57.7	72.1	28.9	43.3
		Tubificida	Naididae	*Nais*	*Nais* sp.							
				Specaria	*Specaria josinae*							
				Vejdovskyella	*Vejdovskyella comata*							
			Tubificidae	*Psammoryctides*	*Psammoryctides californianus*							
				Rhyacodrilus	*Rhyacodrilus coccineus*							
				Undetermined	Tubificidae w/ cap setae	202.0	129.8	86.6	28.9	28.9	115.4	28.9
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.	1269.6	908.9	158.7	129.8	173.1	158.7	245.3
				Undetermined	Sphaeriidae	216.4	129.8	101.0	144.3	28.9	43.3	57.7
				Sphaerium	*Sphaerium* sp.	28.9			72.1	43.3	14.4	28.9
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Stictotarsus*	*Stictotarsus* sp.							
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera		14.4	14.4	14.4	86.6	86.6	86.6
	Malacostraca	Amphipoda	Gammaridae	*Gammarus*	*Gammarus* sp.							
	Maxillopoda	Calanoida	Undetermined	Undetermined	Calanoida		14.4					
		Cyclopoida	Undetermined	Undetermined	Cyclopoida	14.4			14.4		14.4	
	Ostracoda	Ostracoda	Undetermined	Undetermined	Ostracoda	86.6	144.3	634.8	216.4	274.1	202.0	173.1
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.							
			Empididae	Undetermined	Empididae							
			Muscidae	Undetermined	Muscidae							
			Tabanidae	*Chrysops*	*Chrysops* sp.							
			Tipulidae	*Tipula*	*Tipula* sp.							
			Undetermined	Undetermined	Diptera							14.4
			Chironomidae	*Abiskomyia*	*Abiskomyia* sp.							
				Ablabesmyia	*Ablabesmyia* (Karelia) sp.			259.7	158.7	202.0	375.1	360.7
				Ablabesmyia	*Ablabesmyia* sp.			43.3	14.4	28.9	158.7	101.0
				Undetermined	Chironomini							
				Chironomus	*Chironomus* sp.							
				Cladopelma	*Cladopelma* sp.	28.9	43.3		14.4		57.7	14.4
				Cladotanytarsus	*Cladotanytarsus* sp.	144.3	101.0	86.6	274.1	274.1	476.1	1240.8
				Corynocera	*Corynocera* sp.			1284.0	2077.6	1688.0	1298.5	1832.3
				Corynoneura	*Corynoneura* sp.							
				Cricotopus	*Cricotopus* sp.							
				Cryptochironomus	*Cryptochironomus* sp.	101.0	72.1	173.1	72.1	57.7	173.1	173.1
				Demicryptochironomus	*Demicryptochironomus* sp.							
				Dicrotendipes	*Dicrotendipes fumidus*			43.3	43.3	43.3	129.8	144.3
				Dicrotendipes	*Dicrotendipes* sp.						14.4	
				Glyptotendipes	*Glyptotendipes* sp.							
				Heterotanytarsus	*Heterotanytarsus* sp.	14.4	14.4					
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*							
				Hydrobaenus	*Hydrobaenus* sp.							
				Micropsectra	*Micropsectra* sp.							
				Microtendipes	*Microtendipes pedellus gr.*							
				Monodiamesa	*Monodiamesa* sp.							

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose
					Lake	Fox	Fox	Rascal	Rascal	Rascal	Rascal	Rascal
					Replicate	4	5	1	2	3	4	5
					Date Sampled	20-Aug-12	20-Aug-12	15-Aug-12	15-Aug-12	15-Aug-12	8-Aug-12	15-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6138.2-43	6138.2-44	6138.2-11	6138.2-12	6138.2-13	6138.2-14	6138.2-15
Major Group	Class	Order	Family	Genus	Final Designation							
				Undetermined	Orthocladiinae							
				Orthocladius	Orthocladius Complex							
				Pagastiella	*Pagastiella sp.*							
				Parachironomus	*Parachironomus* sp.							
				Paracladius	*Paracladius sp.*							
				Parakiefferiella	*Parakiefferiella* sp.							14.4
				Paratanytarsus	*Paratanytarsus* sp.			533.8	620.4	375.1	259.7	202.0
				Polypedilum	*Polypedilum halterale gr.*	129.8	259.7	187.6	375.1	216.4	505.0	490.5
				Polypedilum	*Polypedilum scalaenum gr.*							
				Polypedilum	*Polypedilum* sp.			72.1	43.3	14.4		
				Potthastia	*Potthastia longimana gr.*							
				Procladius	*Procladius* sp.	274.1	230.8	158.7	115.4	57.7	259.7	101.0
				Protanypus	*Protanypus* sp.							
				Psectrocladius	*Psectrocladius* sp.	158.7	43.3	144.3	202.0	317.4	230.8	461.7
				Pseudosmittia	*Pseudosmittia* sp.							
				Sergentia	*Sergentia* sp.				14.4	14.4	72.1	
				Stempellinella	*Stempellinella* sp.							
				Stictochironomus	*Stictochironomus* sp.			57.7				
				Undetermined	Tanytarsini			14.4	14.4	43.3		14.4
				Tanytarsus	*Tanytarsus* sp.	43.3	28.9		101.0	43.3	158.7	101.0
				Thienemannimyia	*Thienemannimyia* gr. sp.							
				Zalutschia	*Zalutschia* sp.							
Gastropoda	Gastropoda	Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*			57.7			28.9	
				Valvata	*Valvata* sp.				28.9			14.4
Other Organisms	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda		14.4					
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria							
Trichoptera	Insecta	Trichoptera	Hydroptilidae	*Agraylea*	*Agraylea* sp.							
			Limnephilidae	*Grensia*	*Grensia praeterita*			14.4		28.9	14.4	
				Undetermined	Limnephilidae				14.4	14.4		57.7
				Limnephilus	*Limnephilus* sp.							
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.							
					TOTAL	**2798.9**	**2178.6**	**4169.6**	**4862.1**	**4155.1**	**4919.8**	**6016.3**

Note: Only four replicates were collected at Giraffe South as substrate made it difficult to get complete Ekman grabs.

Nematodes, copepods or cladocerans were excluded from analyses.

Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
					Lake	Giraffe North	Giraffe North	Giraffe North	Giraffe North	Giraffe North	Giraffe South	Giraffe South	Giraffe South
					Replicate	1	2	3	4	5	1	2	3
					Date Sampled	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6138.2-31	6138.2-32	6138.2-33	6138.2-34	6138.2-35	6138.2-36	6138.2-37	6138.2-38
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**								
Acari	Arachnida	Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.							14.4	
			Hygrobatidae	*Hygrobates*	*Hygrobates* sp.								
			Lebertiidae	*Lebertia*	*Lebertia* sp.				14.4			43.3	
			Oxidae	*Oxus*	*Oxus* sp.								14.4
			Pionidae	Undetermined	Pionidae		72.1		14.4	43.3	43.3	14.4	14.4
		Undetermined	Undetermined	Undetermined	Acari								
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae								
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae	86.6	86.6	115.4	101.0	72.1	28.9	14.4	
		Tubificida	Naididae	*Nais*	*Nais* sp.								
				Specaria	*Specaria josinae*								
				Vejdovskyella	*Vejdovskyella comata*								
			Tubificidae	*Psammoryctides*	*Psammoryctides californianus*								
				Rhyacodrilus	*Rhyacodrilus coccineus*			14.4					
				Undetermined	Tubificidae w/ cap setae	14.4	14.4	86.6	14.4	14.4		28.9	
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.	404.0	490.5	461.7	505.0	461.7	86.6	259.7	230.8
				Undetermined	Sphaeriidae	101.0	216.4	129.8	288.6	230.8	43.3	187.6	173.1
				Sphaerium	*Sphaerium* sp.	14.4	57.7	14.4	28.9	43.3			28.9
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Stictotarsus*	*Stictotarsus* sp.								
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera	880.1	432.8	476.1	303.0	317.4			14.4
	Malacostraca	Amphipoda	Gammaridae	*Gammarus*	*Gammarus* sp.								
	Maxillopoda	Calanoida	Undetermined	Undetermined	Calanoida	14.4							
		Cyclopoida	Undetermined	Undetermined	Cyclopoida	43.3						28.9	28.9
	Ostracoda	Ostracoda	Undetermined	Undetermined	Ostracoda	86.6	43.3	86.6	115.4	28.9	158.7	72.1	86.6
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.								
			Empididae	Undetermined	Empididae								14.4
			Muscidae	Undetermined	Muscidae								
			Tabanidae	*Chrysops*	*Chrysops* sp.								
			Tipulidae	*Tipula*	*Tipula* sp.								
			Undetermined	Undetermined	Diptera							14.4	
			Chironomidae	*Abiskomyia*	*Abiskomyia* sp.								
				Ablabesmyia	*Ablabesmyia* (Karelia) sp.				14.4			14.4	
				Ablabesmyia	*Ablabesmyia* sp.	28.9	72.1		57.7	43.3	14.4	28.9	14.4
				Undetermined	Chironomini								
				Chironomus	*Chironomus* sp.		14.4				14.4	28.9	14.4
				Cladopelma	*Cladopelma* sp.	101.0	230.8	86.6	245.3	28.9		14.4	43.3
				Cladotanytarsus	*Cladotanytarsus* sp.							14.4	
				Corynocera	*Corynocera* sp.	303.0	259.7	115.4	404.0	158.7			
				Corynoneura	*Corynoneura* sp.								
				Cricotopus	*Cricotopus* sp.								
				Cryptochironomus	*Cryptochironomus* sp.	57.7	28.9	14.4	43.3	43.3	14.4		14.4
				Demicryptochironomus	*Demicryptochironomus* sp.							43.3	
				Dicrotendipes	*Dicrotendipes fumidus*								14.4
				Dicrotendipes	*Dicrotendipes* sp.								
				Glyptotendipes	*Glyptotendipes* sp.								
				Heterotanytarsus	*Heterotanytarsus* sp.	72.1	43.3	28.9	14.4	57.7			
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*	14.4						28.9	
				Hydrobaenus	*Hydrobaenus* sp.								
				Micropsectra	*Micropsectra* sp.								
				Microtendipes	*Microtendipes pedellus gr.*								
				Monodiamesa	*Monodiamesa* sp.	14.4							

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

Major Group	Class	Order	Family	Genus	Final Designation	Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
						Lake	Giraffe North	Giraffe North	Giraffe North	Giraffe North	Giraffe North	Giraffe South	Giraffe South	Giraffe South
						Replicate	1	2	3	4	5	1	2	3
						Date Sampled	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12
						Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
						EcoAnalysts Sample ID	6138.2-31	6138.2-32	6138.2-33	6138.2-34	6138.2-35	6138.2-36	6138.2-37	6138.2-38
				Undetermined	Orthocladiinae									
				Orthocladius	Orthocladius Complex									
				Pagastiella	*Pagastiella sp.*		216.4	548.2	274.1	533.8	230.8	72.1	144.3	86.6
				Parachironomus	*Parachironomus* sp.									
				Paracladius	*Paracladius sp.*									
				Parakiefferiella	*Parakiefferiella* sp.									
				Paratanytarsus	*Paratanytarsus* sp.						14.4		14.4	
				Polypedilum	*Polypedilum halterale gr.*		72.1		28.9	14.4	14.4			
				Polypedilum	*Polypedilum scalaenum gr.*									
				Polypedilum	*Polypedilum* sp.									
				Potthastia	*Potthastia longimana gr.*									
				Procladius	*Procladius* sp.		447.3	577.1	418.4	548.2	259.7	57.7	72.1	43.3
				Protanypus	*Protanypus* sp.									
				Psectrocladius	*Psectrocladius* sp.		28.9	86.6	144.3	43.3	28.9	14.4	72.1	
				Pseudosmittia	*Pseudosmittia* sp.									
				Sergentia	*Sergentia* sp.		14.4	14.4		57.7	28.9			
				Stempellinella	*Stempellinella* sp.									
				Stictochironomus	*Stictochironomus* sp.		288.6	288.6	375.1	259.7	101.0			
				Undetermined	Tanytarsini									
				Tanytarsus	*Tanytarsus* sp.		620.4	317.4	519.4	375.1	173.1		57.7	14.4
				Thienemannimyia	*Thienemannimyia* gr. sp.									
				Zalutschia	*Zalutschia* sp.		43.3	86.6	28.9	86.6	43.3	72.1	144.3	115.4
Gastropoda	Gastropoda	Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*									
				Valvata	*Valvata* sp.									
Other Organisms	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda					14.4	14.4			
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria		14.4			14.4				
Trichoptera	Insecta	Trichoptera	Hydroptilidae	*Agraylea*	*Agraylea* sp.									
			Limnephilidae	*Grensia*	*Grensia praeterita*		28.9		28.9					
				Undetermined	Limnephilidae									
				Limnephilus	*Limnephilus* sp.									
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.									
						TOTAL	**4010.8**	**3982.0**	**3448.2**	**4111.8**	**2452.7**	**620.4**	**1356.2**	**966.6**

Note: Only four replicates were collected at Giraffe South as substrate made it difficult to get complete Ekman grabs.

Nematodes, copepods or cladocerans were excluded from analyses.

Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
					Lake	Giraffe South	Goose Neck	Goose Neck	Goose Neck	Goose Neck	Goose Neck	Goose Central	Goose Central
					Replicate	4	1	2	3	4	5	1	2
					Date Sampled	19-Aug-12	14-Aug-12	14-Aug-12	14-Aug-12	14-Aug-12	14-Aug-12	17-Aug-12	17-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6138.2-39	6138.2-1	6138.2-2	6138.2-3	6138.2-4	6138.2-5	6138.2-21	6138.2-22
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**								
Acari	Arachnida	Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.	14.4							
			Hygrobatidae	*Hygrobates*	*Hygrobates* sp.								
			Lebertiidae	*Lebertia*	*Lebertia* sp.	86.6	14.4	20.3			77.0	20.9	34.6
			Oxidae	*Oxus*	*Oxus* sp.	14.4	14.4					20.9	34.6
			Pionidae	Undetermined	Pionidae	57.7						20.9	
		Undetermined	Undetermined	Undetermined	Acari								
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae								
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae	43.3	144.3	81.4	138.5	173.1	77.0	62.8	
		Tubificida	Naididae	*Nais*	*Nais* sp.								
				Specaria	*Specaria josinae*								
				Vejdovskyella	*Vejdovskyella comata*								
			Tubificidae	*Psammoryctides*	*Psammoryctides californianus*								
				Rhyacodrilus	*Rhyacodrilus coccineus*		14.4					62.8	34.6
				Undetermined	Tubificidae w/ cap setae	28.9	72.1	101.7	277.0	115.4	115.6	125.5	277.0
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.	72.1	389.5	773.0	369.3	1615.9	269.7	418.4	969.5
				Undetermined	Sphaeriidae	288.6	663.7	325.5	277.0	923.4	770.5	439.3	934.8
				Sphaerium	*Sphaerium* sp.		43.3	40.7	46.2	115.4	77.0	62.8	69.2
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Stictotarsus*	*Stictotarsus* sp.								
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera						38.5	20.9	103.9
	Malacostraca	Amphipoda	Gammaridae	*Gammarus*	*Gammarus* sp.								
	Maxillopoda	Calanoida	Undetermined	Undetermined	Calanoida								69.2
		Cyclopoida	Undetermined	Undetermined	Cyclopoida		14.4		23.1		154.1	104.6	1073.3
	Ostracoda	Ostracoda	Undetermined	Undetermined	Ostracoda	303.0	187.6	427.2	115.4	750.2	423.8	502.0	1384.9
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.								
			Empididae	Undetermined	Empididae								
			Muscidae	Undetermined	Muscidae								
			Tabanidae	*Chrysops*	*Chrysops* sp.								
			Tipulidae	*Tipula*	*Tipula* sp.								
			Undetermined	Undetermined	Diptera		28.9		23.1				
			Chironomidae	*Abiskomyia*	*Abiskomyia* sp.								
				Ablabesmyia	*Ablabesmyia* (Karelia) sp.			40.7	115.4			20.9	103.9
				Ablabesmyia	*Ablabesmyia* sp.		14.4			173.1	192.6	41.8	
				Undetermined	Chironomini								
				Chironomus	*Chironomus* sp.								
				Cladopelma	*Cladopelma* sp.	28.9						20.9	69.2
				Cladotanytarsus	*Cladotanytarsus* sp.			20.3	23.1				
				Corynocera	*Corynocera* sp.		14.4	61.0		115.4	154.1	439.3	900.2
				Corynoneura	*Corynoneura* sp.								
				Cricotopus	*Cricotopus* sp.							20.9	34.6
				Cryptochironomus	*Cryptochironomus* sp.								
				Demicryptochironomus	*Demicryptochironomus* sp.	14.4							
				Dicrotendipes	*Dicrotendipes fumidus*			40.7	23.1				
				Dicrotendipes	*Dicrotendipes* sp.								34.6
				Glyptotendipes	*Glyptotendipes* sp.								
				Heterotanytarsus	*Heterotanytarsus* sp.		14.4	40.7		115.4			
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*	14.4				57.7			
				Hydrobaenus	*Hydrobaenus* sp.								
				Micropsectra	*Micropsectra* sp.								
				Microtendipes	*Microtendipes pedellus gr.*		14.4		23.1		38.5	20.9	34.6
				Monodiamesa	*Monodiamesa* sp.		57.7	40.7		115.4			69.2

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
					Lake	Giraffe South	Goose Neck	Goose Neck	Goose Neck	Goose Neck	Goose Neck	Goose Central	Goose Central
					Replicate	4	1	2	3	4	5	1	2
					Date Sampled	19-Aug-12	14-Aug-12	14-Aug-12	14-Aug-12	14-Aug-12	14-Aug-12	17-Aug-12	17-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6138.2-39	6138.2-1	6138.2-2	6138.2-3	6138.2-4	6138.2-5	6138.2-21	6138.2-22
Major Group	Class	Order	Family	Genus	Final Designation								
				Undetermined	Orthocladiinae								
				Orthocladius	Orthocladius Complex								
				Pagastiella	*Pagastiella sp.*	43.3	2568.1	4617.9	4201.3	8771.9	5894.3	62.8	173.1
				Parachironomus	*Parachironomus* sp.								
				Paracladius	*Paracladius sp.*								
				Parakiefferiella	*Parakiefferiella* sp.								
				Paratanytarsus	*Paratanytarsus* sp.		303.0	122.1	92.3	346.3	154.1	376.5	450.1
				Polypedilum	*Polypedilum halterale gr.*								
				Polypedilum	*Polypedilum scalaenum gr.*				23.1				
				Polypedilum	*Polypedilum* sp.								
				Potthastia	*Potthastia longimana gr.*								
				Procladius	*Procladius* sp.	28.9	202.0	183.1	369.3	1789.0	616.4	502.0	1038.7
				Protanypus	*Protanypus* sp.	14.4	28.9				77.0		
				Psectrocladius	*Psectrocladius* sp.	28.9	216.4	305.2	415.5	1500.5	1232.8	251.0	415.5
				Pseudosmittia	*Pseudosmittia* sp.								
				Sergentia	*Sergentia* sp.	14.4							
				Stempellinella	*Stempellinella* sp.								
				Stictochironomus	*Stictochironomus* sp.		490.5	345.8	554.0	1327.3	809.0	1129.6	1177.2
				Undetermined	Tanytarsini								
				Tanytarsus	*Tanytarsus* sp.	72.1	14.4		138.5	57.7	192.6	962.3	1315.7
				Thienemannimyia	*Thienemannimyia* gr. sp.		274.1	325.5	253.9	1154.2	654.9	167.3	173.1
				Zalutschia	*Zalutschia* sp.	72.1					38.5	188.3	346.2
Gastropoda	Gastropoda	Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*		14.4				77.0		173.1
				Valvata	*Valvata* sp.				46.2	173.1	77.0	523.0	415.5
Other Organisms	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda	28.9	57.7	40.7	115.4	230.8	192.6	376.5	138.5
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria						38.5		
Trichoptera	Insecta	Trichoptera	Hydroptilidae	*Agraylea*	*Agraylea* sp.								
			Limnephilidae	*Grensia*	*Grensia praeterita*								
				Undetermined	Limnephilidae		14.4						
				Limnephilus	*Limnephilus* sp.								
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.								
					TOTAL	**1269.6**	**5886.4**	**7954.3**	**7663.9**	**19621.4**	**12443.5**	**6965.9**	**12048.9**

Note: Only four replicates were collected at Giraffe South as substrate made it difficult to get complete Ekman grabs.

Nematodes, copepods or cladocerans were excluded from analyses.

Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
					Lake	Goose Central	Goose Central	Goose Central	Propellor	Propellor	Propellor	Propellor	Propellor
					Replicate	3	4	5	1	2	3	4	5
					Date Sampled	17-Aug-12	17-Aug-12	17-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6138.2-23	6138.2-24	6138.2-25	6138.2-50	6138.2-51	6138.2-52	6138.2-53	6138.2-54
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**								
Acari	Arachnida	Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.								
			Hygrobatidae	*Hygrobates*	*Hygrobates* sp.							28.9	
			Lebertiidae	*Lebertia*	*Lebertia* sp.		38.5	38.5	28.9	19.2		28.9	
			Oxidae	*Oxus*	*Oxus* sp.								
			Pionidae	Undetermined	Pionidae								
		Undetermined	Undetermined	Undetermined	Acari								
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae	25.7							
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae	25.7	115.6	231.1	86.6	19.2		115.4	14.4
		Tubificida	Naididae	*Nais*	*Nais* sp.								
				Specaria	*Specaria josinae*								
				Vejdovskyella	*Vejdovskyella comata*					38.4			
			Tubificidae	*Psammoryctides*	*Psammoryctides californianus*								
				Rhyacodrilus	*Rhyacodrilus coccineus*			77.0				28.9	14.4
				Undetermined	Tubificidae w/ cap setae	256.8	38.5	385.2	86.6	95.9	173.1	115.4	28.9
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.	462.3	963.1	1001.6	375.1	498.9	519.4	750.2	259.7
				Undetermined	Sphaeriidae	487.9	1040.2	847.5	346.3	95.9	86.6	288.6	72.1
				Sphaerium	*Sphaerium* sp.	77.0	308.2	231.1	28.9	38.4		86.6	
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Stictotarsus*	*Stictotarsus* sp.								
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera								
	Malacostraca	Amphipoda	Gammaridae	*Gammarus*	*Gammarus* sp.								
	Maxillopoda	Calanoida	Undetermined	Undetermined	Calanoida								
		Cyclopoida	Undetermined	Undetermined	Cyclopoida				28.9				
	Ostracoda	Ostracoda	Undetermined	Undetermined	Ostracoda	719.1	1695.1	654.9					
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.								
			Empididae	Undetermined	Empididae								
			Muscidae	Undetermined	Muscidae								
			Tabanidae	*Chrysops*	*Chrysops* sp.								
			Tipulidae	*Tipula*	*Tipula* sp.								
			Undetermined	Undetermined	Diptera					19.2			
			Chironomidae	*Abiskomyia*	*Abiskomyia* sp.								
				Ablabesmyia	*Ablabesmyia* (Karelia) sp.	25.7	231.1	231.1					
				Ablabesmyia	*Ablabesmyia* sp.	51.4				76.8	259.7	259.7	14.4
				Undetermined	Chironomini								
				Chironomus	*Chironomus* sp.								
				Cladopelma	*Cladopelma* sp.	51.4	38.5	154.1					
				Cladotanytarsus	*Cladotanytarsus* sp.								
				Corynocera	*Corynocera* sp.	1592.2	1579.5		750.2	172.7	317.4	432.8	187.6
				Corynoneura	*Corynoneura* sp.								
				Cricotopus	*Cricotopus* sp.			115.6					
				Cryptochironomus	*Cryptochironomus* sp.					19.2	28.9		
				Demicryptochironomus	*Demicryptochironomus* sp.								
				Dicrotendipes	*Dicrotendipes fumidus*					153.5		115.4	
				Dicrotendipes	*Dicrotendipes* sp.					19.2			
				Glyptotendipes	*Glyptotendipes* sp.								
				Heterotanytarsus	*Heterotanytarsus* sp.								
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*	25.7				38.4			
				Hydrobaenus	*Hydrobaenus* sp.								
				Micropsectra	*Micropsectra* sp.								
				Microtendipes	*Microtendipes pedellus gr.*	128.4	38.5	154.1	519.4	268.6	317.4	230.8	28.9
				Monodiamesa	*Monodiamesa* sp.	25.7		38.5	57.7	95.9	57.7		101.0

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2														
Taxonomic Classification:						Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
						Lake	Goose Central	Goose Central	Goose Central	Propellor	Propellor	Propellor	Propellor	Propellor
						Replicate	3	4	5	1	2	3	4	5
						Date Sampled	17-Aug-12	17-Aug-12	17-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12
						Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
						EcoAnalysts Sample ID	6138.2-23	6138.2-24	6138.2-25	6138.2-50	6138.2-51	6138.2-52	6138.2-53	6138.2-54
Major Group	Class	Order	Family	Genus	Final Designation									
				Undetermined	Orthocladiinae									
				Orthocladius	Orthocladius Complex									
				Pagastiella	*Pagastiella sp.*		231.1	77.0						
				Parachironomus	*Parachironomus* sp.							28.9	28.9	
				Paracladius	*Paracladius sp.*									
				Parakiefferiella	*Parakiefferiella* sp.									
				Paratanytarsus	*Paratanytarsus* sp.		282.5	500.8	1040.2	404.0	307.0	548.2	432.8	115.4
				Polypedilum	*Polypedilum halterale gr.*					28.9				
				Polypedilum	*Polypedilum scalaenum gr.*									
				Polypedilum	*Polypedilum* sp.									
				Potthastia	*Potthastia longimana gr.*									
				Procladius	*Procladius* sp.		873.1	963.1	886.1	144.3	326.2	404.0	461.7	144.3
				Protanypus	*Protanypus* sp.		25.7	38.5	115.6	57.7	38.4		28.9	
				Psectrocladius	*Psectrocladius* sp.		385.2	1194.3	539.3		153.5	86.6	202.0	14.4
				Pseudosmittia	*Pseudosmittia* sp.									
				Sergentia	*Sergentia* sp.			38.5						
				Stempellinella	*Stempellinella* sp.									
				Stictochironomus	*Stictochironomus* sp.		1566.5	1810.7	2311.5	346.3	153.5	317.4	173.1	72.1
				Undetermined	Tanytarsini							28.9		14.4
				Tanytarsus	*Tanytarsus* sp.		565.0	1078.7	2773.8	202.0	230.3	230.8	115.4	
				Thienemannimyia	*Thienemannimyia* gr. sp.		154.1	115.6	154.1		19.2	28.9	28.9	
				Zalutschia	*Zalutschia* sp.		102.7	346.7	346.7	6348.1	3300.3	5626.7	5280.5	3000.9
Gastropoda	Gastropoda	Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*		205.4	269.7	192.6					
				Valvata	*Valvata* sp.		282.5	577.9	192.6		19.2	57.7	57.7	28.9
Other Organisms	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda		128.4	77.0	154.1	28.9	38.4		86.6	28.9
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria									
Trichoptera	Insecta	Trichoptera	Hydroptilidae	*Agraylea*	*Agraylea* sp.									
			Limnephilidae	*Grensia*	*Grensia praeterita*									
				Undetermined	Limnephilidae									
				Limnephilus	*Limnephilus* sp.									
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.									
						TOTAL	**8757.2**	**13175.5**	**12867.3**	**9868.4**	**6255.3**	**9118.2**	**9377.9**	**4140.7**

Note: Only four replicates were collected at Giraffe South as substrate made it difficult to get complete Ekman grabs.

Nematodes, copepods or cladocerans were excluded from analyses.

Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	George	George	George	George	George	George	George	George
					Lake	Lower Long	Lower Long	Lower Long	Lower Long	Lower Long	Fold	Fold	Fold
					Replicate	1	2	3	4	5	1	2	3
					Date Sampled	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6141.2-26	6141.2-27	6141.2-28	6141.2-29	6141.2-30	6141.2-11	6141.2-12	6141.2-13
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**								
Acari	Arachnida	Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.								
			Hygrobatidae	*Hygrobates*	*Hygrobates* sp.							16.4	28.9
			Lebertiidae	*Lebertia*	*Lebertia* sp.			57.7			28.9		43.3
			Oxidae	*Oxus*	*Oxus* sp.				14.4		28.9	16.4	
			Pionidae	Undetermined	Pionidae								
		Undetermined	Undetermined	Undetermined	Acari								
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae								
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae	14.4	14.4	86.6	43.3		43.3	32.9	
		Tubificida	Naididae	*Nais*	*Nais* sp.								
				Specaria	*Specaria josinae*								
				Vejdovskyella	*Vejdovskyella comata*								
			Tubificidae	*Psammoryctides*	*Psammoryctides californianus*								
				Rhyacodrilus	*Rhyacodrilus coccineus*							16.4	14.4
				Undetermined	Tubificidae w/ cap setae								
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.	663.7	735.8	505.0	562.7	678.1	490.5	361.8	432.8
				Undetermined	Sphaeriidae	519.4	606.0	216.4	288.6	389.5	317.4	197.4	187.6
				Sphaerium	*Sphaerium* sp.		43.3	28.9		14.4	28.9		14.4
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Stictotarsus*	*Stictotarsus* sp.								
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera	43.3	43.3	72.1	144.3	28.9			
	Malacostraca	Amphipoda	Gammaridae	*Gammarus*	*Gammarus* sp.	14.4		14.4	28.9				
	Maxillopoda	Calanoida	Undetermined	Undetermined	Calanoida						57.7		28.9
		Cyclopoida	Undetermined	Undetermined	Cyclopoida					14.4			72.1
	Ostracoda	Ostracoda	Undetermined	Undetermined	Ostracoda	274.1	418.4	72.1	86.6	303.0	706.9	1628.3	620.4
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.								
			Empididae	Undetermined	Empididae								
			Muscidae	Undetermined	Muscidae								
			Tabanidae	*Chrysops*	*Chrysops* sp.								
			Tipulidae	*Tipula*	*Tipula* sp.								
			Undetermined	Undetermined	Diptera								
			Chironomidae	*Abiskomyia*	*Abiskomyia* sp.								
				Ablabesmyia	*Ablabesmyia* (Karelia) sp.							16.4	14.4
				Ablabesmyia	*Ablabesmyia* sp.		28.9			14.4	14.4	49.3	14.4
				Undetermined	Chironomini								
				Chironomus	*Chironomus* sp.							16.4	
				Cladopelma	*Cladopelma* sp.								
				Cladotanytarsus	*Cladotanytarsus* sp.								
				Corynocera	*Corynocera* sp.	14.4							
				Corynoneura	*Corynoneura* sp.								14.4
				Cricotopus	*Cricotopus* sp.								
				Cryptochironomus	*Cryptochironomus* sp.								
				Demicryptochironomus	*Demicryptochironomus* sp.								
				Dicrotendipes	*Dicrotendipes fumidus*							16.4	14.4
				Dicrotendipes	*Dicrotendipes* sp.								
				Glyptotendipes	*Glyptotendipes* sp.								
				Heterotanytarsus	*Heterotanytarsus* sp.								
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*								14.4
				Hydrobaenus	*Hydrobaenus* sp.								
				Micropsectra	*Micropsectra* sp.			28.9	57.7		129.8		375.1
				Microtendipes	*Microtendipes pedellus gr.*	202.0	418.4	86.6	360.7	144.3		16.4	72.1
				Monodiamesa	*Monodiamesa* sp.	14.4		14.4	14.4	28.9	14.4	16.4	28.9

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2													
Taxonomic Classification:						Area	George	George	George	George	George	George	George	George
						Lake	Lower Long	Lower Long	Lower Long	Lower Long	Lower Long	Fold	Fold	Fold
						Replicate	1	2	3	4	5	1	2	3
						Date Sampled	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12
						Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
						EcoAnalysts Sample ID	6141.2-26	6141.2-27	6141.2-28	6141.2-29	6141.2-30	6141.2-11	6141.2-12	6141.2-13
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**									
				Undetermined	Orthocladiinae									
				Orthocladius	Orthocladius Complex									
				Pagastiella	*Pagastiella sp.*									
				Parachironomus	*Parachironomus* sp.								32.9	101.0
				Paracladius	*Paracladius sp.*									
				Parakiefferiella	*Parakiefferiella* sp.									
				Paratanytarsus	*Paratanytarsus* sp.		230.8	1197.5		158.7	360.7	28.9	98.7	115.4
				Polypedilum	*Polypedilum halterale gr.*									
				Polypedilum	*Polypedilum scalaenum gr.*									
				Polypedilum	*Polypedilum* sp.									
				Potthastia	*Potthastia longimana gr.*									
				Procladius	*Procladius* sp.		86.6	86.6	158.7	230.8	158.7	216.4	164.5	259.7
				Protanypus	*Protanypus* sp.		14.4	14.4	14.4	14.4		43.3	115.1	72.1
				Psectrocladius	*Psectrocladius* sp.		14.4	129.8	28.9	14.4	57.7	43.3	32.9	14.4
				Pseudosmittia	*Pseudosmittia* sp.									
				Sergentia	*Sergentia* sp.									
				Stempellinella	*Stempellinella* sp.							28.9		14.4
				Stictochironomus	*Stictochironomus* sp.		86.6	115.4	331.8	187.6	230.8	692.5	1891.4	1832.3
				Undetermined	Tanytarsini									
				Tanytarsus	*Tanytarsus* sp.		14.4			14.4	28.9		559.2	28.9
				Thienemannimyia	*Thienemannimyia* gr. sp.			173.1		28.9	28.9		16.4	43.3
				Zalutschia	*Zalutschia* sp.									14.4
Gastropoda	Gastropoda	Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*									
				Valvata	*Valvata* sp.									
Other Organisms	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda		28.9		28.9	14.4	28.9		16.4	14.4
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria				28.9	14.4				14.4
Trichoptera	Insecta	Trichoptera	Hydroptilidae	*Agraylea*	*Agraylea* sp.									
			Limnephilidae	*Grensia*	*Grensia praeterita*							14.4		14.4
				Undetermined	Limnephilidae							14.4		
				Limnephilus	*Limnephilus* sp.									
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.									
					TOTAL		**2236.3**	**4025.3**	**1774.6**	**2279.5**	**2510.4**	**2943.2**	**5328.9**	**4530.2**

Note: Only four replicates were collected at Giraffe South as substrate made it difficult to get complete Ekman grabs.

Nematodes, copepods or cladocerans were excluded from analyses.

Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	George	George	George	George	George	George	George
					Lake	Fold	Fold	George South	George South	George South	George South	George South
					Replicate	4	5	1	2	3	4	5
					Date Sampled	19-Aug-12	19-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6141.2-14	6141.2-15	6141.2-1	6141.2-2	6141.2-3	6141.2-4	6141.2-5
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**							
Acari	Arachnida	Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.							
			Hygrobatidae	*Hygrobates*	*Hygrobates* sp.							
			Lebertiidae	*Lebertia*	*Lebertia* sp.	43.3		28.9	14.4	14.4		
			Oxidae	*Oxus*	*Oxus* sp.	101.0	14.4	14.4				14.4
			Pionidae	Undetermined	Pionidae							
		Undetermined	Undetermined	Undetermined	Acari	14.4						
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae					28.9	14.4	
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae		43.3	72.1	57.7		28.9	43.3
		Tubificida	Naididae	*Nais*	*Nais* sp.							
				Specaria	*Specaria josinae*							
				Vejdovskyella	*Vejdovskyella comata*							
			Tubificidae	*Psammoryctides*	*Psammoryctides californianus*							
				Rhyacodrilus	*Rhyacodrilus coccineus*					28.9		
				Undetermined	Tubificidae w/ cap setae	28.9	14.4	28.9	14.4			
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.	1543.7	1817.9	2106.4	1226.3	1240.8	2120.8	634.8
				Undetermined	Sphaeriidae	836.8	649.2	1385.0	1327.3	793.5	1168.6	663.7
				Sphaerium	*Sphaerium* sp.	28.9	14.4	28.9				14.4
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Stictotarsus*	*Stictotarsus* sp.							
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera							
	Malacostraca	Amphipoda	Gammaridae	*Gammarus*	*Gammarus* sp.						14.4	
	Maxillopoda	Calanoida	Undetermined	Undetermined	Calanoida					28.9	14.4	28.9
		Cyclopoida	Undetermined	Undetermined	Cyclopoida	57.7	28.9			14.4		
	Ostracoda	Ostracoda	Undetermined	Undetermined	Ostracoda	1413.9	1096.5	14.4	14.4	43.3	28.9	
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.							
			Empididae	Undetermined	Empididae						14.4	14.4
			Muscidae	Undetermined	Muscidae							
			Tabanidae	*Chrysops*	*Chrysops* sp.							
			Tipulidae	*Tipula*	*Tipula* sp.							
			Undetermined	Undetermined	Diptera				14.4			14.4
			Chironomidae	*Abiskomyia*	*Abiskomyia* sp.							
				Ablabesmyia	*Ablabesmyia* (Karelia) sp.	14.4						
				Ablabesmyia	*Ablabesmyia* sp.		14.4	43.3	43.3	14.4	101.0	
				Undetermined	Chironomini							
				Chironomus	*Chironomus* sp.							
				Cladopelma	*Cladopelma* sp.							
				Cladotanytarsus	*Cladotanytarsus* sp.							
				Corynocera	*Corynocera* sp.			43.3	129.8	230.8	245.3	72.1
				Corynoneura	*Corynoneura* sp.							
				Cricotopus	*Cricotopus* sp.							
				Cryptochironomus	*Cryptochironomus* sp.							
				Demicryptochironomus	*Demicryptochironomus* sp.							
				Dicrotendipes	*Dicrotendipes fumidus*							14.4
				Dicrotendipes	*Dicrotendipes* sp.							
				Glyptotendipes	*Glyptotendipes* sp.							
				Heterotanytarsus	*Heterotanytarsus* sp.							
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*				28.9	43.3		
				Hydrobaenus	*Hydrobaenus* sp.							
				Micropsectra	*Micropsectra* sp.		519.4				14.4	
				Microtendipes	*Microtendipes pedellus gr.*		14.4	14.4	43.3	86.6	101.0	28.9
				Monodiamesa	*Monodiamesa* sp.			86.6	57.7	28.9		14.4

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	George	George	George	George	George	George	George
					Lake	Fold	Fold	George South	George South	George South	George South	George South
					Replicate	4	5	1	2	3	4	5
					Date Sampled	19-Aug-12	19-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6141.2-14	6141.2-15	6141.2-1	6141.2-2	6141.2-3	6141.2-4	6141.2-5
Major Group	Class	Order	Family	Genus	Final Designation							
				Undetermined	Orthocladiinae				14.4			
				Orthocladius	Orthocladius Complex							
				Pagastiella	*Pagastiella sp.*							
				Parachironomus	*Parachironomus* sp.	14.4						
				Paracladius	*Paracladius sp.*		101.0					
				Parakiefferiella	*Parakiefferiella* sp.							
				Paratanytarsus	*Paratanytarsus* sp.	43.3	28.9	72.1	43.3	43.3	72.1	14.4
				Polypedilum	*Polypedilum halterale gr.*							
				Polypedilum	*Polypedilum scalaenum gr.*							
				Polypedilum	*Polypedilum* sp.							
				Potthastia	*Potthastia longimana gr.*							
				Procladius	*Procladius* sp.	245.3	404.0	346.3	360.7	317.4	144.3	144.3
				Protanypus	*Protanypus* sp.	72.1	115.4	57.7	14.4	28.9	28.9	28.9
				Psectrocladius	*Psectrocladius* sp.	245.3	72.1	14.4	57.7		43.3	28.9
				Pseudosmittia	*Pseudosmittia* sp.							
				Sergentia	*Sergentia* sp.							
				Stempellinella	*Stempellinella* sp.		28.9					
				Stictochironomus	*Stictochironomus* sp.	404.0	101.0	57.7		14.4		
				Undetermined	Tanytarsini		14.4					
				Tanytarsus	*Tanytarsus* sp.		86.6				14.4	
				Thienemannimyia	*Thienemannimyia* gr. sp.	72.1		202.0	173.1	144.3	216.4	57.7
				Zalutschia	*Zalutschia* sp.		28.9					
Gastropoda	Gastropoda	Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*					14.4		
				Valvata	*Valvata* sp.						14.4	28.9
Other Organisms	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda	28.9	173.1	28.9	72.1			28.9
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria					14.4		
Trichoptera	Insecta	Trichoptera	Hydroptilidae	*Agraylea*	*Agraylea* sp.							
			Limnephilidae	*Grensia*	*Grensia praeterita*						28.9	
				Undetermined	Limnephilidae				28.9	14.4		
				Limnephilus	*Limnephilus* sp.							
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.							
					TOTAL	**5208.3**	**5381.5**	**4645.7**	**3736.7**	**3188.5**	**4429.2**	**1890.0**

Note: Only four replicates were collected at Giraffe South as substrate made it difficult to get complete Ekman grabs.

Nematodes, copepods or cladocerans were excluded from analyses.

Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	George	George	George	George	George	George	George	George
					Lake	George Central	George Central	George Central	George Central	George Central	Lytle	Lytle	Lytle
					Replicate	1	2	3	4	5	1	2	3
					Date Sampled	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	23-Aug-12	23-Aug-12	23-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6141.2-6	6141.2-7	6141.2-8	6141.2-9	6141.2-10	6141.2-46	6141.2-47	6141.2-48
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**								
Acari	Arachnida	Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.								
			Hygrobatidae	*Hygrobates*	*Hygrobates* sp.	28.9			14.4				
			Lebertiidae	*Lebertia*	*Lebertia* sp.	14.4	43.3	14.4	14.4				
			Oxidae	*Oxus*	*Oxus* sp.								
			Pionidae	Undetermined	Pionidae								
		Undetermined	Undetermined	Undetermined	Acari								
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae	274.1	303.0	303.0	158.7	216.4			
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae	28.9	101.0	115.4	187.6	72.1	577.9	462.3	577.1
		Tubificida	Naididae	*Nais*	*Nais* sp.								
				Specaria	*Specaria josinae*								
				Vejdovskyella	*Vejdovskyella comata*								
			Tubificidae	*Psammoryctides*	*Psammoryctides californianus*								
				Rhyacodrilus	*Rhyacodrilus coccineus*								
				Undetermined	Tubificidae w/ cap setae						154.1	115.6	404.0
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.	981.1	894.5	865.7	807.9	721.4	38.5	115.6	
				Undetermined	Sphaeriidae	447.3	1486.0	793.5	908.9	447.3			
				Sphaerium	*Sphaerium* sp.					14.4			
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Stictotarsus*	*Stictotarsus* sp.								
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera				14.4				57.7
	Malacostraca	Amphipoda	Gammaridae	*Gammarus*	*Gammarus* sp.								
	Maxillopoda	Calanoida	Undetermined	Undetermined	Calanoida			14.4					
		Cyclopoida	Undetermined	Undetermined	Cyclopoida								
	Ostracoda	Ostracoda	Undetermined	Undetermined	Ostracoda						192.6		346.3
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.								
			Empididae	Undetermined	Empididae	43.3			14.4		38.5	38.5	
			Muscidae	Undetermined	Muscidae								
			Tabanidae	*Chrysops*	*Chrysops* sp.								
			Tipulidae	*Tipula*	*Tipula* sp.								
			Undetermined	Undetermined	Diptera								
			Chironomidae	*Abiskomyia*	*Abiskomyia* sp.								
				Ablabesmyia	*Ablabesmyia* (Karelia) sp.								
				Ablabesmyia	*Ablabesmyia* sp.						77.0	38.5	
				Undetermined	Chironomini								
				Chironomus	*Chironomus* sp.								57.7
				Cladopelma	*Cladopelma* sp.								115.4
				Cladotanytarsus	*Cladotanytarsus* sp.								
				Corynocera	*Corynocera* sp.								
				Corynoneura	*Corynoneura* sp.								
				Cricotopus	*Cricotopus* sp.								
				Cryptochironomus	*Cryptochironomus* sp.						77.0	115.6	461.7
				Demicryptochironomus	*Demicryptochironomus* sp.								
				Dicrotendipes	*Dicrotendipes fumidus*	28.9							
				Dicrotendipes	*Dicrotendipes* sp.								
				Glyptotendipes	*Glyptotendipes* sp.								
				Heterotanytarsus	*Heterotanytarsus* sp.								
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*	72.1	14.4	14.4					
				Hydrobaenus	*Hydrobaenus* sp.								
				Micropsectra	*Micropsectra* sp.								
				Microtendipes	*Microtendipes pedellus gr.*								
				Monodiamesa	*Monodiamesa* sp.	28.9	14.4	14.4	28.9				

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	George	George	George	George	George	George	George	George
					Lake	George Central	George Central	George Central	George Central	George Central	Lytle	Lytle	Lytle
					Replicate	1	2	3	4	5	1	2	3
					Date Sampled	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	23-Aug-12	23-Aug-12	23-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6141.2-6	6141.2-7	6141.2-8	6141.2-9	6141.2-10	6141.2-46	6141.2-47	6141.2-48
Major Group	Class	Order	Family	Genus	Final Designation								
				Undetermined	Orthocladiinae								
				Orthocladius	Orthocladius Complex								
				Pagastiella	*Pagastiella sp.*								
				Parachironomus	*Parachironomus* sp.								
				Paracladius	*Paracladius sp.*								
				Parakiefferiella	*Parakiefferiella* sp.		14.4	28.9	14.4				
				Paratanytarsus	*Paratanytarsus* sp.						13984.5	11364.8	16909.0
				Polypedilum	*Polypedilum halterale gr.*								
				Polypedilum	*Polypedilum scalaenum gr.*								
				Polypedilum	*Polypedilum* sp.								
				Potthastia	*Potthastia longimana gr.*	28.9	14.4		14.4				
				Procladius	*Procladius* sp.	57.7	389.5	259.7	562.7	404.0	886.1	346.7	519.4
				Protanypus	*Protanypus* sp.								
				Psectrocladius	*Psectrocladius* sp.	57.7	187.6	43.3	144.3	173.1	154.1	38.5	865.7
				Pseudosmittia	*Pseudosmittia* sp.		72.1	101.0		14.4			
				Sergentia	*Sergentia* sp.						38.5		
				Stempellinella	*Stempellinella* sp.								
				Stictochironomus	*Stictochironomus* sp.						38.5	38.5	57.7
				Undetermined	Tanytarsini						269.7		288.6
				Tanytarsus	*Tanytarsus* sp.						154.1		577.1
				Thienemannimyia	*Thienemannimyia* gr. sp.			43.3	28.9	28.9			
				Zalutschia	*Zalutschia* sp.				14.4				
Gastropoda	Gastropoda	Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*		14.4		14.4				
				Valvata	*Valvata* sp.	28.9	28.9	43.3	101.0	28.9			
Other Organisms	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda		28.9	28.9	14.4	14.4			
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria								
Trichoptera	Insecta	Trichoptera	Hydroptilidae	*Agraylea*	*Agraylea* sp.								
			Limnephilidae	*Grensia*	*Grensia praeterita*								
				Undetermined	Limnephilidae	14.4	43.3	14.4		14.4			
				Limnephilus	*Limnephilus* sp.								
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.						38.5	38.5	
					TOTAL	**1962.1**	**3794.4**	**2697.9**	**3058.6**	**2178.6**	**16719.7**	**12713.2**	**21237.3**

Note: Only four replicates were collected at Giraffe South as substrate made it difficult to get complete Ekman grabs.

Nematodes, copepods or cladocerans were excluded from analyses.

Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	George	George	George	George	George	George	George
					Lake	Lytle	Lytle	Occurrence	Occurrence	Occurrence	Occurrence	Occurrence
					Replicate	4	5	1	2	3	4	5
					Date Sampled	23-Aug-12	23-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6141.2-49	6141.2-50	6141.2-31	6141.2-32	6141.2-33	6141.2-34	6141.2-35
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**							
Acari	Arachnida	Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.							
			Hygrobatidae	*Hygrobates*	*Hygrobates* sp.							
			Lebertiidae	*Lebertia*	*Lebertia* sp.		57.7					
			Oxidae	*Oxus*	*Oxus* sp.							
			Pionidae	Undetermined	Pionidae							
		Undetermined	Undetermined	Undetermined	Acari							
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae							
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae	807.9	230.8	72.1		101.0	259.7	57.7
		Tubificida	Naididae	*Nais*	*Nais* sp.							
				Specaria	*Specaria josinae*							
				Vejdovskyella	*Vejdovskyella comata*							
			Tubificidae	*Psammoryctides*	*Psammoryctides californianus*						14.4	
				Rhyacodrilus	*Rhyacodrilus coccineus*							
				Undetermined	Tubificidae w/ cap setae	1038.8	57.7	230.8	72.1	144.3	432.8	86.6
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.			389.5	158.7	447.3	158.7	158.7
				Undetermined	Sphaeriidae			375.1	115.4	173.1	86.6	245.3
				Sphaerium	*Sphaerium* sp.					14.4		
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Stictotarsus*	*Stictotarsus* sp.					14.4		
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera			43.3		14.4	14.4	14.4
	Malacostraca	Amphipoda	Gammaridae	*Gammarus*	*Gammarus* sp.							
	Maxillopoda	Calanoida	Undetermined	Undetermined	Calanoida							
		Cyclopoida	Undetermined	Undetermined	Cyclopoida			14.4				
	Ostracoda	Ostracoda	Undetermined	Undetermined	Ostracoda	807.9	577.1	28.9	14.4	14.4	14.4	
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.							
			Empididae	Undetermined	Empididae							
			Muscidae	Undetermined	Muscidae							
			Tabanidae	*Chrysops*	*Chrysops* sp.							
			Tipulidae	*Tipula*	*Tipula* sp.							
			Undetermined	Undetermined	Diptera		57.7					
			Chironomidae	*Abiskomyia*	*Abiskomyia* sp.							
				Ablabesmyia	*Ablabesmyia* (Karelia) sp.			14.4		14.4	14.4	57.7
				Ablabesmyia	*Ablabesmyia* sp.	115.4						
				Undetermined	Chironomini							
				Chironomus	*Chironomus* sp.		57.7					
				Cladopelma	*Cladopelma* sp.		57.7	86.6		43.3	14.4	57.7
				Cladotanytarsus	*Cladotanytarsus* sp.							
				Corynocera	*Corynocera* sp.							
				Corynoneura	*Corynoneura* sp.							
				Cricotopus	*Cricotopus* sp.							
				Cryptochironomus	*Cryptochironomus* sp.	115.4	404.0	14.4	14.4	86.6	14.4	28.9
				Demicryptochironomus	*Demicryptochironomus* sp.							
				Dicrotendipes	*Dicrotendipes fumidus*	115.4		101.0	28.9	57.7		57.7
				Dicrotendipes	*Dicrotendipes* sp.			28.9				14.4
				Glyptotendipes	*Glyptotendipes* sp.			14.4				
				Heterotanytarsus	*Heterotanytarsus* sp.							
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*							
				Hydrobaenus	*Hydrobaenus* sp.			14.4				
				Micropsectra	*Micropsectra* sp.							
				Microtendipes	*Microtendipes pedellus gr.*							28.9
				Monodiamesa	*Monodiamesa* sp.							

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	George	George	George	George	George	George	George
					Lake	Lytle	Lytle	Occurrence	Occurrence	Occurrence	Occurrence	Occurrence
					Replicate	4	5	1	2	3	4	5
					Date Sampled	23-Aug-12	23-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6141.2-49	6141.2-50	6141.2-31	6141.2-32	6141.2-33	6141.2-34	6141.2-35
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**							
				Undetermined	Orthocladiinae							
				Orthocladius	Orthocladius Complex							
				Pagastiella	*Pagastiella sp.*							
				Parachironomus	*Parachironomus* sp.							
				Paracladius	*Paracladius sp.*							
				Parakiefferiella	*Parakiefferiella* sp.							
				Paratanytarsus	*Paratanytarsus* sp.	29432.1	20371.7	634.8	72.1	331.8	129.8	245.3
				Polypedilum	*Polypedilum halterale gr.*							
				Polypedilum	*Polypedilum scalaenum gr.*							
				Polypedilum	*Polypedilum* sp.							
				Potthastia	*Potthastia longimana gr.*							
				Procladius	*Procladius* sp.	1962.1	577.1	129.8	72.1	115.4	72.1	173.1
				Protanypus	*Protanypus* sp.							
				Psectrocladius	*Psectrocladius* sp.	1154.2	115.4	144.3	14.4	28.9	43.3	57.7
				Pseudosmittia	*Pseudosmittia* sp.							
				Sergentia	*Sergentia* sp.							
				Stempellinella	*Stempellinella* sp.							
				Stictochironomus	*Stictochironomus* sp.	115.4						14.4
				Undetermined	Tanytarsini	115.4	230.8					
				Tanytarsus	*Tanytarsus* sp.	807.9	346.3	43.3		14.4	101.0	101.0
				Thienemannimyia	*Thienemannimyia* gr. sp.							
				Zalutschia	*Zalutschia* sp.			14.4				
Gastropoda	Gastropoda	Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*			28.9		43.3		28.9
				Valvata	*Valvata* sp.					43.3		14.4
Other Organisms	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda		57.7	43.3	28.9		158.7	43.3
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria		57.7					
Trichoptera	Insecta	Trichoptera	Hydroptilidae	*Agraylea*	*Agraylea* sp.							
			Limnephilidae	*Grensia*	*Grensia praeterita*							
				Undetermined	Limnephilidae							
				Limnephilus	*Limnephilus* sp.							
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.							
					TOTAL	**36588.2**	**23257.2**	**2467.1**	**591.5**	**1702.4**	**1529.3**	**1486.0**

Note: Only four replicates were collected at Giraffe South as substrate made it difficult to get complete Ekman grabs.

Nematodes, copepods or cladocerans were excluded from analyses.

Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	George	George	George	George	George	George	George	George
					Lake	Sleigh	Sleigh	Sleigh	Sleigh	Sleigh	Dragon	Dragon	Dragon
					Replicate	1	2	3	4	5	1	2	3
					Date Sampled	22-Aug-12	22-Aug-12	22-Aug-12	22-Aug-12	22-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6141.2-41	6141.2-42	6141.2-43	6141.2-44	6141.2-45	6141.2-16	6141.2-17	6141.2-18
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**								
Acari	Arachnida	Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.				14.4				
			Hygrobatidae	*Hygrobates*	*Hygrobates* sp.								
			Lebertiidae	*Lebertia*	*Lebertia* sp.		14.4	14.4			76.8	72.1	101.0
			Oxidae	*Oxus*	*Oxus* sp.						19.2		
			Pionidae	Undetermined	Pionidae								
		Undetermined	Undetermined	Undetermined	Acari							14.4	28.9
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae		14.4						
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae	28.9	72.1	57.7	28.9	28.9	76.8	43.3	43.3
		Tubificida	Naididae	*Nais*	*Nais* sp.								
				Specaria	*Specaria josinae*								
				Vejdovskyella	*Vejdovskyella comata*								
			Tubificidae	*Psammoryctides*	*Psammoryctides californianus*								
				Rhyacodrilus	*Rhyacodrilus coccineus*								
				Undetermined	Tubificidae w/ cap setae	43.3	14.4	28.9	187.6	14.4	19.2		57.7
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.						1151.3	822.4	1154.2
				Undetermined	Sphaeriidae						1074.5	793.5	476.1
				Sphaerium	*Sphaerium* sp.						38.4	14.4	14.4
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Stictotarsus*	*Stictotarsus* sp.								
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera	28.9	14.4	14.4			844.3	331.8	562.7
	Malacostraca	Amphipoda	Gammaridae	*Gammarus*	*Gammarus* sp.								
	Maxillopoda	Calanoida	Undetermined	Undetermined	Calanoida								
		Cyclopoida	Undetermined	Undetermined	Cyclopoida	14.4	43.3				153.5	86.6	28.9
	Ostracoda	Ostracoda	Undetermined	Undetermined	Ostracoda	28.9		14.4		288.6	1573.4	1399.5	1197.5
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.			14.4	14.4				
			Empididae	Undetermined	Empididae	28.9	28.9	158.7		14.4			
			Muscidae	Undetermined	Muscidae								
			Tabanidae	*Chrysops*	*Chrysops* sp.								
			Tipulidae	*Tipula*	*Tipula* sp.		14.4	14.4		28.9			
			Undetermined	Undetermined	Diptera								14.4
			Chironomidae	*Abiskomyia*	*Abiskomyia* sp.								
				Ablabesmyia	*Ablabesmyia* (Karelia) sp.	28.9	28.9	14.4				14.4	
				Ablabesmyia	*Ablabesmyia* sp.						191.9	245.3	259.7
				Undetermined	Chironomini			14.4					
				Chironomus	*Chironomus* sp.								
				Cladopelma	*Cladopelma* sp.			14.4			153.5	115.4	158.7
				Cladotanytarsus	*Cladotanytarsus* sp.		28.9			43.3			
				Corynocera	*Corynocera* sp.						115.1	57.7	57.7
				Corynoneura	*Corynoneura* sp.								
				Cricotopus	*Cricotopus* sp.	14.4	28.9	28.9	57.7	28.9			
				Cryptochironomus	*Cryptochironomus* sp.	57.7	43.3	14.4	14.4	28.9		72.1	43.3
				Demicryptochironomus	*Demicryptochironomus* sp.					28.9			
				Dicrotendipes	*Dicrotendipes fumidus*	28.9		14.4					
				Dicrotendipes	*Dicrotendipes* sp.		28.9			43.3			
				Glyptotendipes	*Glyptotendipes* sp.								
				Heterotanytarsus	*Heterotanytarsus* sp.								
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*								
				Hydrobaenus	*Hydrobaenus* sp.				14.4				
				Micropsectra	*Micropsectra* sp.	14.4							
				Microtendipes	*Microtendipes pedellus gr.*								
				Monodiamesa	*Monodiamesa* sp.						19.2	28.9	28.9

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2													
Taxonomic Classification:						Area	George	George	George	George	George	George	George	George
						Lake	Sleigh	Sleigh	Sleigh	Sleigh	Sleigh	Dragon	Dragon	Dragon
						Replicate	1	2	3	4	5	1	2	3
						Date Sampled	22-Aug-12	22-Aug-12	22-Aug-12	22-Aug-12	22-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12
						Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
						EcoAnalysts Sample ID	6141.2-41	6141.2-42	6141.2-43	6141.2-44	6141.2-45	6141.2-16	6141.2-17	6141.2-18
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**									
				Undetermined	Orthocladiinae									
				Orthocladius	Orthocladius Complex									
				Pagastiella	*Pagastiella sp.*							153.5	86.6	72.1
				Parachironomus	*Parachironomus* sp.			14.4						
				Paracladius	*Paracladius sp.*									
				Parakiefferiella	*Parakiefferiella* sp.			14.4		57.7	28.9			
				Paratanytarsus	*Paratanytarsus* sp.		1673.6	1500.5	2611.4	1413.9	1139.8		57.7	57.7
				Polypedilum	*Polypedilum halterale gr.*									
				Polypedilum	*Polypedilum scalaenum gr.*									
				Polypedilum	*Polypedilum* sp.									
				Potthastia	*Potthastia longimana gr.*						14.4			
				Procladius	*Procladius* sp.		28.9	57.7	101.0	43.3	245.3	901.8	1053.2	851.2
				Protanypus	*Protanypus* sp.									
				Psectrocladius	*Psectrocladius* sp.		86.6	57.7	144.3	43.3	14.4	95.9	28.9	28.9
				Pseudosmittia	*Pseudosmittia* sp.									
				Sergentia	*Sergentia* sp.									
				Stempellinella	*Stempellinella* sp.									
				Stictochironomus	*Stictochironomus* sp.		28.9	28.9		101.0	490.5	537.3	230.8	389.5
				Undetermined	Tanytarsini					14.4				
				Tanytarsus	*Tanytarsus* sp.		115.4	72.1	86.6	404.0	158.7			
				Thienemannimyia	*Thienemannimyia* gr. sp.		14.4				14.4	19.2		14.4
				Zalutschia	*Zalutschia* sp.		72.1	202.0	72.1	43.3	14.4			
Gastropoda	Gastropoda	Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*			72.1	14.4	14.4				
				Valvata	*Valvata* sp.			14.4	14.4			19.2		
Other Organisms	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda						14.4	19.2		57.7
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria					14.4				14.4
Trichoptera	Insecta	Trichoptera	Hydroptilidae	*Agraylea*	*Agraylea* sp.									
			Limnephilidae	*Grensia*	*Grensia praeterita*									28.9
				Undetermined	Limnephilidae							19.2	14.4	
				Limnephilus	*Limnephilus* sp.									
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.									
						TOTAL	**2337.3**	**2409.4**	**3462.6**	**2481.5**	**2683.5**	**7272.3**	**5583.4**	**5742.2**

Note: Only four replicates were collected at Giraffe South as substrate made it difficult to get complete Ekman grabs.

Nematodes, copepods or cladocerans were excluded from analyses.

Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	George	George	George	George	George	George	George
					Lake	Dragon	Dragon	Komatic	Komatic	Komatic	Komatic	Komatic
					Replicate	4	5	1	2	3	4	5
					Date Sampled	20-Aug-12	20-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6141.2-19	6141.2-20	6141.2-21	6141.2-22	6141.2-23	6141.2-24	6141.2-25
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**							
Acari	Arachnida	Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.							
			Hygrobatidae	*Hygrobates*	*Hygrobates* sp.							
			Lebertiidae	*Lebertia*	*Lebertia* sp.	49.3	202.0	115.4	173.1			38.5
			Oxidae	*Oxus*	*Oxus* sp.	16.4						
			Pionidae	Undetermined	Pionidae							
		Undetermined	Undetermined	Undetermined	Acari							
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae							
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae	32.9	144.3		28.9		192.6	38.5
		Tubificida	Naididae	*Nais*	*Nais* sp.							
				Specaria	*Specaria josinae*							
				Vejdovskyella	*Vejdovskyella comata*							
			Tubificidae	*Psammoryctides*	*Psammoryctides californianus*							
				Rhyacodrilus	*Rhyacodrilus coccineus*				28.9			
				Undetermined	Tubificidae w/ cap setae	49.3	28.9					38.5
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.	1299.3	2250.7	1356.2	1183.1	2157.4	1964.8	577.9
				Undetermined	Sphaeriidae	526.3	923.4	865.7	1298.5	577.9	1040.2	77.0
				Sphaerium	*Sphaerium* sp.	65.8			86.6	38.5	38.5	38.5
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Stictotarsus*	*Stictotarsus* sp.							
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera	937.5	1067.6		57.7		38.5	38.5
	Malacostraca	Amphipoda	Gammaridae	*Gammarus*	*Gammarus* sp.							
	Maxillopoda	Calanoida	Undetermined	Undetermined	Calanoida							
		Cyclopoida	Undetermined	Undetermined	Cyclopoida	115.1	28.9				38.5	
	Ostracoda	Ostracoda	Undetermined	Undetermined	Ostracoda	1348.7	2164.1	432.8	865.7	732.0	847.5	154.1
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.							
			Empididae	Undetermined	Empididae					38.5	38.5	
			Muscidae	Undetermined	Muscidae							
			Tabanidae	*Chrysops*	*Chrysops* sp.							
			Tipulidae	*Tipula*	*Tipula* sp.							
			Undetermined	Undetermined	Diptera							
			Chironomidae	*Abiskomyia*	*Abiskomyia* sp.			375.1	259.7	346.7	346.7	154.1
				Ablabesmyia	*Ablabesmyia* (Karelia) sp.	32.9	28.9					
				Ablabesmyia	*Ablabesmyia* sp.	82.2	375.1	57.7		115.6	154.1	
				Undetermined	Chironomini							
				Chironomus	*Chironomus* sp.							
				Cladopelma	*Cladopelma* sp.	98.7	202.0	28.9		38.5	38.5	
				Cladotanytarsus	*Cladotanytarsus* sp.	16.4	57.7					38.5
				Corynocera	*Corynocera* sp.	213.8	894.5	2366.1	663.7	2311.5	4122.1	4507.4
				Corynoneura	*Corynoneura* sp.							
				Cricotopus	*Cricotopus* sp.	16.4	86.6	28.9	28.9	38.5		77.0
				Cryptochironomus	*Cryptochironomus* sp.	32.9	202.0		115.4		154.1	38.5
				Demicryptochironomus	*Demicryptochironomus* sp.							
				Dicrotendipes	*Dicrotendipes fumidus*							
				Dicrotendipes	*Dicrotendipes* sp.			28.9				
				Glyptotendipes	*Glyptotendipes* sp.							
				Heterotanytarsus	*Heterotanytarsus* sp.							
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*			86.6			38.5	38.5
				Hydrobaenus	*Hydrobaenus* sp.							
				Micropsectra	*Micropsectra* sp.			1731.3	144.3	2080.3	2850.8	2966.4
				Microtendipes	*Microtendipes pedellus gr.*			1125.3	2337.3	1772.1	924.6	1810.7
				Monodiamesa	*Monodiamesa* sp.		28.9			77.0		

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2													
Taxonomic Classification:						Area	George	George	George	George	George	George	George
						Lake	Dragon	Dragon	Komatic	Komatic	Komatic	Komatic	Komatic
						Replicate	4	5	1	2	3	4	5
						Date Sampled	20-Aug-12	20-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12
						Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07
						EcoAnalysts Sample ID	6141.2-19	6141.2-20	6141.2-21	6141.2-22	6141.2-23	6141.2-24	6141.2-25
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**								
				Undetermined	Orthocladiinae								
				Orthocladius	Orthocladius Complex								
				Pagastiella	*Pagastiella sp.*		32.9	86.6	28.9	57.7			
				Parachironomus	*Parachironomus* sp.				28.9				
				Paracladius	*Paracladius sp.*								
				Parakiefferiella	*Parakiefferiella* sp.								
				Paratanytarsus	*Paratanytarsus* sp.		65.8	115.4					
				Polypedilum	*Polypedilum halterale gr.*								
				Polypedilum	*Polypedilum scalaenum gr.*				28.9	28.9		38.5	38.5
				Polypedilum	*Polypedilum* sp.								
				Potthastia	*Potthastia longimana gr.*								
				Procladius	*Procladius* sp.		871.7	1009.9	202.0	202.0	231.1	231.1	346.7
				Protanypus	*Protanypus* sp.				115.4	173.1	77.0	77.0	
				Psectrocladius	*Psectrocladius* sp.		49.3	86.6	115.4	86.6		115.6	115.6
				Pseudosmittia	*Pseudosmittia* sp.								
				Sergentia	*Sergentia* sp.								
				Stempellinella	*Stempellinella* sp.								
				Stictochironomus	*Stictochironomus* sp.		756.6	692.5	1038.8	1327.3	1579.5	886.1	1001.6
				Undetermined	Tanytarsini				404.0	461.7	192.6	192.6	
				Tanytarsus	*Tanytarsus* sp.			28.9			231.1	192.6	154.1
				Thienemannimyia	*Thienemannimyia* gr. sp.			28.9					38.5
				Zalutschia	*Zalutschia* sp.				86.6	173.1	77.0	38.5	77.0
Gastropoda	Gastropoda	Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*			28.9				38.5	
				Valvata	*Valvata* sp.				28.9				
Other Organisms	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda			28.9	28.9				38.5
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria				28.9	144.3	38.5	77.0	
Trichoptera	Insecta	Trichoptera	Hydroptilidae	*Agraylea*	*Agraylea* sp.								
			Limnephilidae	*Grensia*	*Grensia praeterita*								
				Undetermined	Limnephilidae								
				Limnephilus	*Limnephilus* sp.								
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.								
						TOTAL	**6710.5**	**10791.8**	**10734.1**	**9926.1**	**12751.7**	**14716.5**	**12443.5**

Note: Only four replicates were collected at Giraffe South as substrate made it difficult to get complete Ekman grabs.

Nematodes, copepods or cladocerans were excluded from analyses.

Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	George	George	George	George	George
					Lake	Reference C	Reference C	Reference C	Reference C	Reference C
					Replicate	1	2	3	4	5
					Date Sampled	22-Aug-12	22-Aug-12	22-Aug-12	22-Aug-12	22-Aug-12
					Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07
Taxonomic Classification:					EcoAnalysts Sample ID	6141.2-36	6141.2-37	6141.2-38	6141.2-39	6141.2-40
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**					
Acari	Arachnida	Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.					
			Hygrobatidae	*Hygrobates*	*Hygrobates* sp.					
			Lebertiidae	*Lebertia*	*Lebertia* sp.	14.4				
			Oxidae	*Oxus*	*Oxus* sp.					
			Pionidae	Undetermined	Pionidae					
		Undetermined	Undetermined	Undetermined	Acari					
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae					
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae					
		Tubificida	Naididae	*Nais*	*Nais* sp.					
				Specaria	*Specaria josinae*					
				Vejdovskyella	*Vejdovskyella comata*					
			Tubificidae	*Psammoryctides*	*Psammoryctides californianus*					
				Rhyacodrilus	*Rhyacodrilus coccineus*	14.4				
				Undetermined	Tubificidae w/ cap setae	43.3		43.3		14.4
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.	303.0	129.8	144.3	57.7	158.7
				Undetermined	Sphaeriidae	317.4	303.0	72.1	57.7	144.3
				Sphaerium	*Sphaerium* sp.					
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Stictotarsus*	*Stictotarsus* sp.					
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera	14.4				
	Malacostraca	Amphipoda	Gammaridae	*Gammarus*	*Gammarus* sp.					
	Maxillopoda	Calanoida	Undetermined	Undetermined	Calanoida					
		Cyclopoida	Undetermined	Undetermined	Cyclopoida				14.4	28.9
	Ostracoda	Ostracoda	Undetermined	Undetermined	Ostracoda				43.3	
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.					
			Empididae	Undetermined	Empididae					
			Muscidae	Undetermined	Muscidae					
			Tabanidae	*Chrysops*	*Chrysops* sp.					
			Tipulidae	*Tipula*	*Tipula* sp.					
			Undetermined	Undetermined	Diptera					
			Chironomidae	*Abiskomyia*	*Abiskomyia* sp.	28.9	14.4		14.4	
				Ablabesmyia	*Ablabesmyia* (Karelia) sp.					
				Ablabesmyia	*Ablabesmyia* sp.					
				Undetermined	Chironomini					
				Chironomus	*Chironomus* sp.					
				Cladopelma	*Cladopelma* sp.					
				Cladotanytarsus	*Cladotanytarsus* sp.					
				Corynocera	*Corynocera* sp.					
				Corynoneura	*Corynoneura* sp.					
				Cricotopus	*Cricotopus* sp.					
				Cryptochironomus	*Cryptochironomus* sp.					
				Demicryptochironomus	*Demicryptochironomus* sp.					
				Dicrotendipes	*Dicrotendipes fumidus*					
				Dicrotendipes	*Dicrotendipes* sp.					
				Glyptotendipes	*Glyptotendipes* sp.					
				Heterotanytarsus	*Heterotanytarsus* sp.					
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*					
				Hydrobaenus	*Hydrobaenus* sp.					
				Micropsectra	*Micropsectra* sp.		14.4		14.4	
				Microtendipes	*Microtendipes pedellus gr.*					
				Monodiamesa	*Monodiamesa* sp.	28.9		14.4	57.7	

Appendix 3.7-5. Lake Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2										
Taxonomic Classification:										
Area						**George**	**George**	**George**	**George**	**George**
Lake						**Reference C**	**Reference C**	**Reference C**	**Reference C**	**Reference C**
Replicate						**1**	**2**	**3**	**4**	**5**
Date Sampled						**22-Aug-12**	**22-Aug-12**	**22-Aug-12**	**22-Aug-12**	**22-Aug-12**
Surface Area Sampled (m^2)						**0.07**	**0.07**	**0.07**	**0.07**	**0.07**
EcoAnalysts Sample ID						**6141.2-36**	**6141.2-37**	**6141.2-38**	**6141.2-39**	**6141.2-40**
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**					
				Undetermined	Orthocladiinae					
				Orthocladius	Orthocladius Complex					
				Pagastiella	*Pagastiella sp.*					
				Parachironomus	*Parachironomus* sp.					
				Paracladius	*Paracladius sp.*					
				Parakiefferiella	*Parakiefferiella* sp.					
				Paratanytarsus	*Paratanytarsus* sp.					
				Polypedilum	*Polypedilum halterale gr.*					
				Polypedilum	*Polypedilum scalaenum gr.*					
				Polypedilum	*Polypedilum* sp.					
				Potthastia	*Potthastia longimana gr.*					
				Procladius	*Procladius* sp.	14.4		57.7	28.9	43.3
				Protanypus	*Protanypus* sp.					28.9
				Psectrocladius	*Psectrocladius* sp.					
				Pseudosmittia	*Pseudosmittia* sp.					
				Sergentia	*Sergentia* sp.					
				Stempellinella	*Stempellinella* sp.					
				Stictochironomus	*Stictochironomus* sp.	86.6	57.7	202.0	317.4	28.9
				Undetermined	Tanytarsini					
				Tanytarsus	*Tanytarsus* sp.	14.4		14.4		
				Thienemannimyia	*Thienemannimyia* gr. sp.					
				Zalutschia	*Zalutschia* sp.				14.4	
Gastropoda	Gastropoda	Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*					
				Valvata	*Valvata* sp.					
Other Organisms	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda		57.7		28.9	43.3	57.7
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria					
Trichoptera	Insecta	Trichoptera	Hydroptilidae	*Agraylea*	*Agraylea* sp.					
			Limnephilidae	*Grensia*	*Grensia praeterita*					
				Undetermined	Limnephilidae					
				Limnephilus	*Limnephilus* sp.					
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.					
					TOTAL	**937.8**	**519.4**	**577.1**	**663.7**	**505.0**

Note: Only four replicates were collected at Giraffe South as substrate made it difficult to get complete Ekman grabs.
Nematodes, copepods or cladocerans were excluded from analyses.
Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-6

Lake Benthos Richness and Diversity Results, Back River Project, 2012

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Appendix 3.7-6. Lake Benthos Richness and Diversity Results, Back River Project, 2012

Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location	Gander	Gander	Gander	Gander	Gander	Pond 19	Pond 19	Pond 19	Pond 19	Pond 19	Big	Big	Big	Big	Big	Rabbit	Rabbit	Rabbit	Rabbit	Rabbit	Fox	Fox	Fox	Fox	Fox
Replicate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Date Sampled	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	16-Aug-12	16-Aug-12	16-Aug-12	16-Aug-12	16-Aug-12	15-Aug-12	15-Aug-12	15-Aug-12	15-Aug-12	15-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12
Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Eco Analysts Sample ID	6138.2-26	6138.2-27	6138.2-28	6138.2-29	6138.2-30	6138.2-45	6138.2-46	6138.2-47	6138.2-48	6138.2-49	6138.2-16	6138.2-17	6138.2-18	6138.2-19	6138.2-20	6138.2-6	6138.2-7	6138.2-8	6138.2-9	6138.2-10	6138.2-40	6138.2-41	6138.2-42	6138.2-43	6138.2-44
Family Richness (# families)	9	7	7	5	7	3	4	6	6	5	3	4	6	6	5	5	7	7	6	7	5	6	5	5	5
Simpson's Diversity Index	0.64	0.54	0.54	0.54	0.53	0.24	0.10	0.11	0.29	0.12	0.39	0.46	0.53	0.51	0.47	0.26	0.34	0.48	0.33	0.32	0.57	0.59	0.51	0.56	0.57

Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Location	Rascal	Rascal	Rascal	Rascal	Rascal	Giraffe North	Giraffe North	Giraffe North	Giraffe North	Giraffe North	Giraffe South	Giraffe South	Giraffe South	Giraffe South	Neck	Neck	Neck	Neck	Neck	Central	Central	Central	Central	Central	
Replicate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	1	2	3	4	5	1	2	3	4	5	
Date Sampled	15-Aug-12	15-Aug-12	15-Aug-12	8-Aug-12	15-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	14-Aug-12	14-Aug-12	14-Aug-12	14-Aug-12	14-Aug-12	17-Aug-12	17-Aug-12	17-Aug-12	17-Aug-12	17-Aug-12	
Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	
Eco Analysts Sample ID	6138.2-11	6138.2-12	6138.2-13	6138.2-14	6138.2-15	6138.2-31	6138.2-32	6138.2-33	6138.2-34	6138.2-35	6138.2-36	6138.2-37	6138.2-38	6138.2-39	6138.2-1	6138.2-2	6138.2-3	6138.2-4	6138.2-5	6138.2-21	6138.2-22	6138.2-23	6138.2-24	6138.2-25	
Family Richness (# families)	6	6	6	7	7	5	5	5	6	5	4	7	5	8	8	5	5	5	6	8	6	6	6	6	
Simpson's Diversity Index	0.24	0.19	0.20	0.18	0.16	0.36	0.41	0.46	0.41	0.53	0.59	0.56	0.55	0.70	0.39	0.30	0.28	0.29	0.24	0.47	0.48	0.39	0.45	0.43	

Area	Goose	Goose	Goose	Goose	Goose	George	George	George	George	George	George	George	George	George	George	George	George	George	George	George	George	George	George	George	George
Location	Propellor	Propellor	Propellor	Propellor	Propellor	Lower Long	Lower Long	Lower Long	Lower Long	Lower Long	Fold	Fold	Fold	Fold	Fold	George South	George South	George South	George South	George South	George Central	George Central	George Central	George Central	George Central
Replicate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Date Sampled	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	19-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12	18-Aug-12
Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Eco Analysts Sample ID	6138.2-50	6138.2-51	6138.2-52	6138.2-53	6138.2-54	6141.2-26	6141.2-27	6141.2-28	6141.2-29	6141.2-30	6141.2-11	6141.2-12	6141.2-13	6141.2-14	6141.2-15	6141.2-1	6141.2-2	6141.2-3	6141.2-4	6141.2-5	6141.2-6	6141.2-7	6141.2-8	6141.2-9	6141.2-10
Family Richness (# families)	5	7	4	7	5	4	3	5	5	2	6	6	6	5	5	6	6	7	8	6	8	8	7	8	6
Simpson's Diversity Index	0.18	0.24	0.17	0.28	0.19	0.48	0.48	0.59	0.53	0.50	0.54	0.29	0.32	0.48	0.49	0.37	0.44	0.47	0.39	0.43	0.44	0.55	0.56	0.60	0.60

Area	George	George	George	George	George	George	George	George	George	George	George	George	George	George	George	George	George	George	George	George
Location	Lytle	Lytle	Lytle	Lytle	Lytle	Occurrence	Occurrence	Occurrence	Occurrence	Occurrence	Sleigh	Sleigh	Sleigh	Sleigh	Sleigh	Dragon	Dragon	Dragon	Dragon	Dragon
Replicate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Date Sampled	23-Aug-12	23-Aug-12	23-Aug-12	23-Aug-12	23-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	22-Aug-12	22-Aug-12	22-Aug-12	22-Aug-12	22-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12	20-Aug-12
Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Eco Analysts Sample ID	6141.2-46	6141.2-47	6141.2-48	6141.2-49	6141.2-50	6141.2-31	6141.2-32	6141.2-33	6141.2-34	6141.2-35	6141.2-41	6141.2-42	6141.2-43	6141.2-44	6141.2-45	6141.2-16	6141.2-17	6141.2-18	6141.2-19	6141.2-20
Family Richness (# families)	6	6	3	3	4	5	3	6	4	5	4	8	8	6	5	8	5	6	6	6
Simpson's Diversity Index	0.10	0.12	0.09	0.10	0.03	0.60	0.60	0.67	0.73	0.57	0.09	0.20	0.17	0.18	0.07	0.55	0.53	0.55	0.53	0.55

Area	George	George	George	George	George	George	George	George	George	George
Location	Komatic	Komatic	Komatic	Komatic	Komatic	Reference C	Reference C	Reference C	Reference C	Reference C
Replicate	1	2	3	4	5	1	2	3	4	5
Date Sampled	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	21-Aug-12	22-Aug-12	22-Aug-12	22-Aug-12	22-Aug-12	22-Aug-12
Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Eco Analysts Sample ID	6141.2-21	6141.2-22	6141.2-23	6141.2-24	6141.2-25	6141.2-36	6141.2-37	6141.2-38	6141.2-39	6141.2-40
Family Richness (# families)	4	5	3	5	5	4	2	3	2	3
Simpson's Diversity Index	0.36	0.45	0.36	0.38	0.12	0.44	0.28	0.56	0.33	0.42

Note: Only four replicates were collected at Giraffe South as substrate made it difficult to get complete Ekman grabs.

Nematodes, copepods or cladocerans were excluded from analyses.

Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-7

Lake Benthos QA/QC Results, Back River Project, 2012

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Appendix 3.7-7. Lake Benthos QA/QC Results, Back River Project, 2012

EcoA ANALYSTS, INC.

EcoA Sample ID	Sample ID	Replicate	Collection Date	Sorter	Sort Date	Primary Matrix	Estimated Pre-Rinse Volume (L)	Estimated Post-Rinse Volume (L)	QC Sorter	QC Date	Estimated % Recovery 1	Estimated % Recovery 2	Estimated % Recovery3
6138.2-1	Goose Lake Neck	1	14-Aug-12	Laurie Flaherty	09/24/12	Fine Organic	0.06	0.04	Zach Meier	09/27/12	100.00	N/A	N/A
6138.2-2	Goose Lake Neck	2	14-Aug-12	Laura Mills	09/24/12	Coarse Organic	0.21	0.05	Zach Meier	09/26/12	100.00	N/A	N/A
6138.2-3	Goose Lake Neck	3	14-Aug-12	Angela Eagleston	09/24/12	Fine Organic	0.15	0.15	Nora Williams	09/27/12	89.84	N/A	N/A
6138.2-4	Goose Lake Neck	4	14-Aug-12	Nora Williams	09/24/12	Inorganic	0.13	0.05	Zach Meier	09/26/12	100.00	N/A	N/A
6138.2-5	Goose Lake Neck	5	14-Aug-12	Nora Williams	09/24/12	Filamentous Algae	0.10	0.04	Zach Meier	09/26/12	100.00	N/A	N/A
6138.2-6	Rabbit Lake	1	15-Aug-12	Ben Alexander	09/25/12	Coarse Organic	0.13	0.06	Zach Meier	09/26/12	100.00	N/A	N/A
6138.2-7	Rabbit Lake	2	15-Aug-12	Angela Eagleston	09/24/12	Fine Organic	0.11	0.11	Zach Meier	09/27/12	100.00	N/A	N/A
6138.2-8	Rabbit Lake	3	15-Aug-12	Laurie Flaherty	09/24/12	Fine Organic	0.05	0.04	Zach Meier	09/26/12	100.00	N/A	N/A
6138.2-9	Rabbit Lake	4	15-Aug-12	Angela Eagleston	09/25/12	Fine Organic	0.13	0.13	Zach Meier	09/26/12	99.00	N/A	N/A
6138.2-10	Rabbit Lake	5	15-Aug-12	Nora Williams	09/25/12	Filamentous Algae	0.25	0.10	Zach Meier	09/26/12	100.00	N/A	N/A
6138.2-11	Rascal Lake	1	15-Aug-12	Allie Pfeiffer	09/26/12	Vegetation	0.23	0.05	Zach Meier	09/27/12	100.00	N/A	N/A
6138.2-12	Rascal Lake	2	15-Aug-12	Ben Alexander	09/25/12	Coarse Organic	0.33	0.10	Zach Meier	09/26/12	100.00	N/A	N/A
6138.2-13	Rascal Lake	3	15-Aug-12	Laura Mills	09/25/12	Coarse Organic	0.25	0.02	Zach Meier	09/26/12	100.00	N/A	N/A
6138.2-14	Rascal Lake	4	15-Aug-12	Laura Mills	09/25/12	Coarse Organic	0.32	0.02	Zach Meier	09/26/12	100.00	N/A	N/A
6138.2-15	Rascal Lake	5	15-Aug-12	Laura Mills	09/25/12	Coarse Organic	0.40	0.03	Zach Meier	09/26/12	100.00	N/A	N/A
6138.2-16	Big Lake	1	16-Aug-12	Angela Eagleston	09/25/12	Fine Organic	0.25	0.25	Zach Meier	09/27/12	100.00	N/A	N/A
6138.2-17	Big Lake	2	16-Aug-12	Laura Mills	09/25/12	Coarse Organic	0.20	0.03	Zach Meier	09/27/12	100.00	N/A	N/A
6138.2-18	Big Lake	3	16-Aug-12	Amanda Thompson	09/26/12	Fine Organic	0.08	0.03	Zach Meier	09/26/12	100.00	N/A	N/A
6138.2-19	Big Lake	4	16-Aug-12	Nora Williams	09/25/12	Fine Organic	0.20	0.01	Zach Meier	09/26/12	100.00	N/A	N/A
6138.2-20	Big Lake	5	16-Aug-12	Angela Eagleston	09/26/12	Fine Organic	0.12	0.12	Zach Meier	09/26/12	100.00	N/A	N/A
6138.2-21	Goose Lake Central	1	17-Aug-12	Nora Williams	09/27/12	Filamentous Algae	0.25	0.10	Zach Meier	09/27/12	100.00	N/A	N/A
6138.2-22	Goose Lake Central	2	17-Aug-12	Angela Eagleston	09/27/12	Fine Organic	0.30	0.30	Zach Meier	09/27/12	96.33	N/A	N/A
6138.2-23	Goose Lake Central	3	17-Aug-12	Laura Mills	09/26/12	Coarse Organic	0.25	0.05	Zach Meier	09/27/12	100.00	N/A	N/A
6138.2-24	Goose Lake Central	4	17-Aug-12	Steven Little	09/26/12	Coarse Organic	0.08	0.04	Zach Meier	09/26/12	100.00	N/A	N/A
6138.2-25	Goose Lake Central	5	17-Aug-12	Laura Mills	09/26/12	Coarse Organic	0.25	0.05	Zach Meier	09/26/12	100.00	N/A	N/A
6138.2-26	Gander Lake	1	18-Aug-12	Steven Little	09/26/12	Coarse Organic	0.08	0.02	Zach Meier	09/26/12	100.00	N/A	N/A
6138.2-27	Gander Lake	2	18-Aug-12	Laura Mills	09/26/12	Coarse Organic	0.35	0.10	Zach Meier	09/26/12	100.00	N/A	N/A
6138.2-28	Gander Lake	3	18-Aug-12	Amanda Thompson	09/28/12	Vegetation	0.08	0.05	Megan Payne	09/28/12	93.91	N/A	N/A
6138.2-29	Gander Lake	4	18-Aug-12	Steven Little	09/26/12	Coarse Organic	0.08	0.01	Zach Meier	09/27/12	100.00	N/A	N/A
6138.2-30	Gander Lake	5	18-Aug-12	Steven Little	09/27/12	Coarse Organic	0.08	0.04	Zach Meier	09/27/12	100.00	N/A	N/A
6138.2-31	Giraffe Lake North - shallow	1	19-Aug-12	Angela Eagleston	09/27/12	Fine Organic	0.20	0.20	Zach Meier	09/27/12	98.50	N/A	N/A
6138.2-32	Giraffe Lake North - shallow	2	19-Aug-12	Steven Little	09/27/12	Coarse Organic	0.10	0.01	Zach Meier	09/27/12	100.00	N/A	N/A
6138.2-33	Giraffe Lake North - shallow	3	19-Aug-12	Steven Little	09/27/12	Coarse Organic	0.08	0.01	Zach Meier	09/27/12	100.00	N/A	N/A
6138.2-34	Giraffe Lake North - shallow	4	19-Aug-12	Steven Little	09/27/12	Coarse Organic	0.10	0.01	Zach Meier	09/27/12	100.00	N/A	N/A
6138.2-35	Giraffe Lake North - shallow	5	19-Aug-12	Steven Little	09/27/12	Coarse Organic	0.13	0.01	Zach Meier	09/27/12	100.00	N/A	N/A
6138.2-36	Giraffe Lake South - Deep	1	19-Aug-12	Steven Little	09/28/12	Coarse Organic	0.35	0.05	Zach Meier	09/28/12	100.00	N/A	N/A
6138.2-37	Giraffe Lake South - Deep	2	19-Aug-12	Angela Eagleston	10/02/12	Fine Organic	0.55	0.55	Zach Meier	10/03/12	100.00	N/A	N/A
6138.2-38	Giraffe Lake South - Deep	3	19-Aug-12	Nicole Huddleston	10/03/12	Coarse Organic	0.15	0.10	Ben Alexander	10/03/12	100.00	N/A	N/A
6138.2-39	Giraffe Lake South - Deep	4	19-Aug-12	Steven Little	09/28/12	Coarse Organic	0.38	0.10	Megan Payne	09/28/12	95.72	N/A	N/A
6138.2-40	Fox Lake	1	20-Aug-12	Zach Meier	09/28/12	Inorganic	0.15	0.02	Megan Payne	09/28/12	100.00	N/A	N/A
6138.2-41	Fox Lake	2	20-Aug-12	Steven Little	09/28/12	Inorganic	0.05	0.01	Megan Payne	09/28/12	100.00	N/A	N/A
6138.2-42	Fox Lake	3	20-Aug-12	Steven Little	09/28/12	Inorganic	0.03	0.01	Megan Payne	09/28/12	100.00	N/A	N/A
6138.2-43	Fox Lake	4	20-Aug-12	Zach Meier	09/28/12	Inorganic	0.12	0.02	Megan Payne	09/28/12	100.00	N/A	N/A
6138.2-44	Fox Lake	5	20-Aug-12	Ben Alexander	09/28/12	Fine Organic	0.25	0.01	Megan Payne	09/28/12	100.00	N/A	N/A
6138.2-45	Pond 19	1	21-Aug-12	Steven Little	09/28/12	Inorganic	0.93	0.03	Megan Payne	09/28/12	100.00	N/A	N/A
6138.2-46	Pond 19	2	21-Aug-12	Ben Alexander	09/29/12	Filamentous Algae	0.50	0.26	Zach Meier	09/30/12	93.85	N/A	N/A
6138.2-47	Pond 19	3	21-Aug-12	Amanda Thompson	09/29/12	Fine Organic	0.50	0.33	Zach Meier	09/30/12	95.52	N/A	N/A
6138.2-48	Pond 19	4	21-Aug-12	Steven Little	09/28/12	Coarse Organic	0.40	0.08	Zach Meier	09/30/12	88.55	97.71	N/A
6138.2-49	Pond 19	5	21-Aug-12	Allie Pfeiffer	09/30/12	Vegetation	0.67	0.30	Zach Meier	10/01/12	92.54	N/A	N/A
6138.2-50	Propellor Lake	1	21-Aug-12	Ben Alexander	09/29/12	Fine Organic	0.13	0.01	Zach Meier	10/01/12	100.00	N/A	N/A
6138.2-51	Propellor Lake	2	21-Aug-12	Amanda Thompson	10/01/12	Fine Organic	0.08	0.03	Zach Meier	10/01/12	100.00	N/A	N/A
6138.2-52	Propellor Lake	3	21-Aug-12	Ben Alexander	09/30/12	Fine Organic	0.23	0.02	Zach Meier	09/30/12	100.00	N/A	N/A
6138.2-53	Propellor Lake	4	21-Aug-12	Allie Pfeiffer	10/01/12	Fine Organic	0.14	0.02	Zach Meier	10/02/12	100.00	N/A	N/A
6138.2-54	Propellor Lake	5	21-Aug-12	Steven Little	10/01/12	Coarse Organic	0.10	0.04	Zach Meier	10/01/12	100.00	N/A	N/A

Appendix 3.7-7. Lake Benthos QA/QC Results, Back River Project, 2012

EcoA ANALYSTS, INC.

EcoA Sample ID	Sample ID	Replicate	Collection Date	Sorter	Sort Date	Primary Matrix	Estimated Pre-Rinse Volume (L)	Estimated Post-Rinse Volume (L)	QC Sorter	QC Date	Estimated % Recovery 1	Estimated % Recovery 2	Estimated % Recovery3
6141.2-1	George Lake Shallow	1	18-Aug-12	Ben Alexander	10/01/12	Inorganic	0.23	0.01	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-2	George Lake Shallow	2	18-Aug-12	Ben Alexander	10/01/12	Inorganic	0.33	0.01	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-3	George Lake Shallow	3	18-Aug-12	Ben Alexander	10/01/12	Inorganic	0.32	0.01	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-4	George Lake Shallow	4	18-Aug-12	Ben Alexander	10/01/12	Inorganic	0.35	0.01	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-5	George Lake Shallow	5	18-Aug-12	Ben Alexander	10/01/12	Inorganic	0.23	0.01	Nora Williams	10/03/12	100.00	N/A	N/A
6141.2-6	George Lake Deep	1	18-Aug-12	Steven Little	10/01/12	Inorganic	0.10	0.05	Ben Alexander	10/03/12	100.00	N/A	N/A
6141.2-7	George Lake Deep	2	18-Aug-12	Steven Little	10/02/12	Inorganic	0.15	0.05	Ben Alexander	10/03/12	98.84	N/A	N/A
6141.2-8	George Lake Deep	3	18-Aug-12	Ben Alexander	10/01/12	Inorganic	0.16	0.01	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-9	George Lake Deep	4	18-Aug-12	Amanda Thompson	10/01/12	Inorganic	0.05	0.01	Ben Alexander	10/03/12	100.00	N/A	N/A
6141.2-10	George Lake Deep	5	18-Aug-12	Ben Alexander	10/01/12	Inorganic	0.19	0.01	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-11	Fold Lake	1	19-Aug-12	Amanda Thompson	10/01/12	Inorganic	0.05	0.01	Ben Alexander	10/03/12	100.00	N/A	N/A
6141.2-12	Fold Lake	2	19-Aug-12	Tiffany Miller	10/02/12	Vegetation	0.10	0.08	Ben Alexander	10/03/12	93.98	N/A	N/A
6141.2-13	Fold Lake	3	19-Aug-12	Amanda Thompson	10/02/12	Coarse Organic	0.15	0.10	Ben Alexander	10/03/12	78.57	98.21	N/A
6141.2-14	Fold Lake	4	19-Aug-12	Allie Pfeiffer	10/01/12	Inorganic	0.09	0.02	Ben Alexander	10/03/12	100.00	N/A	N/A
6141.2-15	Fold Lake	5	19-Aug-12	Ben Alexander	10/02/12	Inorganic	0.03	0.01	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-16	Dragon Lake	1	20-Aug-12	Ben Alexander	10/02/12	Filamentous Algae	0.20	0.10	Nora Williams	10/03/12	99.10	N/A	N/A
6141.2-17	Dragon Lake	2	20-Aug-12	Tiffany Miller	10/02/12	Inorganic	0.10	0.05	Ben Alexander	10/04/12	100.00	N/A	N/A
6141.2-18	Dragon Lake	3	20-Aug-12	Steven Little	10/02/12	Coarse Organic	0.13	0.01	Ben Alexander	10/03/12	100.00	N/A	N/A
6141.2-19	Dragon Lake	4	20-Aug-12	Steven Little	10/02/12	Coarse Organic	0.15	0.01	Ben Alexander	10/03/12	100.00	N/A	N/A
6141.2-20	Dragon Lake	5	20-Aug-12	Angela Eagleston	10/03/12	Fine Organic	0.20	0.20	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-21	Komatic Lake	1	21-Aug-12	Tiffany Miller	10/02/12	Inorganic	0.08	0.05	Ben Alexander	10/03/12	100.00	N/A	N/A
6141.2-22	Komatic Lake	2	21-Aug-12	Steven Little	10/03/12	Inorganic	0.03	0.01	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-23	Komatic Lake	3	21-Aug-12	Tiffany Miller	10/02/12	Inorganic	0.05	0.05	Ben Alexander	10/03/12	100.00	N/A	N/A
6141.2-24	Komatic Lake	4	21-Aug-12	Tiffany Miller	10/02/12	Inorganic	0.08	0.05	Ben Alexander	10/03/12	100.00	N/A	N/A
6141.2-25	Komatic Lake	5	21-Aug-12	Amanda Thompson	10/03/12	Fine Organic	0.05	0.03	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-26	Lower Long Lake	1	21-Aug-12	Tiffany Miller	10/02/12	Vegetation	0.03	0.03	Zach Meier	10/03/12	100.00	N/A	N/A
6141.2-27	Lower Long Lake	2	21-Aug-12	Allie Pfeiffer	10/02/12	Inorganic	0.02	0.00	Zach Meier	10/03/12	100.00	N/A	N/A
6141.2-28	Lower Long Lake	3	21-Aug-12	Tiffany Miller	10/02/12	Bugs	0.01	0.01	Zach Meier	10/03/12	100.00	N/A	N/A
6141.2-29	Lower Long Lake	4	21-Aug-12	Allie Pfeiffer	10/03/12	Fine Organic	0.00	0.00	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-30	Lower Long Lake	5	21-Aug-12	Tiffany Miller	10/03/12	Fine Organic	0.05	0.03	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-31	Occurrence Lake	1	21-Aug-12	Ben Alexander	10/03/12	Coarse Organic	0.16	0.10	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-32	Occurrence Lake	2	21-Aug-12	Steven Little	10/03/12	Vegetation	0.01	0.01	Ben Alexander	10/04/12	100.00	N/A	N/A
6141.2-33	Occurrence Lake	3	21-Aug-12	Steven Little	10/03/12	Vegetation	0.01	0.01	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-34	Occurrence Lake	4	21-Aug-12	Angela Eagleston	10/03/12	Fine Organic	0.09	0.09	Ben Alexander	10/04/12	100.00	N/A	N/A
6141.2-35	Occurrence Lake	5	21-Aug-12	Zach Meier	10/03/12	Vegetation	0.03	0.03	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-36	Ref C Lake	1	22-Aug-12	Steven Little	10/03/12	Coarse Organic	0.10	0.08	Ben Alexander	10/04/12	91.89	N/A	N/A
6141.2-37	Ref C Lake	2	22-Aug-12	Laurie Flaherty	10/03/12	Fine Organic	0.25	0.10	Ben Alexander	10/04/12	92.11	N/A	N/A
6141.2-38	Ref C Lake	3	22-Aug-12	Amanda Thompson	10/03/12	Fine Organic	0.05	0.03	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-39	Ref C Lake	4	22-Aug-12	Tiffany Miller	10/03/12	Inorganic	0.10	0.05	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-40	Ref C Lake	5	22-Aug-12	Amanda Thompson	10/03/12	Fine Organic	0.05	0.03	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-41	Sleigh Lake	1	22-Aug-12	Zach Meier	10/05/12	Filamentous Algae	0.10	0.08	Megan Payne	10/05/12	92.98	N/A	N/A
6141.2-42	Sleigh Lake	2	22-Aug-12	Angela Eagleston	10/03/12	Fine Organic	0.20	0.20	Ben Alexander	10/04/12	100.00	N/A	N/A
6141.2-43	Sleigh Lake	3	22-Aug-12	Amanda Thompson	10/03/12	Fine Organic	0.05	0.03	Ben Alexander	10/04/12	100.00	N/A	N/A
6141.2-44	Sleigh Lake	4	22-Aug-12	Steven Little	10/03/12	Coarse Organic	0.05	0.01	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-45	Sleigh Lake	5	22-Aug-12	Tiffany Miller	10/03/12	Inorganic	0.35	0.05	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-46	Lytle Lake	1	23-Aug-12	Allie Pfeiffer	10/03/12	Fine Organic	0.05	0.01	Ben Alexander	10/04/12	100.00	N/A	N/A
6141.2-47	Lytle Lake	2	23-Aug-12	Steven Little	10/04/12	Inorganic	0.05	0.02	Ben Alexander	10/04/12	100.00	N/A	N/A
6141.2-48	Lytle Lake	3	23-Aug-12	Allie Pfeiffer	10/03/12	Inorganic	0.10	0.02	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-49	Lytle Lake	4	23-Aug-12	Tiffany Miller	10/04/12	Inorganic	0.05	0.05	Megan Payne	10/04/12	100.00	N/A	N/A
6141.2-50	Lytle Lake	5	23-Aug-12	Allie Pfeiffer	10/04/12	Inorganic	0.05	0.01	Megan Payne	10/05/12	100.00	N/A	N/A

Appendix 3.7-8

Stream Benthos Density and Taxonomic Results, Back River Project, 2012

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Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2																
Taxonomic Classification:																
Area						**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**
Stream						**Moby OF**	**Moby OF**	**Moby OF**	**Moby OF**	**Moby OF**	**Gander IF**	**Gander IF**	**Gander IF**	**Gander IF**	**Gander IF**
Replicate						**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Date Sampled						**12-Aug-12**	**12-Aug-12**	**12-Aug-12**	**12-Aug-12**	**12-Aug-12**	**11-Aug-12**	**11-Aug-12**	**11-Aug-12**	**11-Aug-12**	**11-Aug-12**
Surface Area Sampled (m^2)						**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**
EcoAnalysts Sample ID						**6138.1-36**	**6138.1-37**	**6138.1-38**	**6138.1-39**	**6138.1-40**	**6138.1-26**	**6138.1-27**	**6138.1-28**	**6138.1-29**	**6138.1-30**
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**										
Acari	Arachnida	Sarcoptiformes	Undetermined	Undetermined	Oribatei										
		Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.										
			Hydryphantidae	Undetermined	Hydryphantidae										
			Hygrobatidae	*Atractides*	*Atractides* sp.										
				Hygrobates	*Hygrobates* sp.	27.72	41.58	103.94	124.73	23.70	16.63	25.98	3.46	17.32	20.79
			Lebertiidae	*Lebertia*	*Lebertia* sp.	58.90	142.05	90.08	153.83	148.11	55.43	25.98	20.79	38.11	3.46
			Oxidae	*Oxus*	*Oxus* sp.									3.46	
			Pionidae	Undetermined	Pionidae	3.46									
			Sperchontidae	*Sperchon*	*Sperchon* sp.	3.46	3.46	38.11	74.84	183.66					
			Unionicolidae	*Neumania*	*Neumania* sp.										
		Undetermined	Undetermined	Undetermined	Acari										
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae			6.93	4.16	23.70					
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae	17.32	41.58	48.50	33.26	47.40	5.54				3.46
		Tubificida	Naididae	*Chaetogaster*	*Chaetogaster diastrophus*										
				Nais	*Nais* sp.										
				Uncinais	*Uncinais uncinata*										
			Tubificidae	*Rhyacodrilus*	*Rhyacodrilus* sp.										
				Undetermined	Tubificidae w/ cap setae	3.46	6.93	6.93	8.32	5.92	5.54	5.20			
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.						133.04	62.36	10.39		6.93
				Sphaerium	*Sphaerium* sp.										
				Undetermined	Sphaeriidae	3.46				5.92	288.25	83.15			3.46
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Agabus*	*Agabus* sp.										
				Hydroporus	*Hydroporus* sp.										
				Oreodytes	*Oreodytes* sp.	3.46	3.46	6.93	4.16						6.93
			Haliplidae	*Haliplus*	*Haliplus* sp.										
				Undetermined	Haliplidae										
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera							20.79			
	Maxillopoda	Cyclopoida	Undetermined	Undetermined	Cyclopoida		20.79								
	Ostracoda	Undetermined	Undetermined	Undetermined	Ostracoda	3.46	17.32	3.46		5.92	66.52	36.38		3.46	
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.						5.54				
				Probezzia	*Probezzia* sp.								3.46		
				Undetermined	Ceratopogoninae										
			Chironomidae	*Ablabesmyia*	*Ablabesmyia* (Karelia) sp.										
				Ablabesmyia	*Ablabesmyia* sp.	6.93					16.63	20.79	3.46		3.46
				Acamptocladius	*Acamptocladius* sp.										
				Acricotopus	*Acricotopus* sp.										
				Chaetocladius	*Chaetocladius* sp.										
				Chironomus	*Chironomus* sp.										
				Cladotanytarsus	*Cladotanytarsus* sp.	148.98	97.01	10.39	74.84	5.92	315.97	550.84		131.65	20.79
				Constempellina	*Constempellina* sp.										
				Corynoneura	*Corynoneura* sp.		3.46								
				Cricotopus	*Cricotopus bicinctus gr.*										
				Cricotopus	*Cricotopus* sp.										
				Cryptochironomus	*Cryptochironomus* sp.	3.46			4.16		27.72	5.20			
				Demicryptochironomus	*Demicryptochironomus* sp.						5.54	5.20			
				Dicrotendipes	*Dicrotendipes fumidus*	62.36	128.19	38.11	8.32	17.77	11.09	5.20		58.90	6.93
				Dicrotendipes	*Dicrotendipes* sp.	10.39	20.79	6.93						3.46	
				Eukiefferiella	*Eukiefferiella gracei gr.*			3.46							
				Euryhapsis	*Euryhapsis* sp.	13.86	6.93			11.85					
				Glyptotendipes	*Glyptotendipes* sp.										
				Heterotanytarsus	*Heterotanytarsus* sp.										
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*	3.46			4.16		11.09				
				Lipiniella	*Lipiniella* sp.	3.46	3.46				55.43	36.38		13.86	3.46

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Stream	Moby OF	Moby OF	Moby OF	Moby OF	Moby OF	Gander IF	Gander IF	Gander IF	Gander IF	Gander IF
Replicate	1	2	3	4	5	1	2	3	4	5
Date Sampled	12-Aug-12	12-Aug-12	12-Aug-12	12-Aug-12	12-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12
Surface Area Sampled (m^2)	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289
EcoAnalysts Sample ID	6138.1-36	6138.1-37	6138.1-38	6138.1-39	6138.1-40	6138.1-26	6138.1-27	6138.1-28	6138.1-29	6138.1-30

Major Group	Class	Order	Family	Genus	Final Designation									
				Mesosmittia	*Mesosmittia* sp.									
				Micropsectra	*Micropsectra* sp.									
				Nanocladius	*Nanocladius* sp.									
				Natarsia	*Natarsia* sp.									
				Orthocladius	*Orthocladius (Pogonocladius)* sp.									
				Orthocladius	*Orthocladius* Complex									
				Orthocladius	*Orthocladius* sp.									
				Parachironomus	*Parachironomus* sp.									
				Paracladopelma	*Paracladopelma* sp.						83.15	46.77		17.32	
				Parakiefferiella	*Parakiefferiella* sp.	3.46	10.39								
				Paramerina	*Paramerina* sp.										
				Parametriocnemus	*Parametriocnemus* sp.										
				Paratanytarsus	*Paratanytarsus* sp.	3.46	3.46		4.16	11.85					
				Paratendipes	*Paratendipes* sp.										
				Phaenopsectra	*Phaenopsectra* sp.	10.39									
				Polypedilum	*Polypedilum halterale gr.*	3.46	3.46		4.16						
				Polypedilum	*Polypedilum scalaenum gr.*	93.54	20.79	31.18	74.84	5.92	138.58	530.06	17.32	162.84	34.65
				Polypedilum	*Polypedilum sordens*										
				Polypedilum	*Polypedilum* sp.	31.18			4.16		5.54				
				Potthastia	*Potthastia longimana gr.*				4.16		5.54				
				Procladius	*Procladius* sp.	69.29	17.32		33.26		127.50	239.05	51.97	107.40	65.83
				Protanypus	*Protanypus* sp.										
				Psectrocladius	*Psectrocladius* sp.						266.08	51.97		13.86	
				Pseudochironomus	*Pseudochironomus* sp.										
				Pseudokiefferiella	*Pseudokiefferiella* sp.										
				Pseudosmittia	*Pseudosmittia* sp.	13.86	13.86	20.79	12.47					3.46	3.46
				Rheocricotopus	*Rheocricotopus* sp.					11.85					
				Rheotanytarsus	*Rheotanytarsus exiguus gr.*	6.93		17.32		195.51					
				Saetheria	*Saetheria tylus*	3.46	17.32	51.97	41.58	112.56	33.26	98.74			3.46
				Sergentia	*Sergentia* sp.	58.90	13.86		16.63	11.85	133.04	67.56	10.39	10.39	
				Stempellina	*Stempellina* sp.	24.25			4.16		238.36	478.09			
				Stictochironomus	*Stictochironomus* sp.	3.46	3.46	3.46	4.16		49.89	15.59	3.46	10.39	6.93
				Synorthocladius	*Synorthocladius* sp.										
				Tanytarsus	*Tanytarsus* sp.	13.86	20.79	13.86	20.79	23.70					
				Thienemanniella	*Thienemanniella* sp.										
				Thienemannimyia	*Thienemannimyia* gr. sp.	90.08	124.73	90.08	174.62	53.32	55.43	129.92		48.50	6.93
				Tokunagaia	*Tokunagaia* sp.										
				Tvetenia	*Tvetenia bavarica gr.*				20.79	17.77					
				Undetermined	Chironomini										
				Undetermined	Pentaneurini										
				Undetermined	Tanytarsini	58.90									
				Zalutschia	*Zalutschia* sp.						33.26	10.39			
			Dolichopodidae	Undetermined	Dolichopodidae										
			Empididae	*Clinocera*	*Clinocera* sp.		3.46								
				Trichoclinocera	*Trichoclinocera* sp.										
				Undetermined	Empididae			3.46			11.09	25.98		27.72	10.39
			Muscidae	Undetermined	Muscidae						16.63	20.79			
			Simuliidae	*Simulium*	*Simulium* sp.				33.26	94.79					
				Undetermined	Simuliidae			10.39	20.79	23.70					
			Tipulidae	*Dicranota*	*Dicranota* sp.			24.25	33.26	71.09					
				Limnophila	*Limnophila* sp.										
				Prionocera	*Prionocera* sp.										
				Tipula	*Tipula* sp.	76.22	107.40	76.22	49.89	53.32	5.54	5.20		6.93	

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

Area						Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Stream						Moby OF	Moby OF	Moby OF	Moby OF	Moby OF	Gander IF	Gander IF	Gander IF	Gander IF	Gander IF
Replicate						1	2	3	4	5	1	2	3	4	5
Date Sampled						12-Aug-12	12-Aug-12	12-Aug-12	12-Aug-12	12-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12
Surface Area Sampled (m^2)						0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289
EcoAnalysts Sample ID						6138.1-36	6138.1-37	6138.1-38	6138.1-39	6138.1-40	6138.1-26	6138.1-27	6138.1-28	6138.1-29	6138.1-30
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**										
			Undetermined	Undetermined	Diptera		3.46	3.46	8.32	5.92				3.46	
Ephemeroptera	Insecta	Ephemeroptera	Baetidae	*Acentrella*	*Acentrella lapponica*										
				Baetis	*Baetis flavistriga*										
				Baetis	*Baetis* sp.			6.93	8.32	5.92					
			Ephemerellidae	*Ephemerella*	*Ephemerella* sp.										
			Metretopodidae	*Metretopus*	*Metretopus* sp.		3.46								
				Undetermined	Metretopodidae	3.46	6.93	3.46							
			Undetermined	Undetermined	Ephemeroptera										
Gastropoda	Gastropoda	Basommatophora	Lymnaeidae	*Stagnicola*	*Stagnicola* sp.										
				Undetermined	Lymnaeidae										
			Physidae	*Physa*	*Physa* sp.										
		Gastropoda (class)	Undetermined	Undetermined	Gastropoda										
		Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*						5.54		3.46		
				Valvata	*Valvata* sp.										
Hemiptera	Insecta	Hemiptera	Undetermined	Undetermined	Auchenorrhyncha										
				Undetermined	Hemiptera										
Ichthyoplankton	Actinopterygii	Gasterosteiformes	Gasterosteidae	Undetermined	Gasterosteidae										
Other Insecta	Insecta	Collembola	Undetermined	Undetermined	Collembola										
		Hymenoptera	Undetermined	Undetermined	Hymenoptera										
Other Organisms	Hydrozoa	Hydroida	Hydridae	*Hydra*	*Hydra* sp.										
	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda	20.79	121.26	214.81	157.99	1131.56	16.63	88.34	17.32	13.86	
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria										
Plecoptera	Insecta	Plecoptera	Nemouridae	*Nemoura*	*Nemoura* sp.	13.86	55.43	17.32	29.10	5.92					
				Undetermined	Nemouridae	3.46	3.46	3.46	16.63						
			Perlodidae	*Arcynopteryx*	*Arcynopteryx compacta*										
			Undetermined	Undetermined	Perlodidae										
Trichoptera	Insecta	Trichoptera	Brachycentridae	*Brachycentrus*	*Brachycentrus americanus*	3.46			8.32	5.92					
				Micrasema	*Micrasema* sp.	3.46	3.46		24.95	5.92					
			Hydropsychidae	*Arctopsyche*	*Arctopsyche* sp.										
			Hydroptilidae	*Agraylea*	*Agraylea* sp.										
				Oxyethira	*Oxyethira* sp.			17.32	166.31	35.55					
			Leptoceridae	*Ceraclea*	*Ceraclea* sp.										
				Mystacides	*Mystacides sepulchralis*									10.39	
				Mystacides	*Mystacides* sp.							15.59		10.39	3.46
				Undetermined	Leptoceridae										
			Limnephilidae	*Asynarchus*	*Asynarchus* sp.										
				Grensia	*Grensia praeterita*										
				Undetermined	Limnephilidae								3.46		
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.										
			Rhyacophilidae	*Rhyacophila*	*Rhyacophila brunnea*										
				Rhyacophila	*Rhyacophila mongolica*										
				Rhyacophila	*Rhyacophila* sp.										
			Undetermined	Undetermined	Trichoptera										
					TOTAL	**990.87**	**1094.81**	**973.55**	**1471.82**	**2363.84**	**2245.06**	**2707.45**	**148.98**	**717.17**	**214.81**

Note: Benthos samples were not collected from Echo OF, which was dry during sampling, or Llama Lake where substrate size and water levels prevented sampling.
Only two samples were collected at Pond 19 OF due to low water levels.
Nematodes, copepods or cladocerans were excluded from analyses.
Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2															
Taxonomic Classification:						**Area**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**
						Stream	**Gander US**	**Gander US**	**Gander US**	**Gander US**	**Gander US**	**Pond 19 OF**	**Pond 19 OF**	**Chair OF**	**Chair OF**	**Chair OF**
						Replicate	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**1**	**2**	**3**
						Date Sampled	**11-Aug-12**	**11-Aug-12**	**11-Aug-12**	**11-Aug-12**	**11-Aug-12**	**13-Aug-12**	**13-Aug-12**	**13-Aug-12**	**13-Aug-12**	**13-Aug-12**
						Surface Area Sampled (m^2)	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**
						EcoAnalysts Sample ID	**6138.1-31**	**6138.1-32**	**6138.1-33**	**6138.1-34**	**6138.1-35**	**6138.1-41**	**6138.1-42**	**6138.1-43**	**6138.1-44**	**6138.1-45**
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**											
Acari	Arachnida	Sarcoptiformes	Undetermined	Undetermined	Oribatei							12.13				
		Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.											
			Hydryphantidae	Undetermined	Hydryphantidae											
			Hygrobatidae	*Atractides*	*Atractides* sp.											
				Hygrobates	*Hygrobates* sp.		103.94	103.94	131.65	190.55	273.70			148.02	41.58	471.81
			Lebertiidae	*Lebertia*	*Lebertia* sp.		13.86	17.32	6.93	10.39	45.04		6.17	194.28	31.18	148.02
			Oxidae	*Oxus*	*Oxus* sp.											
			Pionidae	Undetermined	Pionidae		6.93									
			Sperchontidae	*Sperchon*	*Sperchon* sp.		27.72	51.97	48.50	24.25	6.93		6.17	27.75	20.79	92.51
			Unionicolidae	*Neumania*	*Neumania* sp.											
		Undetermined	Undetermined	Undetermined	Acari											
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae		13.86	13.86	83.15					37.01	10.39	9.25
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae			6.93				339.55	92.50	18.50	3.46	64.76
		Tubificida	Naididae	*Chaetogaster*	*Chaetogaster diastrophus*											
				Nais	*Nais* sp.				6.93			48.51				
				Uncinais	*Uncinais uncinata*											
			Tubificidae	*Rhyacodrilus*	*Rhyacodrilus* sp.											
				Undetermined	Tubificidae w/ cap setae							12.13	6.17	18.50	27.72	185.03
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.											
				Sphaerium	*Sphaerium* sp.											
				Undetermined	Sphaeriidae					3.46						
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Agabus*	*Agabus* sp.								6.17			
				Hydroporus	*Hydroporus* sp.								6.17			
				Oreodytes	*Oreodytes* sp.									27.75		18.50
			Haliplidae	*Haliplus*	*Haliplus* sp.											
				Undetermined	Haliplidae											
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera								6.17	55.51	6.93	120.27
	Maxillopoda	Cyclopoida	Undetermined	Undetermined	Cyclopoida							84.89		212.78	17.32	101.76
	Ostracoda	Undetermined	Undetermined	Undetermined	Ostracoda		13.86		13.86	6.93	6.93	133.39	18.50	74.01	17.32	148.02
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.											18.50
				Probezzia	*Probezzia* sp.											
				Undetermined	Ceratopogoninae											
			Chironomidae	*Ablabesmyia*	*Ablabesmyia* (Karelia) sp.											
				Ablabesmyia	*Ablabesmyia* sp.									9.25		
				Acamptocladius	*Acamptocladius* sp.											
				Acricotopus	*Acricotopus* sp.											
				Chaetocladius	*Chaetocladius* sp.											
				Chironomus	*Chironomus* sp.											
				Cladotanytarsus	*Cladotanytarsus* sp.		6.93			3.46	3.46	36.38	43.17	212.78	27.72	120.27
				Constempellina	*Constempellina* sp.											
				Corynoneura	*Corynoneura* sp.		6.93		6.93				6.17			
				Cricotopus	*Cricotopus bicinctus gr.*			3.46								
				Cricotopus	*Cricotopus* sp.		13.86		13.86	3.46		48.51	24.67	120.27	6.93	37.01
				Cryptochironomus	*Cryptochironomus* sp.											
				Demicryptochironomus	*Demicryptochironomus* sp.		20.79	6.93			10.39					
				Dicrotendipes	*Dicrotendipes fumidus*					3.46				37.01		27.75
				Dicrotendipes	*Dicrotendipes* sp.											18.50
				Eukiefferiella	*Eukiefferiella gracei gr.*											
				Euryhapsis	*Euryhapsis* sp.		367.25	263.31	256.38	197.48	228.66			18.50	6.93	27.75
				Glyptotendipes	*Glyptotendipes* sp.											
				Heterotanytarsus	*Heterotanytarsus* sp.							48.51	74.00	18.50		
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*									9.25		
				Lipiniella	*Lipiniella* sp.											

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Stream	Gander US	Gander US	Gander US	Gander US	Gander US	Pond 19 OF	Pond 19 OF	Chair OF	Chair OF	Chair OF
Replicate	1	2	3	4	5	1	2	1	2	3
Date Sampled	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	13-Aug-12	13-Aug-12	13-Aug-12	13-Aug-12	13-Aug-12
Surface Area Sampled (m^2)	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289
EcoAnalysts Sample ID	6138.1-31	6138.1-32	6138.1-33	6138.1-34	6138.1-35	6138.1-41	6138.1-42	6138.1-43	6138.1-44	6138.1-45

Major Group	Class	Order	Family	Genus	Final Designation									
				Mesosmittia	*Mesosmittia* sp.									
				Micropsectra	*Micropsectra* sp.									
				Nanocladius	*Nanocladius* sp.									
				Natarsia	*Natarsia* sp.							12.33		
				Orthocladius	*Orthocladius (Pogonocladius)* sp.									
				Orthocladius	*Orthocladius* Complex									
				Orthocladius	*Orthocladius* sp.								3.46	27.75
				Parachironomus	*Parachironomus* sp.									
				Paracladopelma	*Paracladopelma* sp.					3.46				
				Parakiefferiella	*Parakiefferiella* sp.						12.13	67.84		
				Paramerina	*Paramerina* sp.									
				Parametriocnemus	*Parametriocnemus* sp.	6.93	17.32			3.46				9.25
				Paratanytarsus	*Paratanytarsus* sp.						1503.71	419.35		9.25
				Paratendipes	*Paratendipes* sp.									
				Phaenopsectra	*Phaenopsectra* sp.									
				Polypedilum	*Polypedilum halterale gr.*	83.15	27.72	131.65	3.46	41.58				9.25
				Polypedilum	*Polypedilum scalaenum gr.*							6.17	647.59	3.46
				Polypedilum	*Polypedilum sordens*									
				Polypedilum	*Polypedilum* sp.								18.50	
				Potthastia	*Potthastia longimana gr.*									
				Procladius	*Procladius* sp.					3.46	388.05	117.17	37.01	
				Protanypus	*Protanypus* sp.									
				Psectrocladius	*Psectrocladius* sp.						1103.53	339.18		
				Pseudochironomus	*Pseudochironomus* sp.									
				Pseudokiefferiella	*Pseudokiefferiella* sp.		3.46	6.93						
				Pseudosmittia	*Pseudosmittia* sp.			13.86			169.77	530.36	9.25	3.46
				Rheocricotopus	*Rheocricotopus* sp.									
				Rheotanytarsus	*Rheotanytarsus exiguus gr.*	769.14	142.05	374.18	135.12	41.58			27.75	38.11	111.02
				Saetheria	*Saetheria tylus*	27.72	13.86	27.72	17.32	31.18		6.17		
				Sergentia	*Sergentia* sp.									
				Stempellina	*Stempellina* sp.					3.46			9.25	3.46	83.26
				Stictochironomus	*Stictochironomus* sp.						218.28	74.00		
				Synorthocladius	*Synorthocladius* sp.				3.46					
				Tanytarsus	*Tanytarsus* sp.	13.86					72.76	246.68	157.27	69.29	83.26
				Thienemanniella	*Thienemanniella* sp.									
				Thienemannimyia	*Thienemannimyia* gr. sp.	200.95	55.43	214.81	41.58	38.11	84.89	203.51	1073.15	76.22	508.82
				Tokunagaia	*Tokunagaia* sp.		3.46	62.36	3.46					20.79	55.51
				Tvetenia	*Tvetenia bavarica gr.*	277.17	280.63	367.25	103.94	86.61				20.79	55.51
				Undetermined	Chironomini						12.13				
				Undetermined	Pentaneurini	6.93									
				Undetermined	Tanytarsini								37.01		
				Zalutschia	*Zalutschia* sp.						897.38	43.17			9.25
			Dolichopodidae	Undetermined	Dolichopodidae										
			Empididae	*Clinocera*	*Clinocera* sp.							18.50		3.46	
				Trichoclinocera	*Trichoclinocera* sp.								9.25		
				Undetermined	Empididae				3.46						18.50
			Muscidae	Undetermined	Muscidae				3.46			6.17	9.25		
			Simuliidae	*Simulium*	*Simulium* sp.	34.65	83.15	55.43	24.25	3.46					
				Undetermined	Simuliidae	6.93	38.11	55.43	20.79						9.25
			Tipulidae	*Dicranota*	*Dicranota* sp.						12.13				
				Limnophila	*Limnophila* sp.										
				Prionocera	*Prionocera* sp.										
				Tipula	*Tipula* sp.	6.93	6.93	13.86		6.93	60.63	92.50	194.28	3.46	203.53

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2															
Taxonomic Classification:															
Area						**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**
Stream						**Gander US**	**Gander US**	**Gander US**	**Gander US**	**Gander US**	**Pond 19 OF**	**Pond 19 OF**	**Chair OF**	**Chair OF**	**Chair OF**
Replicate						**1**	**2**	**3**	**4**	**5**	**1**	**2**	**1**	**2**	**3**
Date Sampled						**11-Aug-12**	**11-Aug-12**	**11-Aug-12**	**11-Aug-12**	**11-Aug-12**	**13-Aug-12**	**13-Aug-12**	**13-Aug-12**	**13-Aug-12**	**13-Aug-12**
Surface Area Sampled (m^2)						**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**
EcoAnalysts Sample ID						**6138.1-31**	**6138.1-32**	**6138.1-33**	**6138.1-34**	**6138.1-35**	**6138.1-41**	**6138.1-42**	**6138.1-43**	**6138.1-44**	**6138.1-45**
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**										
			Undetermined	Undetermined	Diptera			13.86	13.86	6.93	12.13			17.32	27.75
Ephemeroptera	Insecta	Ephemeroptera	Baetidae	*Acentrella*	*Acentrella lapponica*		3.46								
				Baetis	*Baetis flavistriga*										
				Baetis	*Baetis* sp.		3.46	13.86	3.46	3.46					
			Ephemerellidae	*Ephemerella*	*Ephemerella* sp.	6.93	6.93	13.86	6.93					3.46	64.76
			Metretopodidae	*Metretopus*	*Metretopus* sp.										
				Undetermined	Metretopodidae										
			Undetermined	Undetermined	Ephemeroptera				3.46						
Gastropoda	Gastropoda	Basommatophora	Lymnaeidae	*Stagnicola*	*Stagnicola* sp.										
				Undetermined	Lymnaeidae										
			Physidae	*Physa*	*Physa* sp.										
		Gastropoda (class)	Undetermined	Undetermined	Gastropoda										
		Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*										
				Valvata	*Valvata* sp.				3.46						
Hemiptera	Insecta	Hemiptera	Undetermined	Undetermined	Auchenorrhyncha					3.46			9.25		9.25
				Undetermined	Hemiptera										
Ichthyoplankton	Actinopterygii	Gasterosteiformes	Gasterosteidae	Undetermined	Gasterosteidae										
Other Insecta	Insecta	Collembola	Undetermined	Undetermined	Collembola										
		Hymenoptera	Undetermined	Undetermined	Hymenoptera				3.46						
Other Organisms	Hydrozoa	Hydroida	Hydridae	*Hydra*	*Hydra* sp.				6.93						
	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda	48.50	17.32	110.87	69.29	24.25	133.39	80.17	166.52	55.43	351.55
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria										
Plecoptera	Insecta	Plecoptera	Nemouridae	*Nemoura*	*Nemoura* sp.	76.22	45.04	34.65	41.58	10.39		43.17	9.25	6.93	18.50
				Undetermined	Nemouridae				3.46					41.58	37.01
			Perlodidae	*Arcynopteryx*	*Arcynopteryx compacta*										
				Undetermined	Perlodidae										
Trichoptera	Insecta	Trichoptera	Brachycentridae	*Brachycentrus*	*Brachycentrus americanus*	6.93	34.65	117.80	10.39	13.86				20.79	83.26
				Micrasema	*Micrasema* sp.										
			Hydropsychidae	*Arctopsyche*	*Arctopsyche* sp.		3.46								
			Hydroptilidae	*Agraylea*	*Agraylea* sp.										
				Oxyethira	*Oxyethira* sp.	6.93								13.86	18.50
			Leptoceridae	*Ceraclea*	*Ceraclea* sp.		3.46								9.25
				Mystacides	*Mystacides sepulchralis*							6.17			
				Mystacides	*Mystacides* sp.								74.01		
				Undetermined	Leptoceridae										
			Limnephilidae	*Asynarchus*	*Asynarchus* sp.										9.25
				Grensia	*Grensia praeterita*										
				Undetermined	Limnephilidae										
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.										
			Rhyacophilidae	*Rhyacophila*	*Rhyacophila brunnea*										
				Rhyacophila	*Rhyacophila mongolica*										
				Rhyacophila	*Rhyacophila* sp.			6.93							
			Undetermined	Undetermined	Trichoptera										
					TOTAL	**2175.77**	**1257.65**	**2203.48**	**970.09**	**900.80**	**5444.89**	**2608.62**	**3728.26**	**623.63**	**3432.22**

Note: Benthos samples were not collected from Echo OF, which was dry during sampling, or Llama Lake where substrate size and water levels prevented sampling.
Only two samples were collected at Pond 19 OF due to low water levels.
Nematodes, copepods or cladocerans were excluded from analyses.
Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2															
Taxonomic Classification:															
Area						**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**
Stream						**Chair OF**	**Chair OF**	**Giraffe OF**	**Giraffe OF**	**Giraffe OF**	**Giraffe OF**	**Giraffe OF**	**Wolf OF**	**Wolf OF**	**Wolf OF**
Replicate						**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**
Date Sampled						**13-Aug-12**	**13-Aug-12**	**8-Aug-12**	**8-Aug-12**	**8-Aug-12**	**8-Aug-12**	**8-Aug-12**	**7-Aug-12**	**7-Aug-12**	**7-Aug-12**
Surface Area Sampled (m^2)						**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**
EcoAnalysts Sample ID						**6138.1-46**	**6138.1-47**	**6138.1-11**	**6138.1-12**	**6138.1-13**	**6138.1-14**	**6138.1-15**	**6138.1-1**	**6138.1-2**	**6138.1-3**
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**										
Acari	Arachnida	Sarcoptiformes	Undetermined	Undetermined	Oribatei									79.51	
		Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.										
			Hydryphantidae	Undetermined	Hydryphantidae										
			Hygrobatidae	*Atractides*	*Atractides* sp.									5.30	
				Hygrobates	*Hygrobates* sp.	346.46	27.72		3.46					5.30	
			Lebertiidae	*Lebertia*	*Lebertia* sp.	159.37	103.94		3.46	27.72	20.79	6.93	6.93	74.21	31.18
			Oxidae	*Oxus*	*Oxus* sp.										
			Pionidae	Undetermined	Pionidae			27.72	6.93	13.86		17.32		5.30	
			Sperchontidae	*Sperchon*	*Sperchon* sp.	76.22									
			Unionicolidae	*Neumania*	*Neumania* sp.										
		Undetermined	Undetermined	Undetermined	Acari										
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae	34.65		3.46			3.46			10.60	6.93
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae	83.15	41.58	17.32		27.72	34.65	13.86		5.30	3.46
		Tubificida	Naididae	*Chaetogaster*	*Chaetogaster diastrophus*										
				Nais	*Nais* sp.			6.93		3.46	27.72		6.93	15.90	
				Uncinais	*Uncinais uncinata*										
			Tubificidae	*Rhyacodrilus*	*Rhyacodrilus* sp.										
				Undetermined	Tubificidae w/ cap setae	27.72	117.80								
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.										
				Sphaerium	*Sphaerium* sp.										
				Undetermined	Sphaeriidae										
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Agabus*	*Agabus* sp.										
				Hydroporus	*Hydroporus* sp.										
				Oreodytes	*Oreodytes* sp.	55.43				3.46				21.20	
			Haliplidae	*Haliplus*	*Haliplus* sp.										
				Undetermined	Haliplidae										
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera	55.43		117.80	3.46	142.05	58.90	17.32	3.46	180.23	
	Maxillopoda	Cyclopoida	Undetermined	Undetermined	Cyclopoida	166.30		51.97	10.39		69.29	187.09	10.39	31.80	
	Ostracoda	Undetermined	Undetermined	Undetermined	Ostracoda	55.43		48.50	6.93	62.36	58.90	13.86	17.32	37.11	6.93
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.	6.93								5.30	
				Probezzia	*Probezzia* sp.										
				Undetermined	Ceratopogoninae										
			Chironomidae	*Ablabesmyia*	*Ablabesmyia* (Karelia) sp.										
				Ablabesmyia	*Ablabesmyia* sp.					3.46					
				Acamptocladius	*Acamptocladius* sp.										
				Acricotopus	*Acricotopus* sp.										
				Chaetocladius	*Chaetocladius* sp.										
				Chironomus	*Chironomus* sp.				3.46						
				Cladotanytarsus	*Cladotanytarsus* sp.	194.02	159.37							21.20	
				Constempellina	*Constempellina* sp.										
				Corynoneura	*Corynoneura* sp.			3.46				3.46			
				Cricotopus	*Cricotopus bicinctus gr.*										
				Cricotopus	*Cricotopus* sp.	41.58	13.86	13.86			51.97	17.32	3.46	265.04	10.39
				Cryptochironomus	*Cryptochironomus* sp.	6.93	48.50					3.46	3.46	10.60	3.46
				Demicryptochironomus	*Demicryptochironomus* sp.			3.46		6.93	3.46	3.46			
				Dicrotendipes	*Dicrotendipes fumidus*	69.29		45.04			6.93	17.32		74.21	45.04
				Dicrotendipes	*Dicrotendipes* sp.			72.76	3.46	24.25	27.72	24.25	45.04	68.91	10.39
				Eukiefferiella	*Eukiefferiella gracei gr.*										
				Euryhapsis	*Euryhapsis* sp.									106.02	
				Glyptotendipes	*Glyptotendipes* sp.										
				Heterotanytarsus	*Heterotanytarsus* sp.		6.93	3.46				3.46		5.30	
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*					3.46	3.46				
				Lipiniella	*Lipiniella* sp.										

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Stream	Chair OF	Chair OF	Giraffe OF	Giraffe OF	Giraffe OF	Giraffe OF	Giraffe OF	Wolf OF	Wolf OF	Wolf OF
Replicate	4	5	1	2	3	4	5	1	2	3
Date Sampled	13-Aug-12	13-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12
Surface Area Sampled (m^2)	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289
EcoAnalysts Sample ID	6138.1-46	6138.1-47	6138.1-11	6138.1-12	6138.1-13	6138.1-14	6138.1-15	6138.1-1	6138.1-2	6138.1-3

Major Group	Class	Order	Family	Genus	Final Designation									
				Mesosmittia	*Mesosmittia* sp.									
				Micropsectra	*Micropsectra* sp.									
				Nanocladius	*Nanocladius* sp.								5.30	
				Natarsia	*Natarsia* sp.									
				Orthocladius	*Orthocladius (Pogonocladius)* sp.									
				Orthocladius	*Orthocladius* Complex								10.60	
				Orthocladius	*Orthocladius* sp.	41.58							5.30	3.46
				Parachironomus	*Parachironomus* sp.			3.46						
				Paracladopelma	*Paracladopelma* sp.									
				Parakiefferiella	*Parakiefferiella* sp.								47.71	27.72
				Paramerina	*Paramerina* sp.									
				Parametriocnemus	*Parametriocnemus* sp.									
				Paratanytarsus	*Paratanytarsus* sp.			121.26	13.86	183.62	349.92	398.43	90.11	10.39
				Paratendipes	*Paratendipes* sp.									
				Phaenopsectra	*Phaenopsectra* sp.									
				Polypedilum	*Polypedilum halterale gr.*									
				Polypedilum	*Polypedilum scalaenum gr.*	242.52	1358.12						84.81	13.86
				Polypedilum	*Polypedilum sordens*						3.46			3.46
				Polypedilum	*Polypedilum* sp.		13.86						3.46	3.46
				Potthastia	*Potthastia longimana gr.*	6.93					3.46		15.90	
				Procladius	*Procladius* sp.	27.72	103.94	6.93	45.04	55.43	20.79	20.79		
				Protanypus	*Protanypus* sp.									
				Psectrocladius	*Psectrocladius* sp.	6.93	13.86	34.65	31.18	69.29	76.22	103.94	47.71	3.46
				Pseudochironomus	*Pseudochironomus* sp.									
				Pseudokiefferiella	*Pseudokiefferiella* sp.									
				Pseudosmittia	*Pseudosmittia* sp.	13.86	13.86	3.46					31.80	31.18
				Rheocricotopus	*Rheocricotopus* sp.									
				Rheotanytarsus	*Rheotanytarsus exiguus gr.*								5.30	
				Saetheria	*Saetheria tylus*		6.93						47.71	
				Sergentia	*Sergentia* sp.									
				Stempellina	*Stempellina* sp.	48.50	69.29						31.80	
				Stictochironomus	*Stictochironomus* sp.		13.86	6.93	3.46	3.46	65.83	3.46	3.46	84.81	24.25
				Synorthocladius	*Synorthocladius* sp.									
				Tanytarsus	*Tanytarsus* sp.	13.86	304.88	3.46	3.46	6.93	31.18	6.93		217.33
				Thienemanniella	*Thienemanniella* sp.									
				Thienemannimyia	*Thienemannimyia* gr. sp.	478.11	263.31	34.65	10.39	34.65	41.58	31.18	34.65	355.15	65.83
				Tokunagaia	*Tokunagaia* sp.	13.86								
				Tvetenia	*Tvetenia bavarica gr.*									5.30
				Undetermined	Chironomini									
				Undetermined	Pentaneurini									
				Undetermined	Tanytarsini		48.50							3.46
				Zalutschia	*Zalutschia* sp.			3.46	3.46		10.39	20.79		
			Dolichopodidae	Undetermined	Dolichopodidae	6.93								
			Empididae	*Clinocera*	*Clinocera* sp.									
				Trichoclinocera	*Trichoclinocera* sp.					13.86			5.30	
				Undetermined	Empididae					3.46	10.39			
			Muscidae	Undetermined	Muscidae					6.93		3.46		
			Simuliidae	*Simulium*	*Simulium* sp.									
				Undetermined	Simuliidae									
			Tipulidae	*Dicranota*	*Dicranota* sp.	6.93								
				Limnophila	*Limnophila* sp.									
				Prionocera	*Prionocera* sp.									
				Tipula	*Tipula* sp.	110.87	159.37	6.93			3.46	6.93	6.93	47.71	31.18

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2															
Taxonomic Classification:															
Area						**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**
Stream						**Chair OF**	**Chair OF**	**Giraffe OF**	**Giraffe OF**	**Giraffe OF**	**Giraffe OF**	**Giraffe OF**	**Wolf OF**	**Wolf OF**	**Wolf OF**
Replicate						**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**
Date Sampled						**13-Aug-12**	**13-Aug-12**	**8-Aug-12**	**8-Aug-12**	**8-Aug-12**	**8-Aug-12**	**8-Aug-12**	**7-Aug-12**	**7-Aug-12**	**7-Aug-12**
Surface Area Sampled (m^2)						**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**
EcoAnalysts Sample ID						**6138.1-46**	**6138.1-47**	**6138.1-11**	**6138.1-12**	**6138.1-13**	**6138.1-14**	**6138.1-15**	**6138.1-1**	**6138.1-2**	**6138.1-3**
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**										
			Undetermined	Undetermined	Diptera	6.93	13.86						17.32	84.81	3.46
Ephemeroptera	Insecta	Ephemeroptera	Baetidae	*Acentrella*	*Acentrella lapponica*										
				Baetis	*Baetis flavistriga*										
				Baetis	*Baetis* sp.										
			Ephemerellidae	*Ephemerella*	*Ephemerella* sp.	6.93								5.30	
			Metretopodidae	*Metretopus*	*Metretopus* sp.										
				Undetermined	Metretopodidae										
			Undetermined	Undetermined	Ephemeroptera										
Gastropoda	Gastropoda	Basommatophora	Lymnaeidae	*Stagnicola*	*Stagnicola* sp.										
				Undetermined	Lymnaeidae										
			Physidae	*Physa*	*Physa* sp.			3.46		10.39	13.86				
		Gastropoda (class)	Undetermined	Undetermined	Gastropoda						3.46				
		Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*										
				Valvata	*Valvata* sp.										
Hemiptera	Insecta	Hemiptera	Undetermined	Undetermined	Auchenorrhyncha								3.46		
				Undetermined	Hemiptera										
Ichthyoplankton	Actinopterygii	Gasterosteiformes	Gasterosteidae	Undetermined	Gasterosteidae								6.93	5.30	
Other Insecta	Insecta	Collembola	Undetermined	Undetermined	Collembola								3.46		
		Hymenoptera	Undetermined	Undetermined	Hymenoptera									10.60	
Other Organisms	Hydrozoa	Hydroida	Hydridae	*Hydra*	*Hydra* sp.										
	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda	152.44	200.95	17.32	13.86	27.72	3.46		10.39	312.75	69.29
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria						3.46				
Plecoptera	Insecta	Plecoptera	Nemouridae	*Nemoura*	*Nemoura* sp.	20.79					10.39			5.30	
				Undetermined	Nemouridae										
			Perlodidae	*Arcynopteryx*	*Arcynopteryx compacta*										
			Undetermined	Undetermined	Perlodidae										
Trichoptera	Insecta	Trichoptera	Brachycentridae	*Brachycentrus*	*Brachycentrus americanus*	34.65									
				Micrasema	*Micrasema* sp.										
			Hydropsychidae	*Arctopsyche*	*Arctopsyche* sp.										
			Hydroptilidae	*Agraylea*	*Agraylea* sp.			17.32					3.46		
				Oxyethira	*Oxyethira* sp.	27.72								5.30	
			Leptoceridae	*Ceraclea*	*Ceraclea* sp.										
				Mystacides	*Mystacides sepulchralis*						3.46			21.20	
				Mystacides	*Mystacides* sp.										
				Undetermined	Leptoceridae										
			Limnephilidae	*Asynarchus*	*Asynarchus* sp.										
				Grensia	*Grensia praeterita*										
				Undetermined	Limnephilidae	6.93				6.93		3.46			
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.		6.93	3.46			6.93				
			Rhyacophilidae	*Rhyacophila*	*Rhyacophila brunnea*		6.93								
				Rhyacophila	*Rhyacophila mongolica*										
				Rhyacophila	*Rhyacophila* sp.										
			Undetermined	Undetermined	Trichoptera										
					TOTAL	**2653.88**	**3118.14**	**682.53**	**166.30**	**741.42**	**1028.99**	**928.51**	**200.95**	**2618.59**	**412.29**

Note: Benthos samples were not collected from Echo OF, which was dry during sampling, or Llama Lake where substrate size and water levels prevented sampling.
Only two samples were collected at Pond 19 OF due to low water levels.
Nematodes, copepods or cladocerans were excluded from analyses.
Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2															
Taxonomic Classification:															
Area						**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**
Stream						**Wolf OF**	**Wolf OF**	**Goose OF**	**Goose OF**	**Goose OF**	**Goose OF**	**Goose OF**	**Propellor OF**	**Propellor OF**	**Propellor OF**
Replicate						**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**
Date Sampled						**7-Aug-12**	**7-Aug-12**	**7-Aug-12**	**7-Aug-12**	**7-Aug-12**	**7-Aug-12**	**7-Aug-12**	**9-Aug-12**	**9-Aug-12**	**9-Aug-12**
Surface Area Sampled (m^2)						**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**
EcoAnalysts Sample ID						**6138.1-4**	**6138.1-5**	**6138.1-6**	**6138.1-7**	**6138.1-8**	**6138.1-9**	**6138.1-10**	**6138.1-16**	**6138.1-17**	**6138.1-18**
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**										
Acari	Arachnida	Sarcoptiformes	Undetermined	Undetermined	Oribatei										
		Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.										
			Hydryphantidae	Undetermined	Hydryphantidae										
			Hygrobatidae	*Atractides*	*Atractides* sp.										
				Hygrobates	*Hygrobates* sp.			15.80	6.93	10.39					
			Lebertiidae	*Lebertia*	*Lebertia* sp.	17.32	20.79	15.80	6.93	13.86	23.28	33.27	6.93	9.25	99.80
			Oxidae	*Oxus*	*Oxus* sp.										
			Pionidae	Undetermined	Pionidae	3.46		3.95		3.46			27.72	148.02	
			Sperchontidae	*Sperchon*	*Sperchon* sp.				3.46	10.39	5.82	99.80			
			Unionicolidae	*Neumania*	*Neumania* sp.										
		Undetermined	Undetermined	Undetermined	Acari	3.46									
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae	17.32	110.87	59.24	145.51	24.25	5.82	16.63		9.25	116.43
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae			31.60	24.25	31.18	87.31	33.27	10.39		16.63
		Tubificida	Naididae	*Chaetogaster*	*Chaetogaster diastrophus*										
				Nais	*Nais* sp.	3.46	17.32	55.29	6.93	86.61	151.34	1463.68		27.75	33.27
				Uncinais	*Uncinais uncinata*			23.70	6.93	10.39	58.21				
			Tubificidae	*Rhyacodrilus*	*Rhyacodrilus* sp.										
				Undetermined	Tubificidae w/ cap setae					6.93			3.46	9.25	
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.										
				Sphaerium	*Sphaerium* sp.										
				Undetermined	Sphaeriidae										
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Agabus*	*Agabus* sp.		3.46								
				Hydroporus	*Hydroporus* sp.										
				Oreodytes	*Oreodytes* sp.	10.39	6.93			3.46			6.93		16.63
			Haliplidae	*Haliplus*	*Haliplus* sp.										
				Undetermined	Haliplidae	3.46			3.46	20.79					
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera	20.79		126.39	24.25	200.95	40.75		166.30	3237.94	382.55
	Maxillopoda	Cyclopoida	Undetermined	Undetermined	Cyclopoida	13.86		3.95	20.79	114.33			3.46	64.76	
	Ostracoda	Undetermined	Undetermined	Undetermined	Ostracoda	10.39	3.46	252.78	114.33	65.83	244.48	166.33	128.19	157.27	365.92
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.			11.85	62.36	114.33	5.82				
				Probezzia	*Probezzia* sp.										
				Undetermined	Ceratopogoninae										
			Chironomidae	*Ablabesmyia*	*Ablabesmyia* (Karelia) sp.										
				Ablabesmyia	*Ablabesmyia* sp.			19.75	6.93	3.46	17.46				
				Acamptocladius	*Acamptocladius* sp.										
				Acricotopus	*Acricotopus* sp.										
				Chaetocladius	*Chaetocladius* sp.		3.46								
				Chironomus	*Chironomus* sp.				3.46						
				Cladotanytarsus	*Cladotanytarsus* sp.										
				Constempellina	*Constempellina* sp.										
				Corynoneura	*Corynoneura* sp.			7.90			17.46				33.27
				Cricotopus	*Cricotopus bicinctus gr.*					3.46		1230.82			
				Cricotopus	*Cricotopus* sp.		62.36	78.99	62.36	51.97	52.39	482.35		64.76	1896.13
				Cryptochironomus	*Cryptochironomus* sp.			7.90	3.46	3.46	5.82				
				Demicryptochironomus	*Demicryptochironomus* sp.			7.90	34.65	6.93	29.10				
				Dicrotendipes	*Dicrotendipes fumidus*	76.22	183.62	19.75					31.18		49.90
				Dicrotendipes	*Dicrotendipes* sp.	17.32	10.39	27.65	41.58	6.93	5.82	83.16		64.76	83.16
				Eukiefferiella	*Eukiefferiella gracei gr.*										
				Euryhapsis	*Euryhapsis* sp.	6.93	13.86				5.82	49.90			
				Glyptotendipes	*Glyptotendipes* sp.										
				Heterotanytarsus	*Heterotanytarsus* sp.	6.93		3.95	3.46				51.97	249.78	33.27
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*	3.46				6.93					
				Lipiniella	*Lipiniella* sp.										

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2														
Taxonomic Classification:					Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
					Stream	Wolf OF	Wolf OF	Goose OF	Goose OF	Goose OF	Goose OF	Goose OF	Propellor OF	Propellor OF	Propellor OF
					Replicate	4	5	1	2	3	4	5	1	2	3
					Date Sampled	7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12
					Surface Area Sampled (m^2)	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289
					EcoAnalysts Sample ID	6138.1-4	6138.1-5	6138.1-6	6138.1-7	6138.1-8	6138.1-9	6138.1-10	6138.1-16	6138.1-17	6138.1-18
Major Group	Class	Order	Family	Genus	Final Designation										
				Mesosmittia	*Mesosmittia* sp.										
				Micropsectra	*Micropsectra* sp.									9.25	16.63
				Nanocladius	*Nanocladius* sp.				3.46						
				Natarsia	*Natarsia* sp.										
				Orthocladius	*Orthocladius (Pogonocladius)* sp.							133.06			
				Orthocladius	*Orthocladius* Complex							133.06			16.63
				Orthocladius	*Orthocladius* sp.			3.95			5.82	49.90	6.93	46.26	299.39
				Parachironomus	*Parachironomus* sp.			3.95		10.39	29.10	182.96		9.25	
				Paracladopelma	*Paracladopelma* sp.							16.63			
				Parakiefferiella	*Parakiefferiella* sp.		10.39		3.46		17.46				
				Paramerina	*Paramerina* sp.									37.01	16.63
				Parametriocnemus	*Parametriocnemus* sp.										
				Paratanytarsus	*Paratanytarsus* sp.	20.79	38.11	339.67	76.22	65.83	174.63	49.90	114.33	157.27	332.65
				Paratendipes	*Paratendipes* sp.										
				Phaenopsectra	*Phaenopsectra* sp.										
				Polypedilum	*Polypedilum halterale gr.*										
				Polypedilum	*Polypedilum scalaenum gr.*	20.79	10.39								
				Polypedilum	*Polypedilum sordens*										
				Polypedilum	*Polypedilum* sp.										
				Potthastia	*Potthastia longimana gr.*	6.93	6.93			3.46					
				Procladius	*Procladius* sp.	3.46	3.46	94.79	13.86		11.64		31.18	18.50	
				Protanypus	*Protanypus* sp.										
				Psectrocladius	*Psectrocladius* sp.	6.93	24.25	35.55	10.39	17.32	75.67	49.90	100.47	286.79	33.27
				Pseudochironomus	*Pseudochironomus* sp.										
				Pseudokiefferiella	*Pseudokiefferiella* sp.										33.27
				Pseudosmittia	*Pseudosmittia* sp.	31.18	138.58		24.25	3.46					49.90
				Rheocricotopus	*Rheocricotopus* sp.										
				Rheotanytarsus	*Rheotanytarsus exiguus gr.*							99.80			
				Saetheria	*Saetheria tylus*	3.46	17.32								
				Sergentia	*Sergentia* sp.										
				Stempellina	*Stempellina* sp.										
				Stictochironomus	*Stictochironomus* sp.	3.46	20.79	110.59	65.83	24.25	34.93	16.63		9.25	
				Synorthocladius	*Synorthocladius* sp.										
				Tanytarsus	*Tanytarsus* sp.	3.46	6.93	55.29	10.39	13.86	5.82	49.90	10.39	9.25	182.96
				Thienemanniella	*Thienemanniella* sp.									18.50	
				Thienemannimyia	*Thienemannimyia* gr. sp.	65.83	76.22	27.65	51.97	48.50	52.39	515.61	31.18	9.25	16.63
				Tokunagaia	*Tokunagaia* sp.										16.63
				Tvetenia	*Tvetenia bavarica gr.*							33.27			133.06
				Undetermined	Chironomini								3.46		
				Undetermined	Pentaneurini										
				Undetermined	Tanytarsini				3.46				3.46		
				Zalutschia	*Zalutschia* sp.		3.46	63.19	3.46	3.46	11.64	33.27	110.87	1184.16	482.35
			Dolichopodidae	Undetermined	Dolichopodidae										
			Empididae	*Clinocera*	*Clinocera* sp.										
				Trichoclinocera	*Trichoclinocera* sp.	3.46									
				Undetermined	Empididae				10.39						
			Muscidae	Undetermined	Muscidae					3.46	5.82				
			Simuliidae	*Simulium*	*Simulium* sp.										
				Undetermined	Simuliidae										
			Tipulidae	*Dicranota*	*Dicranota* sp.										
				Limnophila	*Limnophila* sp.					3.46					
				Prionocera	*Prionocera* sp.										
				Tipula	*Tipula* sp.	24.25	38.11	102.69	86.61	58.90	139.70	49.90			16.63

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

Area						Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Stream						Wolf OF	Wolf OF	Goose OF	Goose OF	Goose OF	Goose OF	Goose OF	Propellor OF	Propellor OF	Propellor OF
Replicate						4	5	1	2	3	4	5	1	2	3
Date Sampled						7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12
Surface Area Sampled (m^2)						0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289
EcoAnalysts Sample ID						6138.1-4	6138.1-5	6138.1-6	6138.1-7	6138.1-8	6138.1-9	6138.1-10	6138.1-16	6138.1-17	6138.1-18
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**										
			Undetermined	Undetermined	Diptera	58.90	211.34	3.95	31.18	65.83	17.46		17.32		
Ephemeroptera	Insecta	Ephemeroptera	Baetidae	*Acentrella*	*Acentrella lapponica*										
				Baetis	*Baetis flavistriga*										
				Baetis	*Baetis* sp.										33.27
			Ephemerellidae	*Ephemerella*	*Ephemerella* sp.	3.46	10.39			10.39		166.33	10.39		49.90
			Metretopodidae	*Metretopus*	*Metretopus* sp.	3.46									
				Undetermined	Metretopodidae										
			Undetermined	Undetermined	Ephemeroptera									9.25	
Gastropoda	Gastropoda	Basommatophora	Lymnaeidae	*Stagnicola*	*Stagnicola* sp.										
				Undetermined	Lymnaeidae										
			Physidae	*Physa*	*Physa* sp.			23.70			29.10				
		Gastropoda (class)	Undetermined	Undetermined	Gastropoda										
		Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*								31.18		
				Valvata	*Valvata* sp.								117.80	46.26	66.53
Hemiptera	Insecta	Hemiptera	Undetermined	Undetermined	Auchenorrhyncha										
				Undetermined	Hemiptera										
Ichthyoplankton	Actinopterygii	Gasterosteiformes	Gasterosteidae	Undetermined	Gasterosteidae	6.93	3.46								
Other Insecta	Insecta	Collembola	Undetermined	Undetermined	Collembola		3.46								
		Hymenoptera	Undetermined	Undetermined	Hymenoptera										
Other Organisms	Hydrozoa	Hydroida	Hydridae	*Hydra*	*Hydra* sp.				31.18	20.79	17.46	748.47	3.46	9.25	
	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda	45.04	65.83	59.24	55.43	76.22	390.00	615.41	27.72	166.52	182.96
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria						5.82	33.27		9.25	
Plecoptera	Insecta	Plecoptera	Nemouridae	*Nemoura*	*Nemoura* sp.	13.86		86.89	76.22	169.77	110.60	282.76	13.86	9.25	
				Undetermined	Nemouridae			15.80	6.93	124.73	52.39	249.49	10.39	9.25	
			Perlodidae	*Arcynopteryx*	*Arcynopteryx compacta*				3.46	3.46					
				Undetermined	Perlodidae					3.46					
Trichoptera	Insecta	Trichoptera	Brachycentridae	*Brachycentrus*	*Brachycentrus americanus*								3.46	18.50	316.02
				Micrasema	*Micrasema* sp.										
			Hydropsychidae	*Arctopsyche*	*Arctopsyche* sp.										
			Hydroptilidae	*Agraylea*	*Agraylea* sp.	20.79	10.39					16.63	48.50	55.51	365.92
				Oxyethira	*Oxyethira* sp.		3.46								
			Leptoceridae	*Ceraclea*	*Ceraclea* sp.										
				Mystacides	*Mystacides sepulchralis*	3.46	6.93		10.39						
				Mystacides	*Mystacides* sp.										
				Undetermined	Leptoceridae										
			Limnephilidae	*Asynarchus*	*Asynarchus* sp.										
				Grensia	*Grensia praeterita*										
				Undetermined	Limnephilidae			7.90	3.46						
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.										
			Rhyacophilidae	*Rhyacophila*	*Rhyacophila brunnea*										
				Rhyacophila	*Rhyacophila mongolica*										
				Rhyacophila	*Rhyacophila* sp.	3.46	3.46		3.46	3.46					
			Undetermined	Undetermined	Trichoptera										
					TOTAL	**568.19**	**1150.25**	**1808.92**	**1167.57**	**1534.82**	**1944.18**	**7185.34**	**1132.92**	**6170.59**	**5788.19**

Note: Benthos samples were not collected from Echo OF, which was dry during sampling, or Llama Lake where substrate size and water levels prevented sampling.
Only two samples were collected at Pond 19 OF due to low water levels.
Nematodes, copepods or cladocerans were excluded from analyses.
Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2															
Taxonomic Classification:					**Area**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**Goose**	**George**	**George**	**George**
					Stream	**Propellor OF**	**Propellor OF**	**Reference B OF**	**Reference B OF**	**Reference B OF**	**Reference B OF**	**Reference B OF**	**George OF**	**George OF**	**George OF**
					Replicate	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**
					Date Sampled	**9-Aug-12**	**9-Aug-12**	**10-Aug-12**	**10-Aug-12**	**10-Aug-12**	**10-Aug-12**	**10-Aug-12**	**5-Aug-12**	**5-Aug-12**	**5-Aug-12**
					Surface Area Sampled (m^2)	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**
					EcoAnalysts Sample ID	**6138.1-19**	**6138.1-20**	**6138.1-21**	**6138.1-22**	**6138.1-23**	**6138.1-24**	**6138.1-25**	**6141.1-6**	**6141.1-7**	**6141.1-8**
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**										
Acari	Arachnida	Sarcoptiformes	Undetermined	Undetermined	Oribatei										6.41
		Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.										
			Hydryphantidae	Undetermined	Hydryphantidae										
			Hygrobatidae	*Atractides*	*Atractides* sp.										
				Hygrobates	*Hygrobates* sp.										6.41
			Lebertiidae	*Lebertia*	*Lebertia* sp.	51.97			17.32	10.39	3.46	3.46	71.09		57.69
			Oxidae	*Oxus*	*Oxus* sp.								11.85		
			Pionidae	Undetermined	Pionidae					6.93					
			Sperchontidae	*Sperchon*	*Sperchon* sp.	31.18							35.55		19.23
			Unionicolidae	*Neumania*	*Neumania* sp.										
		Undetermined	Undetermined	Undetermined	Acari										
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae		124.70			6.93			35.55	75.53	76.92
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae			51.97	45.04	93.54	20.79	65.83		166.17	32.05
		Tubificida	Naididae	*Chaetogaster*	*Chaetogaster diastrophus*		20.78								
				Nais	*Nais* sp.		62.35							60.42	6.41
				Uncinais	*Uncinais uncinata*								11.85		
			Tubificidae	*Rhyacodrilus*	*Rhyacodrilus* sp.									15.11	
				Undetermined	Tubificidae w/ cap setae			6.93		13.86		3.46		60.42	19.23
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.										
				Sphaerium	*Sphaerium* sp.										
				Undetermined	Sphaeriidae										
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Agabus*	*Agabus* sp.										
				Hydroporus	*Hydroporus* sp.										
				Oreodytes	*Oreodytes* sp.	3.46									
			Haliplidae	*Haliplus*	*Haliplus* sp.				6.93			3.46			
				Undetermined	Haliplidae							6.93		7.55	
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera				3.46		31.18	3.46		22.66	
	Maxillopoda	Cyclopoida	Undetermined	Undetermined	Cyclopoida					24.25	6.93	41.58	17.77	15.11	6.41
	Ostracoda	Undetermined	Undetermined	Undetermined	Ostracoda	27.72	374.10	6.93	3.46		51.97	103.94	118.49	626.91	121.79
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.			10.39	20.79	13.86	6.93	13.86	5.92		19.23
				Probezzia	*Probezzia* sp.										
				Undetermined	Ceratopogoninae										
			Chironomidae	*Ablabesmyia*	*Ablabesmyia* (Karelia) sp.						6.93				
				Ablabesmyia	*Ablabesmyia* sp.										
				Acamptocladius	*Acamptocladius* sp.										
				Acricotopus	*Acricotopus* sp.				3.46			17.32		7.55	6.41
				Chaetocladius	*Chaetocladius* sp.										
				Chironomus	*Chironomus* sp.			17.32		3.46	13.86	3.46			
				Cladotanytarsus	*Cladotanytarsus* sp.				3.46			3.46		15.11	6.41
				Constempellina	*Constempellina* sp.										
				Corynoneura	*Corynoneura* sp.		41.57								6.41
				Cricotopus	*Cricotopus bicinctus gr.*								88.87		32.05
				Cricotopus	*Cricotopus* sp.	58.90	2223.83	45.04	3.46	34.65			177.73	45.32	243.58
				Cryptochironomus	*Cryptochironomus* sp.				3.46	3.46	3.46	10.39		7.55	12.82
				Demicryptochironomus	*Demicryptochironomus* sp.						3.46		5.92		6.41
				Dicrotendipes	*Dicrotendipes fumidus*	3.46	103.92	38.11	51.97			6.93	23.70	83.08	25.64
				Dicrotendipes	*Dicrotendipes* sp.		20.78		6.93	24.25				15.11	
				Eukiefferiella	*Eukiefferiella gracei gr.*										
				Euryhapsis	*Euryhapsis* sp.	3.46									
				Glyptotendipes	*Glyptotendipes* sp.			3.46							
				Heterotanytarsus	*Heterotanytarsus* sp.									113.30	32.05
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*										6.41
				Lipiniella	*Lipiniella* sp.										

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	George	George	George
Stream	Propellor OF	Propellor OF	Reference B OF	Reference B OF	Reference B OF	Reference B OF	Reference B OF	George OF	George OF	George OF
Replicate	4	5	1	2	3	4	5	1	2	3
Date Sampled	9-Aug-12	9-Aug-12	10-Aug-12	10-Aug-12	10-Aug-12	10-Aug-12	10-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12
Surface Area Sampled (m^2)	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289
EcoAnalysts Sample ID	6138.1-19	6138.1-20	6138.1-21	6138.1-22	6138.1-23	6138.1-24	6138.1-25	6141.1-6	6141.1-7	6141.1-8

Major Group	Class	Order	Family	Genus	Final Designation									
				Mesosmittia	*Mesosmittia* sp.									6.41
				Micropsectra	*Micropsectra* sp.		20.78						5.92	
				Nanocladius	*Nanocladius* sp.									
				Natarsia	*Natarsia* sp.									
				Orthocladius	*Orthocladius (Pogonocladius)* sp.									
				Orthocladius	*Orthocladius* Complex								7.55	
				Orthocladius	*Orthocladius* sp.	17.32	207.83							
				Parachironomus	*Parachironomus* sp.								82.94	60.42	307.68
				Paracladopelma	*Paracladopelma* sp.										
				Parakiefferiella	*Parakiefferiella* sp.				6.93		3.46	13.86	41.47	98.19	12.82
				Paramerina	*Paramerina* sp.										
				Parametriocnemus	*Parametriocnemus* sp.										
				Paratanytarsus	*Paratanytarsus* sp.	17.32	935.25	145.51	83.15	38.11	13.86	6.93		90.64	96.15
				Paratendipes	*Paratendipes* sp.						3.46	6.93			
				Phaenopsectra	*Phaenopsectra* sp.										
				Polypedilum	*Polypedilum halterale gr.*										
				Polypedilum	*Polypedilum scalaenum gr.*										
				Polypedilum	*Polypedilum sordens*					3.46					
				Polypedilum	*Polypedilum* sp.										
				Potthastia	*Potthastia longimana gr.*								35.55	45.32	25.64
				Procladius	*Procladius* sp.			51.97	173.23	103.94	384.57	498.90	5.92		6.41
				Protanypus	*Protanypus* sp.										6.41
				Psectrocladius	*Psectrocladius* sp.		353.32	31.18	159.37	135.12	297.96	221.73	11.85	22.66	25.64
				Pseudochironomus	*Pseudochironomus* sp.				3.46			10.39			
				Pseudokiefferiella	*Pseudokiefferiella* sp.	17.32							82.94		6.41
				Pseudosmittia	*Pseudosmittia* sp.			3.46	10.39				5.92	7.55	6.41
				Rheocricotopus	*Rheocricotopus* sp.										
				Rheotanytarsus	*Rheotanytarsus exiguus gr.*	3.46							17.77	15.11	
				Saetheria	*Saetheria tylus*										
				Sergentia	*Sergentia* sp.										
				Stempellina	*Stempellina* sp.										
				Stictochironomus	*Stictochironomus* sp.			6.93	10.39	6.93	13.86	6.93		60.42	
				Synorthocladius	*Synorthocladius* sp.										
				Tanytarsus	*Tanytarsus* sp.		270.18		13.86	10.39	162.84	114.33	5.92	37.77	19.23
				Thienemanniella	*Thienemanniella* sp.										
				Thienemannimyia	*Thienemannimyia* gr. sp.		124.70	48.50	17.32	17.32	6.93	27.72	355.46	324.78	339.73
				Tokunagaia	*Tokunagaia* sp.	27.72									
				Tvetenia	*Tvetenia bavarica gr.*	13.86	20.78						118.49	7.55	
				Undetermined	Chironomini										6.41
				Undetermined	Pentaneurini										
				Undetermined	Tanytarsini		20.78	107.40	103.94	79.69	58.90	138.58			
				Zalutschia	*Zalutschia* sp.	3.46	748.20								
			Dolichopodidae	Undetermined	Dolichopodidae										
			Empididae	*Clinocera*	*Clinocera* sp.										
				Trichoclinocera	*Trichoclinocera* sp.										
				Undetermined	Empididae				3.46						
			Muscidae	Undetermined	Muscidae			10.39	27.72	13.86	10.39	3.46			
			Simuliidae	*Simulium*	*Simulium* sp.										
				Undetermined	Simuliidae										6.41
			Tipulidae	*Dicranota*	*Dicranota* sp.										
				Limnophila	*Limnophila* sp.										
				Prionocera	*Prionocera* sp.										
				Tipula	*Tipula* sp.	3.46							35.55	90.64	115.38

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

Area						Goose	Goose	Goose	Goose	Goose	Goose	Goose	George	George	George
Stream						Propellor OF	Propellor OF	Reference B OF	Reference B OF	Reference B OF	Reference B OF	Reference B OF	George OF	George OF	George OF
Replicate						4	5	1	2	3	4	5	1	2	3
Date Sampled						9-Aug-12	9-Aug-12	10-Aug-12	10-Aug-12	10-Aug-12	10-Aug-12	10-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12
Surface Area Sampled (m^2)						0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289
EcoAnalysts Sample ID						6138.1-19	6138.1-20	6138.1-21	6138.1-22	6138.1-23	6138.1-24	6138.1-25	6141.1-6	6141.1-7	6141.1-8
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**										
			Undetermined	Undetermined	Diptera	6.93									
Ephemeroptera	Insecta	Ephemeroptera	Baetidae	*Acentrella*	*Acentrella lapponica*										
				Baetis	*Baetis flavistriga*										
				Baetis	*Baetis* sp.	3.46	20.78								
			Ephemerellidae	*Ephemerella*	*Ephemerella* sp.	17.32	41.57						82.94	22.66	
			Metretopodidae	*Metretopus*	*Metretopus* sp.										
				Undetermined	Metretopodidae										
			Undetermined	Undetermined	Ephemeroptera										
Gastropoda	Gastropoda	Basommatophora	Lymnaeidae	*Stagnicola*	*Stagnicola* sp.										
				Undetermined	Lymnaeidae										
			Physidae	*Physa*	*Physa* sp.						3.46				
		Gastropoda (class)	Undetermined	Undetermined	Gastropoda										
		Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*								47.40	75.53	83.33
				Valvata	*Valvata* sp.	6.93	145.48						59.24	75.53	
Hemiptera	Insecta	Hemiptera	Undetermined	Undetermined	Auchenorrhyncha										
				Undetermined	Hemiptera										
Ichthyoplankton	Actinopterygii	Gasterosteiformes	Gasterosteidae	Undetermined	Gasterosteidae										
Other Insecta	Insecta	Collembola	Undetermined	Undetermined	Collembola										
		Hymenoptera	Undetermined	Undetermined	Hymenoptera										
Other Organisms	Hydrozoa	Hydroida	Hydridae	*Hydra*	*Hydra* sp.										6.41
	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda	3.46	311.75	62.36	24.25	17.32		17.32	308.07	105.74	108.97
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria	3.46		10.39	10.39						
Plecoptera	Insecta	Plecoptera	Nemouridae	*Nemoura*	*Nemoura* sp.								11.85	15.11	
				Undetermined	Nemouridae	6.93							17.77	15.11	
			Perlodidae	*Arcynopteryx*	*Arcynopteryx compacta*										
				Undetermined	Perlodidae										
Trichoptera	Insecta	Trichoptera	Brachycentridae	*Brachycentrus*	*Brachycentrus americanus*	55.43									
				Micrasema	*Micrasema* sp.										
			Hydropsychidae	*Arctopsyche*	*Arctopsyche* sp.										
			Hydroptilidae	*Agraylea*	*Agraylea* sp.	41.58	228.62								
				Oxyethira	*Oxyethira* sp.										
			Leptoceridae	*Ceraclea*	*Ceraclea* sp.										
				Mystacides	*Mystacides sepulchralis*										
				Mystacides	*Mystacides* sp.										
				Undetermined	Leptoceridae									7.55	
			Limnephilidae	*Asynarchus*	*Asynarchus* sp.										
				Grensia	*Grensia praeterita*										70.51
				Undetermined	Limnephilidae					3.46					
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.				3.46			10.39			
			Rhyacophilidae	*Rhyacophila*	*Rhyacophila brunnea*										
				Rhyacophila	*Rhyacophila mongolica*										
				Rhyacophila	*Rhyacophila* sp.										
			Undetermined	Undetermined	Trichoptera										
					TOTAL	**429.61**	**6422.08**	**658.27**	**821.11**	**665.20**	**1108.67**	**1365.05**	**1937.28**	**2522.73**	**2006.33**

Note: Benthos samples were not collected from Echo OF, which was dry during sampling, or Llama Lake where substrate size and water levels prevented sampling.
Only two samples were collected at Pond 19 OF due to low water levels.
Nematodes, copepods or cladocerans were excluded from analyses.
Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2															
Taxonomic Classification:															
Area						**George**	**George**	**George**	**George**	**George**	**George**	**George**	**George**	**George**	**George**
Stream						**George OF**	**George OF**	**Sleigh OF**	**Sleigh OF**	**Sleigh OF**	**Sleigh OF**	**Sleigh OF**	**Dragon OF**	**Dragon OF**	**Dragon OF**
Replicate						**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**
Date Sampled						**5-Aug-12**	**5-Aug-12**	**5-Aug-12**	**5-Aug-12**	**5-Aug-12**	**5-Aug-12**	**5-Aug-12**	**5-Aug-12**	**5-Aug-12**	**5-Aug-12**
Surface Area Sampled (m^2)						**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**
EcoAnalysts Sample ID						**6141.1-9**	**6141.1-10**	**6141.1-11**	**6141.1-12**	**6141.1-13**	**6141.1-14**	**6141.1-15**	**6141.1-1**	**6141.1-2**	**6141.1-3**
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**										
Acari	Arachnida	Sarcoptiformes	Undetermined	Undetermined	Oribatei										
		Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.			13.86					6.93		
			Hydryphantidae	Undetermined	Hydryphantidae						20.78				
			Hygrobatidae	*Atractides*	*Atractides* sp.										
				Hygrobates	*Hygrobates* sp.								6.93	13.86	
			Lebertiidae	*Lebertia*	*Lebertia* sp.	47.54	14.76				20.78		90.08	27.72	55.43
			Oxidae	*Oxus*	*Oxus* sp.		4.92								
			Pionidae	Undetermined	Pionidae										
			Sperchontidae	*Sperchon*	*Sperchon* sp.	71.31	83.64	13.86	1953.64	1462.98	1766.59	169.98	117.80	526.62	291.03
			Unionicolidae	*Neumania*	*Neumania* sp.		4.92								
		Undetermined	Undetermined	Undetermined	Acari			13.86	20.78						13.86
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae	23.77	44.28	124.73	187.05	166.25	270.18	7.73	55.43		41.58
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae		14.76						34.65	284.10	152.44
		Tubificida	Naididae	*Chaetogaster*	*Chaetogaster diastrophus*										
				Nais	*Nais* sp.	463.53	44.28	13.86		66.50			20.79		97.01
				Uncinais	*Uncinais uncinata*										
			Tubificidae	*Rhyacodrilus*	*Rhyacodrilus* sp.										
				Undetermined	Tubificidae w/ cap setae										
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.										
				Sphaerium	*Sphaerium* sp.										
				Undetermined	Sphaeriidae										
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Agabus*	*Agabus* sp.										
				Hydroporus	*Hydroporus* sp.										
				Oreodytes	*Oreodytes* sp.										
			Haliplidae	*Haliplus*	*Haliplus* sp.								13.86	83.15	138.58
				Undetermined	Haliplidae										
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera			13.86	166.27	33.25		15.45	90.08		55.43
	Maxillopoda	Cyclopoida	Undetermined	Undetermined	Cyclopoida		24.60						97.01	34.65	69.29
	Ostracoda	Undetermined	Undetermined	Undetermined	Ostracoda	47.54	127.92	291.03		232.75	20.78		325.67	6.93	568.19
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.								34.65	13.86	13.86
				Probezzia	*Probezzia* sp.										
				Undetermined	Ceratopogoninae								6.93		
			Chironomidae	*Ablabesmyia*	*Ablabesmyia* (Karelia) sp.			41.58							
				Ablabesmyia	*Ablabesmyia* sp.										
				Acamptocladius	*Acamptocladius* sp.										
				Acricotopus	*Acricotopus* sp.										
				Chaetocladius	*Chaetocladius* sp.										
				Chironomus	*Chironomus* sp.										
				Cladotanytarsus	*Cladotanytarsus* sp.			83.15					6.93		
				Constempellina	*Constempellina* sp.										69.29
				Corynoneura	*Corynoneura* sp.			277.17	41.57	33.25					13.86
				Cricotopus	*Cricotopus bicinctus gr.*	130.74									27.72
				Cricotopus	*Cricotopus* sp.	641.81	314.87		166.27	266.00	519.59	92.72	41.58		27.72
				Cryptochironomus	*Cryptochironomus* sp.	11.89							6.93		
				Demicryptochironomus	*Demicryptochironomus* sp.					66.50			6.93		
				Dicrotendipes	*Dicrotendipes fumidus*		9.84						13.86	20.79	
				Dicrotendipes	*Dicrotendipes* sp.				20.78	66.50	20.78		34.65		13.86
				Eukiefferiella	*Eukiefferiella gracei gr.*										
				Euryhapsis	*Euryhapsis* sp.				1558.76	1396.48	956.04	363.15	6.93		
				Glyptotendipes	*Glyptotendipes* sp.										
				Heterotanytarsus	*Heterotanytarsus* sp.										
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*										
				Lipiniella	*Lipiniella* sp.										

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

Area					George	George	George	George	George	George	George	George	George	George
Stream					George OF	George OF	Sleigh OF	Sleigh OF	Sleigh OF	Sleigh OF	Sleigh OF	Dragon OF	Dragon OF	Dragon OF
Replicate					4	5	1	2	3	4	5	1	2	3
Date Sampled					5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12
Surface Area Sampled (m^2)					0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289
EcoAnalysts Sample ID					6141.1-9	6141.1-10	6141.1-11	6141.1-12	6141.1-13	6141.1-14	6141.1-15	6141.1-1	6141.1-2	6141.1-3
Major Group	Class	Order	Family	Genus	Final Designation									
				Mesosmittia	*Mesosmittia* sp.									
				Micropsectra	*Micropsectra* sp.									
				Nanocladius	*Nanocladius* sp.		9.84							
				Natarsia	*Natarsia* sp.									
				Orthocladius	*Orthocladius (Pogonocladius)* sp.									
				Orthocladius	*Orthocladius* Complex		4.92							13.86
				Orthocladius	*Orthocladius* sp.							13.86	48.50	55.43
				Parachironomus	*Parachironomus* sp.	59.43	54.12	13.86	145.48	99.75	124.70	38.63	76.22	13.86	138.58
				Paracladopelma	*Paracladopelma* sp.										
				Parakiefferiella	*Parakiefferiella* sp.								6.93		
				Paramerina	*Paramerina* sp.										
				Parametriocnemus	*Parametriocnemus* sp.										
				Paratanytarsus	*Paratanytarsus* sp.	47.54	4.92	41.58		33.25	20.78		124.73	13.86	55.43
				Paratendipes	*Paratendipes* sp.						20.78				
				Phaenopsectra	*Phaenopsectra* sp.										
				Polypedilum	*Polypedilum halterale gr.*										
				Polypedilum	*Polypedilum scalaenum gr.*										
				Polypedilum	*Polypedilum sordens*										
				Polypedilum	*Polypedilum* sp.										
				Potthastia	*Potthastia longimana gr.*	23.77	24.60				20.78	15.45			
				Procladius	*Procladius* sp.			13.86					27.72		
				Protanypus	*Protanypus* sp.										
				Psectrocladius	*Psectrocladius* sp.	11.89	4.92						20.79	6.93	
				Pseudochironomus	*Pseudochironomus* sp.										
				Pseudokiefferiella	*Pseudokiefferiella* sp.	23.77	9.84								
				Pseudosmittia	*Pseudosmittia* sp.	71.31				33.25	62.35	15.45	48.50	6.93	27.72
				Rheocricotopus	*Rheocricotopus* sp.										
				Rheotanytarsus	*Rheotanytarsus exiguus gr.*	106.97	4.92		103.92			7.73			
				Saetheria	*Saetheria tylus*			692.92	415.67	365.74	311.75	69.54	6.93		
				Sergentia	*Sergentia* sp.										
				Stempellina	*Stempellina* sp.										
				Stictochironomus	*Stictochironomus* sp.			97.01					20.79	6.93	13.86
				Synorthocladius	*Synorthocladius* sp.		4.92				20.78				
				Tanytarsus	*Tanytarsus* sp.	11.89		27.72			20.78		20.79		235.59
				Thienemanniella	*Thienemanniella* sp.										13.86
				Thienemannimyia	*Thienemannimyia* gr. sp.	118.85	167.28	124.73	103.92	133.00	249.40	115.90	457.33	457.33	582.05
				Tokunagaia	*Tokunagaia* sp.							7.73			
				Tvetenia	*Tvetenia bavarica gr.*	142.62	93.48		145.48		249.40	38.63			
				Undetermined	Chironomini										
				Undetermined	Pentaneurini										
				Undetermined	Tanytarsini										
				Zalutschia	*Zalutschia* sp.	11.89		41.58	20.78		20.78				
			Dolichopodidae	Undetermined	Dolichopodidae										
			Empididae	*Clinocera*	*Clinocera* sp.										13.86
				Trichoclinocera	*Trichoclinocera* sp.					33.25			6.93	6.93	
				Undetermined	Empididae								13.86	34.65	41.58
			Muscidae	Undetermined	Muscidae		4.92					7.73	6.93	6.93	
			Simuliidae	*Simulium*	*Simulium* sp.	332.79	19.68	13.86	810.55			363.15		6.93	
				Undetermined	Simuliidae	23.77			20.78			38.63			
			Tipulidae	*Dicranota*	*Dicranota* sp.										
				Limnophila	*Limnophila* sp.				20.78			7.73			
				Prionocera	*Prionocera* sp.				20.78						
				Tipula	*Tipula* sp.	35.66	54.12	485.04	103.92	166.25	145.48	54.09	152.44	187.09	374.18

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

Area						George	George	George	George	George	George	George	George	George	George
Stream						George OF	George OF	Sleigh OF	Sleigh OF	Sleigh OF	Sleigh OF	Sleigh OF	Dragon OF	Dragon OF	Dragon OF
Replicate						4	5	1	2	3	4	5	1	2	3
Date Sampled						5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12
Surface Area Sampled (m^2)						0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289
EcoAnalysts Sample ID						6141.1-9	6141.1-10	6141.1-11	6141.1-12	6141.1-13	6141.1-14	6141.1-15	6141.1-1	6141.1-2	6141.1-3
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**										
			Undetermined	Undetermined	Diptera	11.89				33.25		15.45			13.86
Ephemeroptera	Insecta	Ephemeroptera	Baetidae	*Acentrella*	*Acentrella lapponica*										
				Baetis	*Baetis flavistriga*										
				Baetis	*Baetis* sp.				20.78						
			Ephemerellidae	*Ephemerella*	*Ephemerella* sp.	142.62	73.80	41.58	207.83	631.74	394.89	84.99	20.79	41.58	27.72
			Metretopodidae	*Metretopus*	*Metretopus* sp.										
				Undetermined	Metretopodidae										
			Undetermined	Undetermined	Ephemeroptera										
Gastropoda	Gastropoda	Basommatophora	Lymnaeidae	*Stagnicola*	*Stagnicola* sp.										
				Undetermined	Lymnaeidae										
			Physidae	*Physa*	*Physa* sp.						103.92		117.80	20.79	83.15
		Gastropoda (class)	Undetermined	Undetermined	Gastropoda						83.13		6.93	27.72	
		Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*		63.96								
				Valvata	*Valvata* sp.	71.31	14.76								
Hemiptera	Insecta	Hemiptera	Undetermined	Undetermined	Auchenorrhyncha										
				Undetermined	Hemiptera								6.93		
Ichthyoplankton	Actinopterygii	Gasterosteiformes	Gasterosteidae	Undetermined	Gasterosteidae										
Other Insecta	Insecta	Collembola	Undetermined	Undetermined	Collembola										
		Hymenoptera	Undetermined	Undetermined	Hymenoptera										
Other Organisms	Hydrozoa	Hydroida	Hydridae	*Hydra*	*Hydra* sp.	1604.53	285.35		83.13	631.74		934.92	20.79		457.33
	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda	130.74	73.80	1676.87	665.07	4455.43	1143.09	193.16	187.09	55.43	720.64
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria										
Plecoptera	Insecta	Plecoptera	Nemouridae	*Nemoura*	*Nemoura* sp.	23.77	49.20	97.01	478.02	398.99	207.83	38.63	27.72	55.43	69.29
				Undetermined	Nemouridae	11.89	24.60	27.72		166.25	20.78	7.73			83.15
			Perlodidae	*Arcynopteryx*	*Arcynopteryx compacta*								6.93	13.86	
				Undetermined	Perlodidae										
Trichoptera	Insecta	Trichoptera	Brachycentridae	*Brachycentrus*	*Brachycentrus americanus*										
				Micrasema	*Micrasema* sp.										
			Hydropsychidae	*Arctopsyche*	*Arctopsyche* sp.										
			Hydroptilidae	*Agraylea*	*Agraylea* sp.									55.43	83.15
				Oxyethira	*Oxyethira* sp.										
			Leptoceridae	*Ceraclea*	*Ceraclea* sp.										
				Mystacides	*Mystacides sepulchralis*										
				Mystacides	*Mystacides* sp.										
				Undetermined	Leptoceridae										
			Limnephilidae	*Asynarchus*	*Asynarchus* sp.										
				Grensia	*Grensia praeterita*	23.77	19.68						20.79		
				Undetermined	Limnephilidae	11.89								13.86	
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.										
			Rhyacophilidae	*Rhyacophila*	*Rhyacophila brunnea*										
				Rhyacophila	*Rhyacophila mongolica*										
				Rhyacophila	*Rhyacophila* sp.									6.93	
			Undetermined	Undetermined	Trichoptera								6.93		
					TOTAL	**4492.69**	**1756.41**	**4282.24**	**7482.03**	**10972.33**	**6816.96**	**2704.30**	**2446.01**	**2099.55**	**4753.43**

Note: Benthos samples were not collected from Echo OF, which was dry during sampling, or Llama Lake where substrate size and water levels prevented sampling.
Only two samples were collected at Pond 19 OF due to low water levels.
Nematodes, copepods or cladocerans were excluded from analyses.
Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2															
Taxonomic Classification:															
Area						**George**	**George**	**George**	**George**	**George**	**George**	**George**	**George Reference C**	**George Reference C**	**George Reference C**
Stream						**Dragon OF**	**Dragon OF**	**Komatic IF**	**Komatic IF**	**Komatic IF**	**Komatic IF**	**Komatic IF**	**OF**	**OF**	**OF**
Replicate						**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**
Date Sampled						**5-Aug-12**	**5-Aug-12**	**6-Aug-12**	**6-Aug-12**	**6-Aug-12**	**6-Aug-12**	**6-Aug-12**	**6-Aug-12**	**6-Aug-12**	**6-Aug-12**
Surface Area Sampled (m^2)						**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**	**0.289**
EcoAnalysts Sample ID						**6141.1-4**	**6141.1-5**	**6141.1-16**	**6141.1-17**	**6141.1-18**	**6141.1-19**	**6141.1-20**	**6141.1-21**	**6141.1-22**	**6141.1-23**
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**										
Acari	Arachnida	Sarcoptiformes	Undetermined	Undetermined	Oribatei								3.46		3.78
		Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.										
			Hydryphantidae	Undetermined	Hydryphantidae										
			Hygrobatidae	*Atractides*	*Atractides* sp.										
				Hygrobates	*Hygrobates* sp.	41.57		23.70	20.79	10.39	6.17				
			Lebertiidae	*Lebertia*	*Lebertia* sp.	124.70	34.65	59.24	57.16	31.18	61.67			3.46	15.11
			Oxidae	*Oxus*	*Oxus* sp.										
			Pionidae	Undetermined	Pionidae										7.55
			Sperchontidae	*Sperchon*	*Sperchon* sp.	872.90	159.37						3.46		
			Unionicolidae	*Neumania*	*Neumania* sp.										
		Undetermined	Undetermined	Undetermined	Acari										3.78
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae	187.05	13.86						17.32	24.25	
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae	623.50	332.60	5.92	15.59		12.33	13.51	62.36	97.01	26.44
		Tubificida	Naididae	*Chaetogaster*	*Chaetogaster diastrophus*										
				Nais	*Nais* sp.	83.13	13.86						27.72	24.25	3.78
				Uncinais	*Uncinais uncinata*			23.70		45.04	12.33	18.02			
			Tubificidae	*Rhyacodrilus*	*Rhyacodrilus* sp.	20.78									3.78
				Undetermined	Tubificidae w/ cap setae	62.35	20.79								7.55
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.			5.92	10.39		30.83	4.50			
				Sphaerium	*Sphaerium* sp.								3.46		
				Undetermined	Sphaeriidae			23.70	93.54	24.25	24.67	22.52			
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Agabus*	*Agabus* sp.										
				Hydroporus	*Hydroporus* sp.									6.93	
				Oreodytes	*Oreodytes* sp.			5.92		3.46	6.17				
			Haliplidae	*Haliplus*	*Haliplus* sp.	62.35	34.65								
				Undetermined	Haliplidae			5.92							
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera	41.57		35.55	10.39	24.25		54.05	3.46		
	Maxillopoda	Cyclopoida	Undetermined	Undetermined	Cyclopoida	207.83	13.86	17.77	25.98	10.39			3.46	3.46	
	Ostracoda	Undetermined	Undetermined	Undetermined	Ostracoda	1080.74	311.81	77.02	77.95	27.72	6.17	22.52	13.86	34.65	3.78
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.	83.13	6.93				6.17		34.65	27.72	22.66
				Probezzia	*Probezzia* sp.										
				Undetermined	Ceratopogoninae										
			Chironomidae	*Ablabesmyia*	*Ablabesmyia* (Karelia) sp.					3.46					
				Ablabesmyia	*Ablabesmyia* sp.										
				Acamptocladius	*Acamptocladius* sp.			5.92		3.46					
				Acricotopus	*Acricotopus* sp.										
				Chaetocladius	*Chaetocladius* sp.										
				Chironomus	*Chironomus* sp.										
				Cladotanytarsus	*Cladotanytarsus* sp.	20.78		509.50	41.57	10.39	6.17	135.12			
				Constempellina	*Constempellina* sp.		6.93	35.55	5.20	3.46		9.01			
				Corynoneura	*Corynoneura* sp.		6.93								3.78
				Cricotopus	*Cricotopus bicinctus gr.*	20.78									
				Cricotopus	*Cricotopus* sp.	20.78	6.93			3.46			3.46	24.25	11.33
				Cryptochironomus	*Cryptochironomus* sp.			11.85	15.59				6.93	6.93	11.33
				Demicryptochironomus	*Demicryptochironomus* sp.			29.62		3.46	18.50	4.50			
				Dicrotendipes	*Dicrotendipes fumidus*			5.92		3.46		22.52		3.46	
				Dicrotendipes	*Dicrotendipes* sp.				20.79		6.17				
				Eukiefferiella	*Eukiefferiella gracei gr.*										
				Euryhapsis	*Euryhapsis* sp.	20.78	6.93		10.39	10.39					
				Glyptotendipes	*Glyptotendipes* sp.										
				Heterotanytarsus	*Heterotanytarsus* sp.										
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*										
				Lipiniella	*Lipiniella* sp.			82.94	88.34	10.39	333.02	45.04			

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

Area	George	George	George	George	George	George	George	George	George	George
Stream	Dragon OF	Dragon OF	Komatic IF	Komatic IF	Komatic IF	Komatic IF	Komatic IF	George Reference C OF	George Reference C OF	George Reference C OF
Replicate	4	5	1	2	3	4	5	1	2	3
Date Sampled	5-Aug-12	5-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12
Surface Area Sampled (m^2)	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289
EcoAnalysts Sample ID	6141.1-4	6141.1-5	6141.1-16	6141.1-17	6141.1-18	6141.1-19	6141.1-20	6141.1-21	6141.1-22	6141.1-23

Major Group	Class	Order	Family	Genus	Final Designation									
				Mesosmittia	*Mesosmittia* sp.									
				Micropsectra	*Micropsectra* sp.									
				Nanocladius	*Nanocladius* sp.									
				Natarsia	*Natarsia* sp.									
				Orthocladius	*Orthocladius (Pogonocladius)* sp.									
				Orthocladius	*Orthocladius* Complex									
				Orthocladius	*Orthocladius* sp.	124.70								
				Parachironomus	*Parachironomus* sp.	103.92	34.65						3.46	
				Paracladopelma	*Paracladopelma* sp.									
				Parakiefferiella	*Parakiefferiella* sp.			35.55	5.20					
				Paramerina	*Paramerina* sp.									
				Parametriocnemus	*Parametriocnemus* sp.									
				Paratanytarsus	*Paratanytarsus* sp.	145.48	27.72						62.36	41.58	173.72
				Paratendipes	*Paratendipes* sp.									
				Phaenopsectra	*Phaenopsectra* sp.									
				Polypedilum	*Polypedilum halterale gr.*									
				Polypedilum	*Polypedilum scalaenum gr.*		55.43	325.84	291.01	86.61	585.86	157.65			3.78
				Polypedilum	*Polypedilum sordens*									
				Polypedilum	*Polypedilum* sp.									
				Potthastia	*Potthastia longimana gr.*			5.92						
				Procladius	*Procladius* sp.			331.77	223.46	173.23	499.52	261.24	38.11	41.58	30.21
				Protanypus	*Protanypus* sp.										
				Psectrocladius	*Psectrocladius* sp.				5.20	6.93		58.55			
				Pseudochironomus	*Pseudochironomus* sp.			5.92							
				Pseudokiefferiella	*Pseudokiefferiella* sp.										
				Pseudosmittia	*Pseudosmittia* sp.	62.35	20.79						10.39	10.39	
				Rheocricotopus	*Rheocricotopus* sp.										
				Rheotanytarsus	*Rheotanytarsus exiguus gr.*	20.78	6.93								
				Saetheria	*Saetheria tylus*			272.52	166.29	197.48	166.51	364.84	10.39	3.46	
				Sergentia	*Sergentia* sp.							4.50			
				Stempellina	*Stempellina* sp.										
				Stictochironomus	*Stictochironomus* sp.		6.93			10.39	6.17		13.86	31.18	30.21
				Synorthocladius	*Synorthocladius* sp.										
				Tanytarsus	*Tanytarsus* sp.	83.13	69.29	118.49				4.50	10.39	3.46	
				Thienemanniella	*Thienemanniella* sp.										
				Thienemannimyia	*Thienemannimyia* gr. sp.	1143.09	471.19	171.81	155.90	27.72	92.50	85.58	131.65	173.23	222.82
				Tokunagaia	*Tokunagaia* sp.										
				Tvetenia	*Tvetenia bavarica gr.*	20.78									3.78
				Undetermined	Chironomini										
				Undetermined	Pentaneurini										
				Undetermined	Tanytarsini	20.78		29.62	25.98			4.50	65.83	24.25	135.96
				Zalutschia	*Zalutschia* sp.										
			Dolichopodidae	Undetermined	Dolichopodidae										
			Empididae	*Clinocera*	*Clinocera* sp.	20.78									
				Trichoclinocera	*Trichoclinocera* sp.		6.93							3.46	56.65
				Undetermined	Empididae	41.57								6.93	3.78
			Muscidae	Undetermined	Muscidae	41.57	13.86	130.34	192.28	135.12	135.67	117.11	3.46		
			Simuliidae	*Simulium*	*Simulium* sp.										
				Undetermined	Simuliidae										
			Tipulidae	*Dicranota*	*Dicranota* sp.										
				Limnophila	*Limnophila* sp.										
				Prionocera	*Prionocera* sp.										
				Tipula	*Tipula* sp.	478.02	200.95	53.32	36.38	41.58	49.34	49.55	135.12	86.61	132.18

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

Major Group	Class	Order	Family	Genus	Final Designation									
Area						George	George	George	George	George	George	George	George Reference C OF	George Reference C OF	George Reference C OF
Stream						Dragon OF	Dragon OF	Komatic IF	Komatic IF	Komatic IF	Komatic IF	Komatic IF			
Replicate						4	5	1	2	3	4	5	1	2	3
Date Sampled						5-Aug-12	5-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12
Surface Area Sampled (m^2)						0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289
EcoAnalysts Sample ID						6141.1-4	6141.1-5	6141.1-16	6141.1-17	6141.1-18	6141.1-19	6141.1-20	6141.1-21	6141.1-22	6141.1-23
			Undetermined	Undetermined	Diptera			59.24	51.97	72.76	49.34	22.52	20.79		
Ephemeroptera	Insecta	Ephemeroptera	Baetidae	*Acentrella*	*Acentrella lapponica*										
				Baetis	*Baetis flavistriga*	20.78									
				Baetis	*Baetis* sp.										
			Ephemerellidae	*Ephemerella*	*Ephemerella* sp.	83.13									
			Metretopodidae	*Metretopus*	*Metretopus* sp.										
				Undetermined	Metretopodidae										
			Undetermined	Undetermined	Ephemeroptera										
Gastropoda	Gastropoda	Basommatophora	Lymnaeidae	*Stagnicola*	*Stagnicola* sp.								62.36	41.58	45.32
				Undetermined	Lymnaeidae								194.02	76.22	67.98
			Physidae	*Physa*	*Physa* sp.	228.62	41.58						3.46	13.86	11.33
		Gastropoda (class)	Undetermined	Undetermined	Gastropoda	41.57	20.79								
		Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*			59.24	31.18	24.25	18.50	45.04	194.02	69.29	64.20
				Valvata	*Valvata* sp.			47.40	77.95	45.04	55.50	9.01	138.58	34.65	30.21
Hemiptera	Insecta	Hemiptera	Undetermined	Undetermined	Auchenorrhyncha										
				Undetermined	Hemiptera										
Ichthyoplankton	Actinopterygii	Gasterosteiformes	Gasterosteidae	Undetermined	Gasterosteidae										
Other Insecta	Insecta	Collembola	Undetermined	Undetermined	Collembola										
		Hymenoptera	Undetermined	Undetermined	Hymenoptera										
Other Organisms	Hydrozoa	Hydroida	Hydridae	*Hydra*	*Hydra* sp.	332.53	90.08								
	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda	935.25	325.67	77.02	5.20		6.17	4.50	93.54	69.29	67.98
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria										
Plecoptera	Insecta	Plecoptera	Nemouridae	*Nemoura*	*Nemoura* sp.	41.57							10.39		
				Undetermined	Nemouridae	41.57	6.93								
			Perlodidae	*Arcynopteryx*	*Arcynopteryx compacta*										
				Undetermined	Perlodidae										
Trichoptera	Insecta	Trichoptera	Brachycentridae	*Brachycentrus*	*Brachycentrus americanus*										
				Micrasema	*Micrasema* sp.										
			Hydropsychidae	*Arctopsyche*	*Arctopsyche* sp.										
			Hydroptilidae	*Agraylea*	*Agraylea* sp.	145.48	27.72								
				Oxyethira	*Oxyethira* sp.										
			Leptoceridae	*Ceraclea*	*Ceraclea* sp.										
				Mystacides	*Mystacides sepulchralis*										
				Mystacides	*Mystacides* sp.										
				Undetermined	Leptoceridae			5.92							
			Limnephilidae	*Asynarchus*	*Asynarchus* sp.										
				Grensia	*Grensia praeterita*							9.01			3.78
				Undetermined	Limnephilidae			5.92		3.46	6.17		3.46		
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.										
			Rhyacophilidae	*Rhyacophila*	*Rhyacophila brunnea*										
				Rhyacophila	*Rhyacophila mongolica*	20.78									
				Rhyacophila	*Rhyacophila* sp.										
			Undetermined	Undetermined	Trichoptera		6.93								
					TOTAL	**7773.00**	**2404.43**	**2701.53**	**1761.66**	**1053.24**	**2201.60**	**1549.43**	**1389.30**	**987.41**	**1208.49**

Note: Benthos samples were not collected from Echo OF, which was dry during sampling, or Llama Lake where substrate size and water levels prevented sampling.
Only two samples were collected at Pond 19 OF due to low water levels.
Nematodes, copepods or cladocerans were excluded from analyses.
Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	George Reference C	George Reference C
					Stream	OF	OF
					Replicate	4	5
					Date Sampled	6-Aug-12	6-Aug-12
					Surface Area Sampled (m^2)	0.289	0.289
Taxonomic Classification:					EcoAnalysts Sample ID	6141.1-24	6141.1-25
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**		
Acari	Arachnida	Sarcoptiformes	Undetermined	Undetermined	Oribatei	4.95	3.46
		Trombidiformes	Arrenuridae	*Arrenurus*	*Arrenurus* sp.		3.46
			Hydryphantidae	Undetermined	Hydryphantidae	4.95	
			Hygrobatidae	*Atractides*	*Atractides* sp.		
				Hygrobates	*Hygrobates* sp.		
			Lebertiidae	*Lebertia*	*Lebertia* sp.	14.86	3.46
			Oxidae	*Oxus*	*Oxus* sp.		
			Pionidae	Undetermined	Pionidae		3.46
			Sperchontidae	*Sperchon*	*Sperchon* sp.		
			Unionicolidae	*Neumania*	*Neumania* sp.		
		Undetermined	Undetermined	Undetermined	Acari		3.46
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Undetermined	Enchytraeidae		
		Lumbriculida	Lumbriculidae	Undetermined	Lumbriculidae	4.95	45.04
		Tubificida	Naididae	*Chaetogaster*	*Chaetogaster diastrophus*		
				Nais	*Nais* sp.	19.82	
				Uncinais	*Uncinais uncinata*		
			Tubificidae	*Rhyacodrilus*	*Rhyacodrilus* sp.		
				Undetermined	Tubificidae w/ cap setae		31.18
Bivalvia	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	*Pisidium* sp.		
				Sphaerium	*Sphaerium* sp.		
				Undetermined	Sphaeriidae		
Coleoptera	Insecta	Coleoptera	Dytiscidae	*Agabus*	*Agabus* sp.		
				Hydroporus	*Hydroporus* sp.		6.93
				Oreodytes	*Oreodytes* sp.		
			Haliplidae	*Haliplus*	*Haliplus* sp.		
				Undetermined	Haliplidae		
Crustacea	Branchiopoda	Diplostraca	Undetermined	Undetermined	Cladocera		
	Maxillopoda	Cyclopoida	Undetermined	Undetermined	Cyclopoida	9.91	3.46
	Ostracoda	Undetermined	Undetermined	Undetermined	Ostracoda	9.91	24.25
Diptera	Insecta	Diptera	Ceratopogonidae	*Bezzia/Palpomyia*	*Bezzia/Palpomyia* sp.	19.82	17.32
				Probezzia	*Probezzia* sp.		
				Undetermined	Ceratopogoninae		
			Chironomidae	*Ablabesmyia*	*Ablabesmyia* (Karelia) sp.		
				Ablabesmyia	*Ablabesmyia* sp.		
				Acamptocladius	*Acamptocladius* sp.		
				Acricotopus	*Acricotopus* sp.		
				Chaetocladius	*Chaetocladius* sp.		
				Chironomus	*Chironomus* sp.		
				Cladotanytarsus	*Cladotanytarsus* sp.		
				Constempellina	*Constempellina* sp.		
				Corynoneura	*Corynoneura* sp.		
				Cricotopus	*Cricotopus bicinctus gr.*		
				Cricotopus	*Cricotopus* sp.	29.73	17.32
				Cryptochironomus	*Cryptochironomus* sp.		
				Demicryptochironomus	*Demicryptochironomus* sp.		
				Dicrotendipes	*Dicrotendipes fumidus*		24.25
				Dicrotendipes	*Dicrotendipes* sp.		
				Eukiefferiella	*Eukiefferiella gracei gr.*		
				Euryhapsis	*Euryhapsis* sp.		
				Glyptotendipes	*Glyptotendipes* sp.		
				Heterotanytarsus	*Heterotanytarsus* sp.		
				Heterotrissocladius	*Heterotrissocladius marcidus gr.*		
				Lipiniella	*Lipiniella* sp.		

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2				Area	George Reference C	George Reference C
				Stream	OF	OF
				Replicate	4	5
				Date Sampled	6-Aug-12	6-Aug-12
				Surface Area Sampled (m^2)	0.289	0.289
Taxonomic Classification:				EcoAnalysts Sample ID	6141.1-24	6141.1-25
Major Group	Class	Order	Family	Genus	Final Designation		
				Mesosmittia	*Mesosmittia* sp.		
				Micropsectra	*Micropsectra* sp.		
				Nanocladius	*Nanocladius* sp.		
				Natarsia	*Natarsia* sp.		
				Orthocladius	*Orthocladius (Pogonocladius)* sp.		
				Orthocladius	*Orthocladius* Complex		
				Orthocladius	*Orthocladius* sp.		
				Parachironomus	*Parachironomus* sp.		
				Paracladopelma	*Paracladopelma* sp.		
				Parakiefferiella	*Parakiefferiella* sp.		
				Paramerina	*Paramerina* sp.		
				Parametriocnemus	*Parametriocnemus* sp.		
				Paratanytarsus	*Paratanytarsus* sp.	535.07	148.98
				Paratendipes	*Paratendipes* sp.		
				Phaenopsectra	*Phaenopsectra* sp.		
				Polypedilum	*Polypedilum halterale gr.*		
				Polypedilum	*Polypedilum scalaenum gr.*		
				Polypedilum	*Polypedilum sordens*		
				Polypedilum	*Polypedilum* sp.		
				Potthastia	*Potthastia longimana gr.*		
				Procladius	*Procladius* sp.	24.77	31.18
				Protanypus	*Protanypus* sp.		
				Psectrocladius	*Psectrocladius* sp.	4.95	3.46
				Pseudochironomus	*Pseudochironomus* sp.		
				Pseudokiefferiella	*Pseudokiefferiella* sp.		
				Pseudosmittia	*Pseudosmittia* sp.		6.93
				Rheocricotopus	*Rheocricotopus* sp.		
				Rheotanytarsus	*Rheotanytarsus exiguus gr.*		
				Saetheria	*Saetheria tylus*		
				Sergentia	*Sergentia* sp.		
				Stempellina	*Stempellina* sp.		
				Stictochironomus	*Stictochironomus* sp.	54.50	38.11
				Synorthocladius	*Synorthocladius* sp.		
				Tanytarsus	*Tanytarsus* sp.	4.95	
				Thienemanniella	*Thienemanniella* sp.		
				Thienemannimyia	*Thienemannimyia* gr. sp.	178.36	124.73
				Tokunagaia	*Tokunagaia* sp.		
				Tvetenia	*Tvetenia bavarica gr.*		
				Undetermined	Chironomini		
				Undetermined	Pentaneurini		
				Undetermined	Tanytarsini	14.86	45.04
				Zalutschia	*Zalutschia* sp.		
			Dolichopodidae	Undetermined	Dolichopodidae		
			Empididae	*Clinocera*	*Clinocera* sp.		
				Trichoclinocera	*Trichoclinocera* sp.	29.73	20.79
				Undetermined	Empididae		
			Muscidae	Undetermined	Muscidae		
			Simuliidae	*Simulium*	*Simulium* sp.		
				Undetermined	Simuliidae		
			Tipulidae	*Dicranota*	*Dicranota* sp.		
				Limnophila	*Limnophila* sp.	4.95	
				Prionocera	*Prionocera* sp.		
				Tipula	*Tipula* sp.	54.50	51.97

Appendix 3.7-8. Stream Benthos Density and Taxonomic Results, Back River Project, 2012

EcoAnalysts, Inc.

Data in organisms/m^2					Area	George Reference C	George Reference C
					Stream	OF	OF
					Replicate	4	5
					Date Sampled	6-Aug-12	6-Aug-12
					Surface Area Sampled (m^2)	0.289	0.289
Taxonomic Classification:					EcoAnalysts Sample ID	6141.1-24	6141.1-25
Major Group	**Class**	**Order**	**Family**	**Genus**	**Final Designation**		
			Undetermined	Undetermined	Diptera	9.91	
Ephemeroptera	Insecta	Ephemeroptera	Baetidae	*Acentrella*	*Acentrella lapponica*		
				Baetis	*Baetis flavistriga*		
				Baetis	*Baetis* sp.		
			Ephemerellidae	*Ephemerella*	*Ephemerella* sp.		
			Metretopodidae	*Metretopus*	*Metretopus* sp.		
				Undetermined	Metretopodidae		
			Undetermined	Undetermined	Ephemeroptera		
Gastropoda	Gastropoda	Basommatophora	Lymnaeidae	*Stagnicola*	*Stagnicola* sp.	19.82	24.25
				Undetermined	Lymnaeidae	475.62	41.58
			Physidae	*Physa*	*Physa* sp.	24.77	10.39
		Gastropoda (class)	Undetermined	Undetermined	Gastropoda		
		Heterostropha	Valvatidae	*Valvata*	*Valvata lewisi*	4.95	31.18
				Valvata	*Valvata* sp.	24.77	121.26
Hemiptera	Insecta	Hemiptera	Undetermined	Undetermined	Auchenorrhyncha		
				Undetermined	Hemiptera		
Ichthyoplankton	Actinopterygii	Gasterosteiformes	Gasterosteidae	Undetermined	Gasterosteidae		
Other Insecta	Insecta	Collembola	Undetermined	Undetermined	Collembola		
		Hymenoptera	Undetermined	Undetermined	Hymenoptera		
Other Organisms	Hydrozoa	Hydroida	Hydridae	*Hydra*	*Hydra* sp.		
	Nematoda (phylum)	Undetermined	Undetermined	Undetermined	Nematoda	49.54	62.36
	Turbellaria	Undetermined	Undetermined	Undetermined	Turbellaria		
Plecoptera	Insecta	Plecoptera	Nemouridae	*Nemoura*	*Nemoura* sp.		
				Undetermined	Nemouridae		
			Perlodidae	*Arcynopteryx*	*Arcynopteryx compacta*		
				Undetermined	Perlodidae		
Trichoptera	Insecta	Trichoptera	Brachycentridae	*Brachycentrus*	*Brachycentrus americanus*		
				Micrasema	*Micrasema* sp.		
			Hydropsychidae	*Arctopsyche*	*Arctopsyche* sp.		
			Hydroptilidae	*Agraylea*	*Agraylea* sp.		3.46
				Oxyethira	*Oxyethira* sp.		
			Leptoceridae	*Ceraclea*	*Ceraclea* sp.		
				Mystacides	*Mystacides sepulchralis*		
				Mystacides	*Mystacides* sp.		
				Undetermined	Leptoceridae		
			Limnephilidae	*Asynarchus*	*Asynarchus* sp.		
				Grensia	*Grensia praeterita*		
				Undetermined	Limnephilidae	9.91	
			Phryganeidae	*Agrypnia*	*Agrypnia* sp.		
			Rhyacophilidae	*Rhyacophila*	*Rhyacophila brunnea*		
				Rhyacophila	*Rhyacophila mongolica*		
				Rhyacophila	*Rhyacophila* sp.		
			Undetermined	Undetermined	Trichoptera		
					TOTAL	**1644.85**	**952.76**

Note: Benthos samples were not collected from Echo OF, which was dry during sampling, or Llama Lake where substrate size and water levels prevented sampling.
Only two samples were collected at Pond 19 OF due to low water levels.
Nematodes, copepods or cladocerans were excluded from analyses.
Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-9

Stream Benthos Richness and Diversity Results, Back River Project, 2012

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Appendix 3.7-9. Stream Benthos Richness and Diversity Results, Back River Project, 2012

Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose
Stream	Moby OF	Moby OF	Moby OF	Moby OF	Moby OF	Gander IF	Gander IF	Gander IF	Gander IF	Gander IF	Gander US	Gander US	Gander US	Gander US	Gander US	Pond 19 OF	Pond 19 OF	Chair OF	Chair OF	Chair OF	Chair OF	Chair OF
Replicate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	1	2	3	4	5
Date Sampled	12-Aug-12	12-Aug-12	12-Aug-12	12-Aug-12	12-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	11-Aug-12	13-Aug-12	13-Aug-12	13-Aug-12	13-Aug-12	13-Aug-12	13-Aug-12	13-Aug-12
Surface Area Sampled (m^2)	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289
EcoAnalysts Sample ID	6138.1-36	6138.1-37	6138.1-38	6138.1-39	6138.1-40	6138.1-26	6138.1-27	6138.1-28	6138.1-29	6138.1-30	6138.1-31	6138.1-32	6138.1-33	6138.1-34	6138.1-35	6138.1-41	6138.1-42	6138.1-43	6138.1-44	6138.1-45	6138.1-46	6138.1-47
Family Richness (# families)	13	12	15	14	14	11	9	7	7	8	12	14	13	14	9	5	11	13	13	18	16	8
Simpson's Diversity Index	0.40	0.66	0.79	0.80	0.78	0.40	0.20	0.53	0.30	0.46	0.27	0.54	0.48	0.60	0.56	0.17	0.21	0.41	0.67	0.75	0.67	0.29

Area	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose	Goose Propellor	Goose Propellor	Goose Propellor	Goose Propellor	Goose Propellor
Stream	Giraffe OF	Giraffe OF	Giraffe OF	Giraffe OF	Giraffe OF	Wolf OF	Wolf OF	Wolf OF	Wolf OF	Wolf OF	Goose OF	Goose OF	Goose OF	Goose OF	Goose OF	OF	OF	OF	OF	OF
Replicate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Date Sampled	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	8-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	7-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12	9-Aug-12
Surface Area Sampled (m^2)	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289
EcoAnalysts Sample ID	6138.1-11	6138.1-12	6138.1-13	6138.1-14	6138.1-15	6138.1-1	6138.1-2	6138.1-3	6138.1-4	6138.1-5	6138.1-6	6138.1-7	6138.1-8	6138.1-9	6138.1-10	6138.1-16	6138.1-17	6138.1-18	6138.1-19	6138.1-20
Family Richness (# families)	9	4	10	11	7	5	15	5	15	10	12	17	19	12	11	12	11	12	11	7
Simpson's Diversity Index	0.34	0.20	0.40	0.29	0.14	0.33	0.24	0.37	0.53	0.45	0.54	0.74	0.81	0.74	0.67	0.56	0.25	0.40	0.76	0.21

Area	Goose Reference	Goose Reference	Goose Reference	Goose Reference	Goose Reference	George	George	George	George	George	George	George	George	George	George	George	George	George	George	George
Stream	B OF	B OF	B OF	B OF	B OF	George OF	George OF	George OF	George OF	George OF	Sleigh OF	Sleigh OF	Sleigh OF	Sleigh OF	Sleigh OF	Dragon OF	Dragon OF	Dragon OF	Dragon OF	Dragon OF
Replicate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Date Sampled	10-Aug-12	10-Aug-12	10-Aug-12	10-Aug-12	10-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12	5-Aug-12
Surface Area Sampled (m^2)	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289
EcoAnalysts Sample ID	6138.1-21	6138.1-22	6138.1-23	6138.1-24	6138.1-25	6141.1-6	6141.1-7	6141.1-8	6141.1-9	6141.1-10	6141.1-11	6141.1-12	6141.1-13	6141.1-14	6141.1-15	6141.1-1	6141.1-2	6141.1-3	6141.1-4	6141.1-5
Family Richness (# families)	5	8	9	6	8	11	11	14	12	16	9	9	9	9	9	19	18	15	20	16
Simpson's Diversity Index	0.25	0.29	0.43	0.09	0.17	0.48	0.61	0.49	0.73	0.74	0.54	0.72	0.75	0.67	0.73	0.68	0.81	0.80	0.83	0.76

Area	George	George	George	George	George	George Reference	George Reference	George Reference	George Reference	George Reference
Stream	Komatic IF	Komatic IF	Komatic IF	Komatic IF	Komatic IF	C OF	C OF	C OF	C OF	C OF
Replicate	1	2	3	4	5	1	2	3	4	5
Date Sampled	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12	6-Aug-12
Surface Area Sampled (m^2)	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289
EcoAnalysts Sample ID	6141.1-16	6141.1-17	6141.1-18	6141.1-19	6141.1-20	6141.1-21	6141.1-22	6141.1-23	6141.1-24	6141.1-25
Family Richness (# families)	13	8	10	12	8	14	12	13	12	14
Simpson's Diversity Index	0.33	0.53	0.60	0.35	0.35	0.79	0.77	0.66	0.60	0.69

Note: Benthos samples were not collected from Echo OF, which was dry during sampling, or Llama Lake where substrate size and water levels prevented sampling.

Only two samples were collected at Pond 19 OF due to low water levels.

Nematodes, copepods or cladocerans were excluded from analyses.

Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.7-10

Stream Benthos QA/QC Results, Back River Project, 2012

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Appendix 3.7-10. Stream Benthos QA/QC Results, Back River Project, 2012

EcoA Sample ID | Sample ID | Replicate | Collection Date | Sorter | Sort Date | Primary Matrix | Estimated Pre-Rinse Volume (L) | Estimated Post-Rinse Volume (L) | QC Sorter | QC Date | Estimated % Recovery 1 | Estimated % Recovery 2 | Estimated % Recovery 3

EcoA Sample ID	Sample ID	Replicate	Collection Date	Sorter	Sort Date	Primary Matrix	Estimated Pre-Rinse Volume (L)	Estimated Post-Rinse Volume (L)	QC Sorter	QC Date	Estimated % Recovery 1	Estimated % Recovery 2	Estimated % Recovery 3
6138.1-1	Wolf OF	1	7-Aug-12	Laura Mills	09/12/12	Coarse Organic	0.10	0.10	Megan Payne	09/19/12	100.00	N/A	N/A
6138.1-2	Wolf OF	2	7-Aug-12	Laura Mills	09/18/12	Coarse Organic	1.60	1.30	Megan Payne	09/28/12	100.00	N/A	N/A
6138.1-3	Wolf OF	3	7-Aug-12	Steven Little	09/17/12	Fine Organic	0.25	0.23	Zach Meier	09/20/12	66.07	100.00	N/A
6138.1-4	Wolf OF	4	7-Aug-12	Nicole Huddleston	09/17/12	Coarse Organic	0.20	0.10	Zach Meier	09/19/12	91.37	96.23	N/A
6138.1-5	Wolf OF	5	7-Aug-12	Amanda Thompson	09/14/12	Fine Organic	0.13	0.08	Zach Meier	09/21/12	86.72	92.23	N/A
6138.1-6	Goose OF	1	7-Aug-12	Allie Pfeiffer	09/17/12	Vegetation	0.13	0.10	Zach Meier	09/20/12	85.22	94.56	N/A
6138.1-7	Goose OF	2	7-Aug-12	Zach Meier	09/17/12	Coarse Organic	0.38	0.33	Megan Payne	09/21/12	89.08	94.60	N/A
6138.1-8	Goose OF	3	7-Aug-12	Laurie Flaherty	09/18/12	Vegetation	0.35	0.25	Zach Meier	09/19/12	81.90	97.83	N/A
6138.1-9	Goose OF	4	7-Aug-12	Steven Little	09/17/12	Fine Organic	0.05	0.04	Megan Payne	09/19/12	96.63	N/A	N/A
6138.1-10	Goose OF	5	7-Aug-12	Amanda Thompson	09/17/12	Coarse Organic	0.13	0.10	Megan Payne	09/18/12	100.00	N/A	N/A
6138.1-11	Giraffe OF	1	8-Aug-12	Zach Meier	09/17/12	Coarse Organic	0.14	0.14	Megan Payne	09/18/12	100.00	N/A	N/A
6138.1-12	Giraffe OF	2	8-Aug-12	Zach Meier	09/17/12	Coarse Organic	0.12	0.12	Megan Payne	09/21/12	93.18	N/A	N/A
6138.1-13	Giraffe OF	3	8-Aug-12	Allie Pfeiffer	09/18/12	Inorganic	0.07	0.06	Zach Meier	09/19/12	84.66	98.25	N/A
6138.1-14	Giraffe OF	4	8-Aug-12	Zach Meier	09/18/12	Coarse Organic	0.33	0.31	Megan Payne	09/24/12	93.54	N/A	N/A
6138.1-15	Giraffe OF	5	8-Aug-12	Nicole Huddleston	09/25/12	Coarse Organic	0.20	0.15	Nora Williams	09/27/12	92.34	N/A	N/A
6138.1-16	Propellor OF	1	9-Aug-12	Laurie Flaherty	09/18/12	Vegetation	0.15	0.10	Zach Meier	09/21/12	92.78	N/A	N/A
6138.1-17	Propellor OF	2	9-Aug-12	Zach Meier	09/18/12	Coarse Organic	0.10	0.10	Megan Payne	09/21/12	100.00	N/A	N/A
6138.1-18	Propellor OF	3	9-Aug-12	Allie Pfeiffer	09/22/12	Vegetation	0.26	0.25	Zach Meier	09/22/12	93.31	N/A	N/A
6138.1-19	Propellor OF	4	9-Aug-12	Steven Little	09/19/12	Coarse Organic	0.10	0.04	Zach Meier	09/21/12	93.33	N/A	N/A
6138.1-20	Propellor OF	5	9-Aug-12	Ben Alexander	09/20/12	Filamentous Algae	6.50	5.25	Zach Meier	09/21/12	100.00	N/A	N/A
6138.1-21	Ref B OF	1	10-Aug-12	Steven Little	09/19/12	Coarse Organic	0.30	0.10	Zach Meier	09/21/12	98.05	N/A	N/A
6138.1-22	Ref B OF	2	10-Aug-12	Steven Little	09/20/12	Coarse Organic	0.70	0.05	Zach Meier	09/20/12	82.14	95.08	N/A
6138.1-23	Ref B OF	3	10-Aug-12	Steven Little	09/21/12	Coarse Organic	1.43	0.25	Zach Meier	09/21/12	85.82	100.00	N/A
6138.1-24	Ref B OF	4	10-Aug-12	Tiffany Miller	09/29/12	Vegetation	3.30	1.10	Megan Payne	10/03/12	100.00	N/A	N/A
6138.1-25	Ref B OF	5	10-Aug-12	Zach Meier	09/30/12	Coarse Organic	2.90	0.75	Nora Williams	10/02/12	100.00	N/A	N/A
6138.1-26	MN-02-OF	1	11-Aug-12	Tiffany Miller	10/01/12	Inorganic	1.00	0.10	Zach Meier	10/02/12	100.00	N/A	N/A
6138.1-27	MN-02-OF	2	11-Aug-12	Zach Meier	09/29/12	Inorganic	2.08	0.23	Nora Williams	10/01/12	76.16	100.00	N/A
6138.1-28	MN-02-OF	3	11-Aug-12	Megan Payne	09/25/12	Vegetation	3.40	0.70	Zach Meier	09/26/12	83.33	91.52	N/A
6138.1-29	MN-02-OF	4	11-Aug-12	Amanda Thompson	09/20/12	Fine Organic	0.08	0.03	Zach Meier	09/22/12	100.00	N/A	N/A
6138.1-30	MN-02-OF	5	11-Aug-12	Laura Mills	09/20/12	Coarse Organic	0.15	0.05	Zach Meier	09/21/12	100.00	N/A	N/A
6138.1-31	MN-02-US	1	11-Aug-12	Ben Alexander	09/20/12	Coarse Organic	0.23	0.13	Zach Meier	09/21/12	100.00	N/A	N/A
6138.1-32	MN-02-US	2	11-Aug-12	Laura Mills	09/20/12	Coarse Organic	0.15	0.02	Zach Meier	09/21/12	100.00	N/A	N/A
6138.1-33	MN-02-US	3	11-Aug-12	Angela Eagleston	09/20/12	Fine Organic	0.20	0.15	Zach Meier	09/21/12	97.36	N/A	N/A
6138.1-34	MN-02-US	4	11-Aug-12	Laurie Flaherty	09/20/12	Vegetation	0.15	0.11	Zach Meier	09/21/12	88.30	98.93	N/A
6138.1-35	MN-02-US	5	11-Aug-12	Amanda Thompson	09/20/12	Fine Organic	0.13	0.03	Zach Meier	09/22/12	100.00	N/A	N/A
6138.1-36	MN-01-OF	1	12-Aug-12	Ben Alexander	09/22/12	Coarse Organic	0.60	0.53	Zach Meier	09/22/12	88.97	94.19	N/A
6138.1-37	MN-01-OF	2	12-Aug-12	Amanda Thompson	09/21/12	Fine Organic	0.23	0.10	Zach Meier	09/21/12	72.16	100.00	N/A
6138.1-38	MN-01-OF	3	12-Aug-12	Nora Williams	09/24/12	Filamentous Algae	0.20	0.10	Zach Meier	09/27/12	86.55	96.14	N/A
6138.1-39	MN-01-OF	4	12-Aug-12	Laurie Flaherty	09/22/12	Vegetation	0.55	0.35	Zach Meier	09/22/12	96.96	N/A	N/A
6138.1-40	MN-01-OF	5	12-Aug-12	Amanda Thompson	09/21/12	Coarse Organic	0.33	0.18	Zach Meier	09/22/12	85.04	95.08	N/A
6138.1-41	Pond 19 OF	1	13-Aug-12	Zach Meier	09/24/12	Coarse Organic	1.25	1.25	Megan Payne	09/25/12	100.00	N/A	N/A
6138.1-42	Pond 19 OF	2	13-Aug-12	Allie Pfeiffer	09/24/12	Fine Organic	0.24	0.22	Megan Payne	09/26/12	89.52	95.99	N/A
6138.1-43	Chair OF	1	13-Aug-12	Amanda Thompson	09/25/12	Fine Organic	0.30	0.08	Megan Payne	09/26/12	87.31	100.00	N/A
6138.1-44	Chair OF	2	13-Aug-12	Angela Eagleston	09/21/12	Fine Organic	0.15	0.15	Zach Meier	09/21/12	100.00	N/A	N/A
6138.1-45	Chair OF	3	13-Aug-12	Ben Alexander	09/23/12	Coarse Organic	0.13	0.10	Megan Payne	09/26/12	100.00	N/A	N/A
6138.1-46	Chair OF	4	13-Aug-12	Ben Alexander	09/24/12	Coarse Organic	0.20	0.10	Zach Meier	09/24/12	99.13	N/A	N/A
6138.1-47	Chair OF	5	13-Aug-12	Steven Little	09/25/12	Fine Organic	1.08	0.15	Megan Payne	09/26/12	74.90	94.09	N/A
6141.1-1	Dragon Lake OF	1	5-Aug-12	Tiffany Miller	10/04/12	Fine Organic	0.45	0.25	Megan Payne	10/10/12	100.00	N/A	N/A
6141.1-2	Dragon Lake OF	2	5-Aug-12	Nicole Huddleston	10/05/12	Coarse Organic	0.02	0.01	Megan Payne	10/08/12	100.00	N/A	N/A
6141.1-3	Dragon Lake OF	3	5-Aug-12	Laurie Flaherty	10/04/12	Fine Organic	0.20	0.10	Megan Payne	10/04/12	100.00	N/A	N/A
6141.1-4	Dragon Lake OF	4	5-Aug-12	Angela Eagleston	10/04/12	Fine Organic	0.15	0.15	Megan Payne	10/04/12	100.00	N/A	N/A
6141.1-5	Dragon Lake OF	5	5-Aug-12	Amanda Thompson	10/04/12	Fine Organic	0.13	0.10	Megan Payne	10/04/12	100.00	N/A	N/A
6141.1-6	George Lake OF	1	5-Aug-12	Ben Alexander	10/05/12	Coarse Organic	0.63	0.45	Zach Meier	10/09/12	98.86	N/A	N/A
6141.1-7	George Lake OF	2	5-Aug-12	Angela Eagleston	10/08/12	Fine Organic	0.50	0.50	Ben Alexander	10/08/12	92.23	N/A	N/A

Appendix 3.7-10. Stream Benthos QA/QC Results, Back River Project, 2012

EcoA ANALYSTS, INC.

EcoA Sample ID	Sample ID	Replicate	Collection Date	Sorter	Sort Date	Primary Matrix	Estimated Pre-Rinse Volume (L)	Estimated Post-Rinse Volume (L)	QC Sorter	QC Date	Estimated % Recovery 1	Estimated % Recovery 2	Estimated % Recovery 3
6141.1-8	George Lake OF	3	5-Aug-12	Amanda Thompson	10/10/12	Fine Organic	0.50	0.15	Megan Payne	10/11/12	96.43	N/A	N/A
6141.1-9	George Lake OF	4	5-Aug-12	Laurie Flaherty	10/05/12	Fine Organic	0.25	0.25	Megan Payne	10/09/12	94.29	N/A	N/A
6141.1-10	George Lake OF	5	5-Aug-12	Allie Pfeiffer	10/05/12	Filamentous Algae	0.15	0.10	Ben Alexander	10/08/12	100.00	N/A	N/A
6141.1-11	Sleigh Lake OF	1	5-Aug-12	Nora Williams	10/05/12	Fine Organic	0.35	0.23	Ben Alexander	10/08/12	98.13	N/A	N/A
6141.1-12	Sleigh Lake OF	2	5-Aug-12	Ben Alexander	10/08/12	Coarse Organic	0.79	0.46	Megan Payne	10/08/12	100.00	N/A	N/A
6141.1-13	Sleigh Lake OF	3	5-Aug-12	Laurie Flaherty	10/08/12	Vegetation	0.60	0.40	Ben Alexander	10/10/12	100.00	N/A	N/A
6141.1-14	Sleigh Lake OF	4	5-Aug-12	Nora Williams	10/09/12	Fine Organic	0.55	0.45	Zach Meier	10/11/12	100.00	N/A	N/A
6141.1-15	Sleigh Lake OF	5	5-Aug-12	Allie Pfeiffer	10/07/12	Vegetation	0.14	0.10	Megan Payne	10/08/12	100.00	N/A	N/A
6141.1-16	Komatic Lake IF	1	6-Aug-12	Allie Pfeiffer	10/08/12	Fine Organic	0.45	0.15	Megan Payne	10/11/12	100.00	N/A	N/A
6141.1-17	Komatic Lake IF	2	6-Aug-12	Angela Eagleston	10/09/12	Fine Organic	0.70	0.25	Zach Meier	10/11/12	95.66	N/A	N/A
6141.1-18	Komatic Lake IF	3	6-Aug-12	Laurie Flaherty	10/09/12	Fine Organic	0.30	0.10	Megan Payne	10/09/12	100.00	N/A	N/A
6141.1-19	Komatic Lake IF	4	6-Aug-12	Zach Meier	10/08/12	Inorganic	0.27	0.02	Ben Alexander	10/09/12	100.00	N/A	N/A
6141.1-20	Komatic Lake IF	5	6-Aug-12	Allie Pfeiffer	10/10/12	Fine Organic	0.40	0.15	Zach Meier	10/11/12	92.44	N/A	N/A
6141.1-21	Ref C OF	1	6-Aug-12	Tiffany Miller	10/07/12	Fine Organic	1.60	0.45	Ben Alexander	10/09/12	72.20	93.30	N/A
6141.1-22	Ref C OF	2	6-Aug-12	Zach Meier	10/08/12	Filamentous Algae	1.83	0.75	Ben Alexander	10/10/12	100.00	N/A	N/A
6141.1-23	Ref C OF	3	6-Aug-12	Tiffany Miller	10/08/12	Fine Organic	1.80	0.35	Zach Meier	10/11/12	93.29	N/A	N/A
6141.1-24	Ref C OF	4	6-Aug-12	Laurie Flaherty	10/10/12	Filamentous Algae	1.15	1.00	Zach Meier	10/11/12	92.41	N/A	N/A
6141.1-25	Ref C OF	5	6-Aug-12	Zach Meier	10/10/12	Filamentous Algae	2.37	0.40	Megan Payne	10/11/12	100.00	N/A	N/A

Appendix 4-1

Summary of 2012 Freshwater Baseline Results for Lakes

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Appendix 4-1. Summary of 2012 Freshwater Baseline Results for Lakes

Lake	Summer Sampling Max Depth (m)	Dissolved Oxygen: Seasons and Depths that Exceed CCME Guidelines*	Water Quality: General Description	Water Quality: Nutrient Status	Water Quality: CCME Guideline Exceedances*	Sediment Quality: CCME Guideline Exceedances*	Primary producers: Phytoplankton	Aquatic Macroinvertebrates: Zooplankton	Aquatic Macroinvertebrates: Benthos
Goose Area									
Moby	14.8	none	near neutral, soft, low TDS	ultraoligotrophic	Cd	nc	moderate chl a biomass, low densities, more than 60% chlorophytes	nc	nc
Gander	2.4	all life stages: Apr, all depths	near neutral, soft, low TDS	oligotrophic - mesotrophic	Cd, Cu	ISQG: As, Cr	euglenophytes present; highest richness	highest densities; vast majority rotifers; highest richness	high densities; high richness and diverstiy
Pond 19	1.5	none	slightly basic, soft, low TDS	ultraoligotrophic	Cu	PEL: As	nc	nc	low densities; vast majority dipteran; low richness and diversity
Big	5.0	all life stages: Apr, bottom depths	near neutral, soft, low TDS	ultraoligotrophic - oligotrophic	Cd	ISQG: As, Cu; PEL: As	moderate chl *a* biomass and densities, highest richness in Aug	rotifer dominated; high richness	high densities; over half dipteran; low richness; moderate diversity
Rabbit	3.6	none	slightly acidic, soft, low TDS	ultraoligotrophic	pH, Al, Cd and Cu	ISQG: As, Cu; PEL: As	low chl a biomass; almost 80% myxophyte (cyanobacteria)	moderate densities; crustacean dominated; moderate richness; high diversity	low densities; over half dipteran; high richness
Fox	5.8	early life stages: Apr, bottom depths	near neutral, soft, low TDS	ultraoligotrophic - oligotrophic	Cd and Pb	ISQG: As, Cu; PEL: As	low densities, only Goose area lake with significant chrysophyte component	highest copepodite densities; rotifer dominated; high richness	low densities; over half bivalves
Echo	0.4	none	near neutral, soft, low TDS	mesoeutrophic	Cu and Fe	ISQG: As, Cu	nc	nc	nc
Rascal	2.8	all life stages: Apr, all depths	near neutral, soft, low TDS	ultraoligotrophic - oligotrophic	pH, Al, Cd and Cu	ISQG: Cu	relatively high chl *a* biomass, low density, more than 90% cryptophytes, lowest richness and low diversity	nc	vast majority dipteran; moderate richness; low diversity
Giraffe North	3.7	none	near neutral, soft, low TDS	ultraoligotrophic - oligotrophic	Cd and Cu	ISQG: As, Cu	low chl *a* biomass, low densities, moderate richness and high diversity	nc	low densities; over half dipteran
Giraffe South	7.7	all life stages: Apr, bottom depths; Early life stages: Apr, bottom depths	near neutral, soft, low TDS	ultraoligotrophic	Cd and Cu	ISQG: As, Cu	low Apr biomass and densities, over 80% cryptophyte in Apr; greatest genera richness in Aug, high diversity	moderate densities; moderate richness and diversity	low densities; high diversity
Goose Neck	3.0	none	near neutral, soft, low TDS	ultraoligotrophic - oligotrophic	Cu	ISQG: As, Cu; PEL: As	low Apr densities; greatest genera richness in Aug; high diversity	moderate densities; high richness and diversity	high densities; vast majority dipteran
Goose Central	4.7	none	near neutral, soft, low TDS	ultraoligotrophic	-	ISQG: As, Cu	moderate chl *a* biomass; low Apr densities; high genera richness and diversity in Aug	moderate densities; high richness and diversity	high densities; over half dipteran; low richness; moderate diversity
Goose Tail	2.8	all life stages: Apr, mid to bottom depths; Early life stages: Apr, bottom depths	near neutral, soft, low TDS	ultraoligotrophic - oligotrophic	Cu	ISQG: none	low chl *a* biomass and densities; more than 80% cryptophytes; moderate diversity	nc	nc
Propellor	7.8	all life stages: Apr, mid to bottom depths; Early life stages: Apr, bottom depths	near neutral, soft, low TDS	ultraoligotrophic	Cd	ISQG: Cu	low chl a biomass and density; dominated by myxophyte (cyanobacteria)s; low richness and diversity	nc	high densities; vast majority dipteran; low diverstiy

(continued)

Appendix 4-1. Summary of 2012 Freshwater Baseline Results for Lakes (completed)

Lake	Summer Sampling Max Depth (m)	Dissolved Oxygen: Seasons and Depths that Exceed CCME Guidelines*	Water Quality: General Description	Water Quality: Nutrient Status	Water Quality: CCME Guideline Exceedances*	Sediment Quality: CCME Guideline Exceedances*	Primary producers: Phytoplankton	Aquatic Macroinvertebrates: Zooplankton	Aquatic Macroinvertebrates: Benthos
George Area									
Lower Long	5.2	all life stages: Apr, mid to bottom depths, Aug, all depths; Early life stages: Apr, bottom depths	slightly basic, soft, low TDS	ultraoligotrophic	-	ISQG: As, Cr, Cu; PEL: As	high chl *a* biomass; moderate densities; more than 5% chrysophytes; moderate richness and diversity	moderate densities; high richness and moderately high diversity	low densities; low richness
Fold	9.8	all life stages: Aug, all depths	slightly basic, soft, low TDS	ultraoligotrophic - oligotrophic	-	ISQG: As, Cr, Cu; PEL: As	higher Apr chl *a* biomass; high Aug densities; more than 5% chrysophytes; low Aug diversity	highest densities; highest copepodite densities; high richness and diversity	moderate densities, richness and diversity
George Central	14.5	all life stages: Aug, all depths	near neutral, soft, low TDS	ultraoligotrophic	-	ISQG: As; PEL: As	low chl a biomass; high Aug densities; more than 90% myxophyte (cyanobacteria)s in Aug; more than 5% chrysophytes; low diversity	crustacean dominated; lowest richness; very low diversity	over half bivalves; moderately high richness and diversity
George South	3.0	none	slightly acidic, soft, low TDS	ultraoligotrophic	-	ISQG: As, Cr; PEL: As	nc	nc	over half bivalves; moderate high richness and diversity
Lytle	1.4	all life stages: Aug, all depths	near neutral, soft, low TDS	ultraoligotrophic	Cu	ISQG: As, Cr, Cu, Zn; PEL: As	low chl *a* biomass; more than 5% chrysophytes; lowest genera richness	lowest densities; crustacean dominated; low richness and diversity	highest densities; vast majority dipteran; lowest diversity
Occurrence	1.5	all life stages: Aug, all depths	slightly basic, soft, low TDS	ultraoligotrophic	Cu	ISQG: As, Cr, Cu, Zn; PEL: AS, Cr	low chl *a* biomass; more than 5% chrysophytes; lowest genera richness	lowest densities; crustacean dominated; low richness and diversity	low densities; highest diversity
Sleigh	1.5	all life stages: Aug, all depths	near neutral, soft, low TDS	ultraoligotrophic	Cu	ISQG: As	low chl *a* biomass; more than 5% chrysophytes	lowest densities; crustacean dominated; low richness and diversity	low densities; vast majority dipteran; low diversity
Dragon	3.4	all life stages: Apr, bottom depths, Aug, all depths; Early life stages: Apr, bottom depths	near neutral, almost moderately hard in Apr, higher TDS in Apr	ultraoligotrophic	-	ISQG: As, Cr, Cu, Zn; PEL: As	higher Apr chl *a* biomass; more than 5% chrysophytes	crustacean dominated; high richness	moderate densities, richness and diversity
Komatic	7.0	all life stages: Apr, bottom depths, Aug, all depths; Early life stages: Apr, bottom depths	slightly basic, moderately hard in Apr, higher TDS in Apr	ultraoligotrophic - oligotrophic	Cu	ISQG: As, Cd, Cr, Cu, Zn; PEL: As	high Apr chl a biomass; high Aug densities; more than 50% bacillariophyte (diatoms) in Apr; more than 90% myxophyte (cyanobacteria)s in Aug; more than 5% chrysophytes; low Aug diversity	highest copepodite densities; crustacean dominated; high richness and diversity	high densities; vast majority dipteran
Reference C	35.0	all life stages: Aug, all depths above thermocline and most depths below thermocline	slightly basic, moderately hard, higher TDS	ultraoligotrophic - oligotrophic	-	ISQG: As, Cu	moderate chl a biomass and density; more than 90% myxophyte (cyanobacteria)s in Apr; very low diversity in Apr	moderate densities; crustacean dominated; moderate richness and diversity	lowest densities; over half bivalves; lowest richness

nc = not collected

** Parameters which, on average, exceeded CCME guidelines as calculated in tables.*

Half the detection limit was substituted for values that were below the detection limit for the calculation of exceedance factors.

Underlined values show sites where all samples that exceeded a particular parameters guideline were below the detection limit.

Appendix 4-2

Summary of 2012 Freshwater Baseline Results for Streams

Rescan™
Engineers and Scientists

Appendix 4-2. Summary of 2012 Freshwater Baseline Results for Streams

			Dissolved Oxygen	Water Quality			Sediment Quality	Primary Producers	Aquatic Macroinvertebrates
Stream	General Description	Substrate	Seasons that Exceed CCME Guidelines	General Description	Nutrient Status	CCME Guideline Exceedances*	Parameters that Exceed CCME Guidelines	Periphyton	Benthos
Goose Area									
Moby OF	Small stream running through flood plain.	Mainly silt, few small stones	-	Slightly acidic, soft, low TDS	Ultraoligotrophic - Oligotrophic	Cd, Cu, Ni	-	dominated by myxophyceae (cyanobacteria)	high richness and diverstiy
Gander IF	Wide and deep, slow moving stream.	Mainly silt, few small stones	-	Near neutral, soft, low TDS	Oligotrophic	Cd	-	dominated by myxophyceae (cyanobacteria); highest richness	over 80% chironomids; over 10% bivalves; lowest richness; low diversity
Gander US	Medium stream with medium flow over cobble to boulders.	Mainly cobbles, some large stones, boulders	-	Near neutral, soft, low TDS	Oligotrophic	Cd	ISQG: As	low chl a biomass; dominated by myxophyceae (cyanobacteria); highest richness	high richness; moderate diversity
Pond 19 OF	Very small stream, nearly dry during summer sampling.	Mainly silt, few small stones	Early life stages: Aug	Near neutral, soft, low TDS	Ultraoligotrophic - Oligotrophic	Cd, Cu	-	low chl *a* biomass; dominated by bacillariophyceae	high and variable densities; over 80% chironomids; lowest richness and diversity
Chair OF	Small stream through floodplain.	Mainly silt, few small stones	-	Variable pH, soft, low TDS	Oligotrophic - Mesotrophic	pH, Al	ISQG: As, Cr	high chl *a* biomass; more than 20% chlorophyceae; high diversity	high richness; moderate diversity
Llama OF	Medium stream through large boulder field.	Cobbles, large stones, boulders	Early life stages: Aug, Sept; All life stages: Aug, Sept	Slighty acidic, soft (June) to hard (Sept) water, highest TDS particularly high in Sept	Ultraoligotrophic	Cd	nc	low chl *a* biomass; more than 20% chlorophyceae; lowest richness and diversity	nc
Echo OF	Very small stream through flood plain, dry during summer sampling.	Mainly silt, few small stones	-	Slightly acidic, soft, low TDS	Ultraoligotrophic	pH, Al, Cd, Cu	nc	nc	nc
Giraffe OF	Short, medium-sized stream, cobbles.	Cobbles, large stones, boulders	Early life stages: Aug	Slightly acidic, soft, low TDS	Ultraoligotrophic - Oligotrophic	Cd	-	highest and most variable densities; dominated by myxophyceae (cyanobacteria); high diversity	lowest densities; over 80% chironomids; lowest richness; low diversity
Wolf OF	Small stream running through flood plain.	Mainly silt, few small stones	-	Near neutral, soft, low TDS	Ultraoligotrophic - Oligotrophic	Cd	-	dominated by myxophyceae (cyanobacteria)	lowest densities; over 80% chironomids
Goose OF	Short, medium-sized stream, cobbles.	Cobbles, large stones, boulders	-	Slightly acidic, soft, low TDS	Ultraoligotrophic - Oligotrophic	Cd	-	dominated by myxophyceae (cyanobacteria); high diversity	high richness and diversity
Propellor OF	Large stream draining largest lake in the area. Runs through boulder field.	Large stones, boulders	Early life stages: Aug	Slightly acidic, soft, low TDS	Ultraoligotrophic - Oligotrophic	<u>Cd</u>	ISQG: As, Cr; PEL: As	dominated by myxophyceae (cyanobacteria); high diversity	over 80% chironomids; moderate richness and diversity
Reference B OF	Small stream through floodplain.	Mainly silt, few small stones	Early life stages: Aug	Near neutral, soft, low TDS	Oligotrophic - Mesotrophic	Cd, Fe	-	dominated by myxophyceae (cyanobacteria); more than 20% chlorophyceae; high richness; high diversity	lowest densities; over 80% chironomids; lowest richness; low diversity
George Area									
George OF	Short, small-sized stream, cobbles. Split into two channels.	Cobbles, gravel, sand	-	Near neutral, soft, low TDS	Ultraoligotrophic - Oligotrophic	Cd	ISQG: As, Cu; PEL: As	low densities; high diversity	moderately high richness and diversity
Sleigh OF	Small stream running through flood plain.	Cobbles, silt	Early life stages: Aug	Near neutral, soft, low TDS	Ultraoligotrophic - Oligotrophic	Cd, Cu	ISQG: As, Cr	low densities; low richness; high diversity	high densities; moderate richness; high diversity
Dragon OF	Small stream running through flood plain.	Cobbles, silt	Early life stages: Aug	Slightly basic, soft, low TDS	Ultraoligotrophic - Oligotrophic	-	ISQG: As, Cr; PEL: As	high chl biomass; low densities; high richness; high diversity	highest richness and diversity
Komatic IF	Medium stream meandering through grass plain. No rocks present.	Mainly silt, no stones present	-	Slightly basic, soft, low TDS	Oligotrophic - Mesotrophic	Cu	ISQG: As, Cr	low densities; moderate richness; high diversity	moderate richness and diversity
Reference C OF	Short, small-sized stream, cobbles. Nearly dry during summer. Split into two channels.	Cobbles, gravel, silt	-	Slightly basic, soft to moderately hard, low TDS	Ultraoligotrophic - Oligotrophic	-	-	high densities; dominated by myxophyceae (cyanobacteria); high diversity	over 10% gastropods; moderate richness; high diversity

nc = not collected

** Parameters which, on average, exceeded CCME guidelines as calculated in tables.*

Half the detection limit was substituted for values that were below the detection limit for the calculation of exceedance factors.

Underlined values show sites where all samples that exceeded a particular parameters guideline were below the detection limit.

Appendix V6-3D

Back River Project: Bathymetric Surveys of Lakes in the Goose and George Property Areas

Sabina
GOLD & SILVER CORP.

Appendix V6-3D. Back River Project: Bathymetric Surveys of Lakes in the Goose and George Property Areas

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Appendix V6-3D. Back River Project: Bathymetric Surveys of Lakes in the Goose and George Property Areas

1.1 SUMMARY

Bathymetric surveys of lakes in the Project area were conducted from 2010 to 2013 during open-water and ice-covered seasons. Surveys were conducted on lakes closest to potential infrastructure and activities as well as lakes identified as potential water sources for Project domestic and industrial uses.

1.2 METHODS

The bathymetric surveys were conducted as part of the baseline sampling program, and detailed in the following reports:

- *Back River Project: 2010 Lake Water and Sediment Quality Baseline Report* (Rescan 2011; Appendix V6-3A);
- *Back River Project: 2011 Freshwater Baseline Report* (Rescan 2012; Appendix V6-3B);
- *Back River Project: 2012 Freshwater Baseline Report* (Rescan 2013a; Appendix V6-3C); and
- *Back River Project: 2013 Freshwater Baseline Report* (Rescan 2013b).

Bathymetric surveys were also conducted on ice-covered lakes in 2013 using a ground-penetrating radar system (Appendix V6-3E).

Open-water bathymetric surveys from 2010 to 2013 consisted of two parts:

1. The collection of continuous depth measurements along perpendicular and perimeter transects on the lake and pond surfaces using a Differential Global Positioning System (DGPS) and a Garmin depth sounder; and
2. Establishing on-land benchmarks via DGPS surveys of the lake shorelines.

A Trimble PF Power DGPS was used for positioning during the depth survey, and a Garmin depth sounder and a Trimble TSC1 datalogger were used to collect and store the depth data in electronic files. The DGPS and sounder were mounted on the boat for surveys along the lake surfaces.

Depth surveys were carried out by navigating a course of regularly spaced transects across the width of each lake, followed by a longitudinal transect through the long axis of the lake (i.e., e-line). A hand-held GPS, pre-loaded with transect tracks, was used to maintain the correct course with the boat.

Bathymetric surveys conducted on ice-covered lakes in 2013 used a Ground-Penetrating RADAR (GPR) array. MALA's Ramac CUII was used with a 50 MHz rough-terrain antenna. Real-time positioning was attained using a Topcon HyperLite+GPS/Glonass unit. Positions were recorded at 1 Hz with a typical absolute horizontal accuracy of ± 1 metre. The GPR survey was conducted at a speed of approximately 15 km/hr and data were acquired at a frequency of approximately 10 readings per second, giving an

average horizontal resolution of approximately one GPR trace per 42 cm along survey lines. Data were later corrected for ice thickness (Appendix V6-3E).

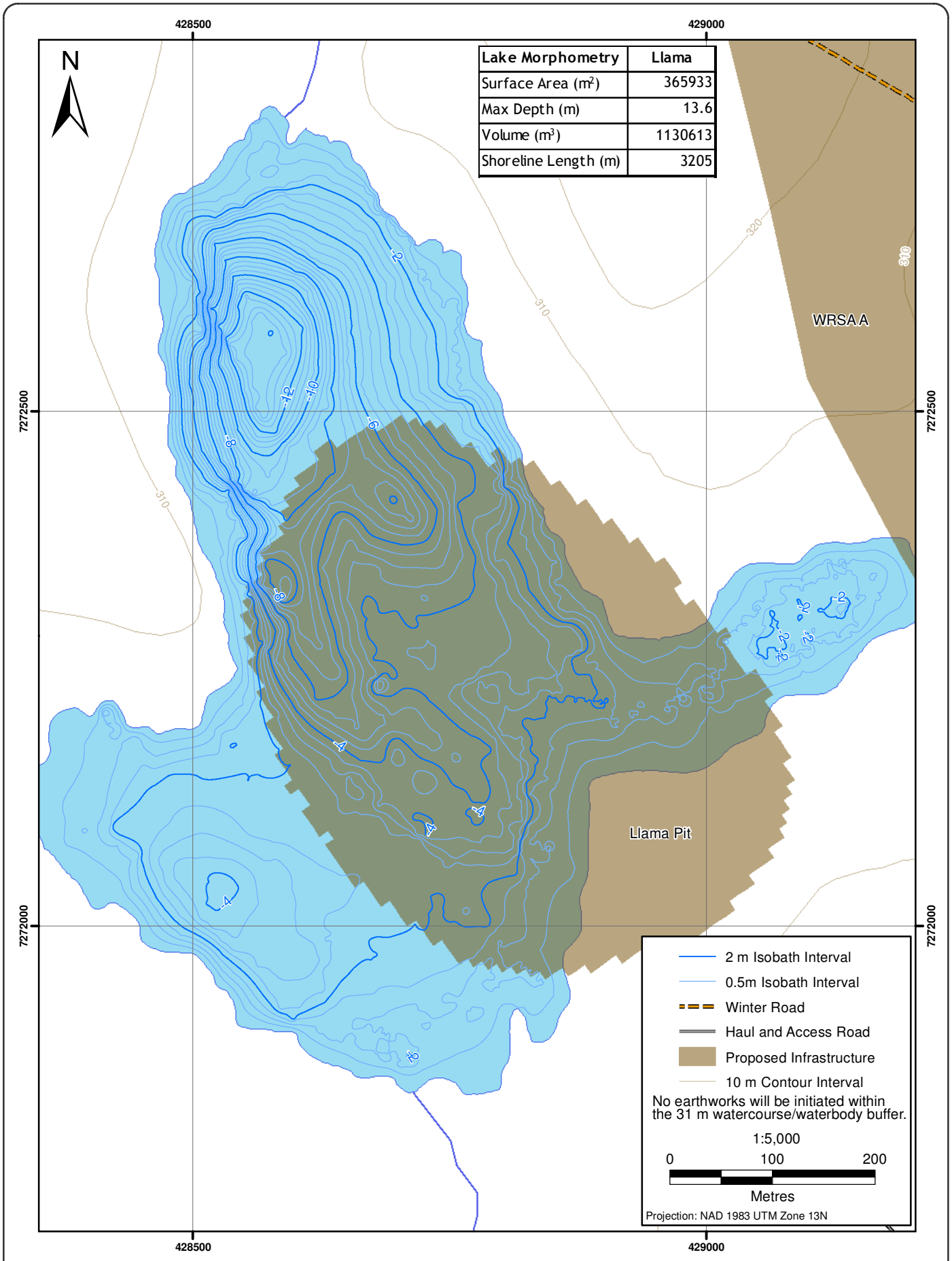
1.3 RESULTS

The bathymetry of 19 lakes in the Goose Property Area and 10 lakes in the George Property Area were surveyed between 2010 and 2013 (summarized in Table V6-3D-1). Smooth bathymetric contours were calculated using standard interpolation techniques and were used to create the bathymetric maps shown in Figures V6-3D-1 to V6-3D-27. For results of bathymetric surveys completed by EBA in winter on ice-covered lakes see Appendix V6-3E.

Table V6-3D-1. Summary of Bathymetry Data Collected in the George and Goose Property Areas, Back River Project, 2010 to 2013

Lake	Year Bathymetry Completed	Lake	Year Bathymetry Completed
George Property		***Goose Property (cont'd)***	
Lytle Lake	2012	Reference Lake B	2010
Occurrence Lake	2012	Goose Lake	2011
Sleigh Lake	2012	Round Pond[1]	2011
George Lake	2012	Pond NE of Round Pond[2]	2011
Reference Lake C	2012	Del Lake	2012
Mosquito	2013	Big Lake	2012
Bob	2013	Fox Lake	2012
Komatic	2013	Rabbit Lake	2012
Reference Q	2013	Giraffe Lake	2012
McCoy	2013	Rascal	2013
Goose Property		Wasp	2013
Llama Lake	2010	Pond A	2013
Umwelt Lake	2010	Propeller[3]	2013
Mam Lake	2010	Leaf[4]	2013
Chair Lake	2010	Wolf[4]	2013

Notes:
[1] Round Pond is also known as Pond 1.
[2] Pond NE of Round Pond is also known as Pond 2.
[3] Bathymetry was conducted on Propeller Lake in the open-water season using the standard methods and by GPR (Rescan 2013b and Appendix V6-3E).
[4] Under-ice bathymetry conducted using GPR (Appendix V6-3E).



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Bathymetry of Llama Lake, Back River Project, 2010

Figure V6-3D-1

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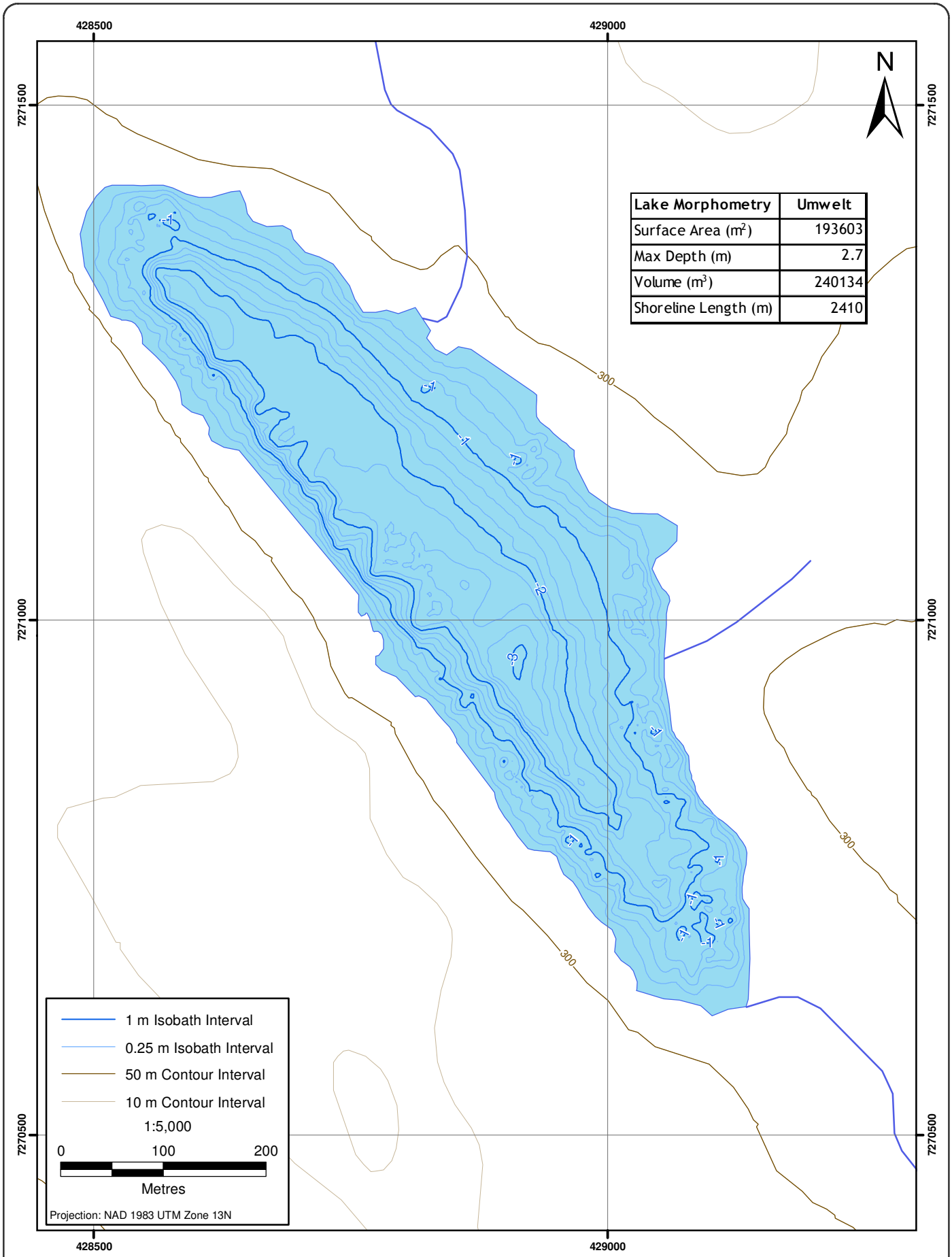

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Bathymetry of Umwelt Lake, Back River Project, 2010

Figure V6-3D-2

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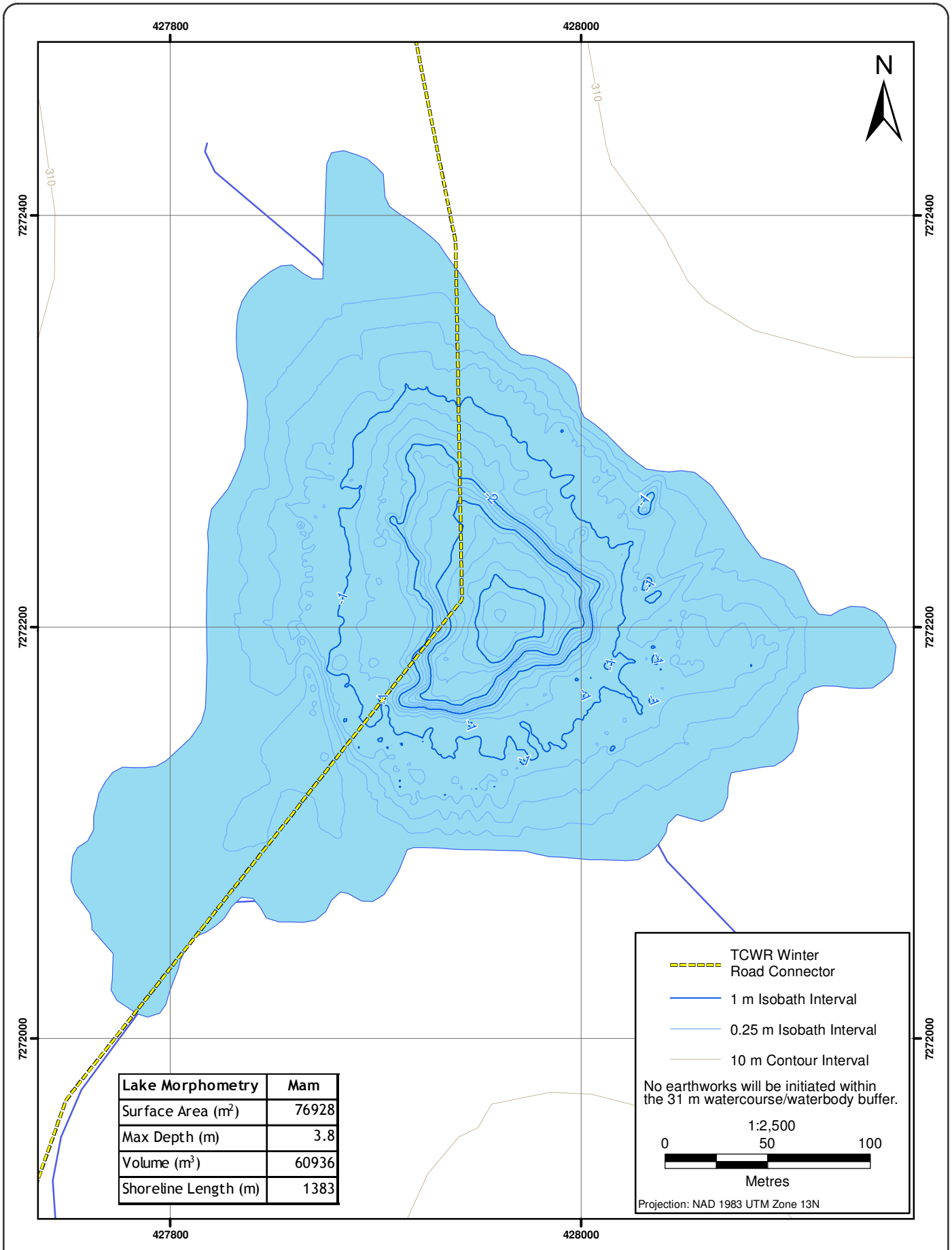

Lake Morphometry	Mam
Surface Area (m^2)	76928
Max Depth (m)	3.8
Volume (m^3)	60936
Shoreline Length (m)	1383

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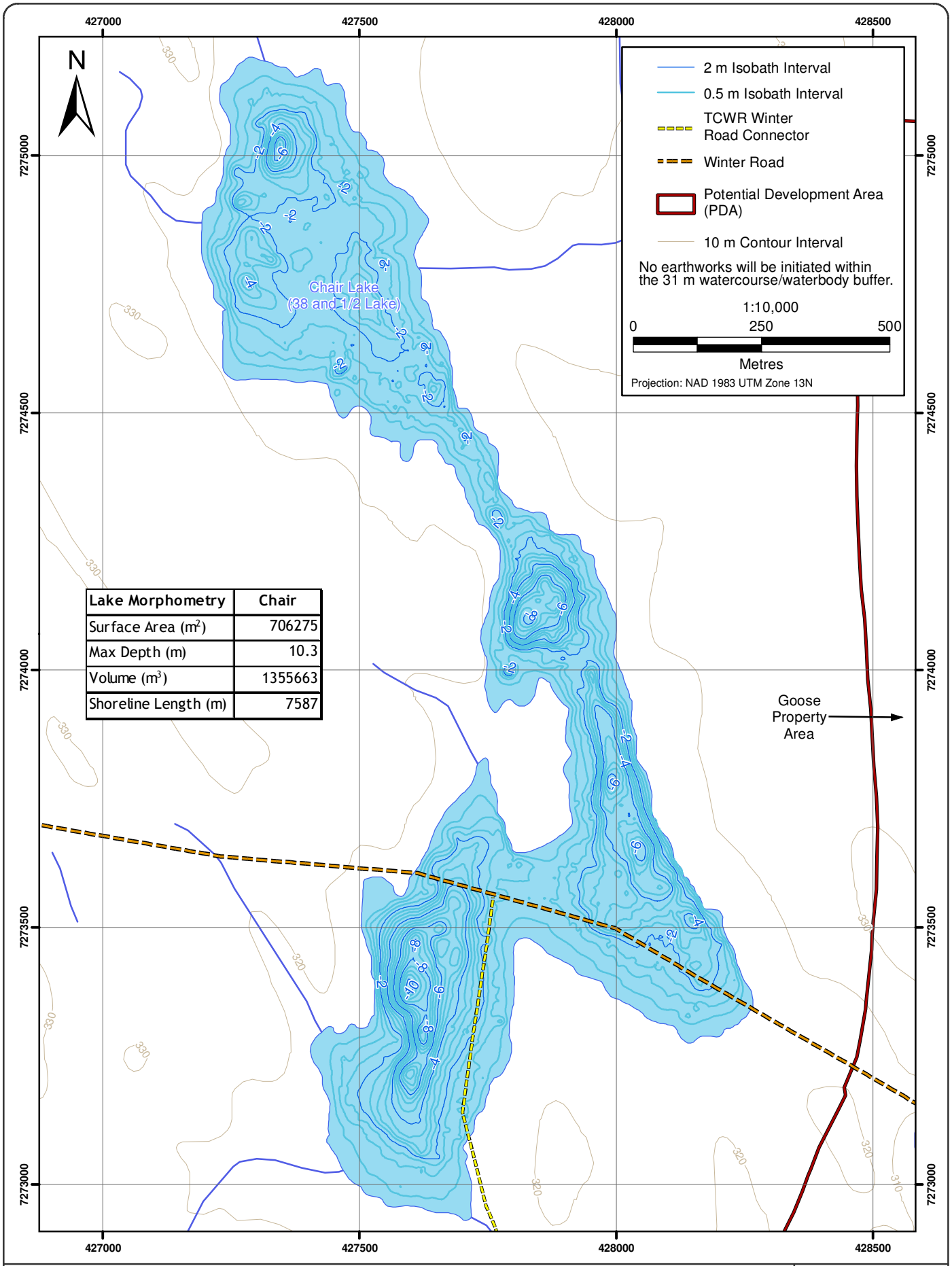
Bathymetry of Mam Lake, Back River Project, 2010

Figure V6-3D-3

Rescan an ERM company

PROJECT # 0194096-0040 GIS # BAC-10-083c October 30 2013



Lake Morphometry	Chair
Surface Area (m^2)	706275
Max Depth (m)	10.3
Volume (m^3)	1355663
Shoreline Length (m)	7587

Figure V6-3D-4

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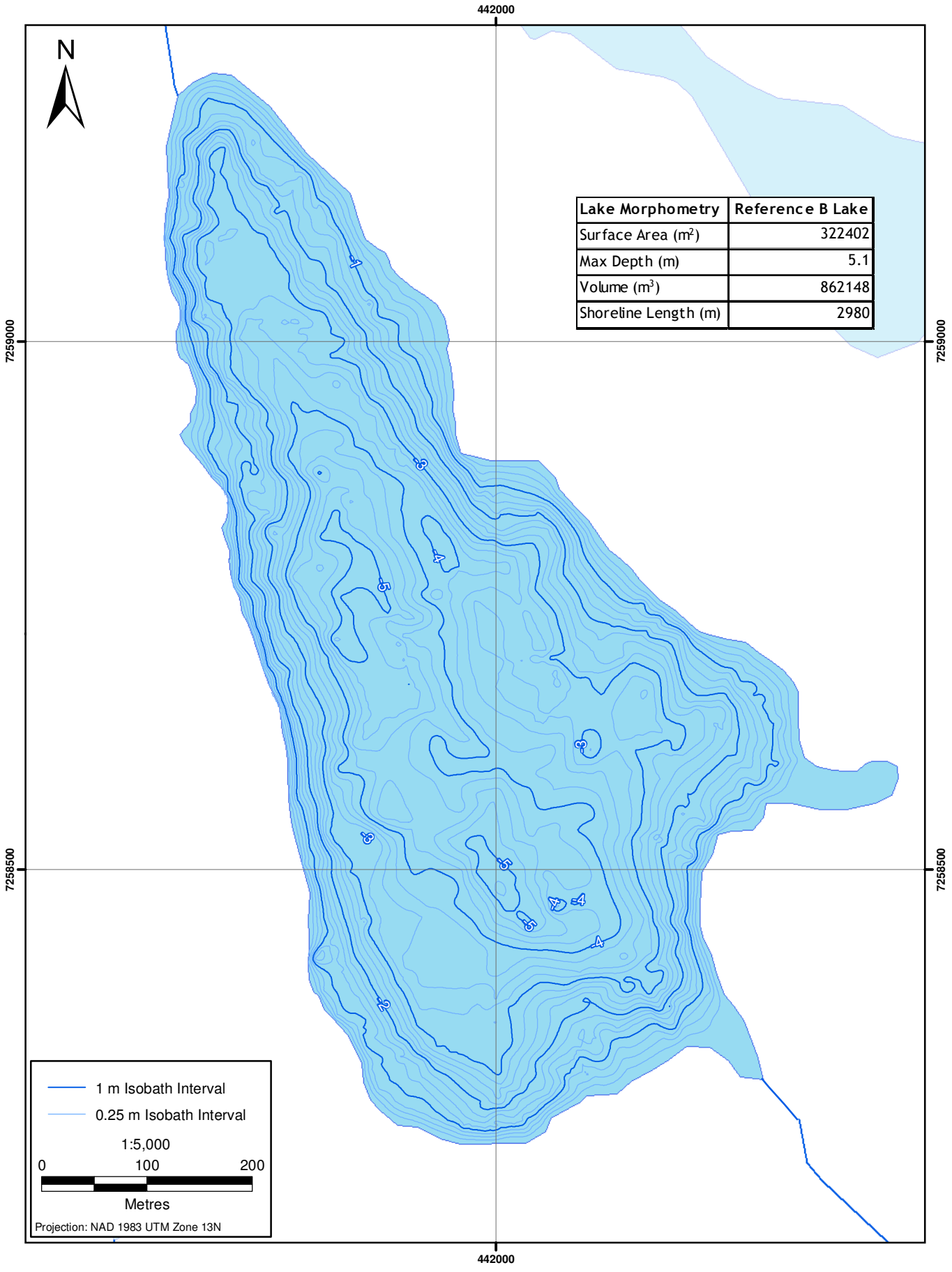
Bathymetry of Chair Lake, Back River Project, 2010

Rescan an ERM company



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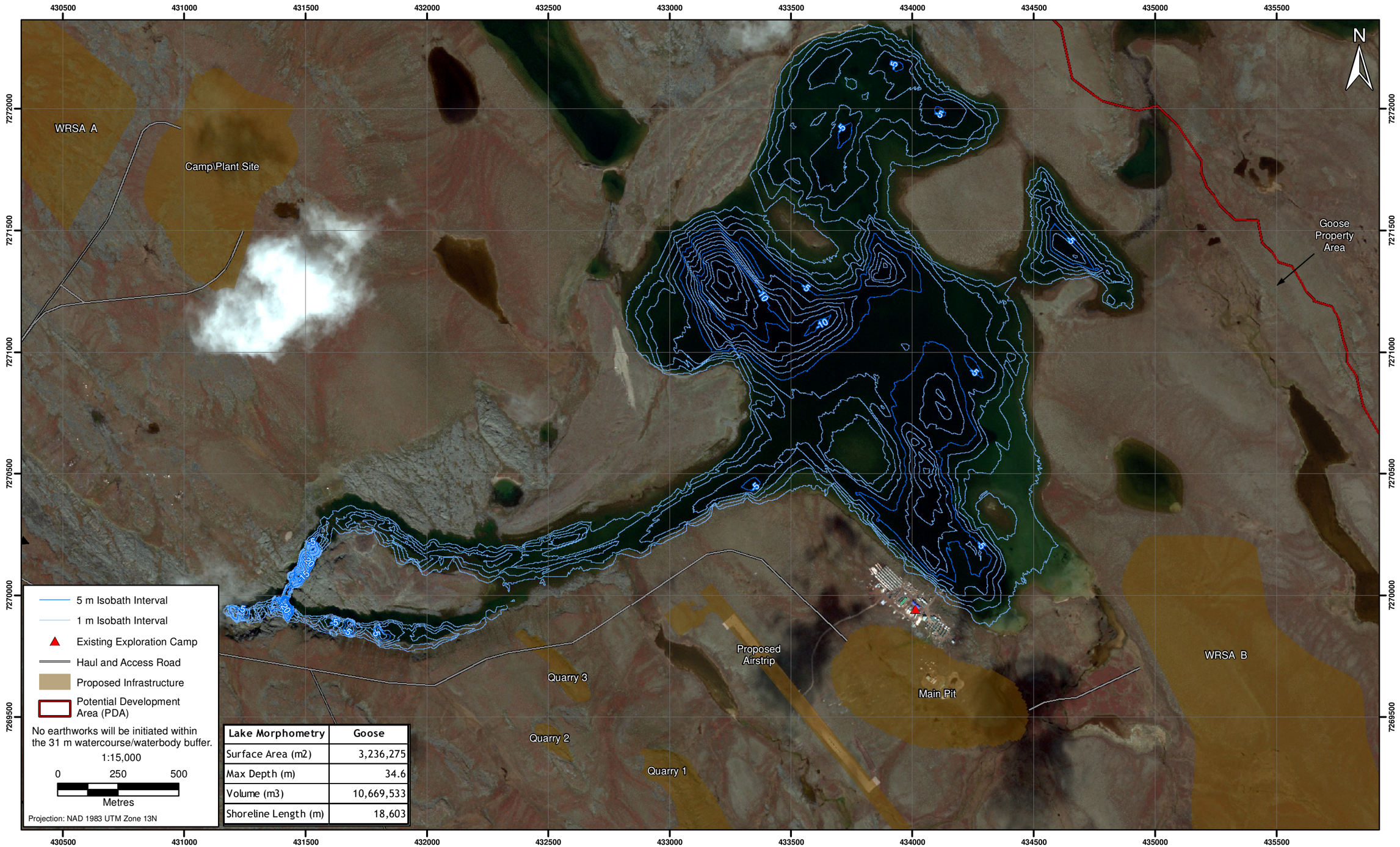
Bathymetry of Reference B Lake, Back River Project, 2010

Figure V6-3D-5

Rescan an ERM company



Lake Morphometry	Goose
Surface Area (m2)	3,236,275
Max Depth (m)	34.6
Volume (m3)	10,669,533
Shoreline Length (m)	18,603

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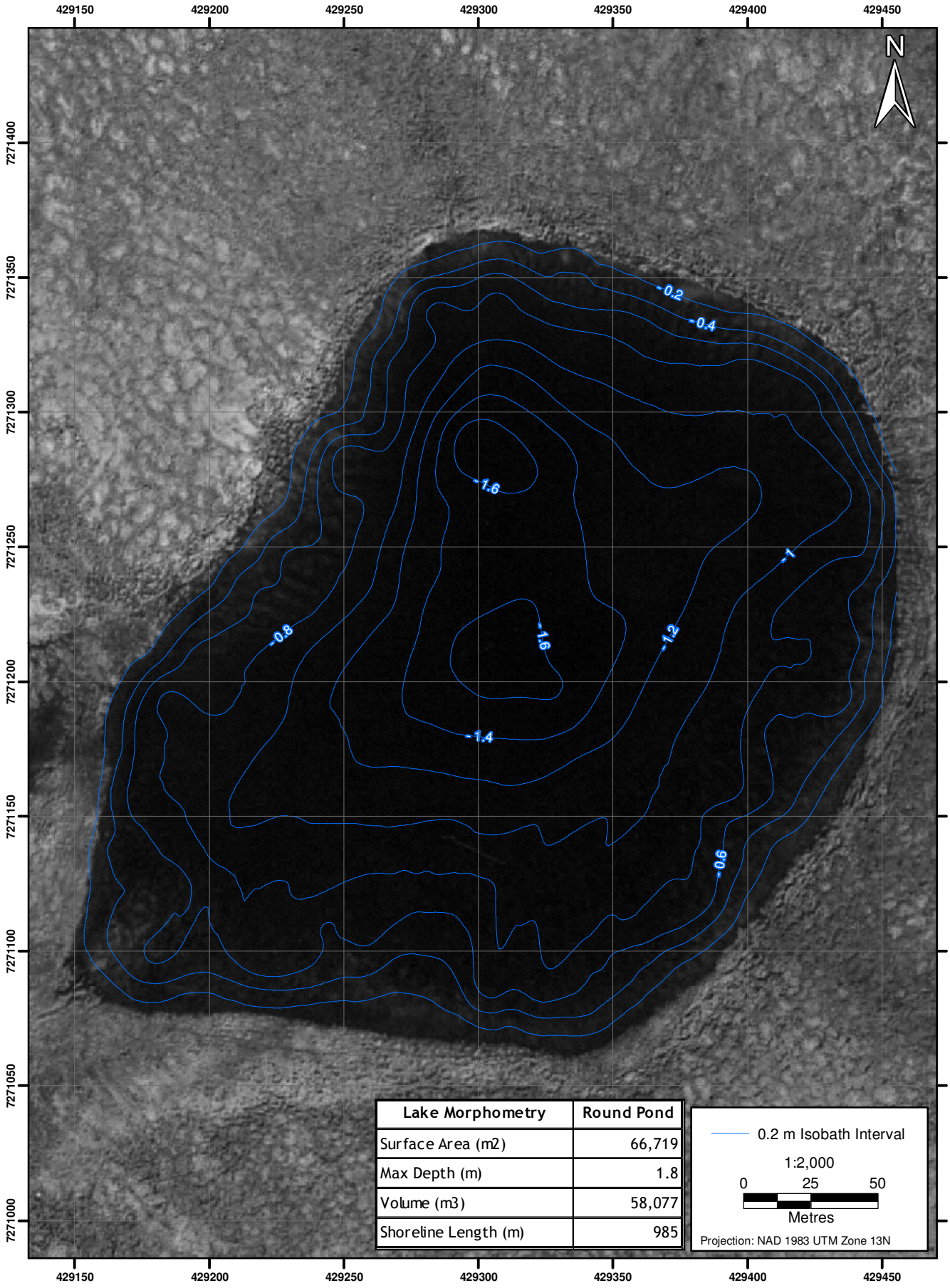
Figure V6-3D-6

Bathymetry of Goose Lake, Back River Project, 2011



Lake Morphometry	Round Pond
Surface Area (m2)	66,719
Max Depth (m)	1.8
Volume (m3)	58,077
Shoreline Length (m)	985

0.2 m Isobath Interval

1:2,000

0 25 50

Metres

Projection: NAD 1983 UTM Zone 13N

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Bathymetry of Round Pond (Pond 1), Back River Project, 2011

Figure V6-3D-7

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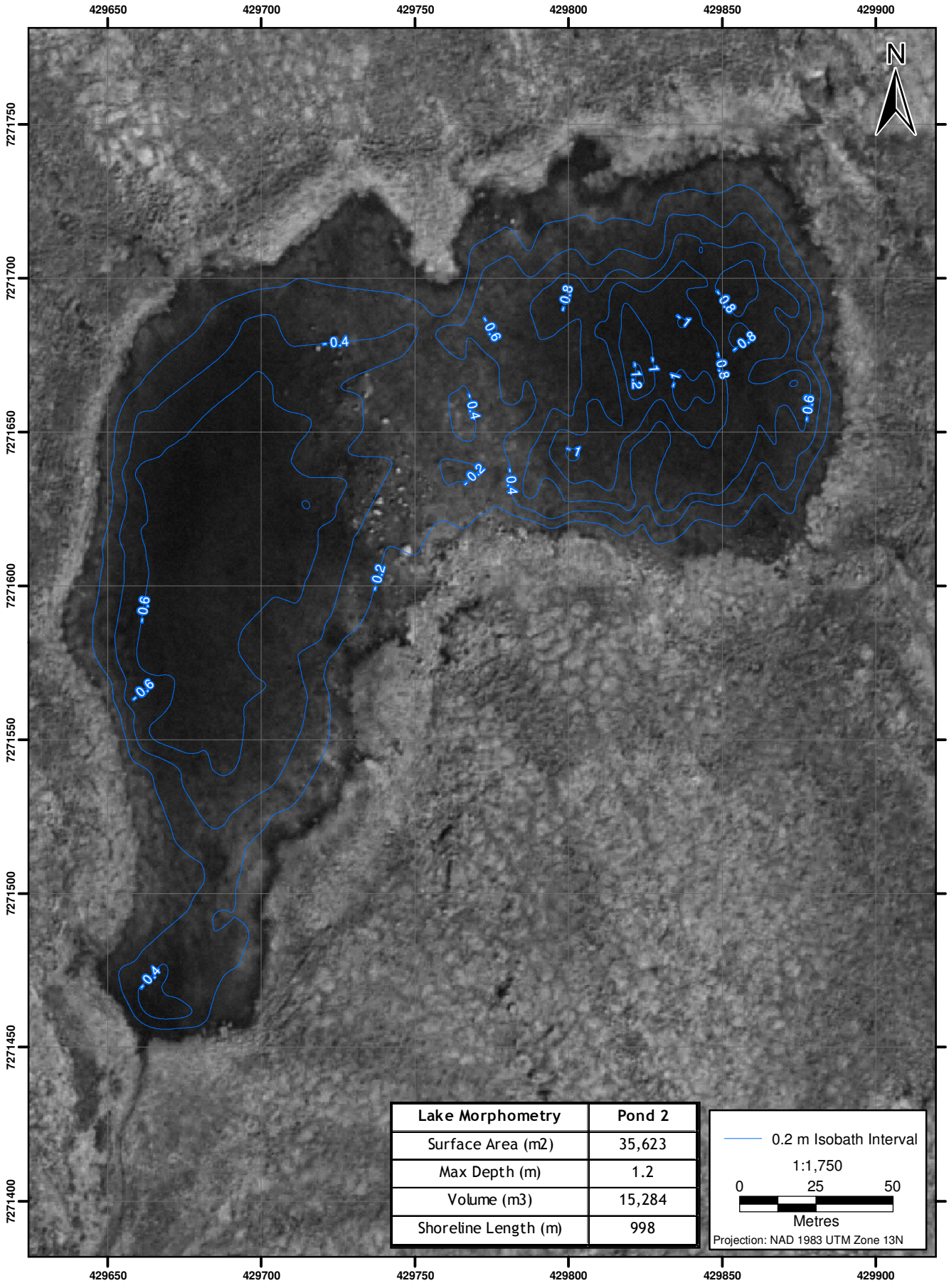

Figure V6-3D-8

Bathymetry of Pond NE of Round Pond (Pond 2), Back River Project, 2011

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Rescan an ERM company

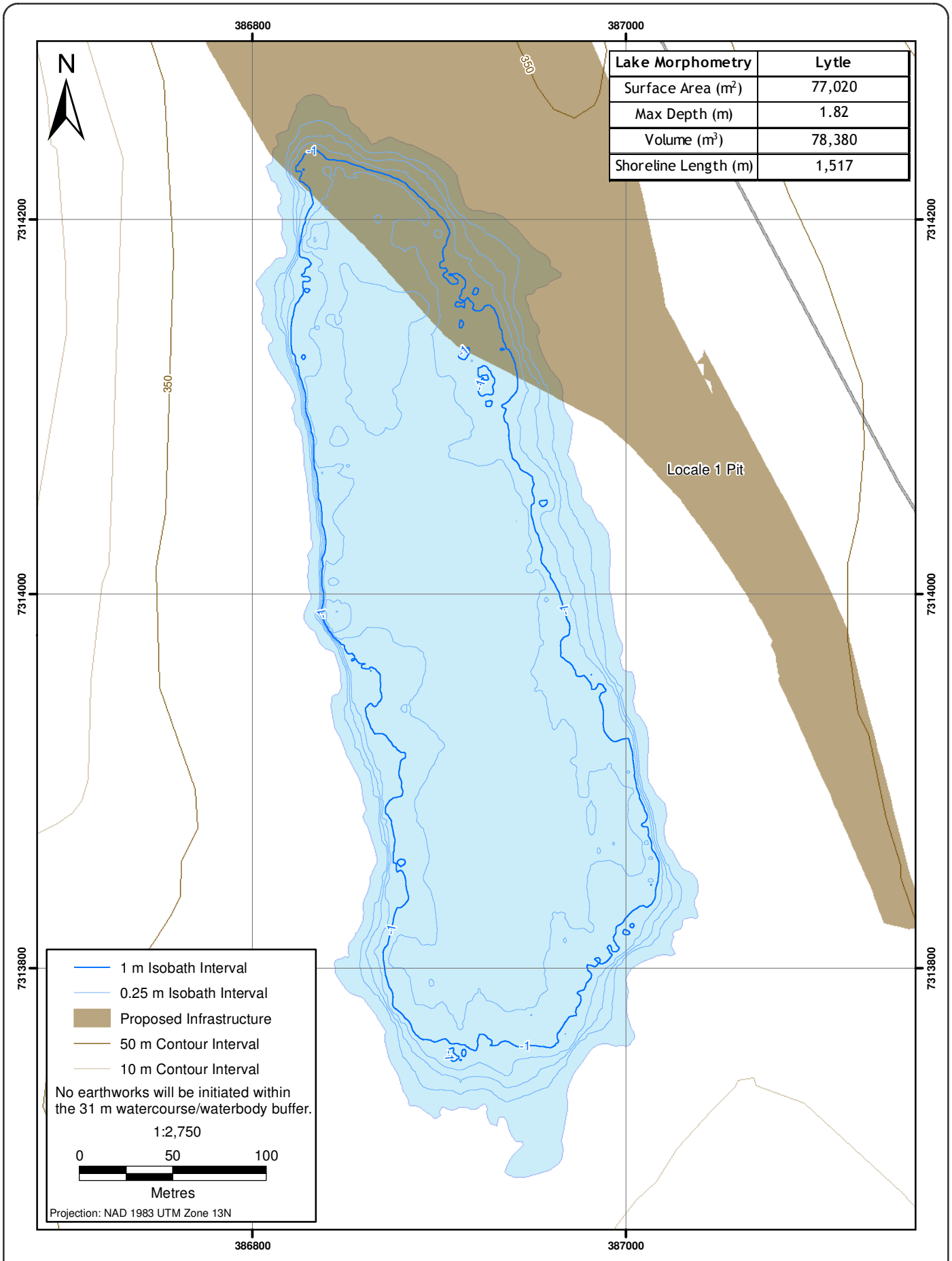

Figure V6-3D-9

Bathymetry of Lytle Lake, Back River Project, 2012

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PROJECT # 0194096-0040 GIS # BAC-10-083j October 30, 2013

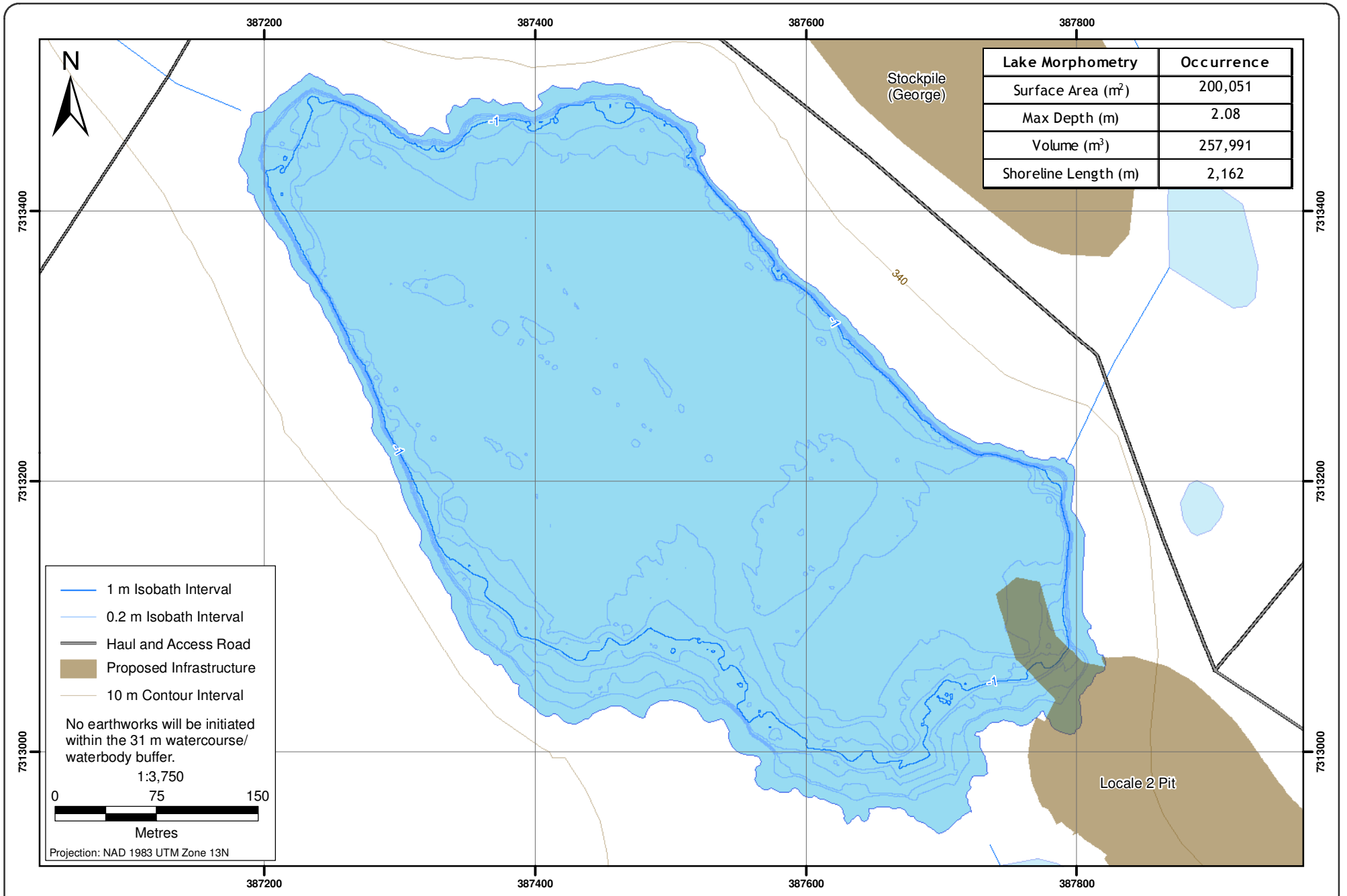

Figure V6-3D-10

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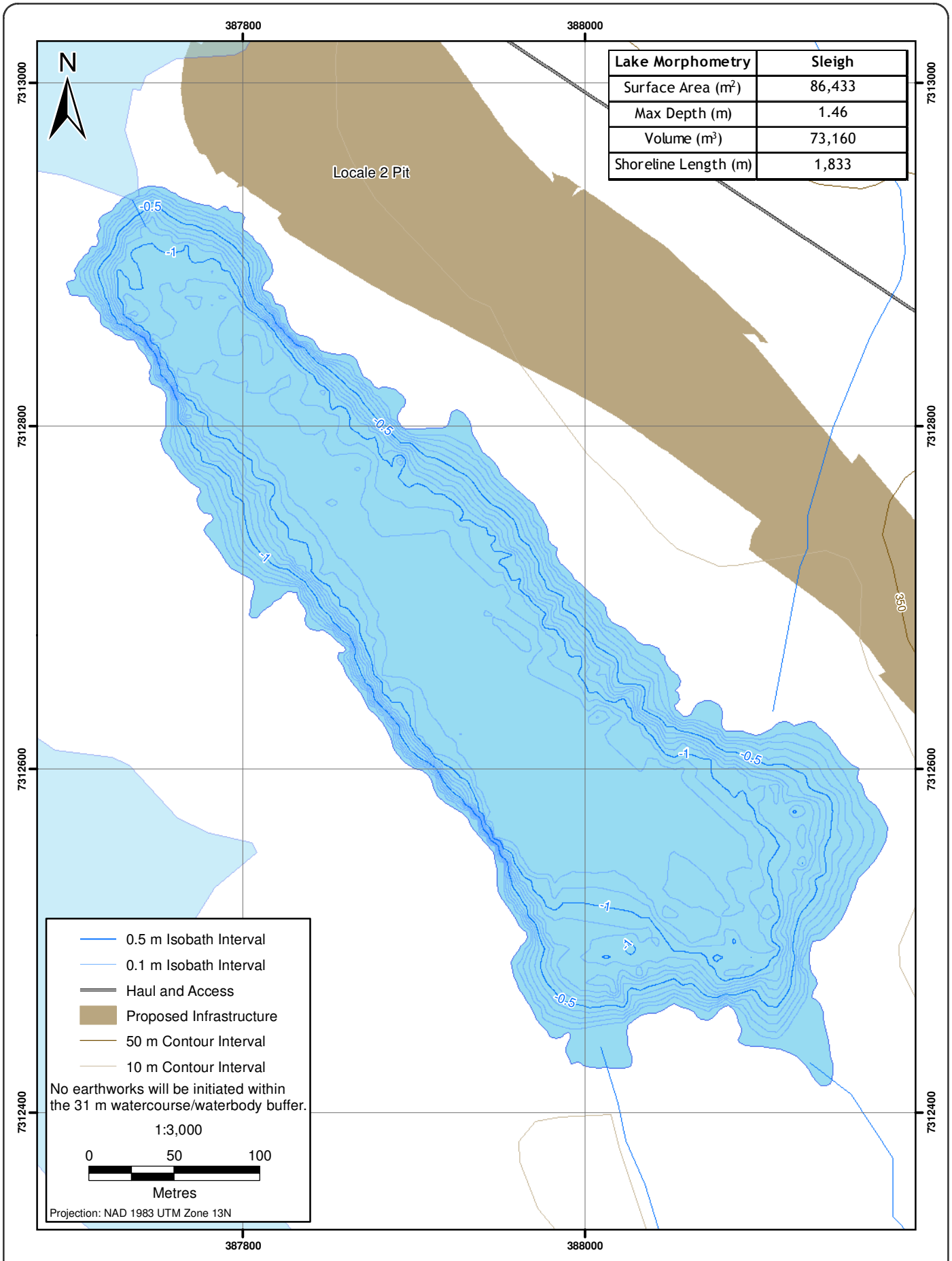
Bathymetry of Occurrence Lake, Back River Project, 2012

Figure V6-3D-10

Rescan an ERM company



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Bathymetry of Sleigh Lake, Back River Project, 2012

Figure V6-3D-11

Rescan an ERM company

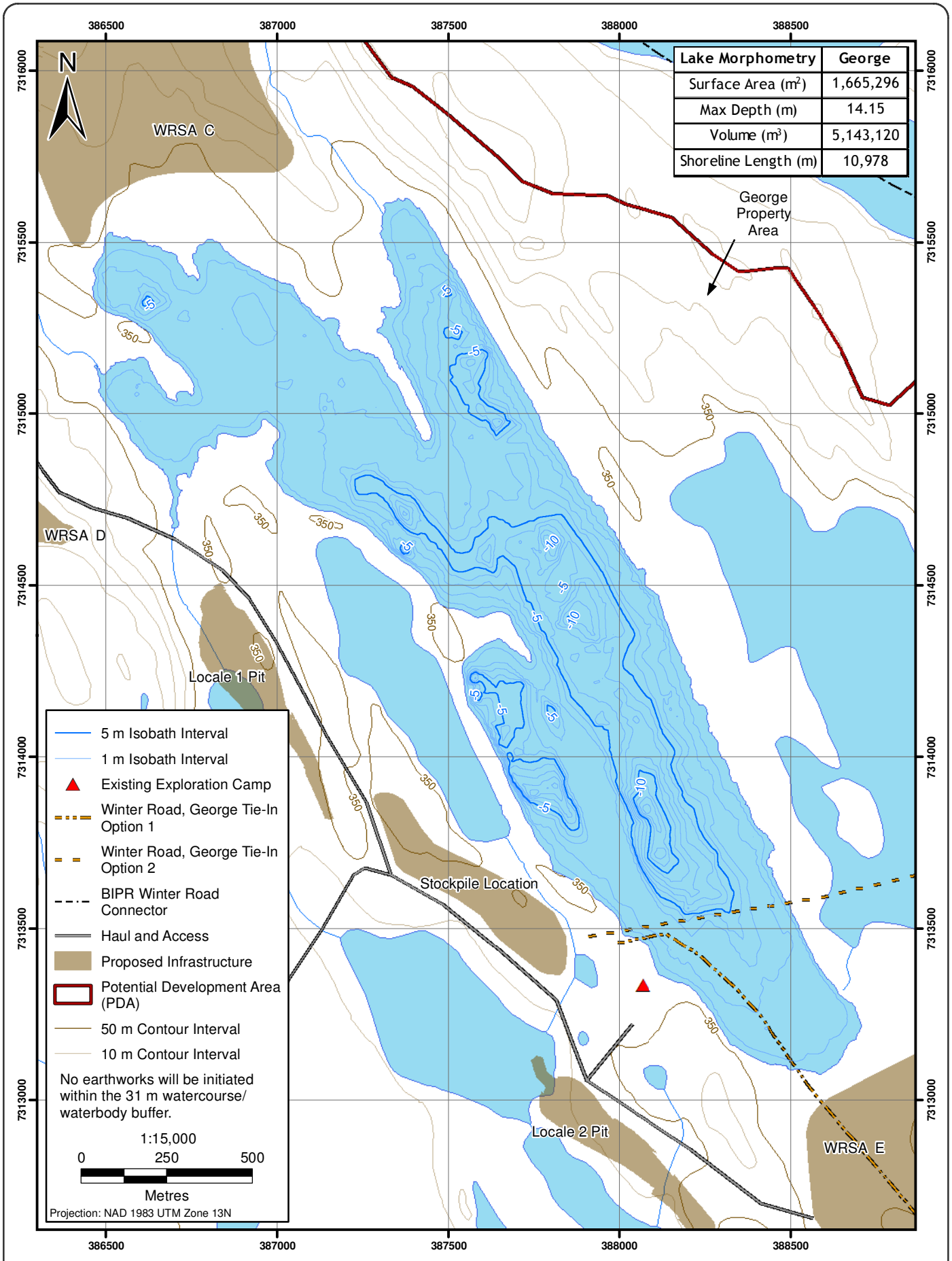
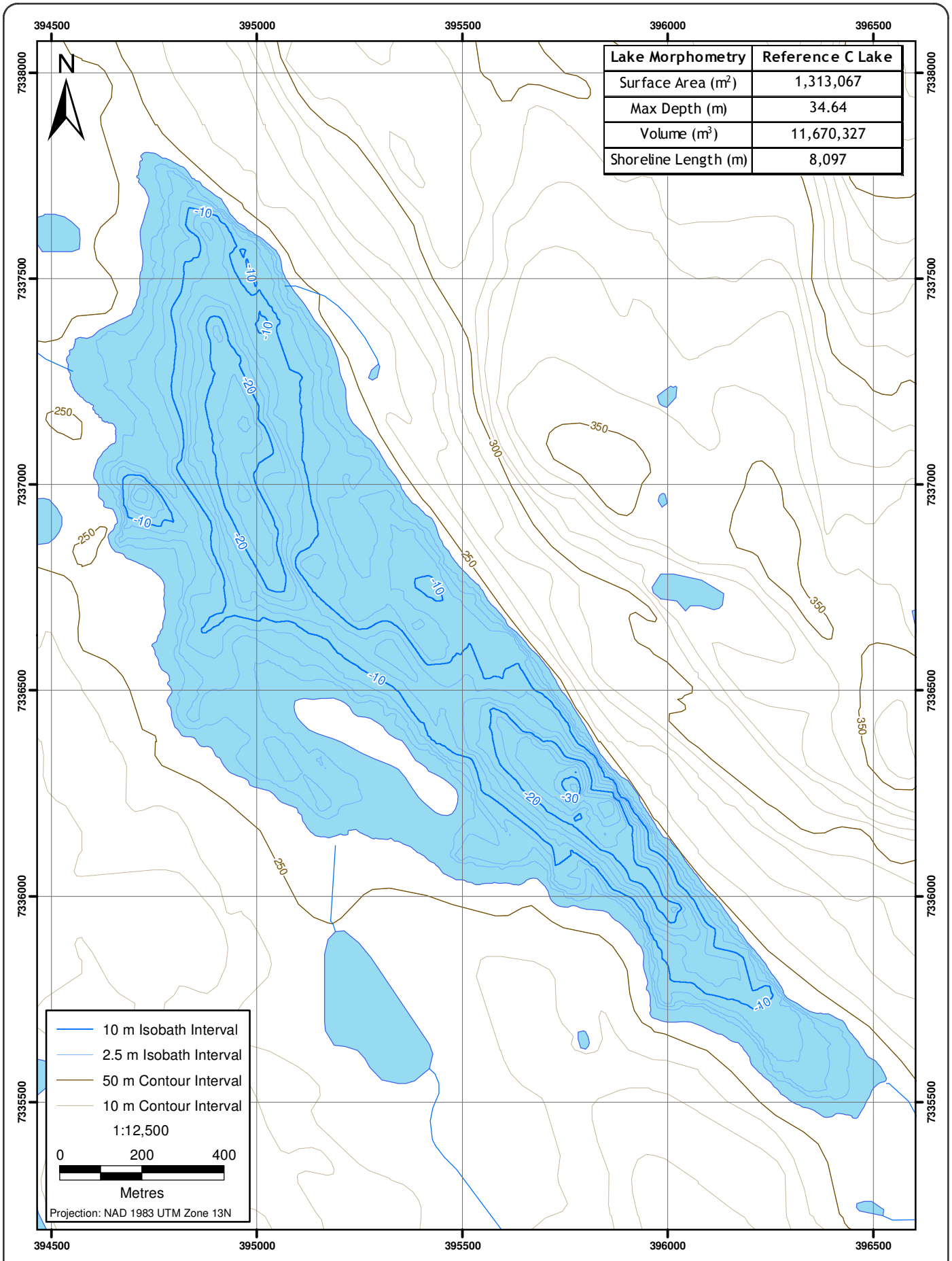


Figure V6-3D-12

Bathymetry of George Lake, Back River Project, 2012

Sabina GOLD & SILVER CORP.

Rescan an ERM company



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Bathymetry of Reference C Lake, Back River Project, 2012

Figure V6-3D-13

Rescan an ERM company

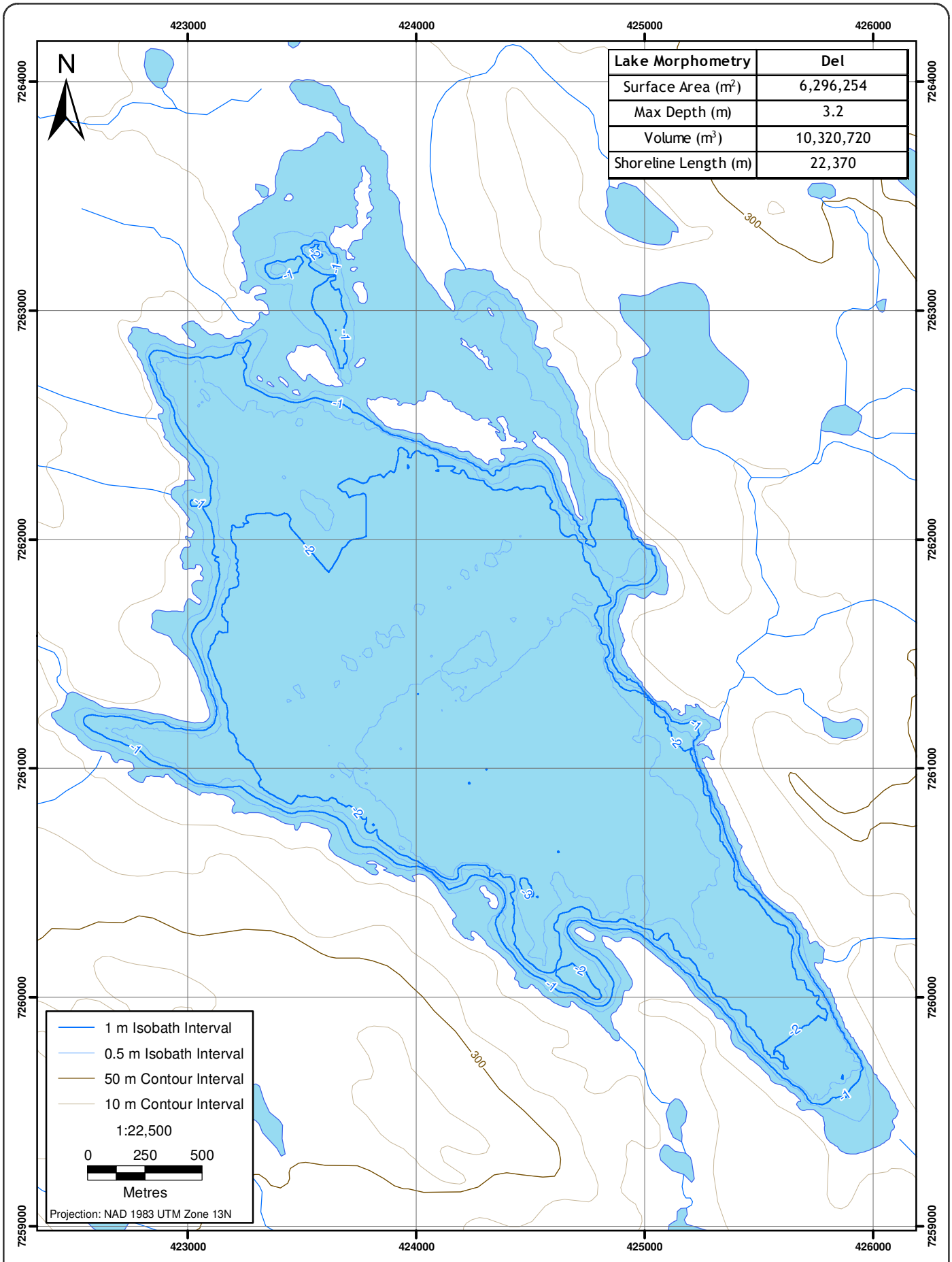

Figure V6-3D-14

Bathymetry of Del Lake, Back River Project, 2012

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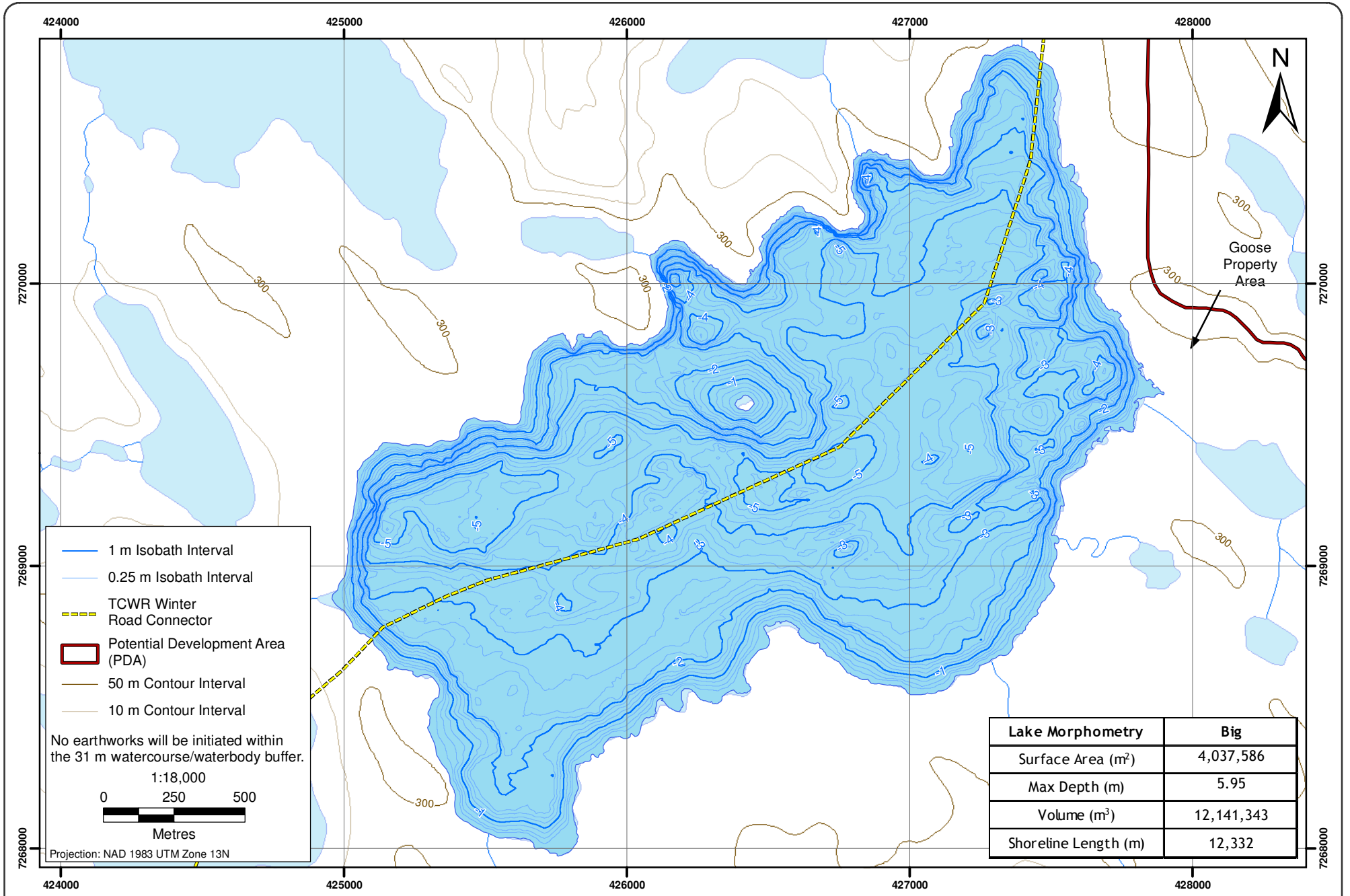
Rescan an ERM company

PROJECT # 0194096-0040 GIS # BAC-10-083o October 30, 2013



Lake Morphometry	Big
Surface Area (m^2)	4,037,586
Max Depth (m)	5.95
Volume (m^3)	12,141,343
Shoreline Length (m)	12,332

Figure V6-3D-15

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Bathymetry of Big Lake, Back River Project, 2012

Figure V6-3D-15

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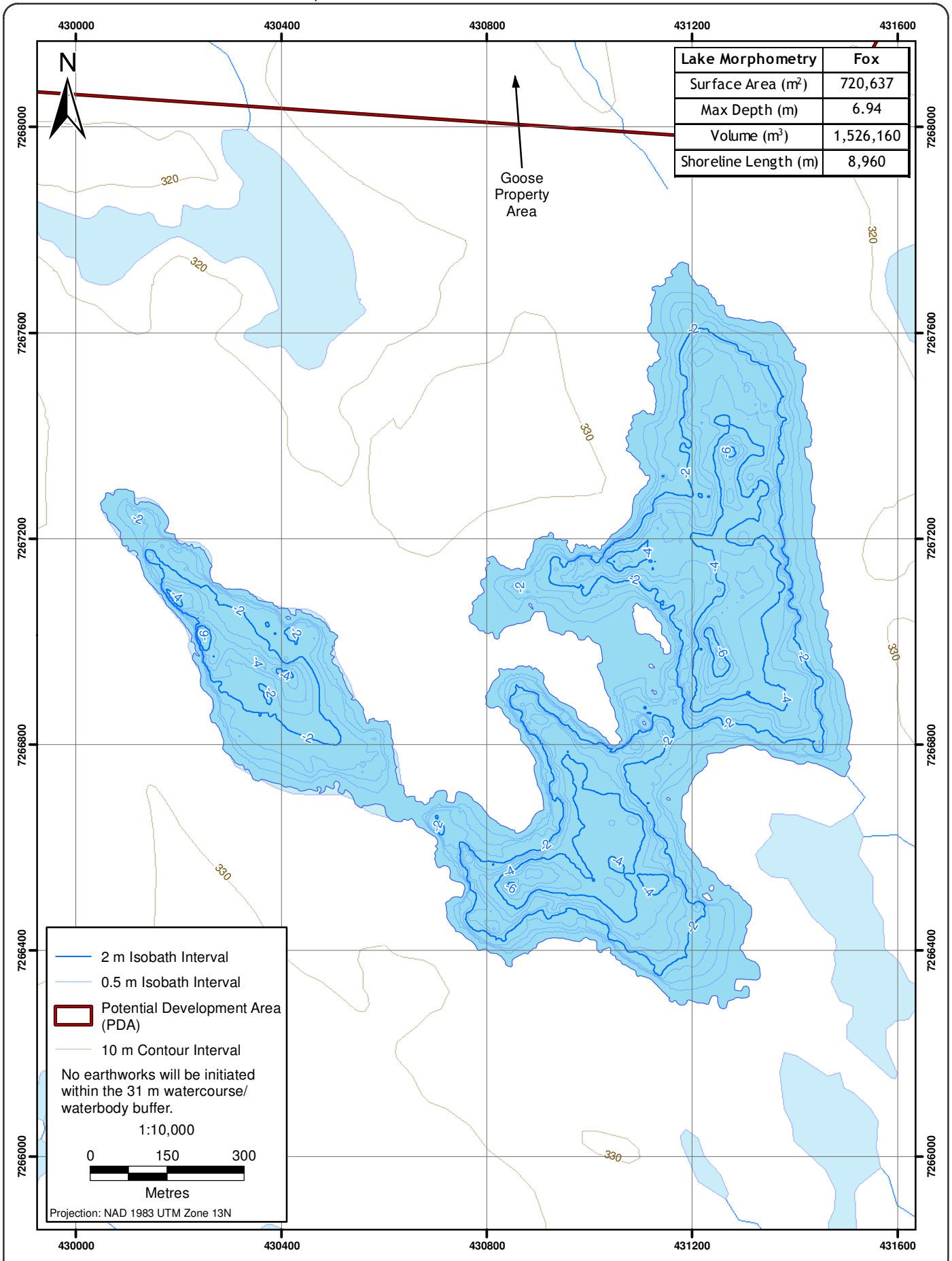

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Bathymetry of Fox Lake, Back River Project, 2012

Figure V6-3D-16

Rescan an ERM company

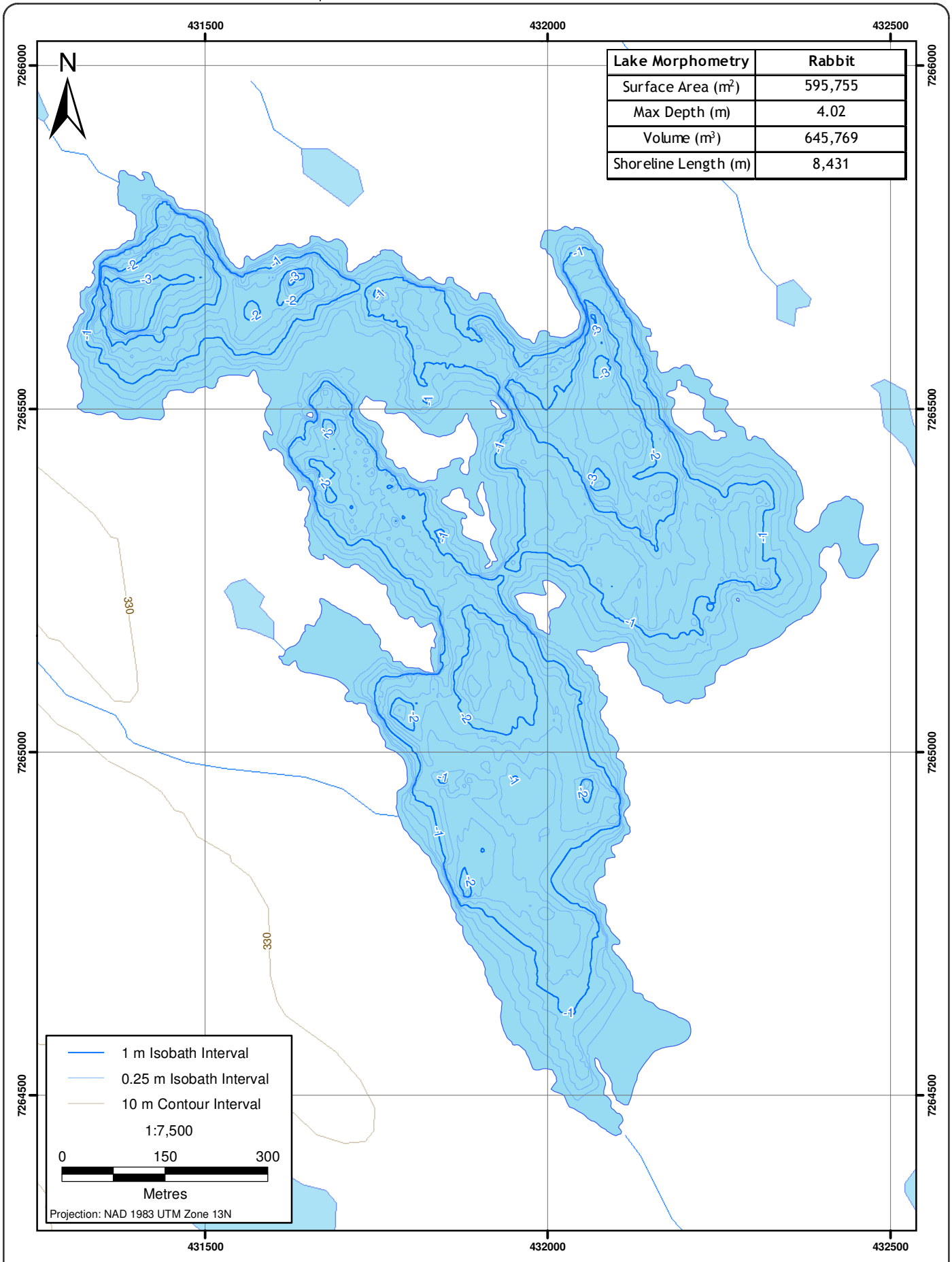
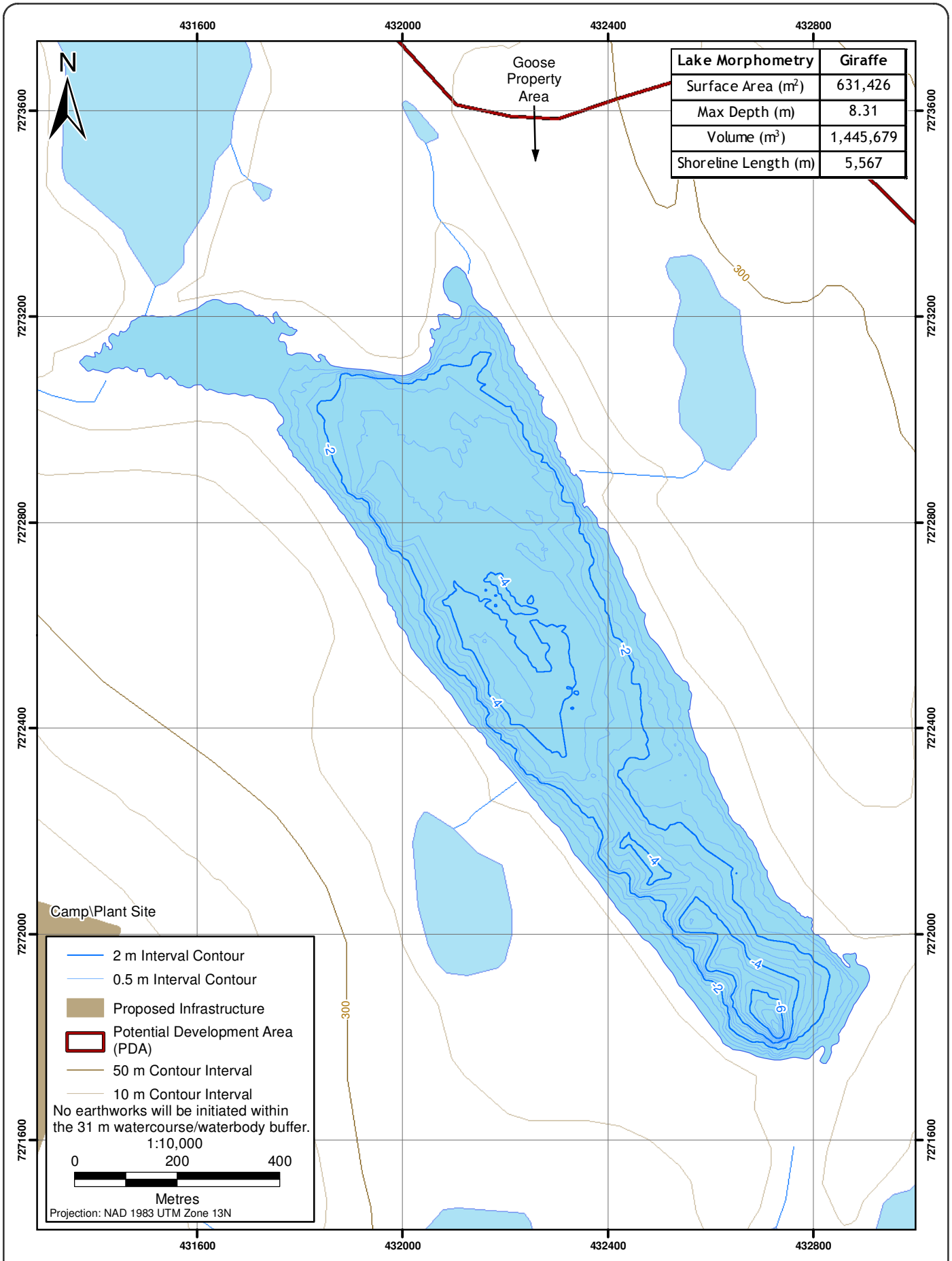


Figure V6-3D-17

Sabina GOLD & SILVER CORP.

Bathymetry of Rabbit Lake, Back River Project, 2012

Rescan an ERM company

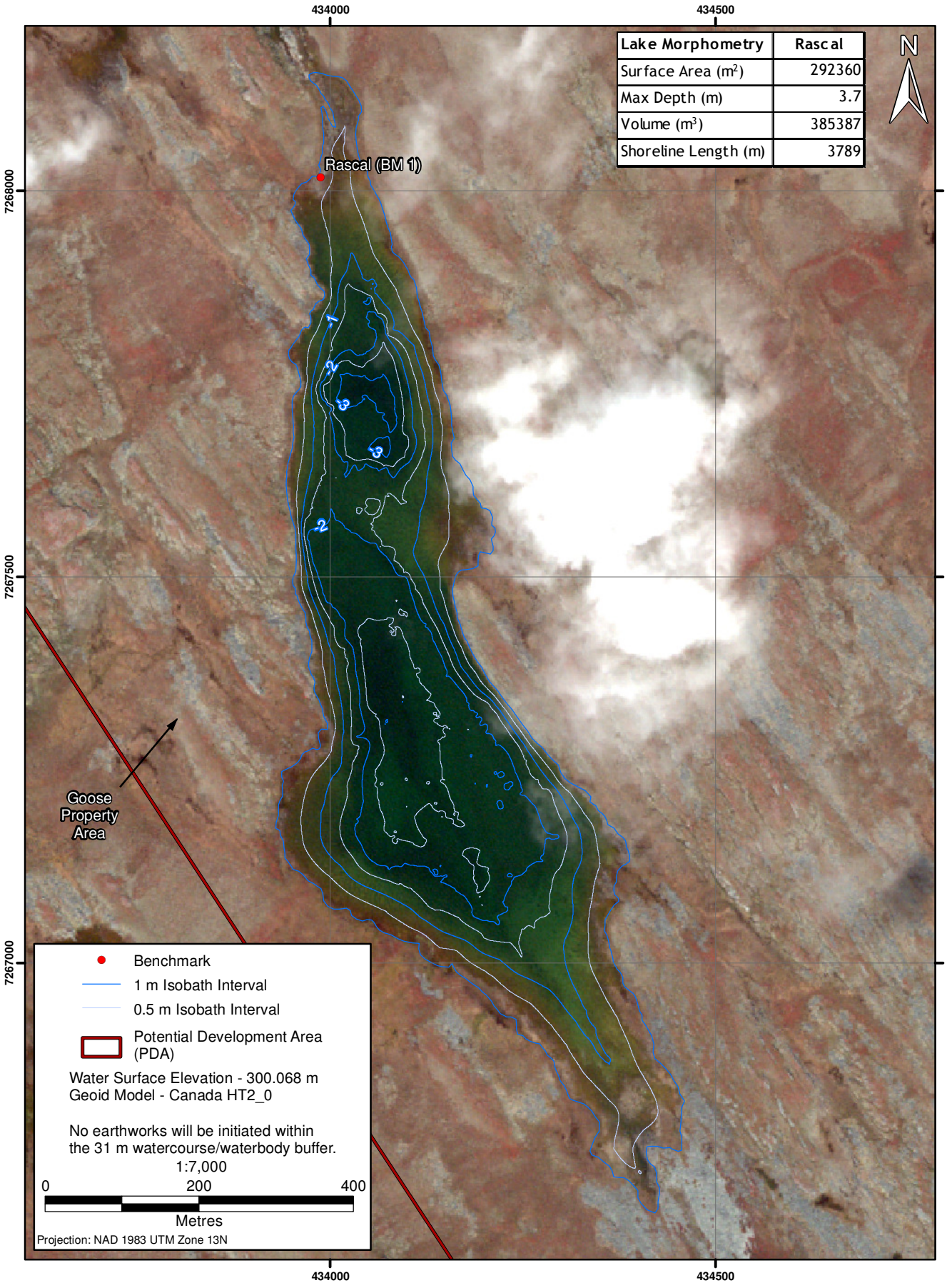


Sabina GOLD & SILVER CORP.

Bathymetry of Giraffe Lake, Back River Project, 2012

Figure V6-3D-18

Rescan an ERM company

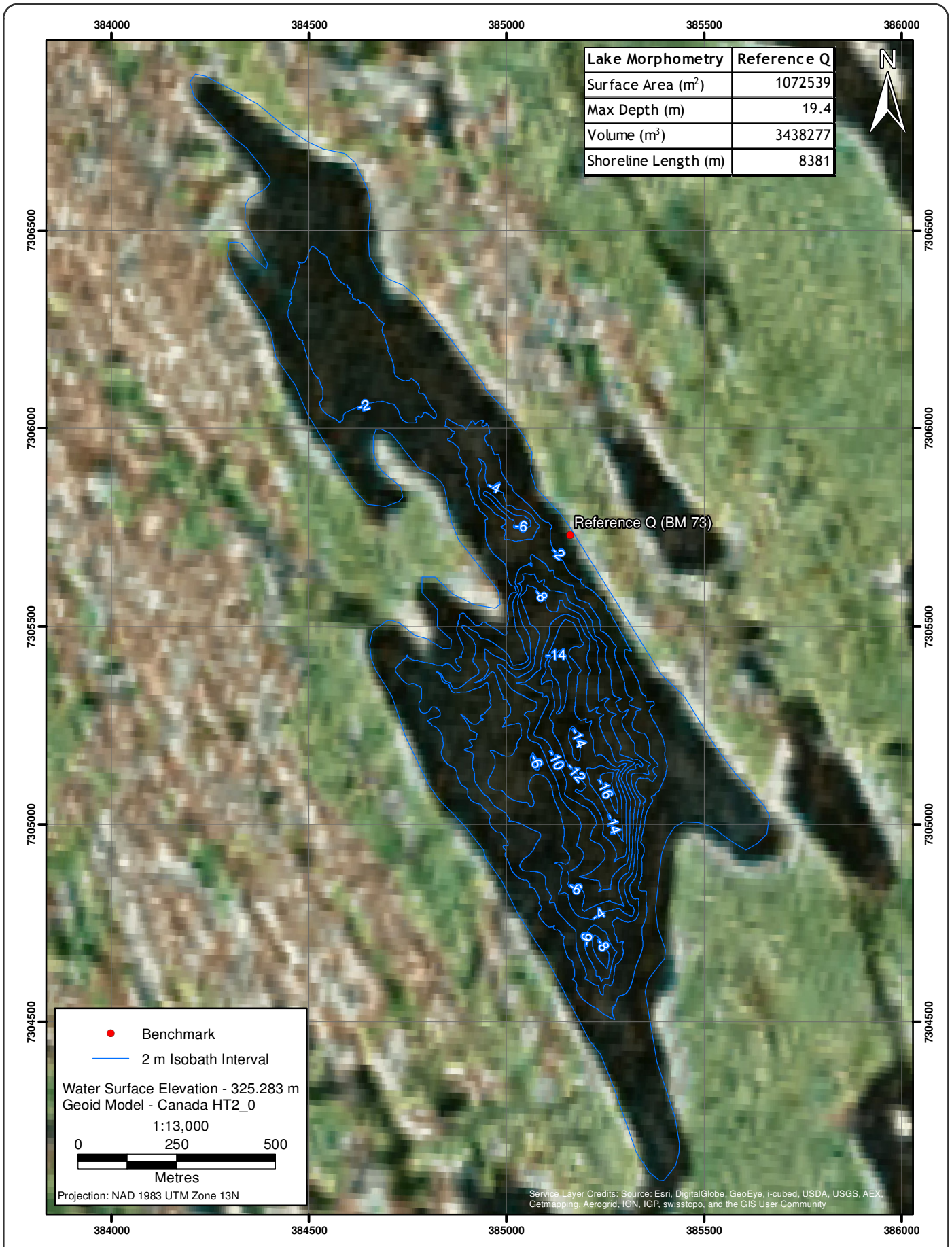


Sabina GOLD & SILVER CORP.

Bathymetry of Rascal Lake, Back River Project, 2013

Figure V6-3D-19

Rescan an ERM company



Sabina GOLD & SILVER CORP.

Bathymetry of Reference Q Lake, Back River Project, 2013

Figure V6-3D-20

Rescan an ERM company

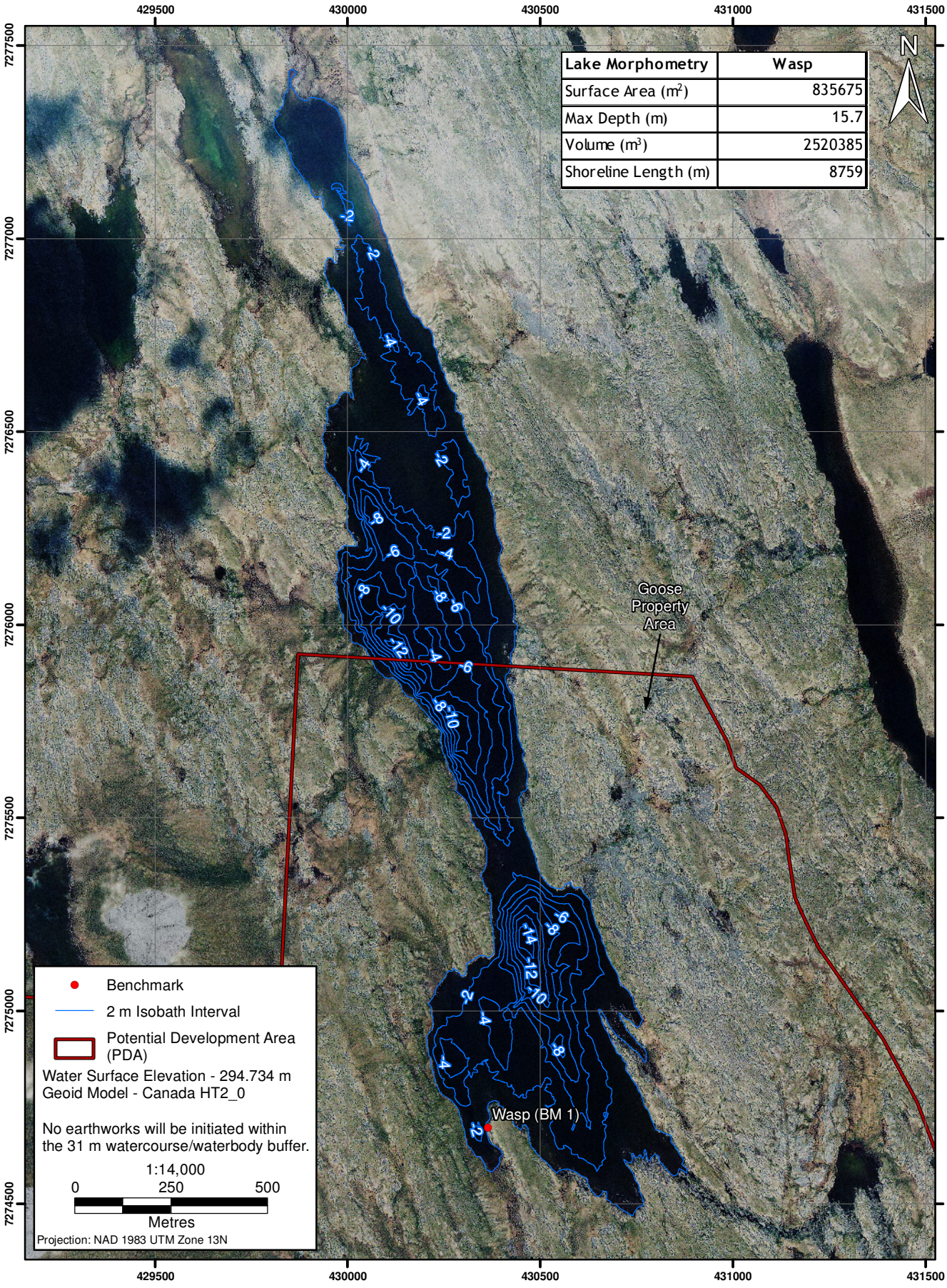
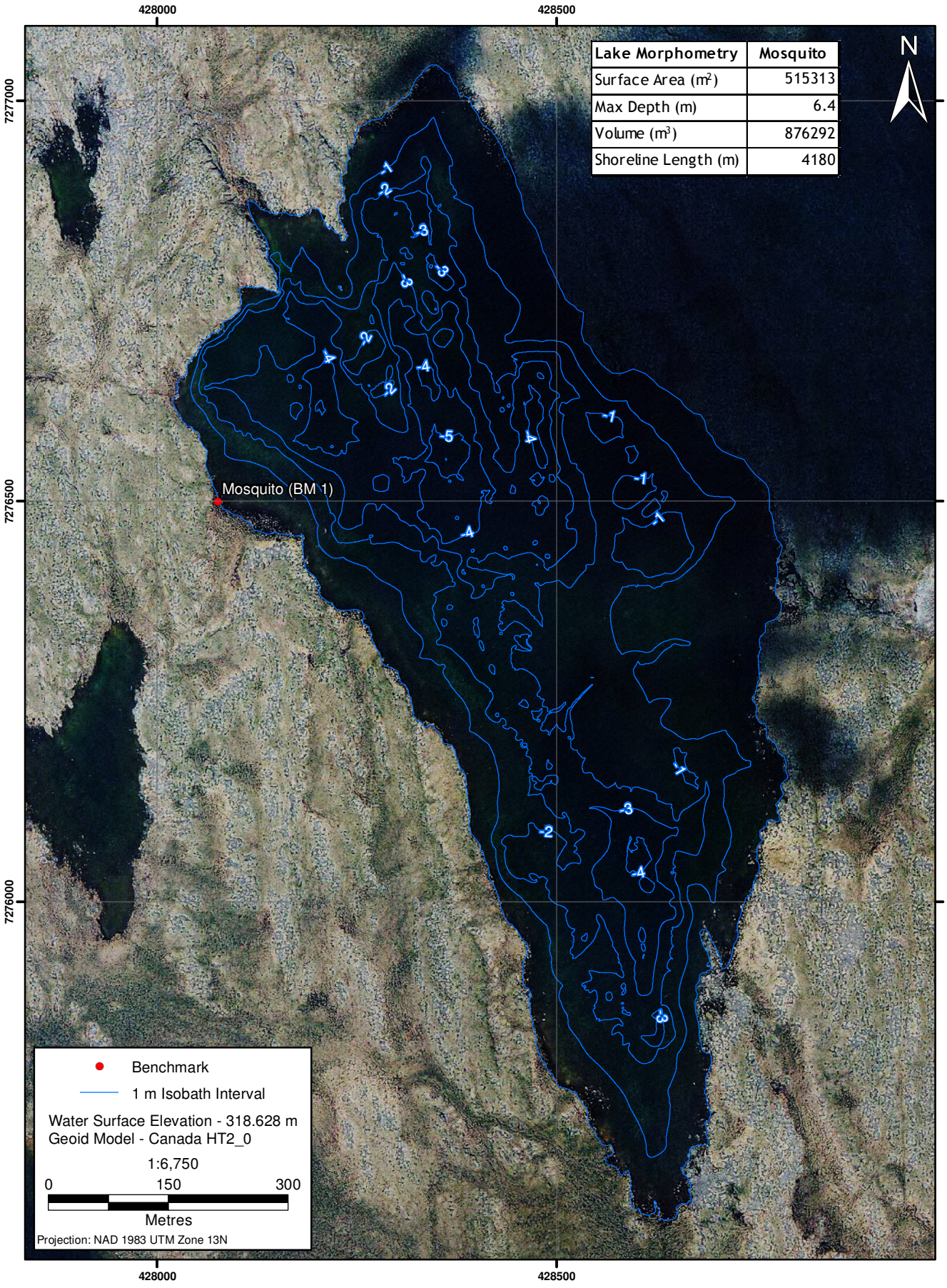


Figure V6-3D-21

Sabina GOLD & SILVER CORP.

Bathymetry of Wasp Lake, Back River Project, 2013

Rescan an ERM company

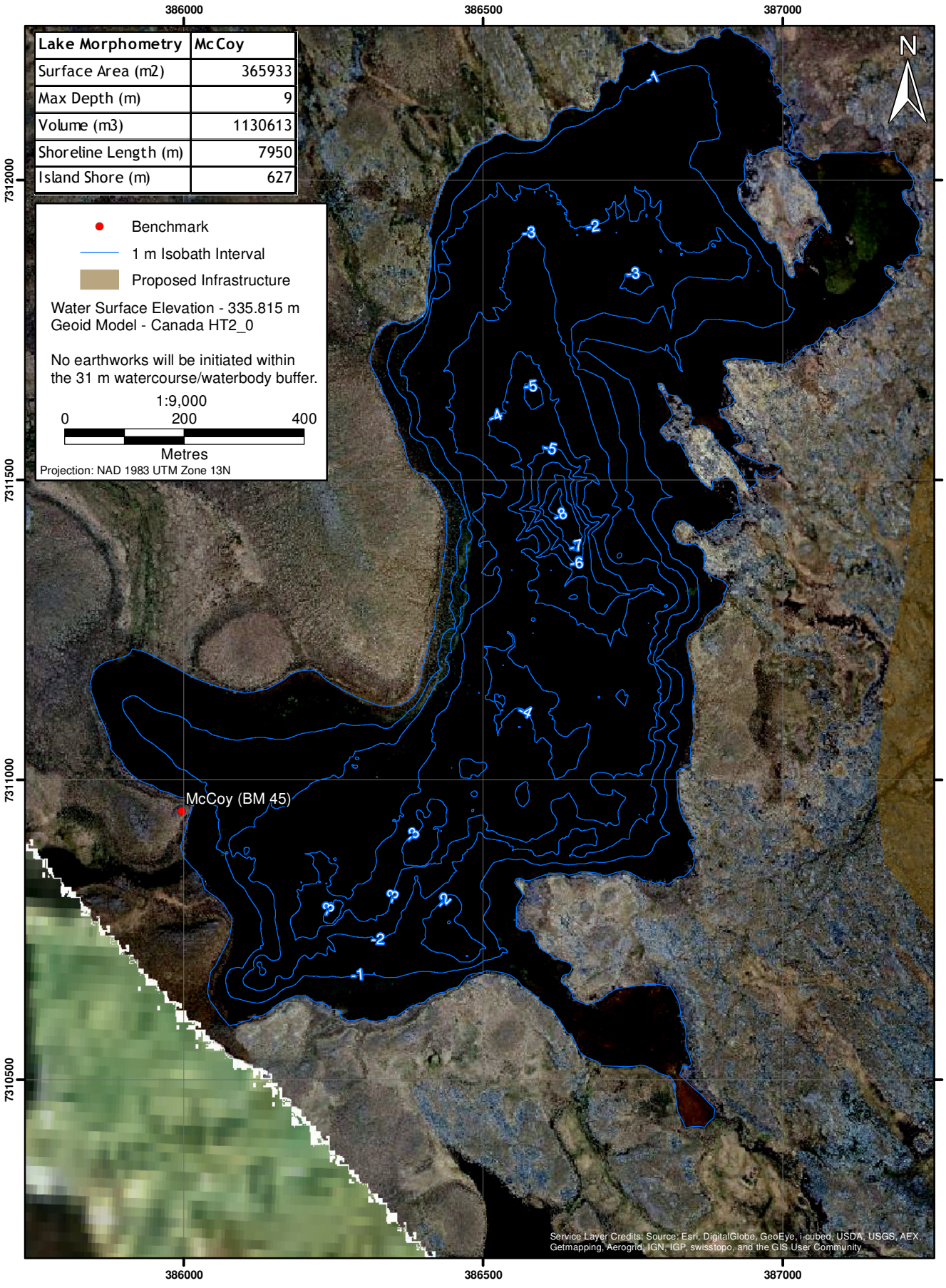


Sabina GOLD & SILVER CORP.

Bathymetry of Mosquito Lake, Back River Project, 2013

Figure V6-3D-22

Rescan an ERM company

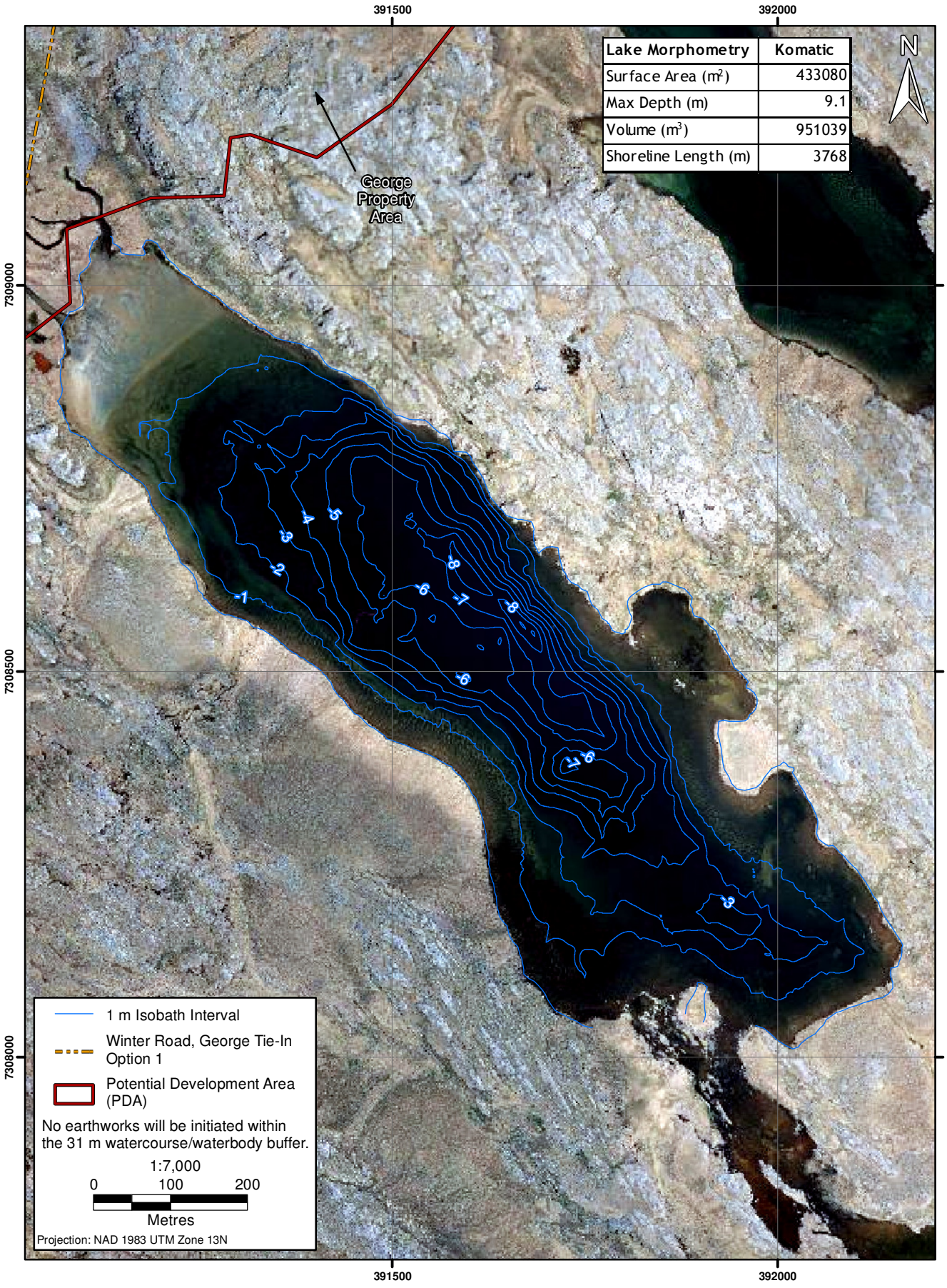


Sabina GOLD & SILVER CORP.

Bathymetry of McCoy Lake, Back River Project, 2013

Figure V6-3D-23

Rescan an ERM company

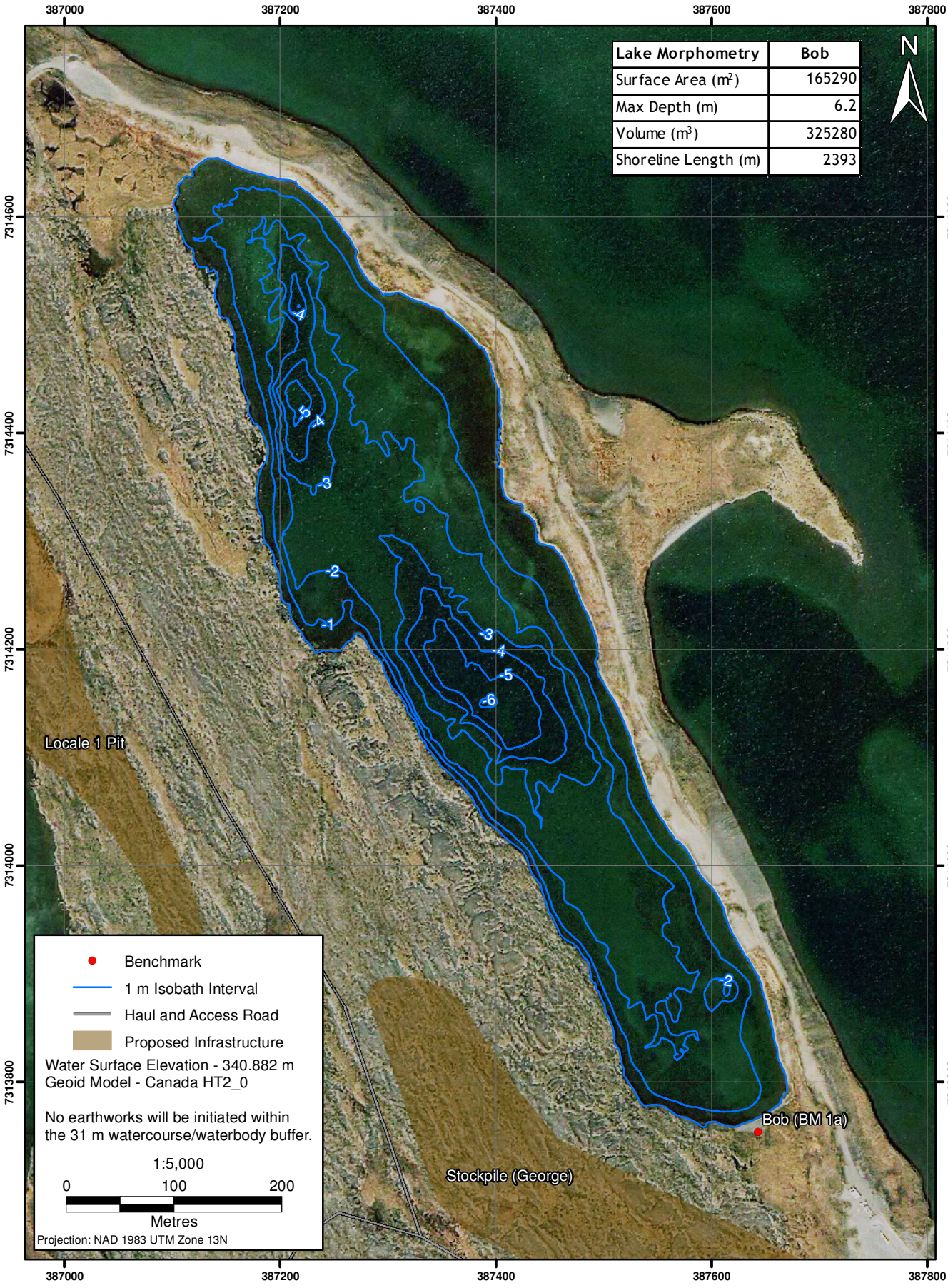


Sabina GOLD & SILVER CORP.

Bathymetry of Komatic Lake, Back River Project, 2013

Figure V6-3D-24

Rescan an ERM company



Sabina GOLD & SILVER CORP.

Bathymetry of Bob Lake, Back River Project, 2013

Figure V6-3D-25

Rescan an ERM company

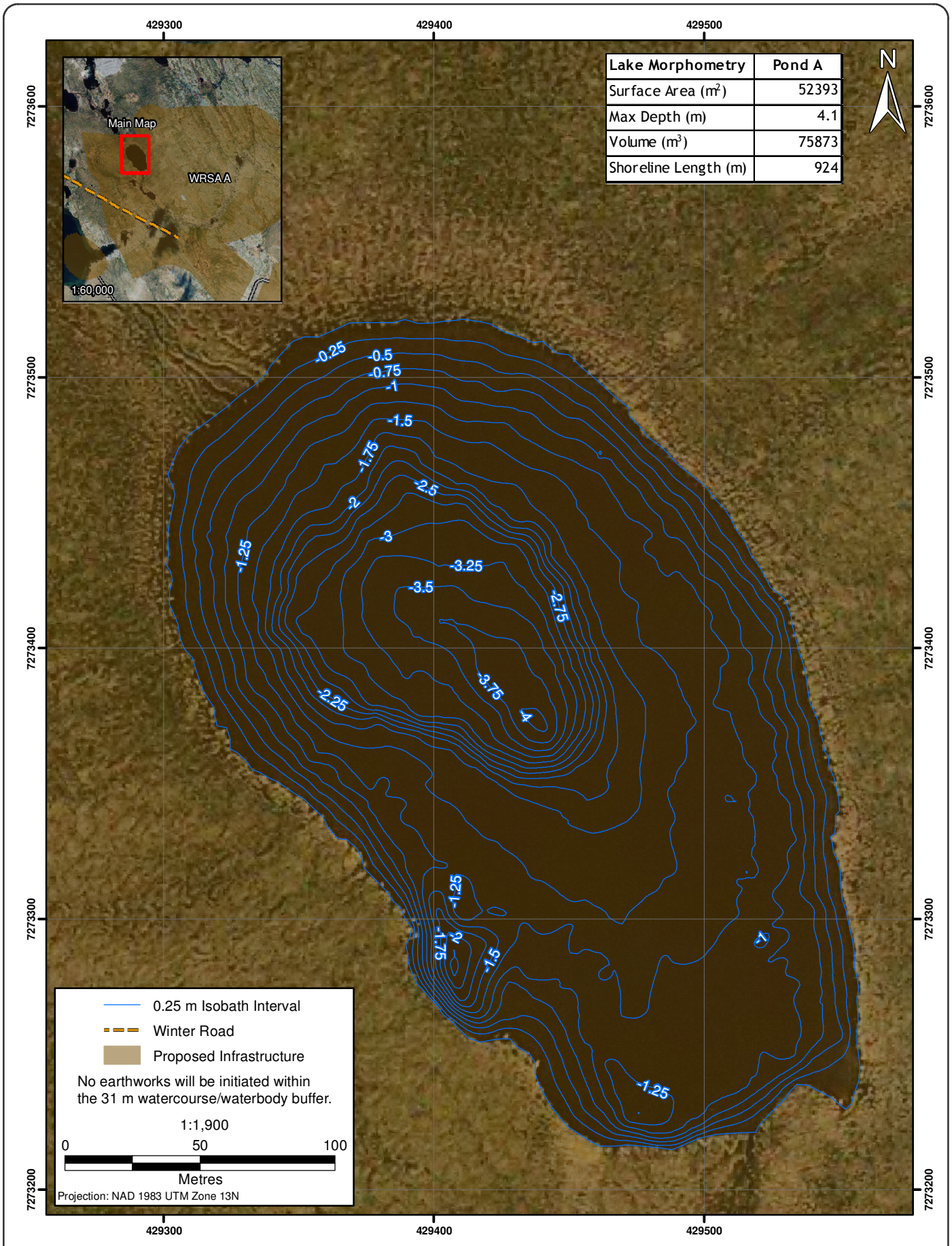


Figure V6-3D-26

Bathymetry of Pond A, Back River Project, 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company

Lake Morphometry	Propeller
Surface Area (m^2)	12647951
Max Depth (m)	17.1
Volume (m^3)	52652320
Shoreline Length (m)	34351

Goose Property Area

5 m Interval Isobath
1 m Interval Isobath
Potential Development Area (PDA)

1:24,000

0 500 1,000
Metres

Projection: NAD 1983 UTM Zone 13N

Figure V6-3D-27

Sabina GOLD & SILVER CORP.

Bathymetry of Propeller Lake, Back River Project, 2013

Figure V6-3D-27

Rescan an ERM company

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Rescan. 2013b. *Back River Project: 2013 Freshwater Baseline Report (in preparation)*. Prepared for Sabina Gold & Silver Corp.: Vancouver, B.C.

Appendix V6-3E

Geophysical Survey - Sabina Back River Project

Sabina
GOLD & SILVER CORP.

Geophysical Survey
Sabina Gold & Silver Corp.
Back River

File V33103008-01.E111
October 7, 2013

PRESENTED TO

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PERMIT TO PRACTICE
EBA ENGINEERING CONSULTANTS LTD.
Signature
Date October 8th, 2013
PERMIT NUMBER: P 018
NWT/NU Association of Professional
Engineers and Geoscientists

Restriction on Disclosure and Use of Data

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APPENDICES

APPENDIX A: GENERAL CONDITIONS

APPENDIX B: DFO REPORTS

1.0 INTRODUCTION

1.1 GENERAL

Tetra Tech was retained by Sabina Gold & Silver Corp. (Sabina) to conduct a geophysical investigation at the company's Back River pro ect, based out of Sabina's Goose Lake camp approximately 500 km northeast of Yellowknife, NT, Canada. The geophysical field program, consisting of ground penetrating radar profiling by snowmobile, was carried out by Mr. James Mickle, P.Geoph., and Mr. Gordon Brasnett, Geoph.I.T., of Tetra Tech. The field program was conducted between April 23 and April 29, 2013 and included three main components:

- a ground penetrating radar-based bathymetric survey of three lakes near the Goose Lake camp to calculate under-ice free water volume, for DFO winter water-withdrawal permitting purposes (referred to in this report as DFO Surveys);
- a ground penetrating radar-based ice thickness and bathymetric survey along several proposed winter road (i.e., ice road) routes between Sabina's Goose Lake and George Lake camps and Bathurst Inlet (referred to in this report as the Winter Road Survey); and
- a ground penetrating radar survey of Bathurst Inlet in an attempt to identify areas of grounded sea ice in the vicinity of the proposed winter road alignment

This report details the fieldwork methodology and graphically presents the results of the geophysical investigations.

2.0 THEORY

2.1 GPR THEORY

A ground penetrating radar (GPR) unit operates on the same principles as conventional radar systems used for air traffic or speed enforcement purposes, but is directed into the ground, rather than the air. In basic terms, an electromagnetic (EM) pulse of extremely short duration is transmitted downwards into the ground from a transmitter antenna, is partially reflected from multiple subsurface objects, and the reflections are detected at the receiver antenna, which accurately records their travel time. A series of these soundings, taken at known intervals along a line, builds up a cross-sectional profile of the reflections within the medium, beneath the profile line.

As the EM wave propagates through the ground, it encounters and passes through materials having specific physical properties. The two important properties in radar surveys are the dielectric permittivity and electrical conductivity of the various materials.

The dielectric permittivity (whose ratio to that of empty space is called the material's dielectric constant') affects the velocity of the EM wave within that material. At interfaces having different dielectric constants, a reflection occurs, the magnitude of which is proportional to the contrast in permittivity. Ice, for instance, typically has a dielectric constant of approximately 4, while air has a dielectric constant of 1, and water has a dielectric constant of 80. Furthermore, the magnitude of the reflection is also a function of how sudden the change is in dielectric permittivity generally, a sharp change will produce a stronger reflection than a gradual change. Thus, a very strong reflection occurs at the interface between the bottom of floating ice and the water beneath it. A moderately strong reflection typically occurs at the water bottom, where the EM wave encounters a sudden change from water to saturated sediments. Similarly, a moderate reflection often occurs at the interface where ice is frozen to solid ground.

The other physical property of concern, electrical conductivity, serves to attenuate the radar pulse. When a high-frequency EM pulse encounters an electrically-conductive material, it induces electrical currents within that material that are proportional to the pulse's frequency, removing energy from the pulse. In practical terms, this means that electrically conductive materials (such as saltwater) are impossible to penetrate with GPR and that higher radar frequencies, while providing better resolution, are attenuated more easily than lower frequencies.

The result of a GPR survey is typically a collection of profile lines. These cross-sections consist of all the individual GPR soundings (or traces') acquired on a particular profile displayed next to each other. The trace number represents the location along the profile line at which the trace was collected and the distance down the trace represents the time it took for any particular reflection to be detected after the pulse transmission. This time is proportional to the depth below grade at which the reflection occurred, as well as the velocities of the materials through which the EM pulse travelled. Knowing the time it took until each reflection was received and the velocity of the EM wave in the subsurface, the depth to the various reflectors can be determined. Additionally, when GPS positioning is collected along with the GPR data, each trace has a real-world coordinate associated with it.

2.2 THROUGH-ICE GPR BATHYMETRY

GPR is a very useful tool for through-ice fresh water bathymetric surveying. As mentioned above, the difference in dielectric permittivities between fresh water and the lake bottom is relatively high and the transition is abrupt, typically resulting in a strong, easy to identify reflection in the dataset. In addition, ice and clear fresh water are low-loss materials to GPR signals and therefore the GPR bathymetry data can be collected through the ice surface during the winter months. Undulations in the ice thickness, however, will lead to amplified apparent undulations in the bathymetry for instance, for each centimetre that the ice thickness decreases, the water depth will appear to increase by 4.5 cm, and vice versa. By simultaneously collecting ice-thickness and water depth GPR datasets along the same track, the larger ice thickness undulations can be identified and the resulting artificial undulations in the bathymetric data can be corrected.

3.0 SURVEY METHODOLOGY

3.1 UNDER-ICE LAKE VOLUME ("DFO") SURVEYS

The GPR system utilized in the survey was a Mala Geosciences Ramac CUII system using an unshielded 50MHz rough terrain antenna. The GPR system was set to acquire 10 radar traces per second, while the antennas were towed behind a snowmobile at a speed of approximately 15 km/h. This yielded an average horizontal data density of 2.4 scans per metre, or 42 cm spacings. All GPR data was recorded using Mala's GroundVision software and saved to a field laptop. Real time positioning of the data was achieved using a Topcon GPS/GLONASS unit operating in autonomous mode, with positions recorded once per second. Positions were integrated with the GPR data as it was collected.

Handheld GPS units with pre-programmed survey grids were used for navigation purposes during data acquisition. The exact survey profile location was a function of terrain and other obstacles encountered while acquiring the GPR data.

In total, 76 km of GPR data was collected during the DFO surveys: 14 km on Wolf Lake, 60 km on Propeller Lake and 2 km on Leaf Lake, which had respective grid line spacings of 450 m, 450 m and 200 m.

3.2 WINTER ROAD SURVEY

The Winter Road Survey was performed in much the same manner as the DFO Surveys, with the addition of a second Ramac CUII GPR unit towed behind a snowmobile while following the first system. The second system used a shielded 500 MHz antenna to measure ice and snow thickness, and had its own Topcon GPS/GLONASS unit to provide positioning information once per second.

In total, approximately 200 km of ice and bathymetry GPR data was collected, divided into four datasets: Goose Camp to George Camp (65 km, taking the southern route from the junction), George North (13 km, heading south-east from George Camp to the northern junction), Bypass Southbound (16 km, collected from the northern junction to the southern junction), and Junction to Bathurst (75 km, collected from the northern junction to the south edge of Bathurst Inlet). Data was collected along a single profile track along each of the routes. The Goose Camp to George Camp route started approximately 5 km NW of Goose Camp, due to a lack of water body crossings along the proposed route in the omitted area. The current proposed road route goes around the lake on land at Goose Camp.

Because the depths of the lakes to be encountered along the winter road route were completely unknown prior to the program, the bathymetry system was initially set to acquire approximately 10 m of water depth. At some point on the first day, between Goose and George Lakes, it was discovered that this depth had been exceeded at one point, meaning the water bottom reflection temporarily dropped off the bottom of the GPR profile, and thus no conclusive water depth could be determined at this one location (although it can be conclusively stated that the water at this location is at least greater than 10 m deep). The bathymetric system was then adjusted to acquire approximately 15 m of water depth and remained at this setting for the remainder of the program, with the exception of Bathurst Lake. It was reasoned that 15 m struck the best compromise between obtaining good vertical resolution at the shallower depths (as shallow water is often more likely to cause issues related to ice road operation), while providing as complete a record as possible of the deeper lake bottoms. The ice GPR system was configured to maximize the resolution of the ice-water interface, at an average depth of approximately 1.8 m.

It is not anticipated that these scaling adjustments compromise either the validity of the water depth data for DFO purposes or the accuracy of the ice profile data.

3.3 BATHURST INLET SURVEY

Although GPR signals cannot penetrate through saltwater to map bathymetry (due to the high conductivity of saltwater), GPR can be used to successfully identify areas of grounded sea ice. The ice overlying the solid ground generally has low conductivity, and therefore the signal is not significantly attenuated and is able to penetrate through and reflect off the frozen ground. As explained in Section 2.1, a moderate reflection often occurs at the interface between ice and solid ground (grounded ice).

Survey lines were run perpendicular to the shoreline of Bathurst Inlet in the vicinity of the proposed alignment with the objective of identifying which areas had grounded ice and locating the transition between grounded ice and floating ice.

4.0 DATA REDUCTION AND RESULTS

4.1 DFO SURVEYS

For each lake, the data was gained and filtered to best accentuate the lake bottom reflections. Layback corrections were applied to shift the GPS positioning back to account for the fact that the GPS units were mounted on the back of the snowmobiles, some distance forward of the GPR antennas, which were towed behind the snowmobiles. The lake bottom was then digitized in the GPR records; lake depths were compared where grid lines intersected crosslines. An excellent match was observed at all such intersection points. Finally, depths were calculated using a standard radar wave velocity in water of 0.0333 m/ns. Following the DFO protocol for determining under-ice water volumes for areas north of the tree line, the GPR-derived depths were adjusted to account for 2 m of ice cover.

Lake outlines (representing a water depth of zero) were merged into the GPR-derived results, and the resulting dataset was then contoured for display as colour contour plots. It is important to note that in addition to the lake outlines, areas of grounded ice were also included in this dataset to prevent the Kriging contouring algorithm from extrapolating water depth contours into areas that were known to be grounded.

Standalone DFO reports outlining the results of the surveys were provided to Sabina on May 30, 2013 via email. A copy of these reports has been included in Appendix B for convenience. The main points of interest regarding the lake surveys are outlined in sections 4.1.1 through 4.1.3 below.

4.1.1 Wolf Lake Note

Wolf Lake consisted of three distinct basins, all of which were isolated from each other by grounded ice, as illustrated in figure Wolf-02 of Appendix B. Since the intention of the DFO water withdrawal protocols is to avoid over-use of water in a lake, this information should be kept in mind if/when withdrawing water from a particular location in the lake. The largest of the three reservoirs of water is located in the southern half of the lake.

4.1.2 Propeller Lake Note

Information made available to Tetra Tech prior to conducting the GPR bathymetry program was that the maximum expected lake depth in Propeller Lake was 7.8 m. In order to maximize the vertical resolution of the GPR records, the GPR system was set to acquire just slightly more than this depth, approximately 9 m worth of bathymetry. However, in one region, the lake bottom unexpectedly fell off the bottom of the GPR profile (location indicated in figure Propeller-02 in Appendix B). This wasn't noticed until several days later, when Tetra Tech personnel were out of the area, making a re-survey of the appropriate profile lines impractical. The area in question encompasses approximately 16.4 ha, or 1.28% of the entire surface area of the lake. Assuming an average undocumented additional depth of 2 m (ie. the lake in this region is 2 m deeper than the bottom of the GPR record), this would represent a volume underestimate of approximately 329,000 m³, or 1.22% of the total available water volume. The volume reported herein is the lesser amount, ie. assuming the lake bottom to be the maximum proven depth obtained from the GPR.

4.1.3 Leaf Lake Note

Leaf Lake is a relatively small lake, only 635 m in length and 350 m in width. The absolute accuracy of its outlines (and indeed of many of the small- and medium-sized lakes in the remote arctic region) on GPS mapping software is dubious. However, in the absence of any other high-resolution GPS route-planning resources, this mapping software was used to create the DFO survey tracks prior to Tetra Tech's mobilization to site. Once on-site, in instances where there was an obvious discrepancy between where the GPS maps indicated the edge of the lake to be and what was visually distinguishable as the lake edge, the survey lines were extended/moved based on where the edge of the lake was visually obvious. In the case of Leaf Lake, it appears that the survey grid was shifted south by approximately 100 m, but due to snow cover and a lack of any visually identifying features, it was not obvious in the field that this was the case. In practical terms, this means that the north end of the lake was not fully profiled, while the GPR survey proceeded onto dry land on the south end.

4.2 WINTER ROAD SURVEY

The bathymetric GPR data was processed in the same manner as that obtained in the DFO survey. As before, the lake bottom was identified and digitized in the GPR records. Since the ice-water interface is typically very strong and clear, as discussed in Section 2.1, the second GPR dataset, representing the ice thickness record, required very little processing. The ice-water interface was identified and digitized, as was the ice-ground interface (i.e., where the lake had frozen down to the bottom). Custom processing routines developed by Tetra Tech were used to merge the ice and bathymetry datasets together and remove the ice's influence from the bathymetric record (as discussed in Section 2.2). Additionally, the grounded ice identification was used to supplement the bathymetric data, as the bathymetric GPR unit was generally unable to resolve this interface.

Due to the settings used for each GPR instrument, it is often difficult to identify the lake bottom if it lies immediately beneath the ice-water interface. In some areas, the lake bottom is faintly visible in the GPR ice record, but not always. Typically, when the lake became shallower than approximately 2.2 m, it became difficult or impossible to identify its reflection in the bathymetric record. This in of itself is useful information, as for water withdrawal purposes it indicates that the lake is unsuitable unless dissolved oxygen readings are taken which demonstrate that the lake is not fish habitable.

Results of the winter road survey are presented in Figures A1 through D11.

4.2.1 Winter Road Survey Notes

In Figures A10.4 through A10.8, the lake bottom data is intermittent this was caused by a dying GPR transmitter battery, which went unnoticed until later that day.

The lake bottom reflector drops off the bottom of the GPR record in Figures A11.9 & A11.10 (GPR set to record 10 m of water depth), C2.2 & D3.4 (GPR set to 15 m) and numerous pages of D11 (Bathurst Lake) (GPR set to 50 m, but only seeing to a maximum depth of 28 m).

In Figure D12.1 the majority of the lake bottom has not been marked this is due to a bathymetry system malfunction which went unnoticed until later in the day. Select areas of bathymetry have been identified in areas where the lake bottom was visible in the ice data.

In some figures (ie A11.5), there is a slight discrepancy between where the background plan view map indicates that the survey was on land, and where land was actually encountered. Though it was not always visually obvious where the shoreline was, the survey was conducted on ice wherever possible. The discrepancy in the background image is thus simply due to inaccuracies in the map data at this scale.

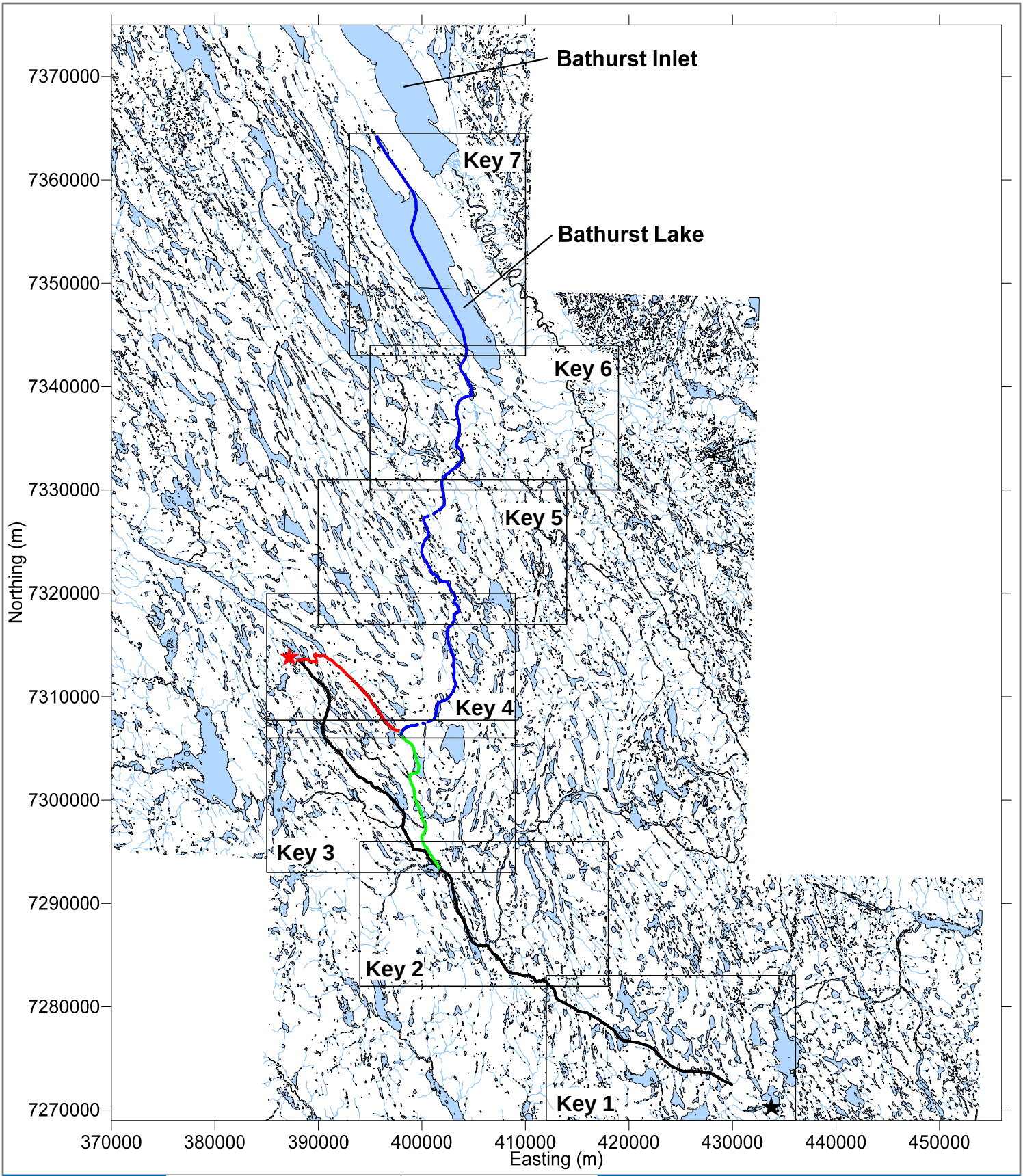
4.3 BATHURST INLET SURVEY

Figure E outlines the results of the Bathurst Inlet Survey in plan map view, indicating areas of grounded versus floating ice cover, where identifiable.

5.0 DATA LIMITATIONS

It should be noted that the results presented in this report are representative of the conditions at the time of data collection (April 23 29, 2013). Ice thicknesses can vary significantly over short periods of time due to changes in conditions such as snow cover or air temperature. The reported ice thicknesses are meant to provide an indication of typical ice characteristics that may be expected along the route under similar conditions. The presented data is not intended for use in any load-bearing capacity calculations.

FIGURES



LEGEND

N

SCALE 1:500,000
NAD83
UTM z13

- Figure Set A
- Figure Set B
- Figure Set C
- Figure Set D
- George Lake Camp
- Goose Lake Camp

CLIENT

Sabina GOLD & SILVER CORP.

TETRA TECH

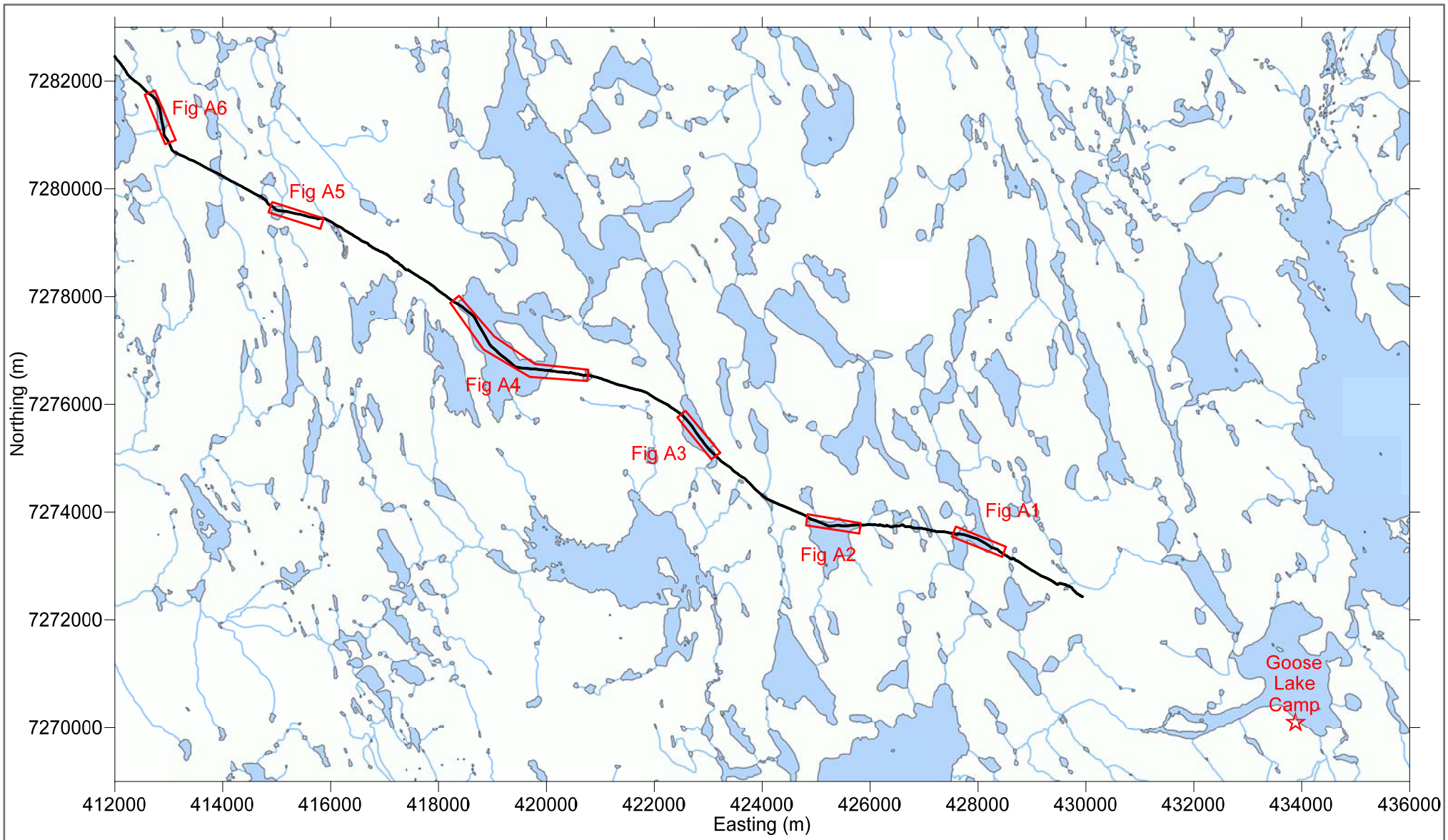
Sabina Gold & Silver
Back River Project GPR Profiling

Winter Road Option
GPR Profile Survey Overview

PROJECT NO.	DWN	CKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
EBA-EDM	June 15, 2013

Figure 01



LEGEND

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SCALE 1:100,000
NAD83
UTM z13

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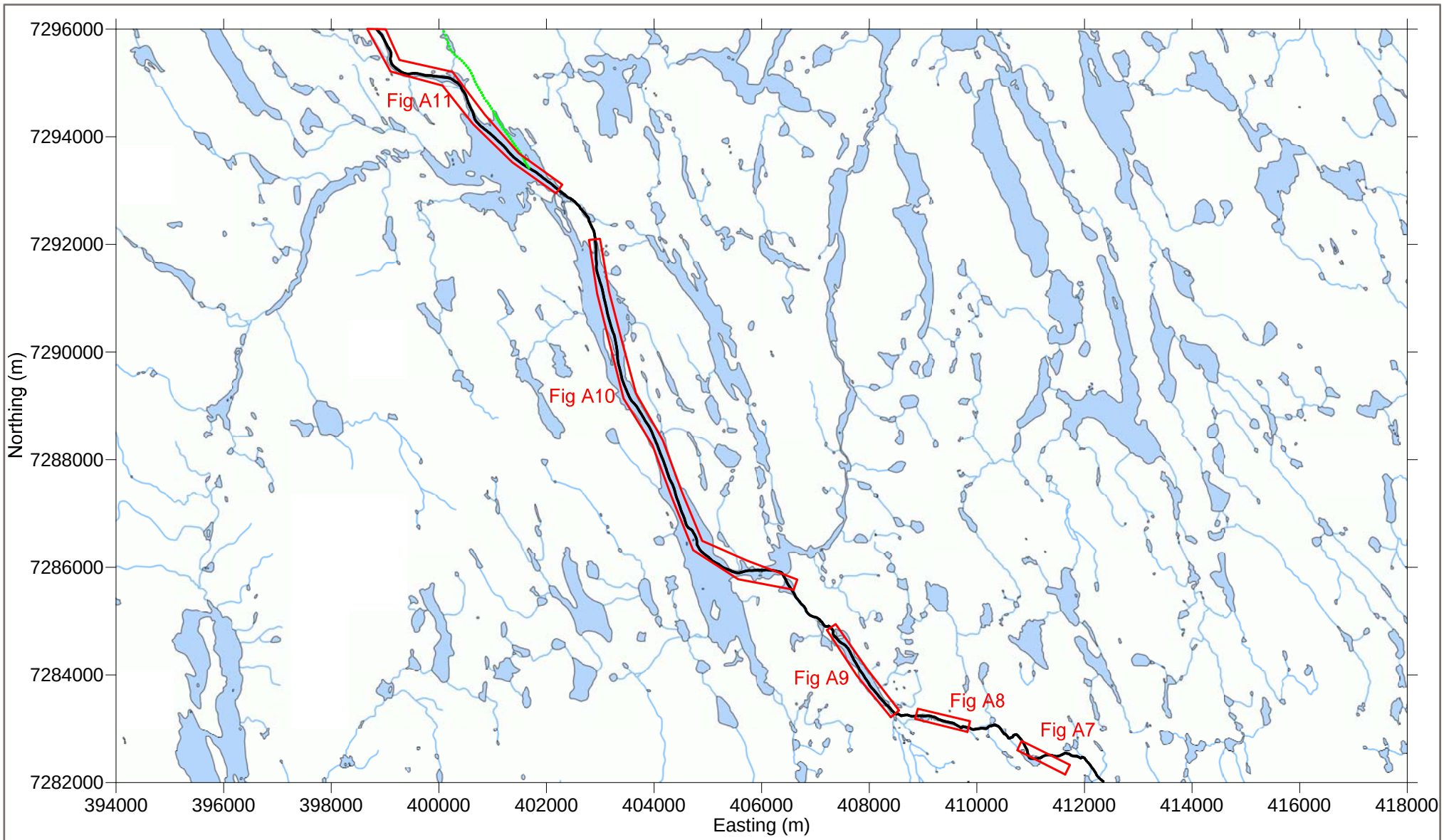
Sabina Gold & Silver
Back River Project GPR Profiling

Winter Road Option
GPR Profiles
Key 1

PROJECT NO.	DWN	CKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
EBA-EDM	June 15, 2013

Figure 02



LEGEND

N

SCALE 1:100,000
NAD83
UTM z13

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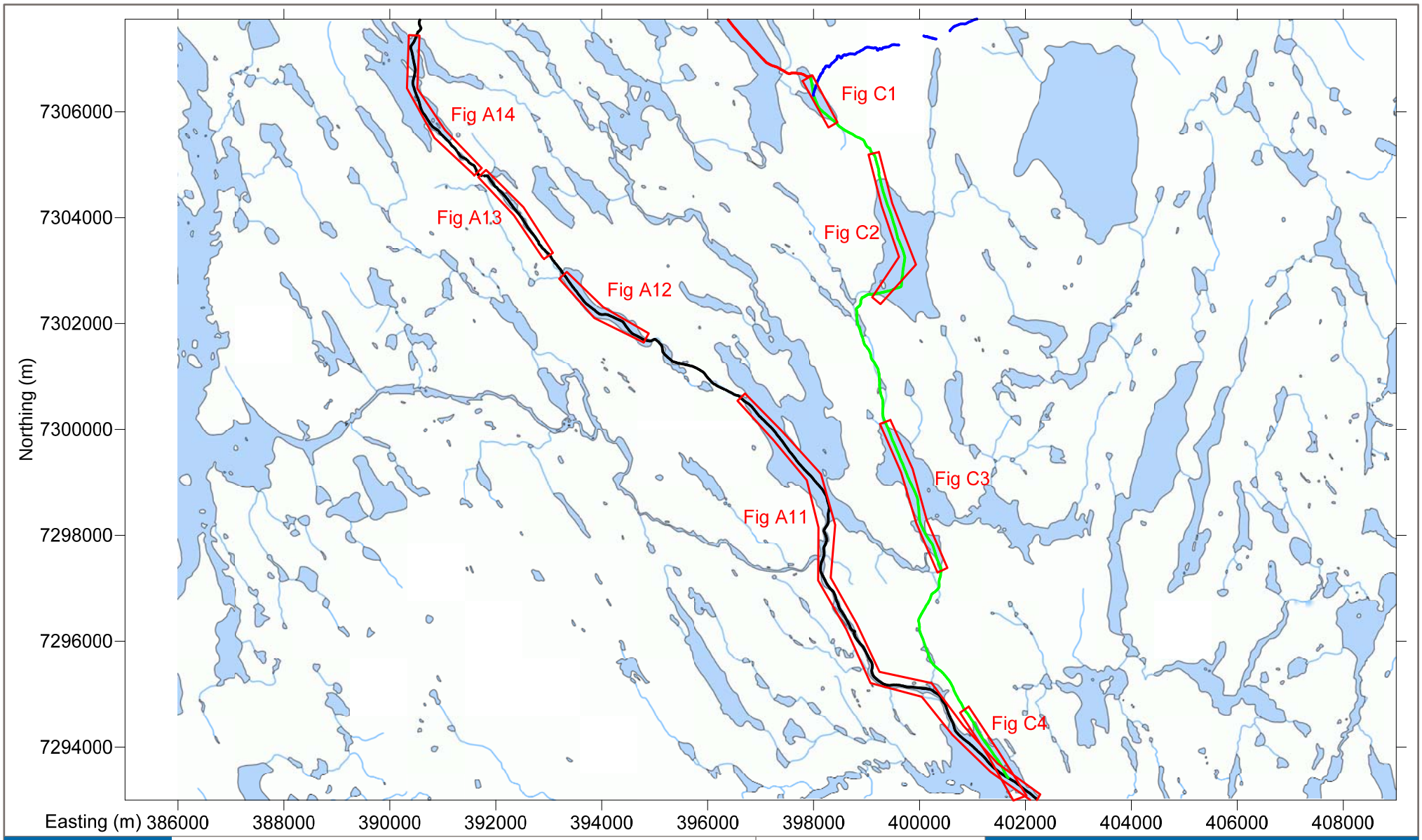
Winter Road Option
GPR Profiles
Key 2

PROJECT NO.	DWN	CKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
EBA-EDM	June 15, 2013

Figure 03



LEGEND

N

SCALE 1:100,000
NAD83
UTM z13

CLIENT

Sabina GOLD & SILVER CORP.

TETRA TECH

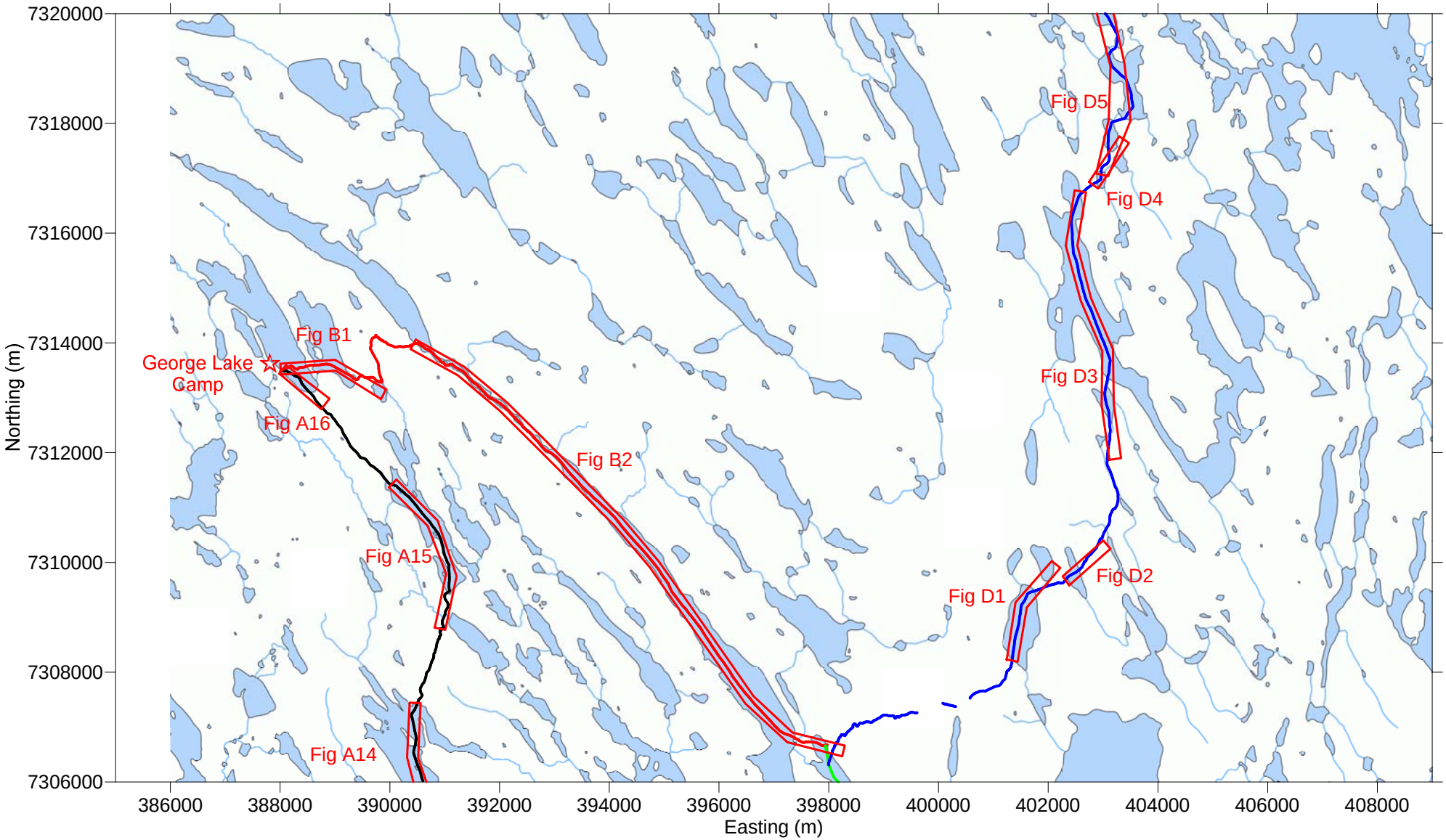
Sabina Gold & Silver
Back River Project GPR Profiling

Winter Road Option
GPR Profiles
Key 3

PROJECT NO.	DWN	CKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
EBA-EDM	June 15, 2013

Figure 04



LEGEND

N

SCALE 1:100,000
NAD83
UTM z13

CLIENT

Sabina
GOLD & SILVER CORP.

TETRA TECH

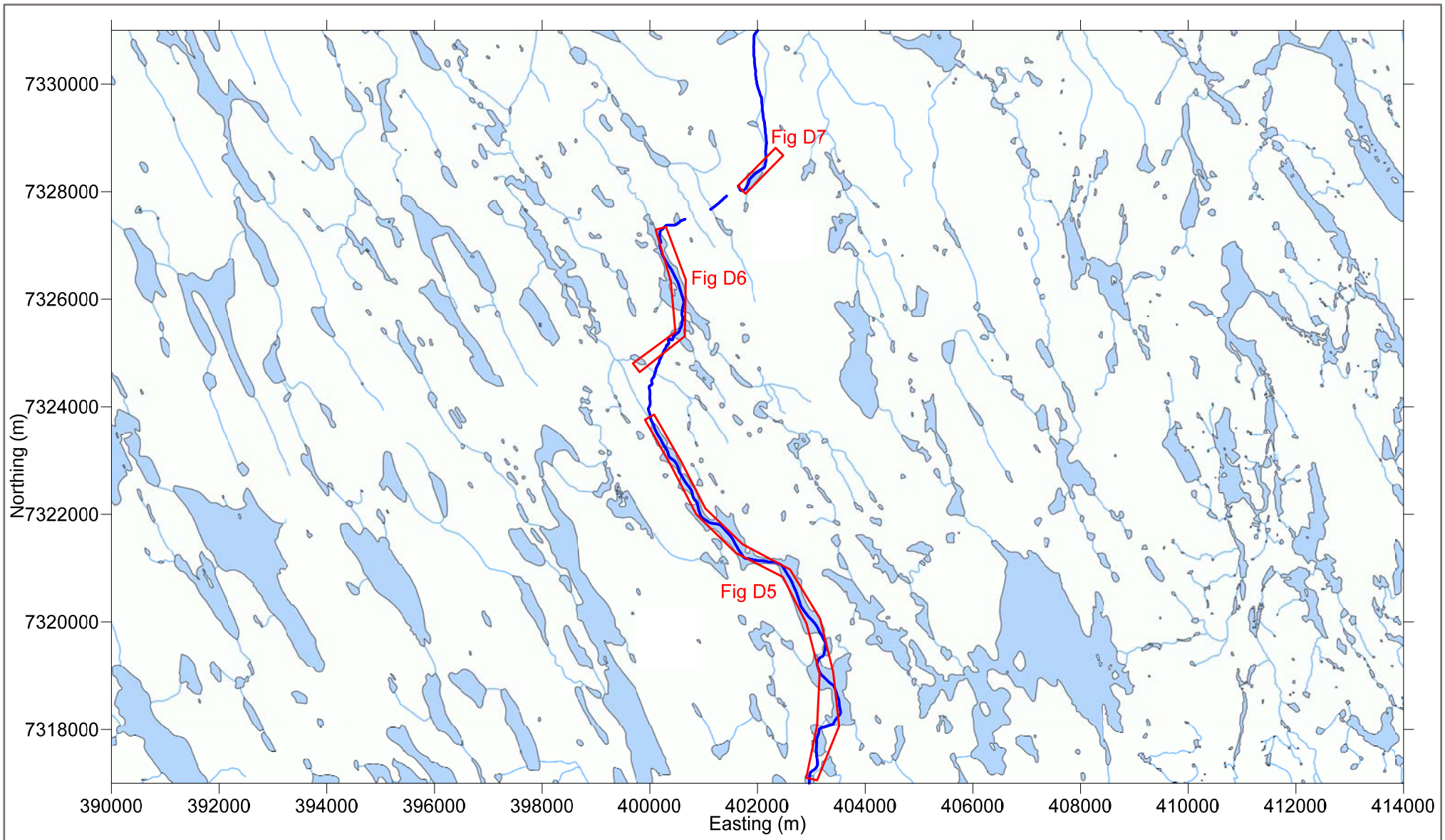
Sabina Gold & Silver
Back River Project GPR Profiling

Winter Road Option
GPR Profiles
Key 4

PROJECT NO.	DWN	CKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
EBA-EDM	June 15, 2013

Figure 05



LEGEND

N

SCALE 1:100,000
NAD83
UTM z13

CLIENT

Sabina GOLD & SILVER CORP.

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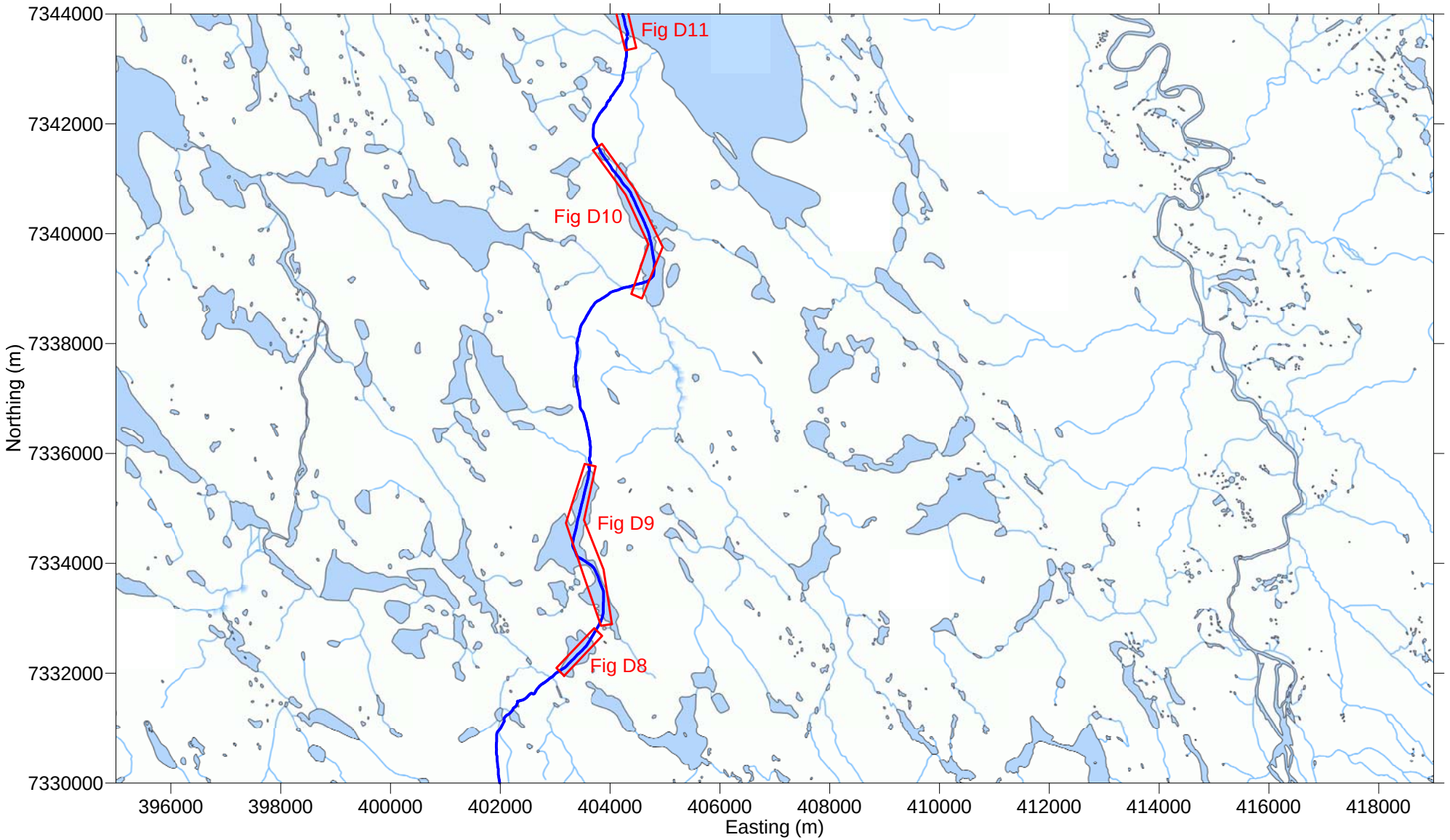
Back River Project GPR Profiling

Winter Road Option
GPR Profiles
Key 5

PROJECT NO.	DWN	CKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
EBA-EDM	June 15, 2013

Figure 06



LEGEND

N

SCALE 1:100,000
NAD83
UTM z13

CLIENT

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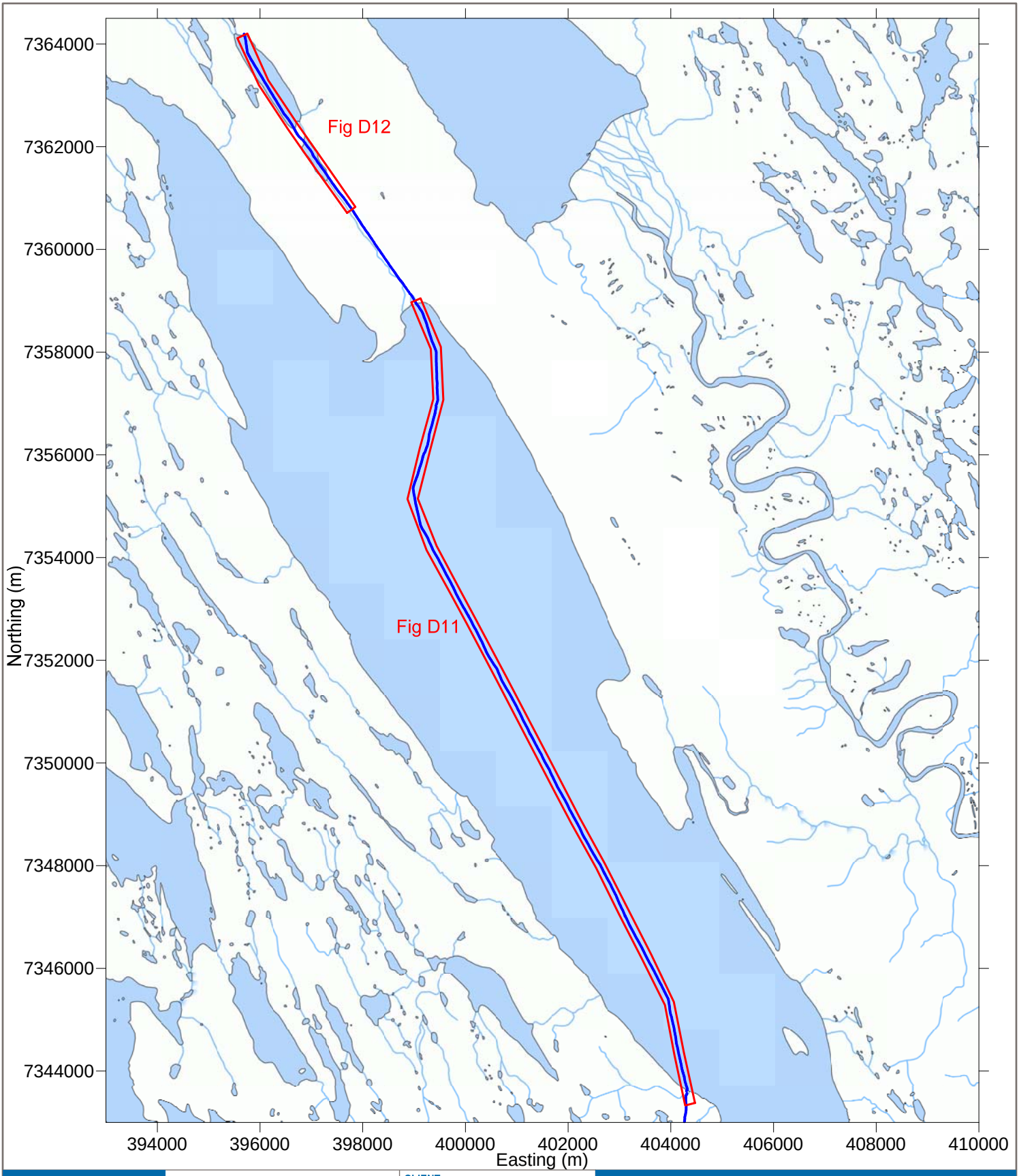
Winter Road Option
GPR Profiles
Key 6

PROJECT NO.	DWN	CKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
EBA-EDM	June 15, 2013

Figure 07



LEGEND

N

SCALE 1:100,000
NAD83
UTM z13

CLIENT

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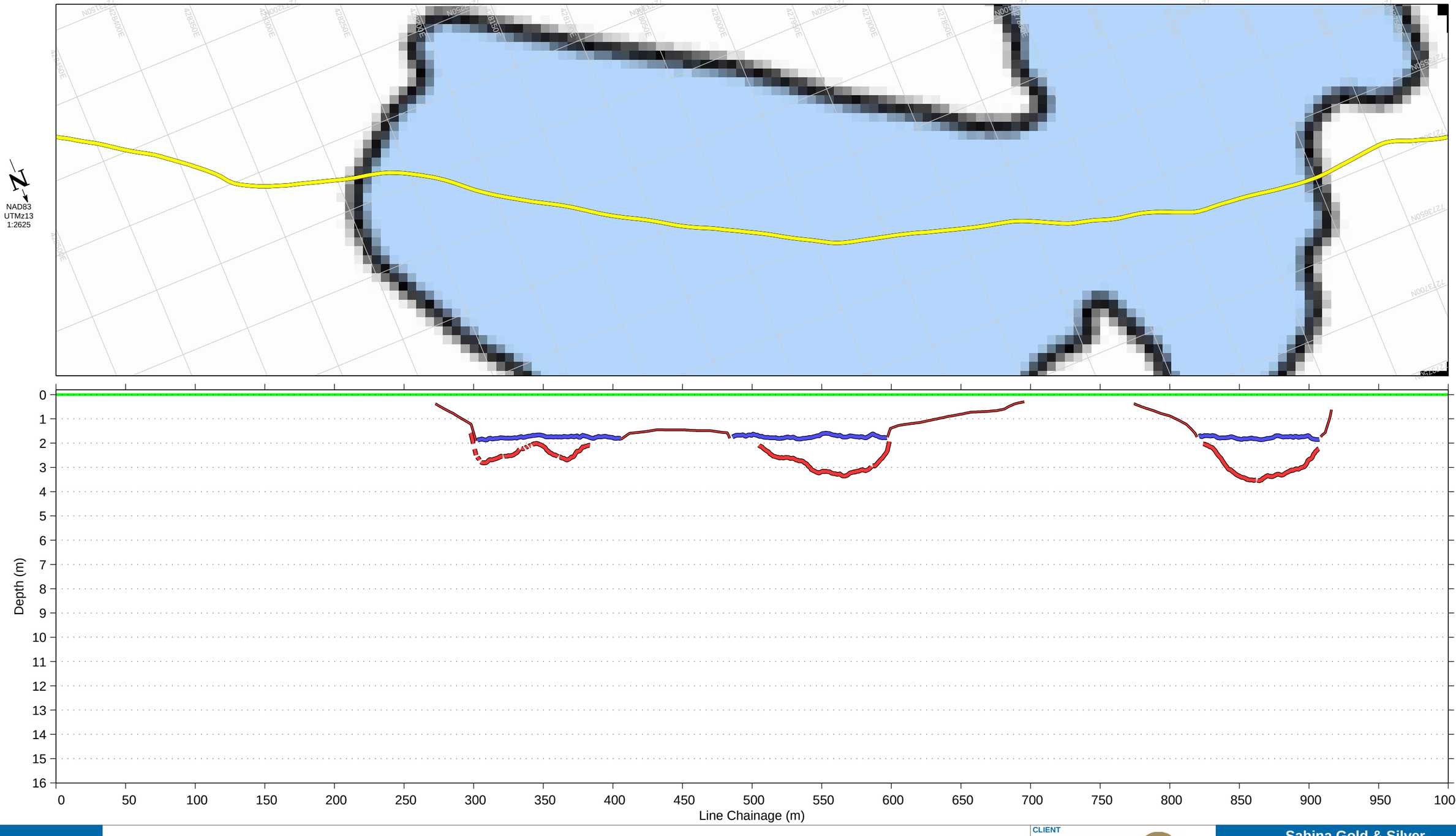
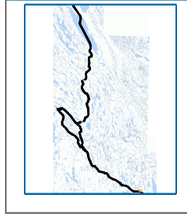
Winter Road Option
GPR Profiles
Key 7

PROJECT NO.	DWN	CKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
EBA-EDM	June 15, 2013

Figure 08





LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

CLIENT

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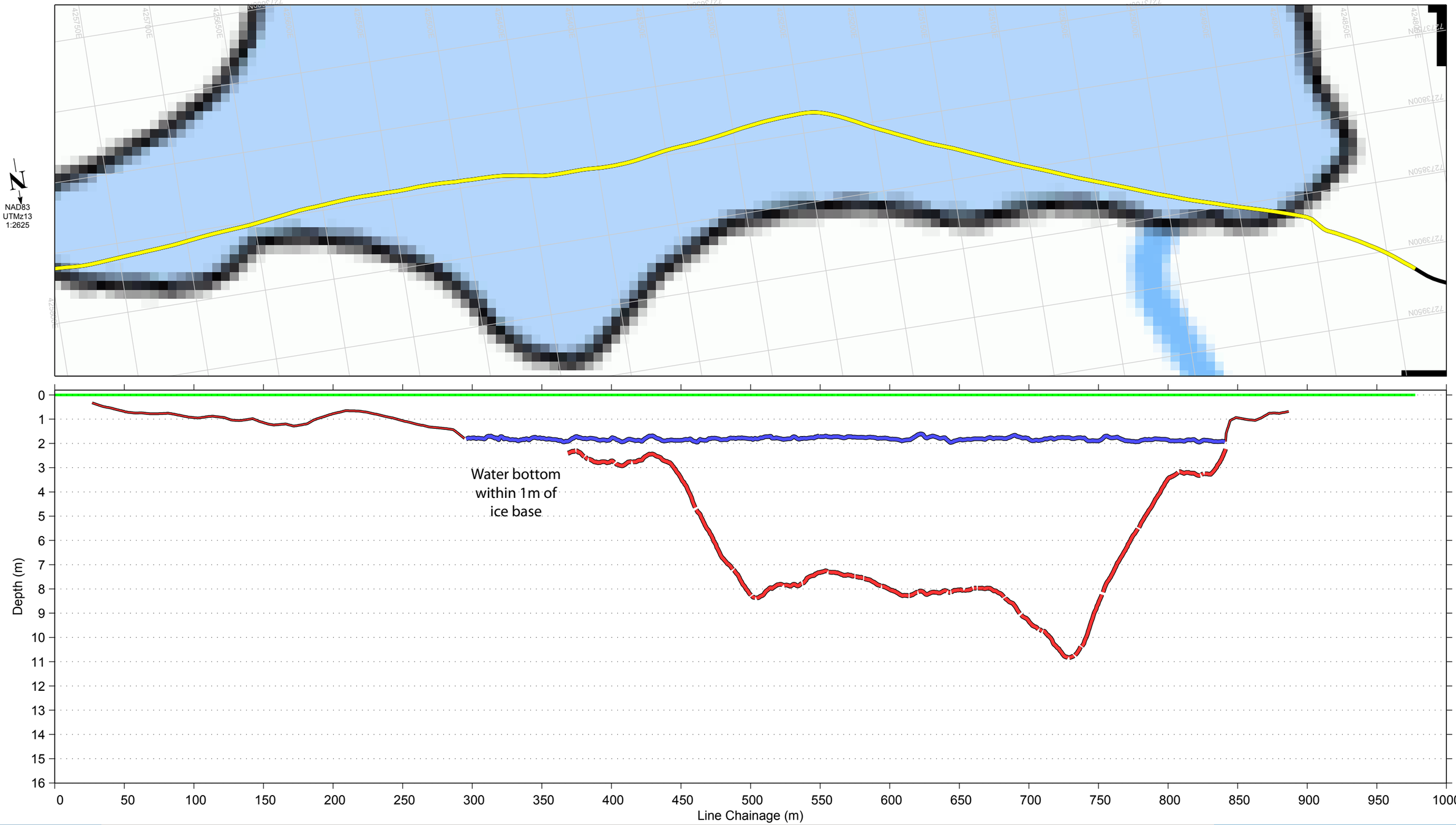
Winter Road Option – Major Lake Profiles
Goose to George
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure A1



LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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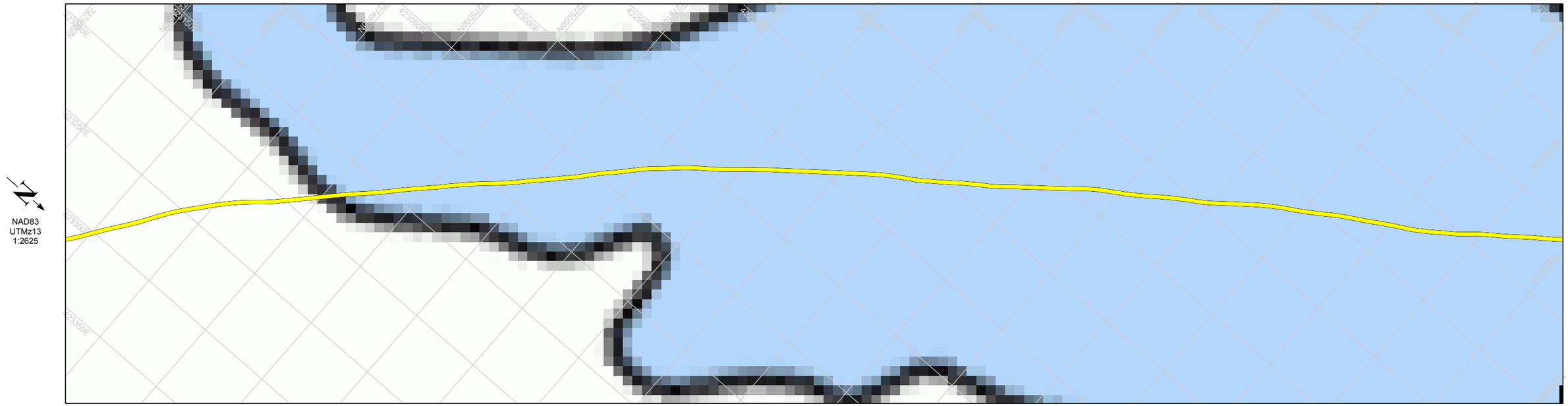
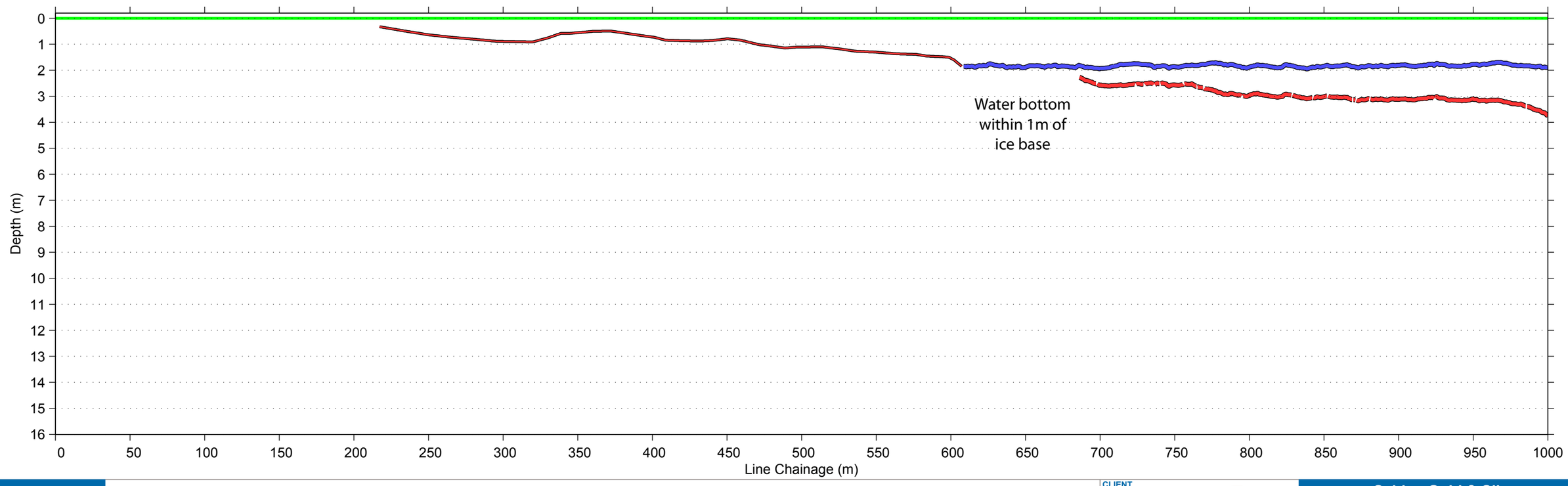
Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

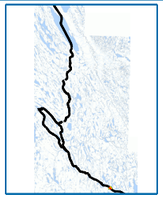
OFFICE: Edmonton

DATE: June 14, 2013

Figure A2







LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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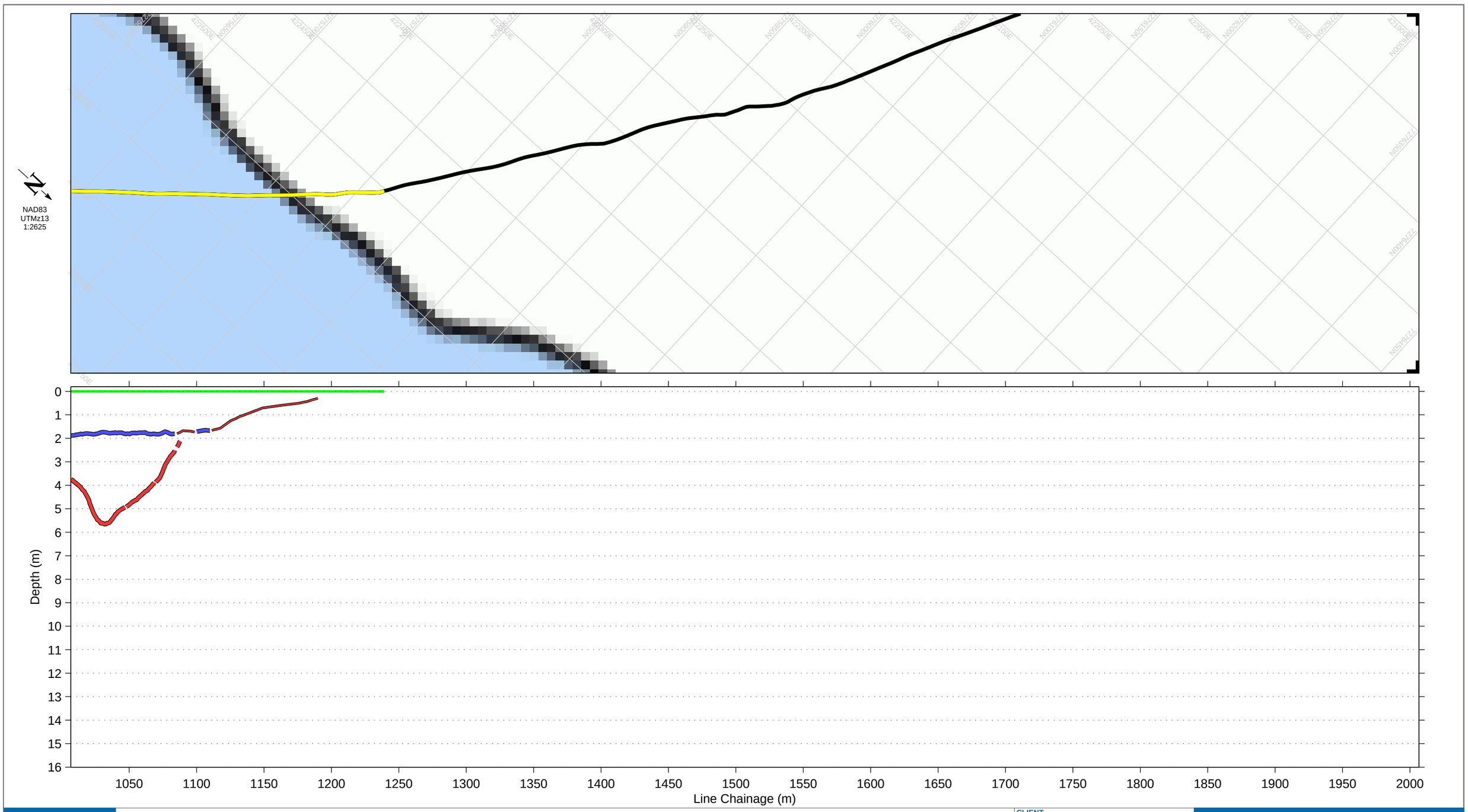
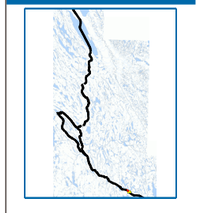
Winter Road Option – Major Lake Profiles
Goose to George
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure A3.1





LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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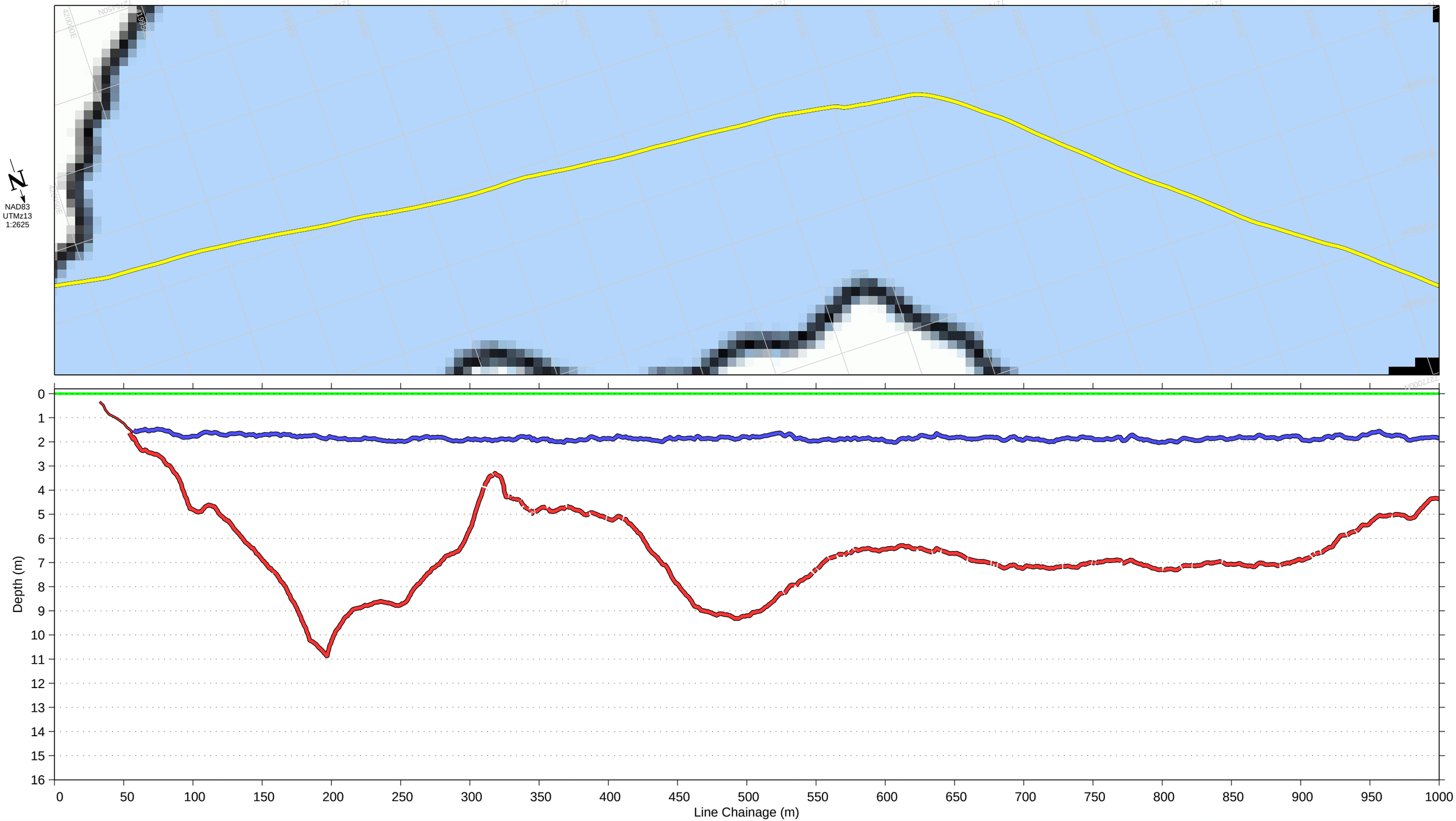
Goose to George
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure A3.2



LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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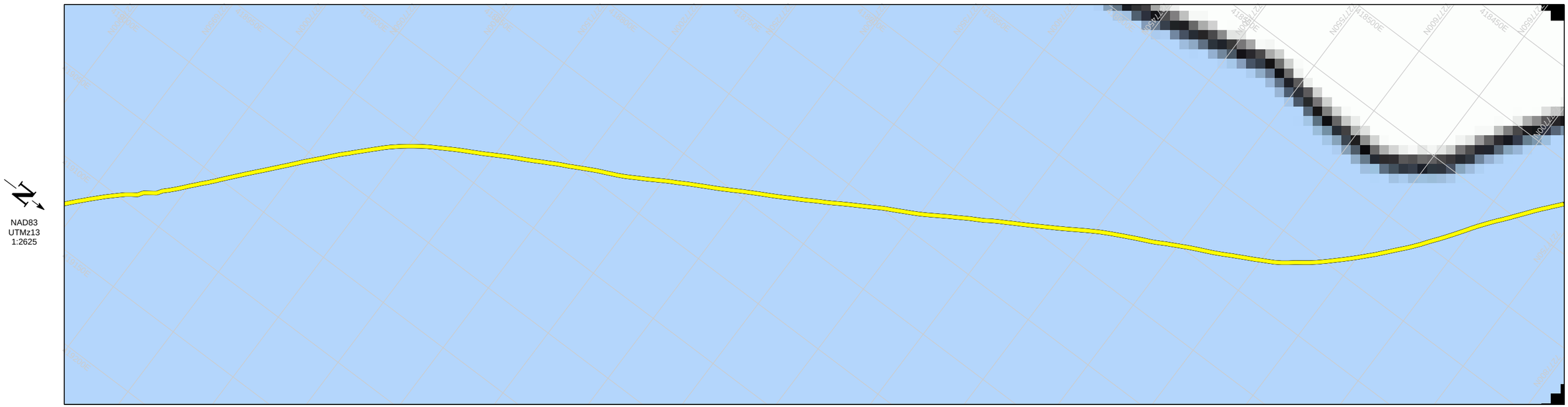
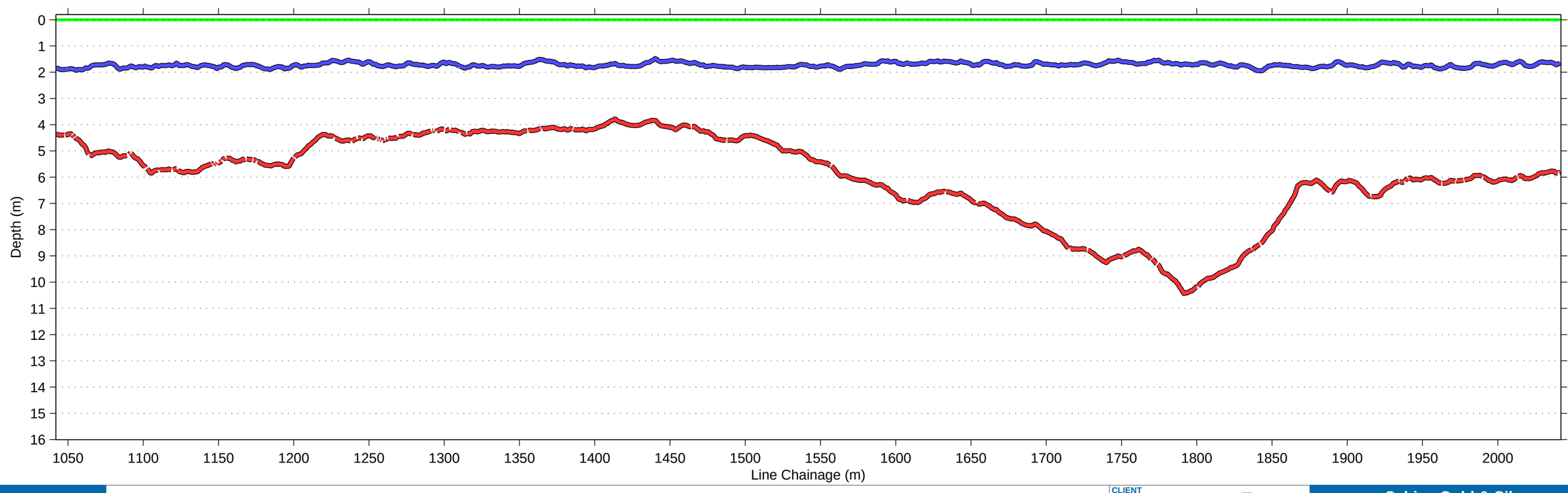
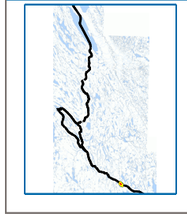
Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure A4.1







LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
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- Floating Ice
- Water Bottom

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Winter Road Option – Major Lake Profiles
Goose to George
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure A4.2

NAD83
UTMz13
1:2625

Depth (m)

Line Chainage (m)

LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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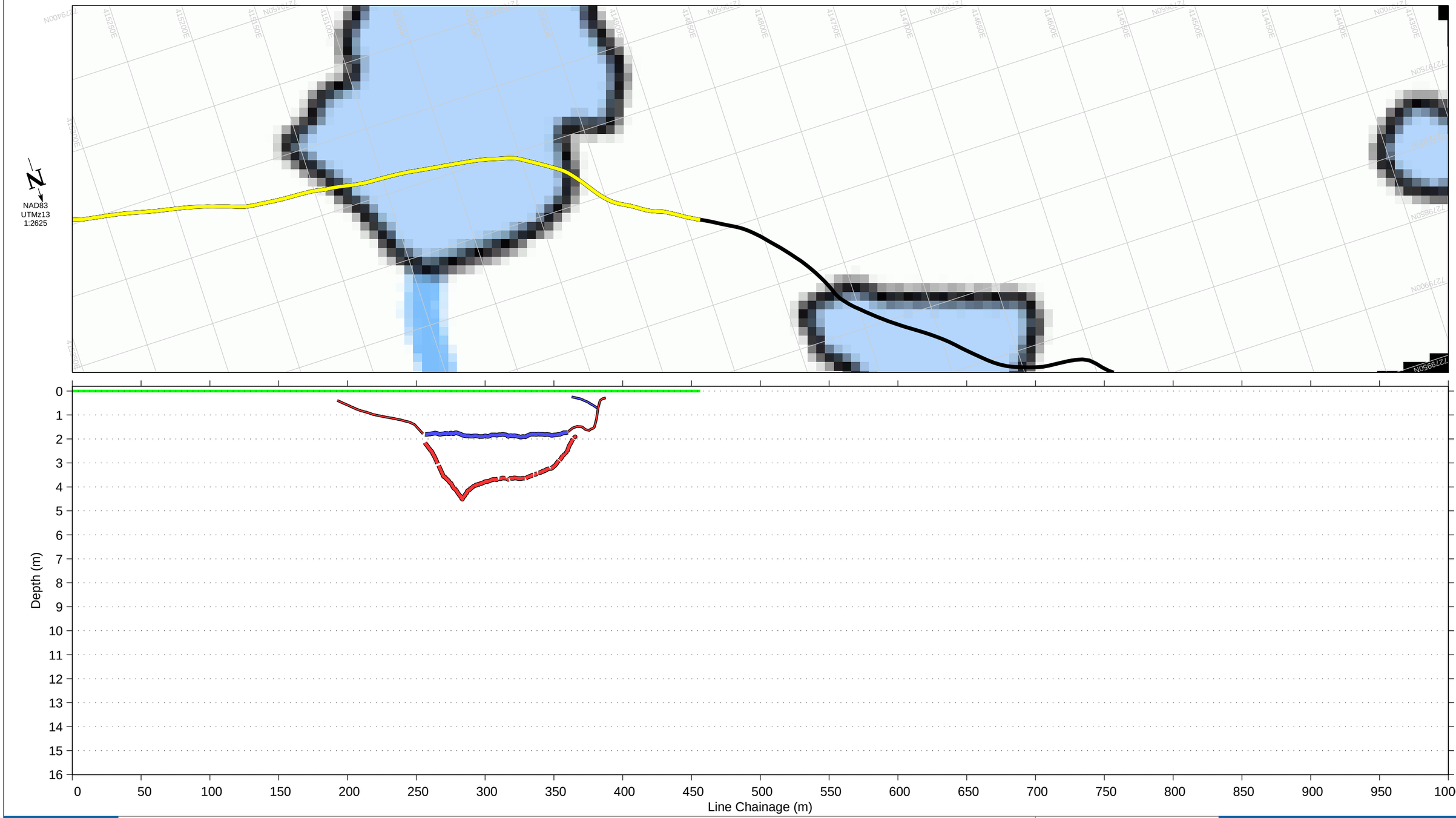
Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure A4.3



LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
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- Water Bottom

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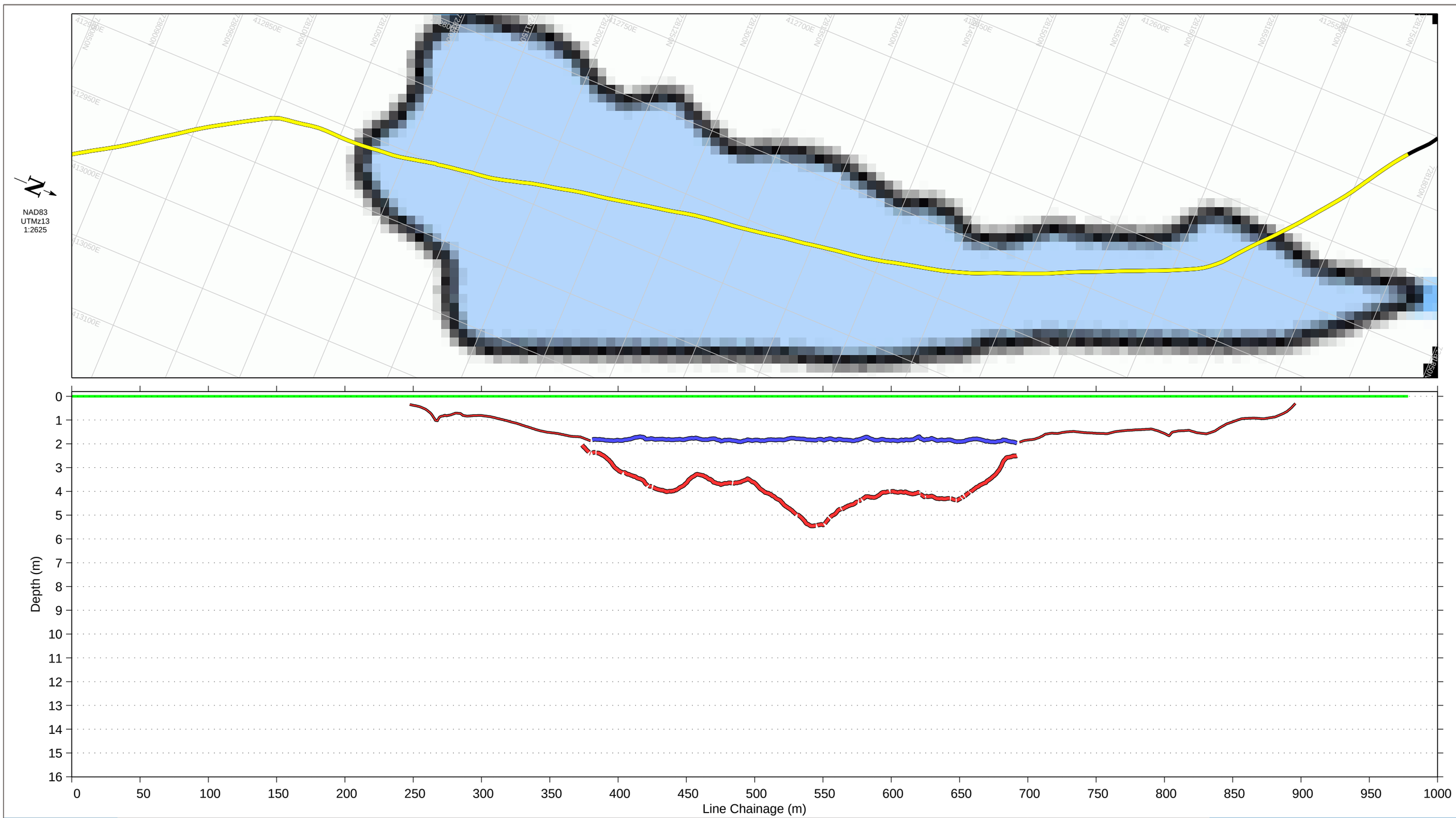
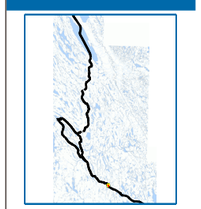
Winter Road Option – Major Lake Profiles
Goose to George
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure A5





LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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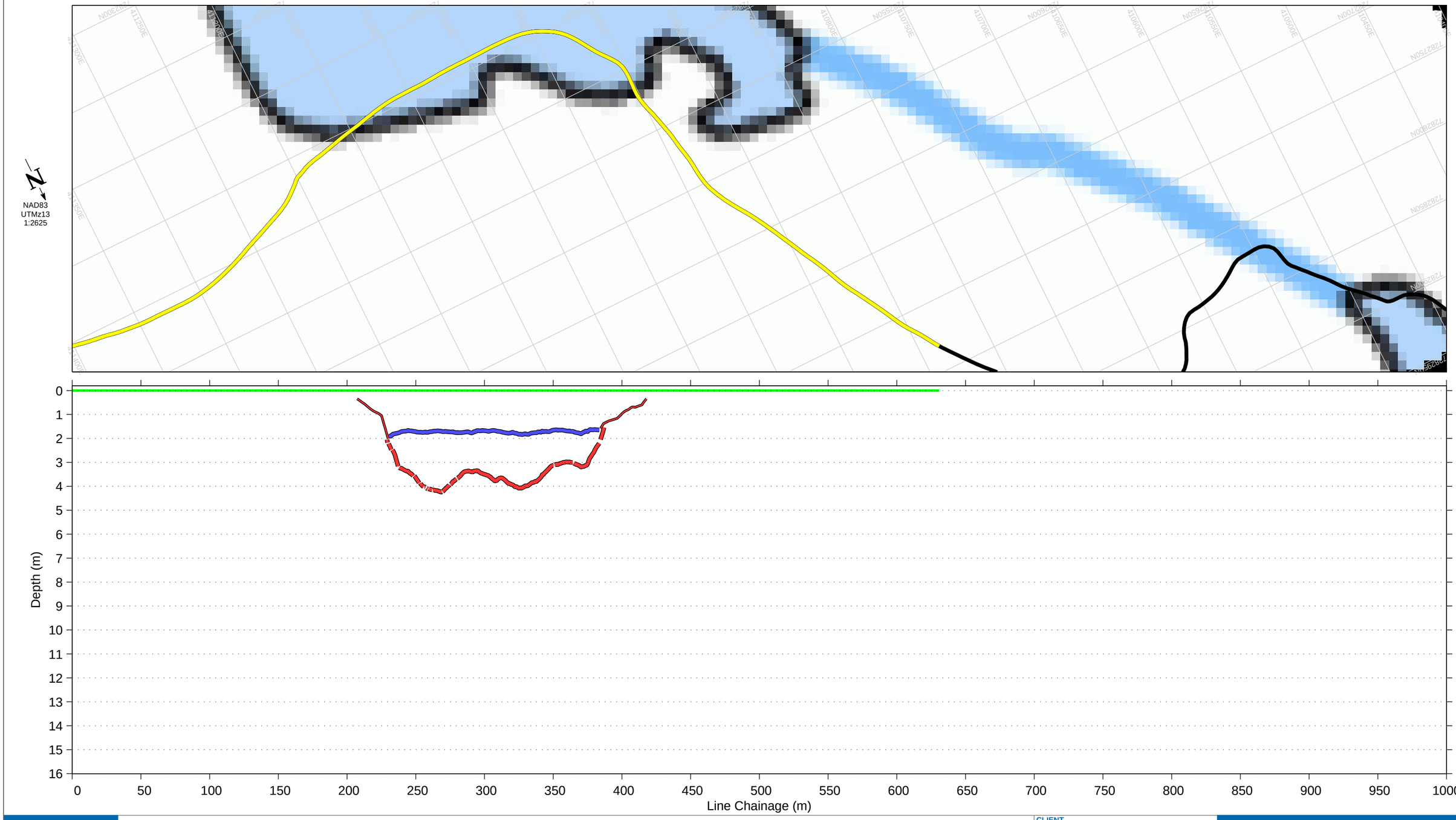
Winter Road Option – Major Lake Profiles
Goose to George
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure A6



LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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Winter Road Option – Major Lake Profiles
Goose to George
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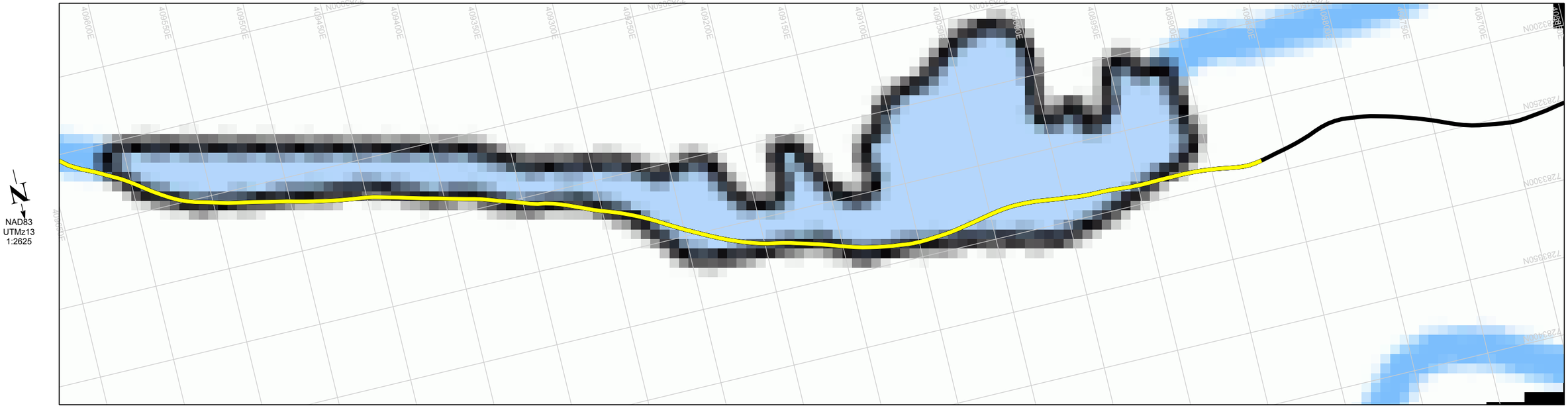
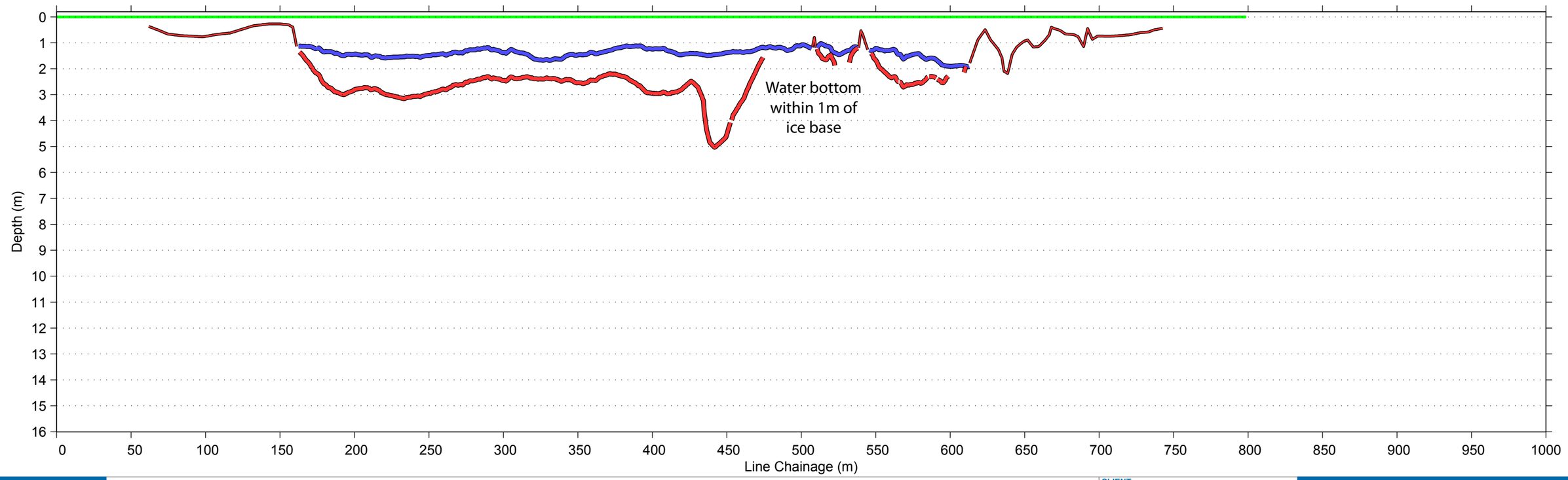
Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure A7





LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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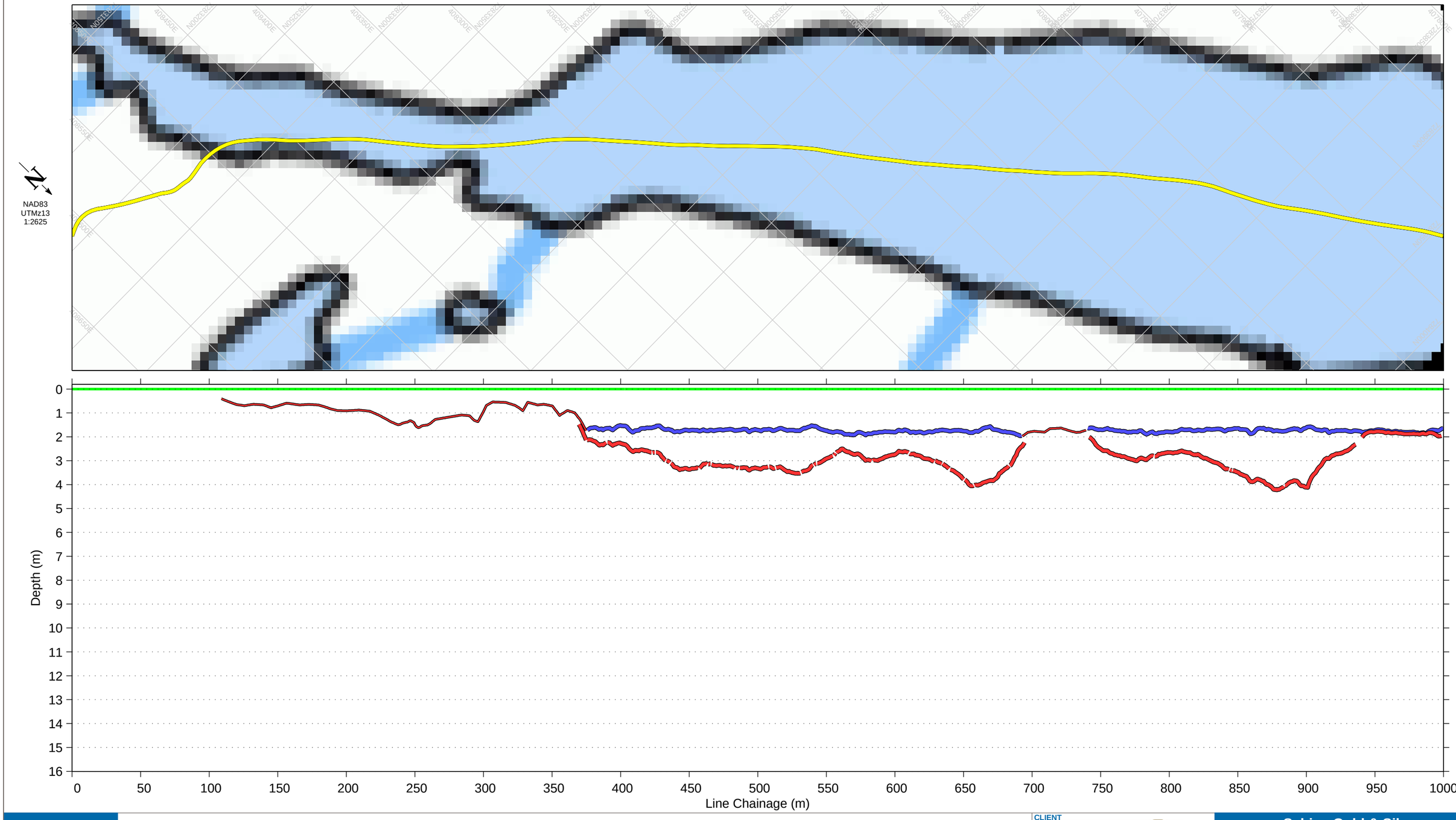
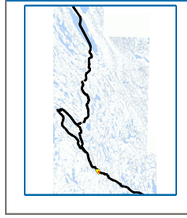
Goose to George
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure A8





LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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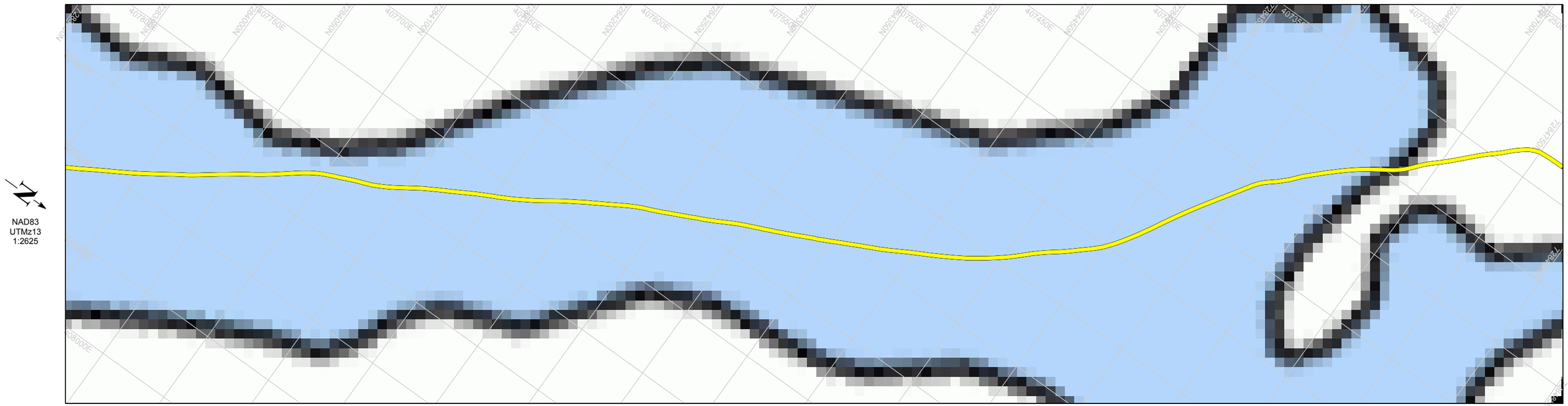
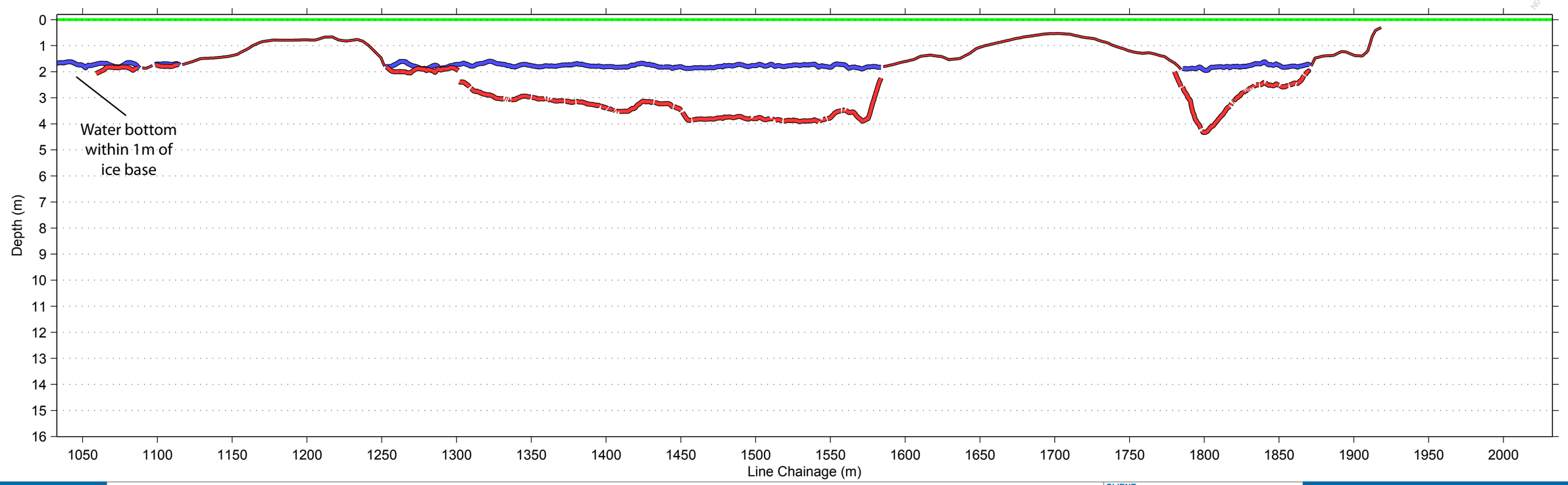
Winter Road Option – Major Lake Profiles
Goose to George
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure A9.1





LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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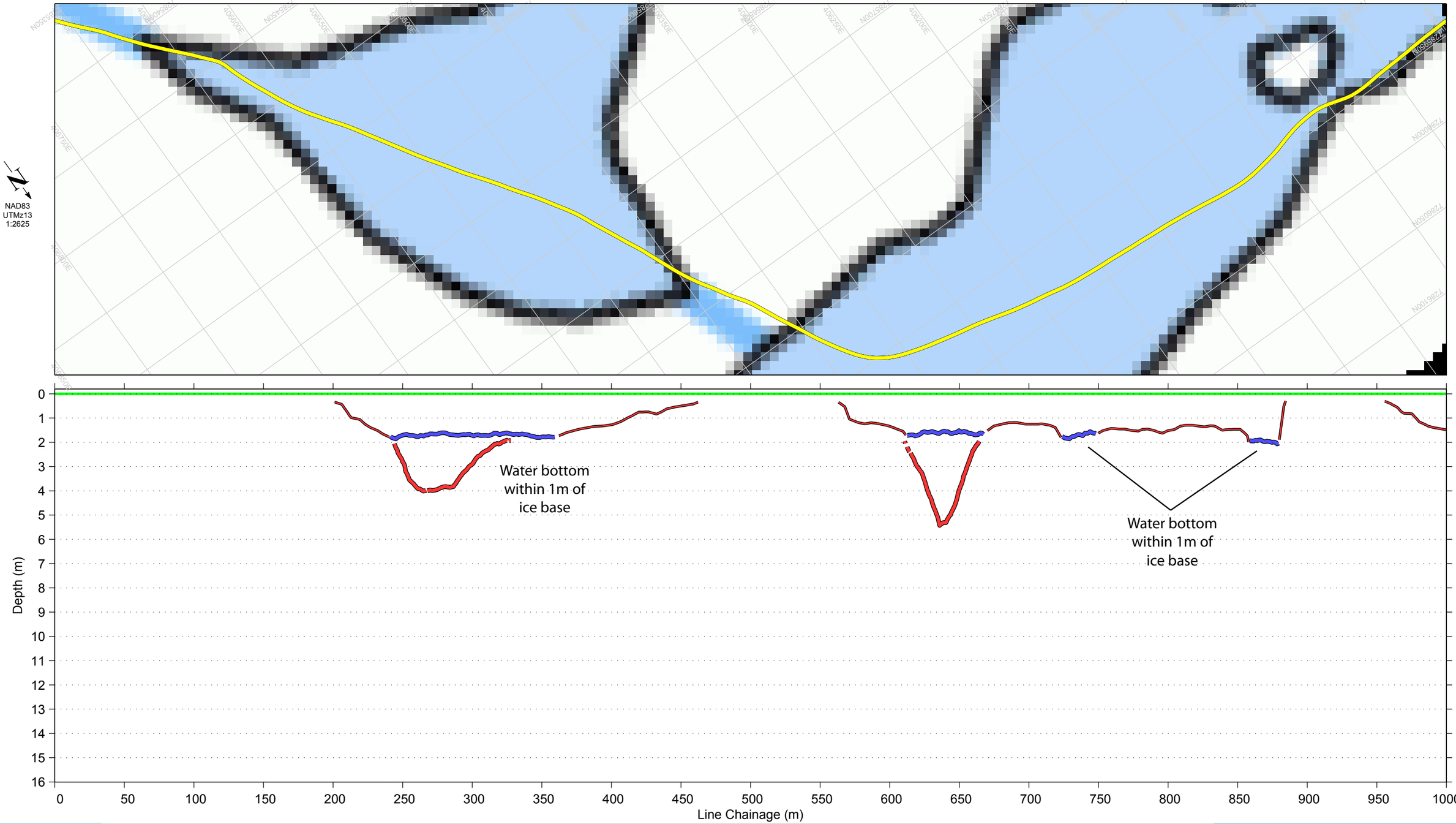
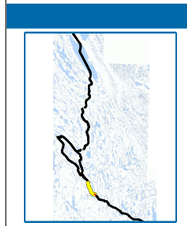
Winter Road Option – Major Lake Profiles
Goose to George
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure A9.2





LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE: Edmonton

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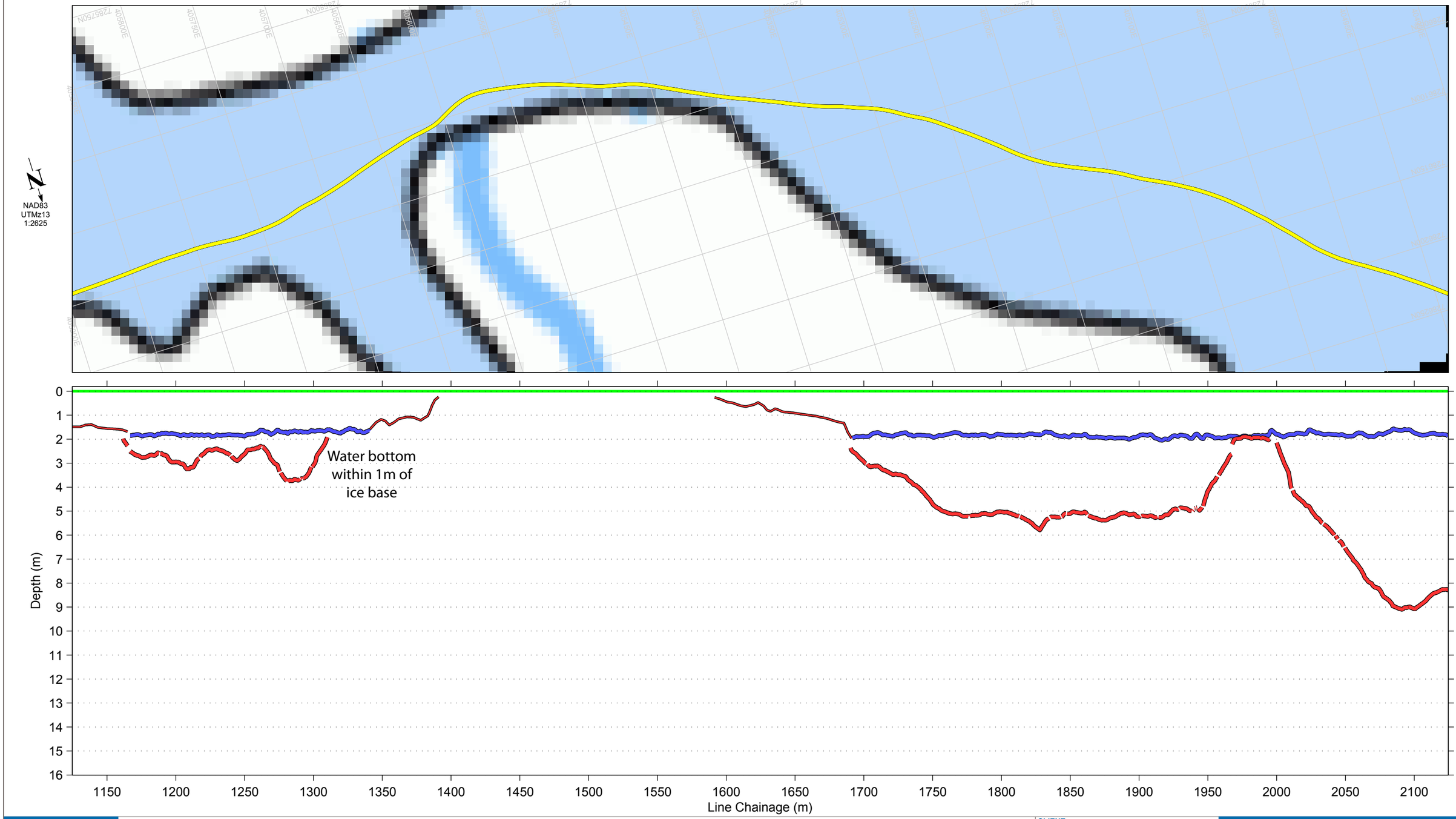
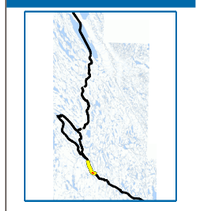
Figure A10.1





LEGEND

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- Ground/Ice Surface
- Snow Drift Bottom
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- Floating Ice
- Water Bottom

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Goose to George
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Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE: Edmonton
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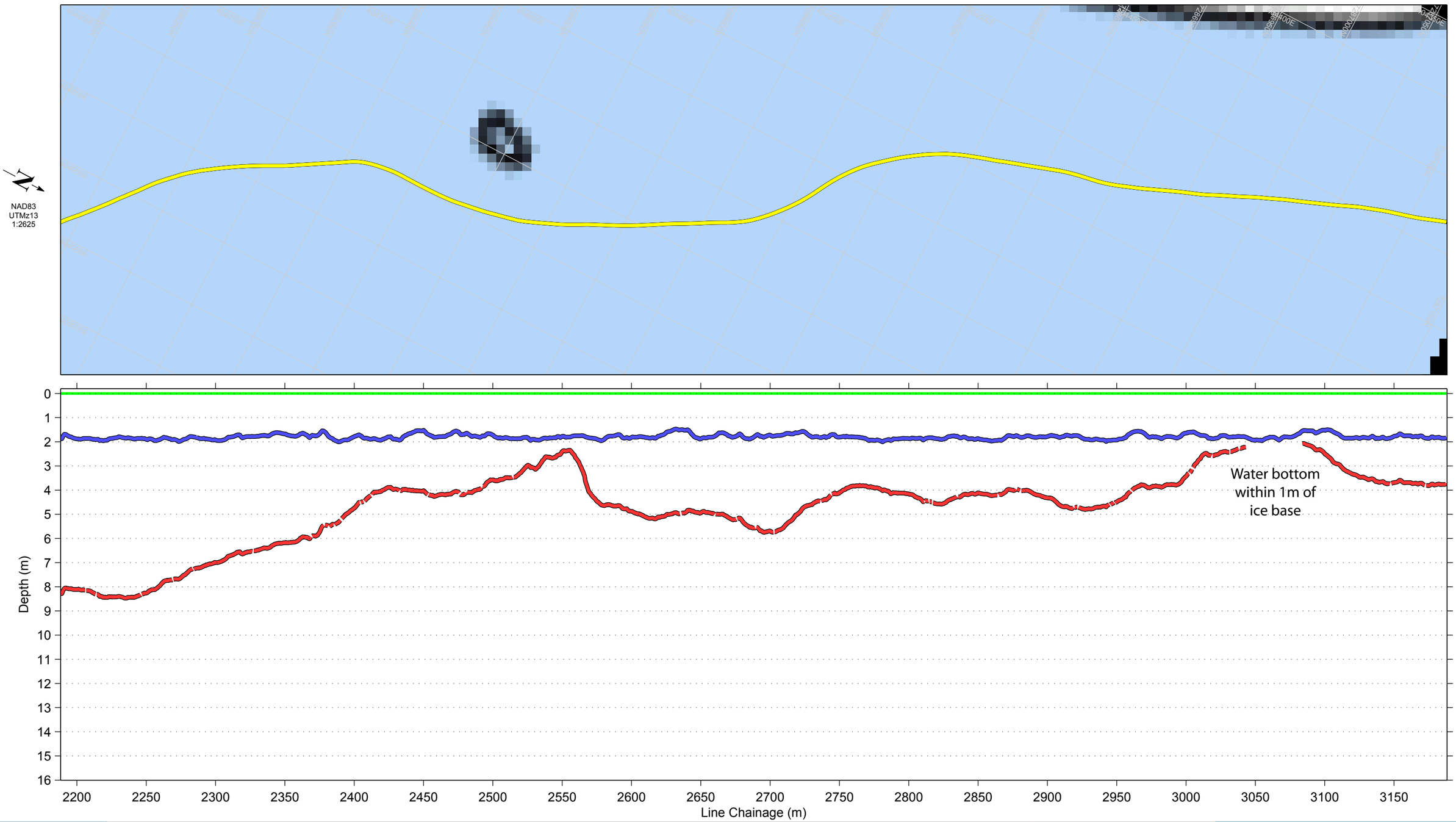
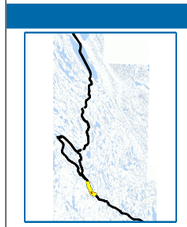
Figure A10.2





LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

CLIENT

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Winter Road Option – Major Lake Profiles
Goose to George
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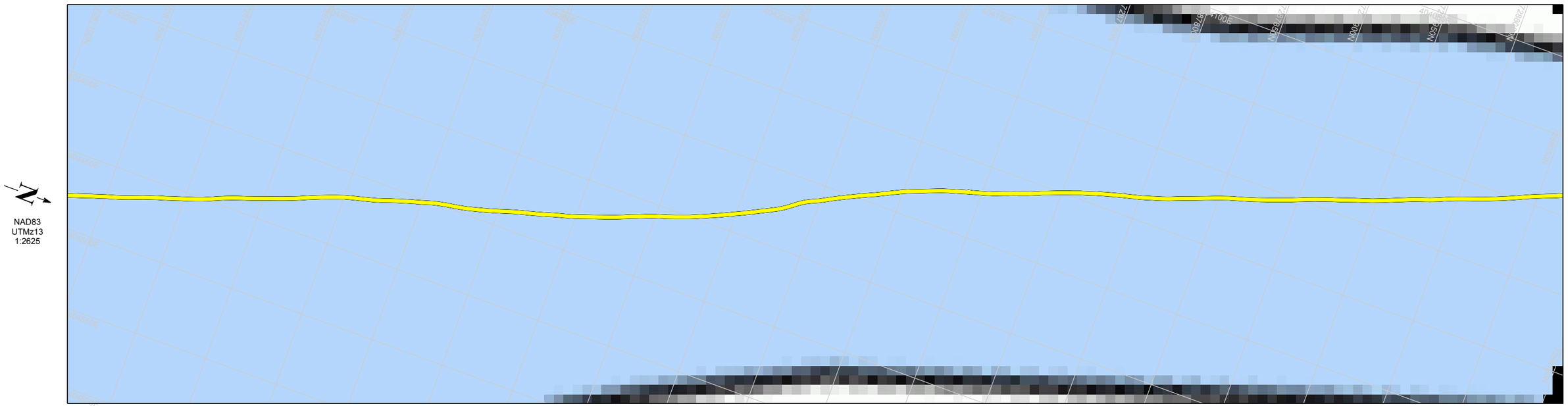
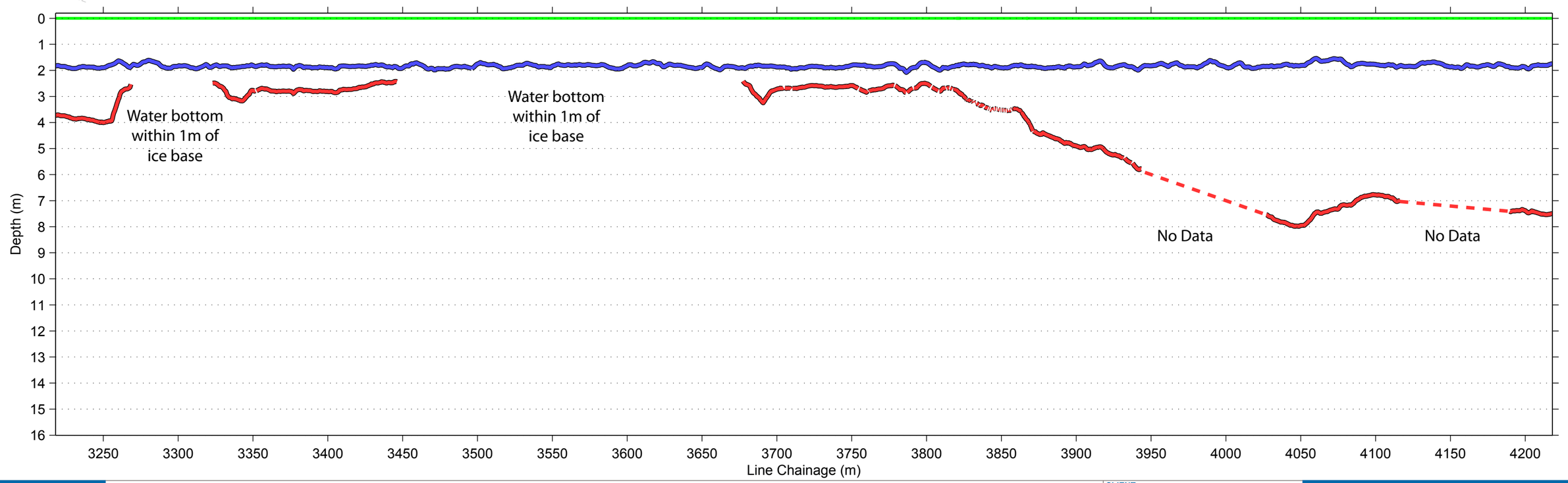
Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE: Edmonton
DATE: June 14, 2013

Figure A10.3





LEGEND

- Plotted GPR Tracks
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V33103008.E111	RJM	CB	RJM	0

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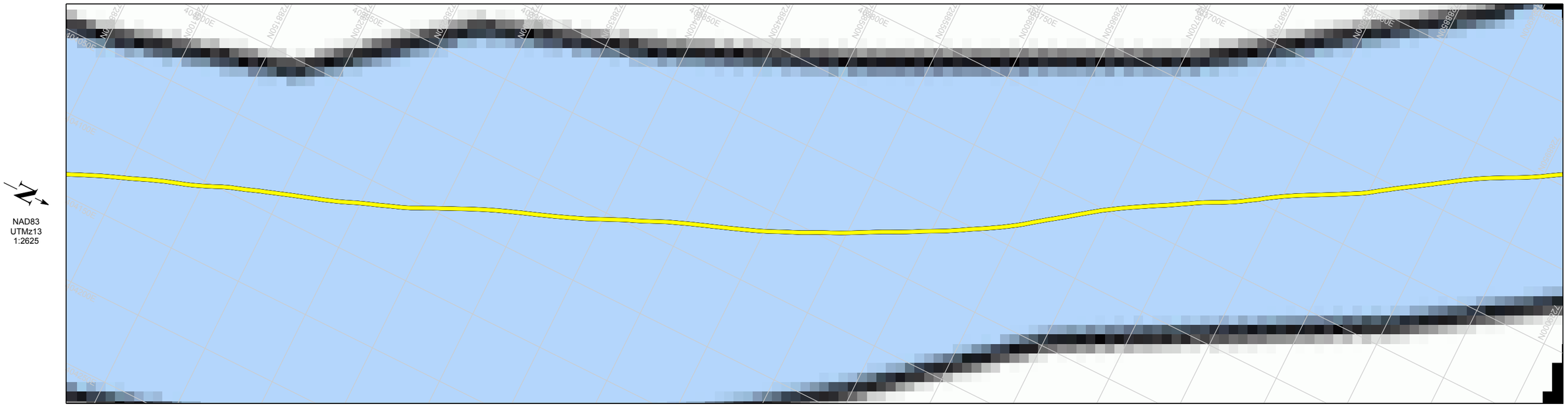
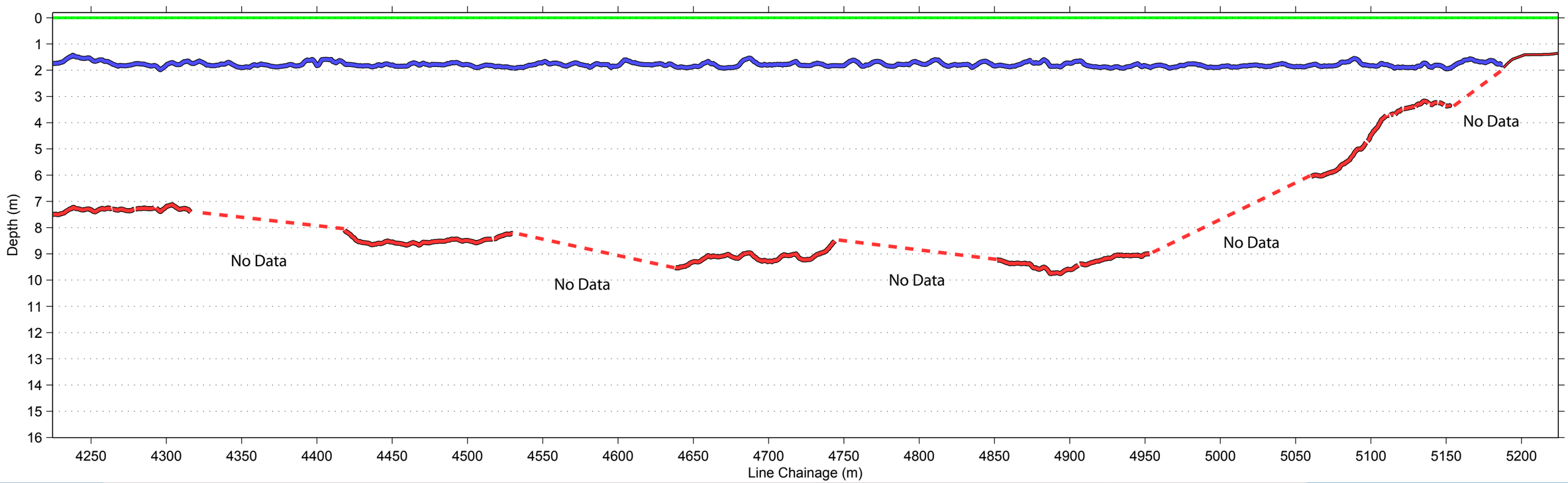
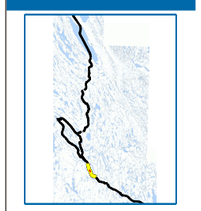
Figure A10.4







LEGEND

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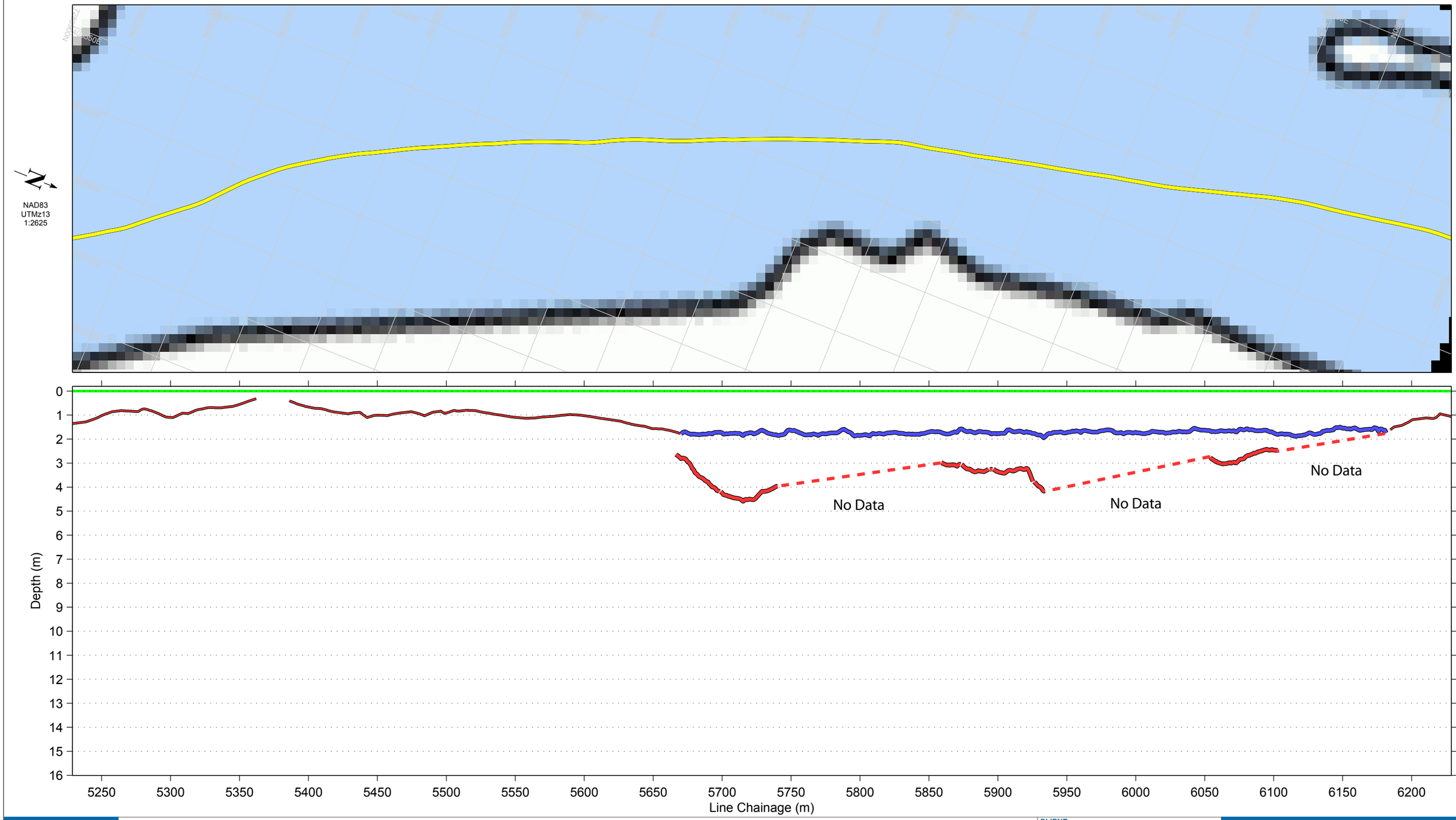
Figure A10.5



LEGEND

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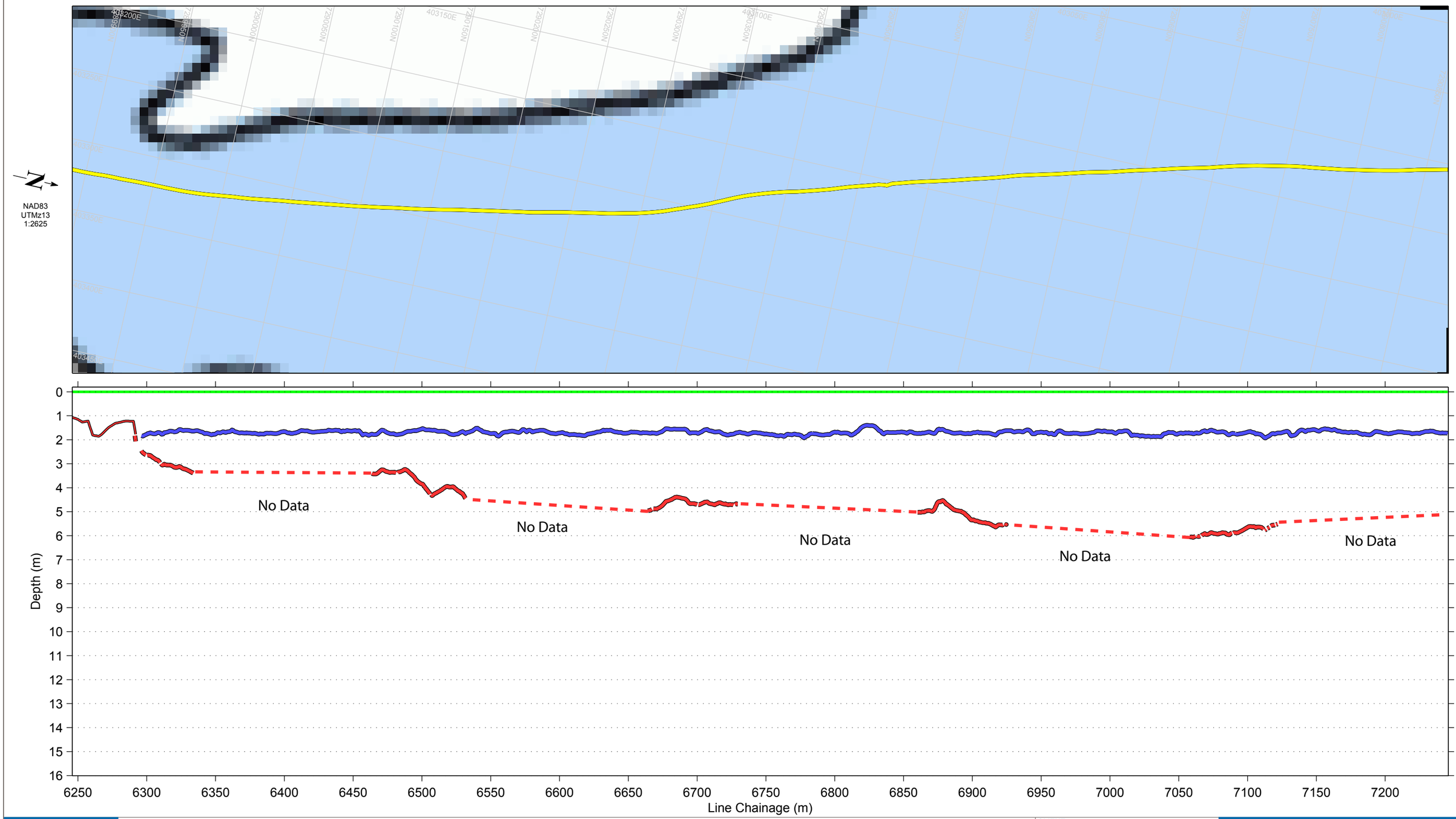
Figure A10.6



LEGEND

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Figure A10.7

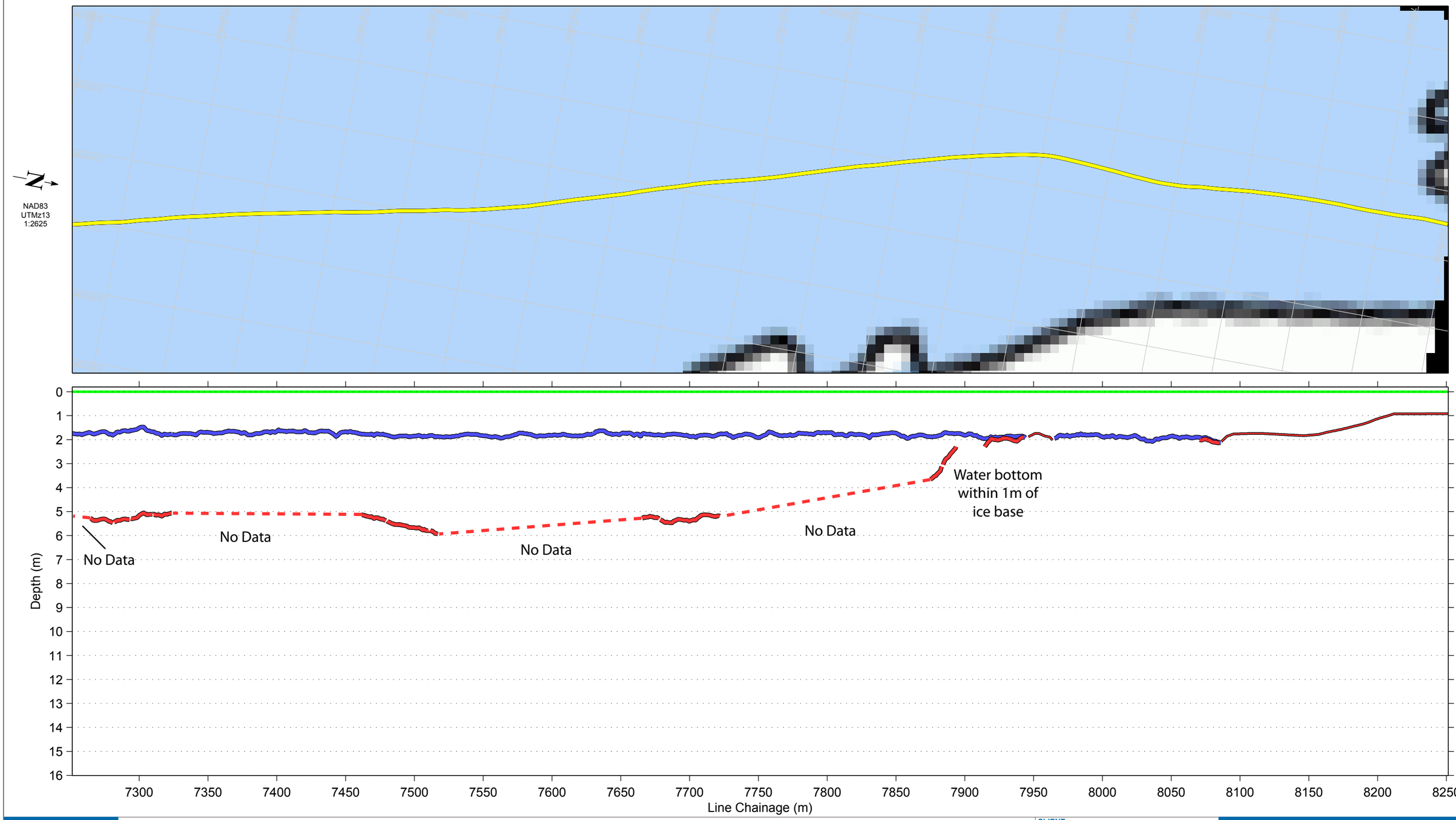

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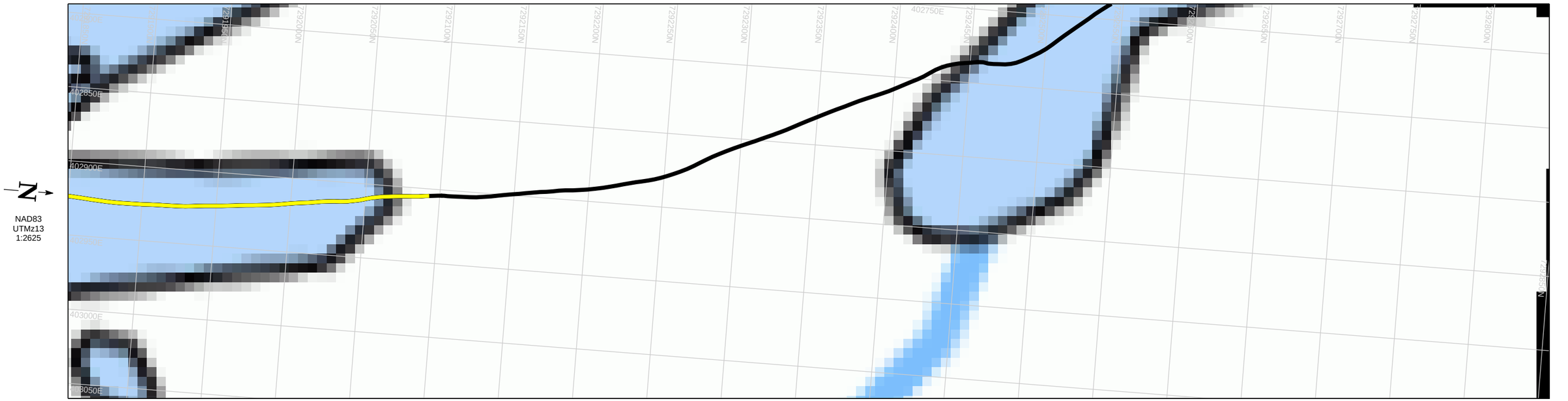
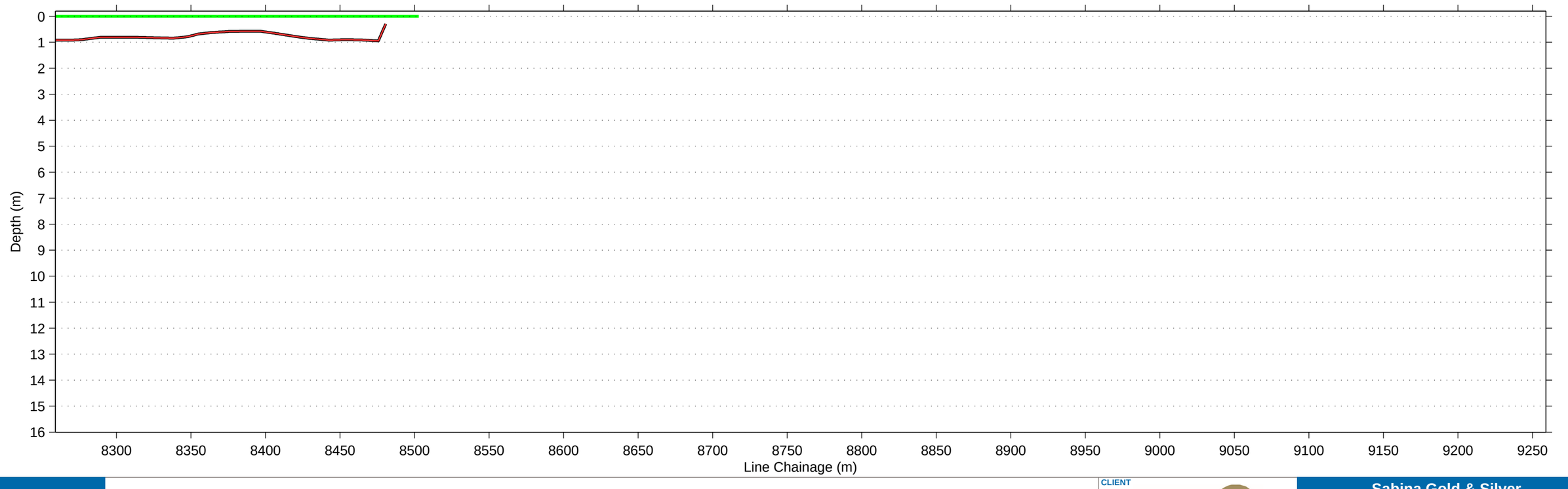
Figure A10.8





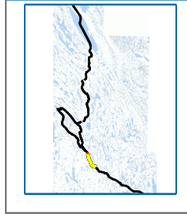


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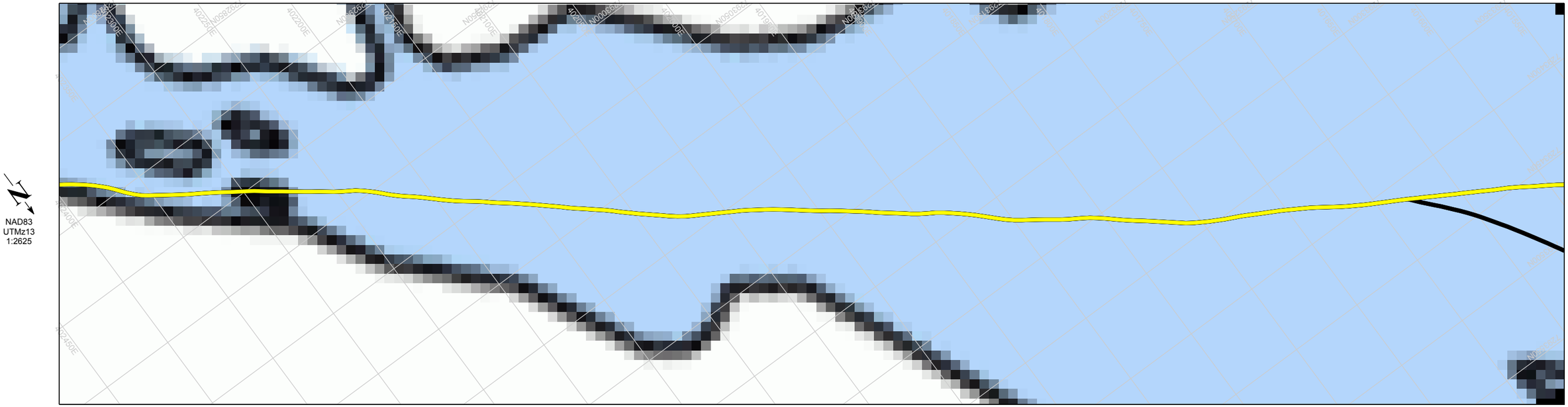
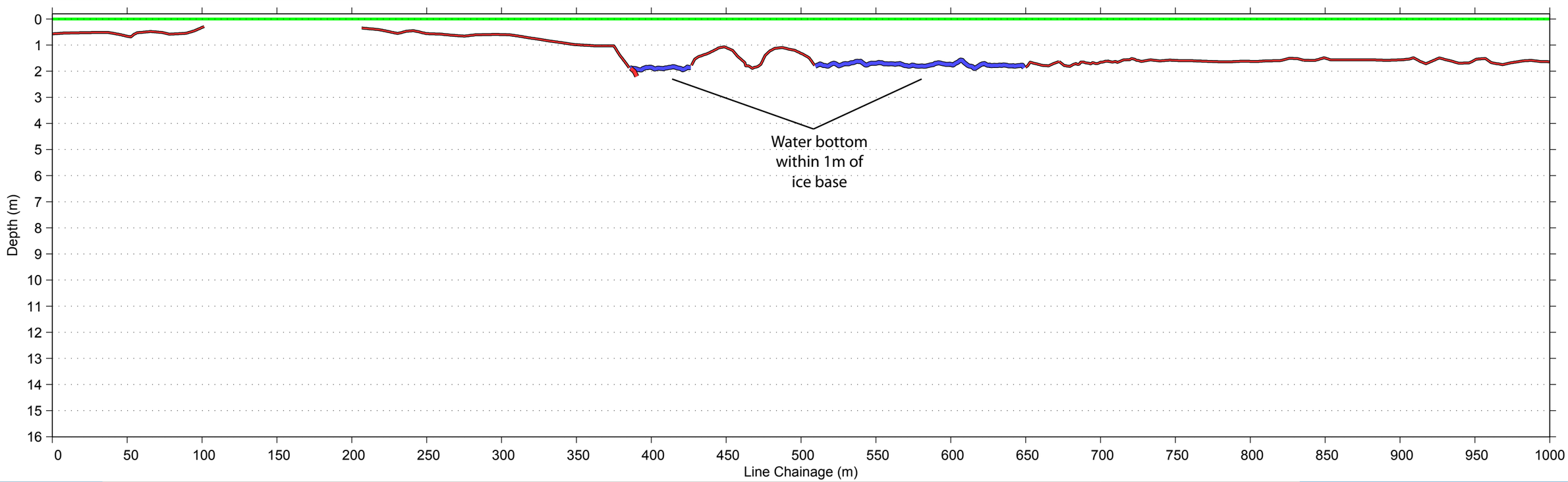
Figure A10.9





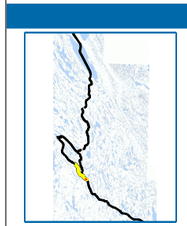


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Figure A11.1

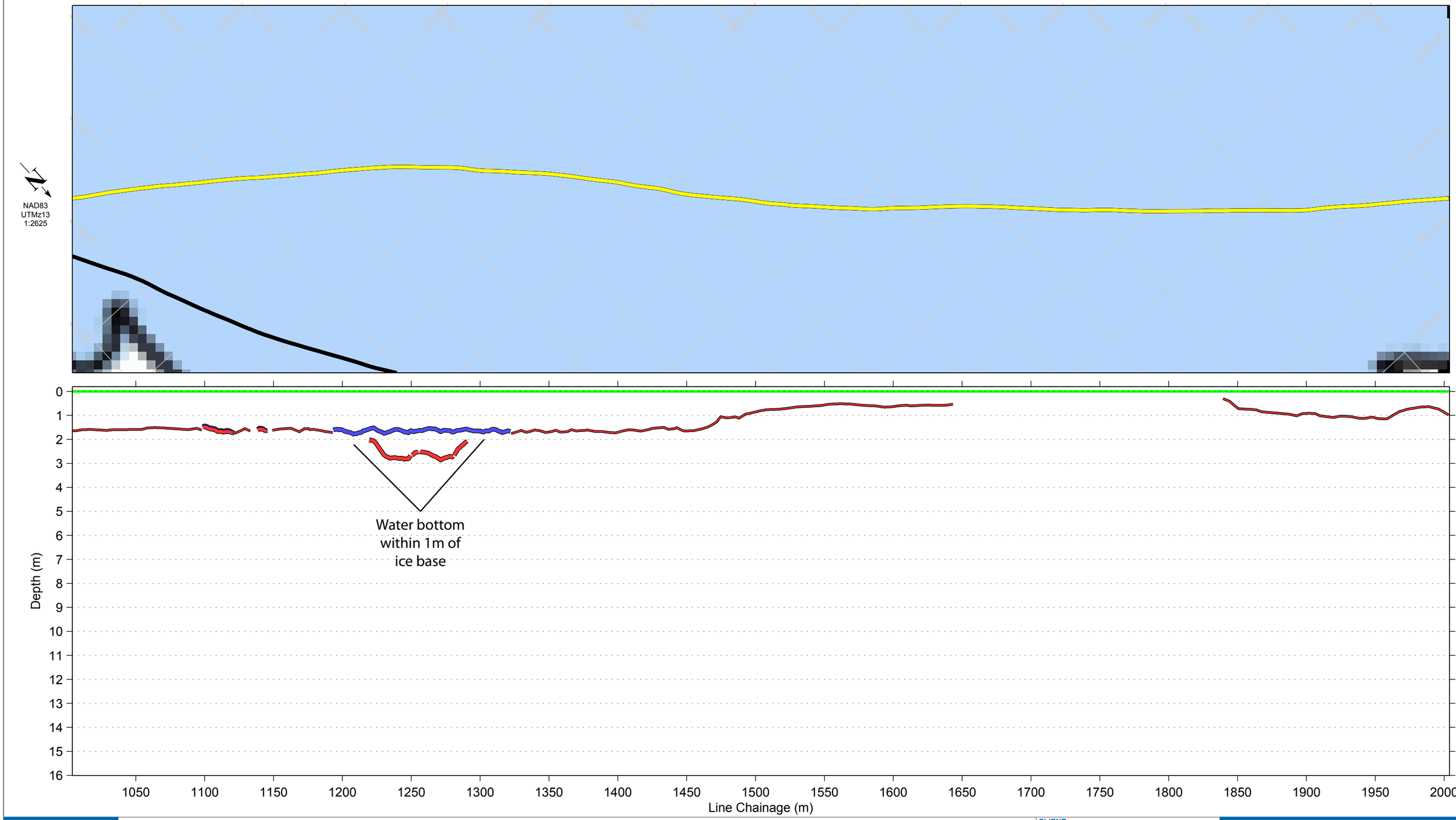

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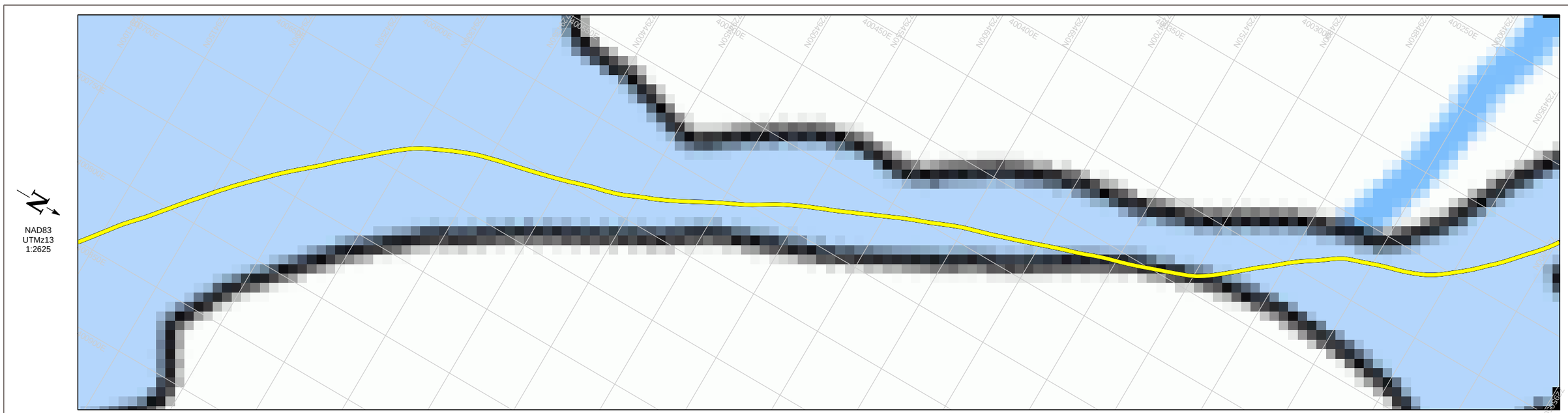
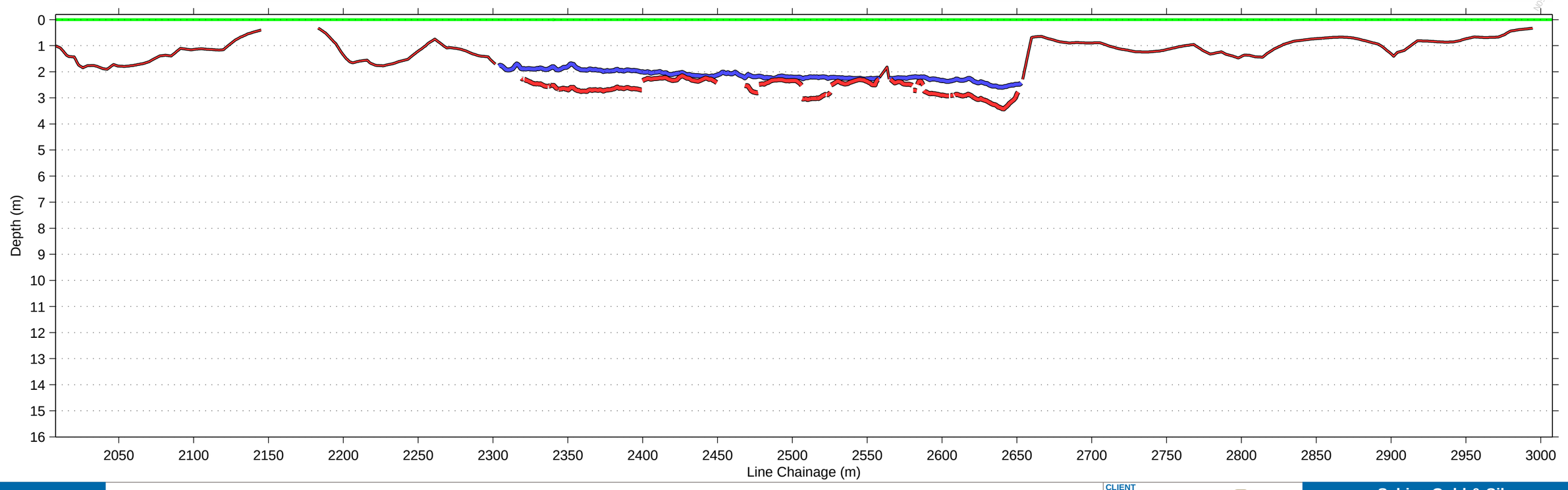
Figure A11.2





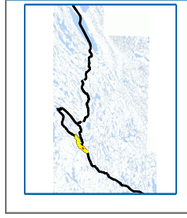


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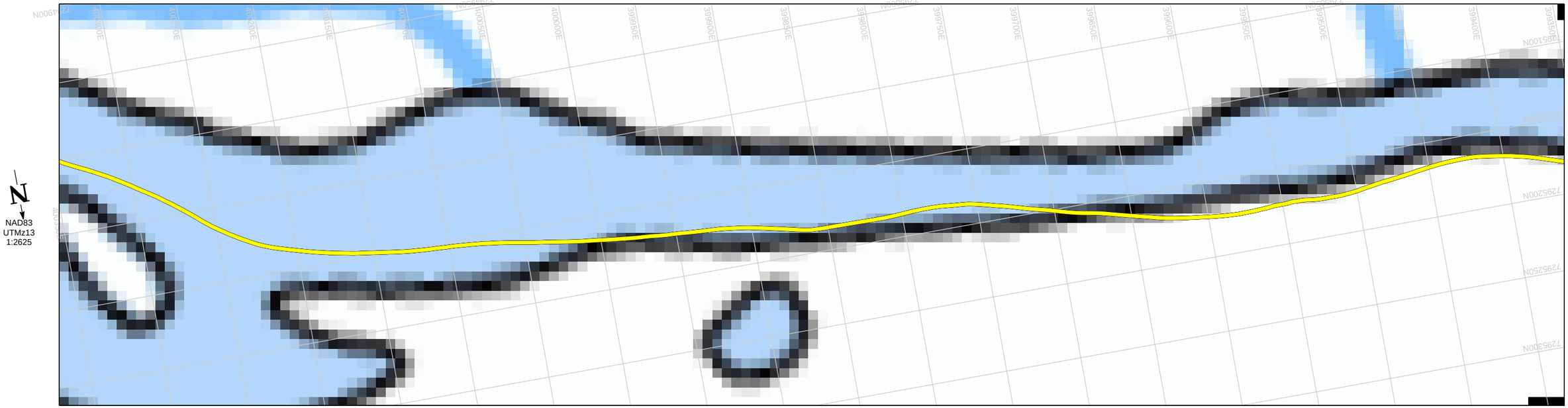
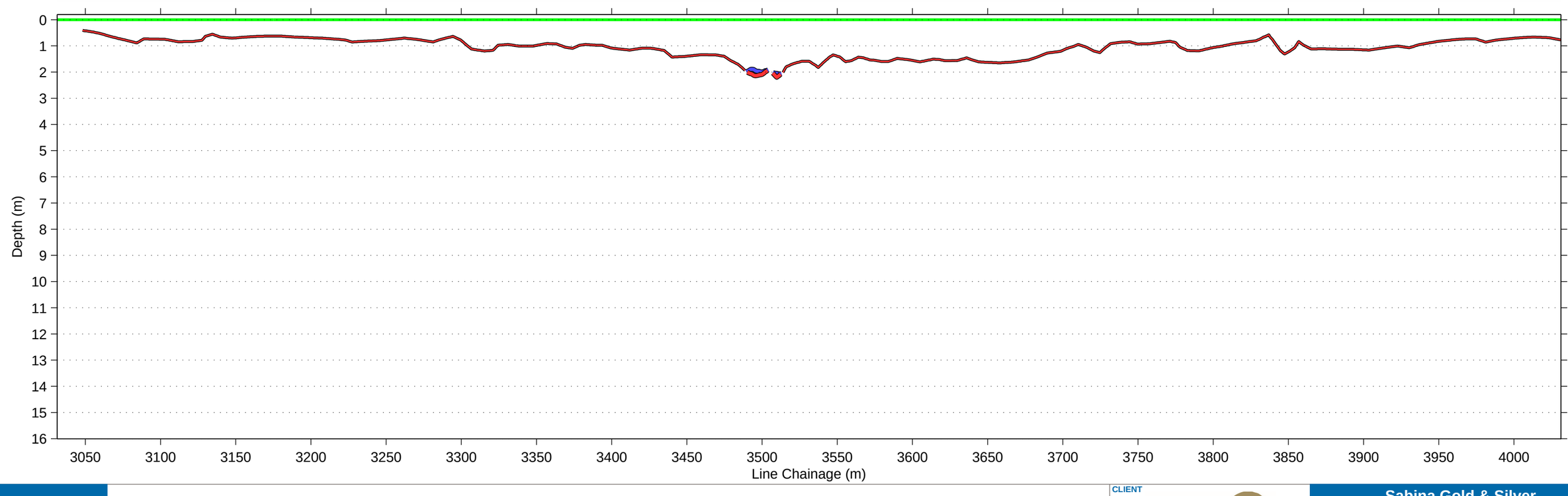
Figure A11.3





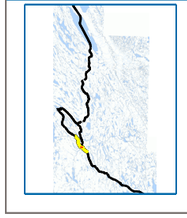


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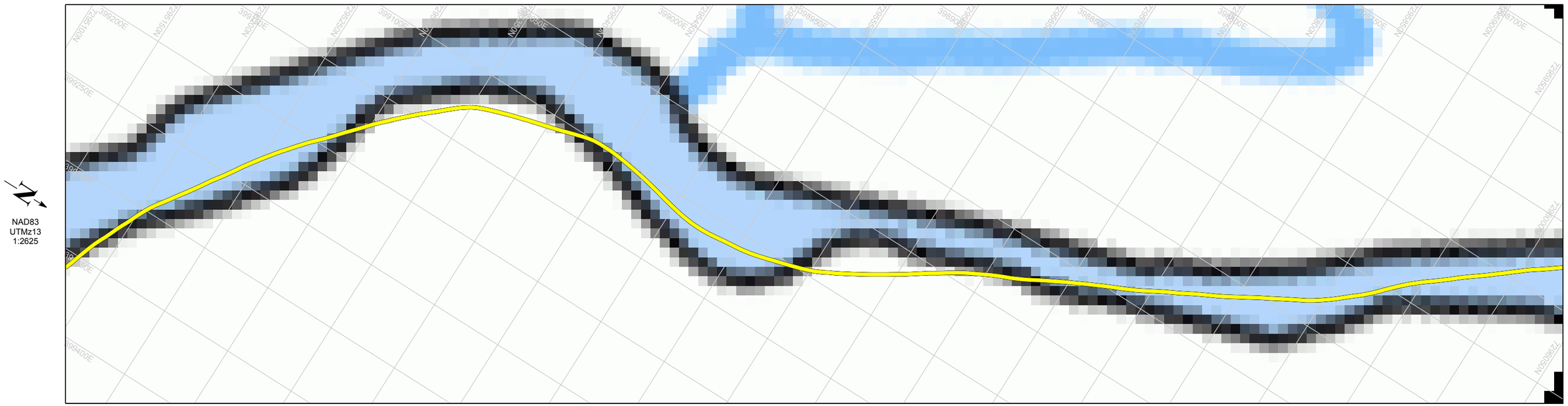
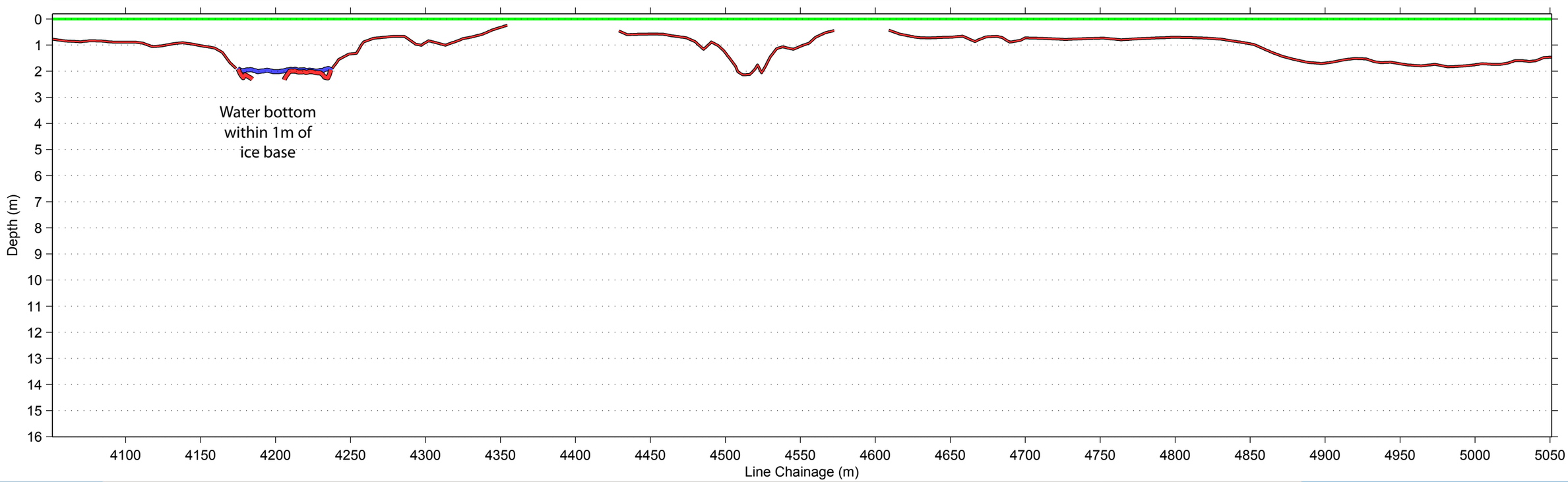
Figure A11.4





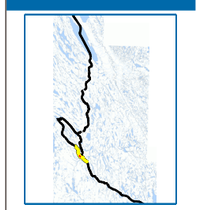


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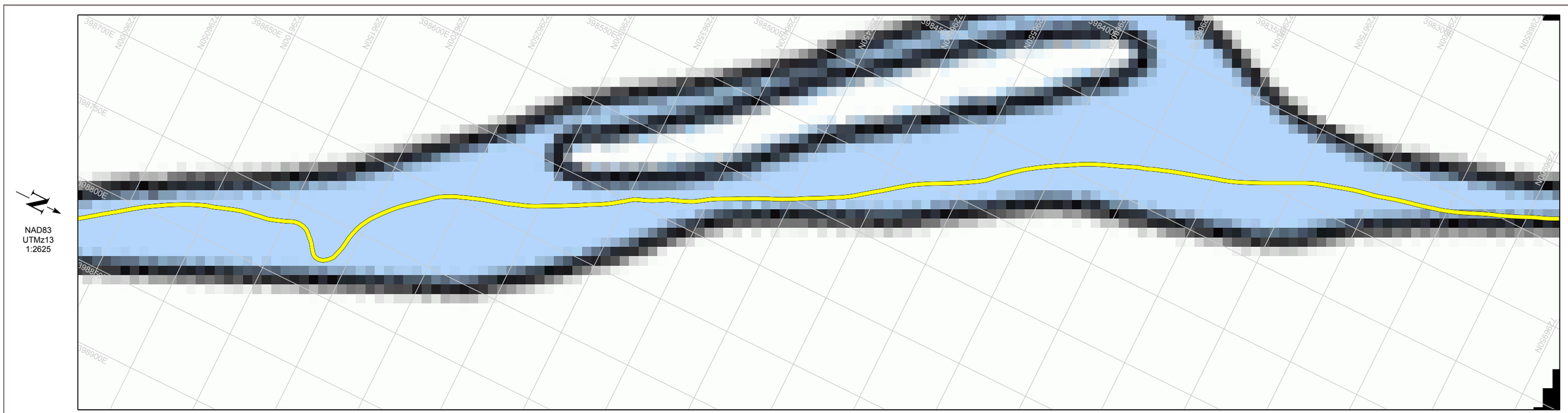
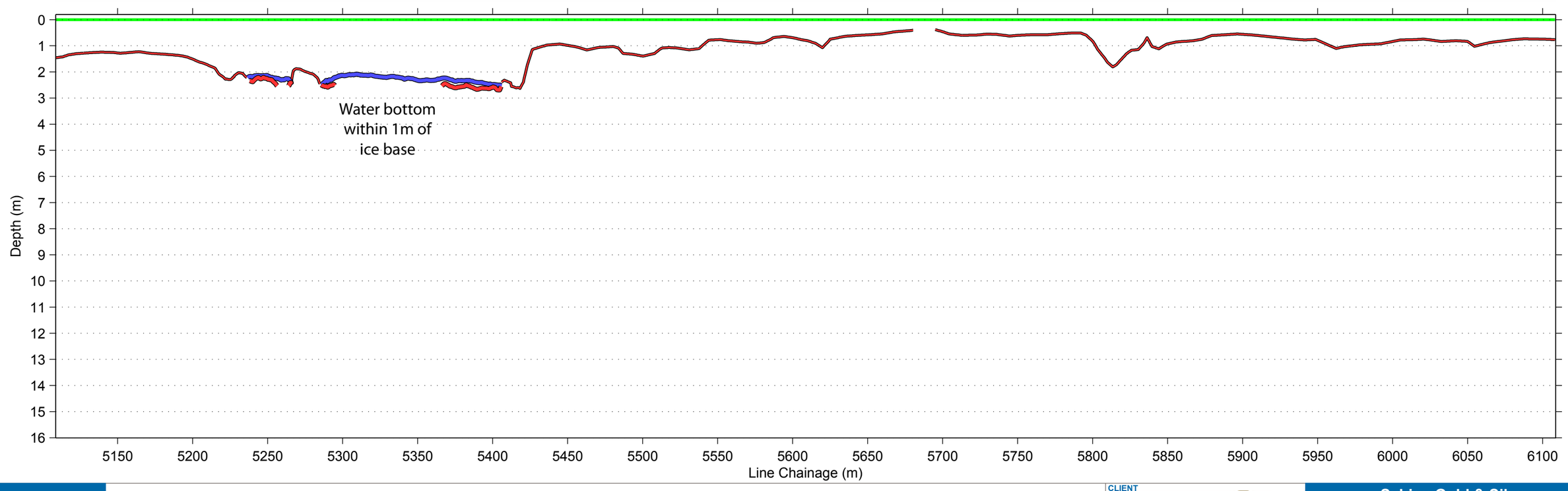
Figure A11.5





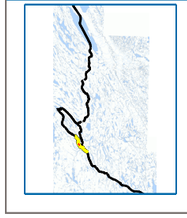


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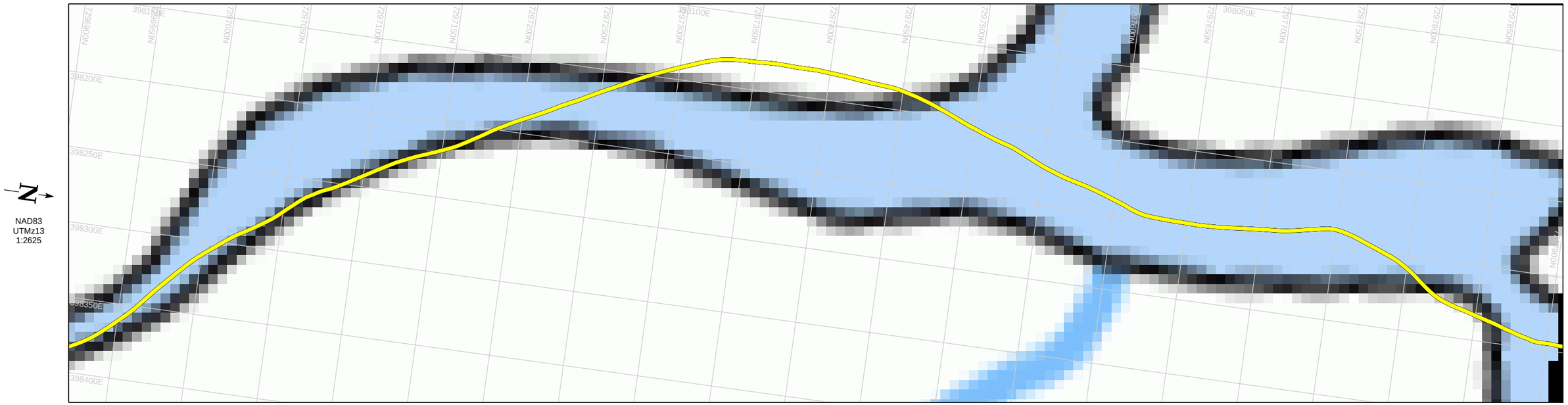
Figure A11.6



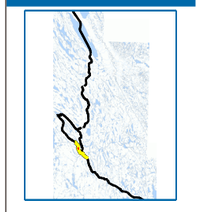


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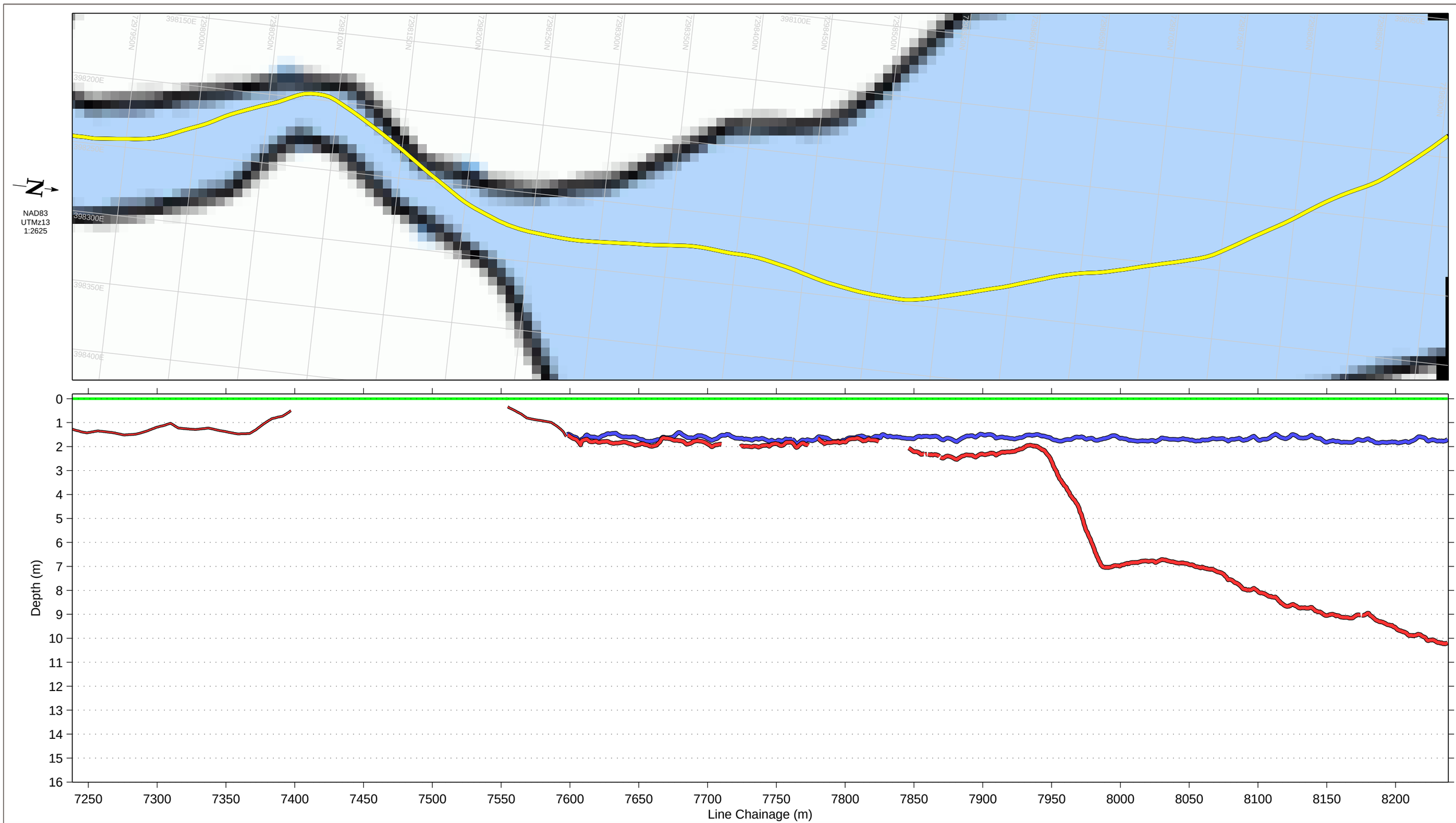
Figure A11.7



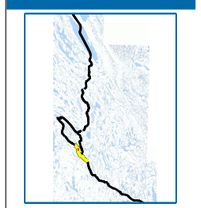


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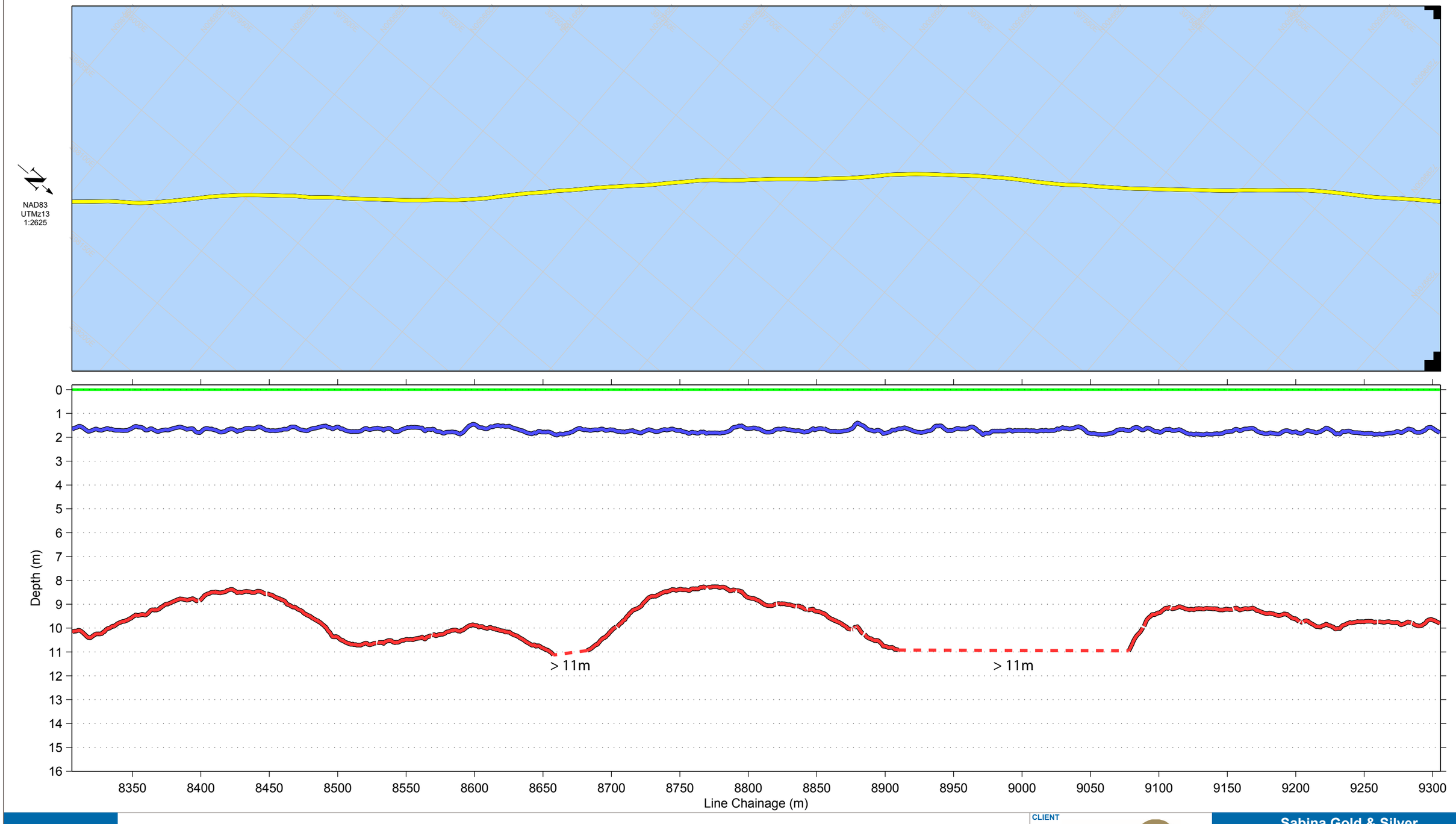
Figure A11.8



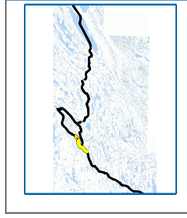


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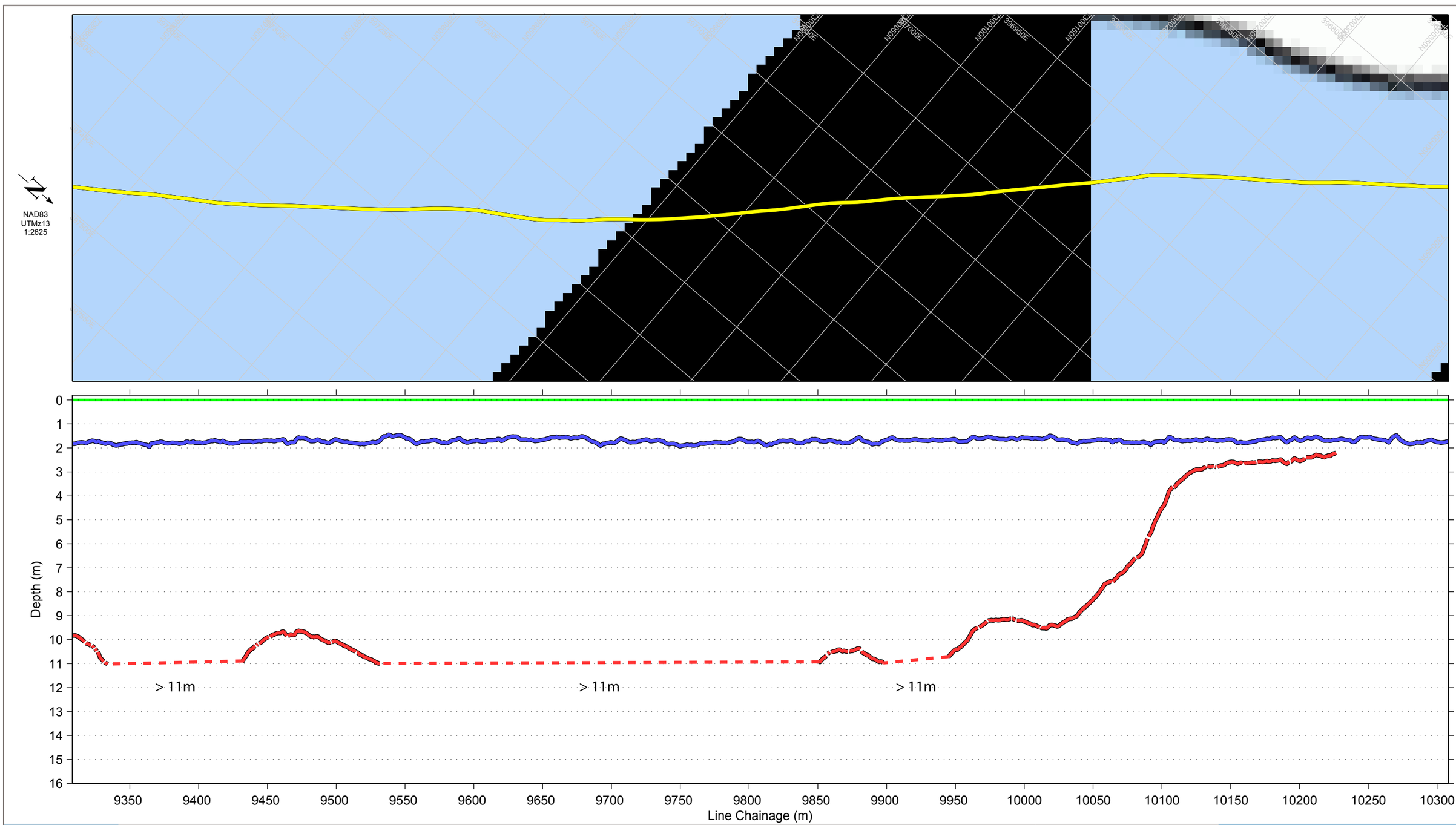
Figure A11.9



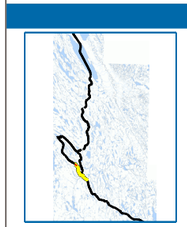


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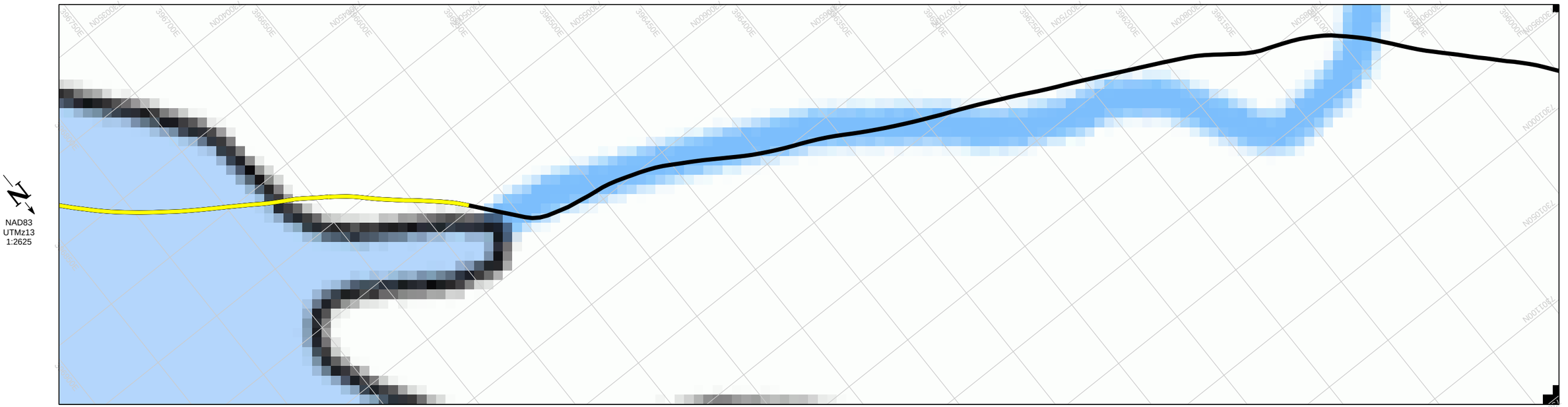
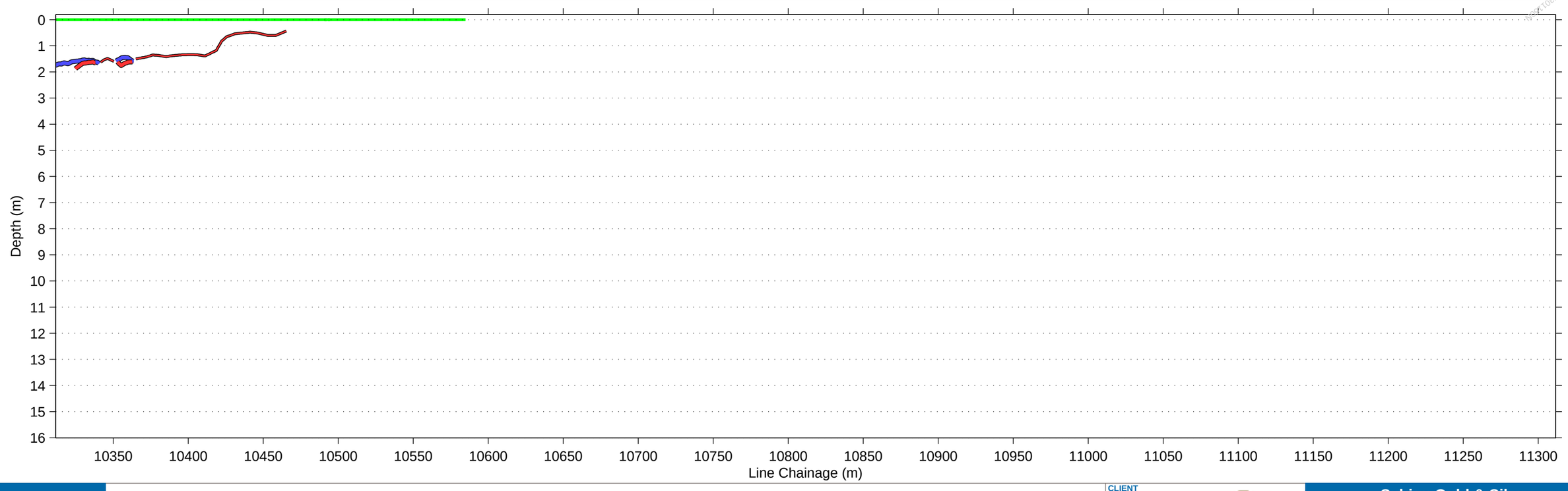
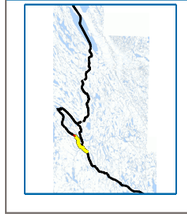
Figure A11.10







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OFFICE	DATE
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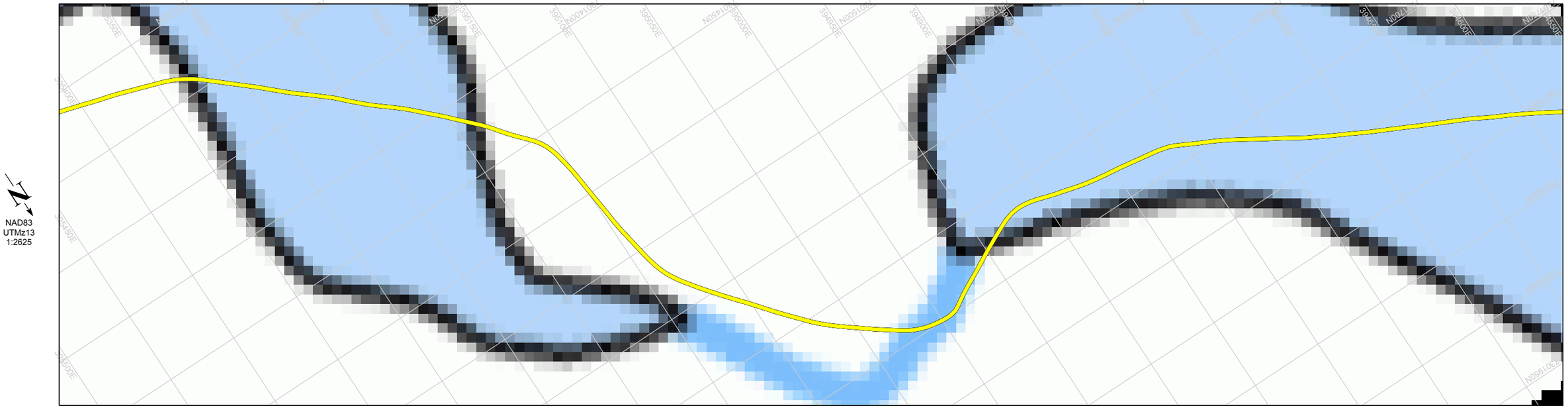
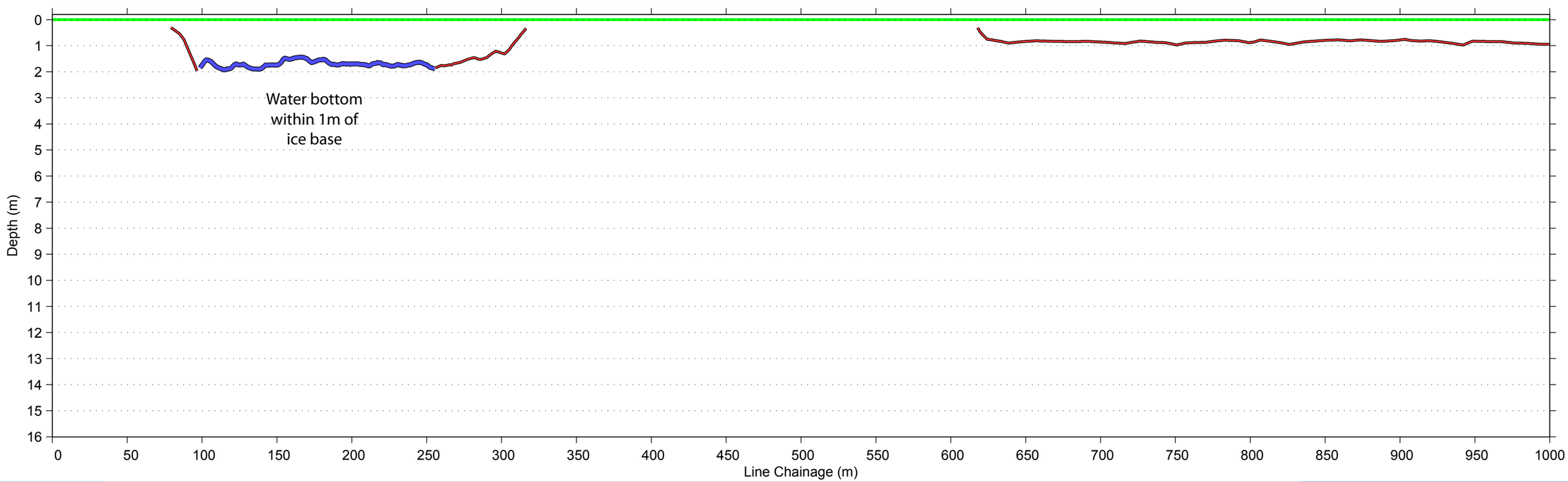
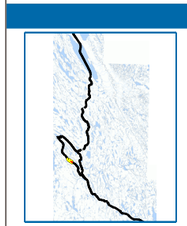
Figure A11.11







LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
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- Water Bottom

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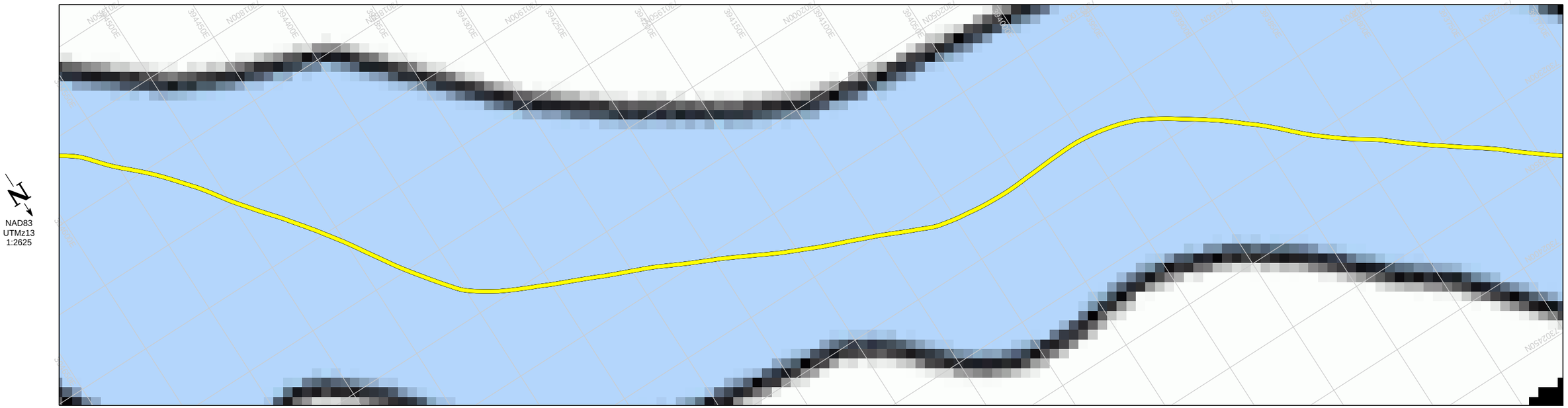
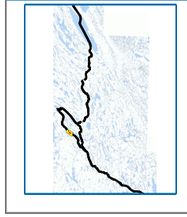
Figure A12.1





LEGEND

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V33103008.E111	RJM	CB	RJM	0

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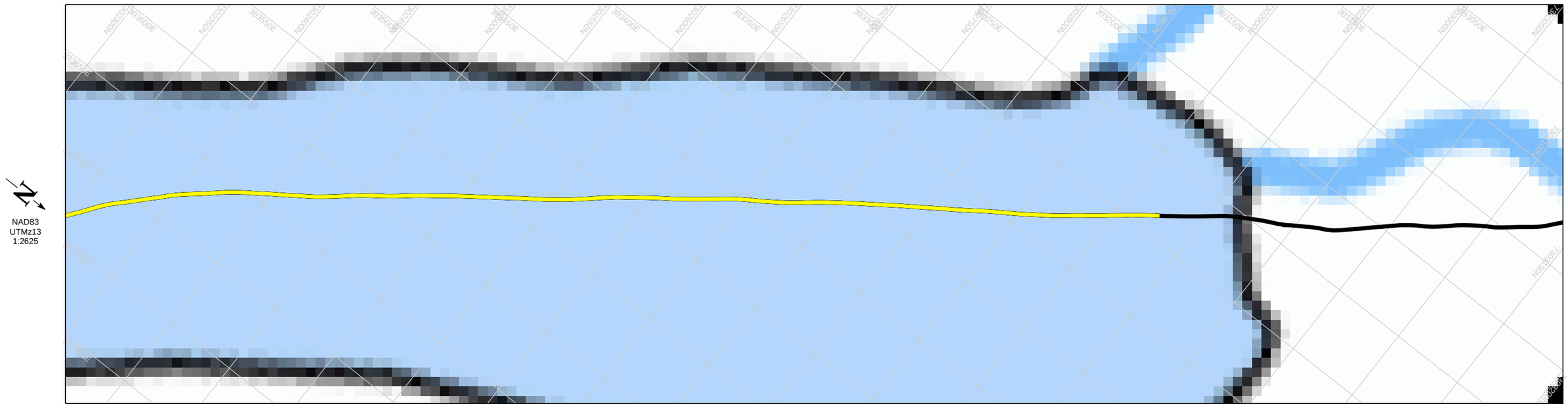
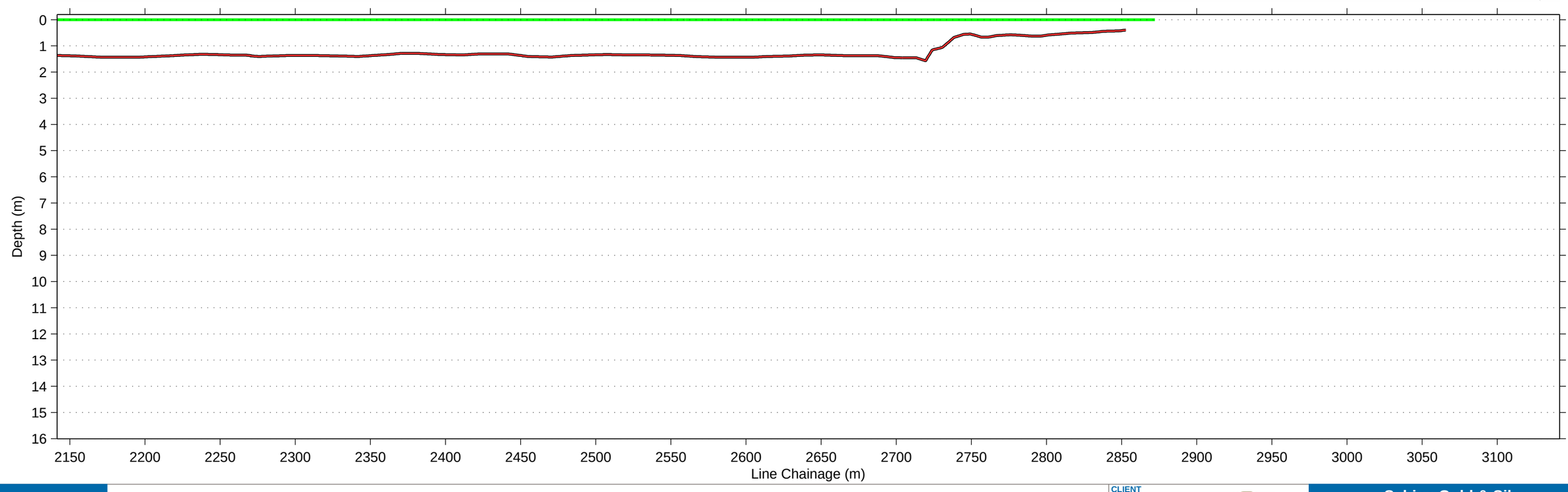
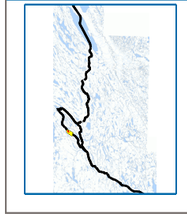
Figure A12.2







LEGEND

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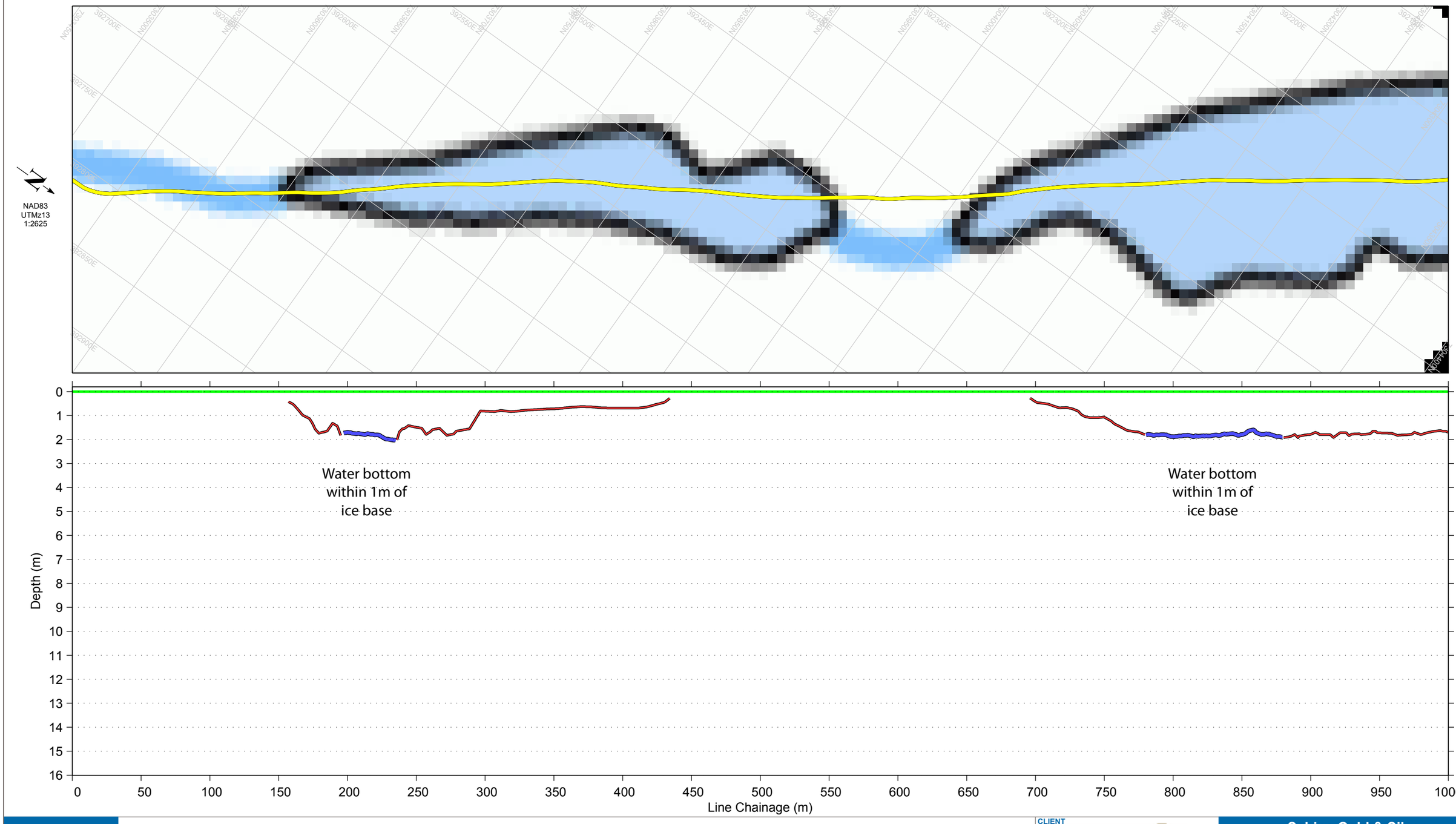
Figure A12.3



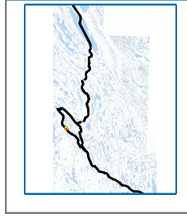


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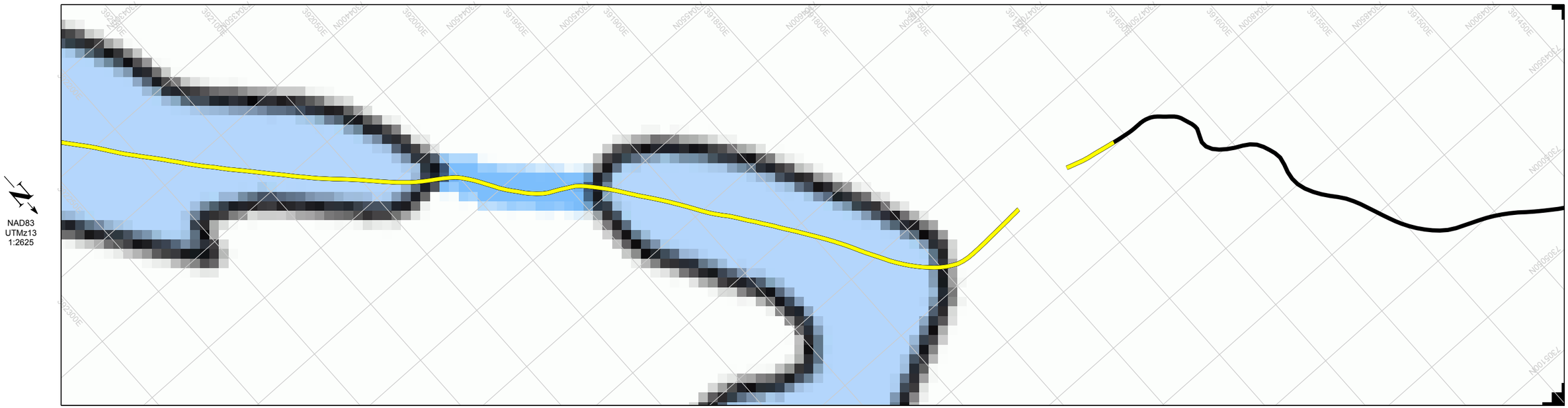
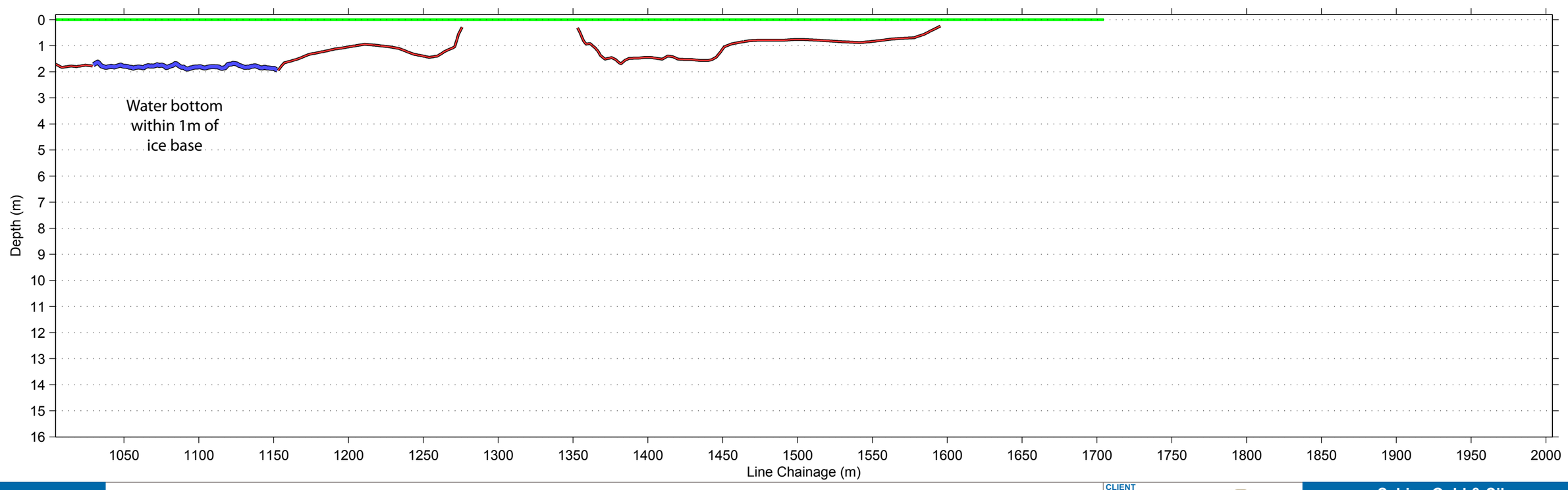
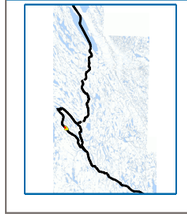
Figure A13.1







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OFFICE	DATE
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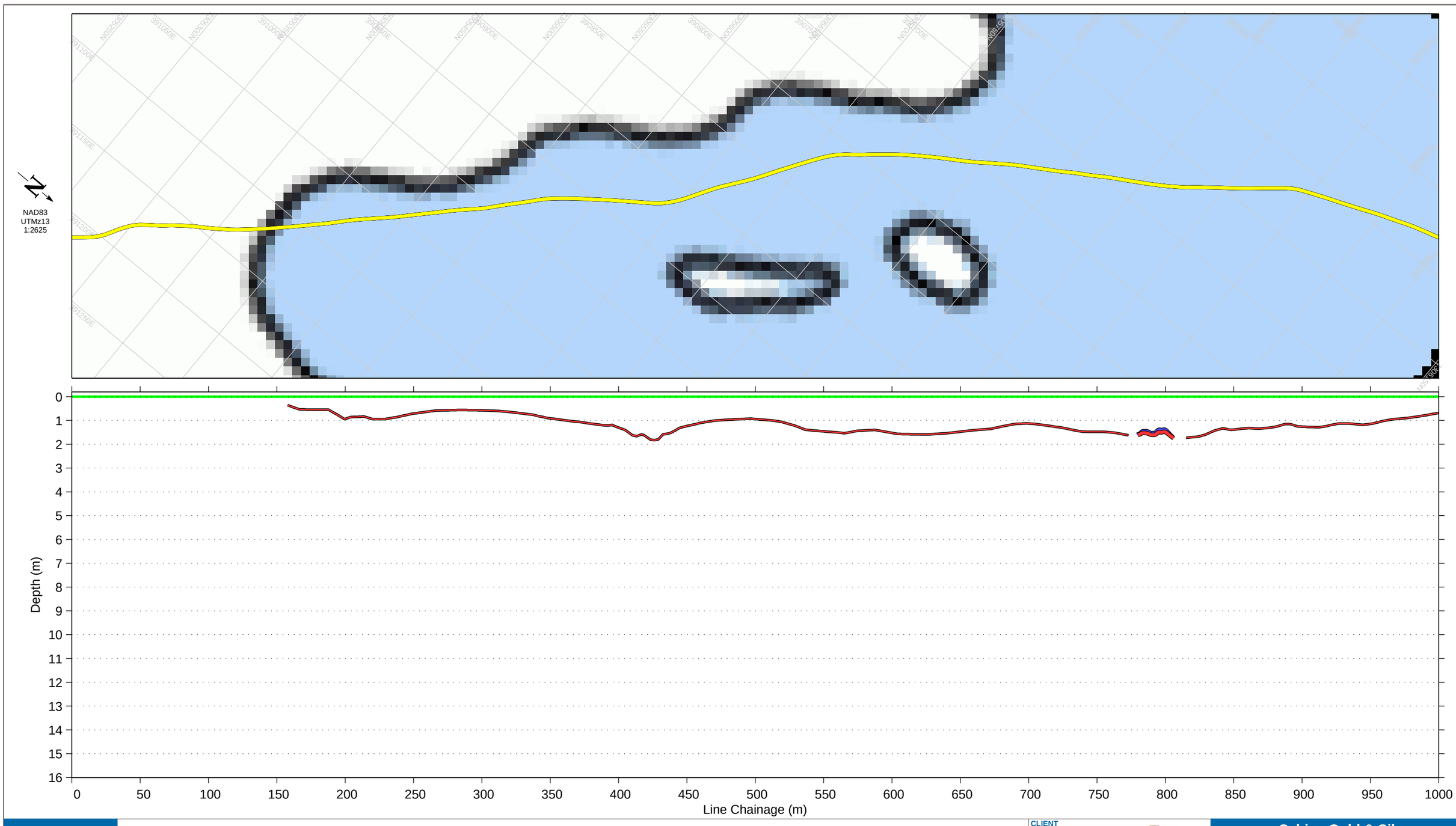
Figure A13.2



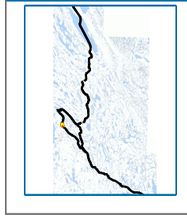


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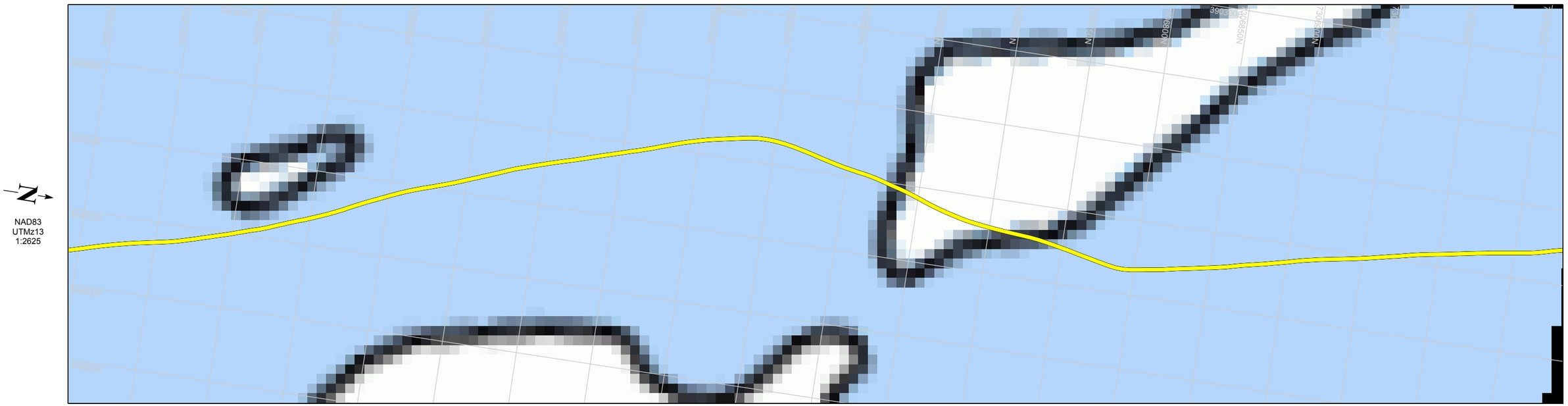
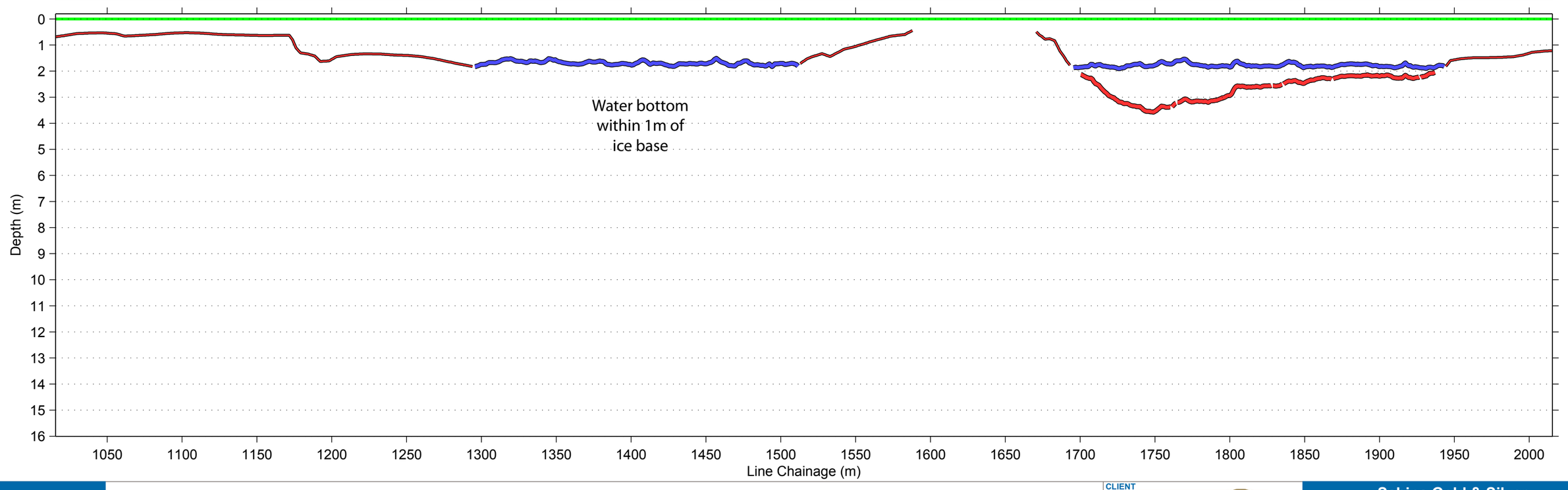
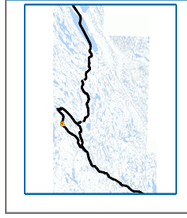
Figure A14.1







LEGEND

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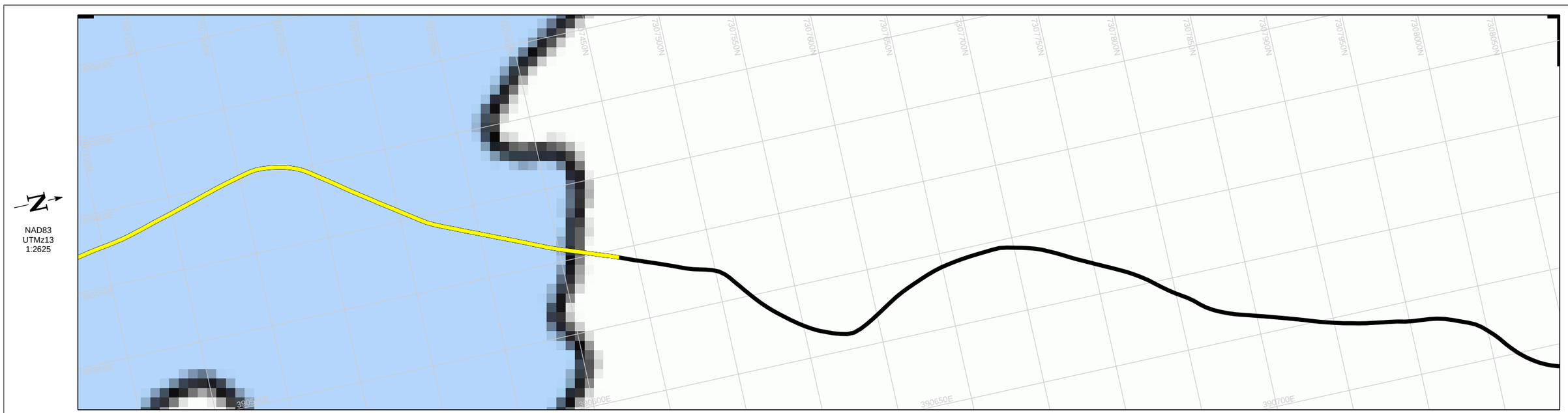
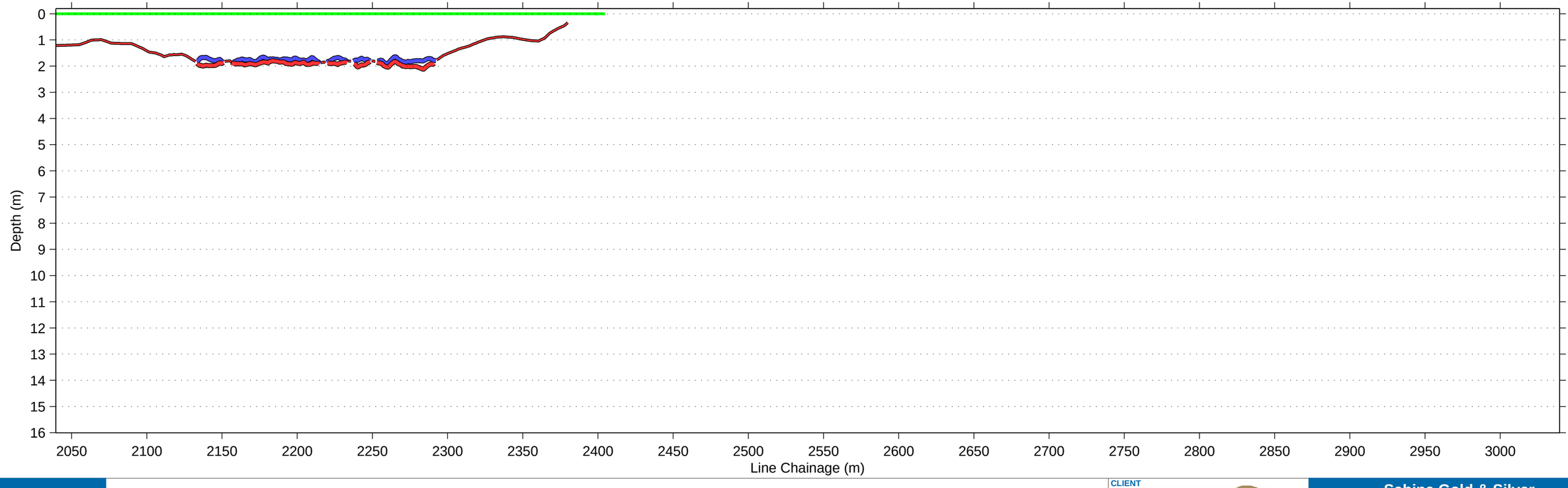
Figure A14.2





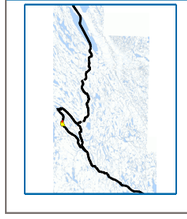


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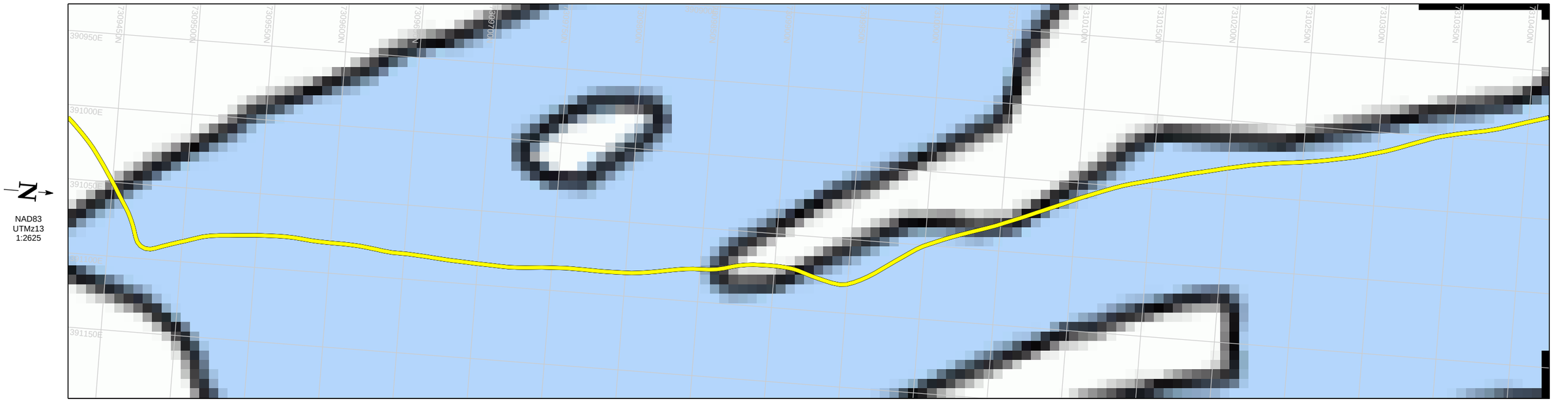
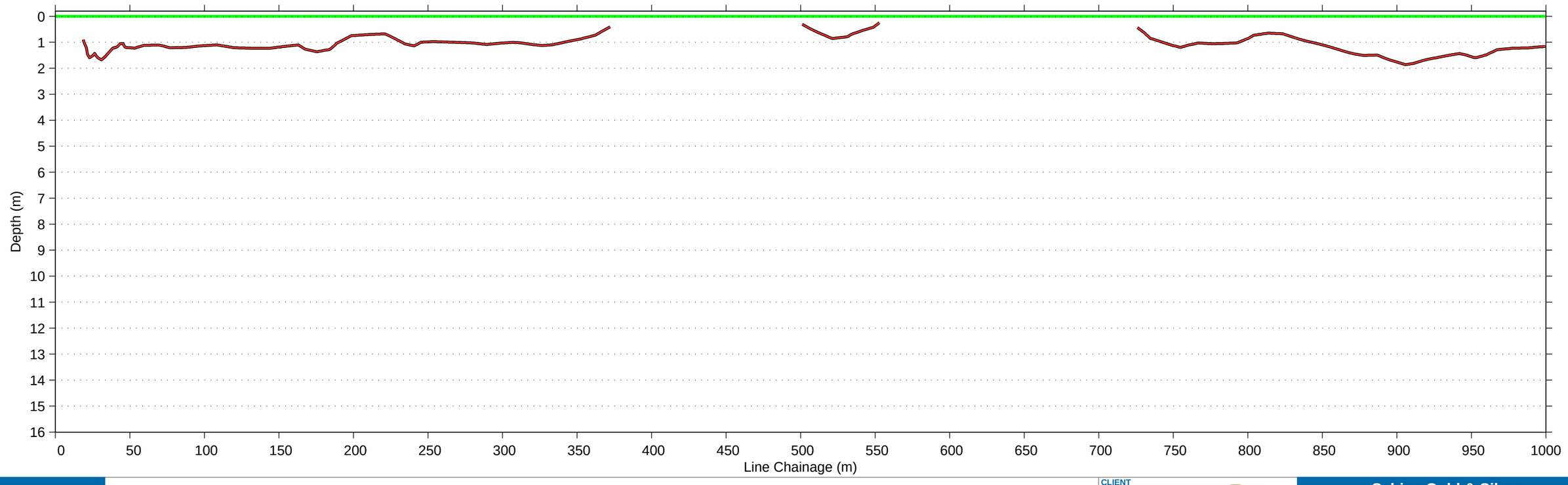
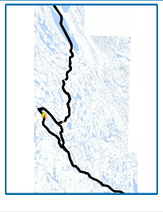
Figure A14.3







LEGEND

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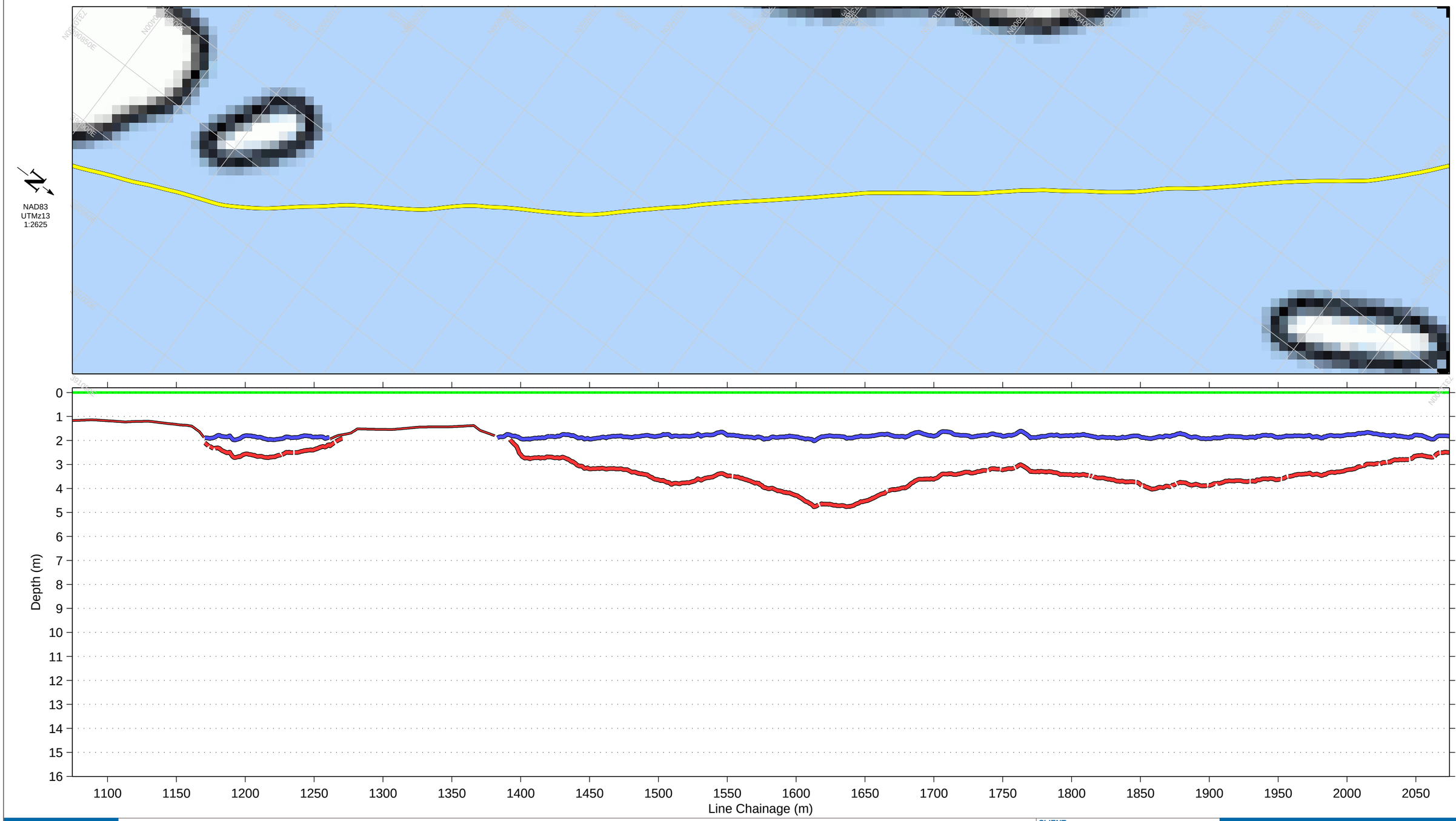
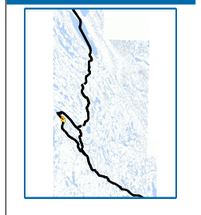
Figure A15.1





LEGEND

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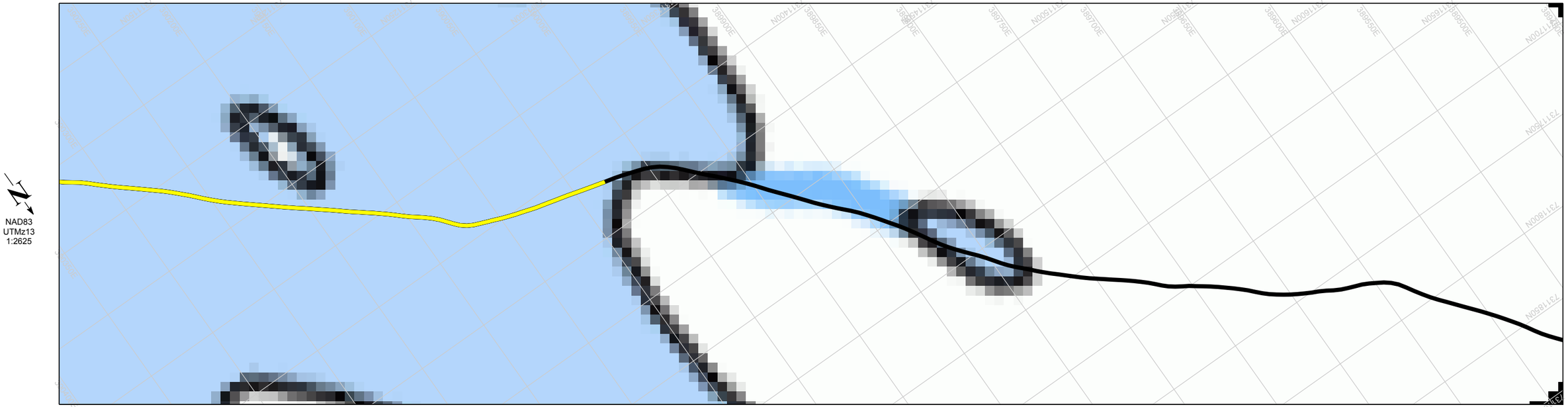
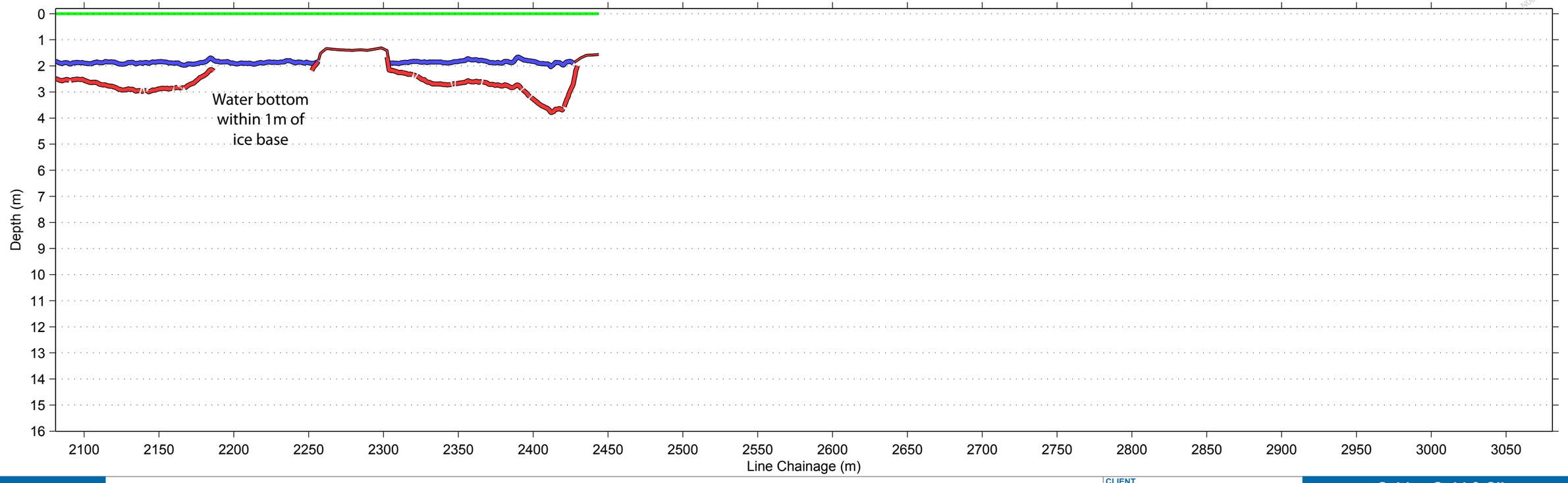
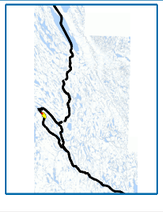
Figure A15.2







LEGEND

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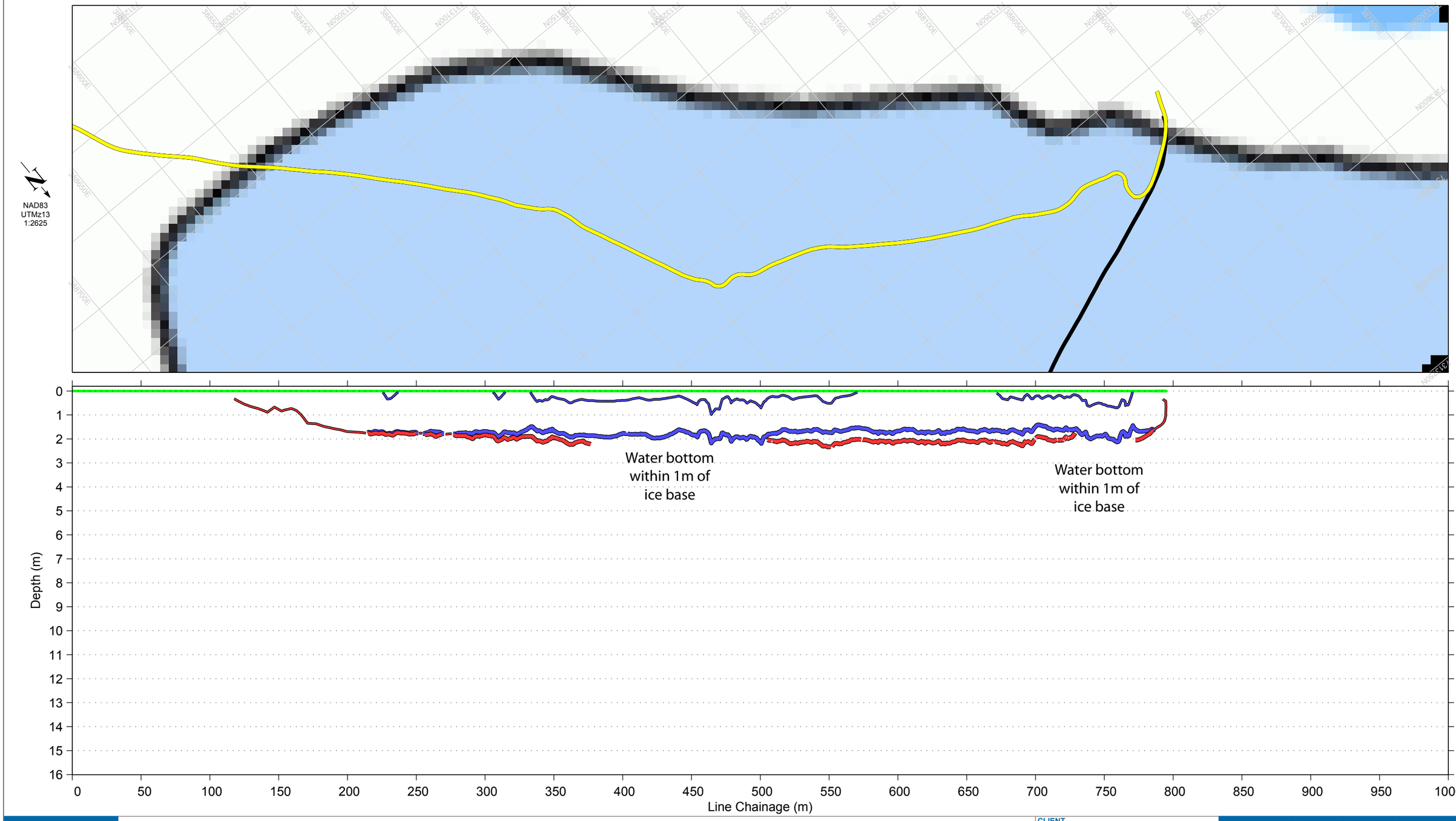
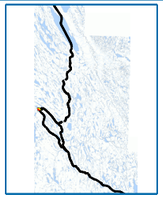
Figure A15.3





LEGEND

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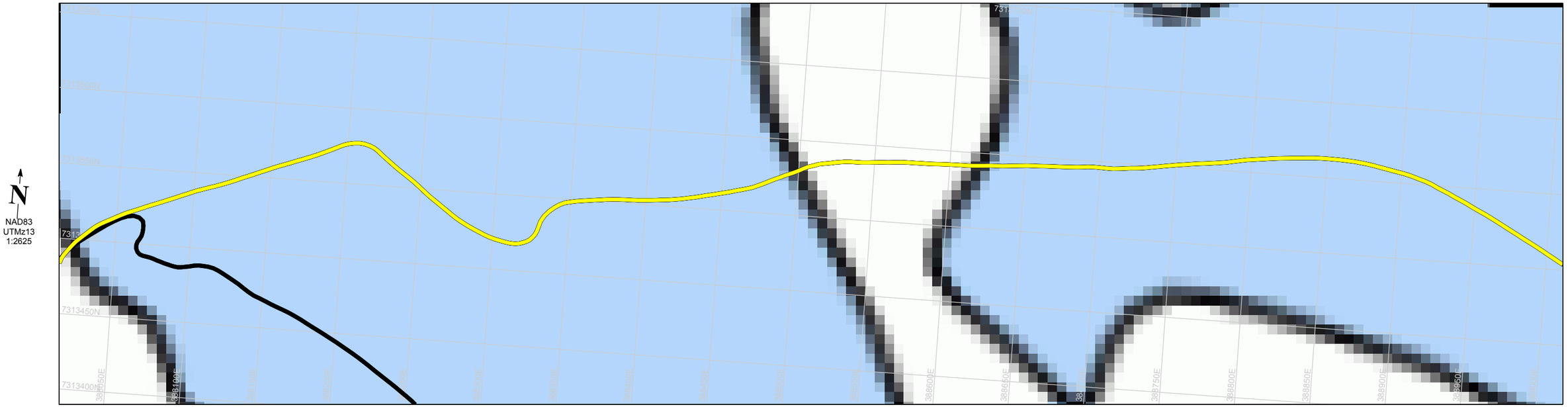
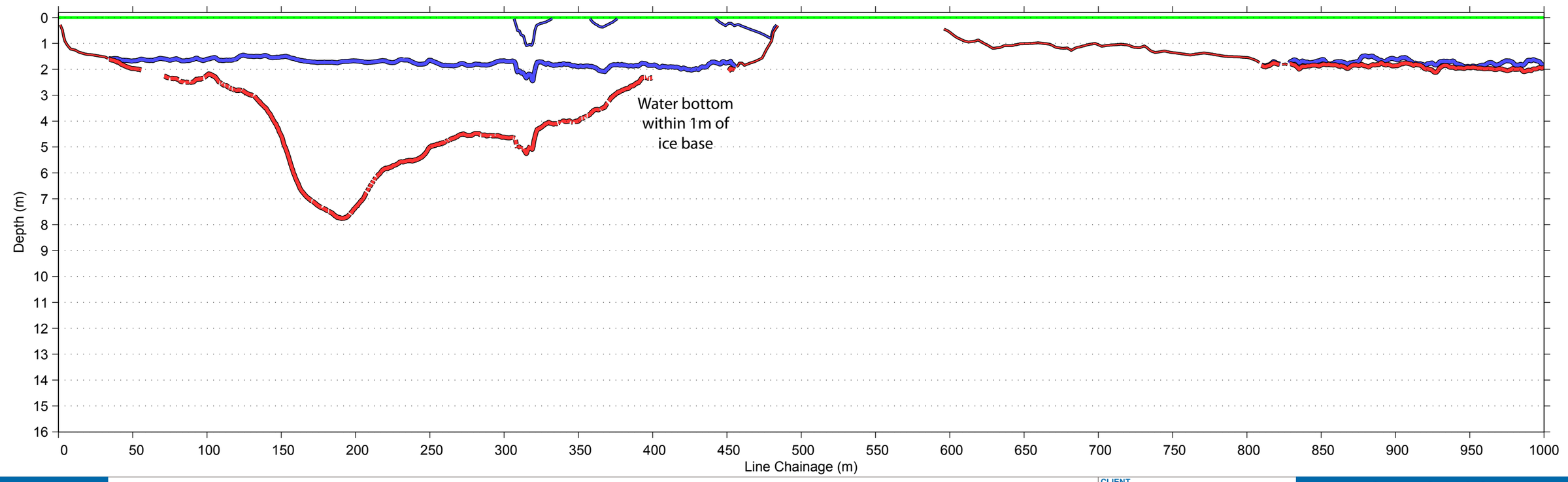
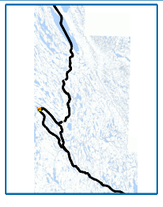
Figure A16.1







LEGEND

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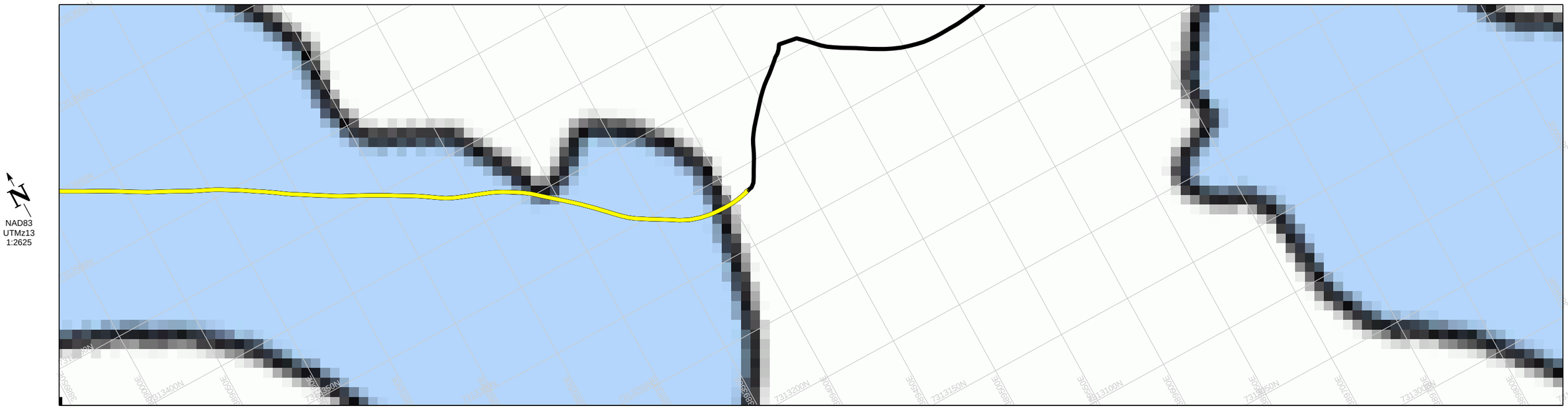
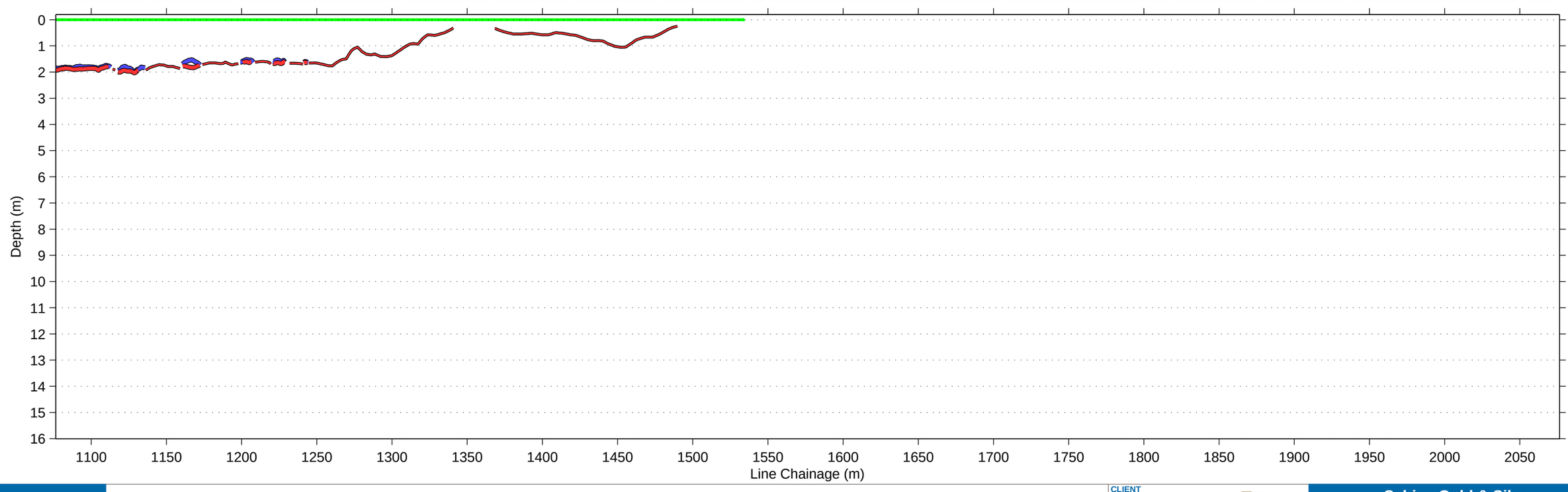
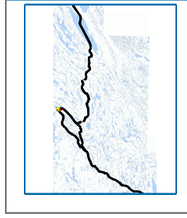
Figure B1.1







LEGEND

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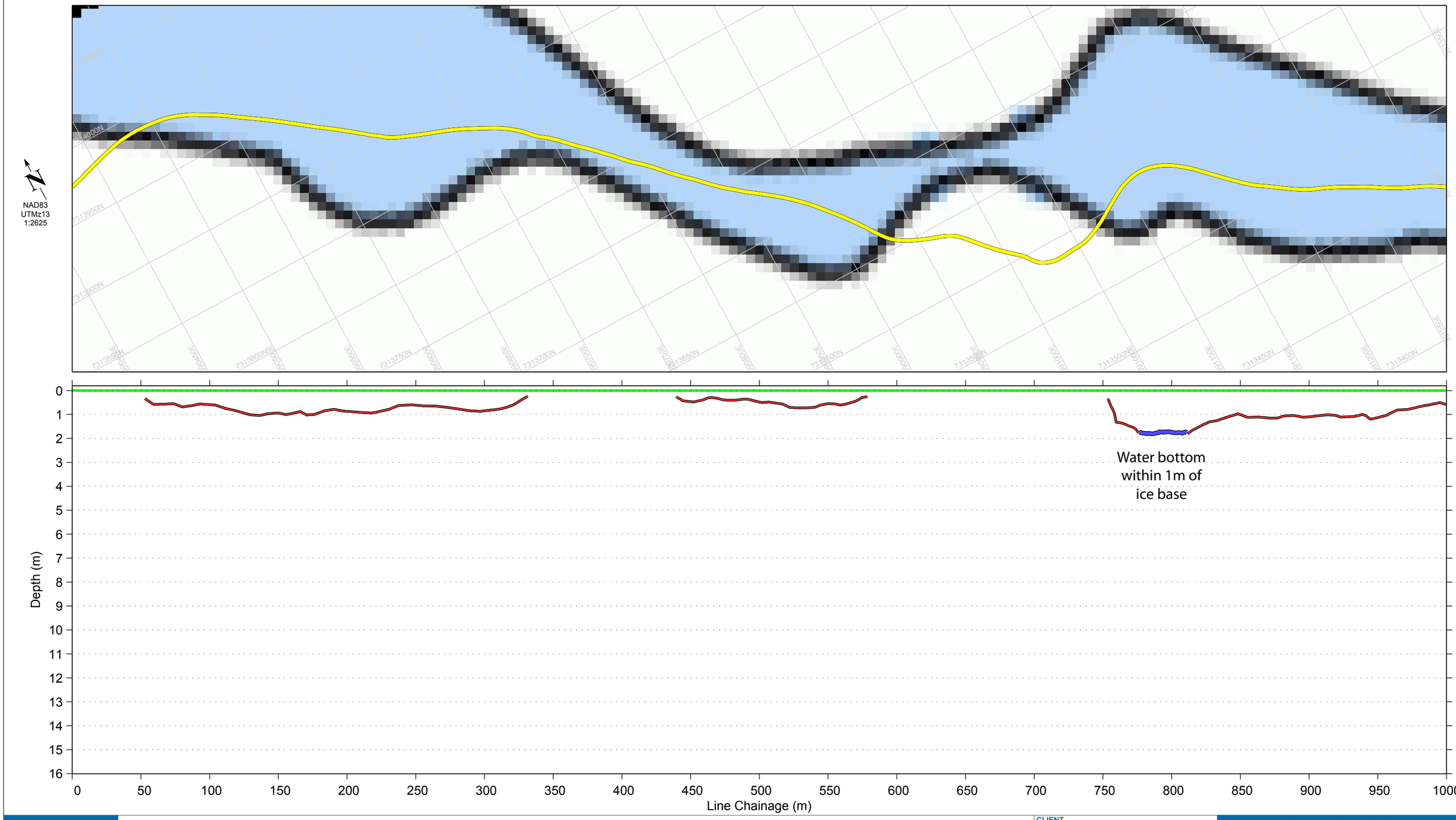
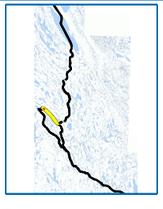
Figure B1.2





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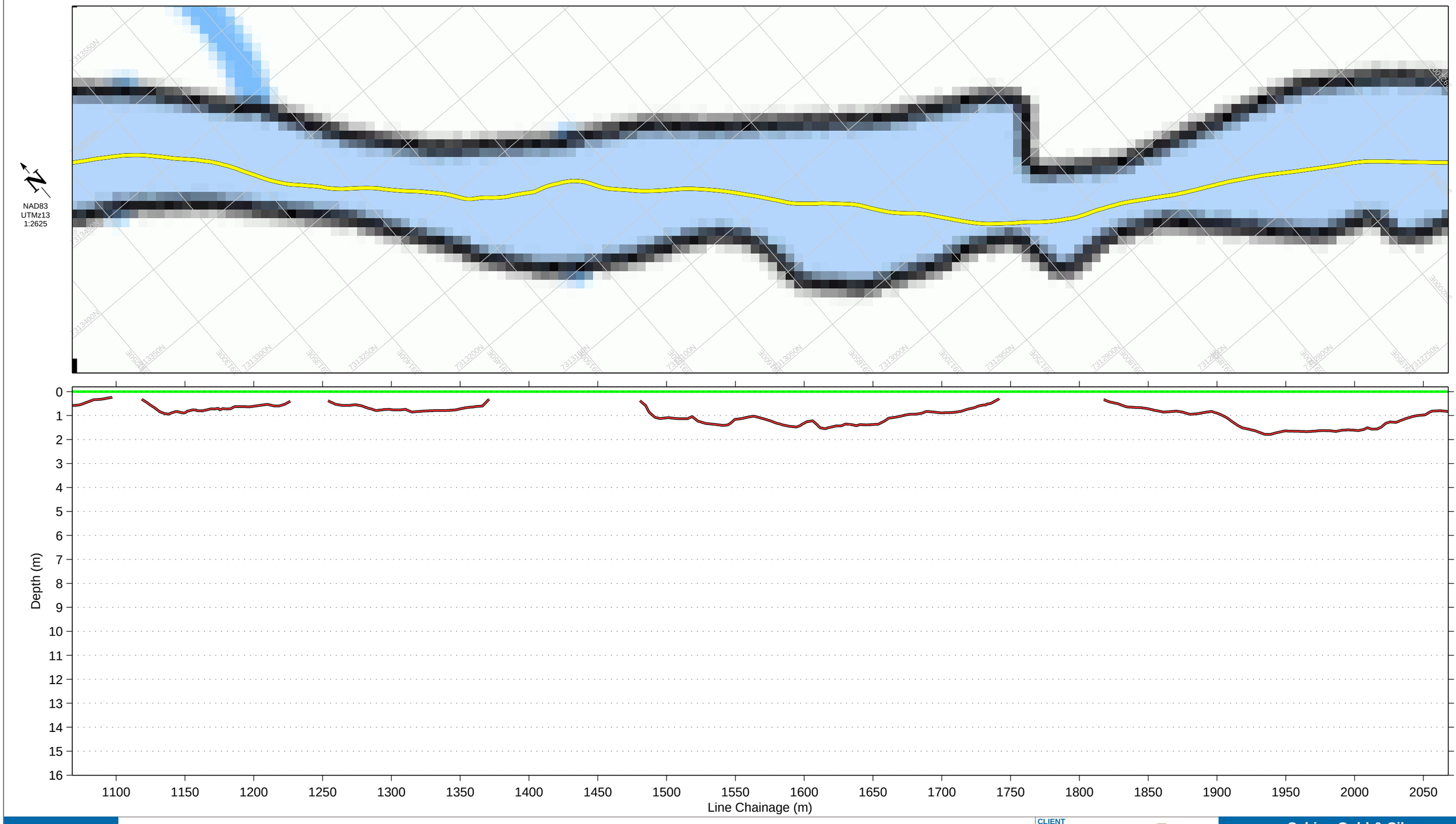
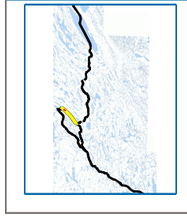
Edmonton	June 14, 2013

Figure B2.1





LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

CLIENT

Sabina GOLD & SILVER CORP.

TETRA TECH

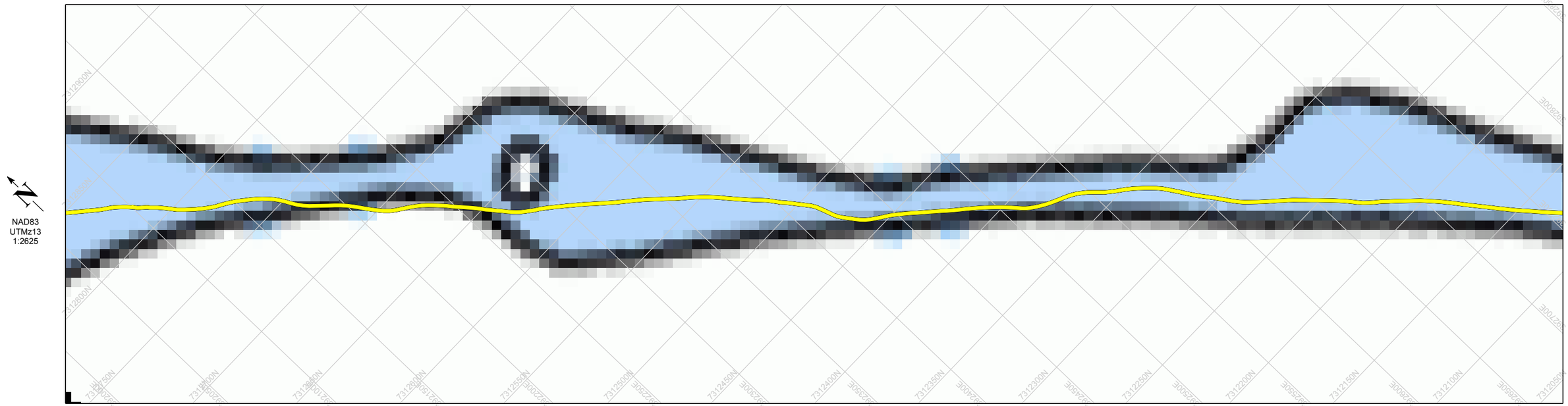
Sabina Gold & Silver
Back River Project GPR Profiling

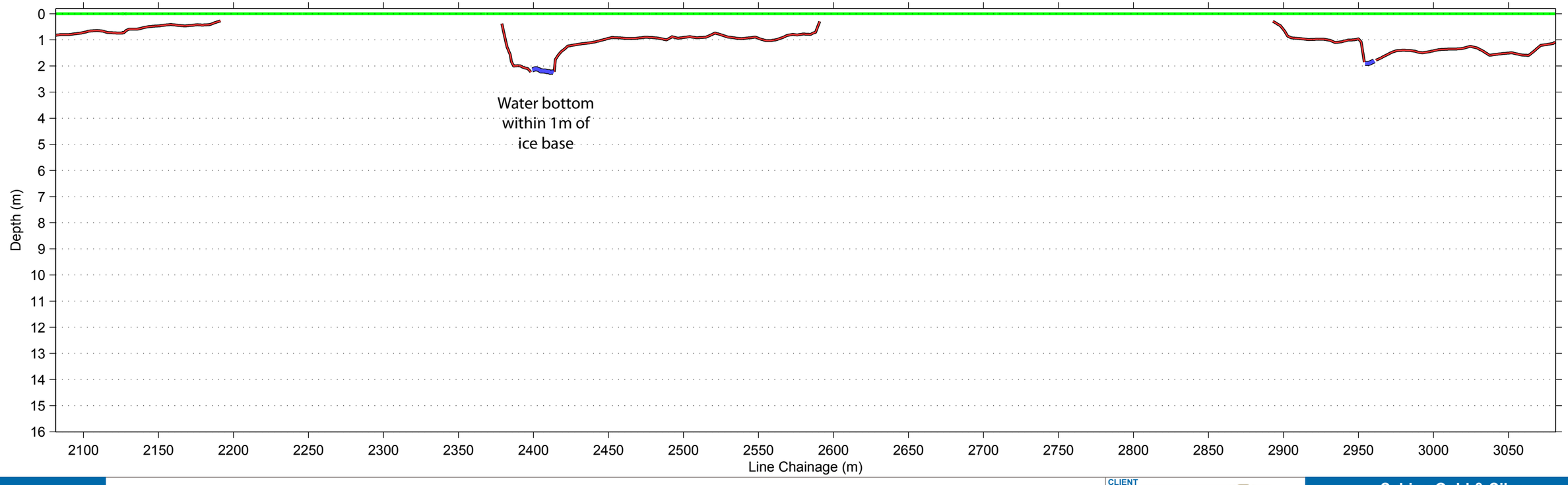
Winter Road Option – Major Lake Profiles
George to Northern Junction
Collected April 25 – 28, 2013

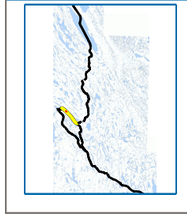
Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure B2.2







LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
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V33103008.E111	RJM	CB	RJM	0

OFFICE: Edmonton
DATE: June 14, 2013

Figure B2.3

NAD83
UTMz13
1:2625

Water bottom
within 1m of
ice base

Depth (m)

Line Chainage (m)

LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
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- Water Bottom

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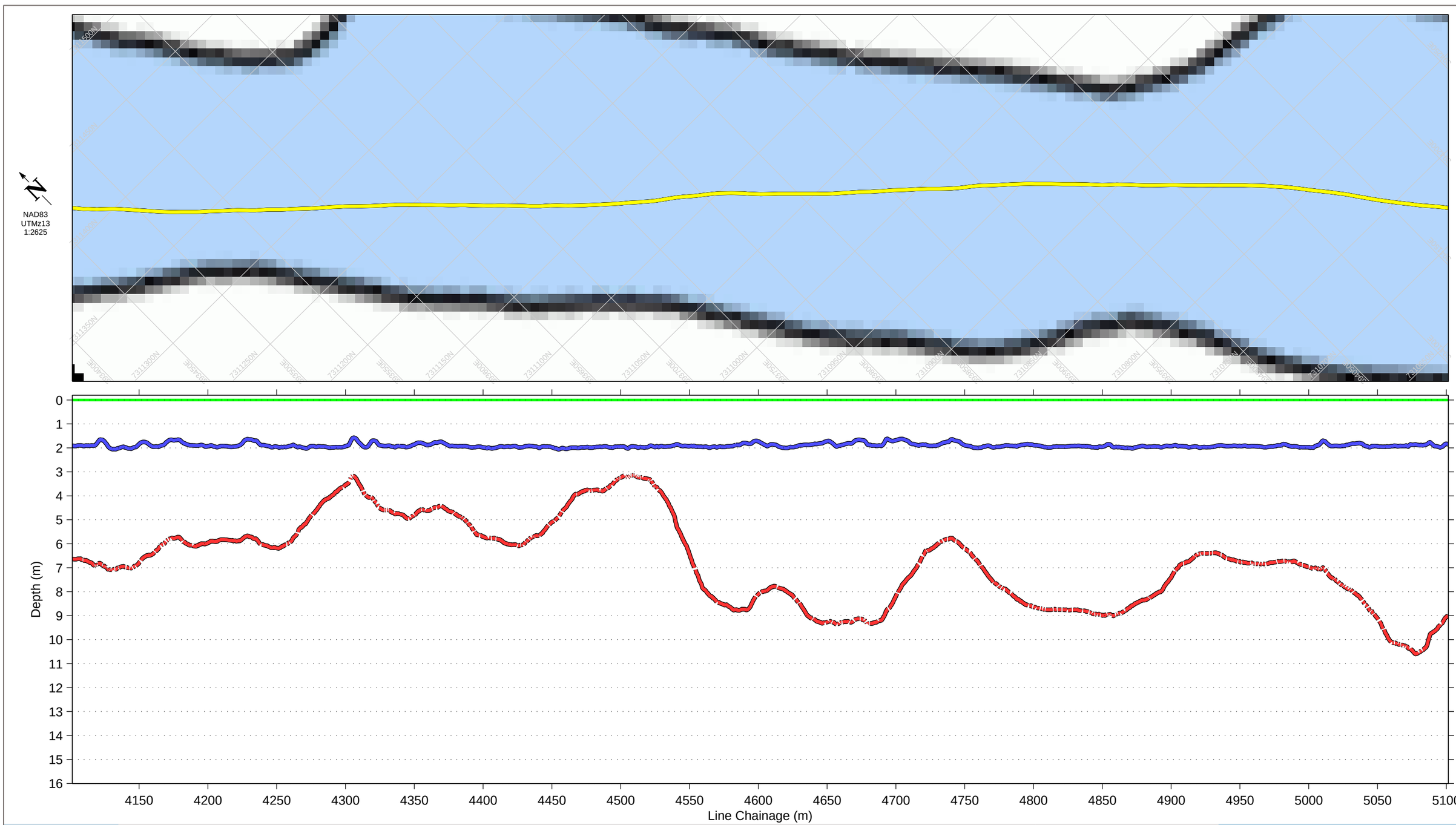
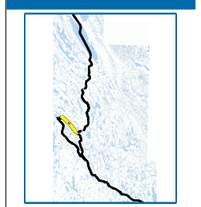
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure B2.4





LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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George to Northern Junction
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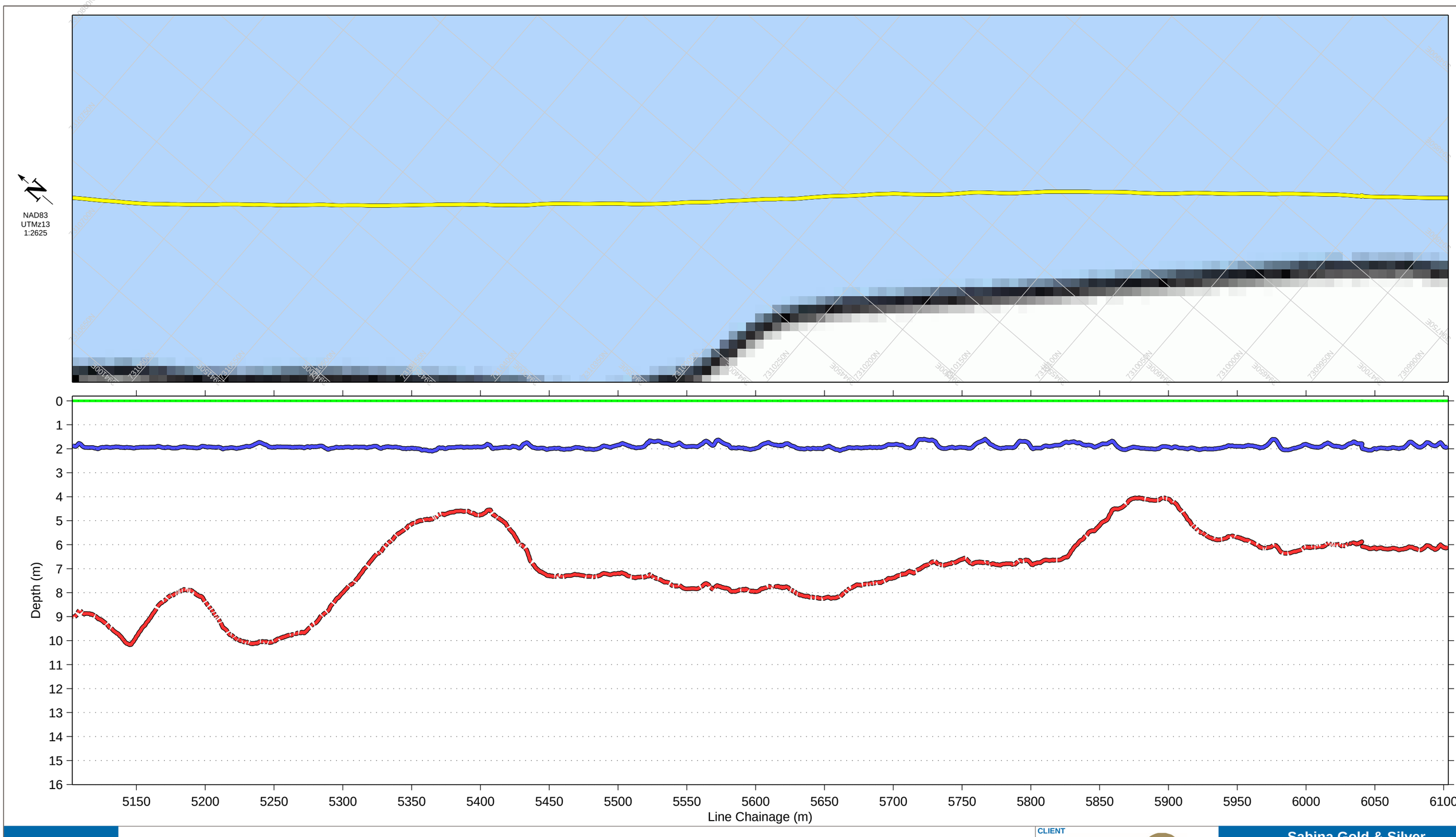
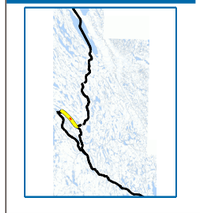
Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure B2.5





LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
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- Floating Ice
- Water Bottom

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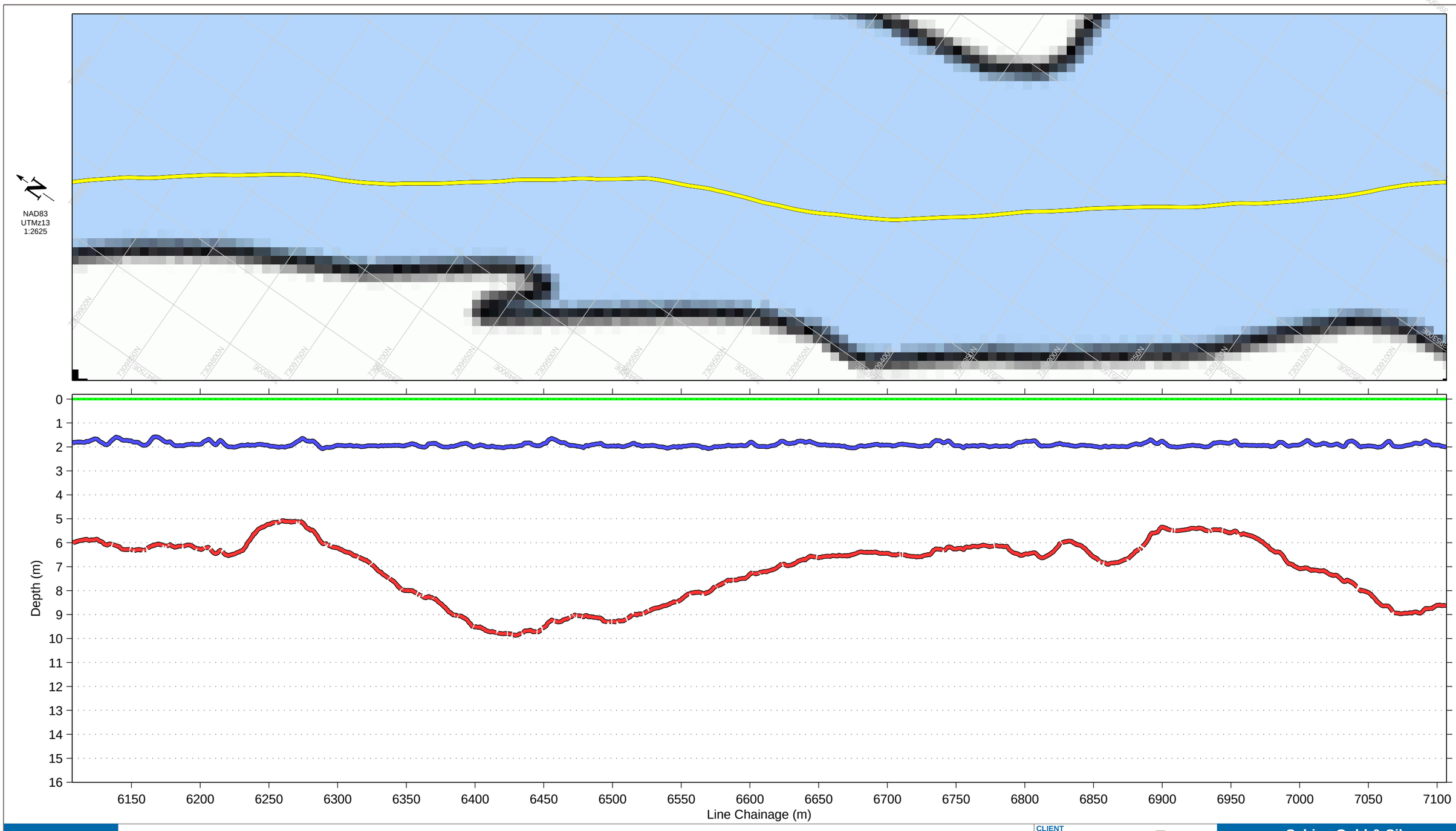
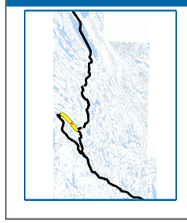
Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure B2.6





LEGEND

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- Ground/Ice Surface
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- Water Bottom

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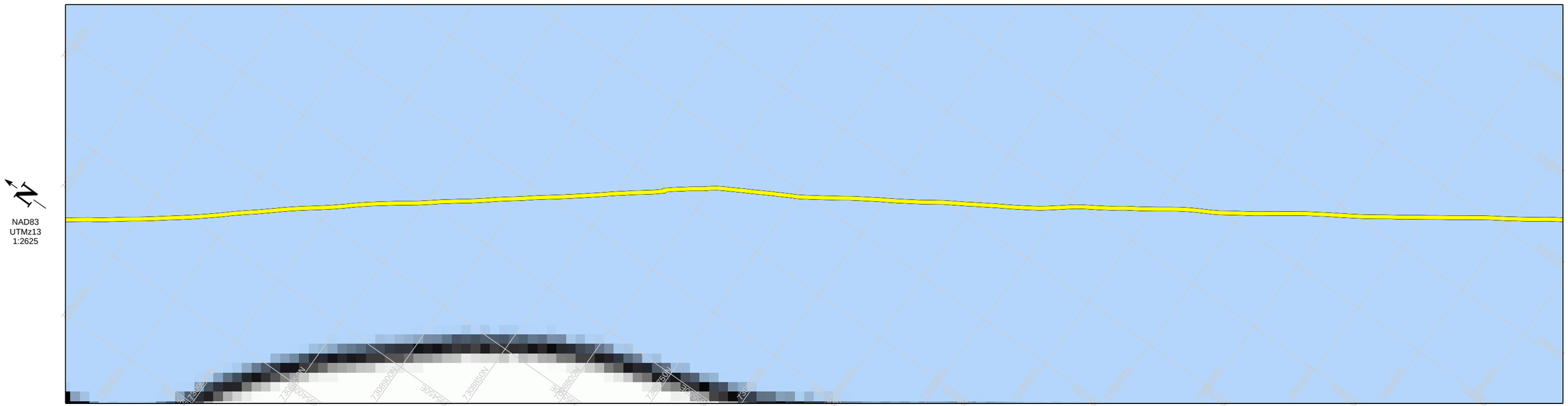
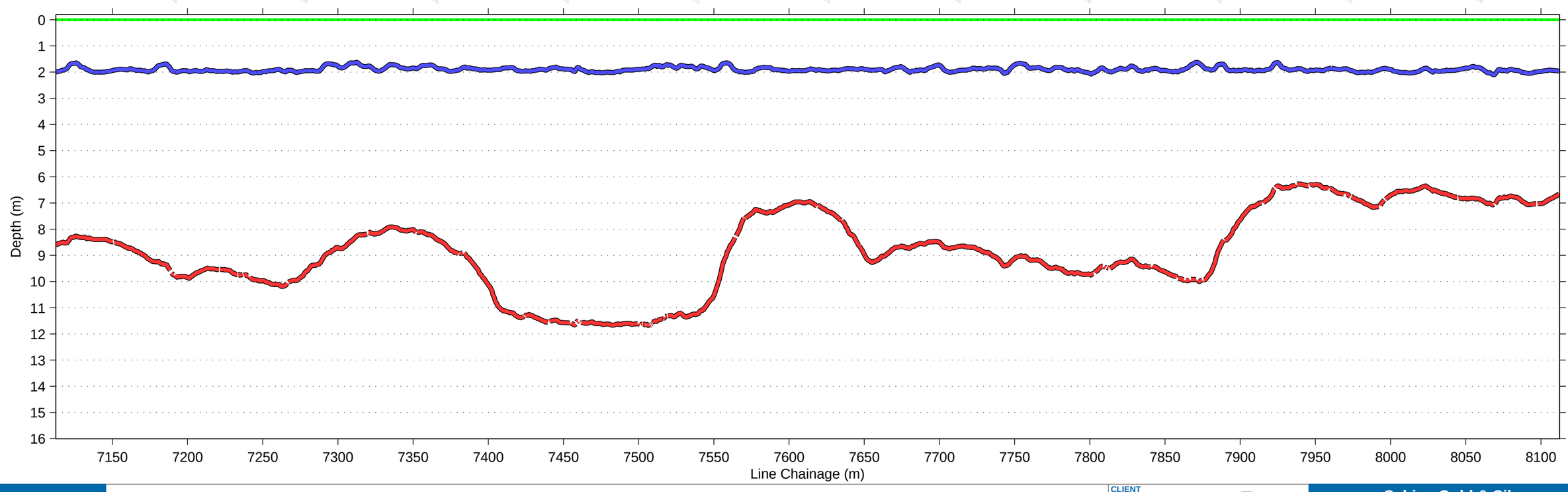
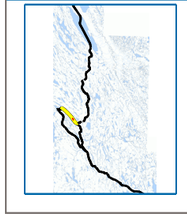
OFFICE	DATE
Edmonton	June 14, 2013

Figure B2.7







LEGEND

- Plotted GPR Tracks
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- Water Bottom

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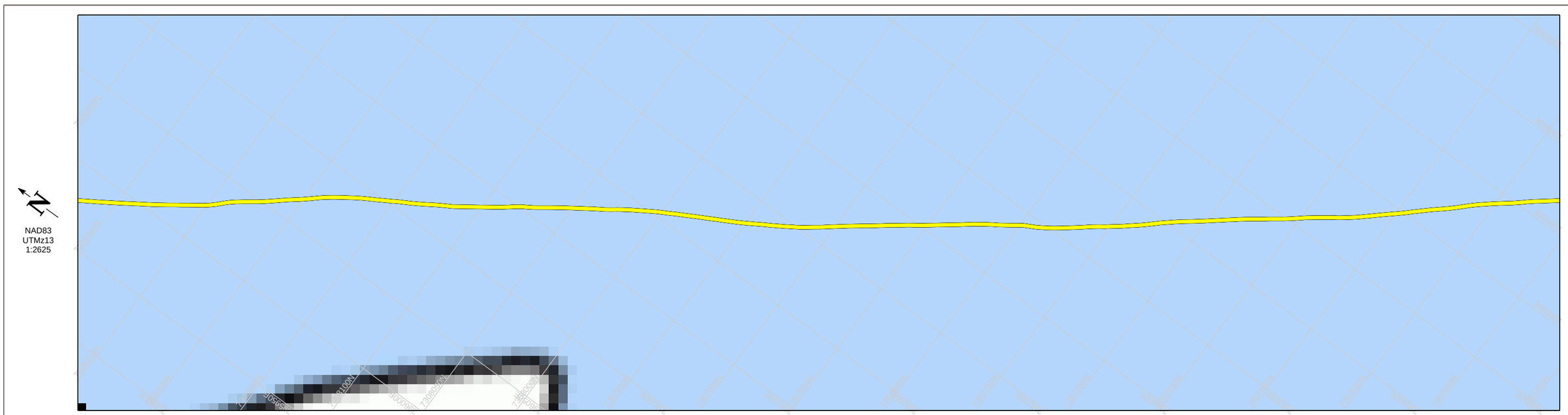
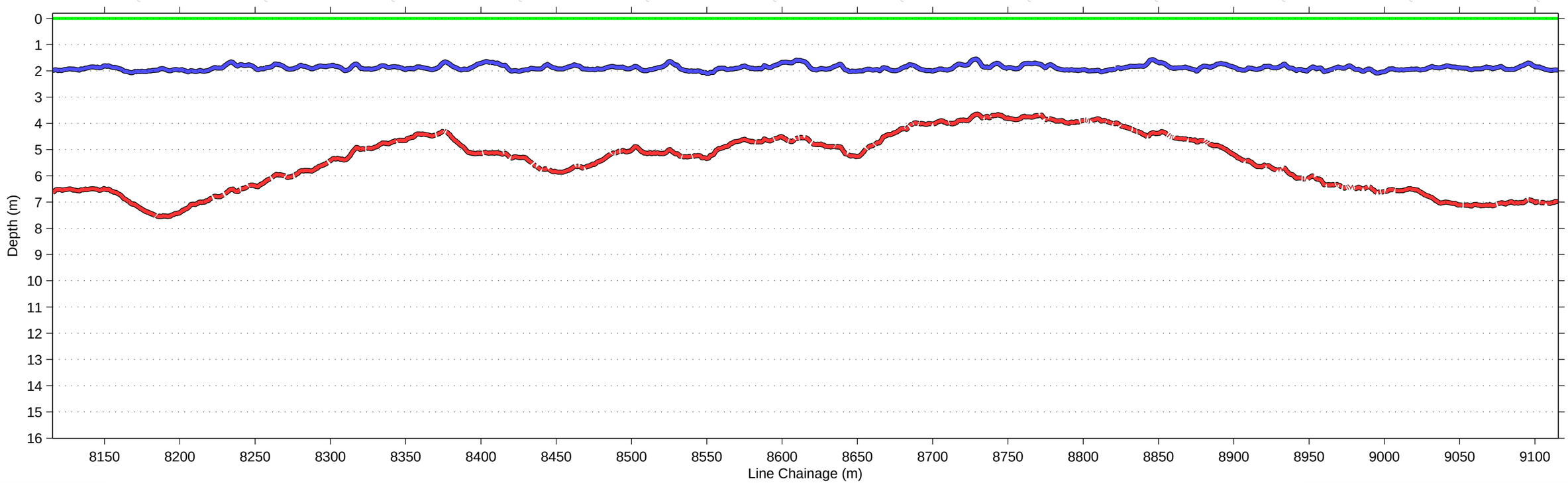
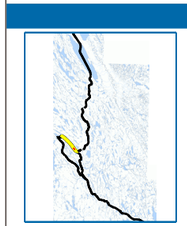
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure B2.8







LEGEND

- Plotted GPR Tracks
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- Water Bottom

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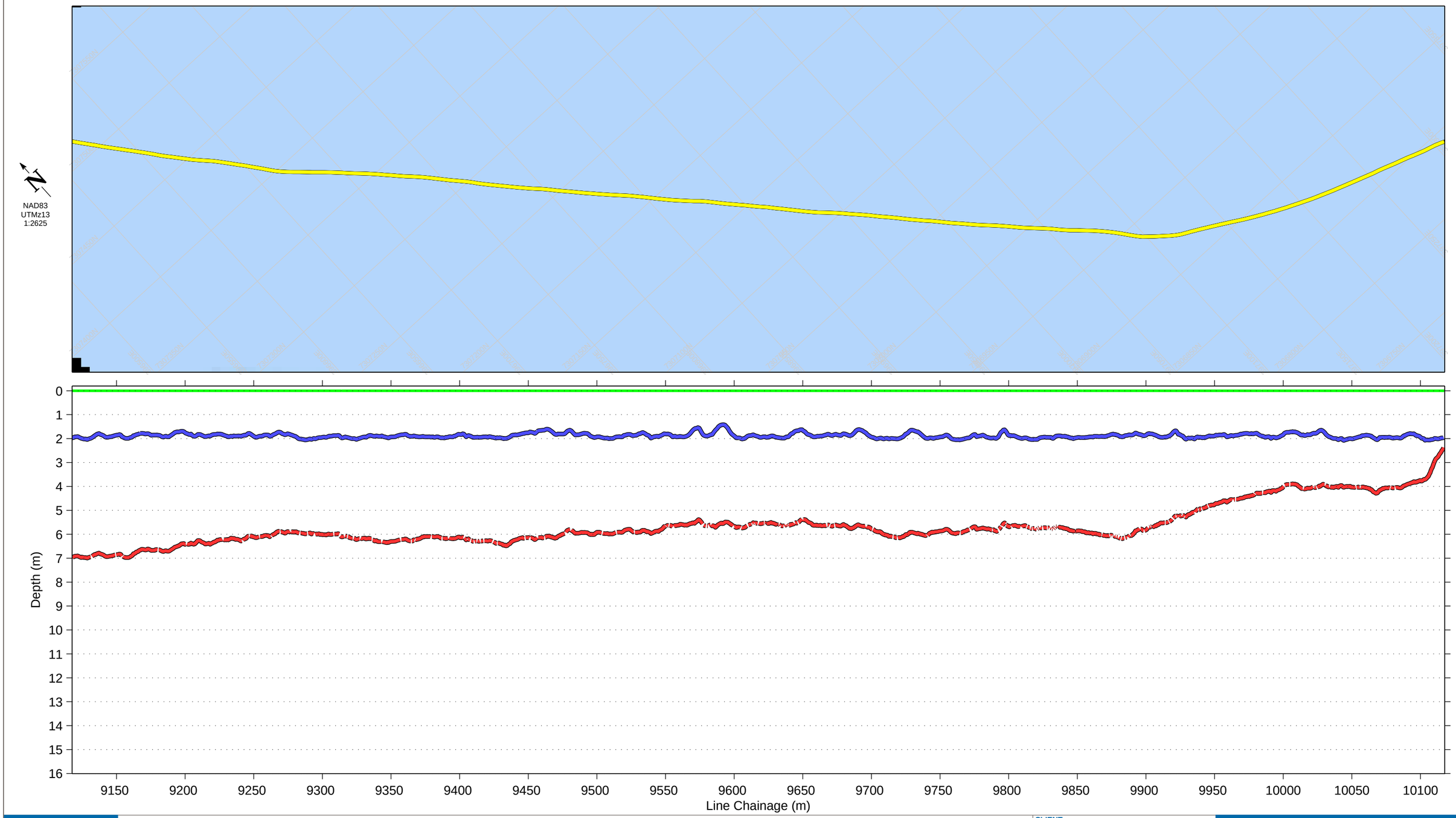
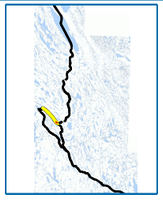
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure B2.9





LEGEND

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- Ground/Ice Surface
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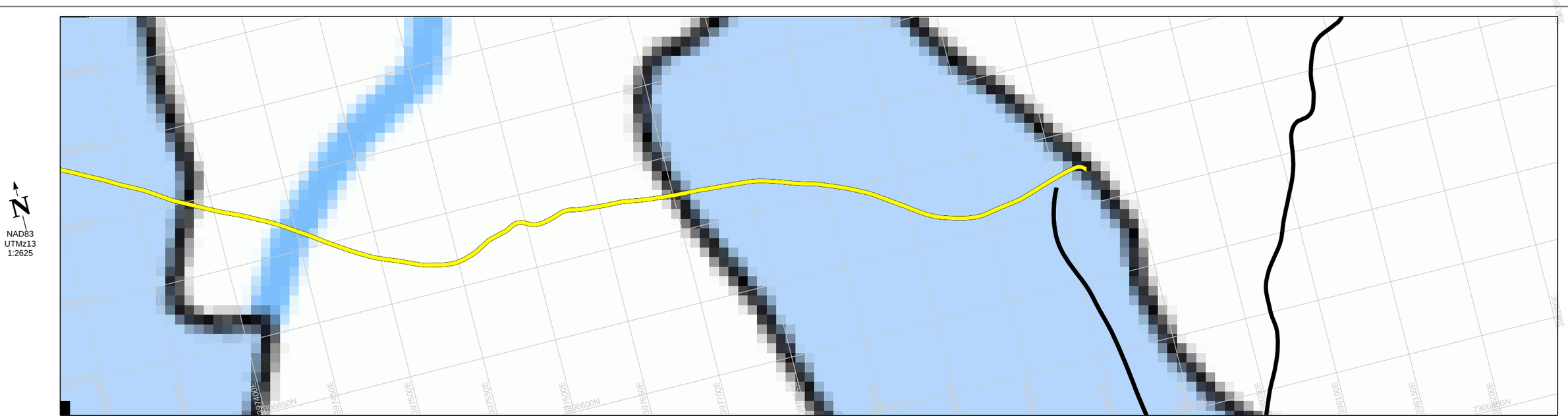
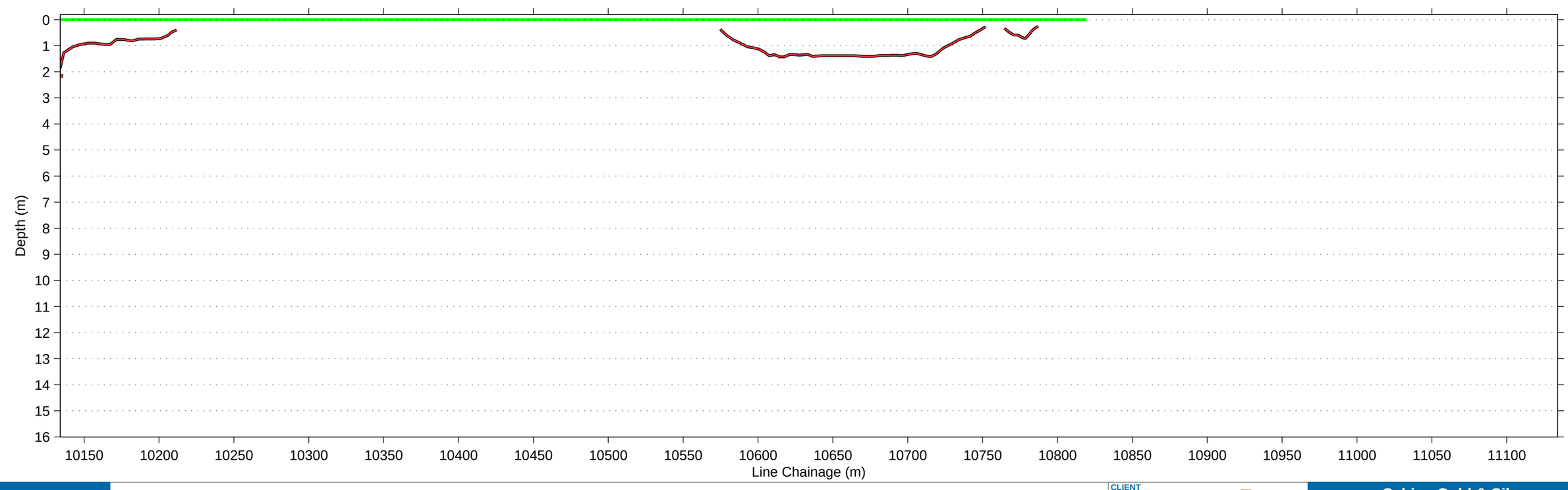
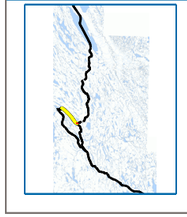
OFFICE	DATE
Edmonton	June 14, 2013

Figure B2.10







LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
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- Floating Ice
- Water Bottom

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George to Northern Junction
Collected April 25 – 28, 2013

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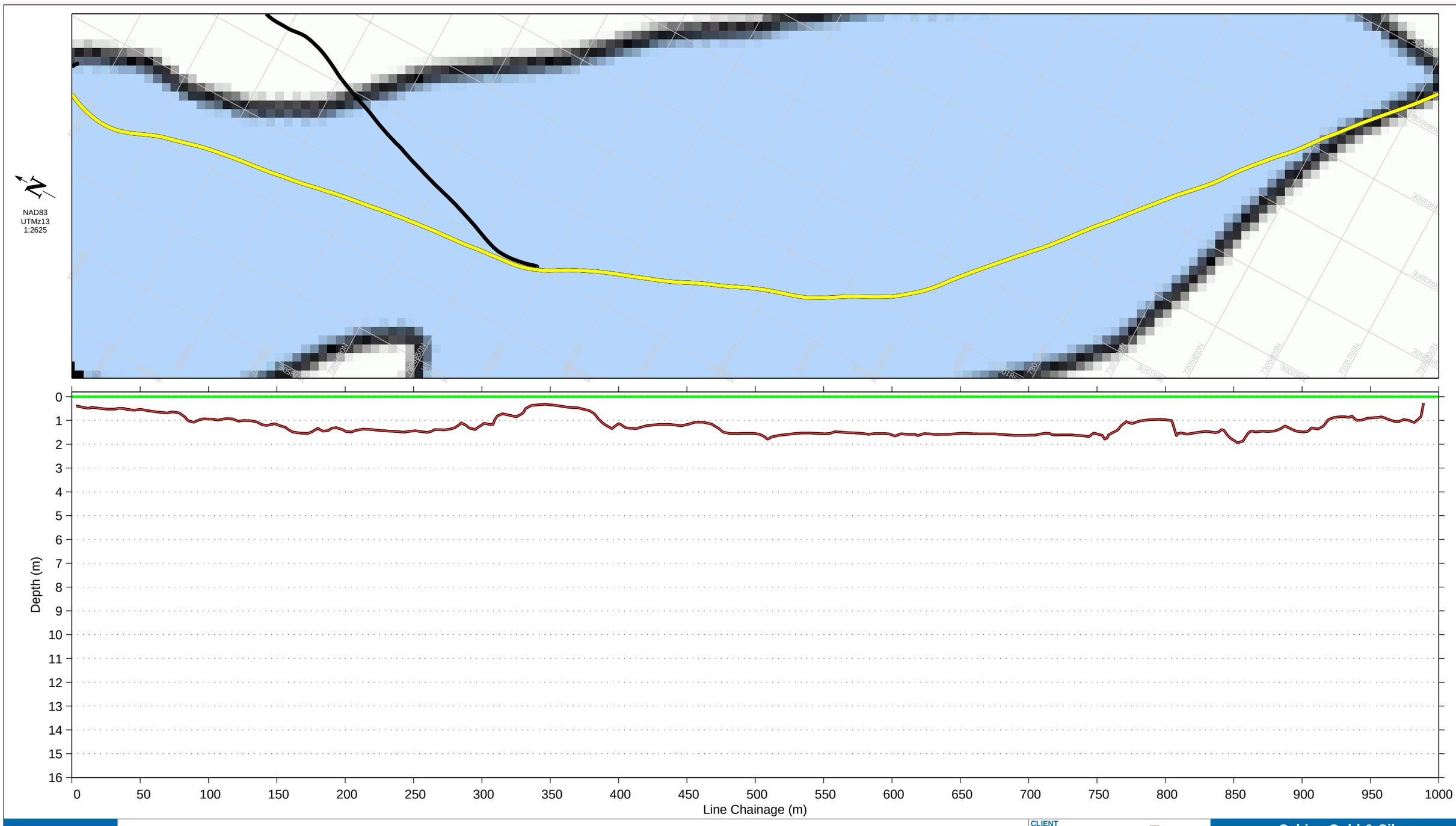
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure B2.11



LEGEND

- Plotted GPR Tracks
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- Floating Ice
- Water Bottom

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Winter Road Option – Major Lake Profiles
Northern to Southern Junction
Collected April 25 – 28, 2013

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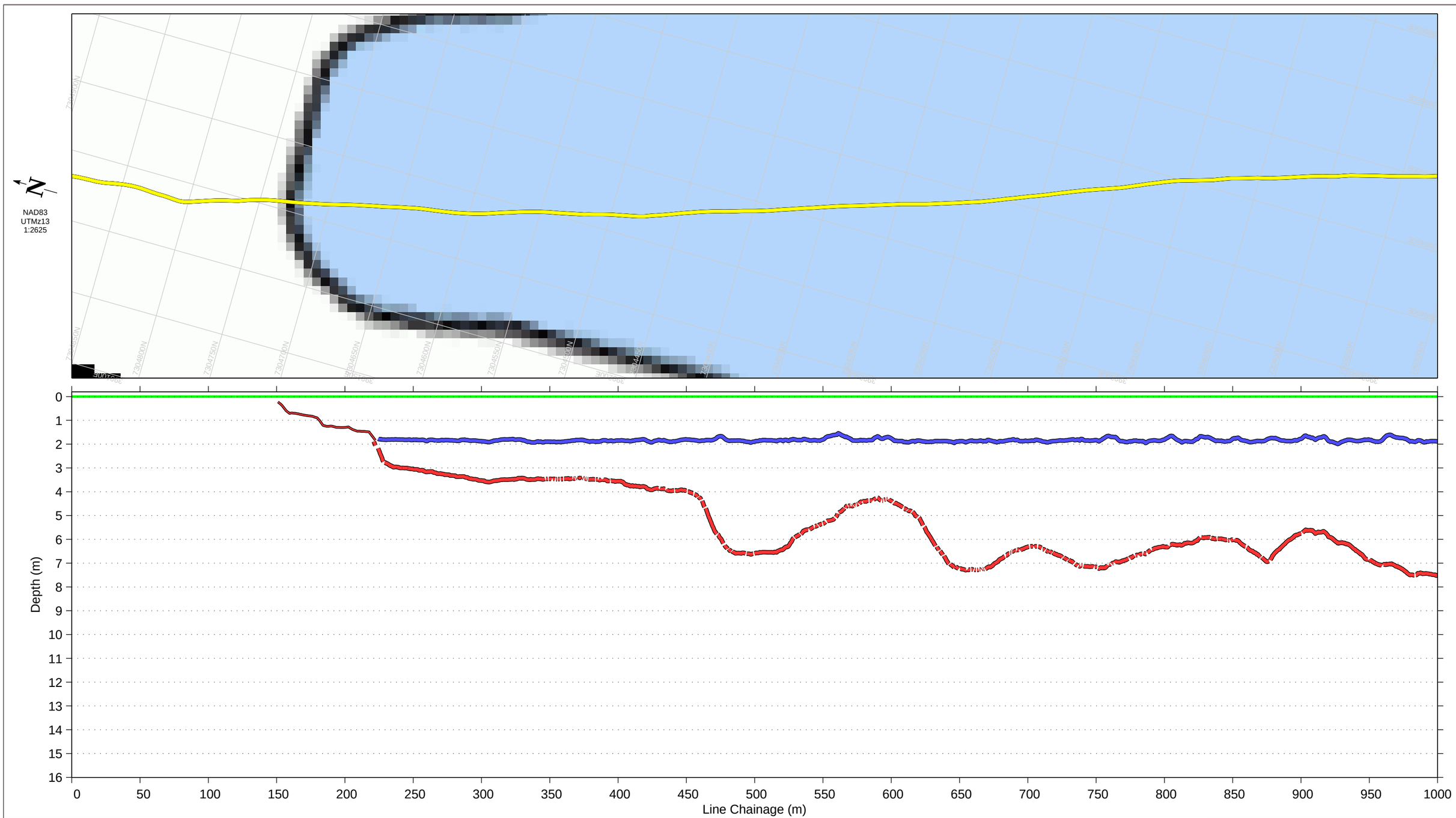
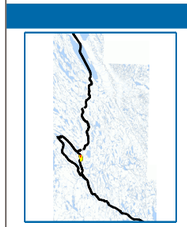
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure C1.1





LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
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- Floating Ice
- Water Bottom

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V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
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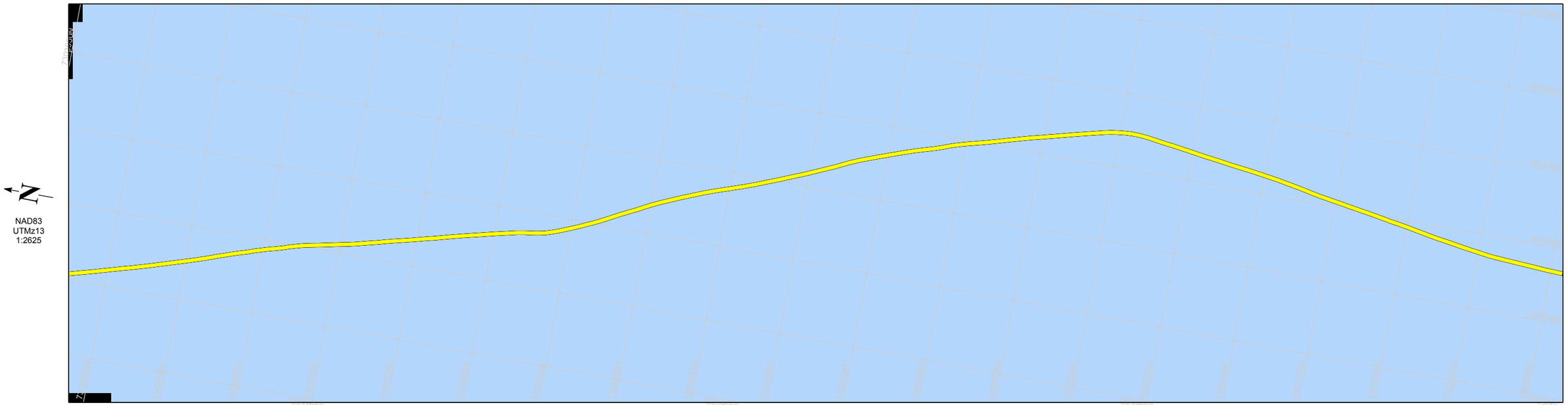
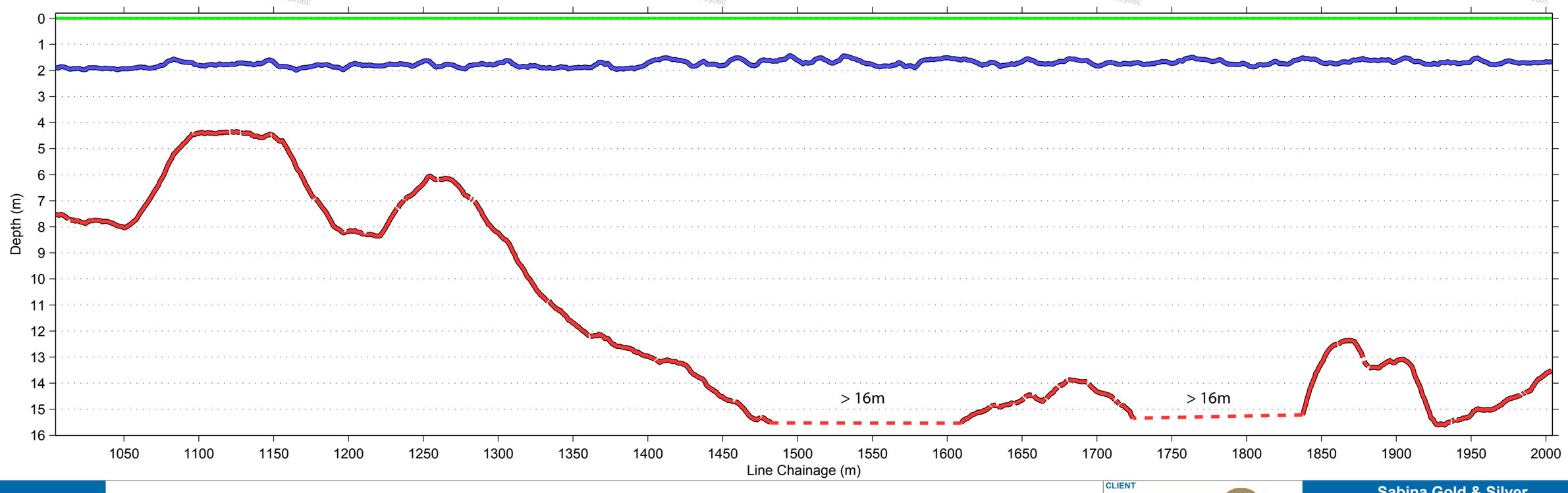
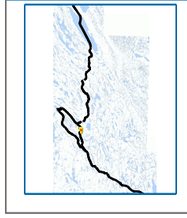
Figure C2.1



NAD83
UTMz13
1:2625





LEGEND

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V33103008.E111	RJM	CB	RJM	0

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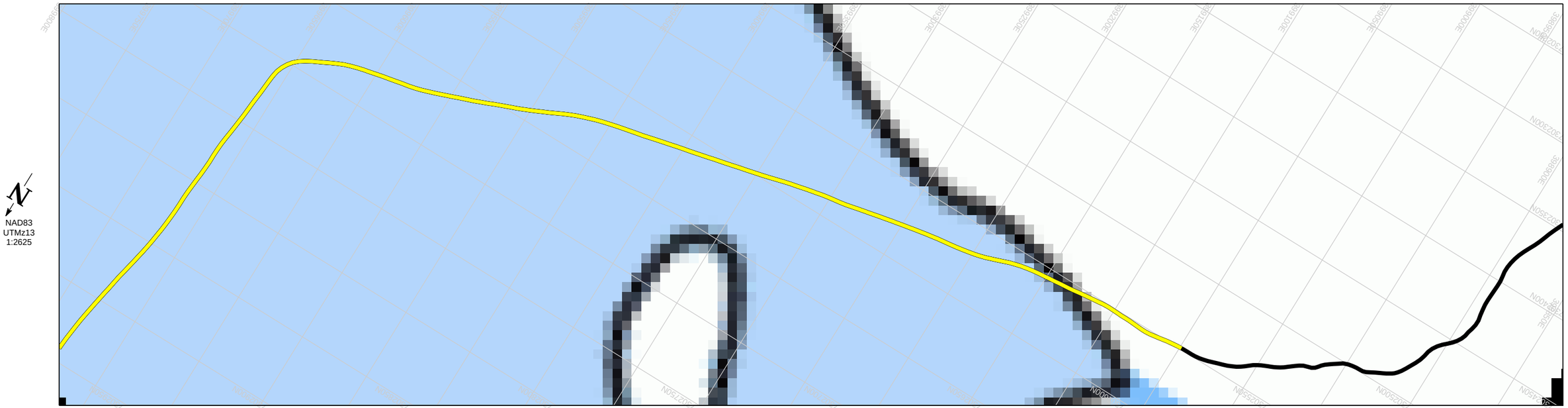
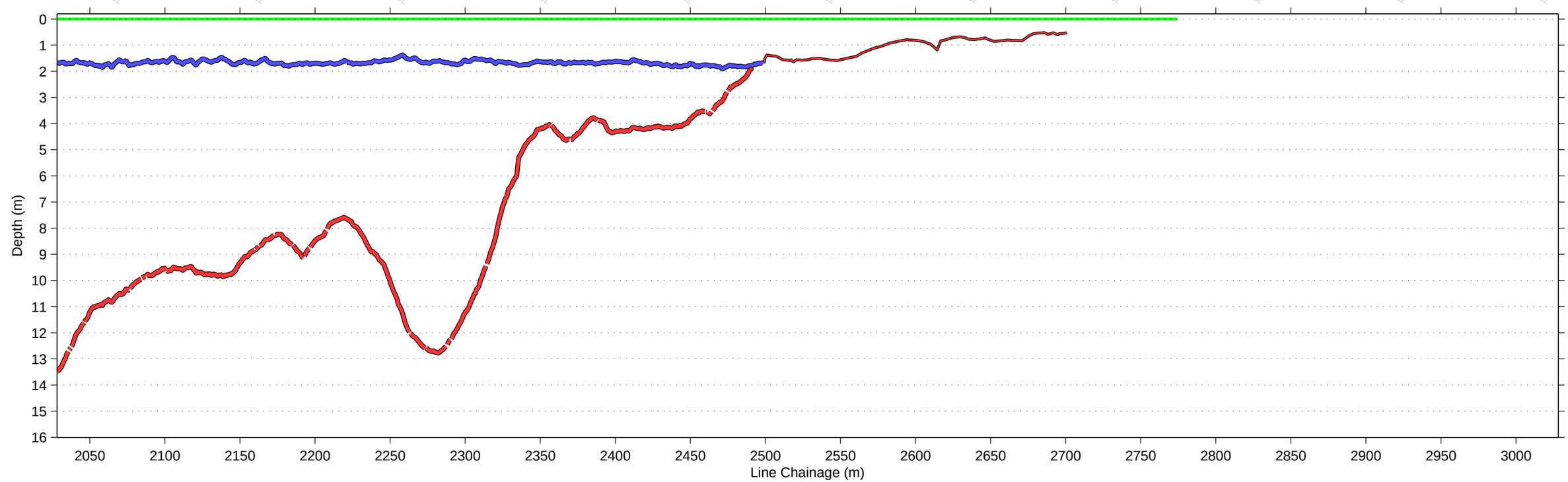
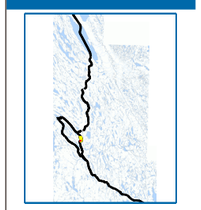
DATE: June 14, 2013

Figure C2.2







LEGEND

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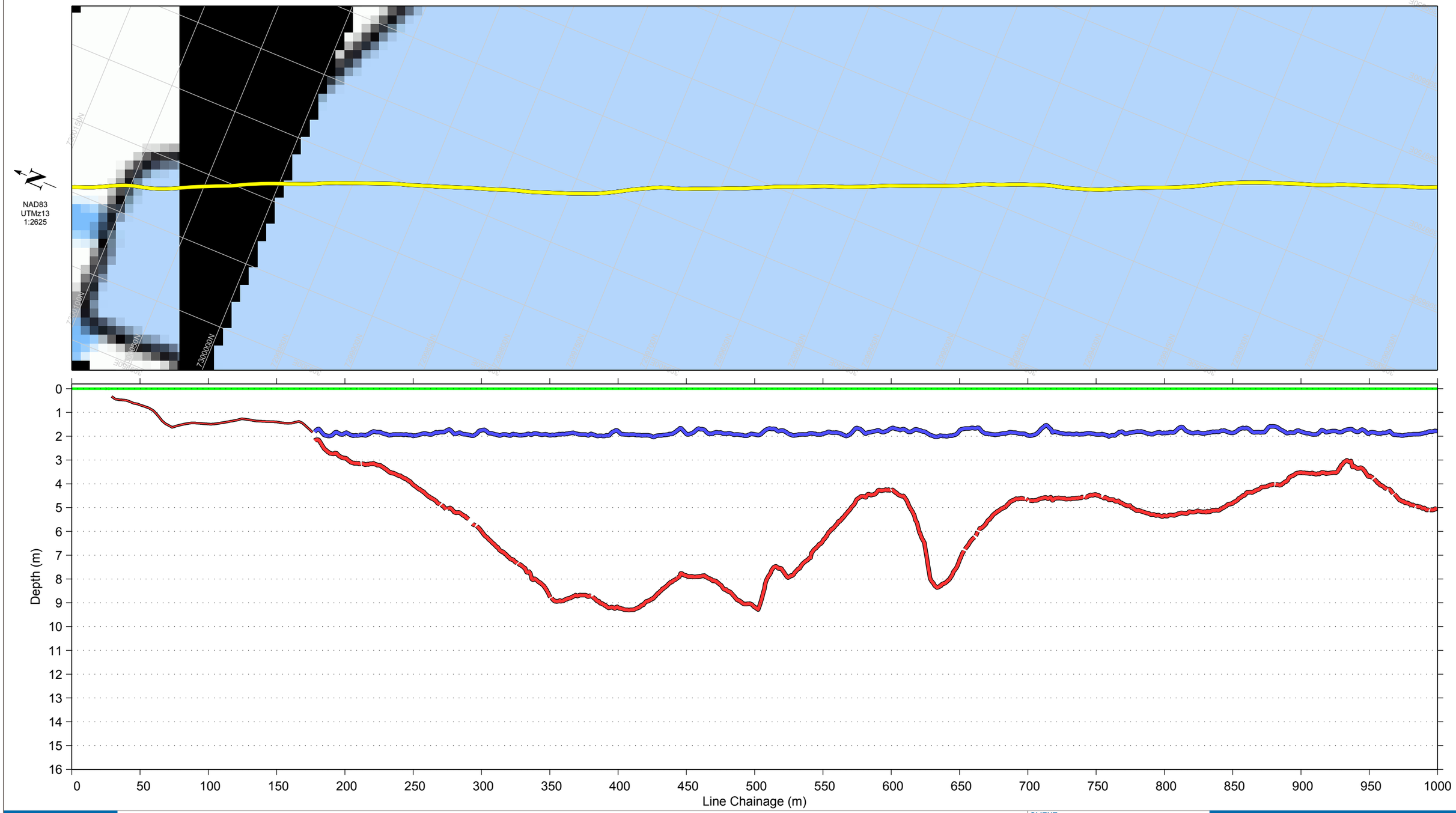
Figure C2.3



LEGEND

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- Water Bottom

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Winter Road Option − Major Lake Profiles
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V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
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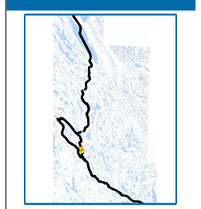
Figure C3.1

NAD83
UTMz13
1:2625

Depth (m)

Line Chainage (m)



LEGEND

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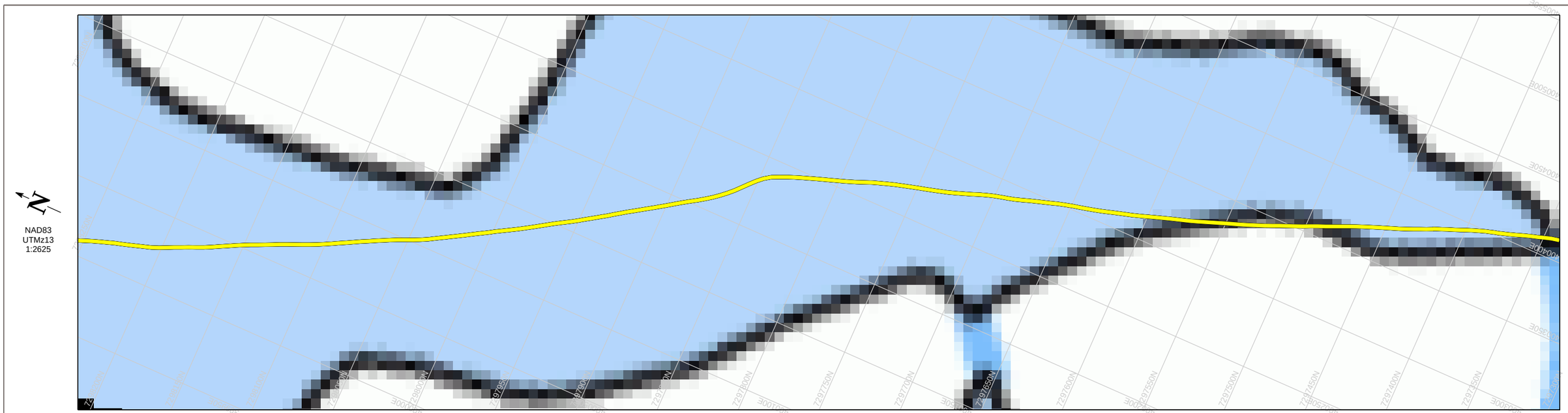
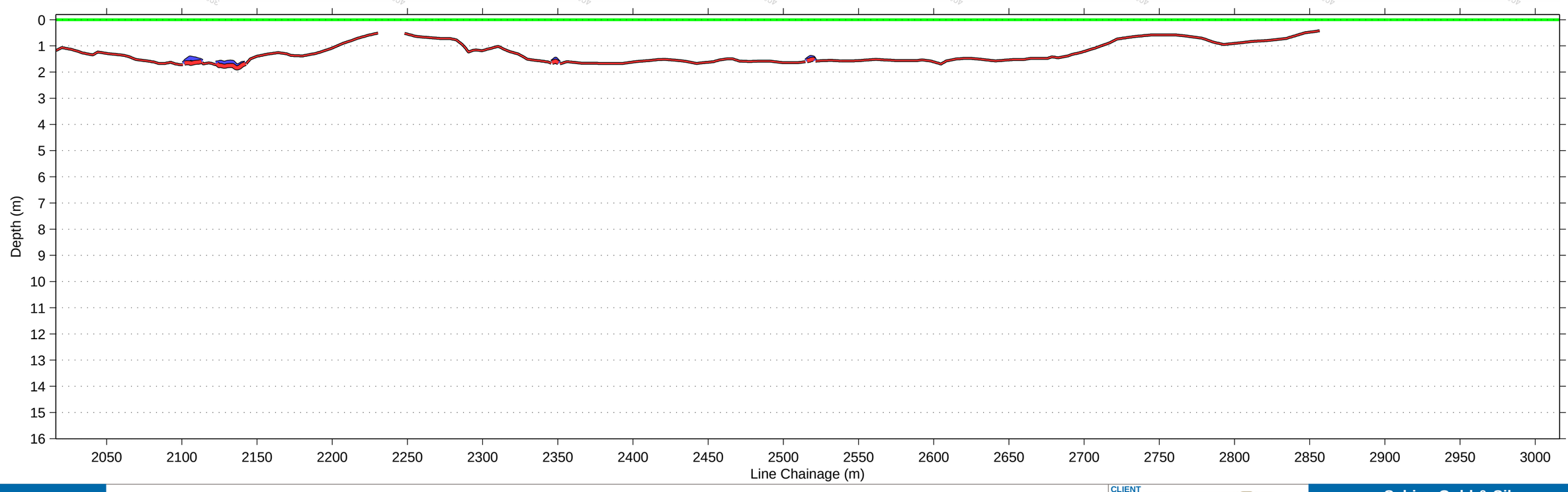
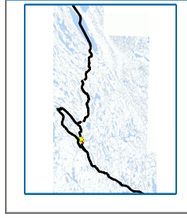
Edmonton	June 14, 2013

Figure C3.2







LEGEND

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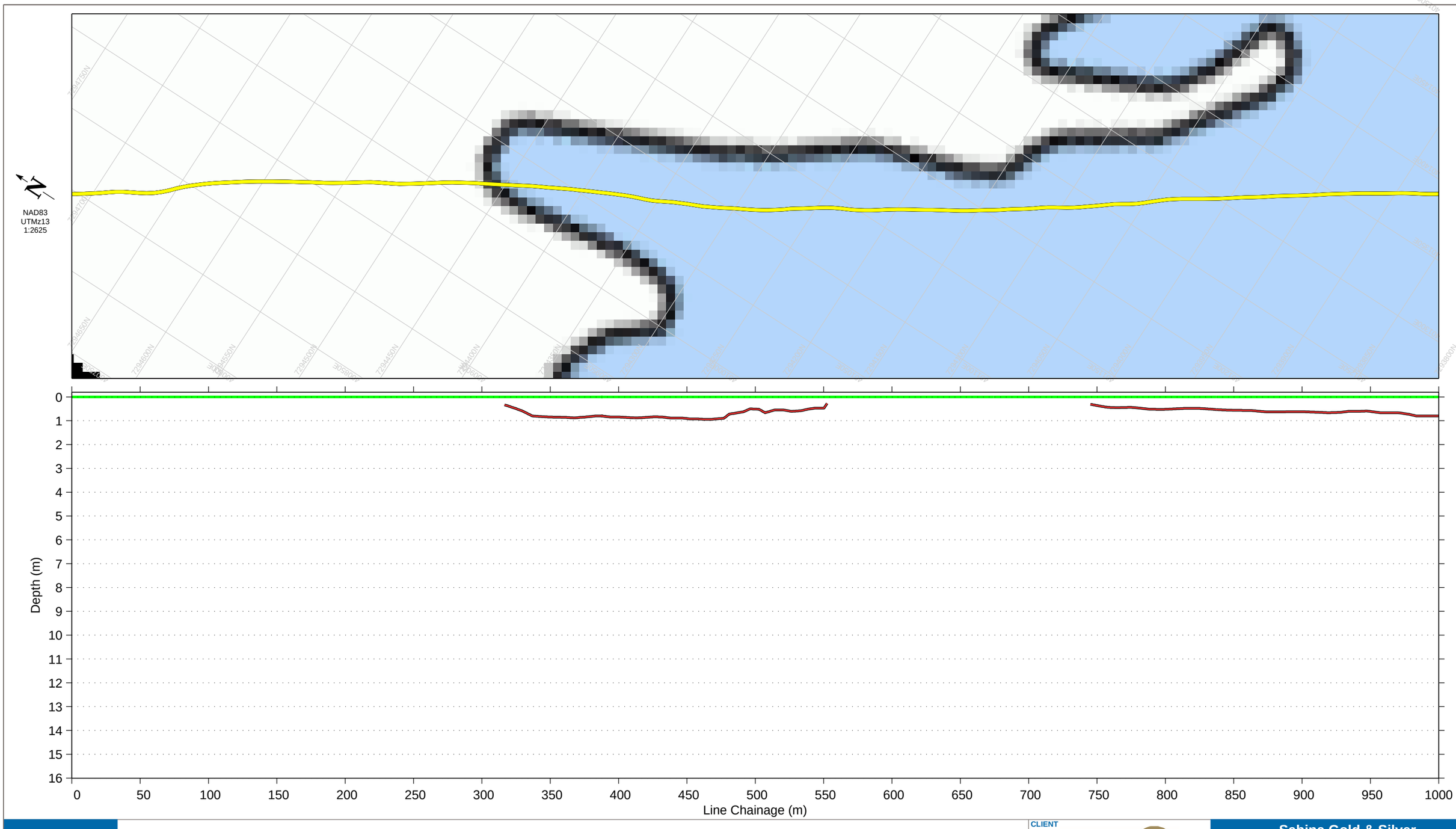
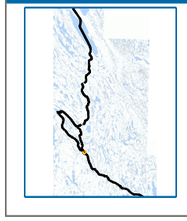
OFFICE	DATE
Edmonton	June 14, 2013

Figure C3.3





LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
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- Floating Ice
- Water Bottom

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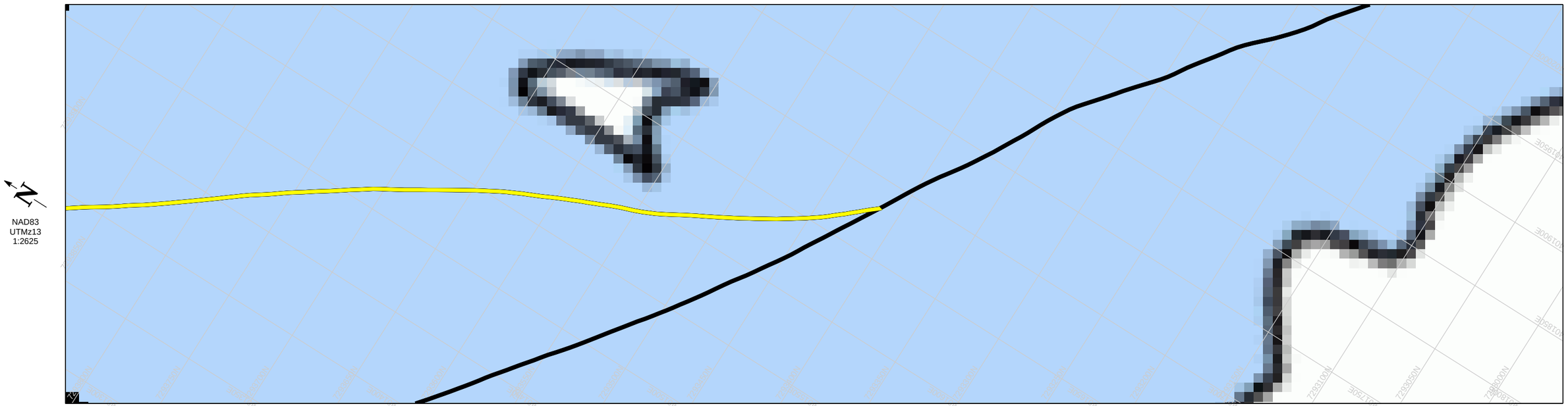
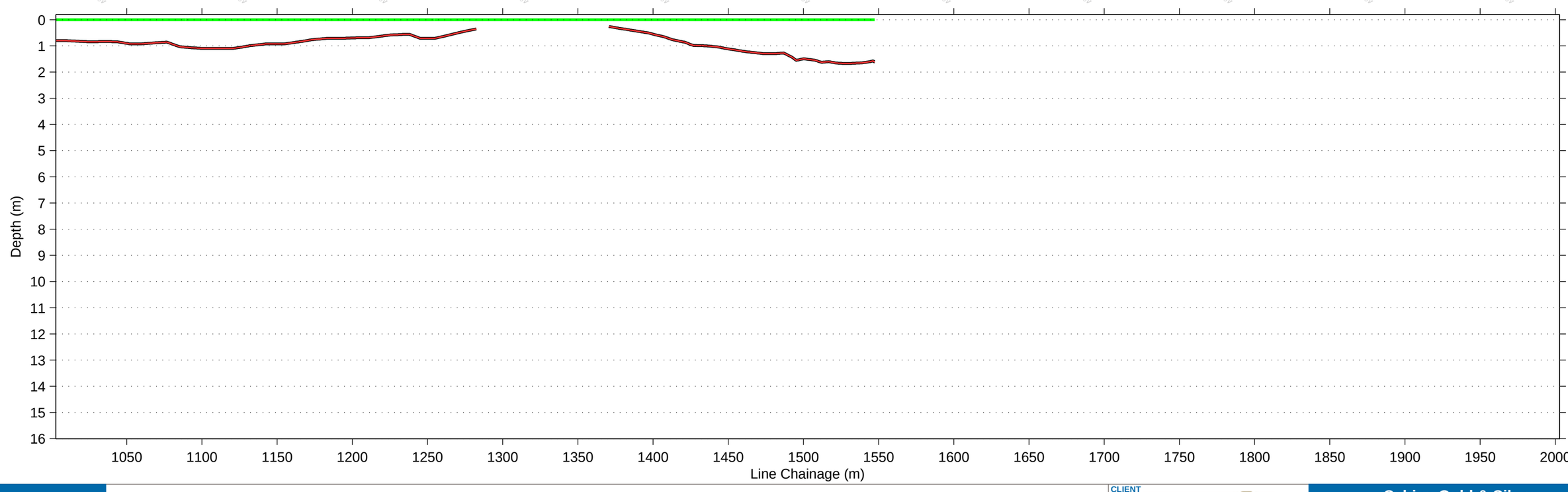
Winter Road Option – Major Lake Profiles
Northern to Southern Junction
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure C4.1





LEGEND

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V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
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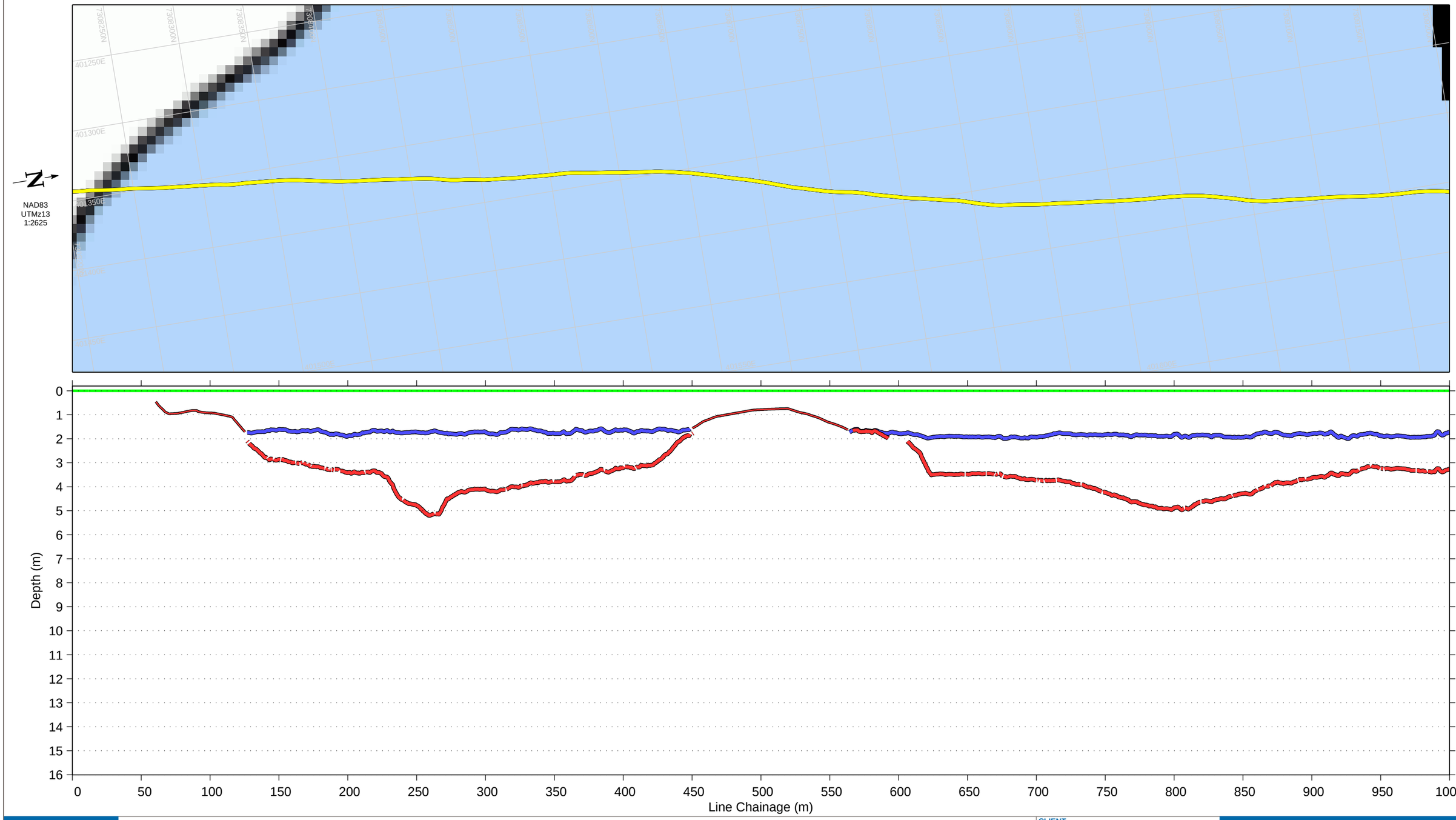
Figure C4.2



LEGEND

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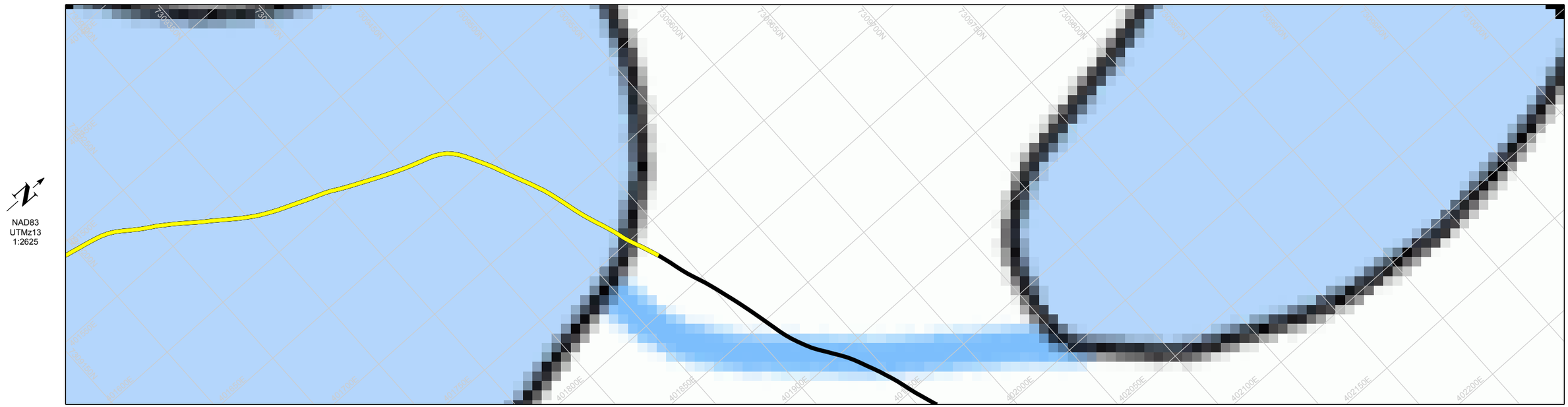
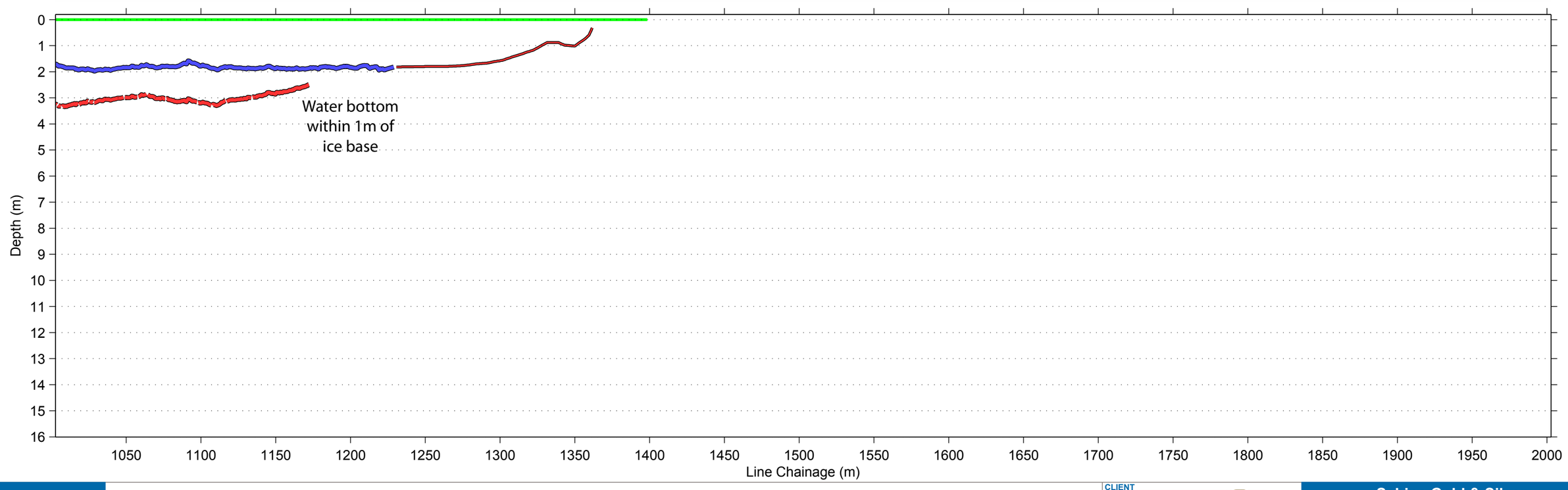
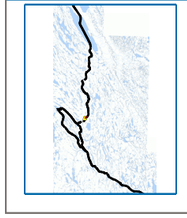
Figure D1.1







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V33103008.E111	RJM	CB	RJM	0

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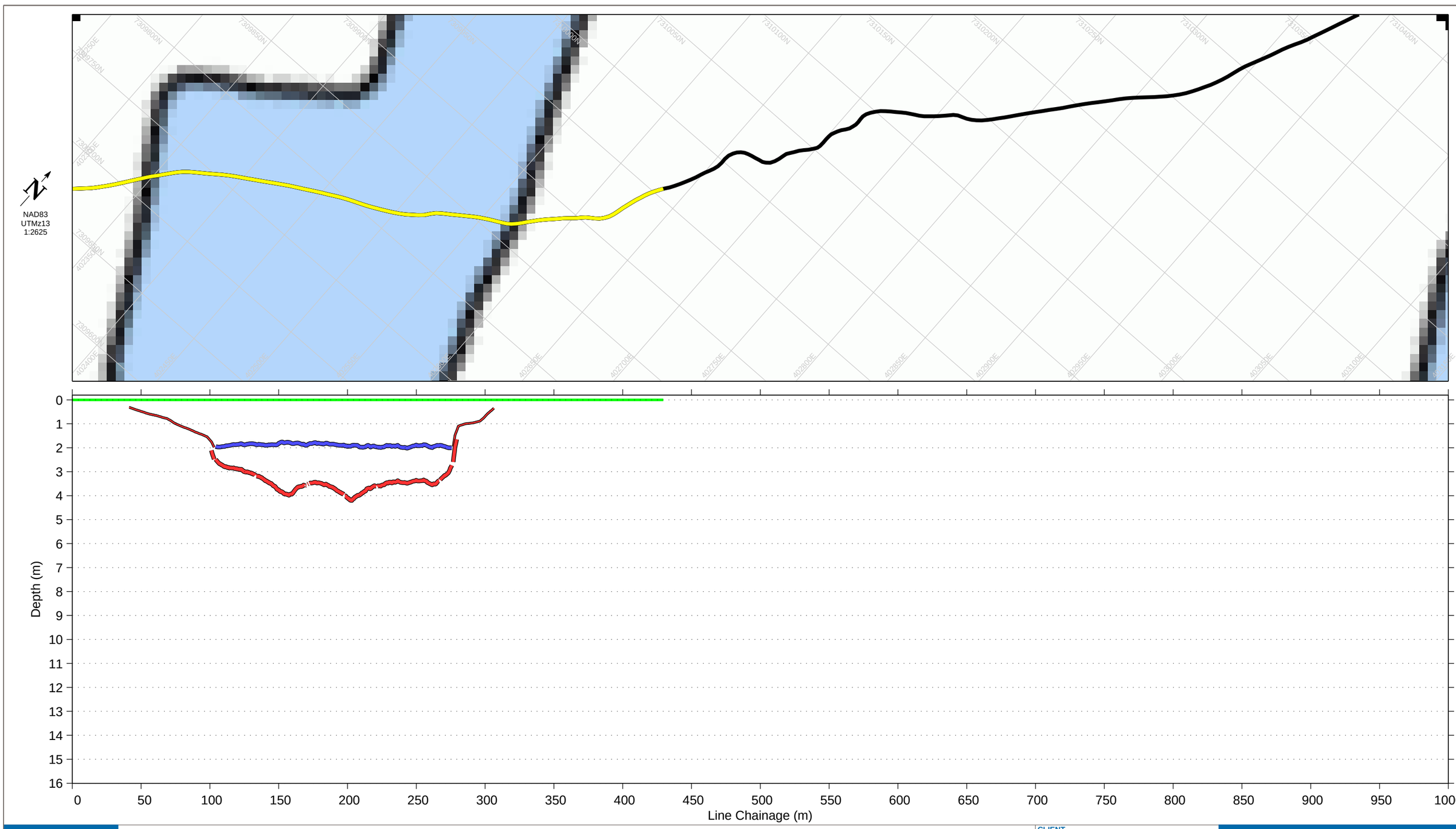
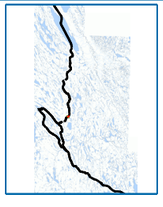
Figure D1.2





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V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
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Figure D2

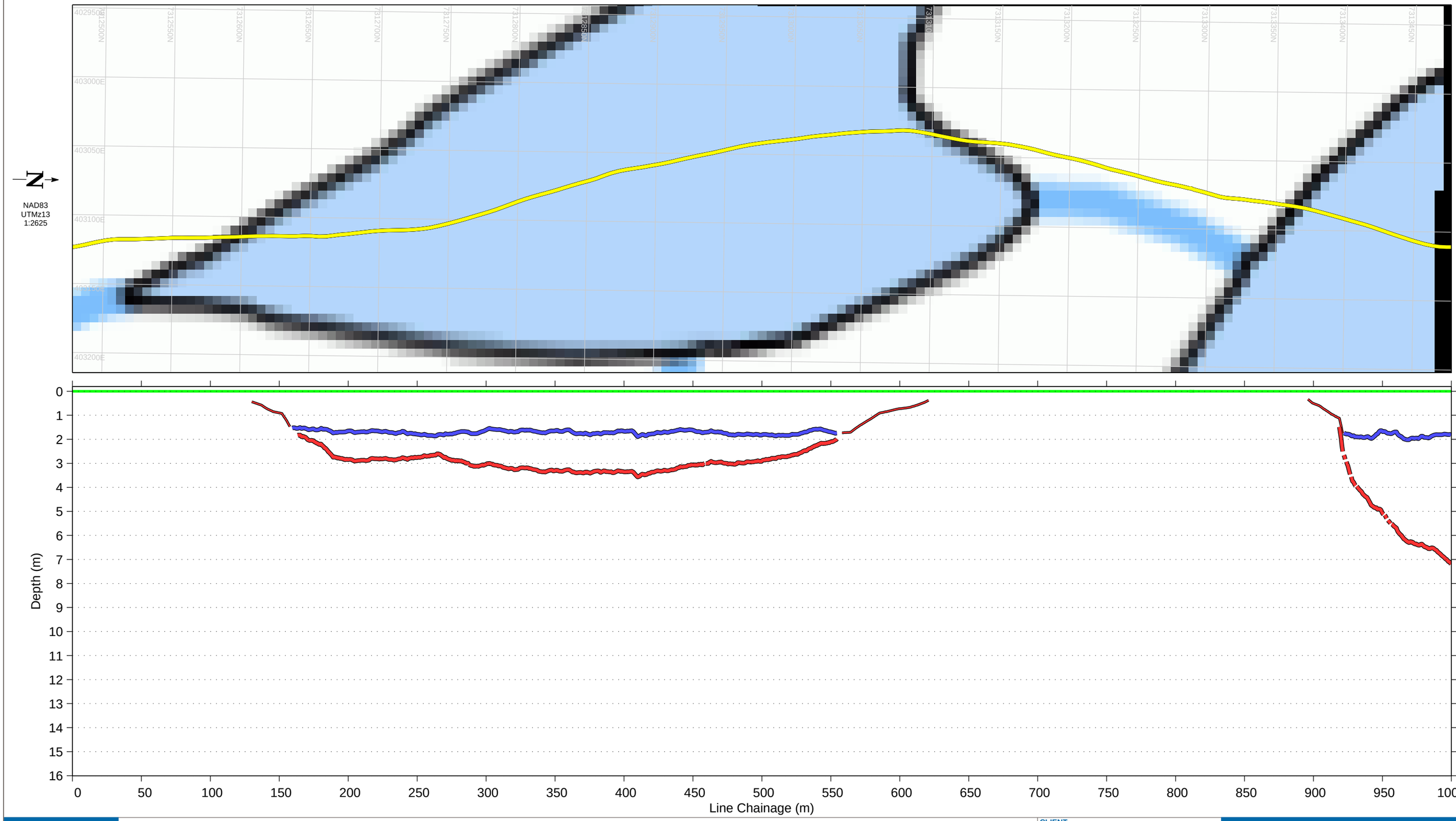

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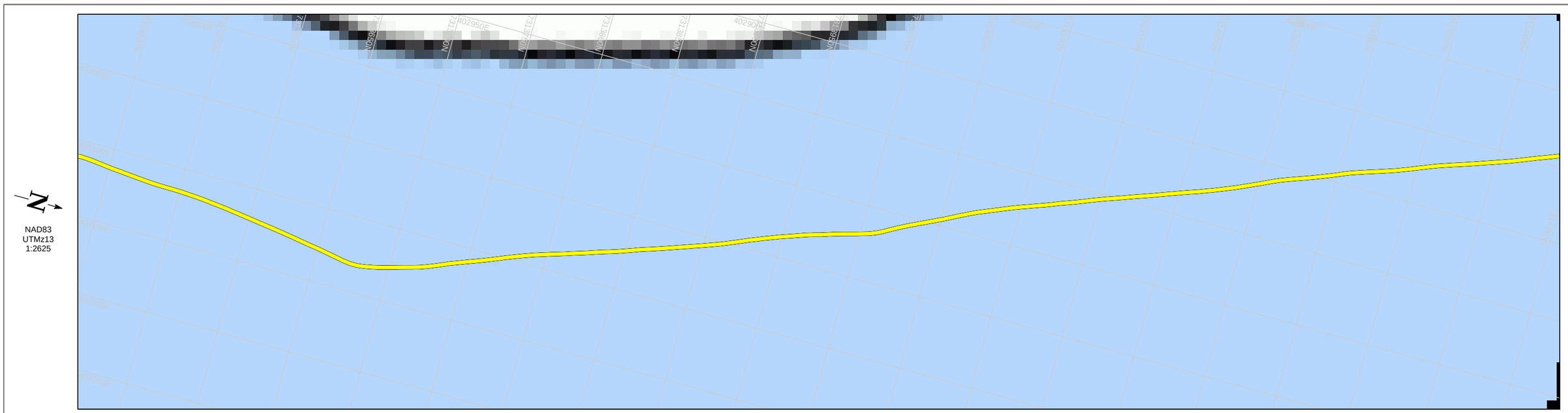
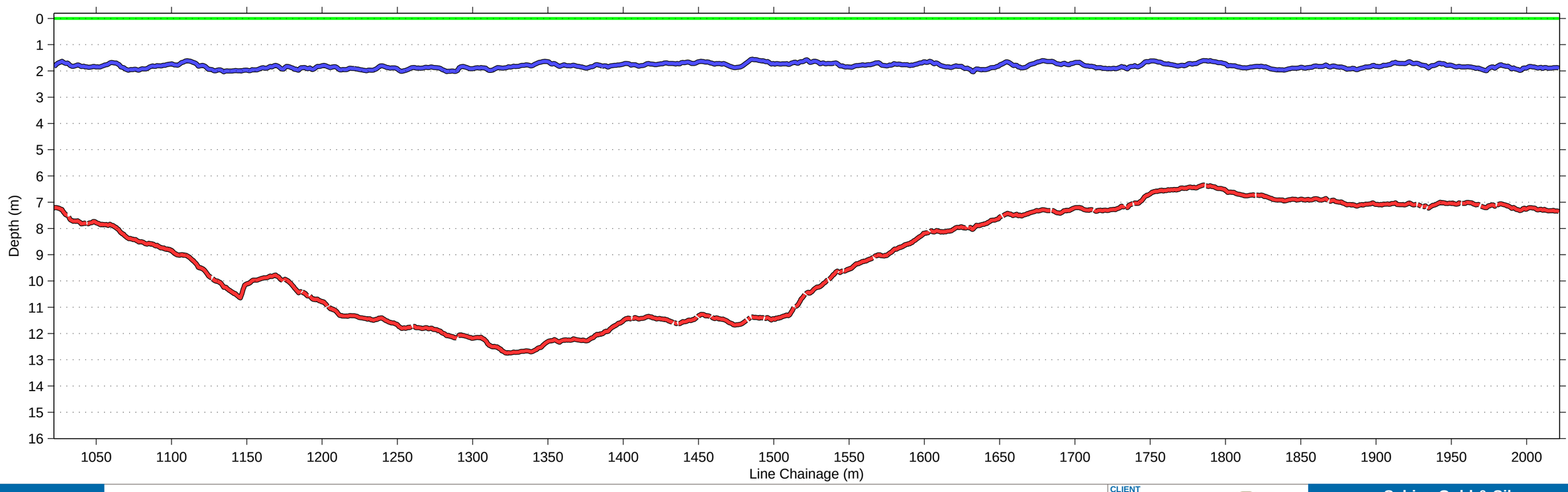
Figure D3.1





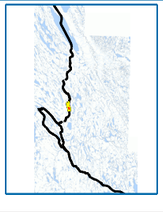


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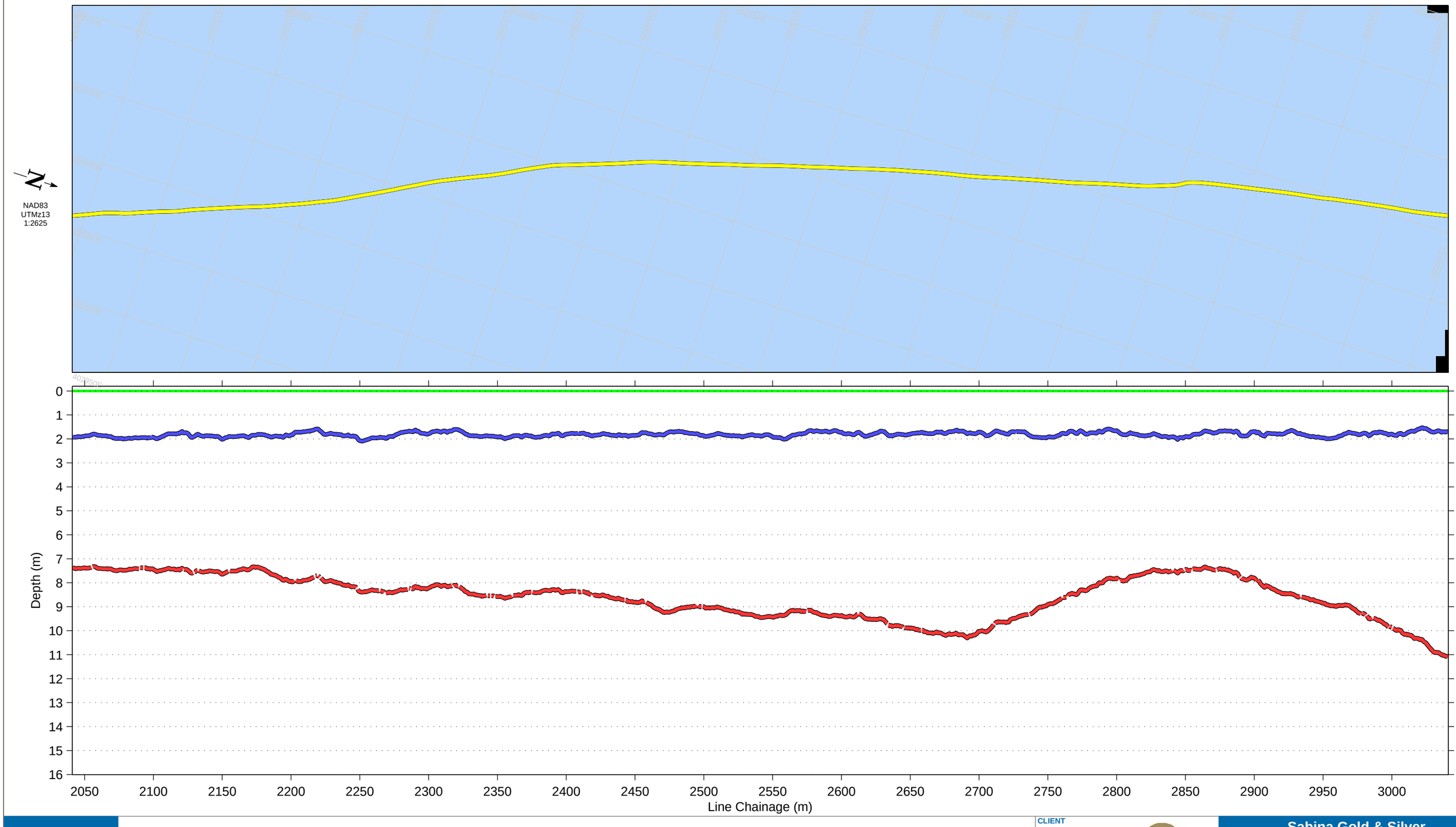
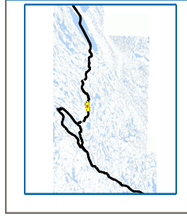
Figure D3.2





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OFFICE	DATE
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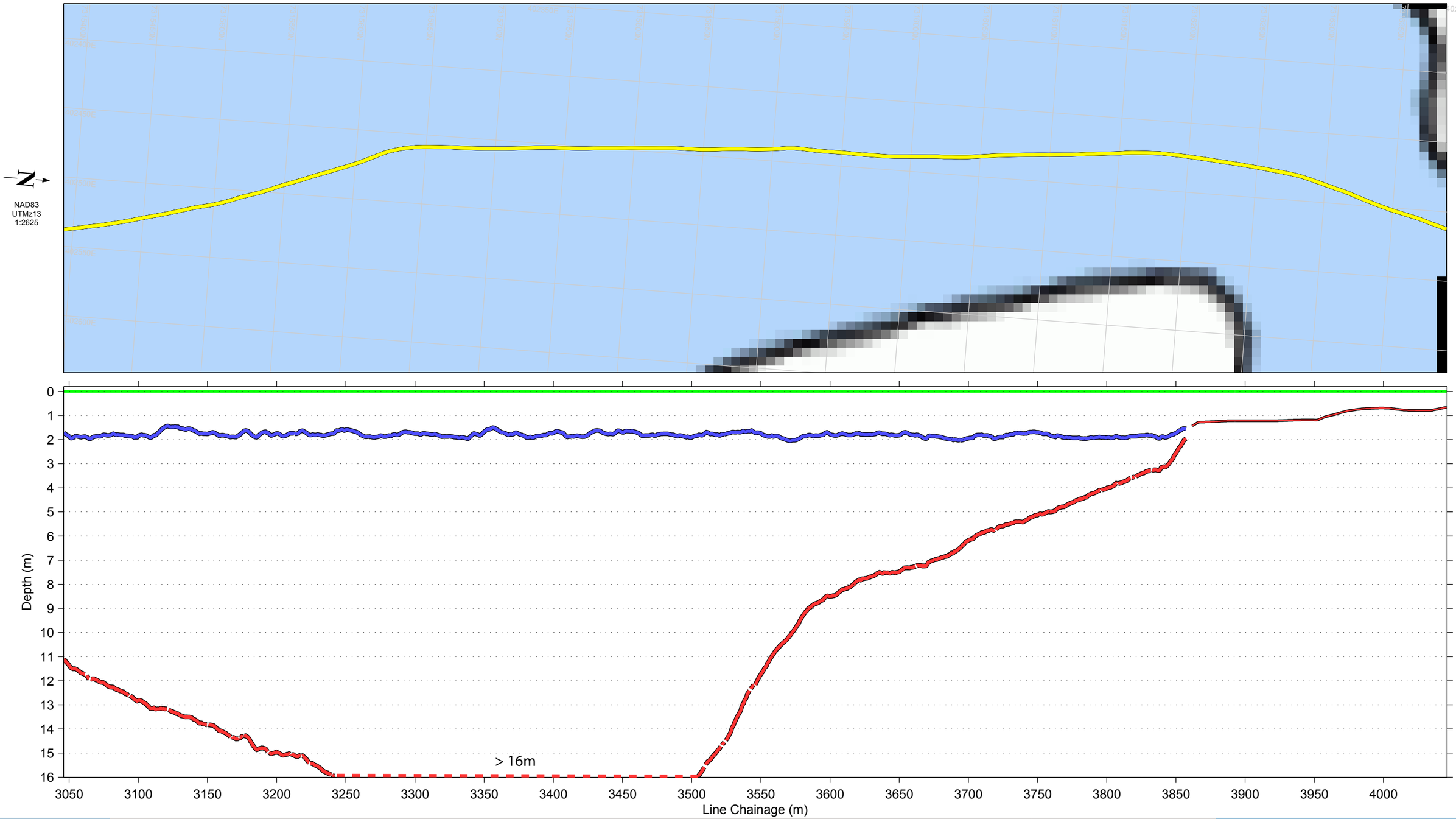
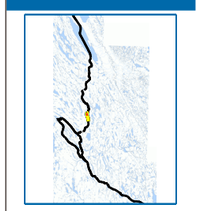
Figure D3.3





LEGEND

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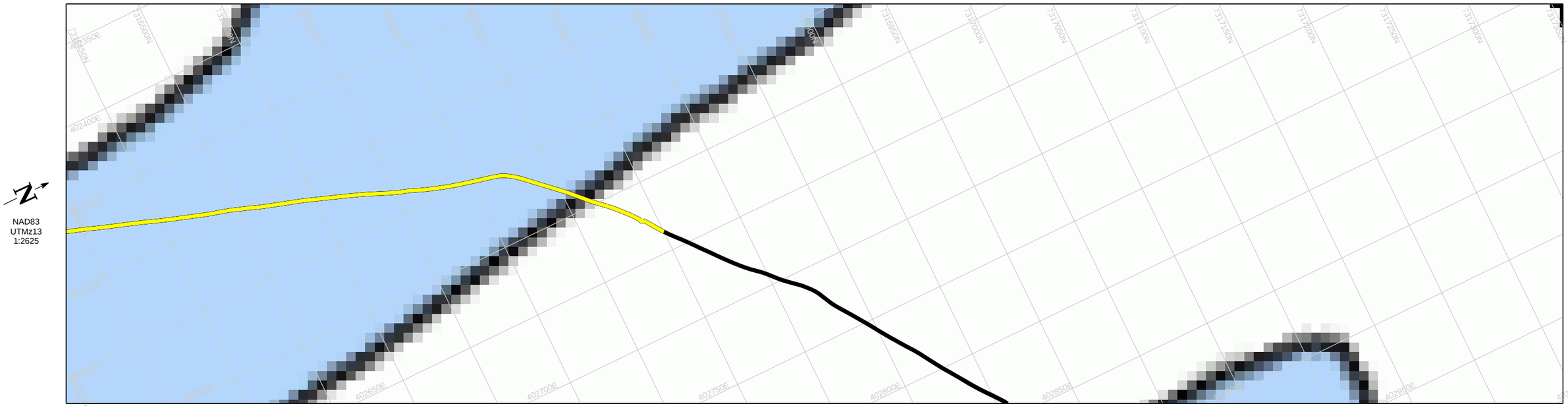
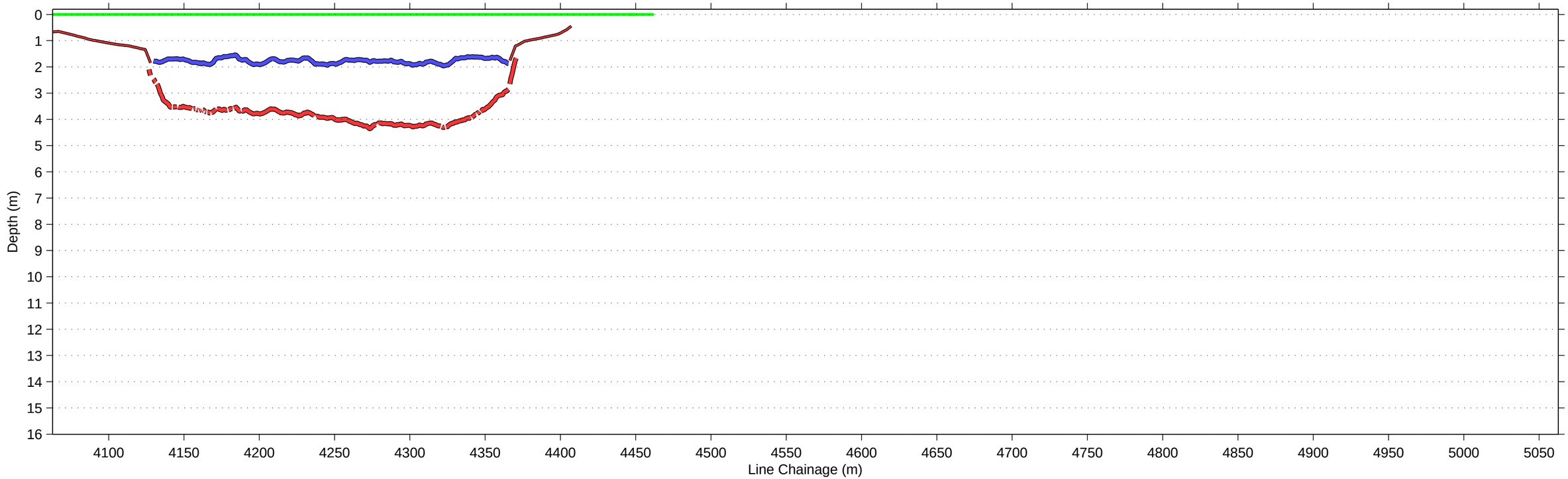
Figure D3.4





LEGEND

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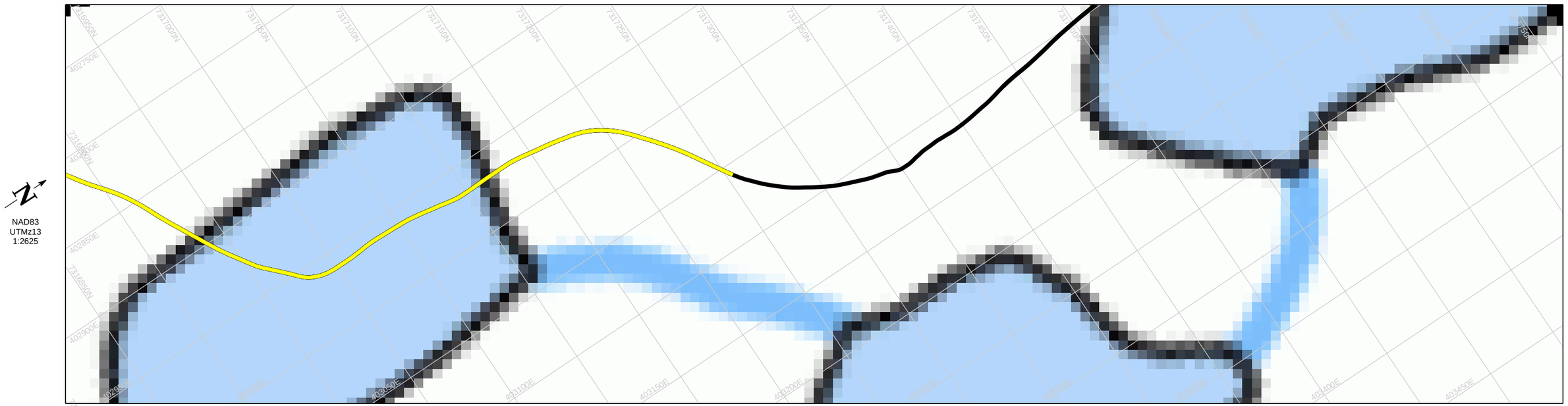
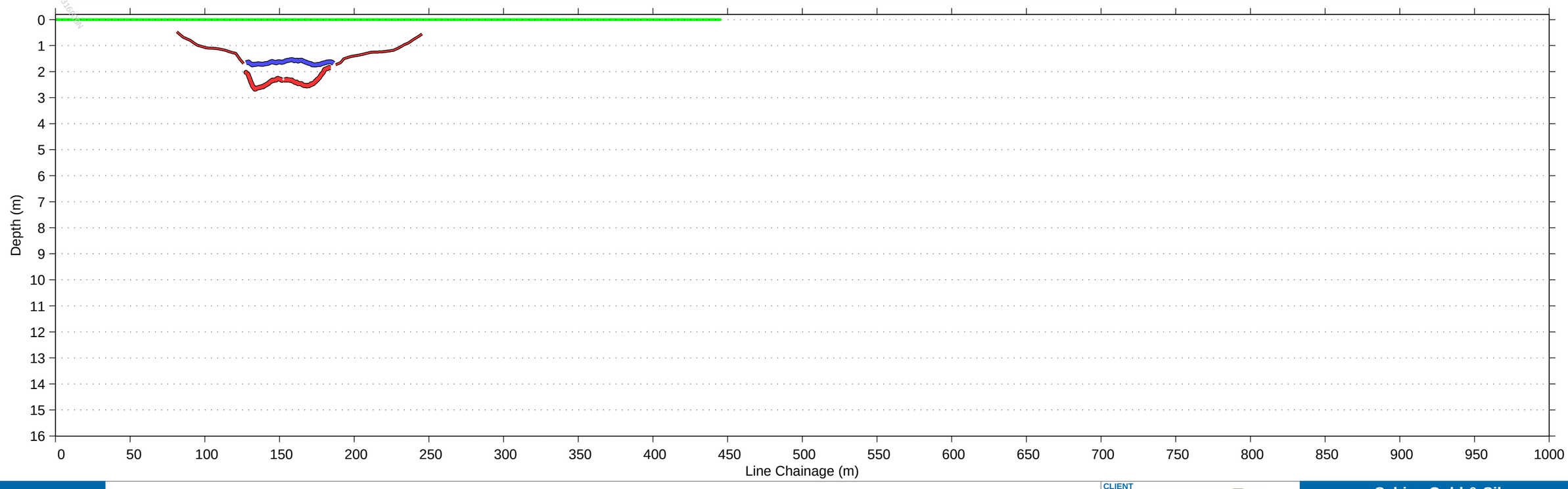
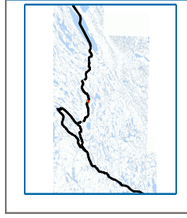
Figure D3.5







LEGEND

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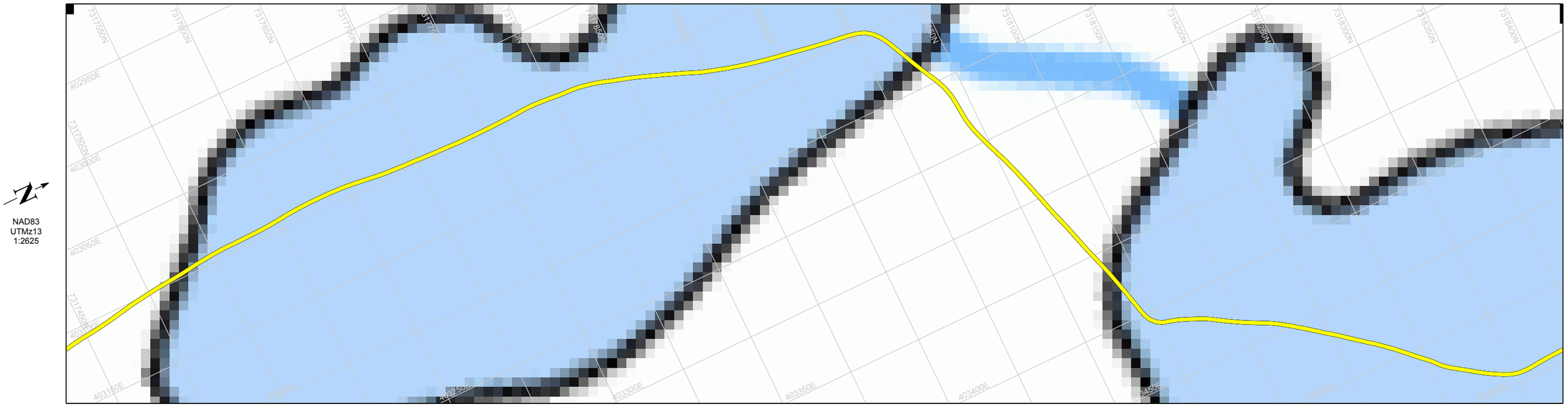
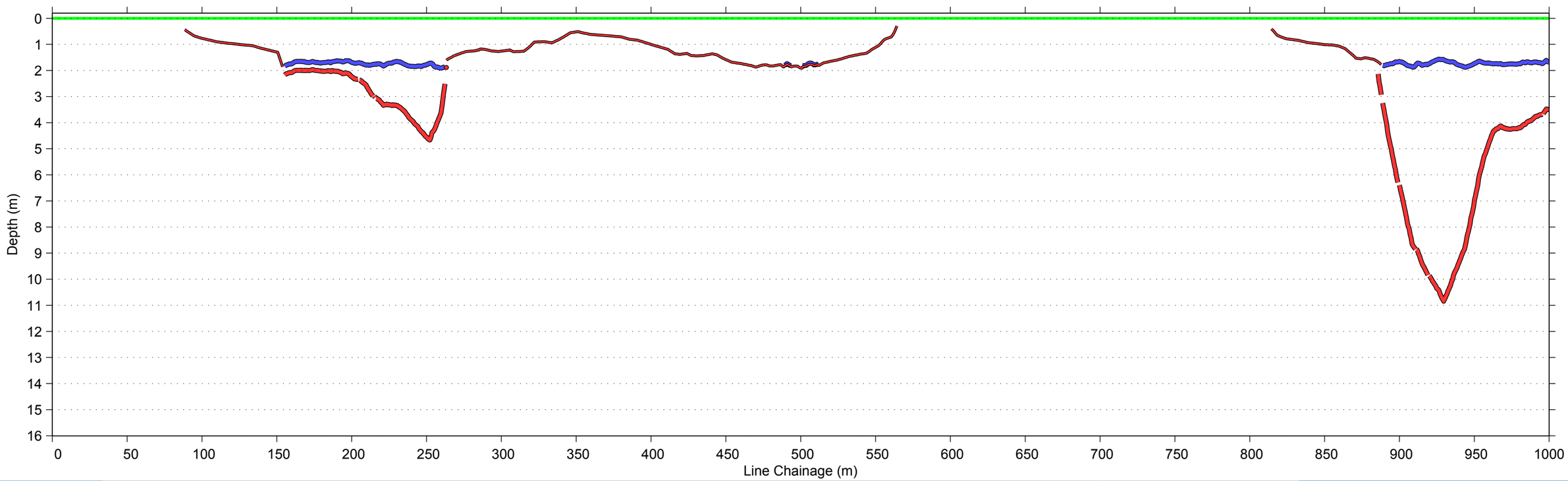
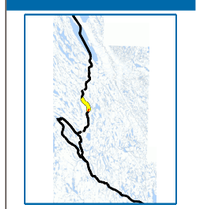
Figure D4







LEGEND

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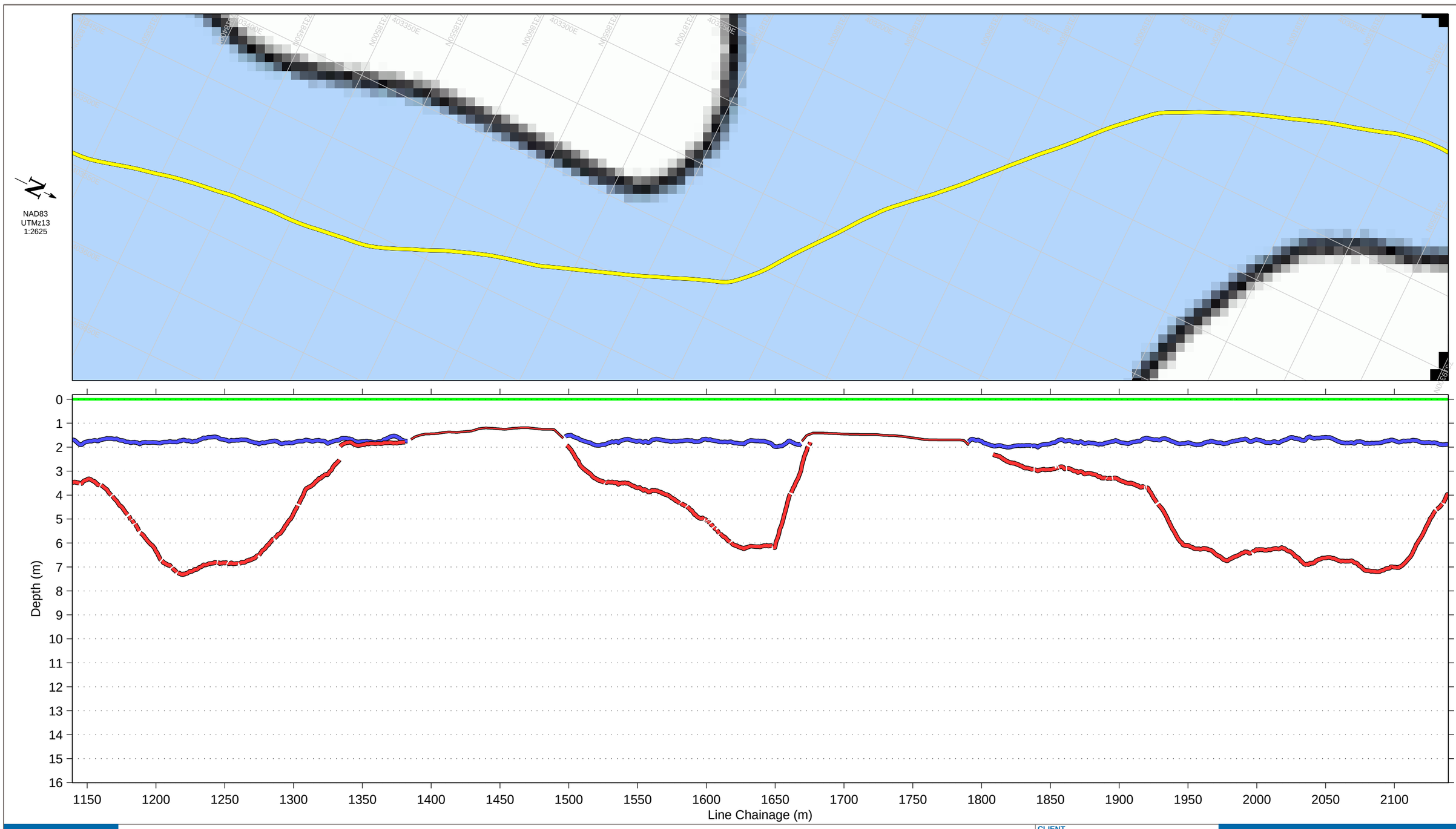
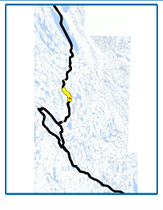
Figure D5.1





LEGEND

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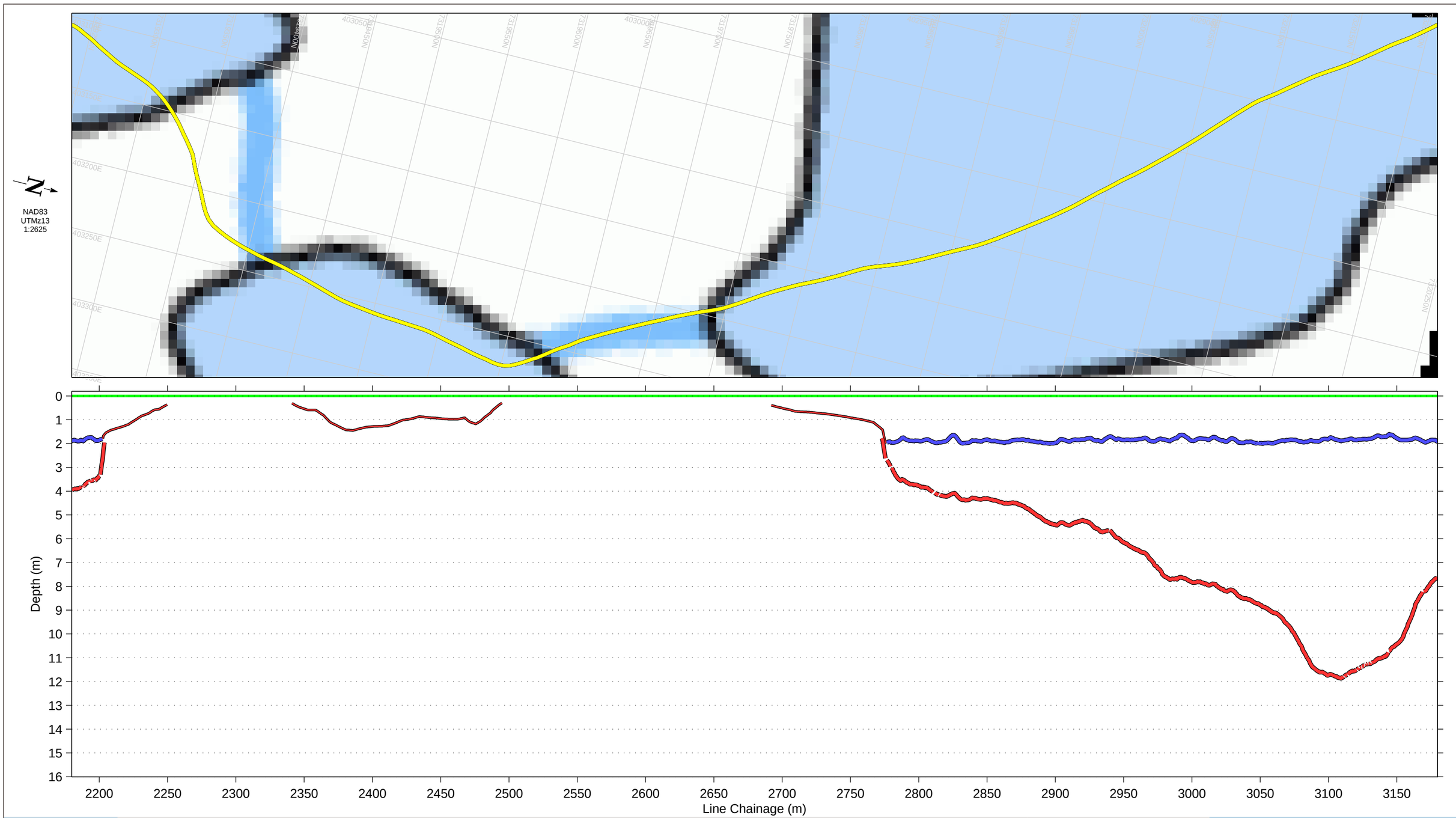
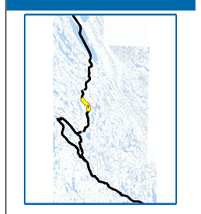
Figure D5.2





LEGEND

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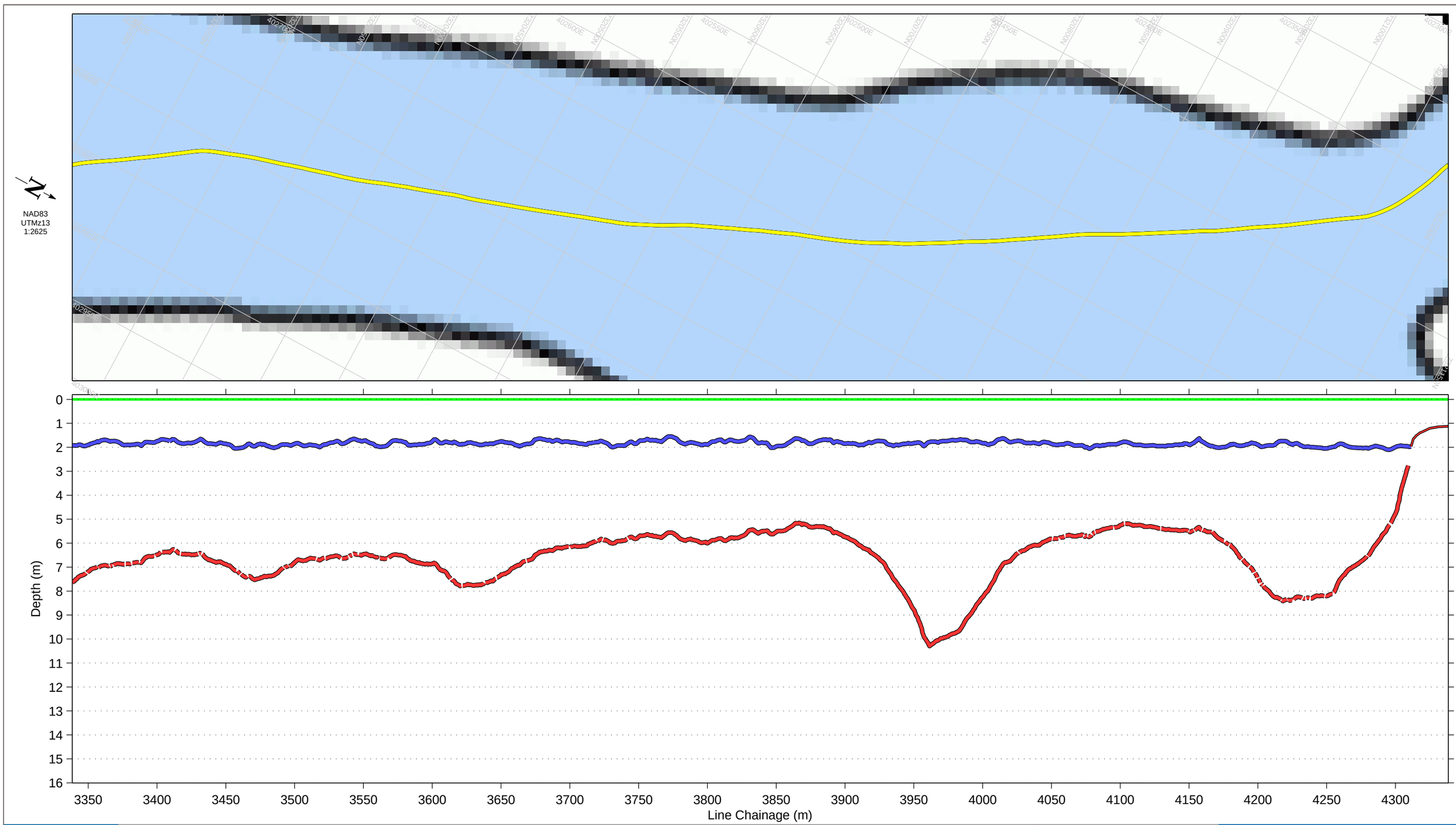
Figure D5.3



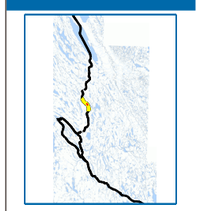


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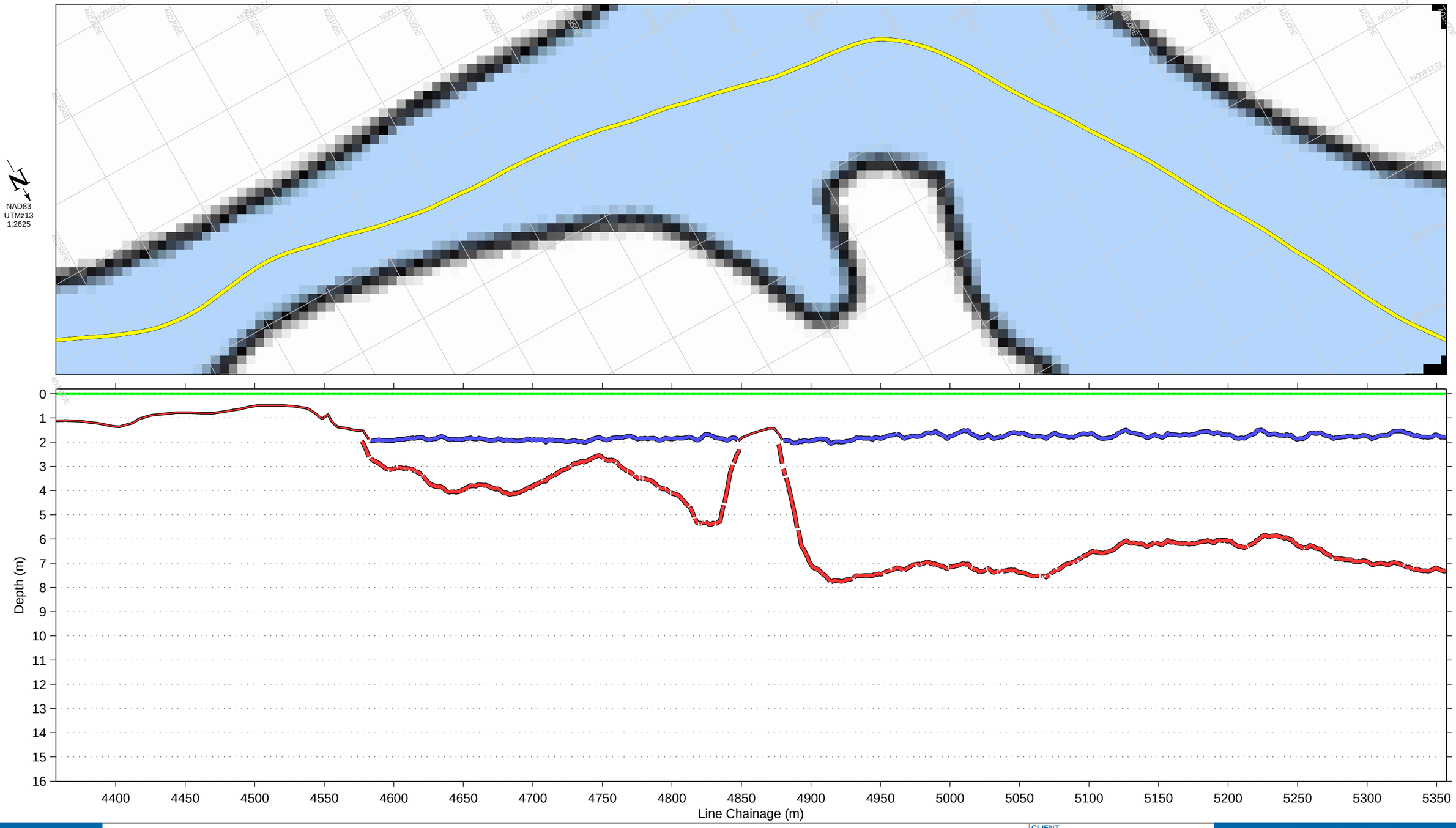
Figure D5.4



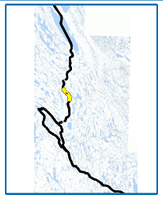


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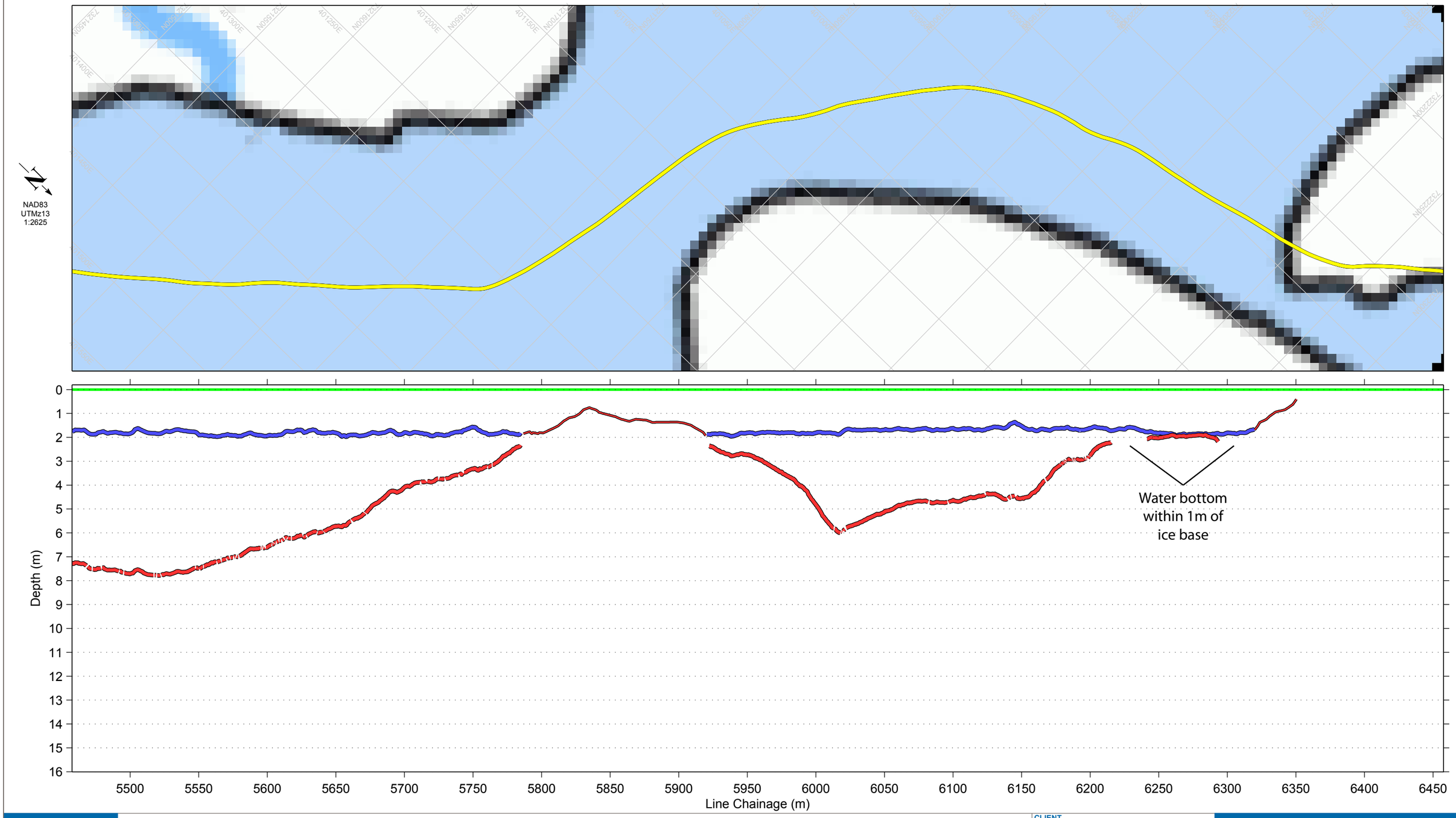
Figure D5.5



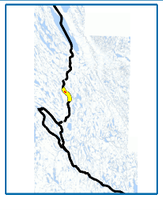


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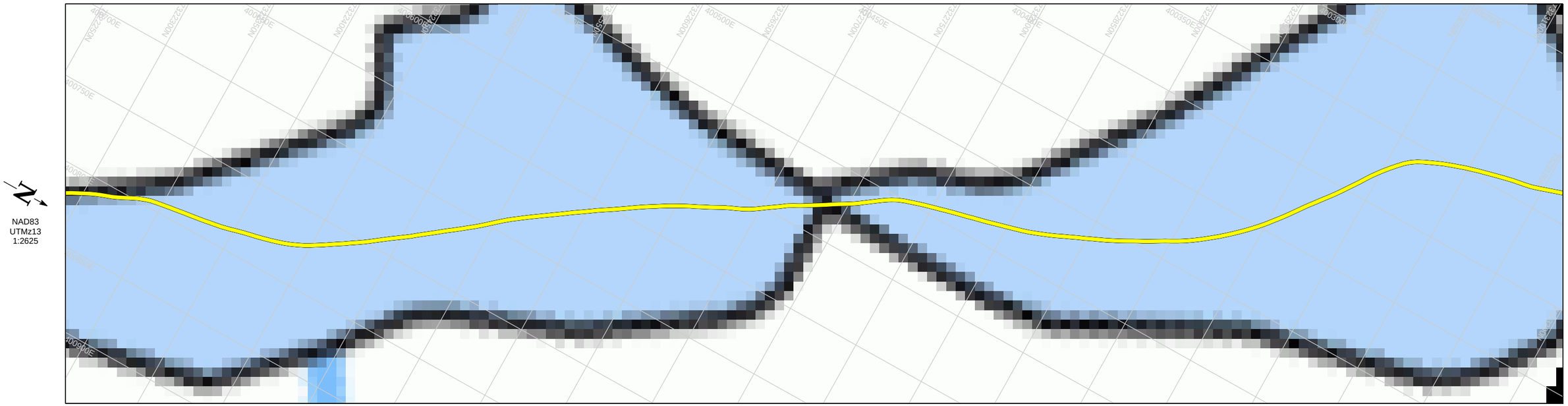
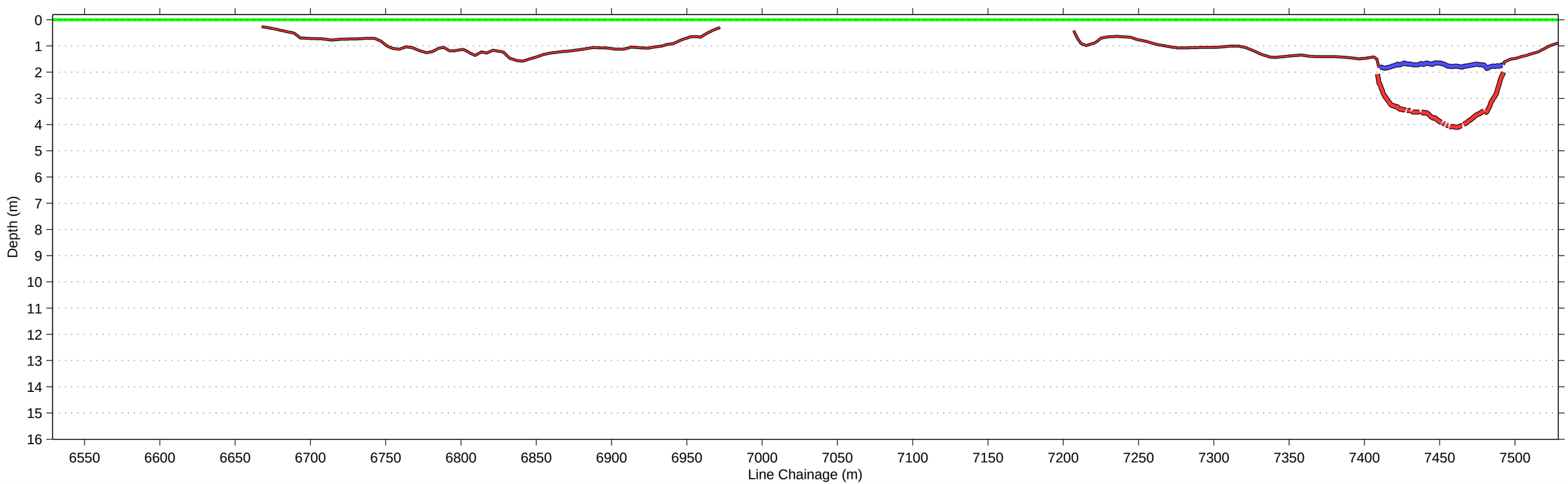
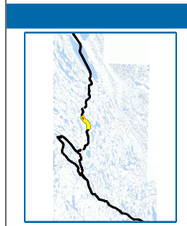
Figure D5.6







LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
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Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
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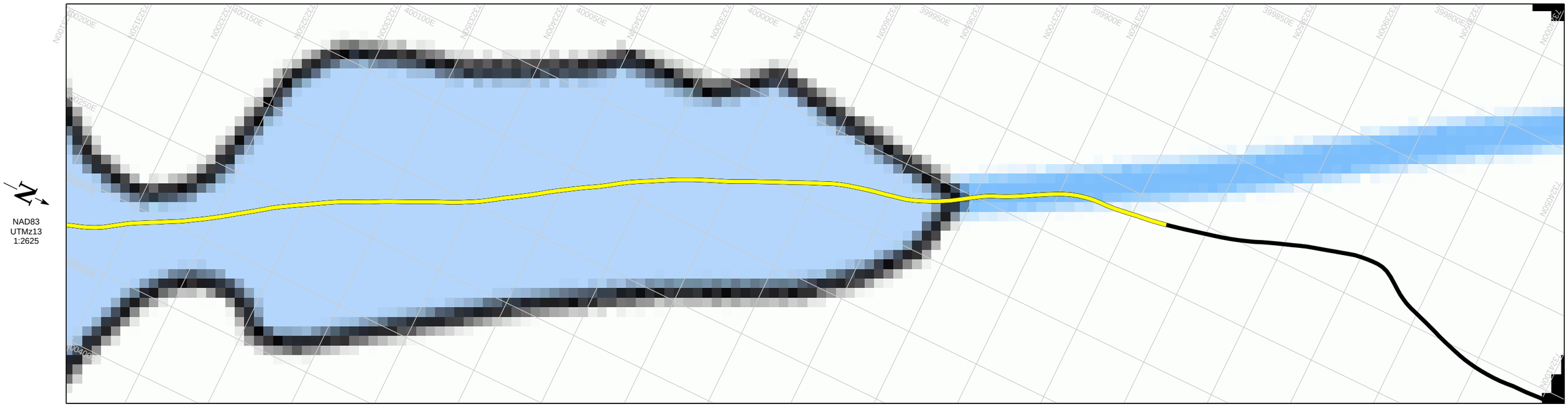
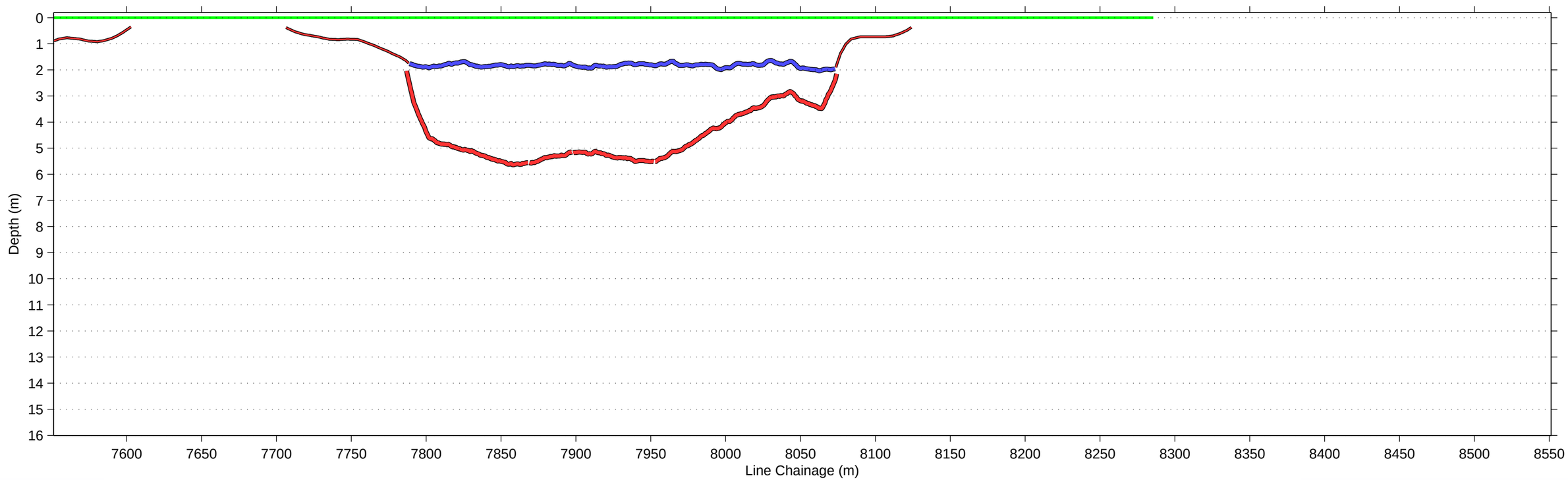
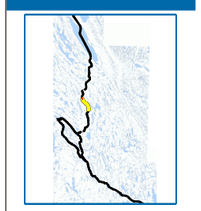
Figure D5.7







LEGEND

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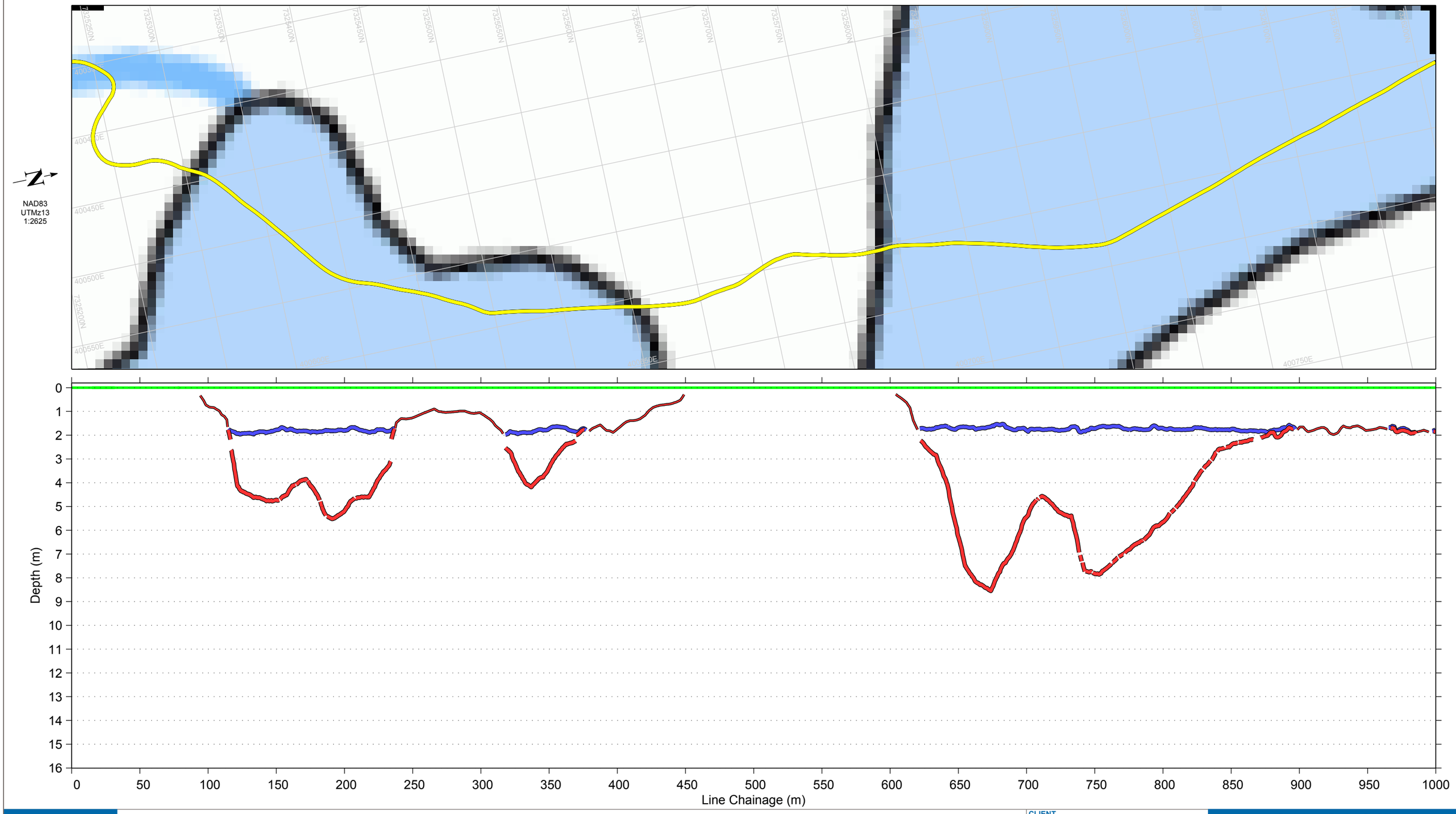
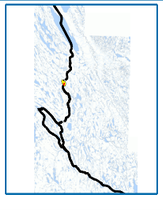
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure D5.8





LEGEND

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V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
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Figure D6.1

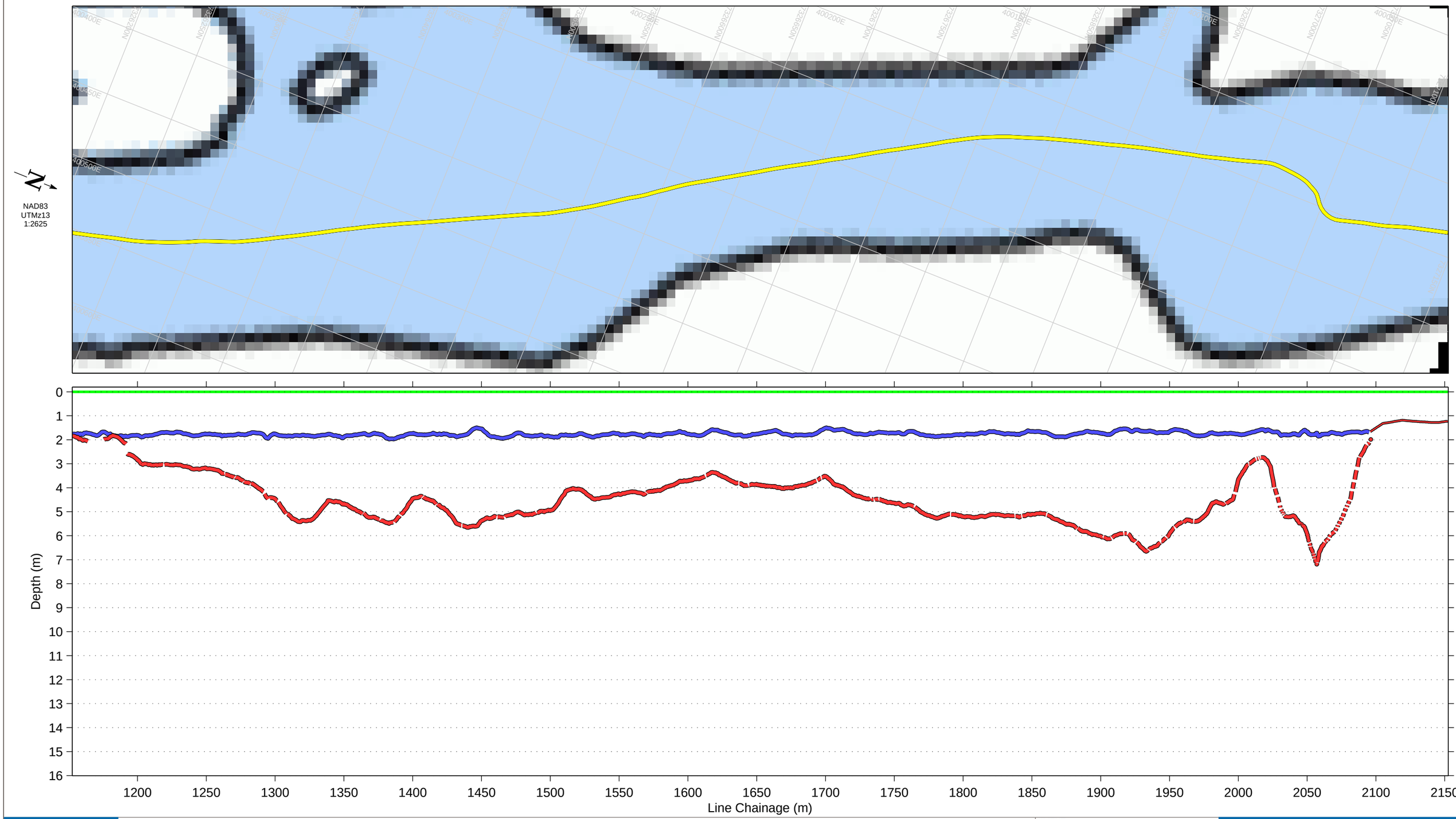

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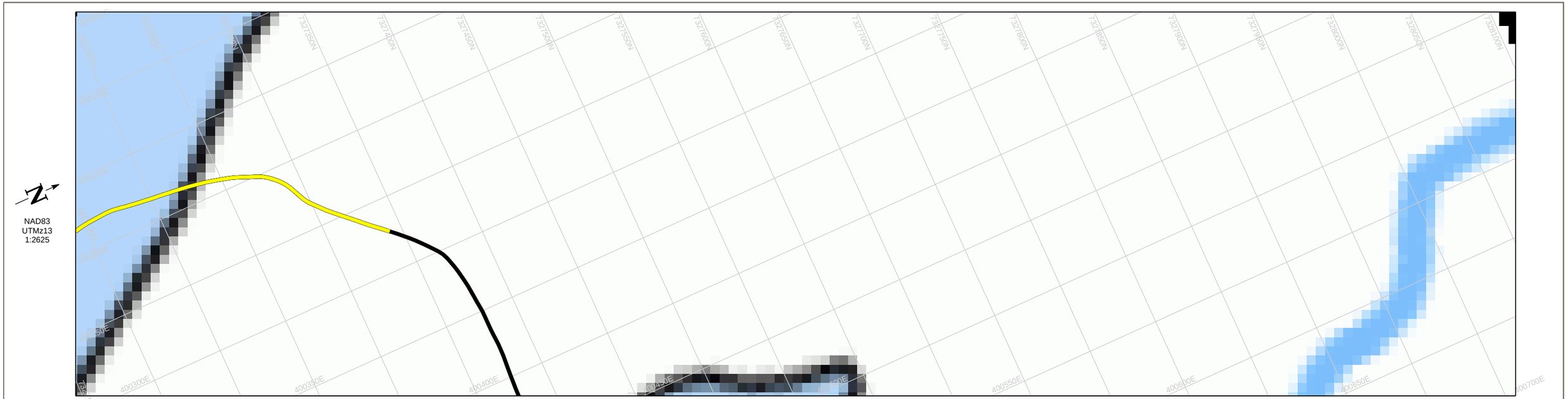
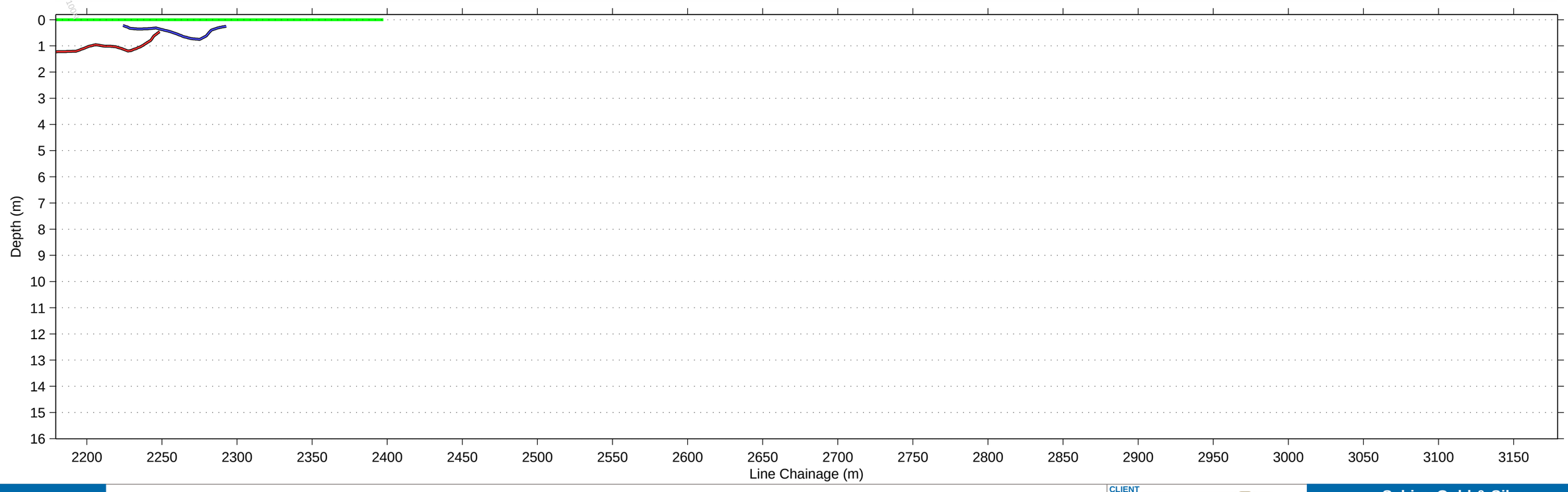
Figure D6.2





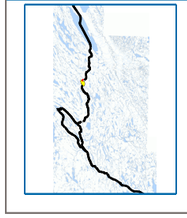


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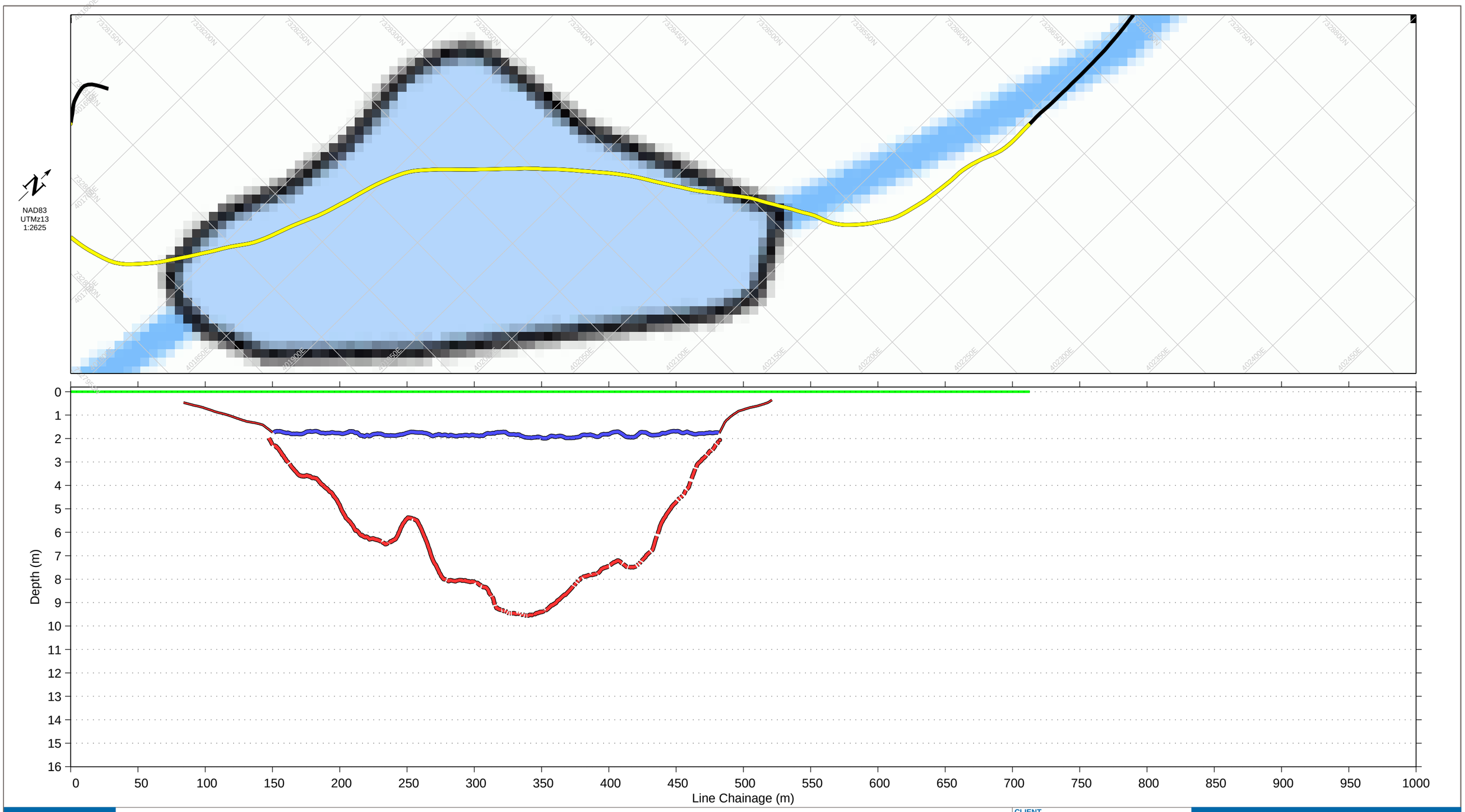
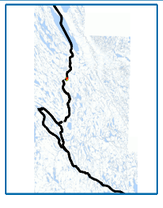
Figure D6.3





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V33103008.E111	RJM	CB	RJM	0

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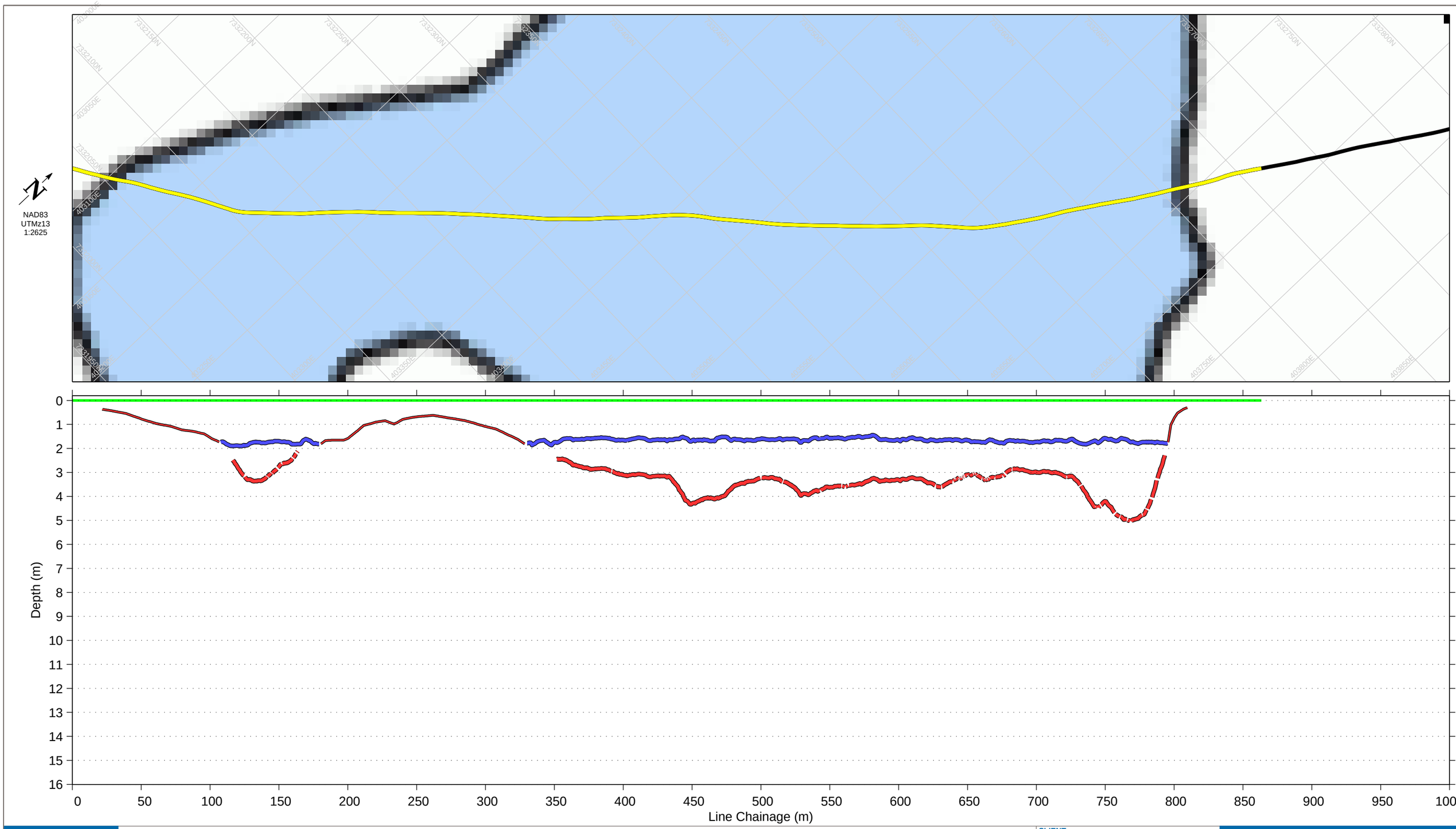
Edmonton	June 14, 2013

Figure D7



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V33103008.E111	RJM	CB	RJM	0

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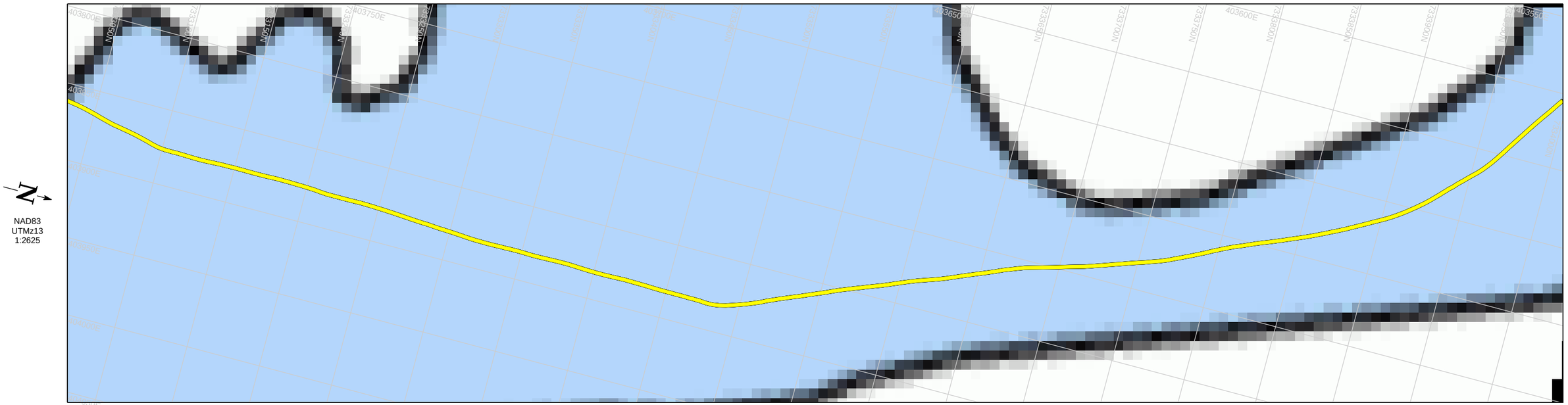
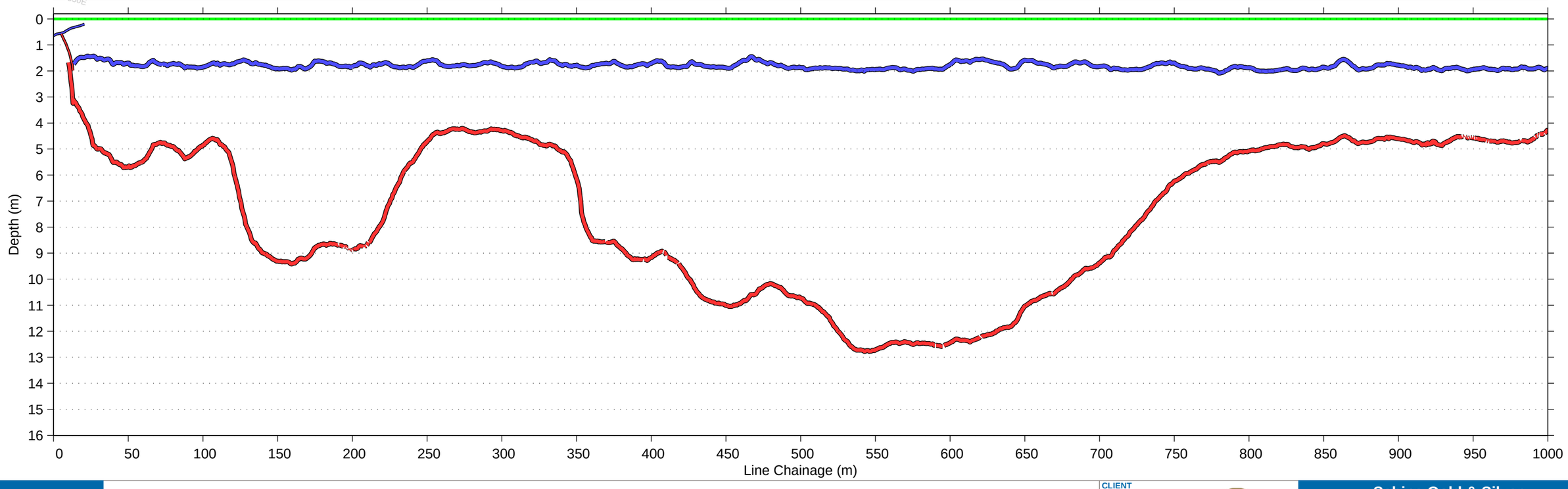
Figure D8





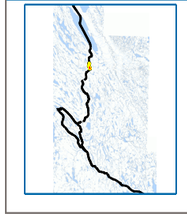


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Figure D9.1

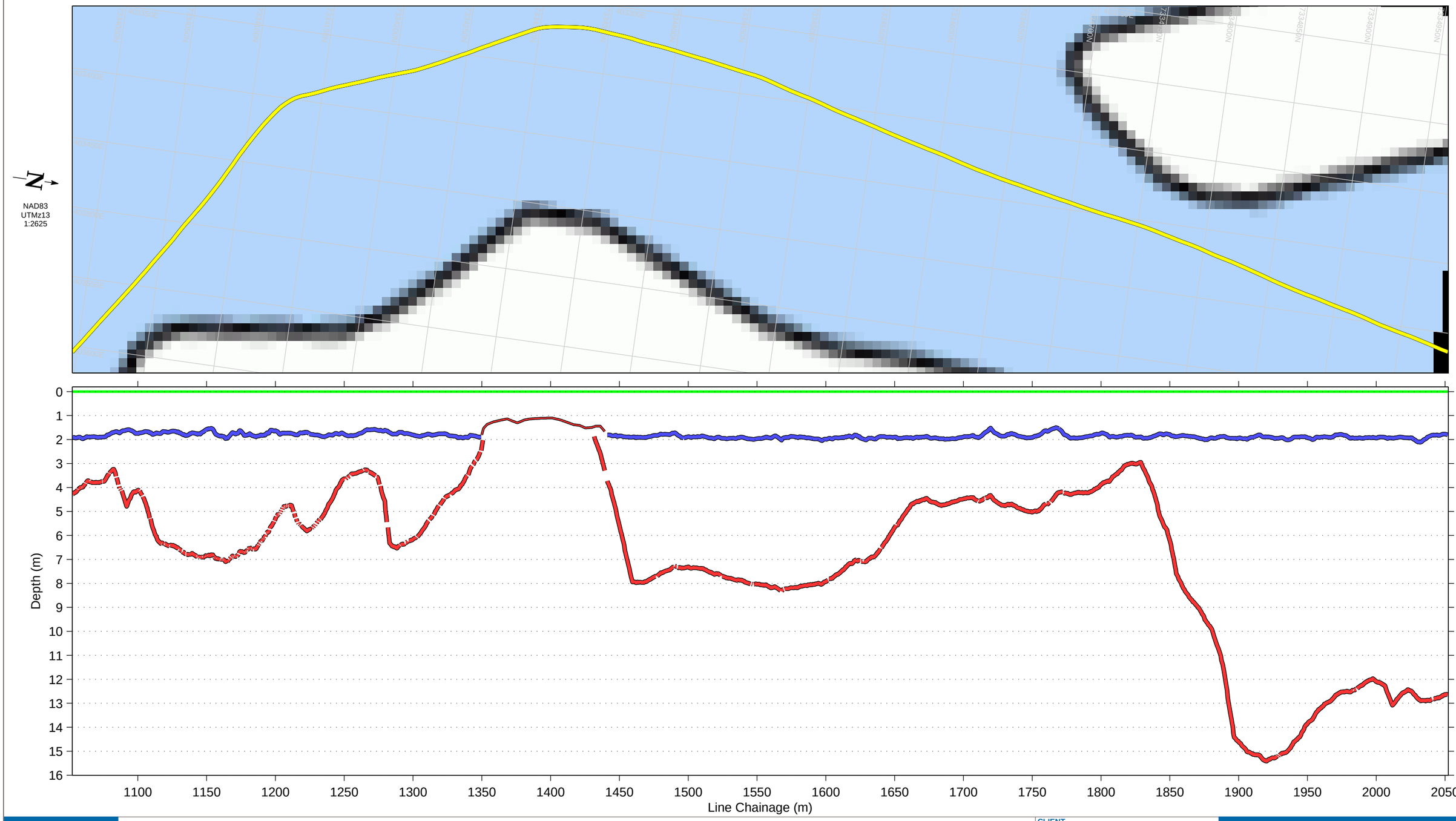

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Figure D9.2

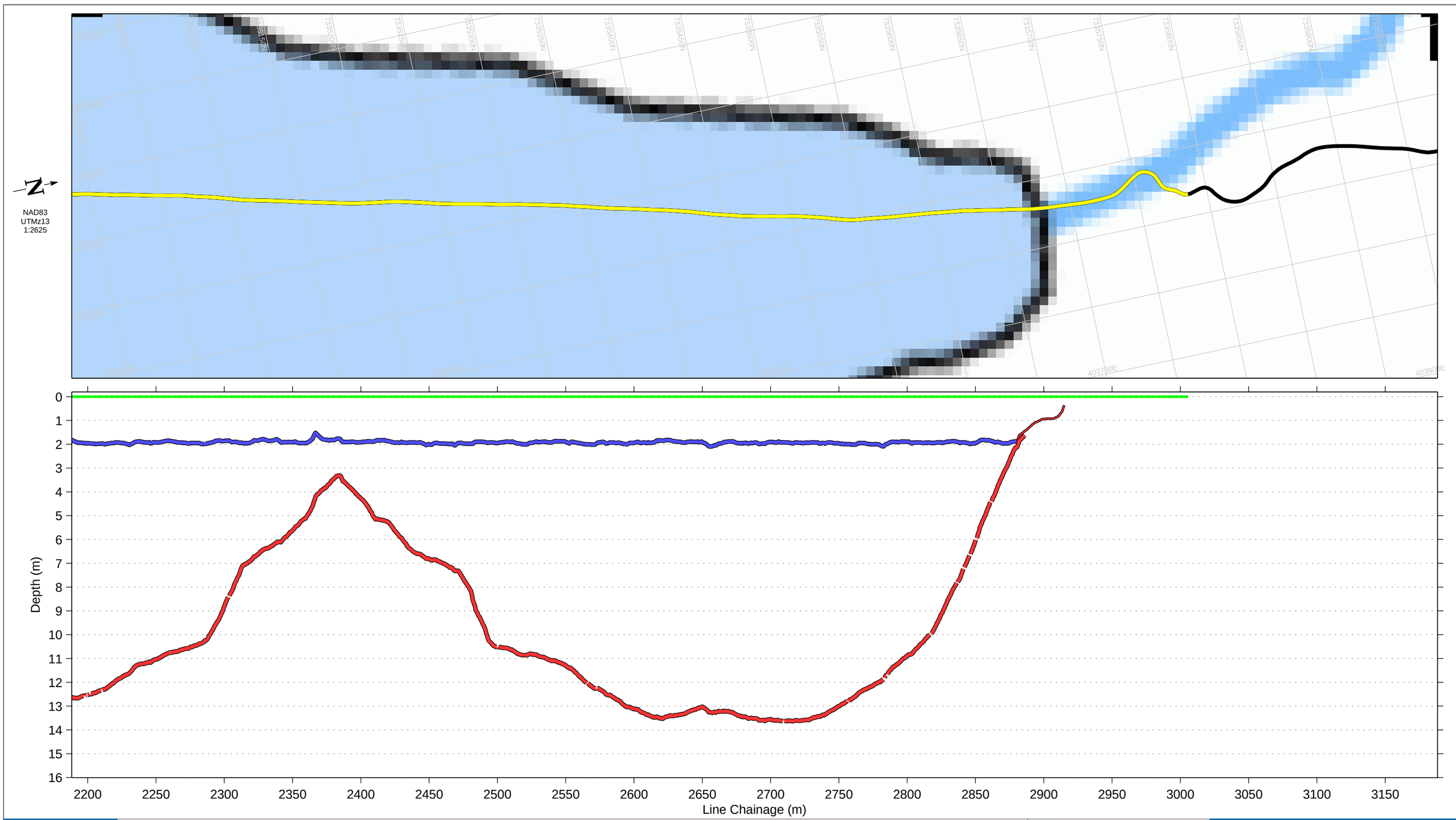

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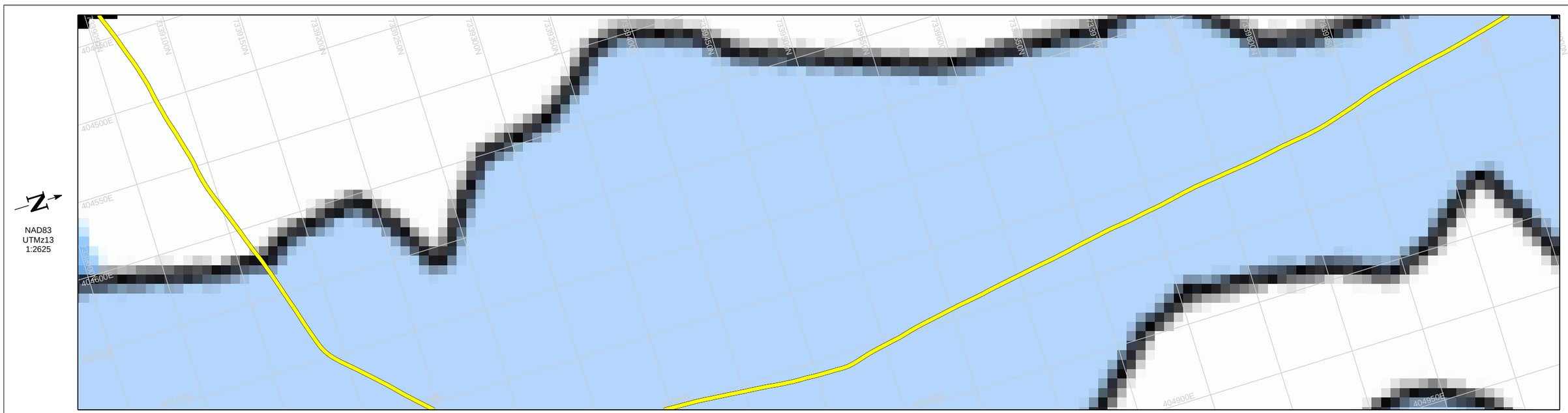
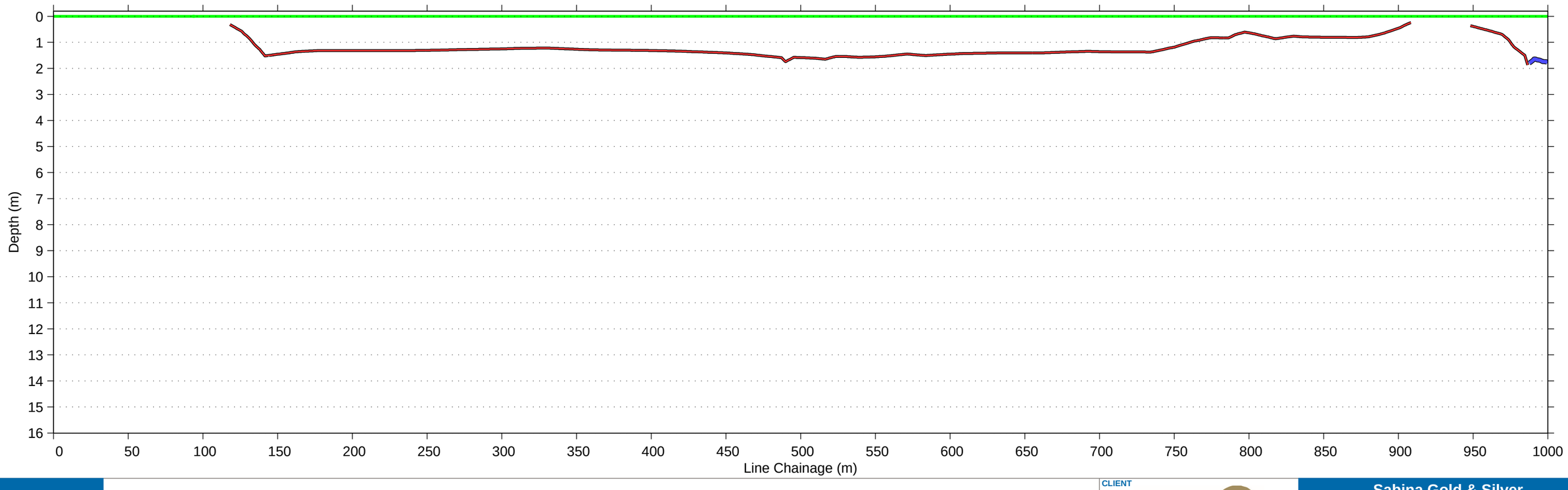
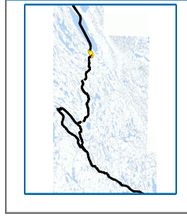
Figure D9.3







LEGEND

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V33103008.E111	RJM	CB	RJM	0

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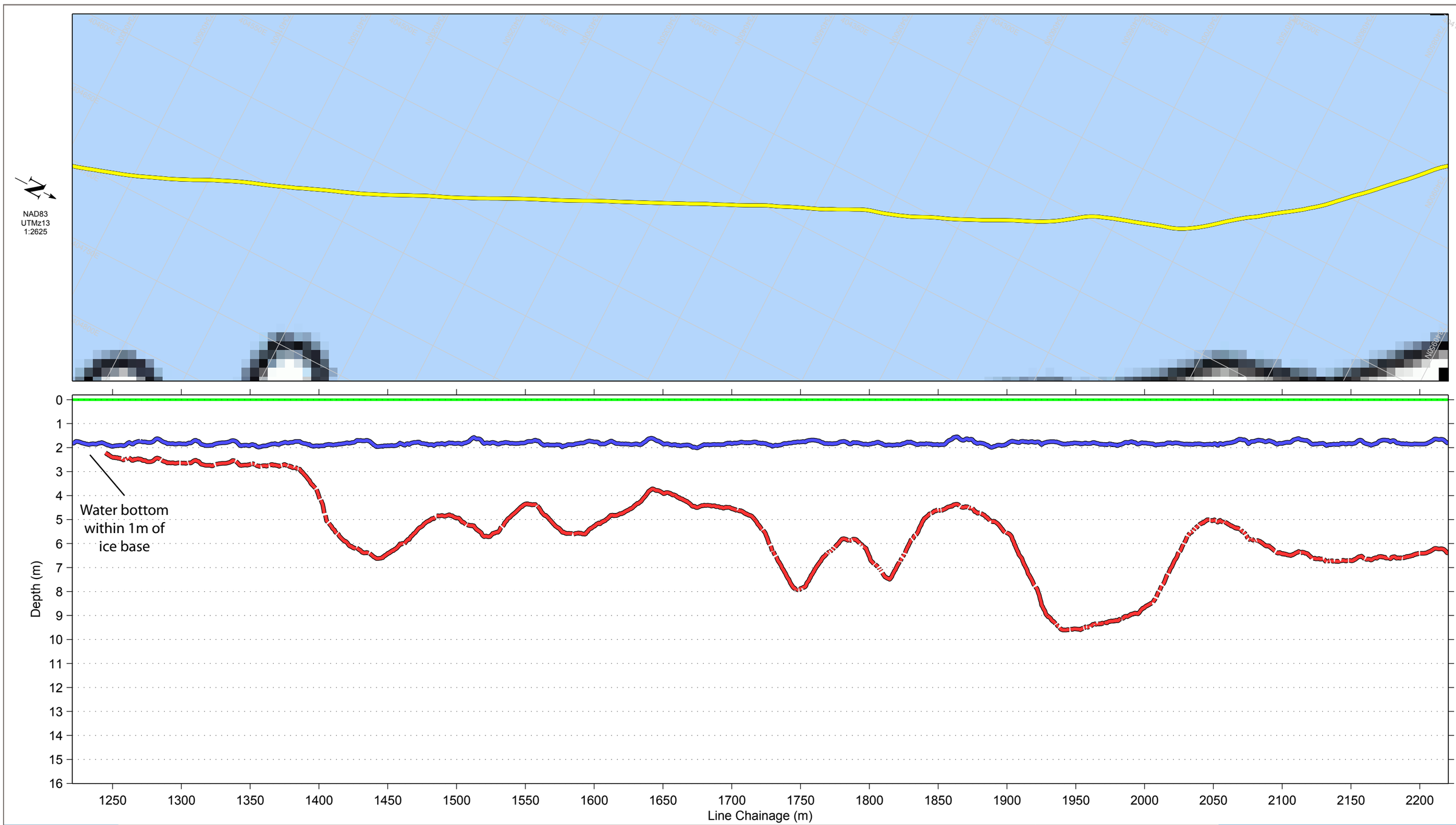
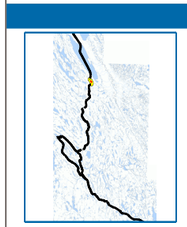
Figure D10.1





LEGEND

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OFFICE	DATE
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Figure D10.2

NAD83
UTMz13
1:2625

Depth (m)

Line Chainage (m)

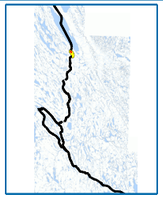

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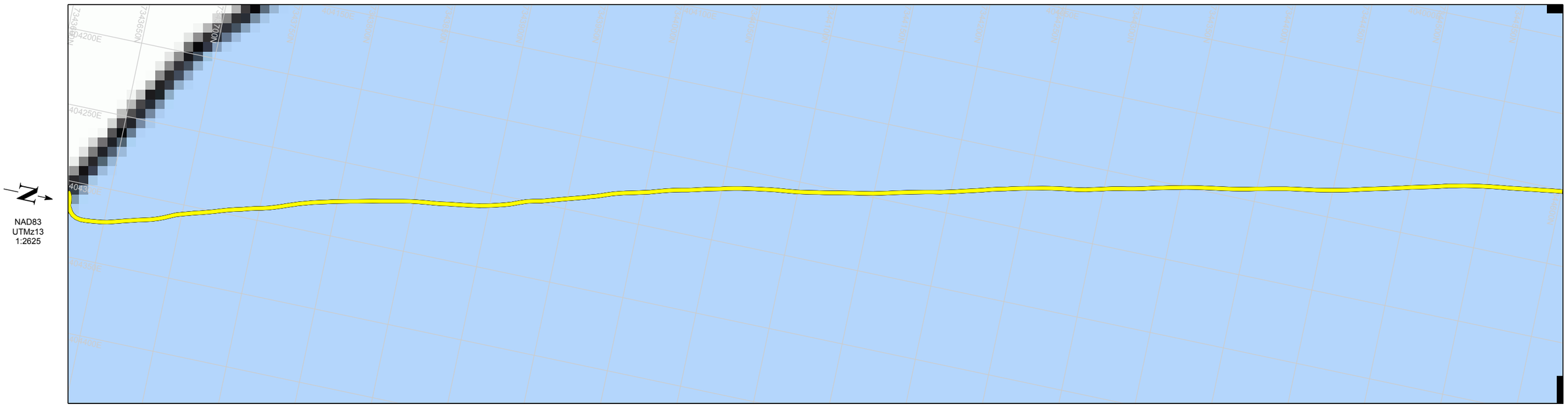
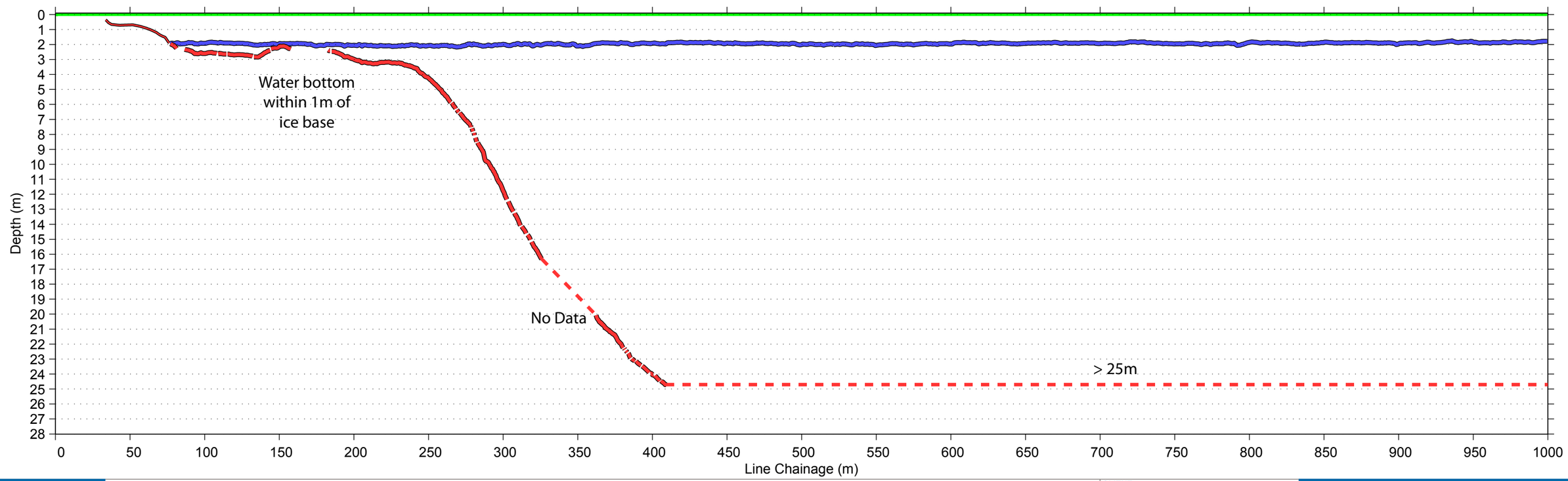
Figure D10.3





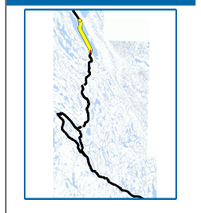


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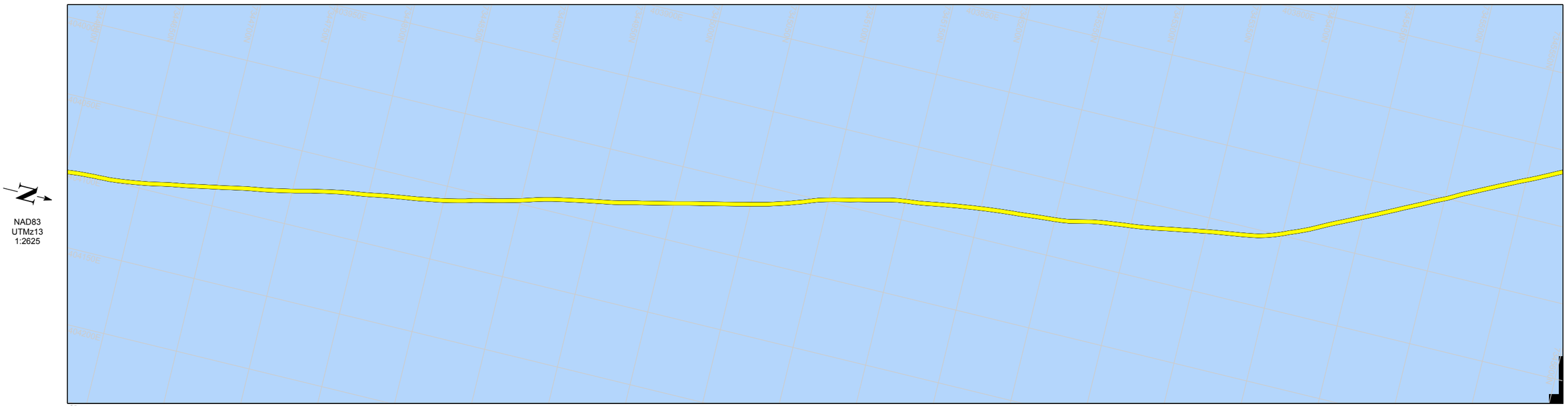
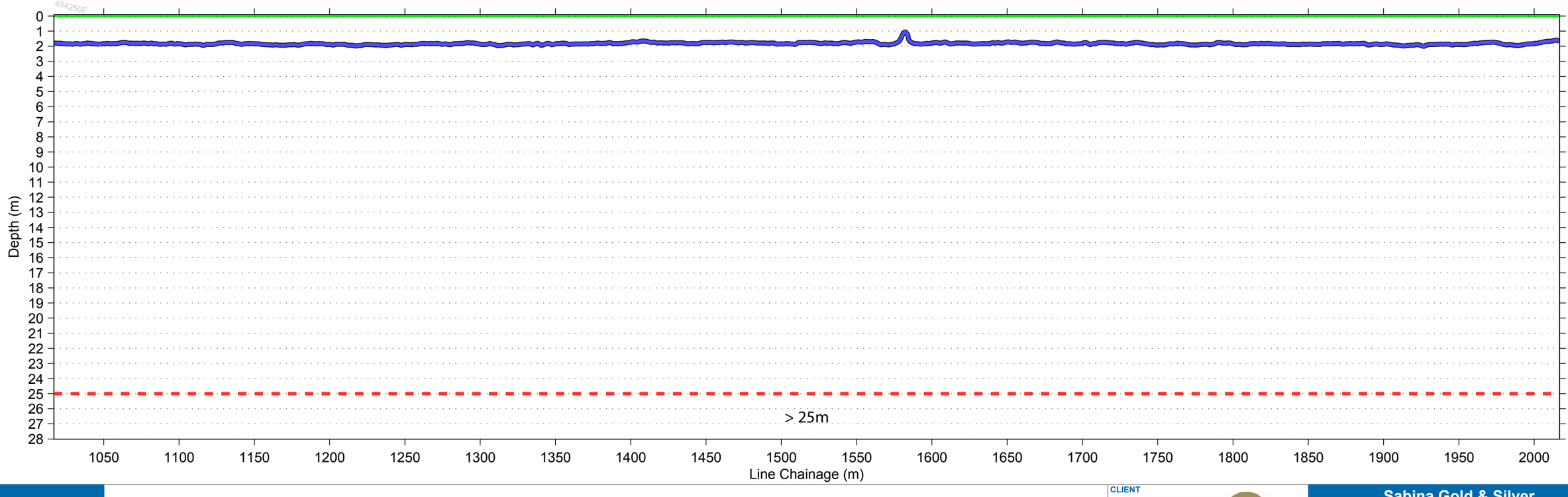
Figure D11.1





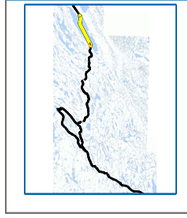


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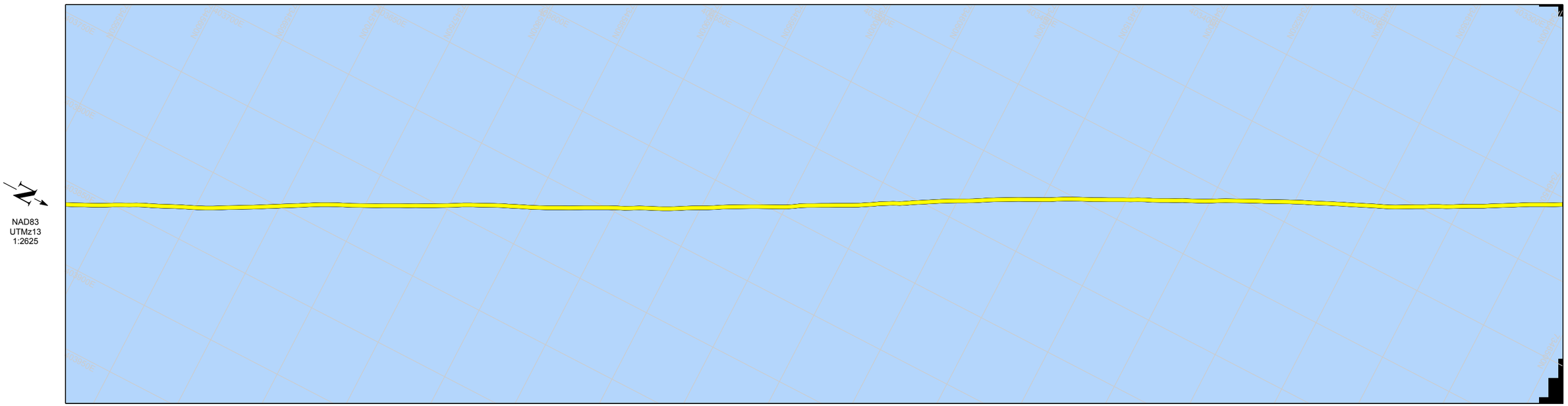
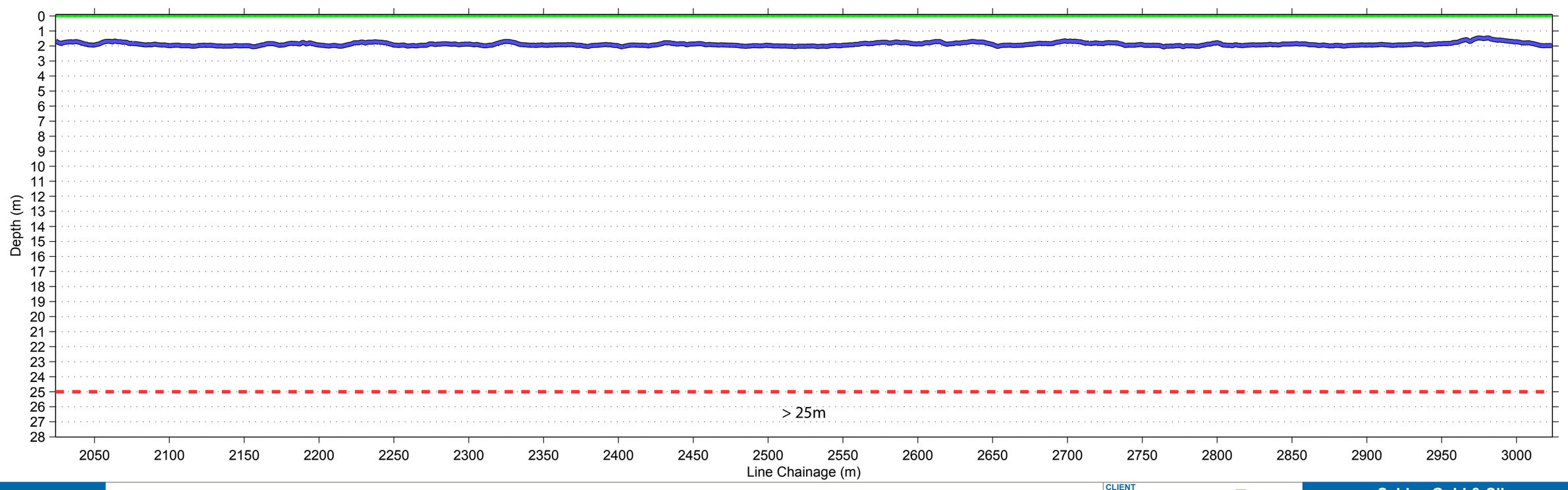
Figure D11.2





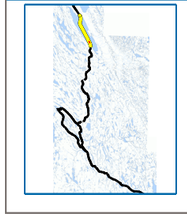


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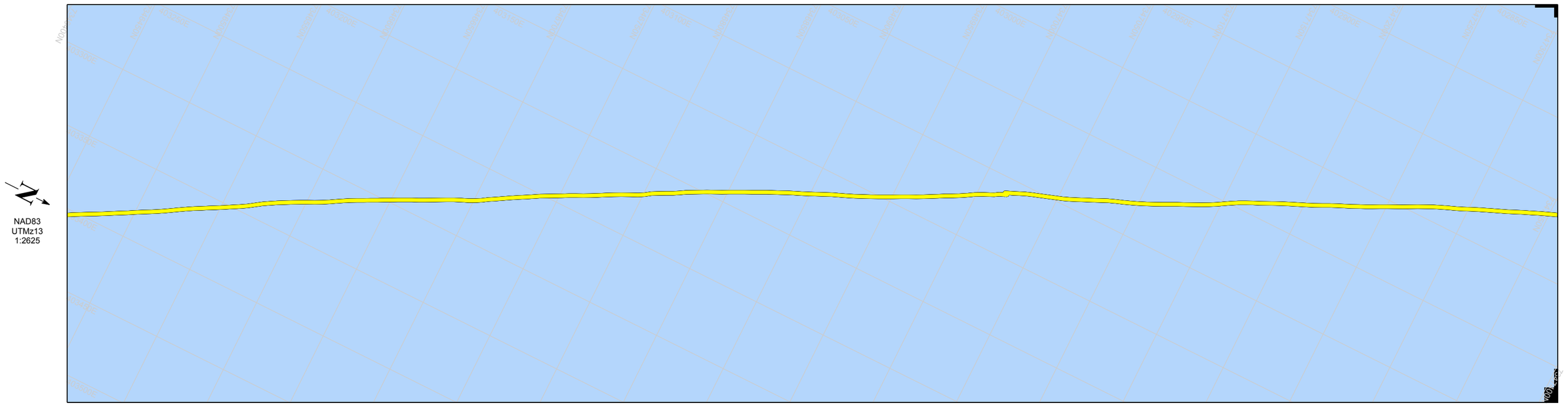
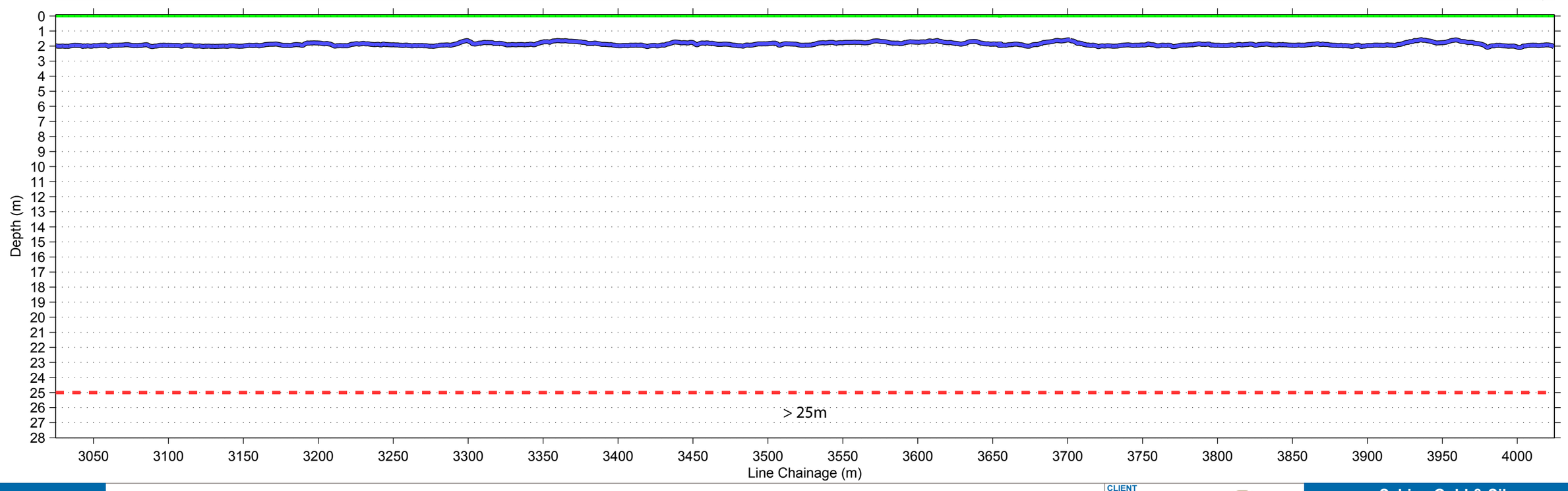
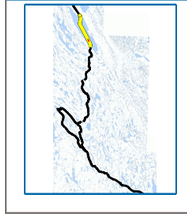
Figure D11.3







LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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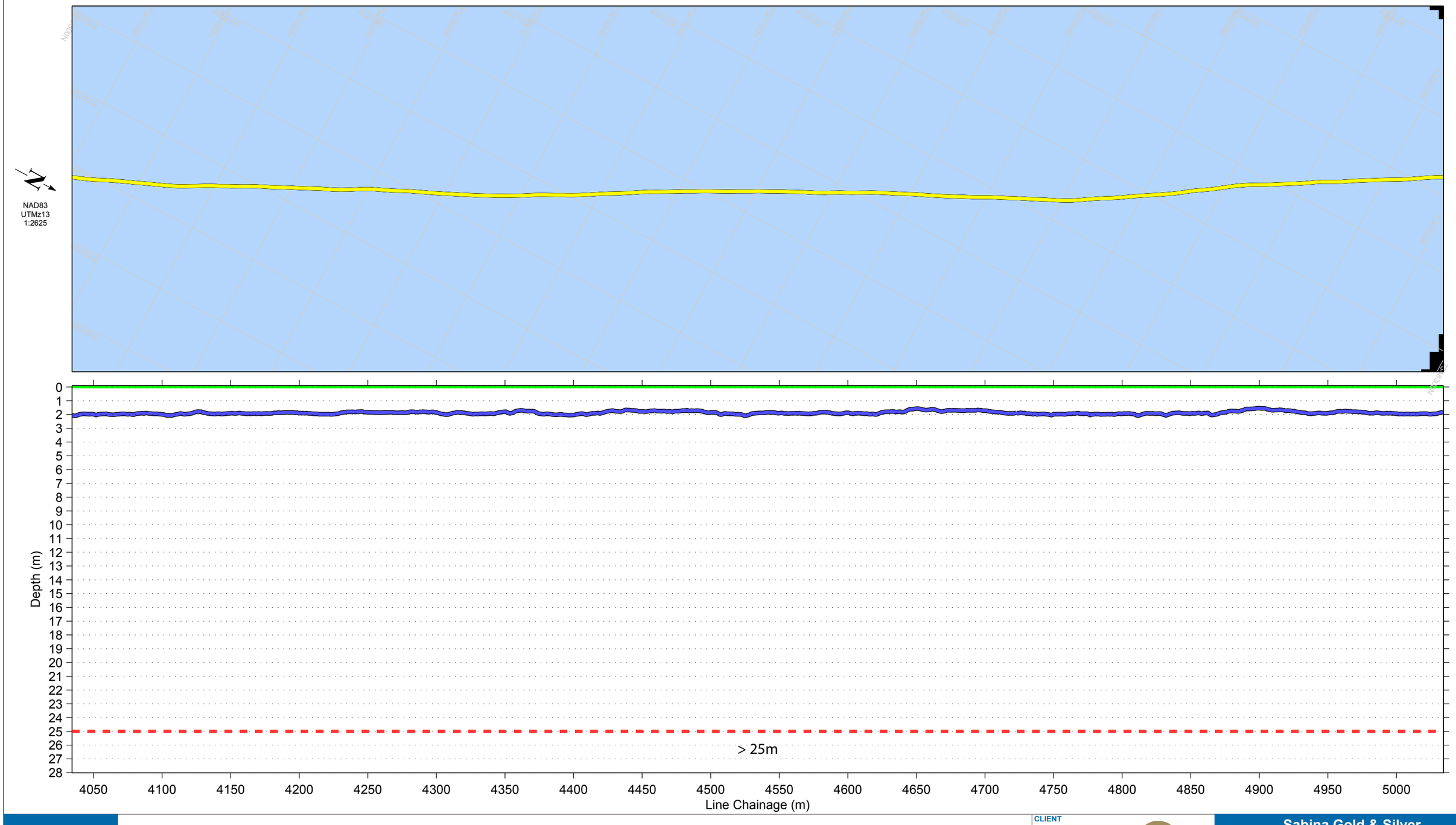
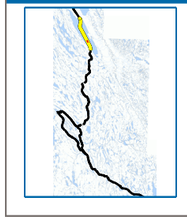
Winter Road Option – Major Lake Profiles
Bathurst Lake
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure D11.4





LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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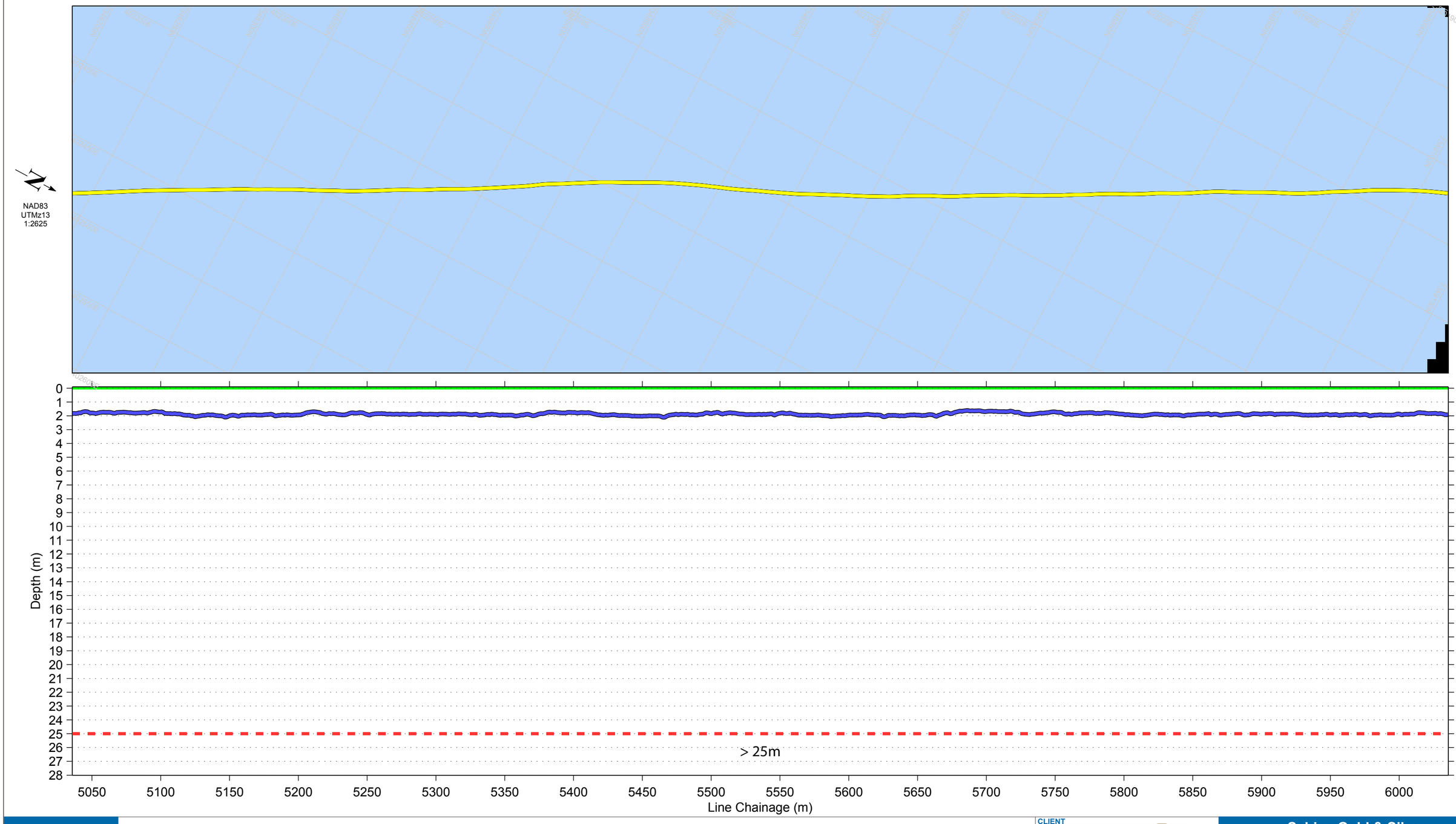
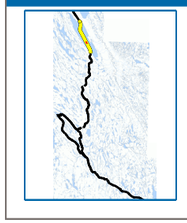
Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure D11.5





LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
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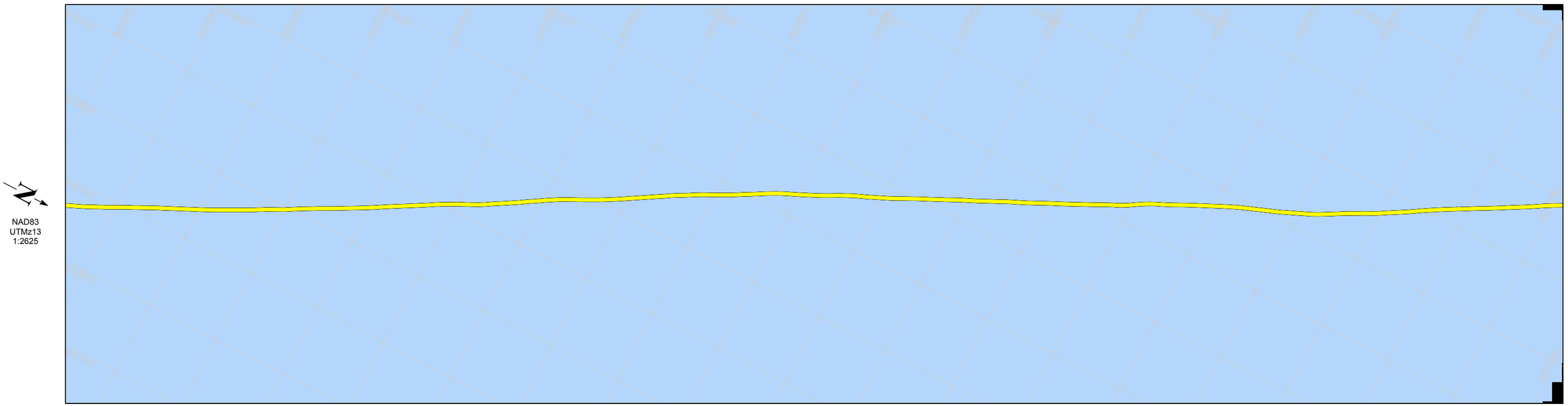
Figure D11.6



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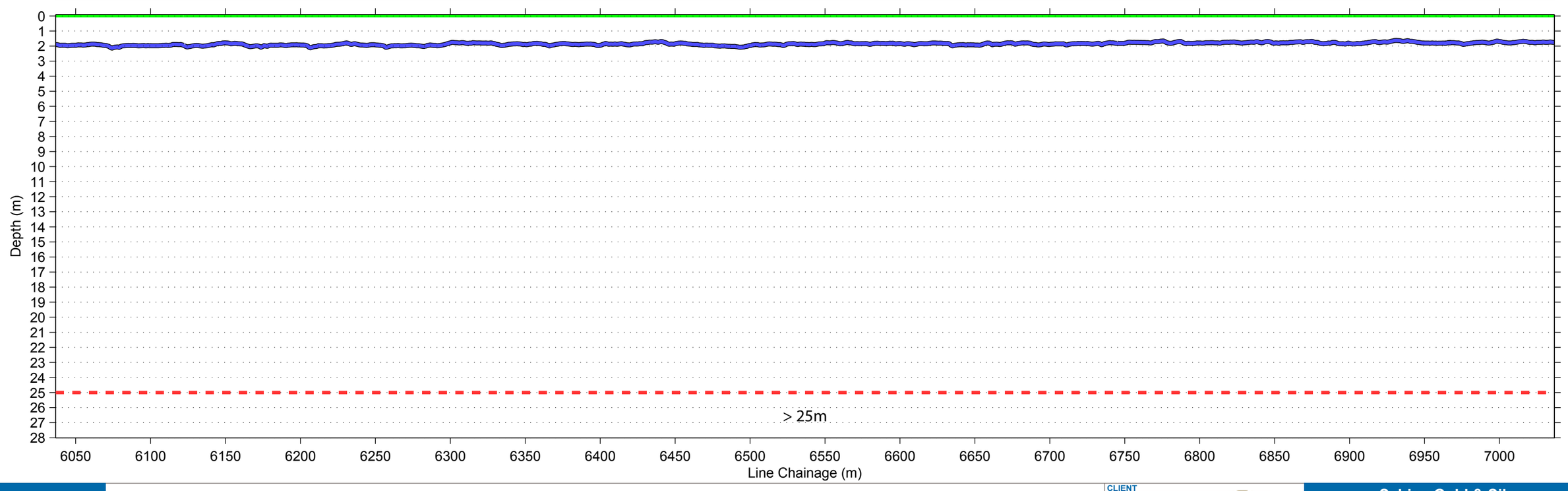

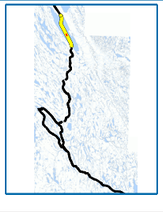

LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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Bathurst Lake
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Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
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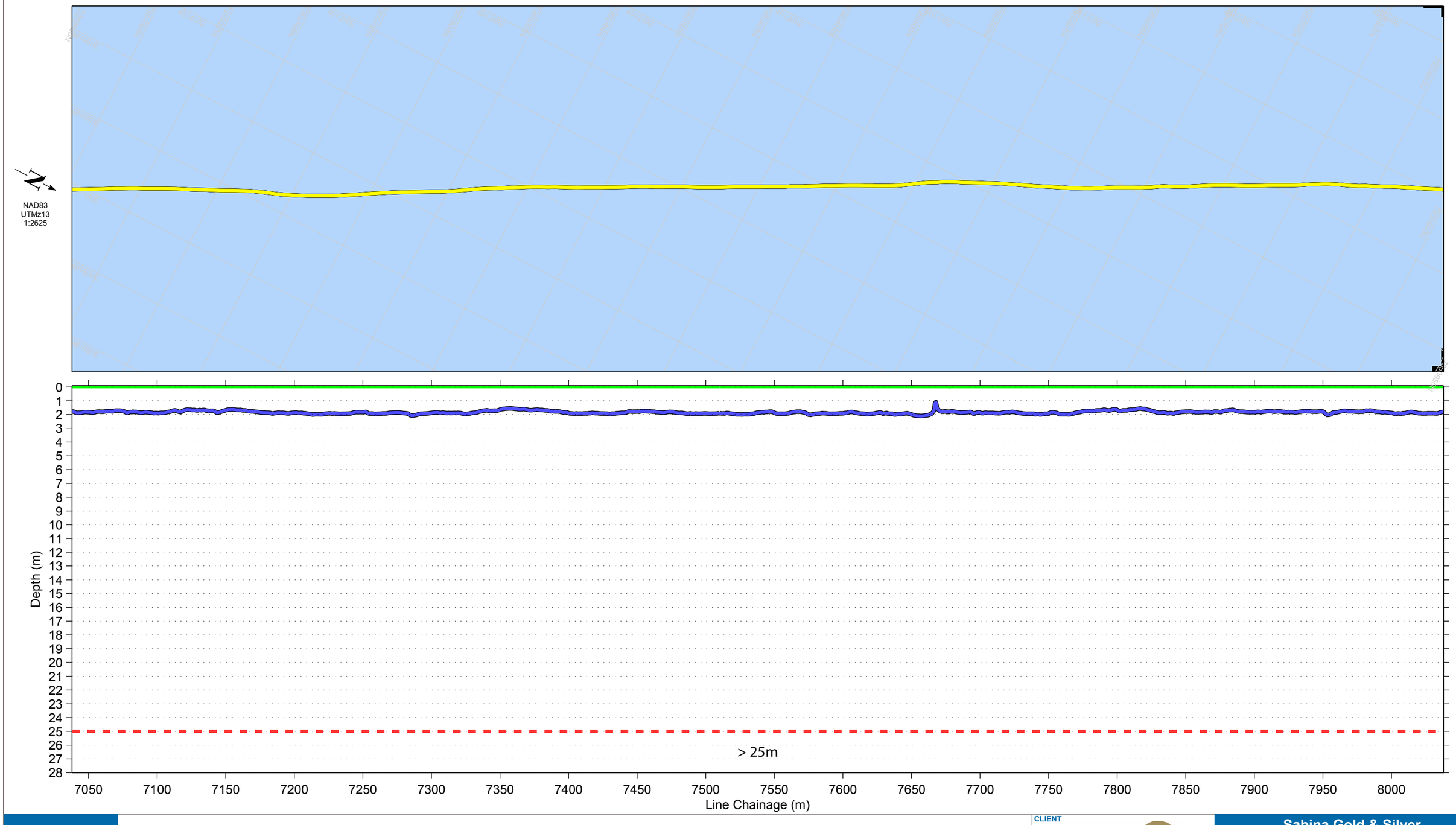
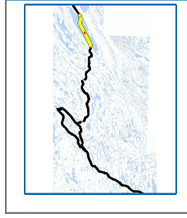
Figure D11.7





LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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Bathurst Lake
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
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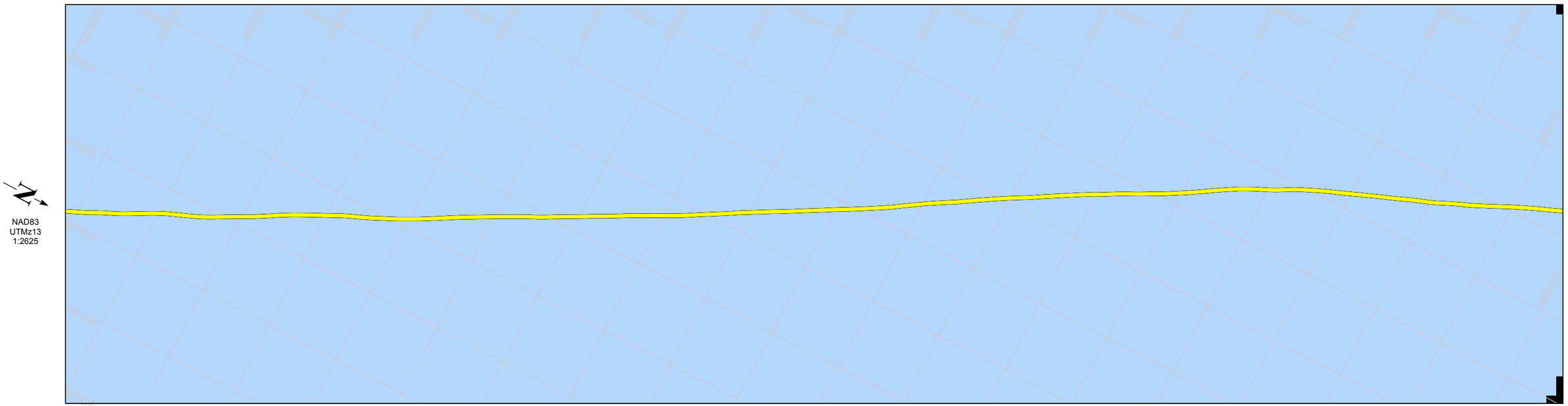
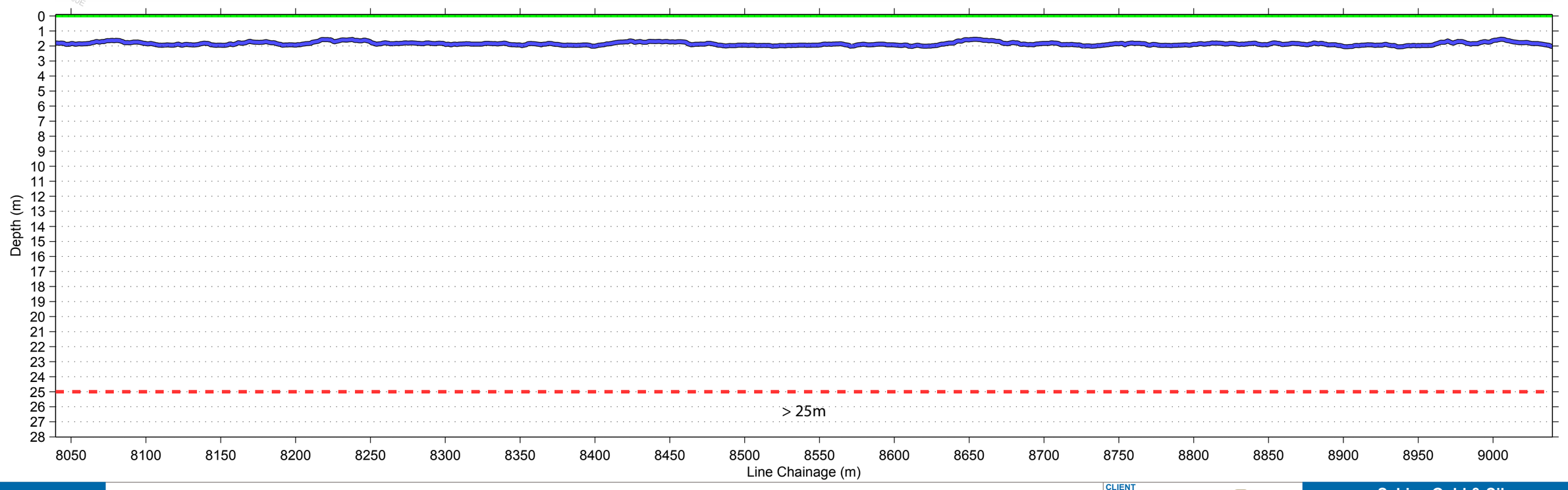
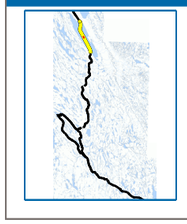
Figure D11.8







LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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Bathurst Lake
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
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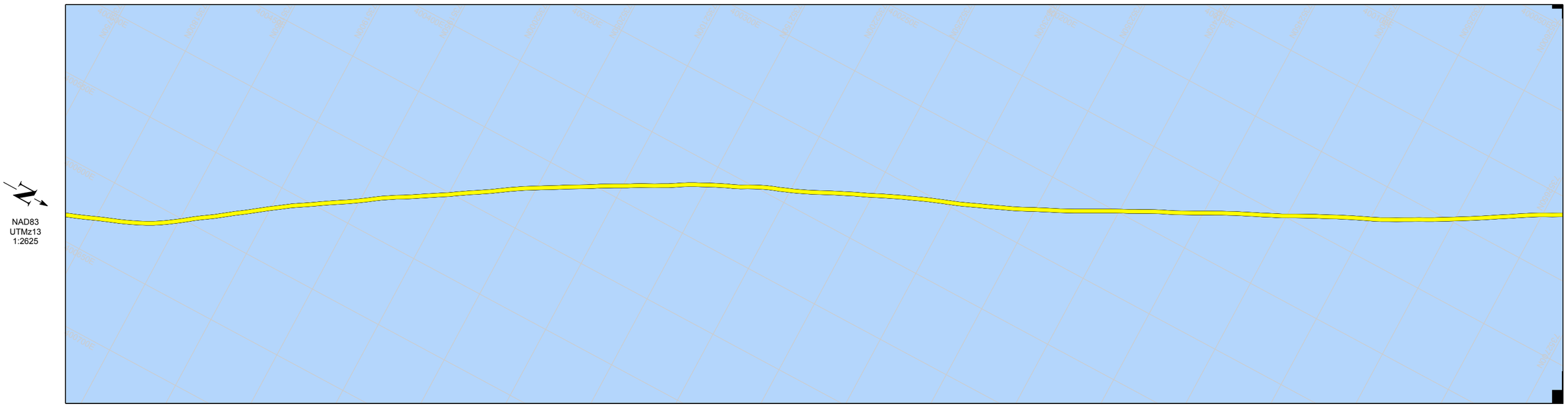
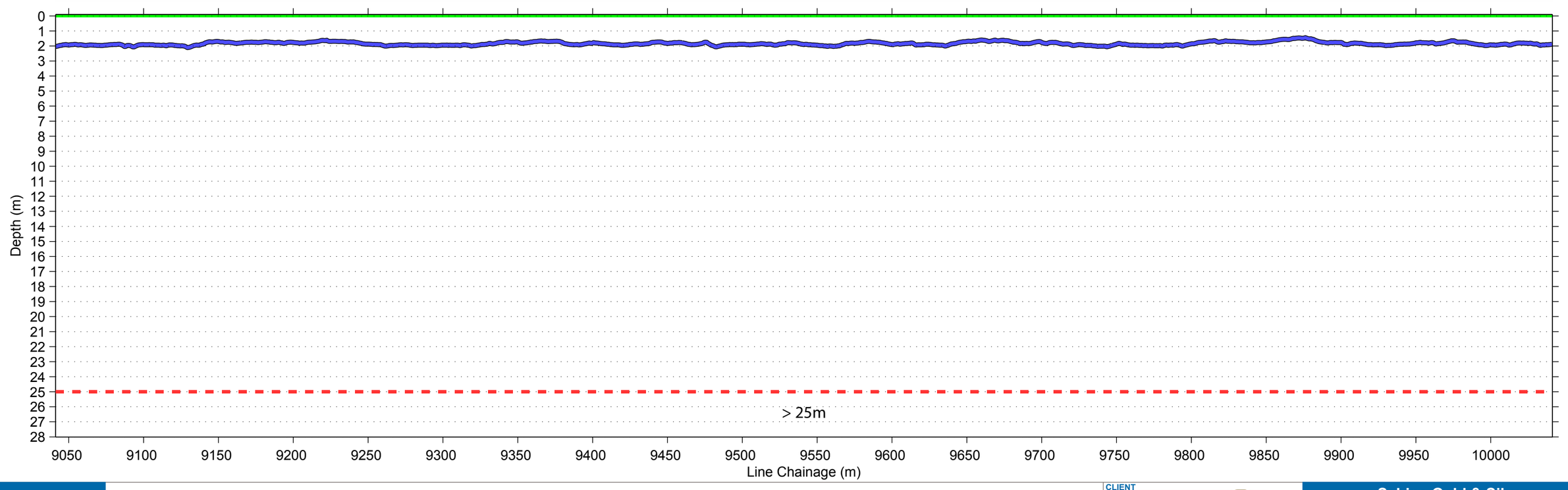
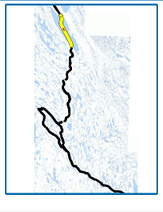
Figure D11.9







LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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Bathurst Lake
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
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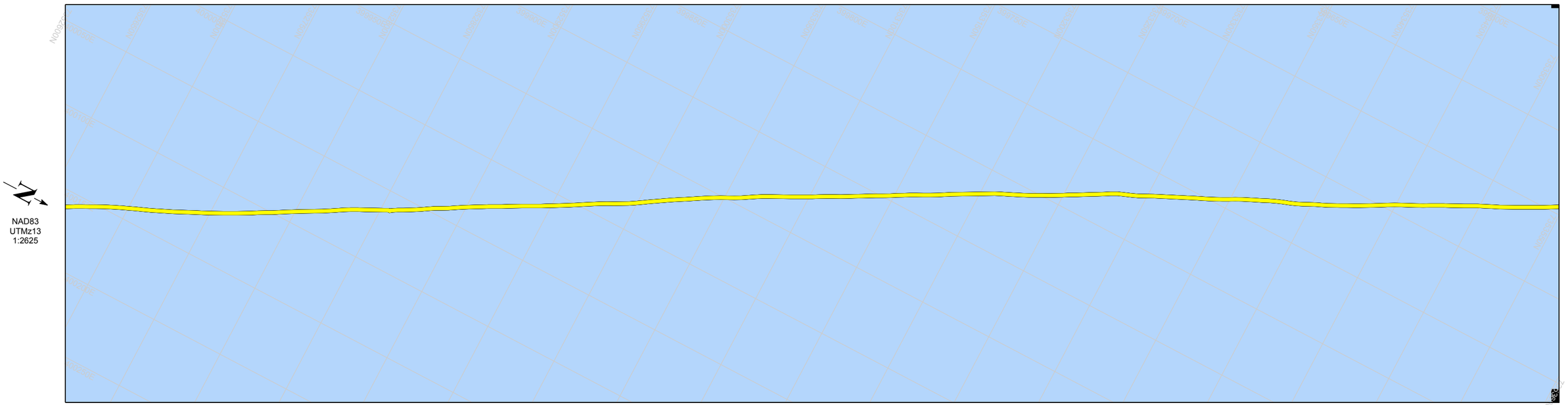
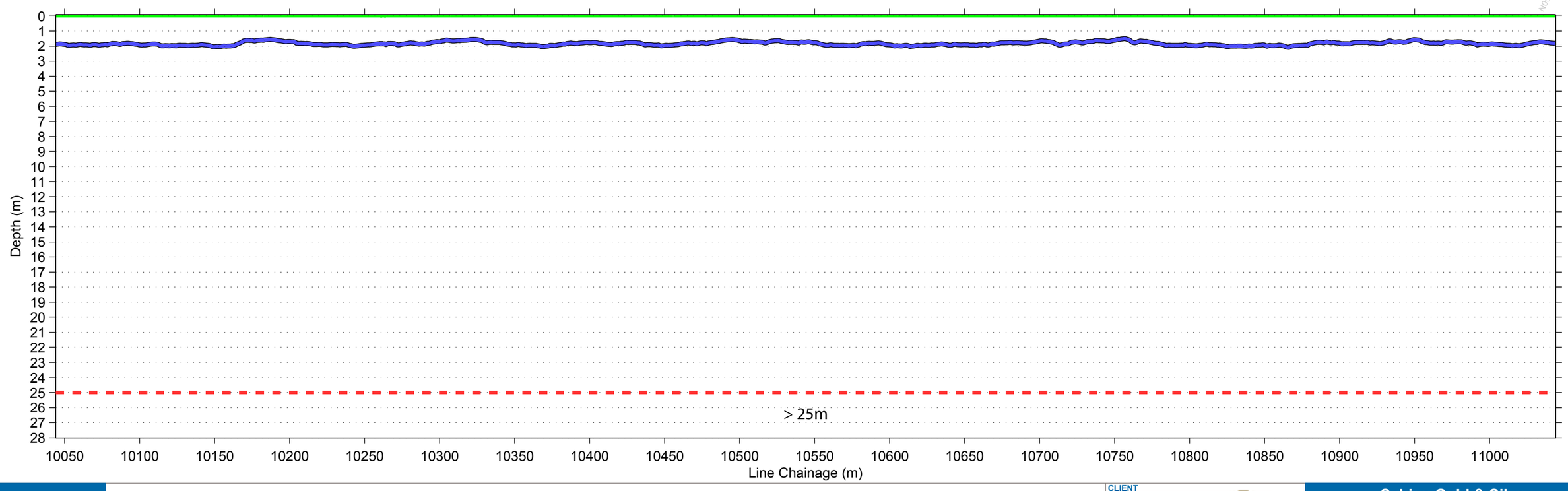
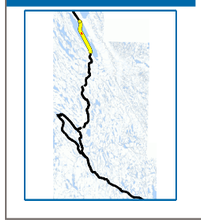
Figure D11.10







LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
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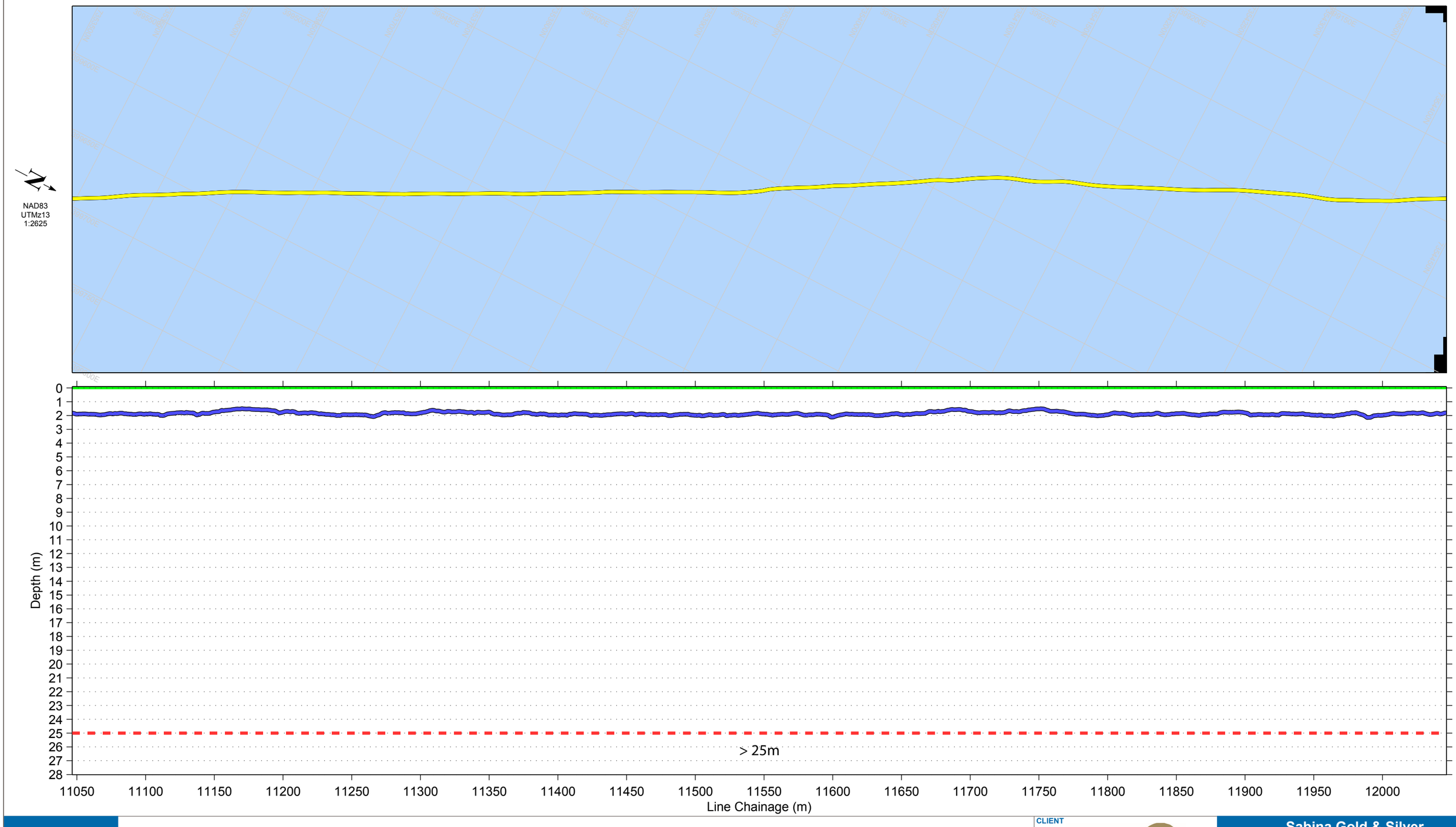
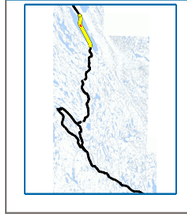
Figure D11.11





LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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Winter Road Option – Major Lake Profiles
Bathurst Lake
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

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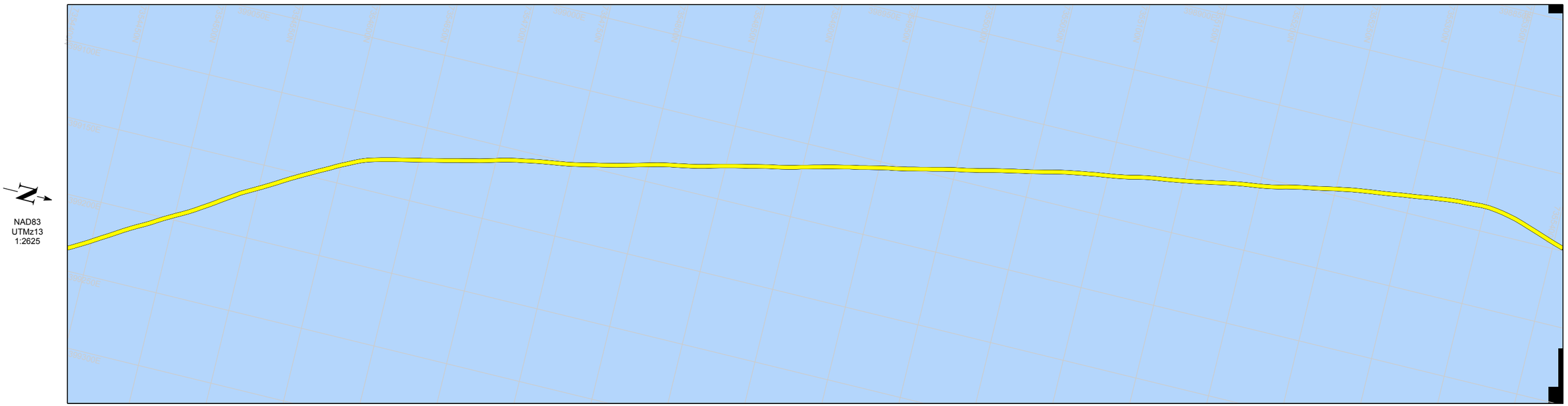
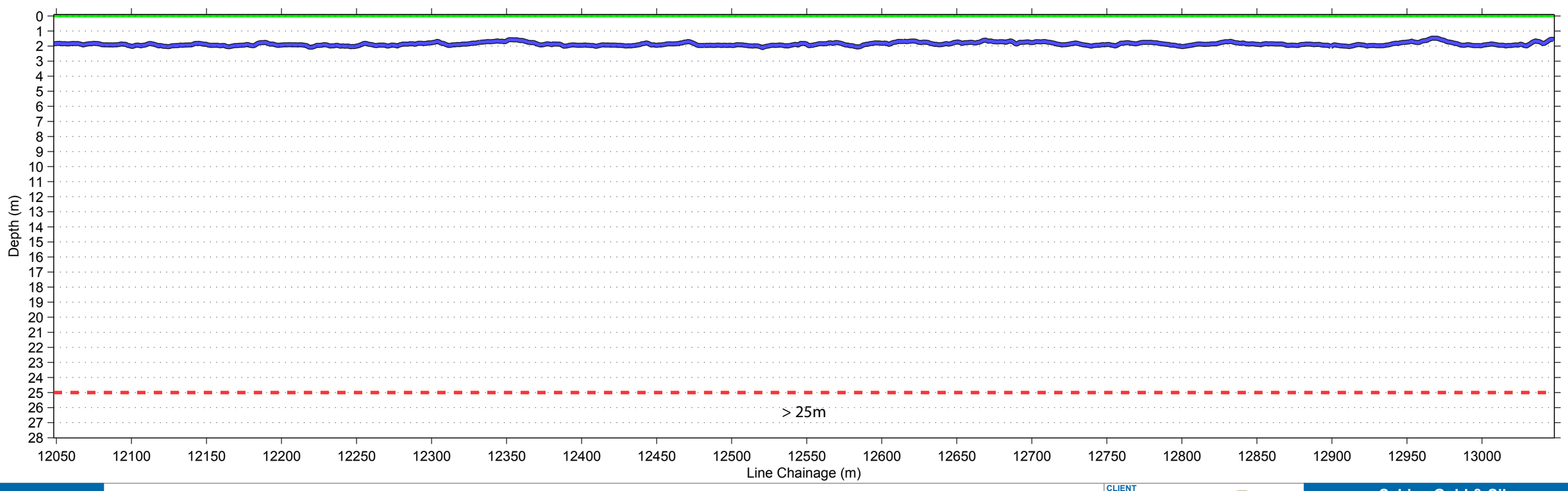
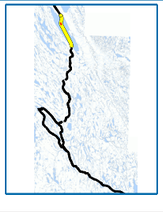
Figure D11.12







LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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Winter Road Option – Major Lake Profiles
Bathurst Lake
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
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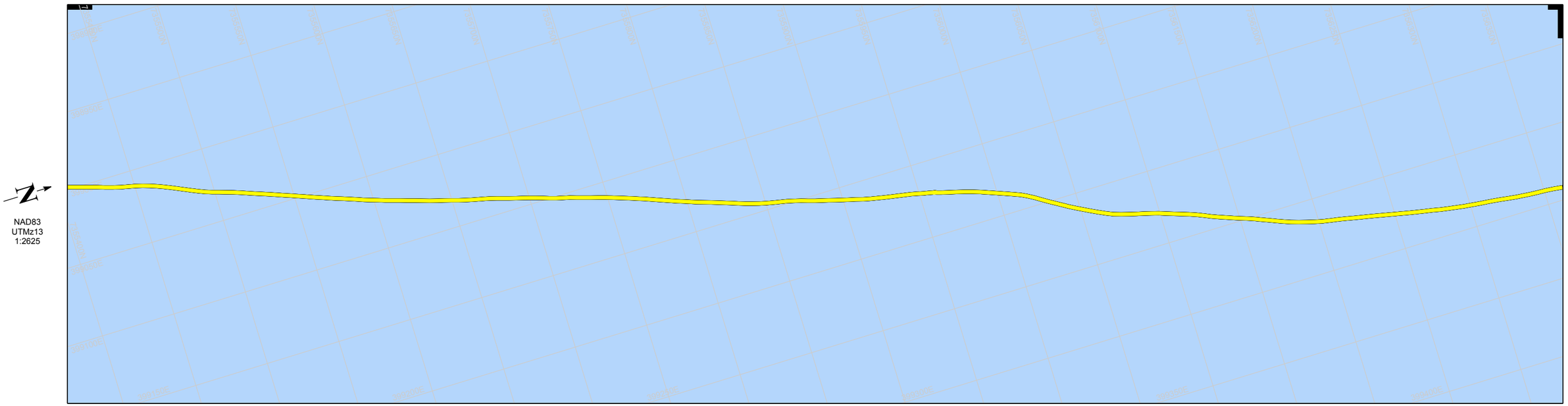
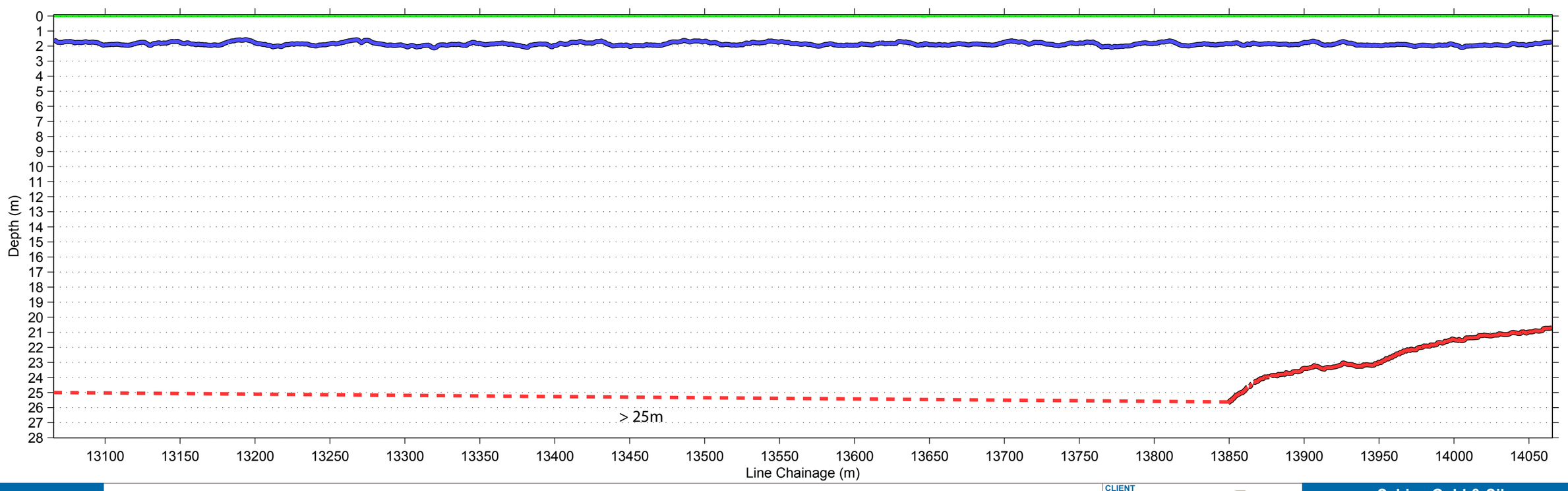
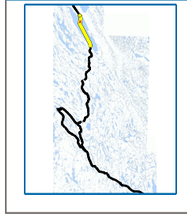
Figure D11.13







LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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Winter Road Option – Major Lake Profiles
Bathurst Lake
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

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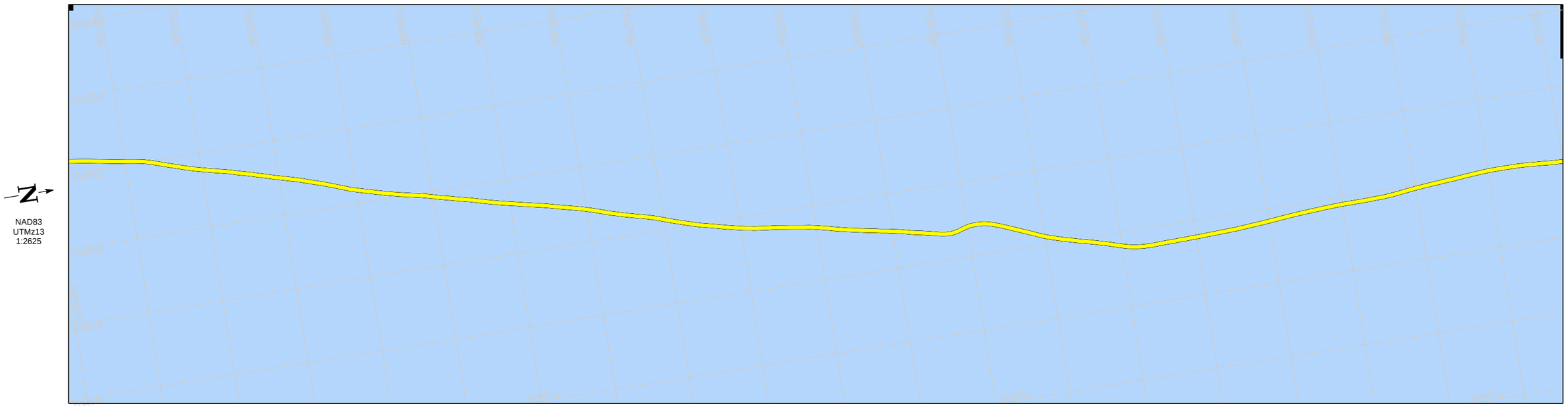
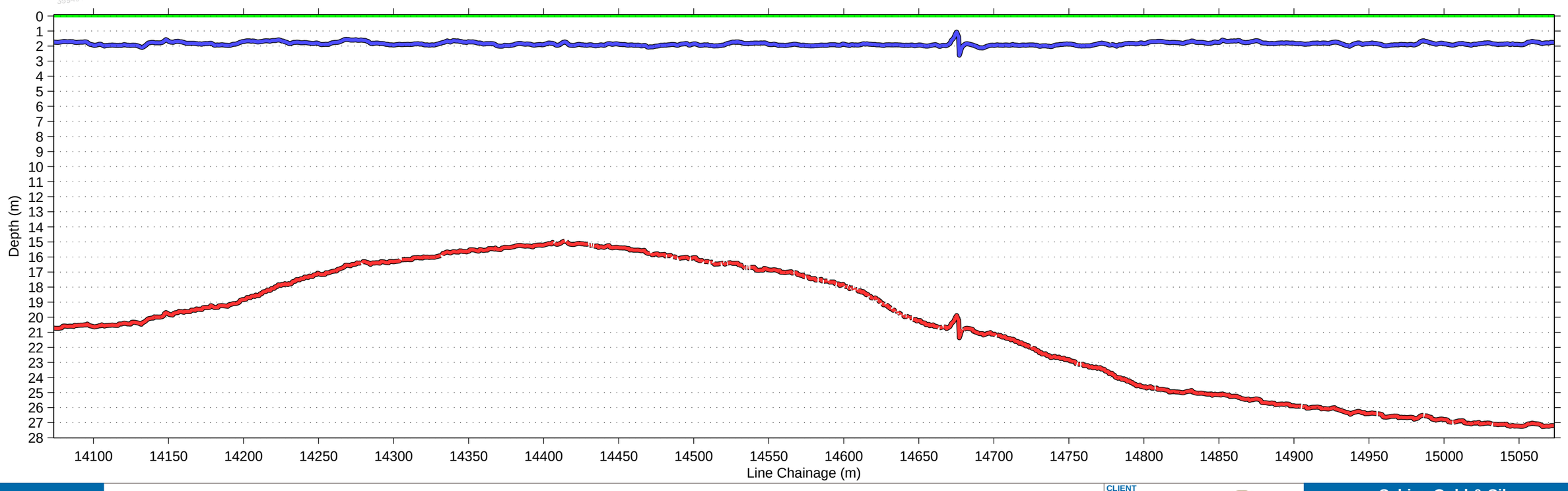
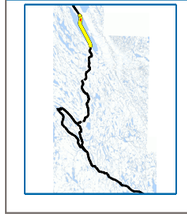
DATE: June 14, 2013

Figure D11.14







LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
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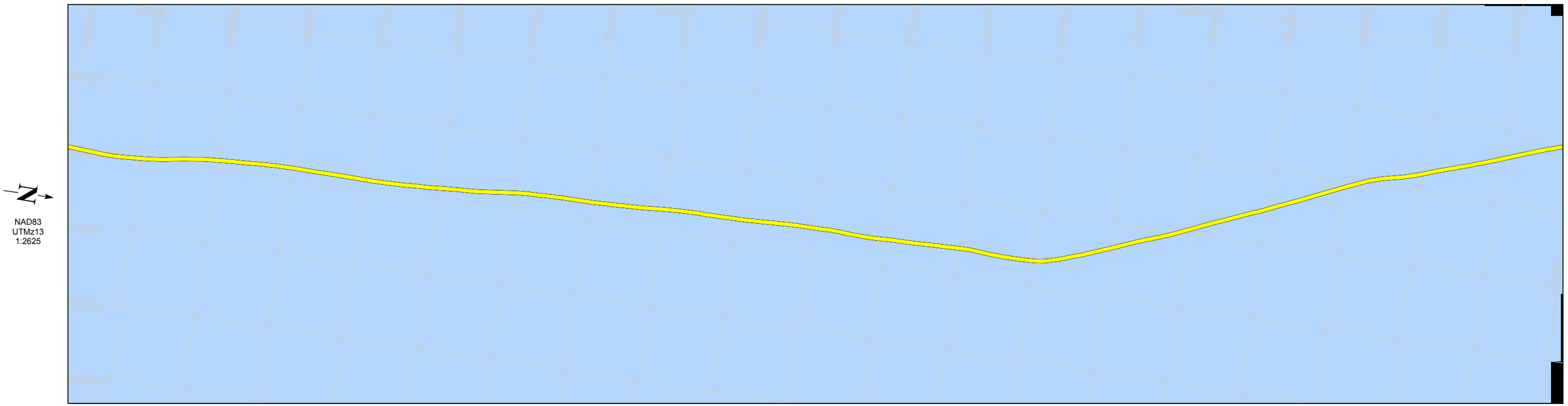
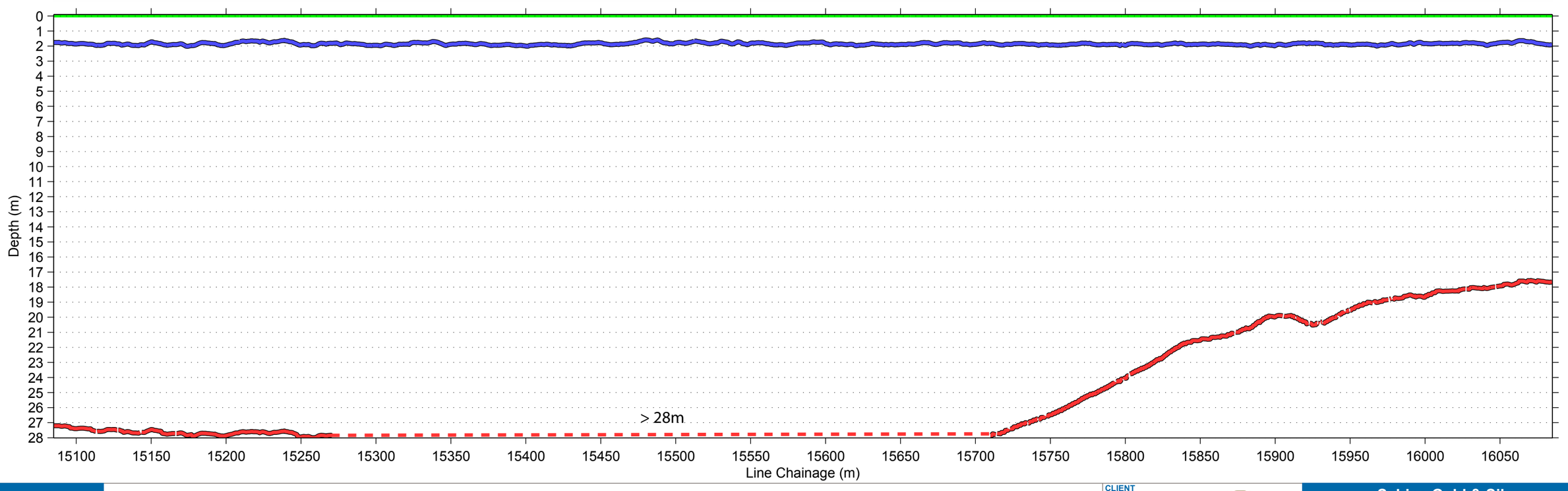
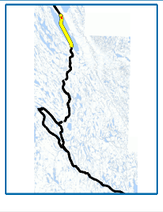
Figure D11.15







LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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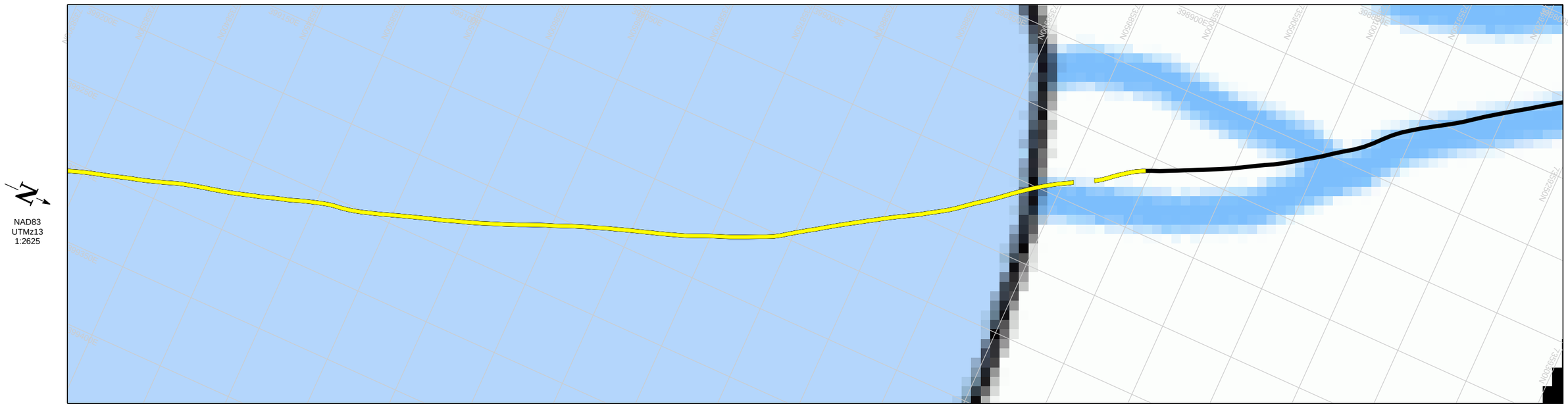
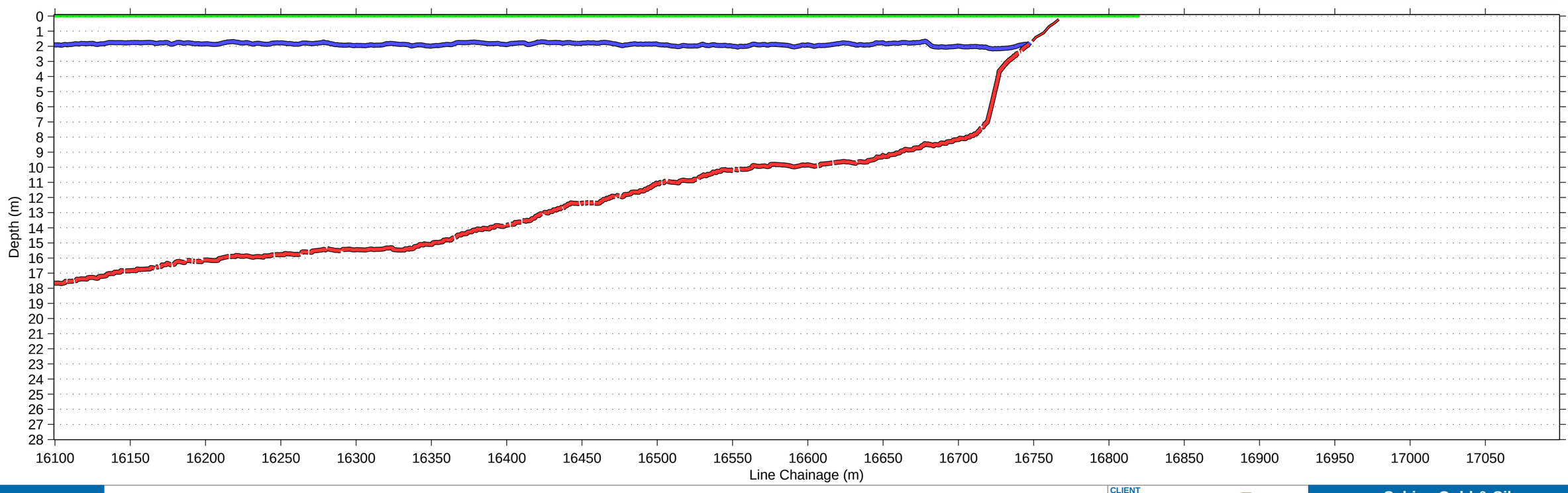
Bathurst Lake
Collected April 25 – 28, 2013

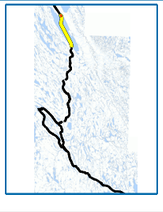
Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure D11.16







LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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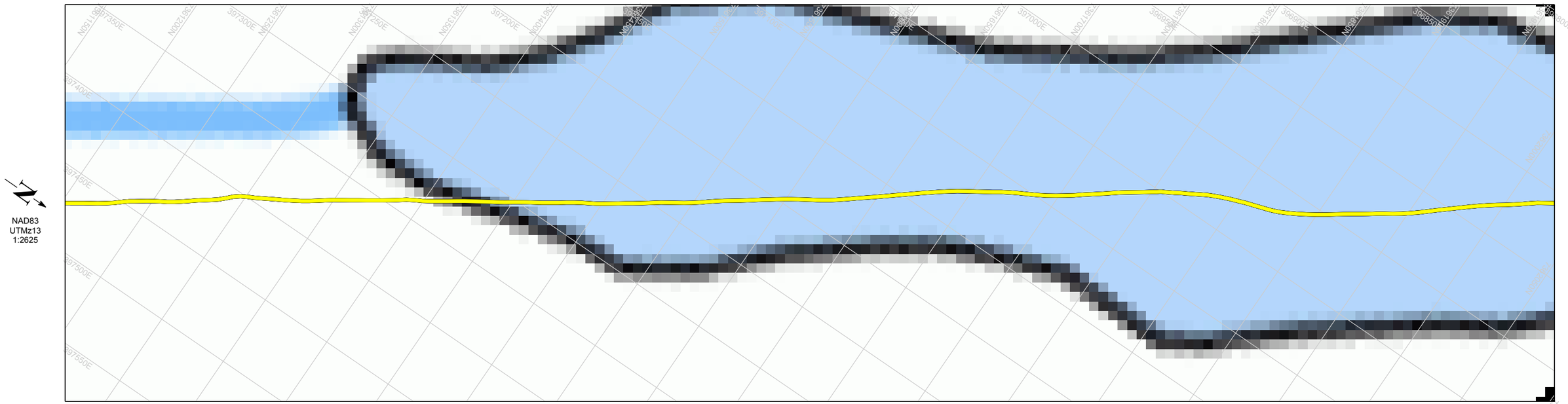
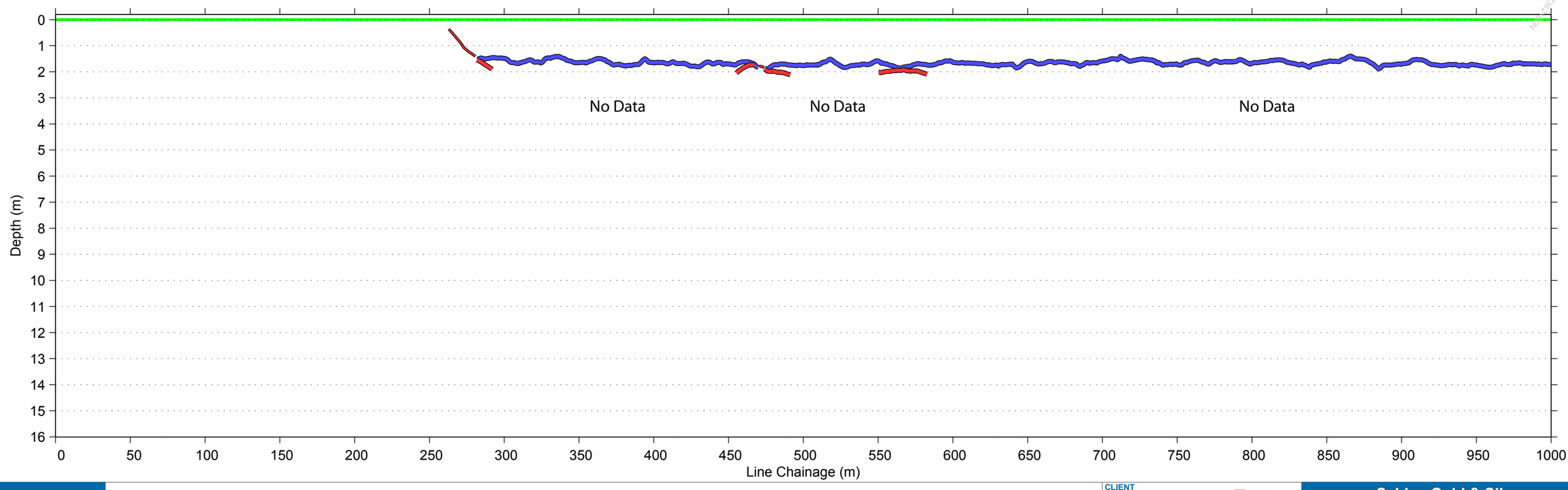
Winter Road Option – Major Lake Profiles
Bathurst Lake
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure D11.17





LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

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Winter Road Option – Major Lake Profiles
N. Junction to Bathurst Inlet
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure D12.1

NAD83
UTMz13
1:2625

No Data

Depth (m)

Line Chainage (m)

LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

CLIENT

Sabina GOLD & SILVER CORP.

TETRA TECH

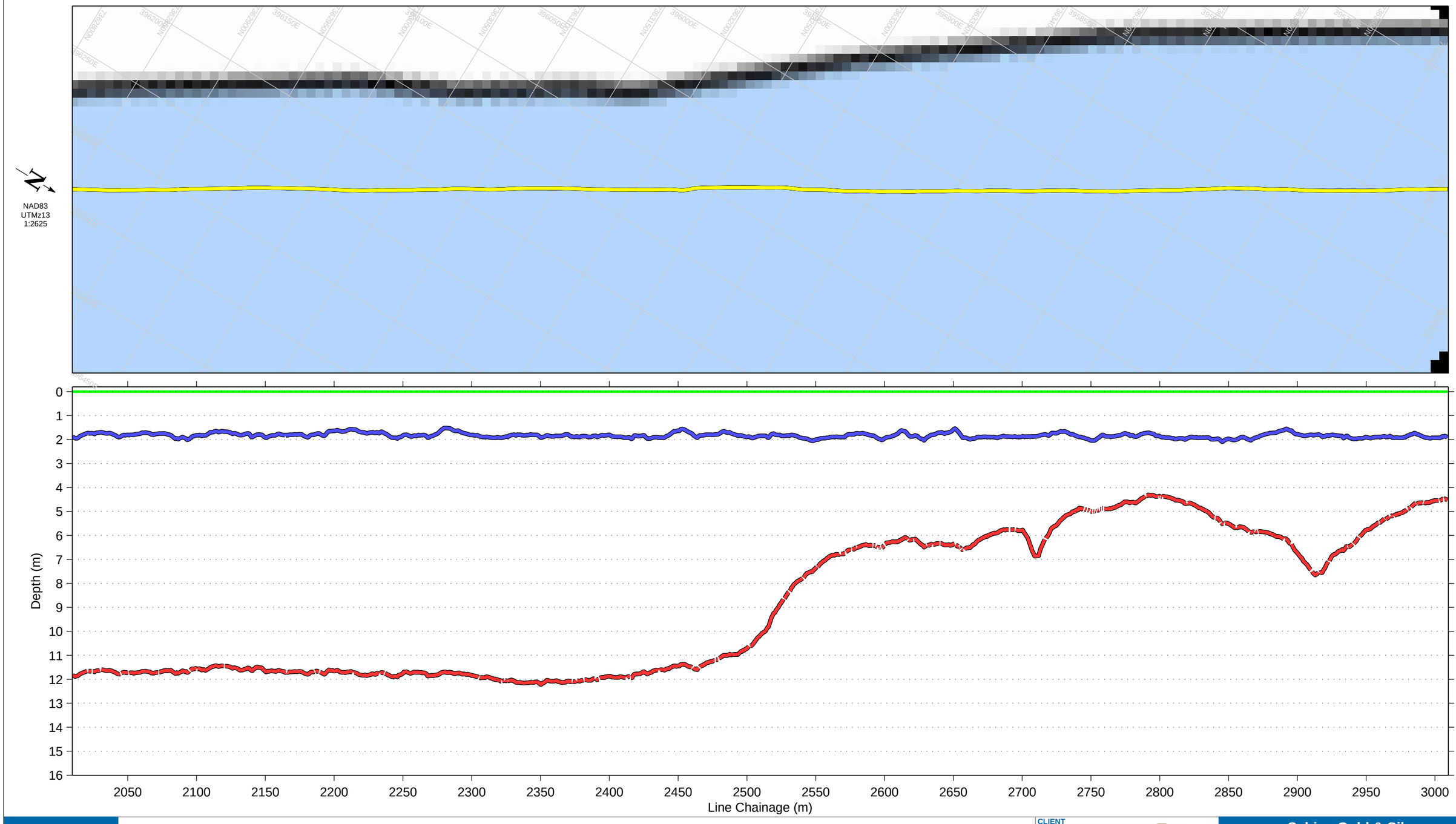
Sabina Gold & Silver
Back River Project GPR Profiling

Winter Road Option – Major Lake Profiles
N. Junction to Bathurst Inlet
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure D12.2



LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

CLIENT

Sabina GOLD & SILVER CORP.

TETRA TECH

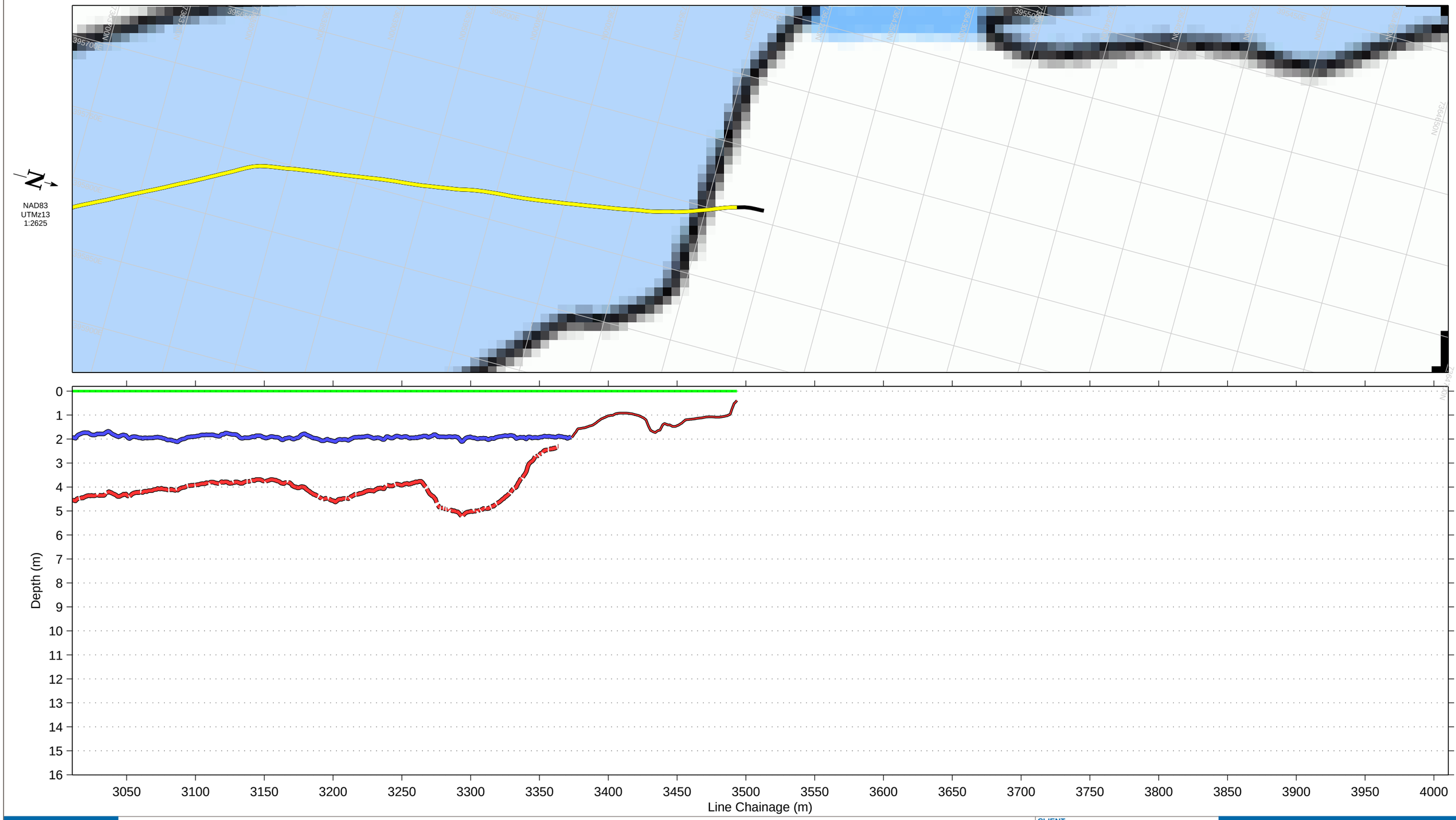
Sabina Gold & Silver
Back River Project GPR Profiling

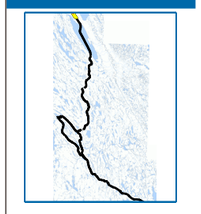
Winter Road Option – Major Lake Profiles
N. Junction to Bathurst Inlet
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure D12.3





LEGEND

- Plotted GPR Tracks
- Ground/Ice Surface
- Snow Drift Bottom
- Grounded Ice
- Floating Ice
- Water Bottom

CLIENT

Sabina GOLD & SILVER CORP.

TETRA TECH

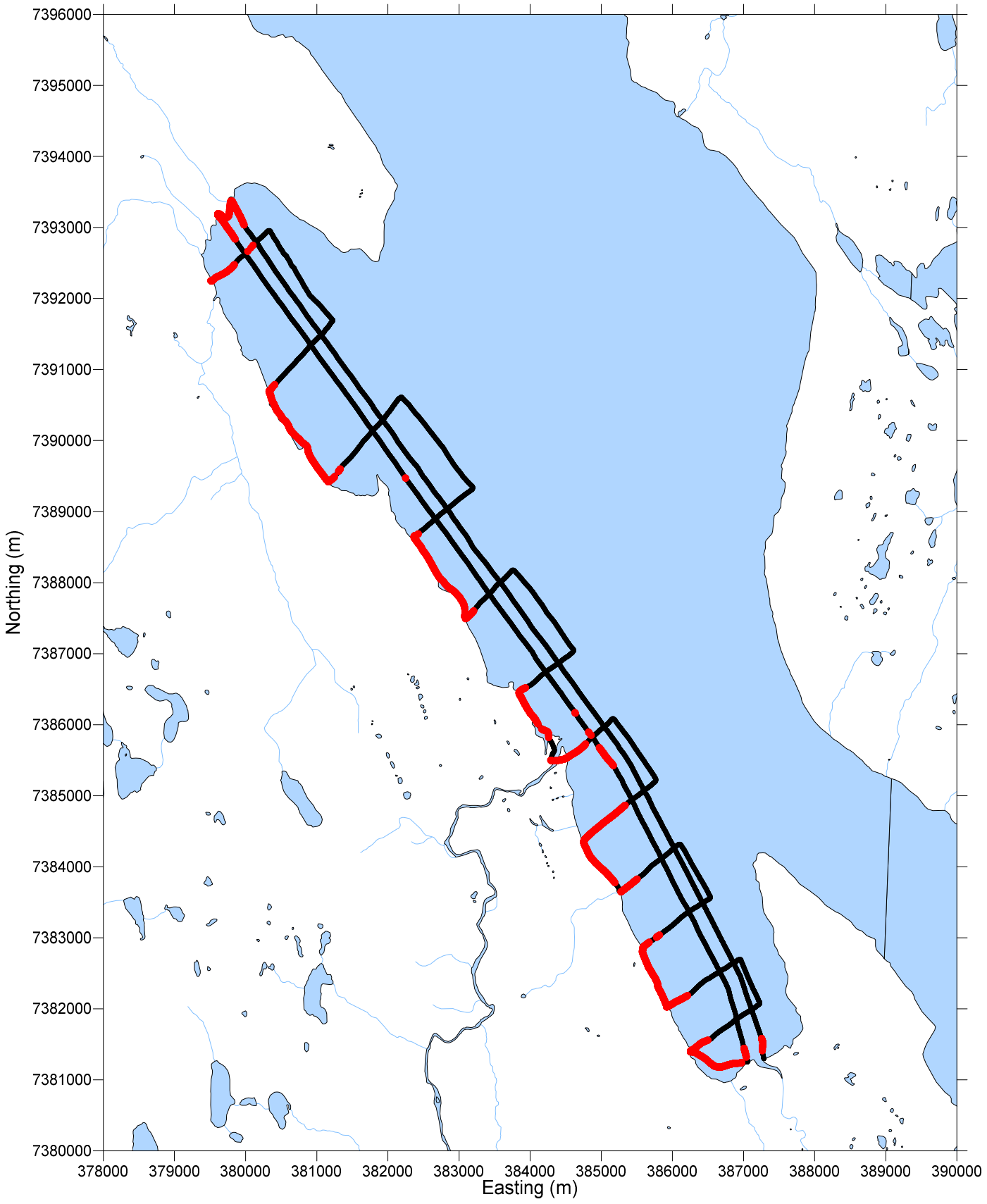
Sabina Gold & Silver
Back River Project GPR Profiling

Winter Road Option – Major Lake Profiles
N. Junction to Bathurst Inlet
Collected April 25 – 28, 2013

Project No.	DWN	CHKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
Edmonton	June 14, 2013

Figure D12.4



LEGEND

N

Grounded Ice

GPR Survey Track

SCALE 1:75,000
NAD83
UTM z13

CLIENT

Sabina
GOLD & SILVER CORP.

TETRA TECH

Sabina Gold & Silver
Back River Project GPR Profiling

Bathurst Inlet
Locations of Grounded Ice

PROJECT NO.	DWN	CKD	APVD	REV
V33103008.E111	RJM	CB	RJM	0

OFFICE	DATE
EBA-EDM	June 27, 2013

Figure E

APPENDIX A: GENERAL CONDITIONS

GENERAL CONDITIONS

GEOPHYSICAL REPORT

This report incorporates and is subject to these “General Conditions”.

1.1 USE OF REPORT

This geophysical report pertains to a specific site, a specific development, and a specific scope of work. It is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site or proposed development would necessitate a supplementary investigation and assessment.

This report and the assessments and recommendations contained in it are intended for the sole use of TETRA TECH’s client. TETRA TECH does not accept any responsibility for the accuracy of any of the data, the analysis or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than TETRA TECH’s client unless otherwise authorized in writing by TETRA TECH. Any unauthorized use of the report is at the sole risk of the user.

This report contains figures, maps, drawings and sketches that represent processed geophysical data collected at a specific site. This processed data will have inherent interpretation assumptions and accuracies that are discussed in the report. Consequently, the report can only be considered in its entirety and individual figures, maps, drawings and sketches shall not be distributed without the text of the report unless authorized in writing by TETRA TECH.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of TETRA TECH. Additional copies of the report, if required, may be obtained upon request.

1.2 ALTERNATE REPORT FORMAT

Where TETRA TECH submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed TETRA TECH’s instruments of professional service); the Client agrees that only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by TETRA TECH shall be deemed to be the original for the project.

Both electronic file and hard copy versions of TETRA TECH’s instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except TETRA TECH. TETRA TECH’s instruments of professional service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client’s current or future software and hardware systems.

1.3 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, TETRA TECH has not been retained to investigate, address, or consider and has not investigated, addressed, or considered any environmental or regulatory issues associated with the development of the site.

1.4 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgemental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

1.5 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

1.6 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

1.7 SURFACE WATER AND GROUNDWATER CONDITIONS

Surface and groundwater conditions mentioned in this report are those observed at the times recorded in the report. These conditions vary with geological detail between observation sites; annual, seasonal and special meteorological conditions; and with development activity. Interpretation of water conditions from observations and records is judgmental and constitutes an evaluation of circumstances as influenced by geology, meteorology and development activity. Deviations from these observations may occur during the course of development activities.

1.8 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of the report, TETRA TECH may rely on information provided by persons other than the Client. While TETRA TECH endeavours to verify the accuracy of such information when instructed to do so by the Client, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

APPENDIX B: DFO REPORTS

1.0 INTRODUCTION

Wolf Lake is located 5.9 km south of Sabina's Goose Lake Camp at 65.49217°N, 106.42258°W. This lake is approximately 4.0 km in length along its long axis (N20°W), and 1.3 km wide at its widest point, with a total surface area of 227 ha. This lake has a maximum under-ice water depth of 2.28 m, with the deepest section being in the central portion of the lake. The attached figure, Wolf-01, is a regional area map showing the location of Wolf Lake.

2.0 SURVEY METHODOLOGY

On April 23, 2013, EBA Engineering Consultants Ltd. operating as EBA, A Tetra Tech Company (EBA) collected bathymetric data using a ground penetrating radar (GPR) system. The system used was MALA's Ramac CUII with a 50 MHz rough-terrain antenna. Real-time positioning was achieved using a Topcon HyperLite+ GPS/Glonass unit. Positions were recorded at 1 Hz with a typical absolute horizontal accuracy of ± 1 metre, given appropriate satellite constellations. The survey was typically conducted at a speed of approximately 15 km/h. The GPR unit was set to acquire data at a frequency of approximately 10 readings per second, giving an average horizontal resolution of approximately one GPR trace per 42 cm along survey lines.

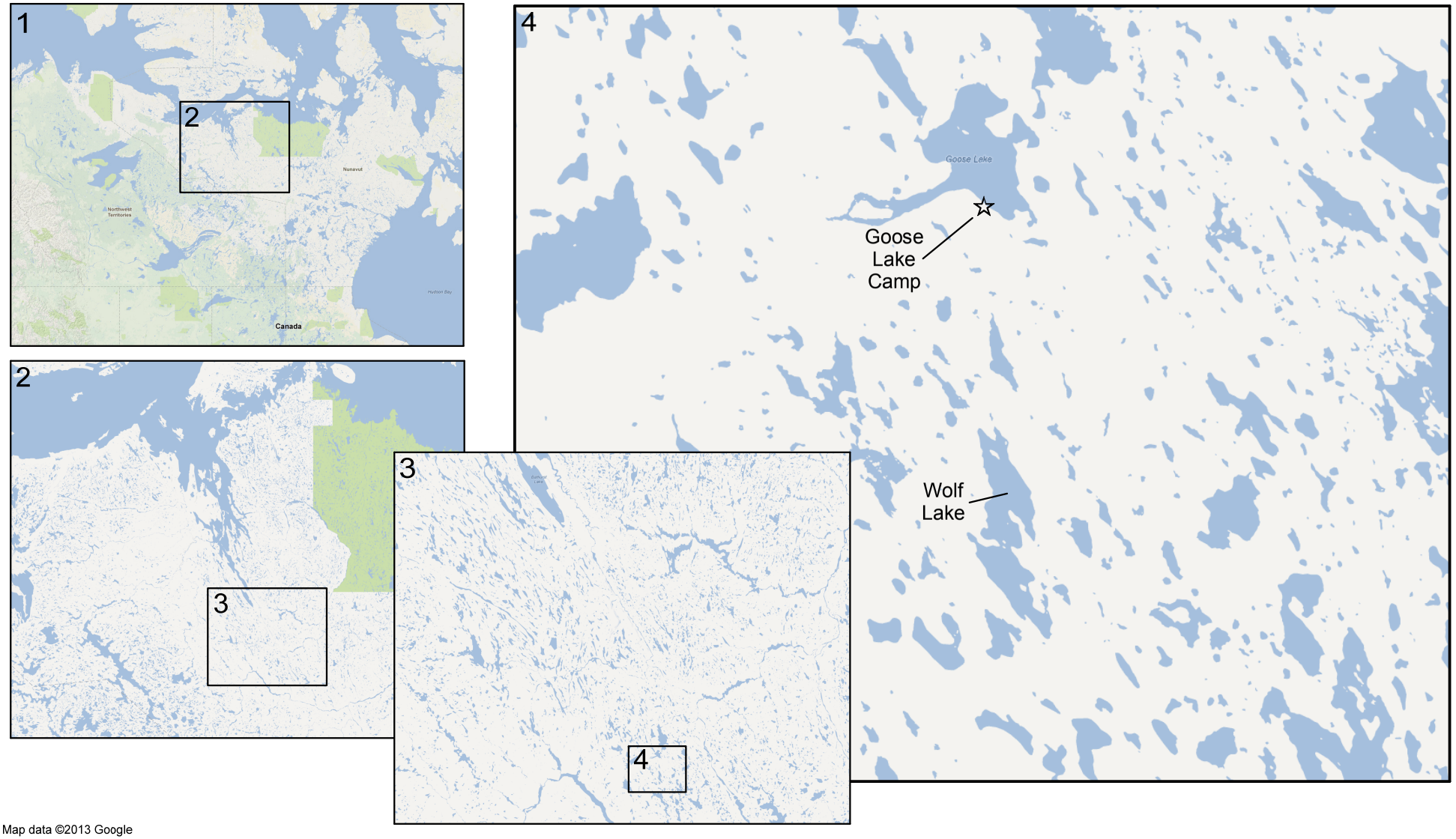
3.0 DATA REDUCTION AND RESULTS

All data has been corrected for ice thickness and GPS offsets. The Surfer 10 software contouring package from Golden Software was used to grid, contour, and calculate volumes for the dataset. Wolf Lake lies north of the tree line; thus, according to the DFO protocols, a maximum expected ice thickness of 2 m was used in the calculation of available winter water. See figure Wolf-02 for the contoured results. Surface area and volumetric values are listed in Table 1.

Of likely significance is the fact that the under-ice free water is divided into at least three distinct sections, separated by shallow areas of completely grounded ice.

Table 1: DFO Lake Calculations

Lake ID	Wolf Lake
Centre Coordinates	65.49217°N, 106.42258°W
Surface Area	227 ha
Total Lake Volume	5,148,323 m^3
Under Ice Volume	601,412 m^3
Max Expected Ice Thickness Value Used	2 m
Max Under-Ice Water Depth	2.28 m
Calculated 10% Withdrawal Volume	60,141 m^3



Map data ©2013 Google

LEGEND

CLIENT

Sabina GOLD & SILVER CORP.

TETRA TECH

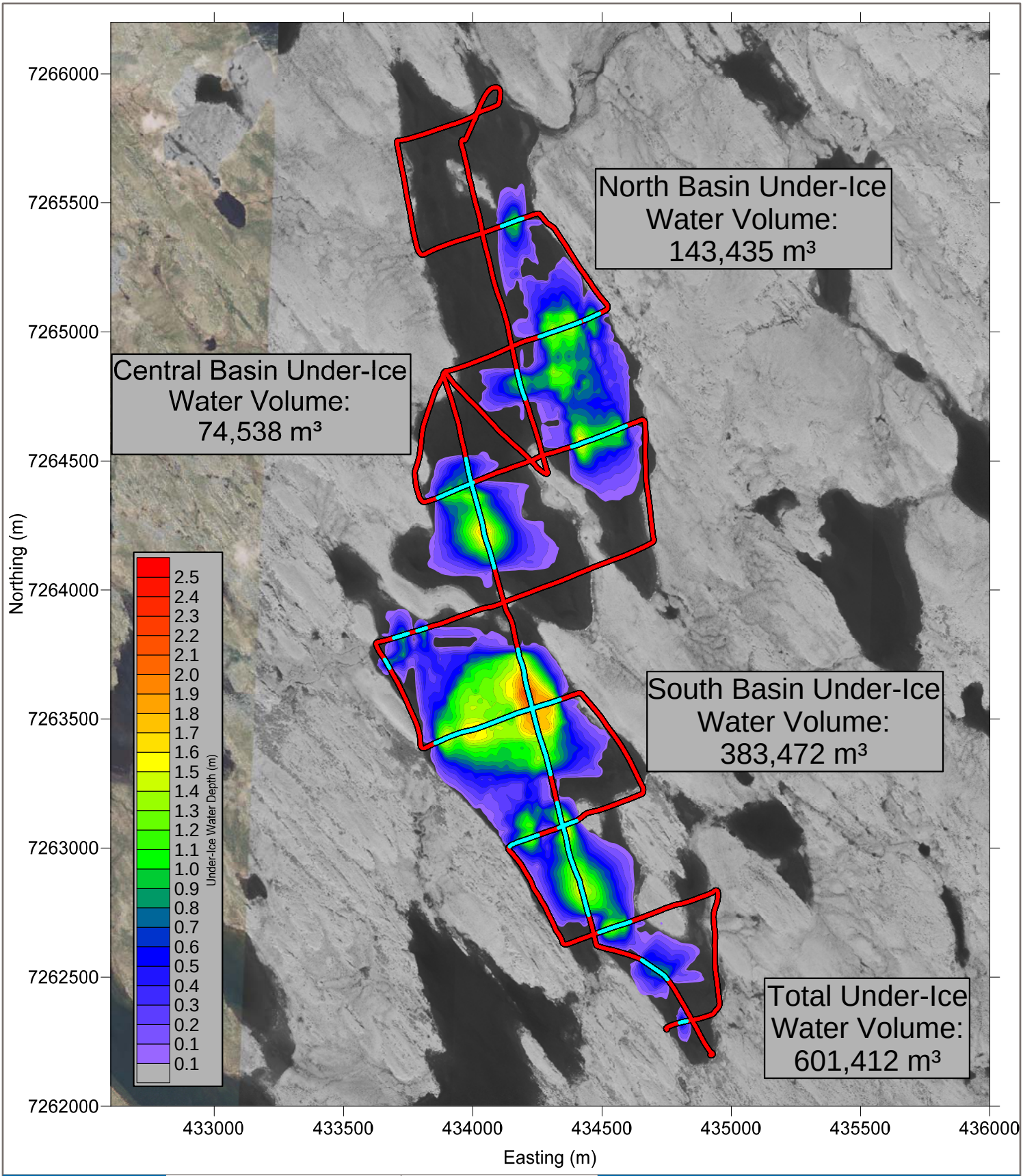
Sabina Gold & Silver
Back River GPR Bathymetry Program

Location of Wolf Lake
(65.49217°N, 106.42258°W)

PROJECT NO.	DWN	CKD	APVD	REV
V33103008-01.E111	RJM	CB	NSP	0

OFFICE	DATE
EBA-EDM	May 23, 2013

Wolf-01



LEGEND

N

Under-Ice Water

Ground / Grounded Ice

SCALE 1:20,000
NAD83
UTM z13

CLIENT

Sabina GOLD & SILVER CORP.

TETRA TECH

Sabina Gold & Silver
Back River GPR Bathymetry Program

Wolf Lake
GPR DFO Results

PROJECT NO.	DWN	CKD	APVD	REV
704-V33103008-01	RJM	CB	NSP	0

OFFICE	DATE
EBA-EDM	May 13, 2013

Wolf-02

1.0 INTRODUCTION

Propeller Lake is located 5.9 km north of Sabina's Goose Lake Camp at 65.59759°N, 106.40621°W. This lake is approximately 8.4 km in length along its long axis (N12°W), and 3.2 km wide at its widest point, with a total surface area of 1284 ha. This lake has a maximum under-ice water depth of greater than 8.96 m. The attached figure, Propeller-01, is a regional area map showing the location of Propeller Lake.

2.0 SURVEY METHODOLOGY

On April 24, 2013, EBA Engineering Consultants Ltd. operating as EBA, A Tetra Tech Company (EBA) collected bathymetric data using a ground penetrating radar (GPR) system. The system used was MALA's Ramac CUII with a 50 MHz rough-terrain antenna. Real-time positioning was achieved using a Topcon HyperLite+ GPS/Glonass unit. Positions were recorded at 1 Hz with a typical absolute horizontal accuracy of ± 1 metre, given appropriate satellite constellations. The survey was typically conducted at a speed of approximately 15 km/h. The GPR unit was set to acquire data at a frequency of approximately 10 readings per second, giving an average horizontal resolution of approximately one GPR trace per 42 cm along survey lines.

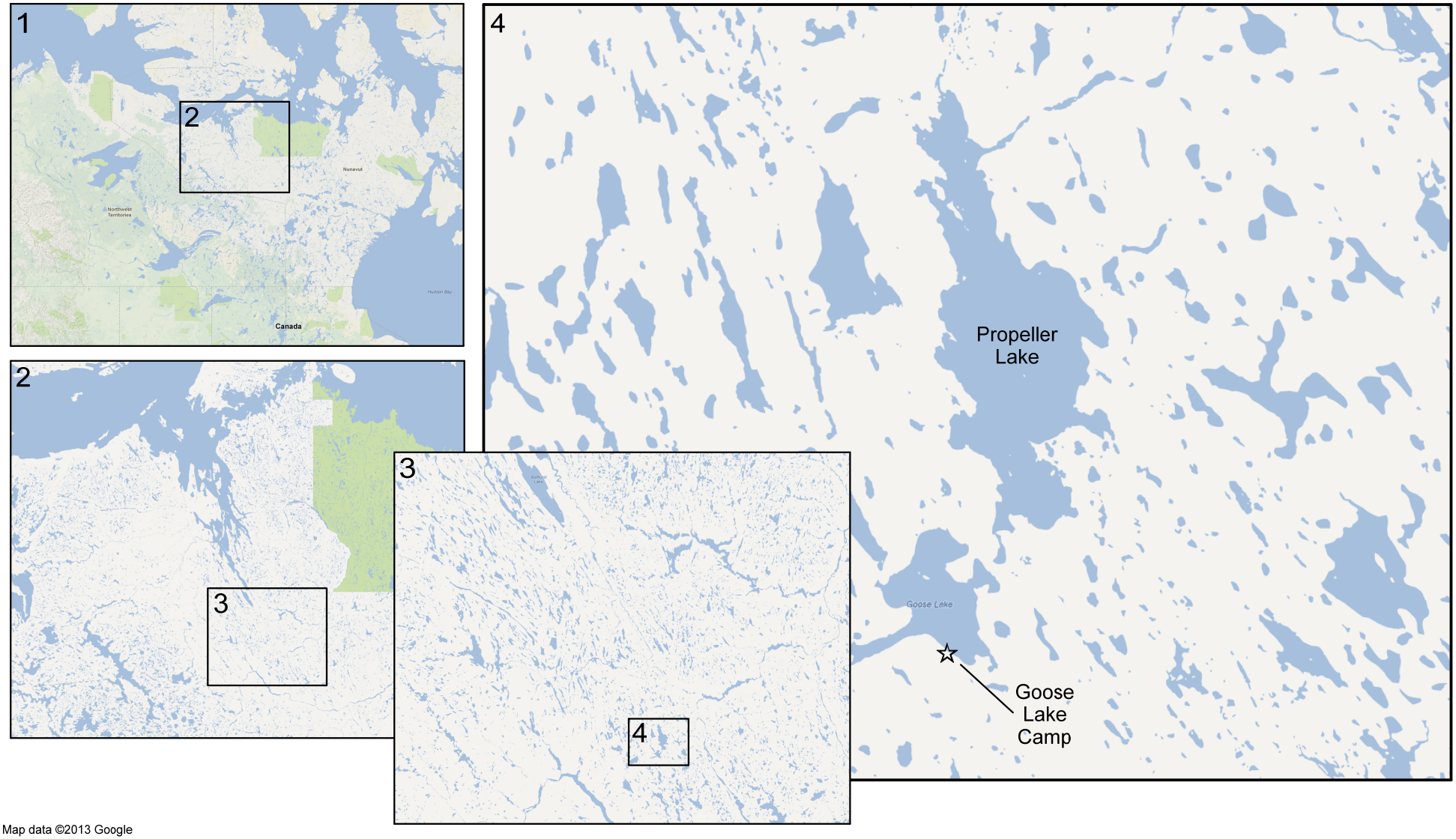
3.0 DATA REDUCTION AND RESULTS

All data has been corrected for ice thickness and GPS offsets. The Surfer 10 software contouring package from Golden Software was used to grid, contour, and calculate volumes for the dataset. Propeller Lake lies north of the tree line; thus, according to the DFO protocols, a maximum expected ice thickness of 2 m was used in the calculation of available winter water. See figure Propeller-02 for the contoured results. Surface area and volumetric values are listed in Table 1.

Information made available to EBA prior to conducting the GPR bathymetry program was that the maximum lake depth was 7.8 m, so EBA adjusted the GPR settings accordingly, to provide the maximum vertical resolution possible. However, in one region, the lake bottom unexpectedly fell off the bottom of the GPR profile (location indicated in figure Propeller-02). This wasn't noticed until several days later, when EBA personnel were out of the area, making a re-survey of these areas impractical. The area in question encompasses approximately 16.4 ha, or 1.28% of the entire surface area of the lake. Assuming an average undocumented depth of 2 m, this would represent a volume underestimate of approximately 329,000 m^3, or 1.22% of the total available water volume. The volume reported herein is the lesser amount, i.e., assuming the lake bottom to be the maximum proven depth obtained from the GPR.

Table 1: DFO Lake Calculations

Lake ID	Propeller Lake
Centre Coordinates	65.59759°N, 106.40621°W
Surface Area	1284 ha
Total Lake Volume	52,246,498 m^3
Under Ice Volume	26,558,785 m^3
Max Expected Ice Thickness Value Used	2 m
Max Under-Ice Water Depth	>8.96 m
Calculated 10% Withdrawal Volume	2,655,879 m^3



LEGEND

CLIENT

Sabina GOLD & SILVER CORP.

TETRA TECH

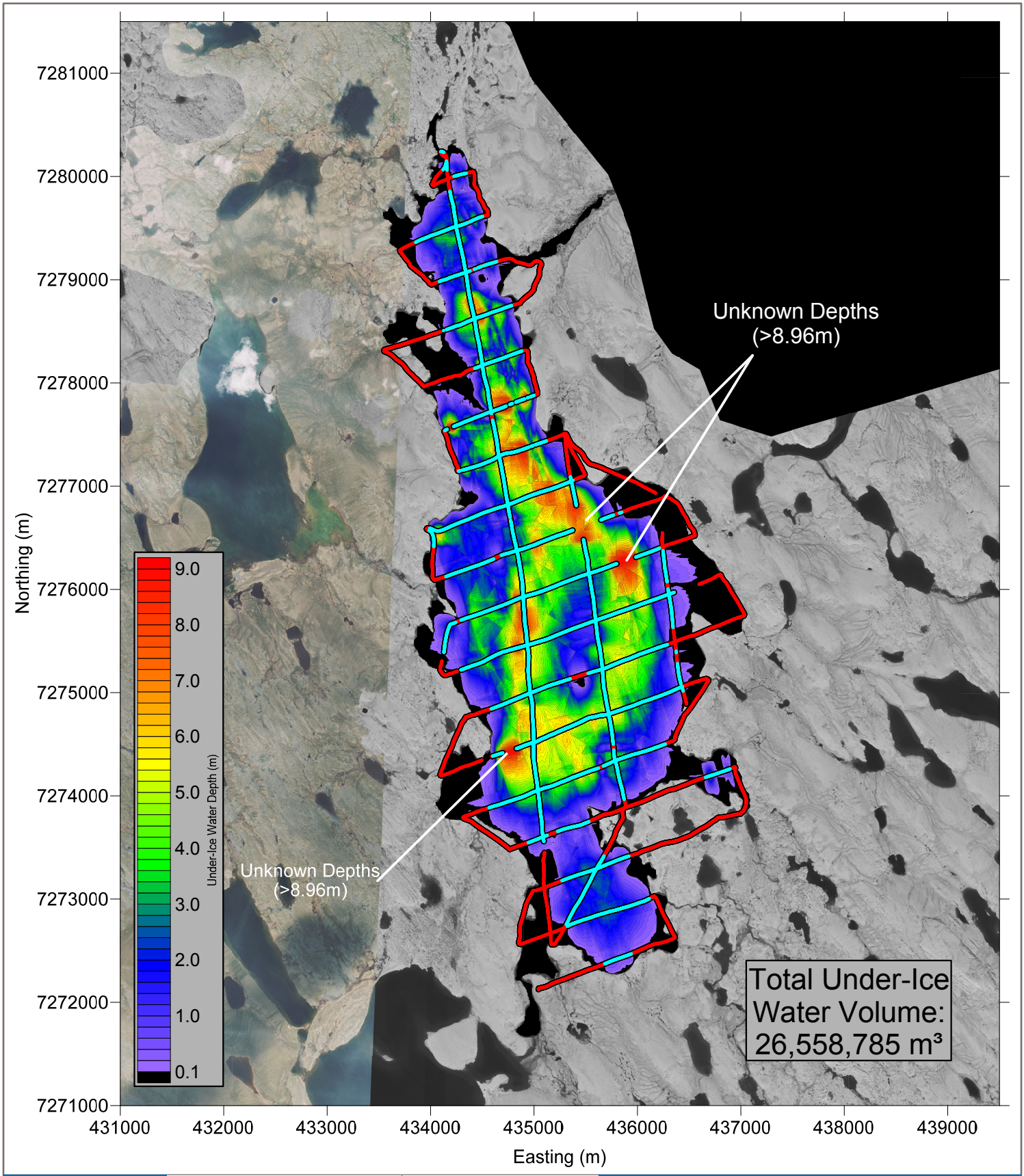
Sabina Gold & Silver
Back River GPR Bathymetry Program

Location of Propeller Lake
(65.59759°N, 106.40621°W)

PROJECT NO.	DWN	CKD	APVD	REV
V33103008-01.E111	RJM	CB	NSP	0

OFFICE	DATE
EBA-EDM	May 23, 2013

Propeller-01



LEGEND

N

Under-Ice Water

Ground / Grounded Ice

SCALE 1:50,000
NAD83
UTM z13

CLIENT

Sabina
GOLD & SILVER CORP.

TETRA TECH

Sabina Gold & Silver
Back River GPR Bathymetry Program

Propeller Lake
GPR DFO Results

PROJECT NO.	DWN	CKD	APVD	REV
704-V33103008-01	RJM	CB	NSP	0

OFFICE	DATE
EBA-EDM	May 13, 2013

Propeller-02

1.0 INTRODUCTION

Leaf Lake is located 4.3 km northwest of Sabina's Goose Lake Camp at 65.57656°N, 106.48500°W. This lake is approximately 635 m in length along its long axis (N-S), and 350 m wide at its widest point, with a total surface area of 15.6 ha. This lake has a maximum under-ice water depth of 3.87 m, with the deepest section being slightly northwest of the central portion of the lake. The attached figure, Leaf-01, is a regional area map showing the location of Leaf Lake.

2.0 SURVEY METHODOLOGY

On April 25, 2013, EBA Engineering Consultants Ltd. operating as EBA, A Tetra Tech Company (EBA) collected bathymetric data using a ground penetrating radar (GPR) system. The system used was MALA's Ramac CUII with a 50 MHz rough-terrain antenna. Real-time positioning was achieved using a Topcon HyperLite+ GPS/Glonass unit. Positions were recorded at 1 Hz with a typical absolute horizontal accuracy of ± 1 metre, given appropriate satellite constellations. The survey was typically conducted at a speed of approximately 15 km/h. The GPR unit was set to acquire data at a frequency of approximately 10 readings per second, giving an average horizontal resolution of approximately one GPR trace per 42 cm along survey lines.

3.0 DATA REDUCTION AND RESULTS

All data has been corrected for ice thickness and GPS offsets. The Surfer 10 software contouring package from Golden Software was used to grid, contour, and calculate volumes for the dataset. Leaf Lake lies north of the tree line; thus, according to the DFO protocols, a maximum expected ice thickness of 2 m was used in the calculation of available winter water. See figure Leaf-02 for the contoured results. Surface area and volumetric values are listed in Table 1.

Table 1: DFO Lake Calculations

Lake ID	Leaf Lake
Centre Coordinates	65.57656°N, 106.48500°W
Surface Area	15.6 ha
Total Lake Volume	367,704 m^3
Under Ice Volume	56,158 m^3
Max Expected Ice Thickness Value Used	2 m
Max Under-Ice Water Depth	3.87 m
Calculated 10% Withdrawal Volume	5,616 m^3

LEGEND

CLIENT

Sabina GOLD & SILVER CORP.

TETRA TECH

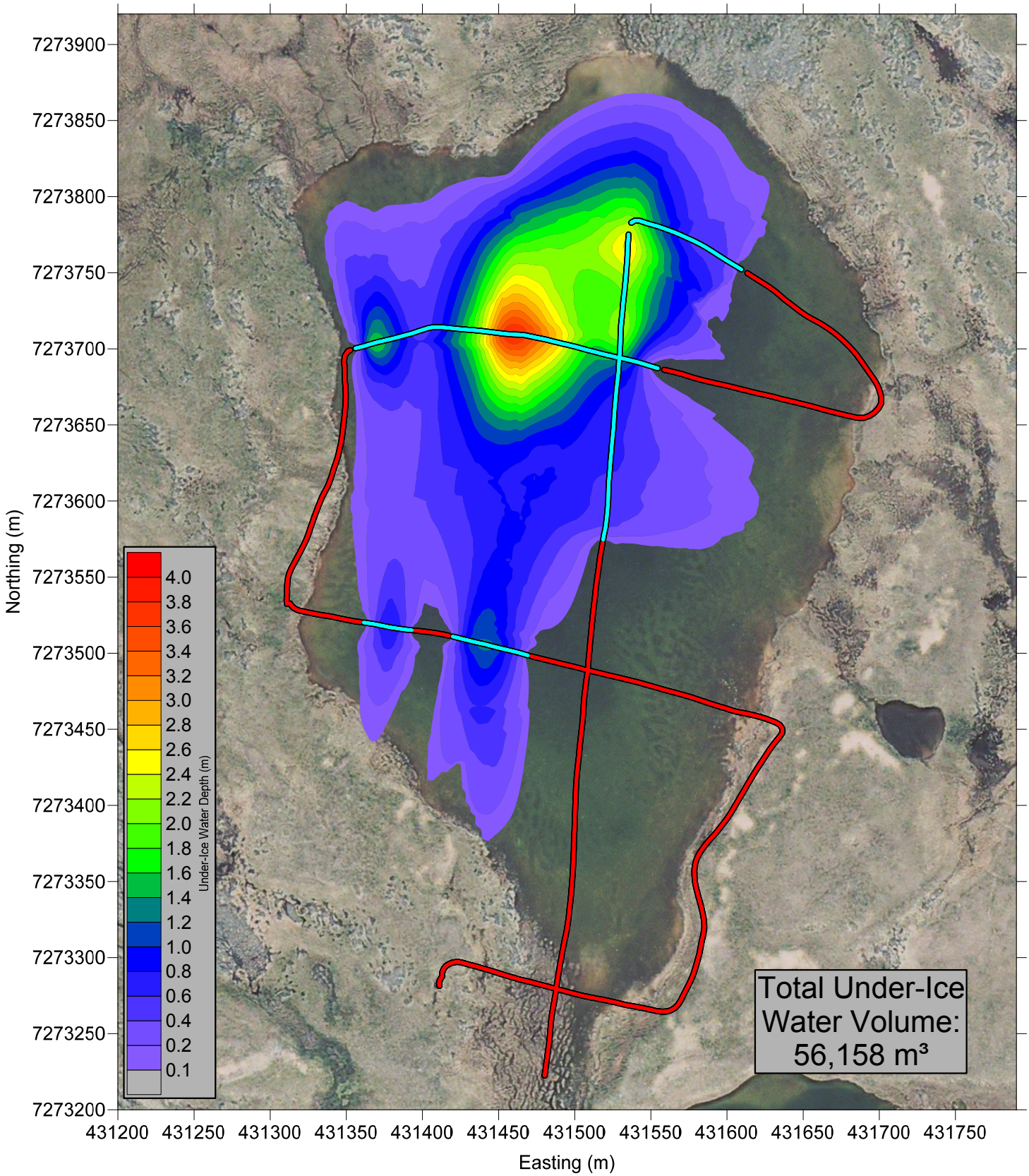
Sabina Gold & Silver
Back River GPR Bathymetry Program

Location of Leaf Lake
(65.57656°N, 106.48500°W)

PROJECT NO.	DWN	CKD	APVD	REV
V33103008-01.E111	RJM	CB	NSP	0

OFFICE	DATE
EBA-EDM	May 23, 2013

Leaf-01



LEGEND

N

SCALE 1:3500
NAD83
UTM z13

Under-Ice Water

Ground / Grounded Ice

CLIENT

Sabina GOLD & SILVER CORP.

TETRA TECH

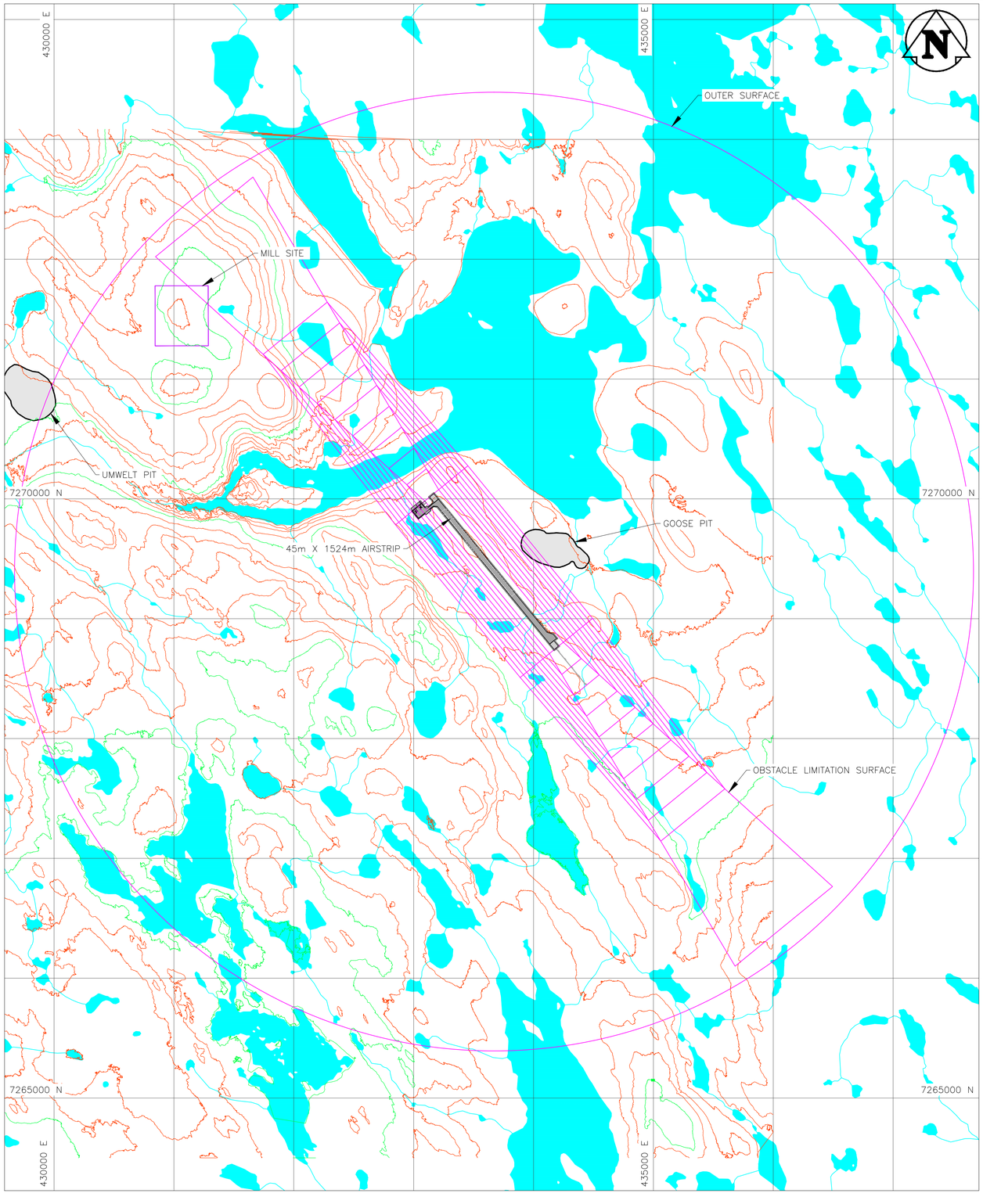
Sabina Gold & Silver
Back River GPR Bathymetry Program

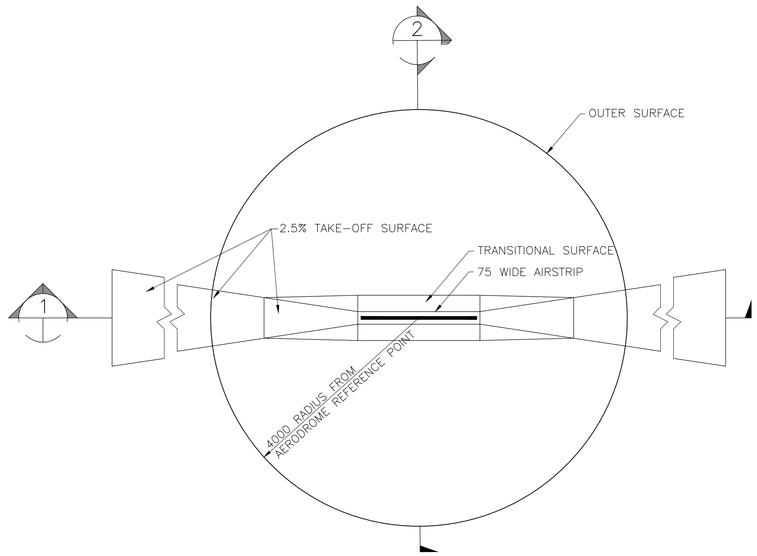
Leaf Lake
GPR DFO Results

PROJECT NO.	DWN	CKD	APVD	REV
704-V33103008-01	RJM	CB	NSP	0

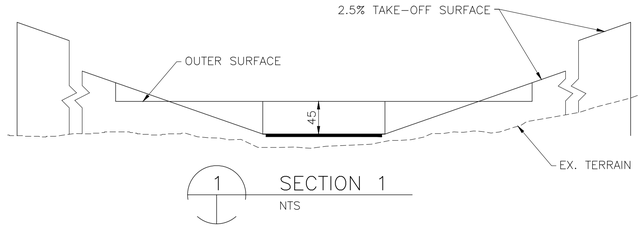
OFFICE	DATE
EBA-EDM	May 13, 2013

Leaf-02

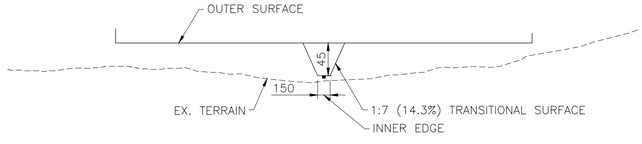




TYPICAL OBSTRUCTION SURFACES – PLAN VIEW
NTS



1 SECTION 1
NTS



2 SECTION 2
NTS

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN METRES.
2. UTM NAD83 COORDINATE SYSTEM USED FOR DRAWINGS.

500 0 500 1000 1500
METRES 1:20000

NO.	DESCRIPTION	NO.	DATE	DESCRIPTION	PREPARED	REVIEW	DESIGN	AUTHORIZE
		00	13.09.18	ISSUED FOR REVIEW	MD	JW	EH	AE
REFERENCE DRAWINGS		REVISIONS/ISSUE			DRAFTING		ENGINEERING	

SUB-CONSULTANT(S) :

PERMIT STAMP

SEAL

PRELIMINARY DRAWING

NOT TO BE USED FOR CONSTRUCTION

DESIGNED BY:	PREPARED BY:	REVIEWED BY:
E. HURRELL	M. DOMINGO	J. WILLMS
AUTHORIZED BY:	DATE:	SCALE:
A. EVANS	13.09.18	AS NOTED

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Sabina GOLD & SILVER CORP.

TETRA TECH

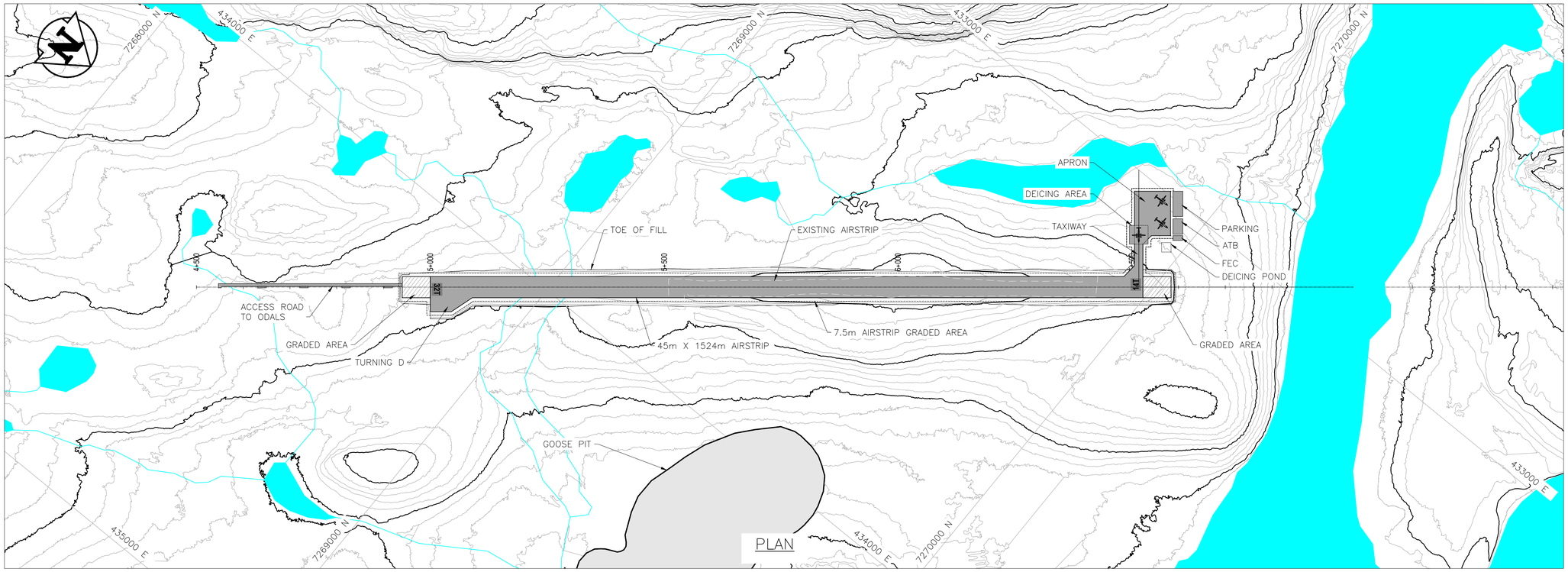
TETRA TECH DWG. No.	REV.
-	00

PROJECT NAME:
SABINA-BACKRIVER PROJECT PFS
NUNAVUT

DRAWING DESCRIPTION:
GOOSE AIRSTRIP 5000'
OBSTACLE LIMITATION SURFACE

DRAWING NO:	REV:
C1.0	00

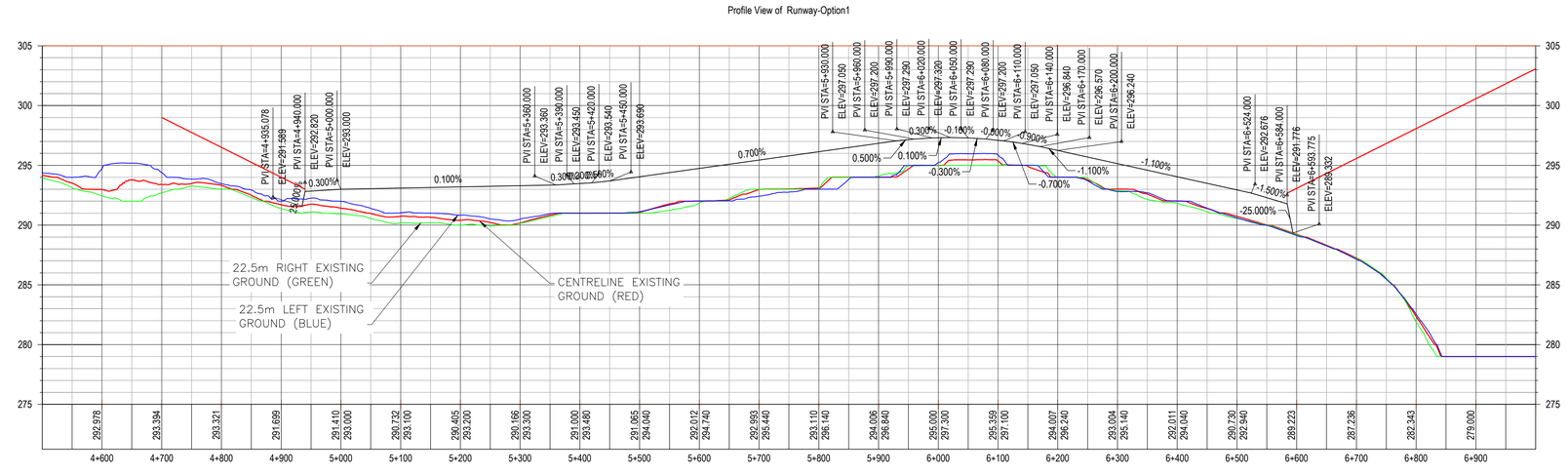
V:\CH\103349 - Sabina Mine\Phase\Design\Goose Airstrip 5000\C01\103349-Goose Airstrip 5000-C1.0 - OBSTACLE LIMITATION SURFACE.dwg [C1.0] September 18, 2013 - 9:14:15 am (BY: domingo, marc)



PLAN

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN METRES.
2. UTM NAD83 COORDINATE SYSTEM USED FOR DRAWINGS.
3. 14T TRUE BEARING. "T" DENOTES TRUE BEARING NOT MAGNETIC BEARING.



PROFILE

HORIZONTAL SCALE
100 0 200 400
METRES 1:5000

VERTICAL SCALE
1000 0 2000 4000
MILLIMETRES 1:50

NO.	DESCRIPTION	NO.	DATE:	DESCRIPTION	PREPARED	REVIEW	DESIGN	AUTHORIZE
REFERENCE DRAWINGS		REVISIONS/ISSUE			DRAFTING		ENGINEERING	
		00	13.09.18	ISSUED FOR REVIEW	MD	JW	EH	AE

SUB-CONSULTANT(S) :

PERMIT STAMP

SEAL

PRELIMINARY DRAWING

NOT TO BE USED FOR CONSTRUCTION

DESIGNED BY:	PREPARED BY:	REVIEWED BY:
E. HURRELL	M. DOMINGO	J. WILLMS
AUTHORIZED BY:	DATE:	SCALE:
A. EVANS	13.09.18	AS NOTED

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Sabina GOLD & SILVER CORP.

TETRA TECH

TETRA TECH DWG. No.	REV.
-	00

PROJECT NAME:
SABINA-BACK RIVER PROJECT PFS
NUNAVUT

DRAWING DESCRIPTION:
GOOSE AIRSTRIP 5000'
PLAN AND PROFILE

DRAWING NO:	REV:
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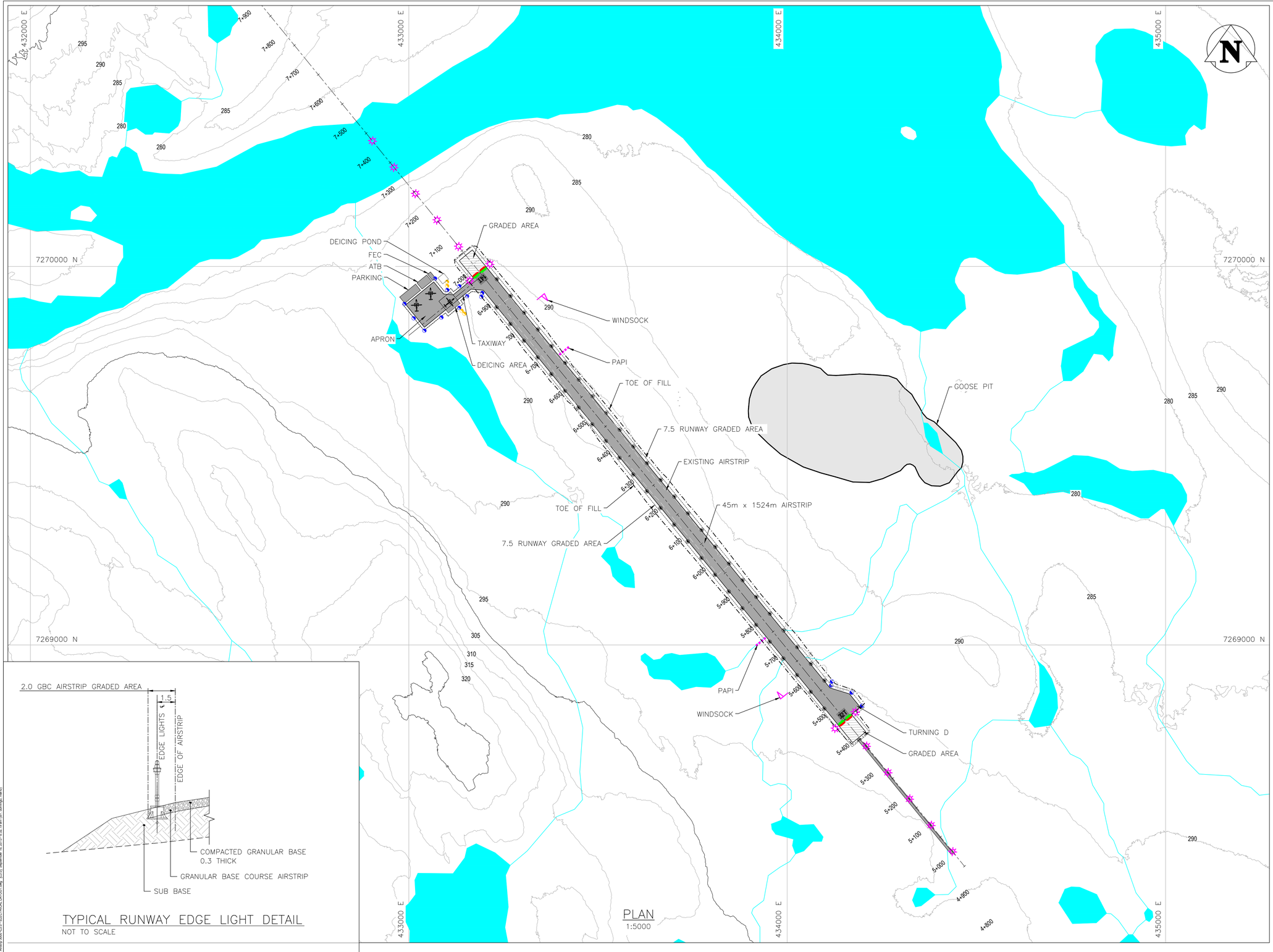

TYPICAL RUNWAY EDGE LIGHT DETAIL

NOT TO SCALE

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN METRES.
2. UTM NAD83 COORDINATE SYSTEM USED FOR DRAWINGS.

LEGEND

- REILS AND ODALS
- WHITE RUNWAY EDGE LIGHT
- BLUE TAXIWAY EDGE LIGHT
- YELLOW APRON ENTRANCE LIGHT
- RUNWAY THRESHOLD LIGHT

ABBREVIATIONS

REILS	– RUNWAY END IDENTIFIER LIGHTING SYSTEM
ATB	– AIR TERMINAL BUILDING
FEC	– FIELD ELECTRICAL CENTRE
PAPI	– PRECISION APPROACH PATH INDICATOR
GBC	– GRANULAR BASE COURSE
ODALS	– OMNI–DIRECTIONAL APPROACH LIGHTING SYSTEM

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TETRA TECH

TETRA TECH DWG. No.: –

REV.: 00

PROJECT NAME: SABINA-BACK RIVER PROJECT PFS NUNAVUT

DRAWING DESCRIPTION: GOOSE AIRSTRIP 5000' ELECTRICAL LAYOUT

DRAWING NO: C3.0

REV.: 00

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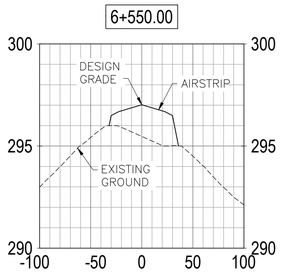

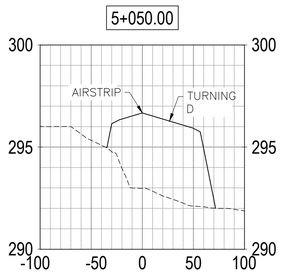

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METRES 1:3000

VERTICAL SCALE

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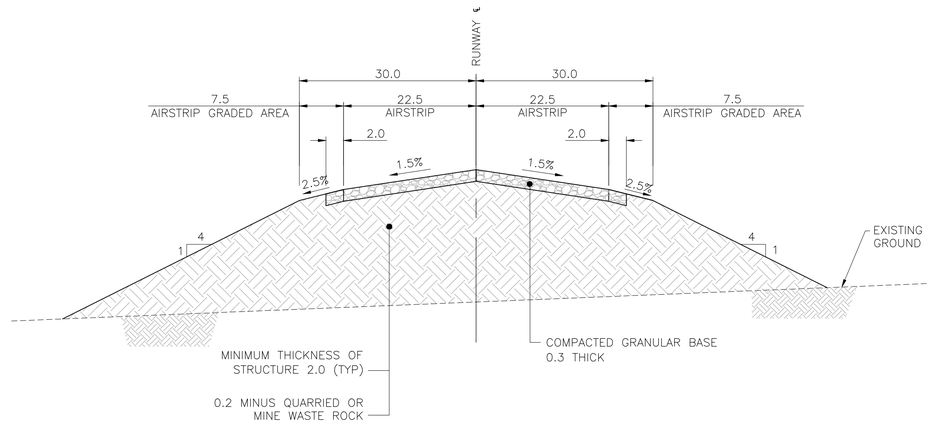
MILLIMETRES 1:30



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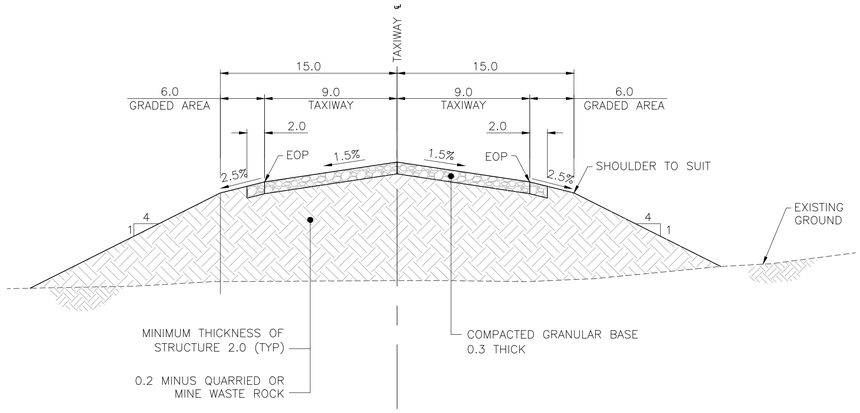

TYPICAL TAXIWAY SECTION

NOT TO SCALE

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN METRES.
2. UTM NAD83 COORDINATE SYSTEM USED FOR DRAWINGS.

ABBREVIATION

EOP – EDGE OF PAVEMENT

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TETRA TECH DWG. No.: –

REV.: 00

PROJECT NAME: SABINA-BACK RIVER PROJECT PFS NUNAVUT

DRAWING DESCRIPTION: GOOSE AIRSTRIP 5000' TYPICAL SECTIONS AND CROSS SECTIONS

DRAWING NO.: C4.0

REV.: 00

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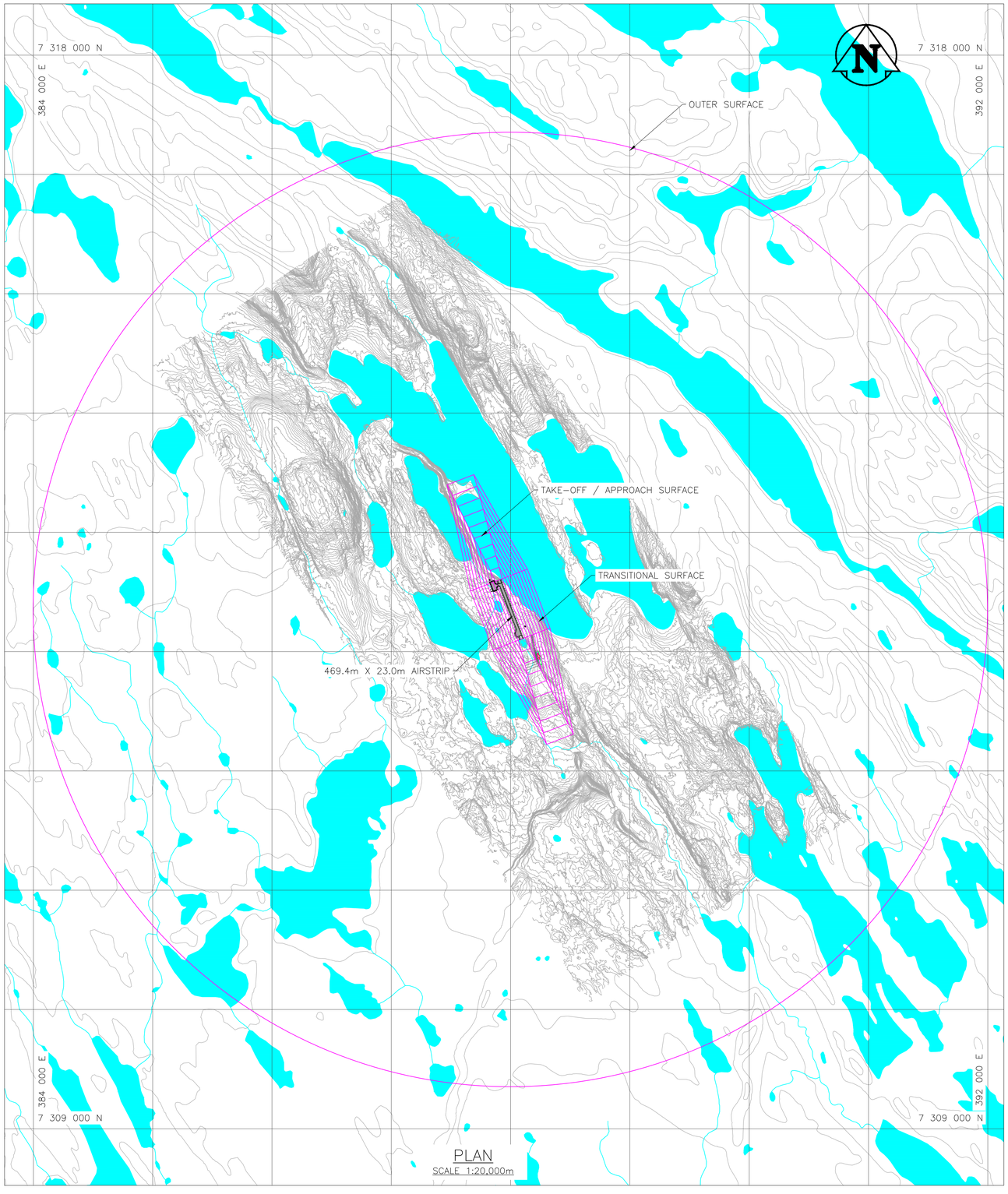

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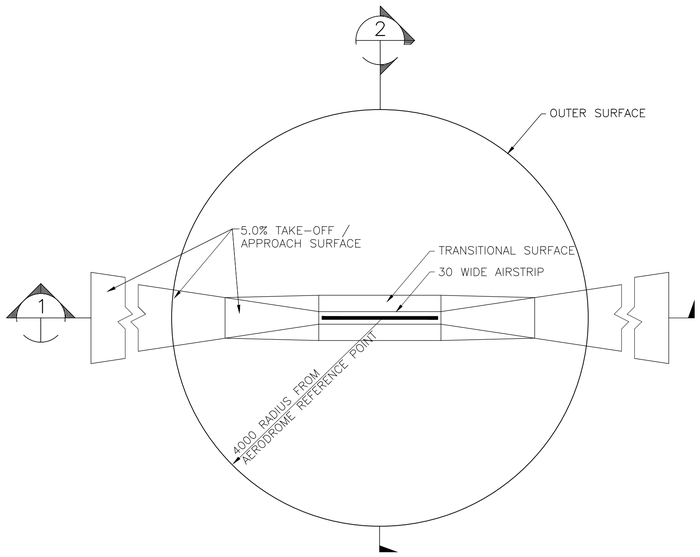
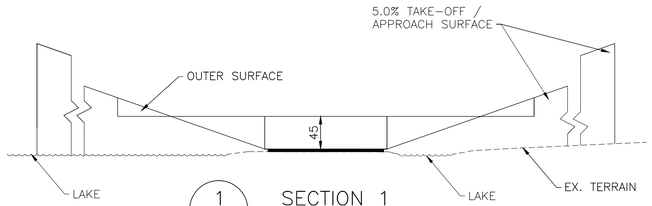


TYPICAL OBSTRUCTION SURFACES – PLAN VIEW
NOT TO SCALE



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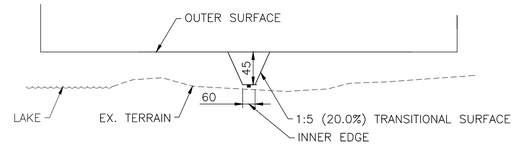

2 SECTION 2
NOT TO SCALE

SCALE
0 1 000
Scale: 1: 20 000 (metres)

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN METRES.
2. UTM NAD83 COORDINATES SYSTEM USED FOR DRAWINGS.

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TETRA TECH

TETRA TECH DWG. No.: -
REV.: 00

PROJECT NAME:
SABINA-BACK RIVER PROJECT PFS
NUNAVUT

DRAWING DESCRIPTION:
GEORGE AIRSTRIP 1540'
OBSTACLE LIMITATION SURFACE

DRAWING NO.: C5.0
REV.: 00

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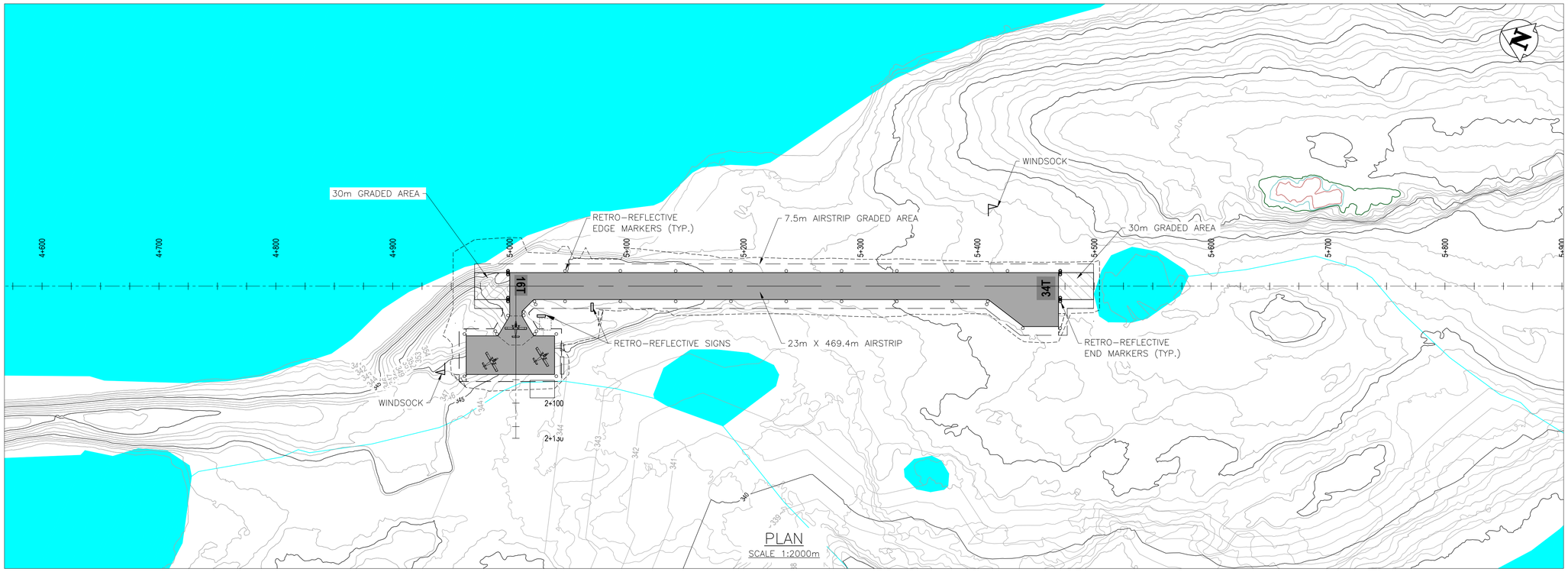


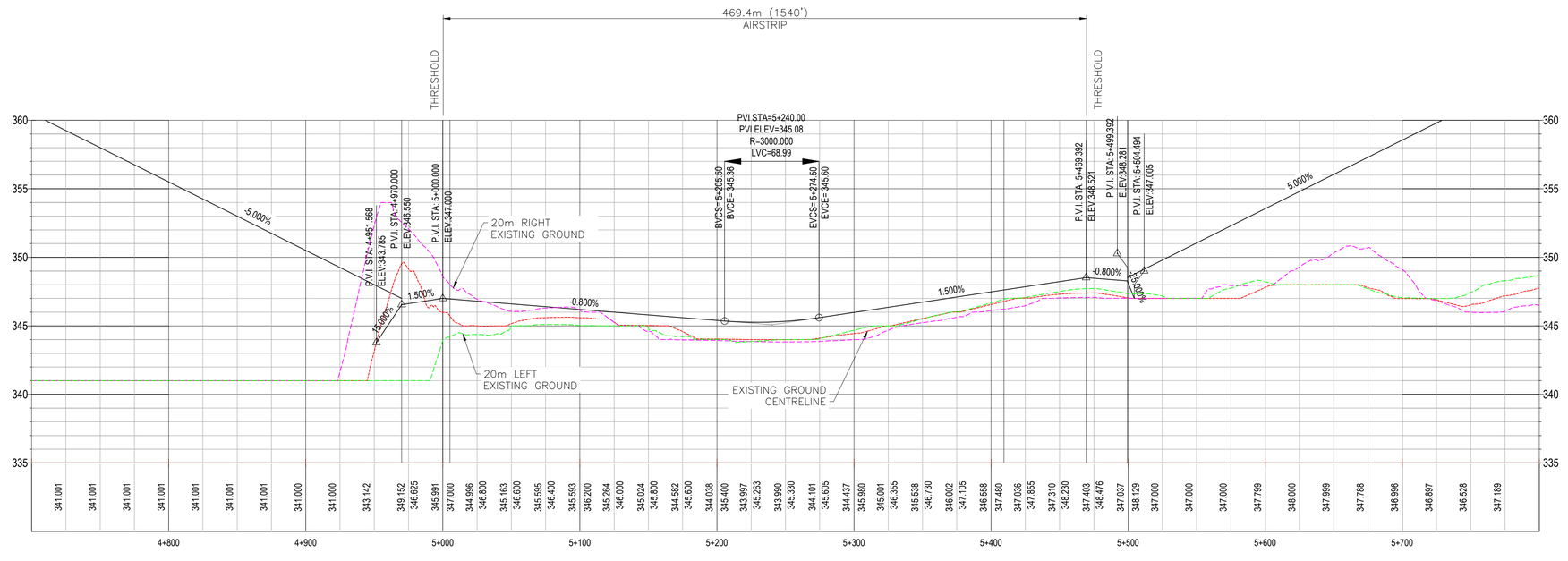
PLAN
SCALE 1:2000m

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN METRES.
2. UTM NAD83 COORDINATES SYSTEM USED FOR DRAWINGS.
3. CONTOUR INTERVALS AT 1.0m.

LEGEND

- RETRO-REFLECTIVE EDGE MARKER
- RETRO-REFLECTIVE END MARKER
- WINDSOCK
- RETRO-REFLECTIVE SIGN



PROFILE
HOR. 1:2000m
VERT. 1:200m

HORIZONTAL SCALE
0 100
Scale: 1: 2 000 (metres)

VERTICAL SCALE
0 10
Scale: 1: 200 (metres)

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TETRA TECH

TETRA TECH DWG. No.	REV.
-	00

PROJECT NAME:
SABINA-BACK RIVER PROJECT PFS
NUNAVUT

DRAWING DESCRIPTION:
GEORGE AIRSTRIP 1540'
PLAN & PROFILE AND
SIGNS & MARKERS

DRAWING NO:	REV:
C6.0	00

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GENERAL NOTES:

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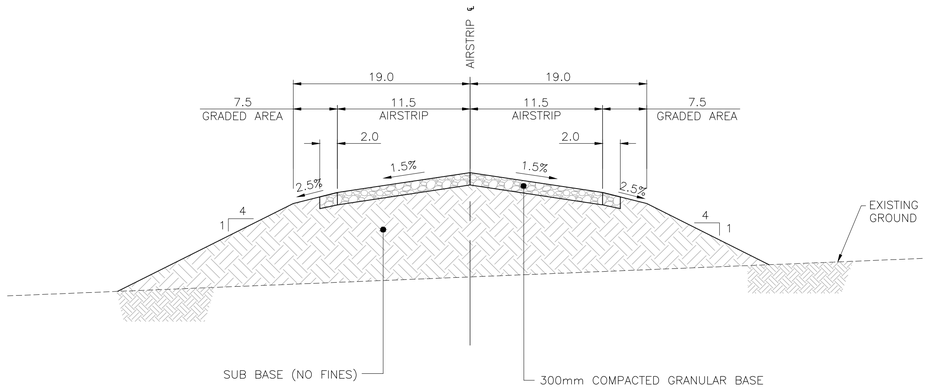
2. UTM NAD83 COORDINATES SYSTEM USED FOR DRAWINGS.



TYPICAL AIRSTRIP SECTION
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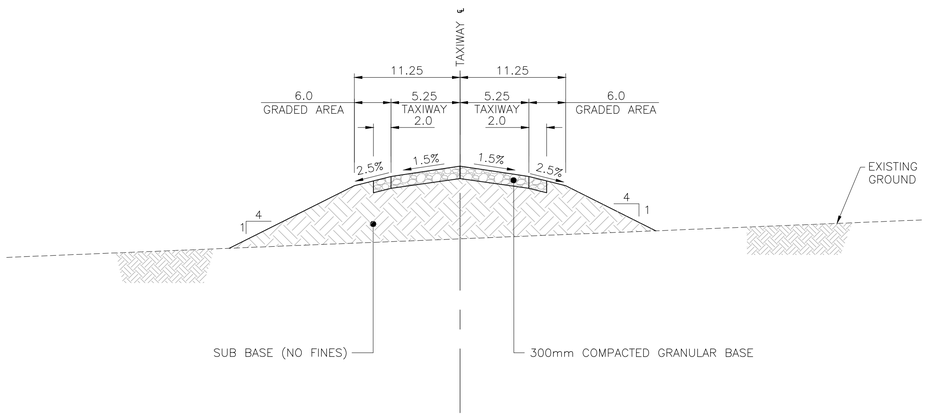

TYPICAL TAXIWAY SECTION
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TETRA TECH

TETRA TECH DWG. No.: -

REV.: 00

PROJECT NAME:
SABINA-BACK RIVER PROJECT PFS
NUNAVUT

DRAWING DESCRIPTION:
GEORGE AIRSTRIP 1540'
TYPICAL SECTIONS

DRAWING NO: C7.0

REV.: 00

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Appendix V6-3F

2014 Bathymetric Survey Report

Sabina
GOLD & SILVER CORP.

Sabina Gold & Silver Corp.

BACK RIVER PROJECT
2014 Bathymetric Survey Data Report

Rescan Environmental Services Ltd., an ERM company
ERM Rescan Building, 15th Floor - 1111 West Hastings Street
Vancouver, BC Canada V6E 2J3
Tel: (604) 689-9460 Fax: (604) 687-4277

September 2014

BACK RIVER PROJECT
2014 BATHYMETRIC SURVEY DATA REPORT

September 2014
Project #0234411-0023

Citation:
Rescan. 2014. *Back River Project: 2014 Bathymetric Survey Data Report*. Prepared for Sabina Gold & Silver Corp. by Rescan Environmental Services Ltd., an ERM company.

Prepared for:

Sabina Gold & Silver Corp.

Prepared by:

Rescan Environmental Services Ltd., an ERM company
Vancouver, British Columbia

Acknowledgements

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an ERM company

Acknowledgements

This report was prepared for Sabina Gold & Silver Corp. (Sabina) by Rescan Environmental Services Ltd., an ERM company (Rescan). The 2014 bathymetric survey field work was conducted by Luke Powell (M.Sc.) and April Hayward (Ph.D.). Rescan staff were assisted in the field by Kokiak Peetooloot (assistant provided by Sabina). The report was prepared by Luke Powell and was reviewed by Pieter van Leuzen (M.Sc.) and Deborah Muggli (Ph.D., M.Sc., R.P.Bio.). The Back River Project was managed by Deborah Muggli, with project coordination assistance from Korina Houghton (B.Sc.).

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BACK RIVER PROJECT
2014 BATHYMETRIC SURVEY DATA REPORT

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Glossary and Abbreviations

Rescan™
an ERM company

Glossary and Abbreviations

Terminology used in this document is defined where it is first used. The following list will assist readers who may choose to review only portions of the document.

DGPS	Differential Global Positioning System
MLA	Marine Laydown Area

1. Introduction

1. Introduction

The Back River Project (the Project) is a proposed gold project owned by Sabina Gold & Silver Corp. (Sabina) located in the West Kitikmeot region of Nunavut (Figure 1-1). This report presents the results of the bathymetric surveys that were conducted on site in 2014.

During 2014, the following lakes were surveyed via boat methods:

- Lower Long Lake (George Property Area);
- Fold Lake (George Property Area);
- Winter Road lakes WR01, WR02, WR03, WR05, and WR06 (located along the winter road route between the Goose Property Area and the Marine Laydown Area);
- MLA Pond S1 (west of the Marine Laydown Area); and
- MLA Pond S2 (west of the Marine Laydown Area).

Chapter 2 of this report presents the methods used for the bathymetric survey work and Chapter 3 presents all of the bathymetric maps along with a summary of the results.

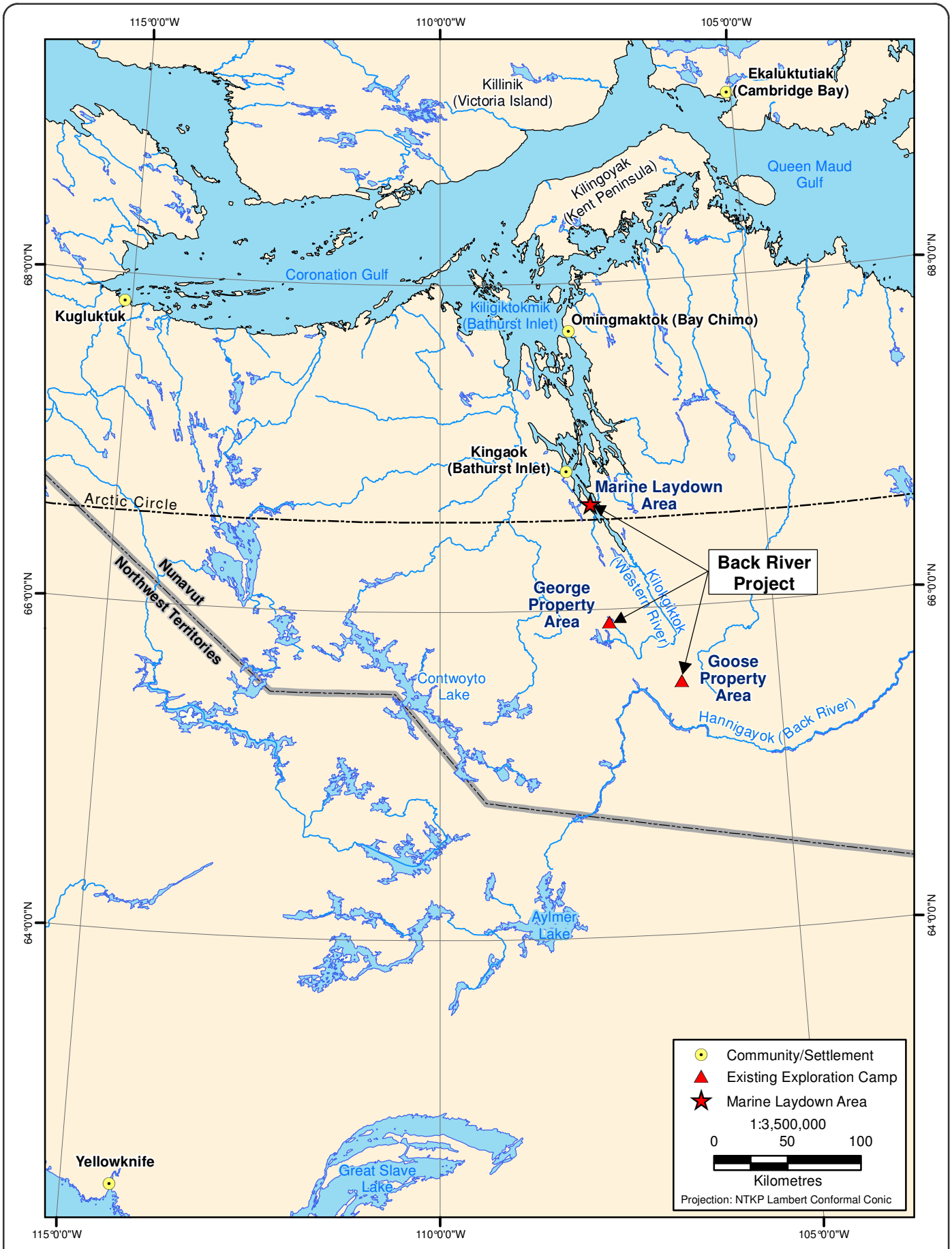

Figure 1-1

Back River Project Location

Sabina GOLD & SILVER CORP.

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2. Methods

2. Methods

2.1 DATA COLLECTION

Bathymetric maps display the topography of lake bottoms in a similar manner to terrestrial topographic contour maps. Bathymetric maps are based on systematic depth soundings that are taken from a boat across the water body. These maps are used to calculate surface area and water volumes, as well as determine maximum depths and the relative size of the littoral zone.

The locations of all of the waterbodies surveyed are presented in Figure 2.1-1. Bathymetric surveys of Lower Long Lake, Fold Lake, Winter Road Lakes 01, 02, 03, 05 and 06, and MLA ponds S1 and S2 were conducted between July 3 and 17, 2014.

Each survey was conducted using a BioSonics MX Aquatic Habitat Echosounder. The unit has an integrated differential global positioning system (DGPS) connected to a single-frequency 204.8 kHz transducer which records water depths using BioSonics' proprietary software Visual Acquisition. The transducer was attached to a steel rod mounted to the gunnel of a 12-foot aluminum boat, and placed underwater at a depth of between 15 and 25 cm (Plate 2.1-1). Water temperatures were taken to calculate the speed of sound and absorption coefficient in order to calibrate the transducer. The Visual Acquisition software automatically corrected all depth measurements for transducer depth and water properties.

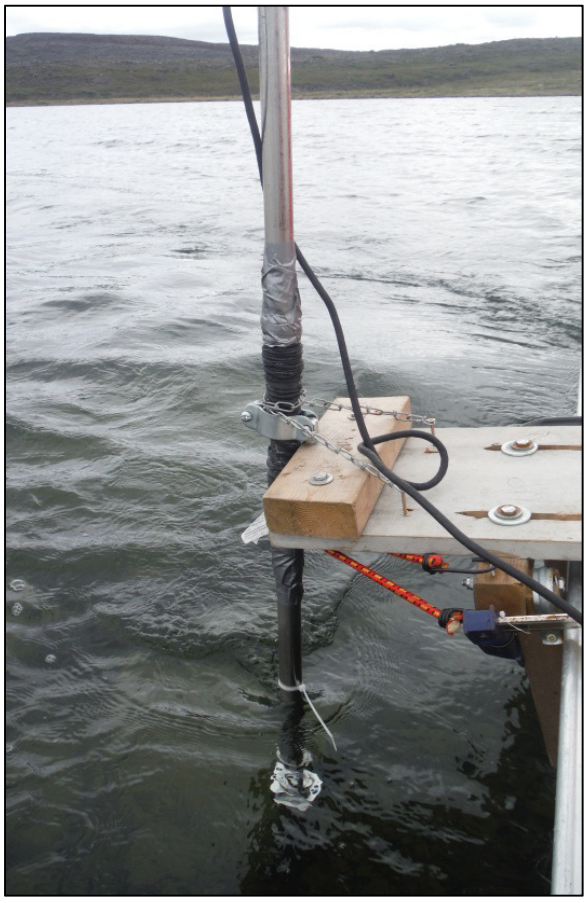


Plate 2.1-1. Typical setup of transducer.

The surveys were carried out by navigating a course of regularly spaced transects across the width of each lake, along with a longitudinal transect through the long axis of the lake. Spacing between the transects was determined based on the desired level of detail of the survey; transects placed closer together would produce a more detailed survey. A hand-held Garmin GPSMap 60cx, pre-loaded with the transect tracks, was used to maintain the correct course with the boat. In areas that were too shallow for reliable depth readings using the echosounder, personnel waded through the water using a stadia rod and the hand-held GPS to collect lake depths and associated GPS coordinates.

For Lower Long Lake and Fold Lake, the elevation of the water surface was surveyed on the same day the bathymetric survey was completed using established elevation benchmarks.

2.2 DATA ANALYSIS

The shoreline of each lake was digitized from high resolution satellite imagery. The digitized shorelines were compared to points recorded with the hand-held GPS taken at the shoreline to ensure the digitized shorelines were accurate. The digitized shorelines, sounding depth points, and any point manually recorded in shallow areas were then used to create a triangular irregular network (TIN). The TIN was converted to a raster (i.e., grid) with a cell size ranging from 1 to 5 m, depending on the spacing of the transects (i.e., the larger the transect spacing, the larger the cell size). The values from the raster were then interpolated back into points which were compared to the recorded depths. Readings with a variation greater than 0.5 m were individually assessed against other nearby points to determine if it was likely an erroneous point or simply in an area of high variability. Sounding data that seemed likely to be in error was removed from the dataset, and the TIN was recreated using the corrected data, and the points were reassessed against the generalized average.

A grid of fill points was then created and values from the corrected TIN transferred back to the point grid. The corrected sounding data, densified TIN grid points and the shoreline were used as inputs in an interpolation to a raster dataset that was then used to produce depth contours.

PROJECT #0234411-0023 GIS # BAC-10-107 September 09 2014

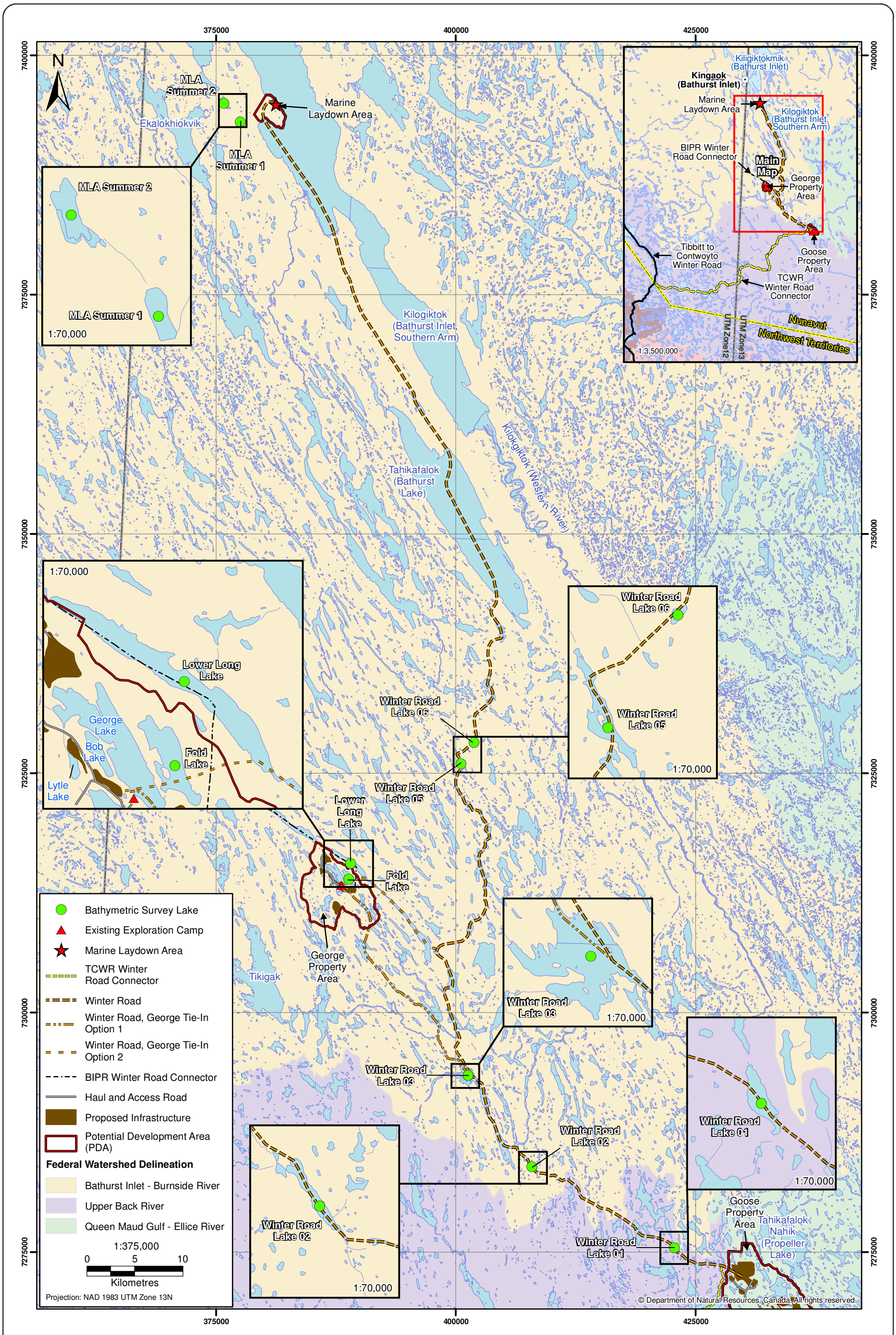


Figure 2.1-1

Sabina GOLD & SILVER CORP.

2014 Bathymetric Survey Lakes

Figure 2.1-1

Rescan an ERM company

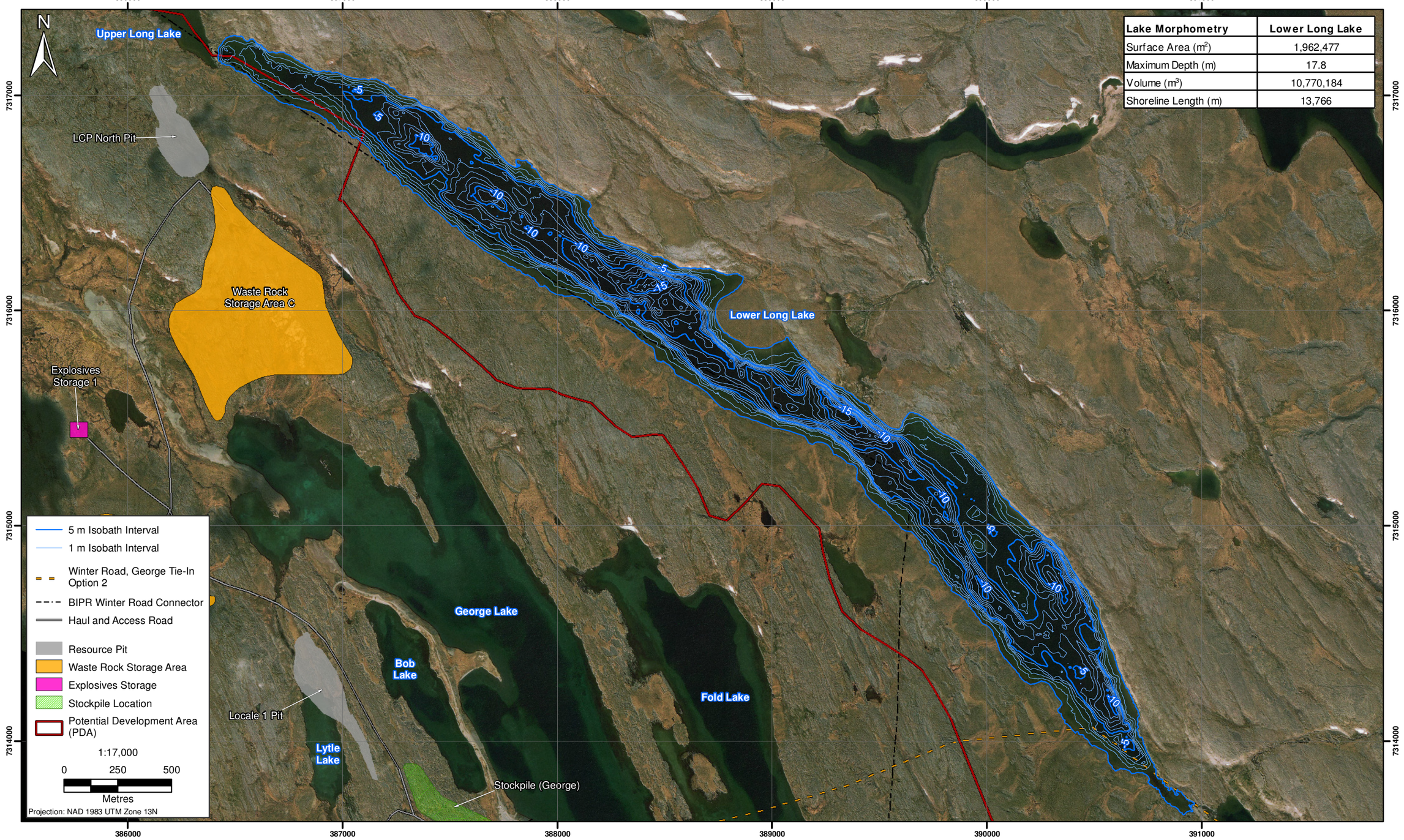
3. Results

3. Results

Bathymetric maps of each lake are presented in Figures 3-1 to 3-9. A summary of the physical properties of each lake is presented in Table 3-1.

Table 3-1. Morphometry of Lakes Surveyed in 2014

Waterbody	Max Depth (m)	Volume (m^3)	Surface Area (m^2)	Shoreline Length (m)
Lower Long Lake	17.8	10,770,184	1,962,477	13,766
Fold Lake	15.4	2,970,486	786,881	8,080
MLA Pond S1	4.1	843,355	377,671	2,863
MLA Pond S2	3.7	577,689	442,045	4,165
Winter Road Lakes				
WR Lake 01	8.5	664,318	632,030	3,851
WR Lake 02	5.4	435,046	288,570	5,270
WR Lake 03	5.1	2,167,398	2,335,544	15,281
WR Lake 05	11.3	1,482,102	517,945	7,947
WR Lake 06	10.5	190,557	59,903	1,307



Lake Morphometry	Lower Long Lake
Surface Area (m^2)	1,962,477
Maximum Depth (m)	17.8
Volume (m^3)	10,770,184
Shoreline Length (m)	13,766

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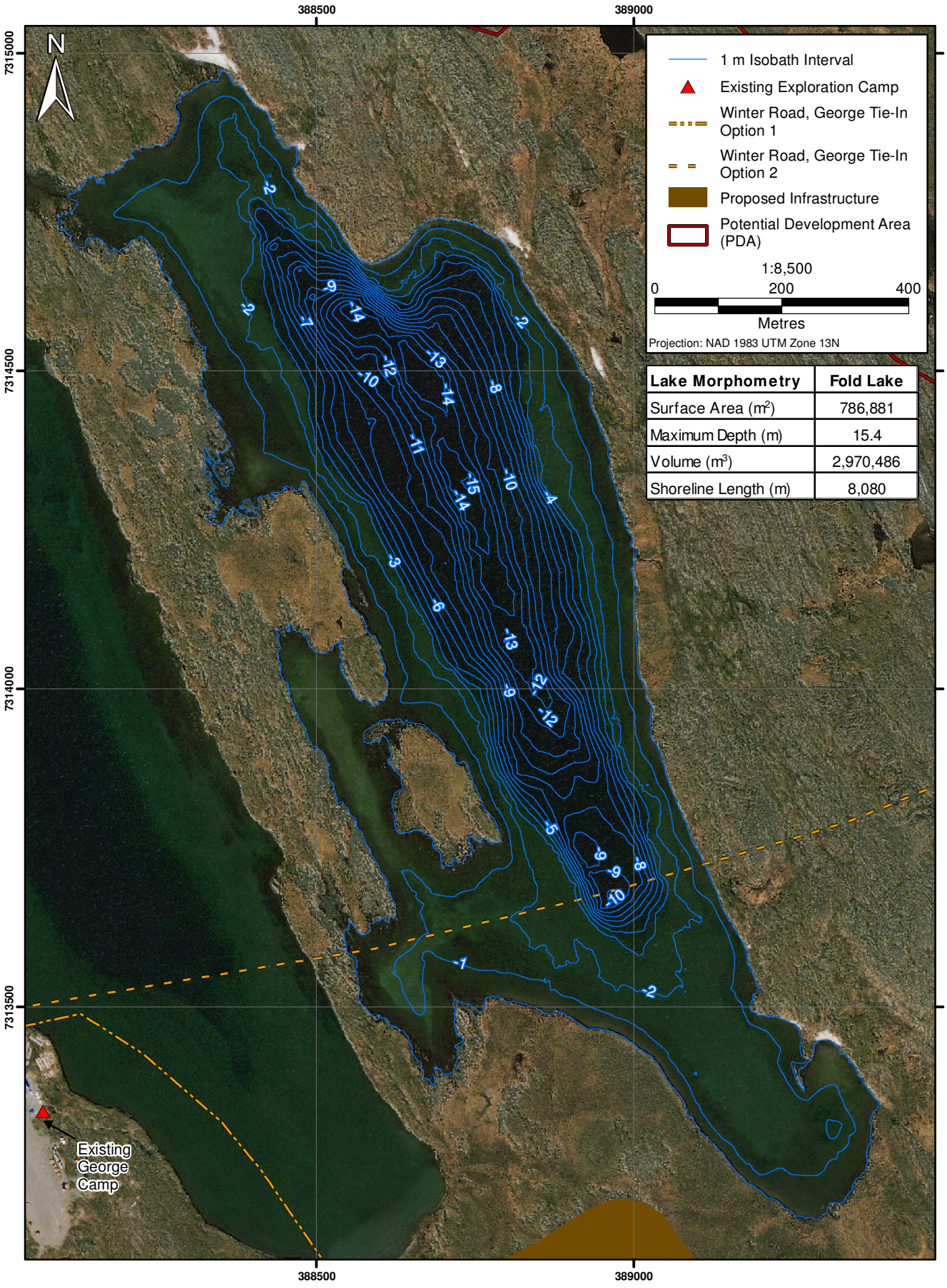
Figure 3-1

Bathymetry of Lower Long Lake, Back River Project, 2014



Lake Morphometry	Fold Lake
Surface Area (m^2)	786,881
Maximum Depth (m)	15.4
Volume (m^3)	2,970,486
Shoreline Length (m)	8,080

Figure 3-2

Bathymetry of Fold Lake, Back River Project, 2014

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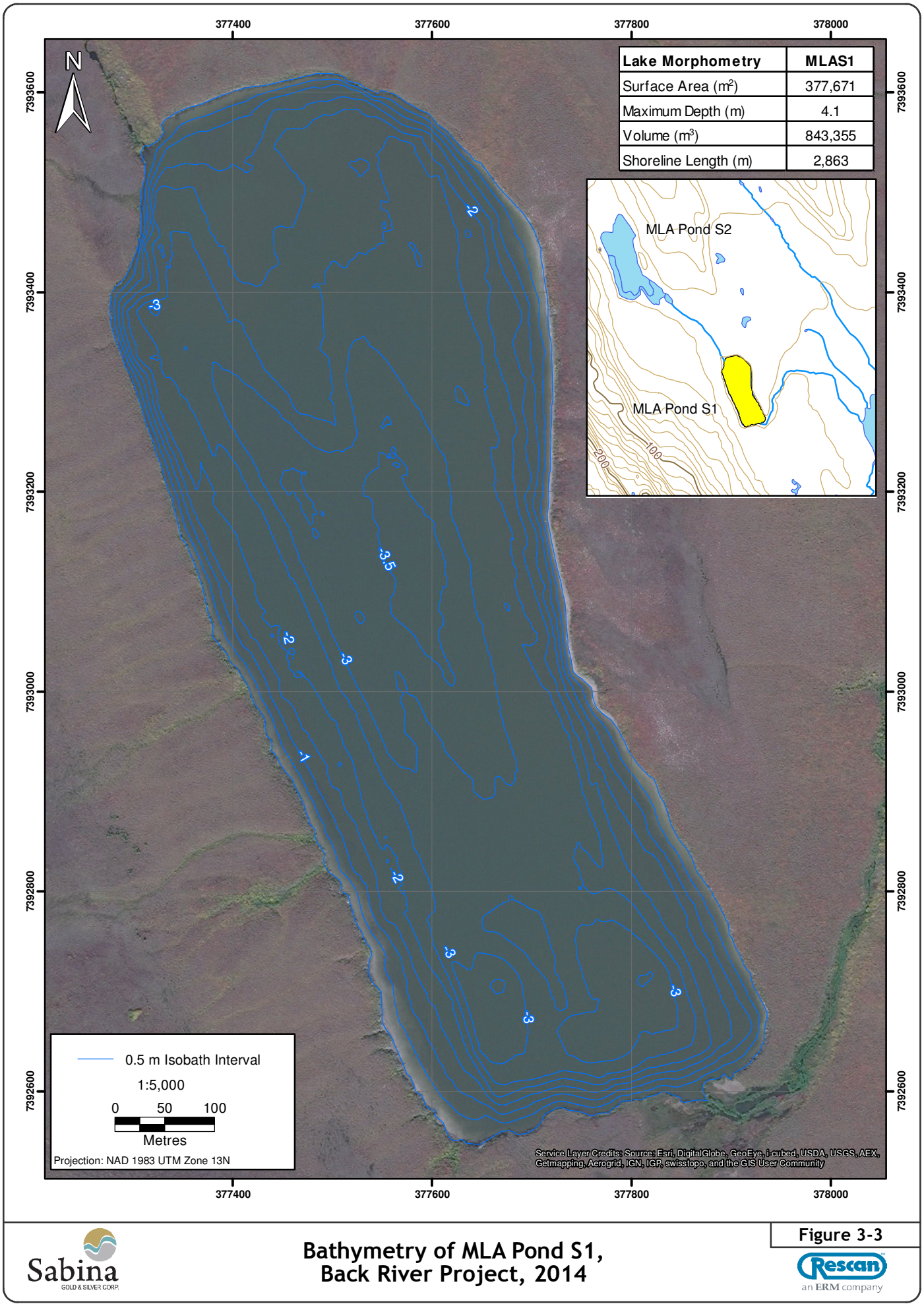

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Bathymetry of MLA Pond S1, Back River Project, 2014

Figure 3-3

Rescan an ERM company

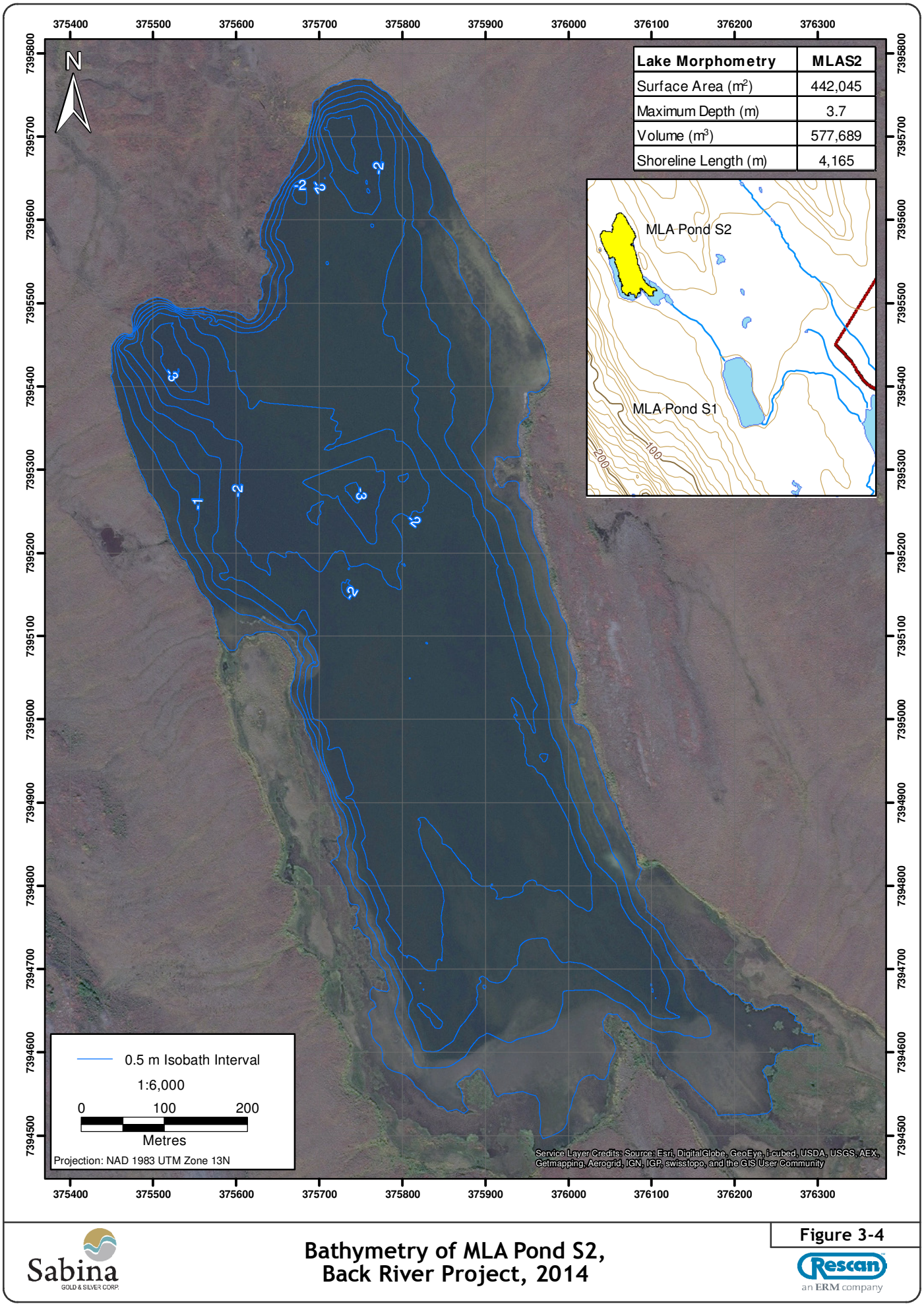

Figure 3-4

Bathymetry of MLA Pond S2, Back River Project, 2014

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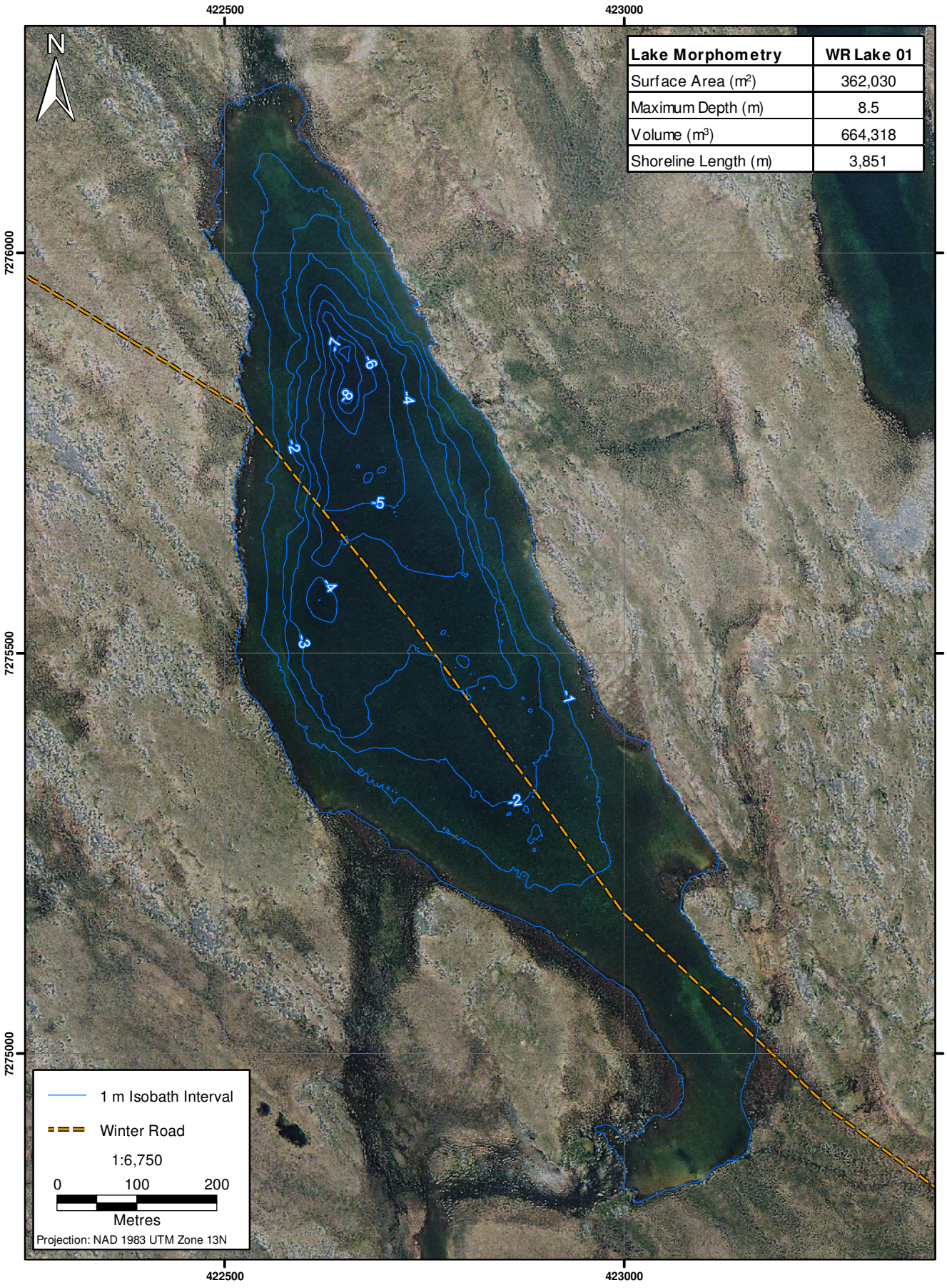
Rescan an ERM company



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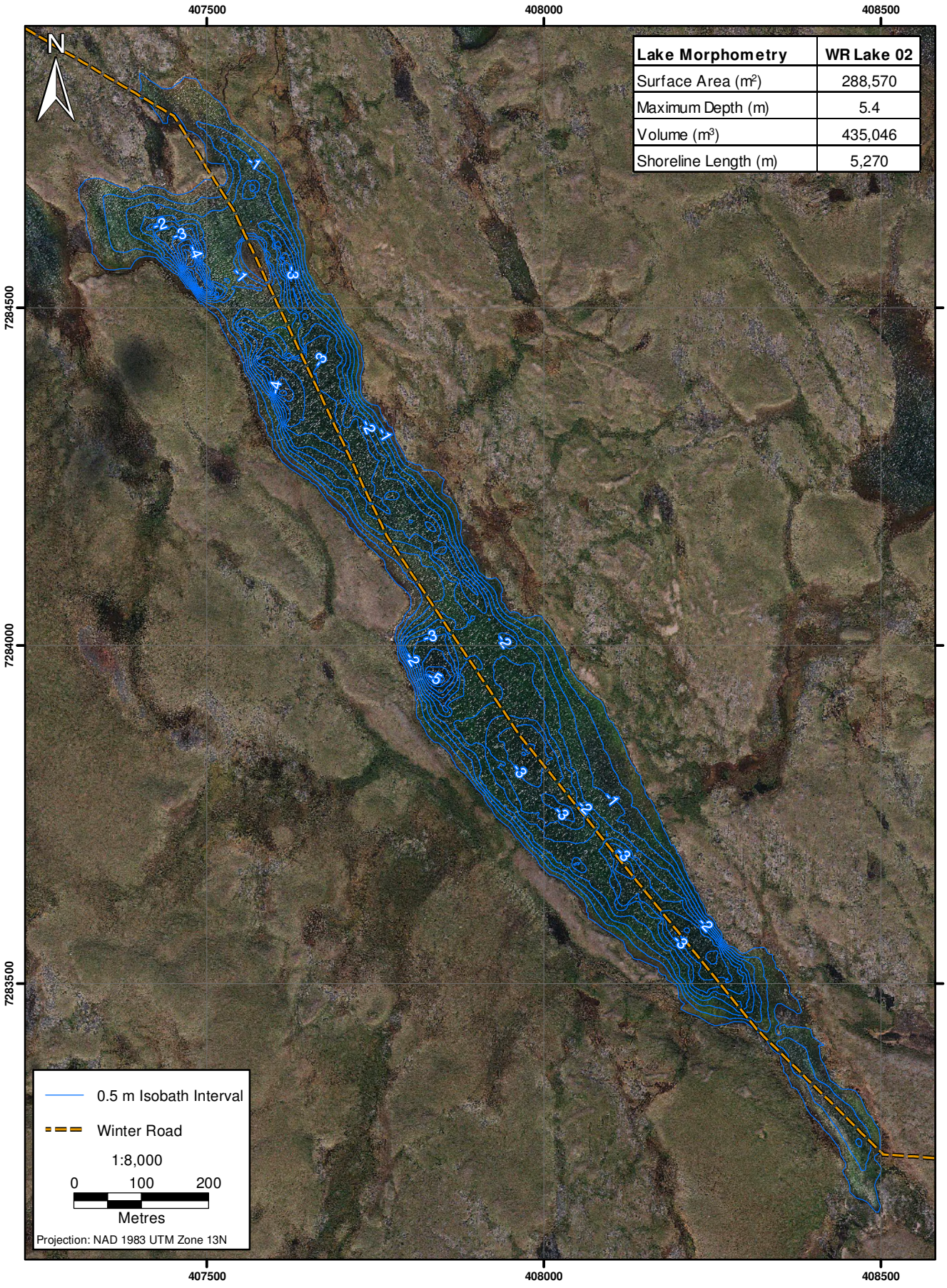
Bathymetry of Winter Road Lake 01
Back River Project, 2014

Figure 3-5

Rescan an ERM company



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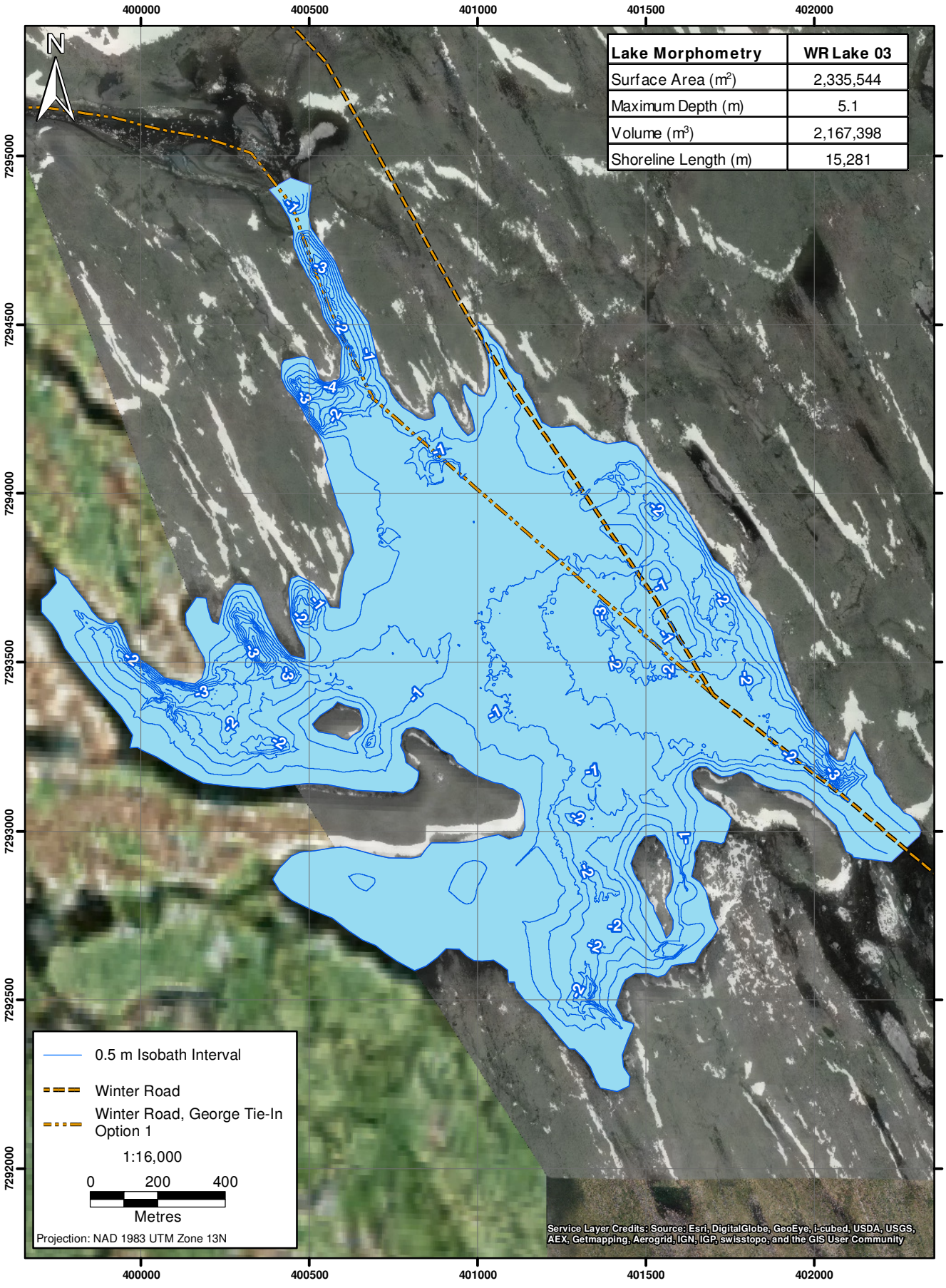
Bathymetry of Winter Road Lake 02
Back River Project, 2014

Figure 3-6

Rescan an ERM company



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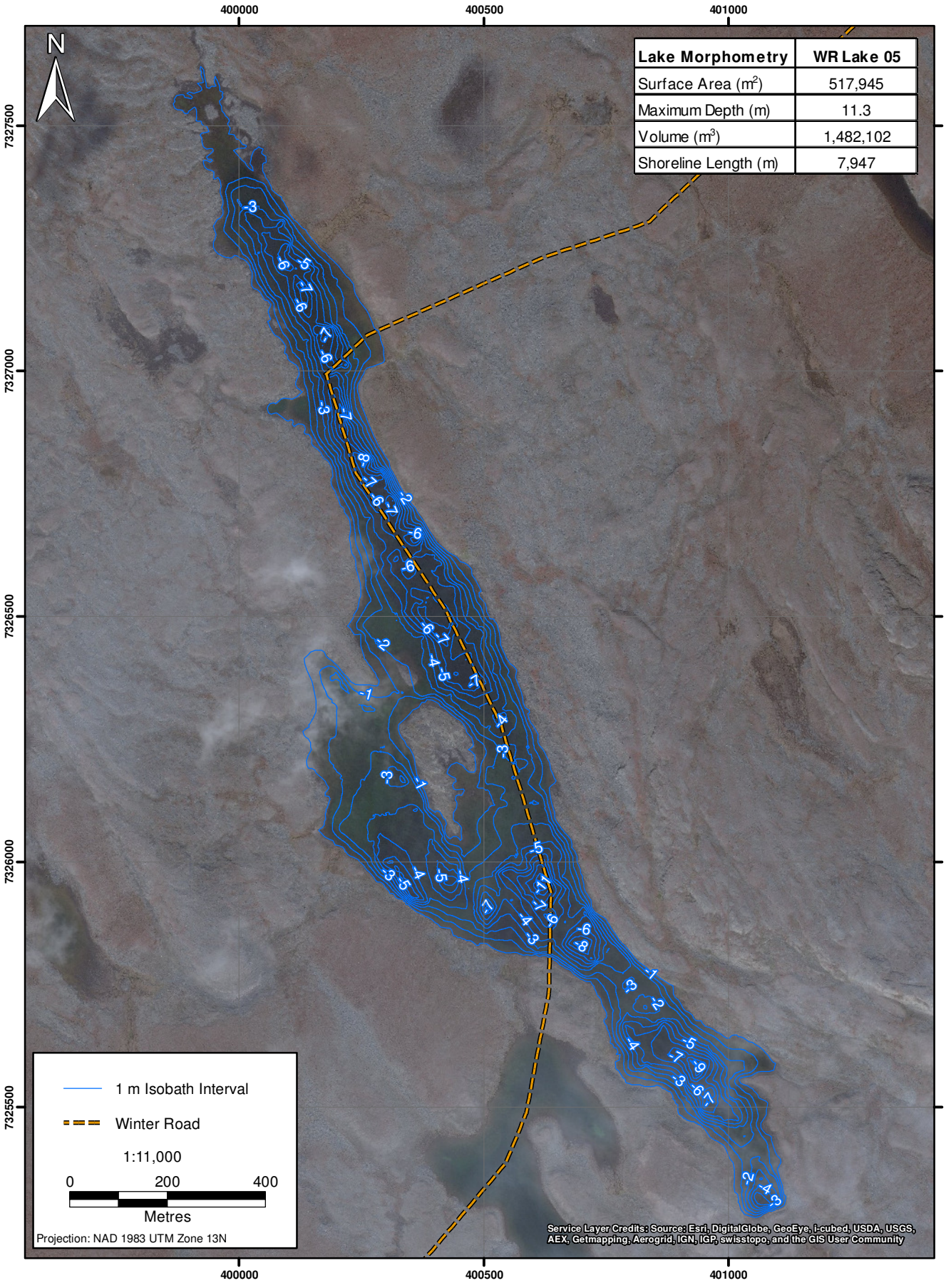
Bathymetry of Winter Road Lake 03
Back River Project, 2014

Figure 3-7

Rescan an ERM company

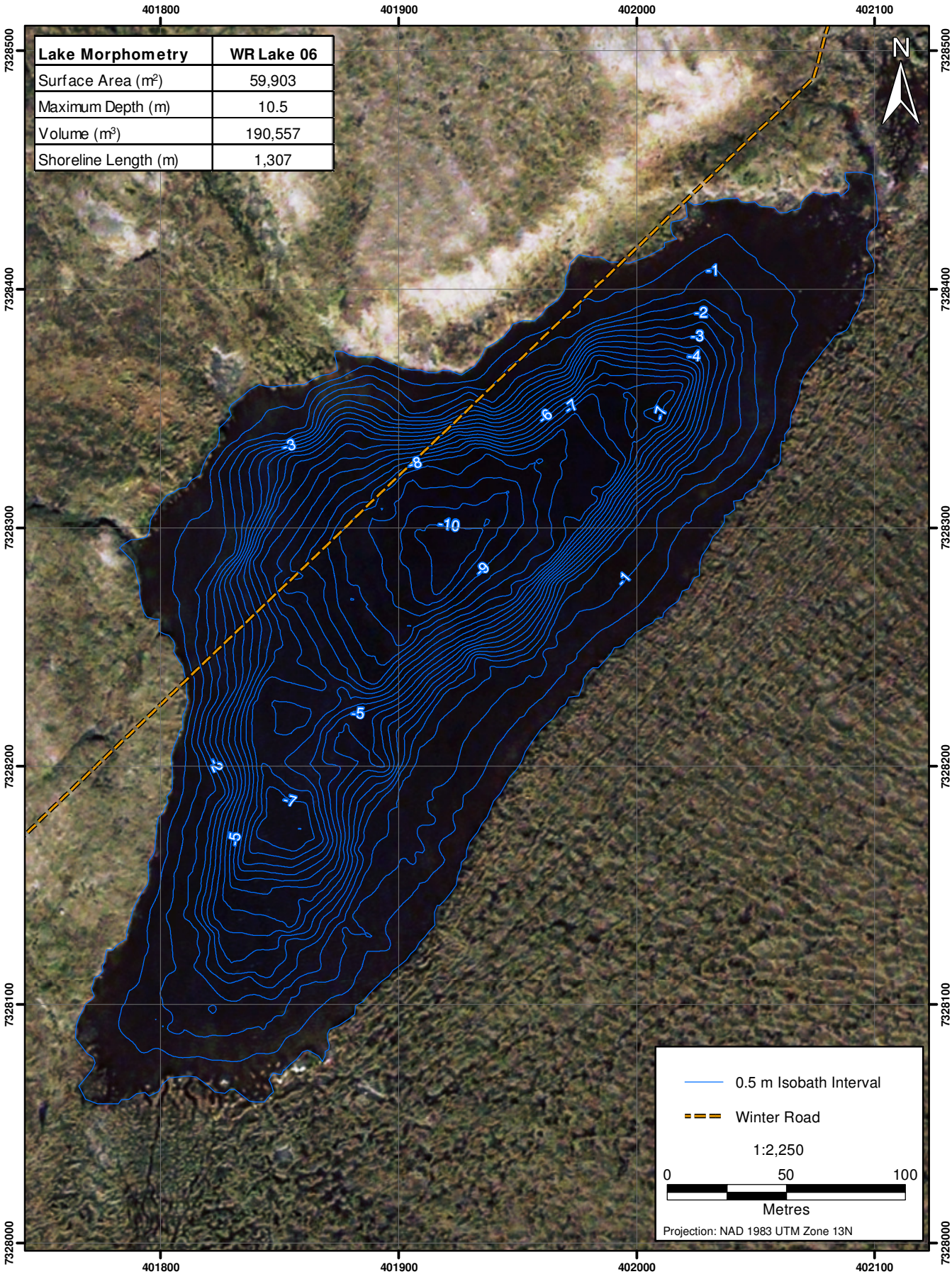


Sabina GOLD & SILVER CORP.

Bathymetry of Winter Road Lake 05
Back River Project, 2014

Figure 3-8

Rescan an ERM company



Lake Morphometry	WR Lake 06
Surface Area (m^2)	59,903
Maximum Depth (m)	10.5
Volume (m^3)	190,557
Shoreline Length (m)	1,307

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Bathymetry of Winter Road Lake 06
Back River Project, 2014

Figure 3-9

Rescan an ERM company