Avanti Mining Inc.

KITSAULT PROJECT
Aquatics Baseline Report 2009

Rescan™ Environmental Services Ltd.
Rescan Building, Sixth Floor - 1111 West Hastings Street
Vancouver, BC Canada V6E 2J3
Tel: (604) 689-9460 Fax: (604) 687-4277

March 2010

KITSAULT PROJECT AQUATICS BASELINE REPORT 2009

March 2010
Project #1003-001-20

Prepared for:

Avanti Mining Inc.

Prepared by:

Rescan™
Engineers and Scientists

Rescan™ Environmental Services Ltd.
Vancouver, British Columbia

Executive Summary

Rescan™
Engineers and Scientists

Executive Summary

The proponent for the Kitsault Project (the Project) is Avanti Kitsault Mine Ltd. (Avanti). Avanti is a wholly owned subsidiary of Avanti Mining Inc. The Kitsault property is about 140 km north of Prince Rupert, British Columbia, and south of the head of Alice Arm, an inlet of the Pacific Ocean. The principal mining feature on the property is the Kitsault open pit mine, which last operated in 1982. Avanti is proposing to re-develop the Kitsault deposit.

This report presents the results of the 2009 baseline aquatics assessment. The 2009 sampling program was designed to characterize the freshwater aquatic resources within the Kitsault Project area, including water quality, sediment quality, and primary and secondary producers.

Stream water nutrients, as nitrate and total phosphate, were generally greatest at the reference site RC1 and followed a similar temporal and spatial pattern to turbidity values. Stream metal concentrations were generally associated with either turbidity or dissolved solids. Based on their monthly concentrations total aluminum, copper, iron, and manganese were associated with stream turbidity in 2009. Metals that were more associated with total dissolved solids included cadmium, molybdenum, and zinc. The greatest stream total metal concentrations most often occurred at PC5 (adjacent to the pit) during low flow periods or at RC1 during freshet. The BC Maximum guidelines were exceeded by cadmium, chromium, and copper while the CCME guidelines were exceeded by aluminum, cadmium, chromium, copper, iron, lead, and molybdenum.

Stream sediments exceeded guidelines at several sites. The available ISQG and PEL guidelines for arsenic, cadmium, chromium, copper, and zinc were exceeded at most stream sites. The available LEL and SEL guidelines for iron and nickel concentrations were exceeded by all stream sites. The sediments from Patsy Lake were also observed to have high metal concentrations exceeding guidelines for arsenic, cadmium, chromium, copper, mercury, and zinc.

Generally, the stream sites lower in the watershed had greater periphyton biomass than upper Patsy or Lime Creeks. All wetland sites had an average biomass value of at least 2.5 times greater than Patsy Lake.

Relatively high benthic invertebrate densities were observed at PC2. Ephemeroptera and Plecoptera, which often occur in large numbers in high-quality habitat, were the dominant taxonomic groups at all stream sites. The average density of benthic invertebrates among lake and wetland sites was somewhat variable with a patchy distribution and generally dominated by chironomids. Lake zooplankton density was relatively low with a total of nine genera identified. Few rare species and a high density of a single rotifer species, *Kellicottia longispina*, in the samples contributed to this low diversity.

Table of Contents

Rescan™
Engineers and Scientists

KITSAULT PROJECT AQUATICS BASELINE REPORT 2009

Table of Contents

List of Appendices

List of Figures

FIGURE **PAGE**

List of Tables

TABLE **PAGE**

List of Plates

PLATE **PAGE**

Acronyms and Abbreviations

Rescan™
Engineers and Scientists

Acronyms and Abbreviations

Avanti	*Avanti Kitsault Mine Ltd.*
BC	*British Columbia*
BC EAA	*British Columbia* Environmental Assessment Act
BC MOE	*British Columbia Ministry of Environment*
CCME	*Canadian Council of the Ministers of the Environment*
COC	*Chain of custody*
D-Al	*Dissolved aluminum*
D-As	*Dissolved arsenic*
DO	*Dissolved oxygen*
EPT	*Ephemeroptera/Plecoptera/Trichoptera*
ISQG	*Interim Sediment Quality Guideline*
LEL	*Lowest Effect Level*
MDL	*Method detection limits*
MWSF	*Mine waste storage facilities*
NFA	*Nisga'a Final Agreement*
NWA	*Nass Wildlife Area*
NTU	*Nephelometric turbidity units*
PEL	*Probable Effect Level*
Project	*Kitsault Project*
QA/QC	*Quality assurance and quality control*
Rescan	*Rescan Environmental Services Ltd.*
RISC	*Resources Information Standards Committee*
RPD	*Relative percent differences*

SEL	*Severe Effect Level*
TDS	*Total dissolved solids*
TKN	*Total kjeldahl nitrogen*
TMF	*Tailings management facility*
TN	*Total nitrogen*
TOC	*Total organic carbon*
TP	*Total phosphorus*
TSS	*Total suspended solids*

1. Introduction

Rescan™
Engineers and Scientists

1. Introduction

1.1 PROJECT SUMMARY

The Kitsault property is about 140 km north of Prince Rupert, British Columbia, and south of the head of Alice Arm, an inlet of the Pacific Ocean (Figure 1.1-1). It includes three known molybdenum resources: Kitsault, Bell Moly, and Roundy Creek. The principal mining feature on the property is the Kitsault open pit mine, which last operated in 1982. The Kitsault mine site is within NTS maps 103P044 and 043, at approximately latitude 55° 25′ 19″ N and longitude 129° 25′ 10″ and at about 600 m elevation above mean sea level. The Project is within the Nass Area and the Nass Wildlife Area (NWA) as defined by the Nisga'a Final Agreement (NFA). However, the mine area falls outside of Nisga'a Lands owned by the Nisga'a Nation in fee simple under the terms of the NFA.

The proponent for the Kitsault Project (the Project) is Avanti Kitsault Mine Ltd. (Avanti). Avanti is a wholly owned subsidiary of Avanti Mining Inc., a junior exploration company listed on the Toronto Venture Exchange (TSX-V: AVT) with its registered office in Vancouver, BC. The land status of the Kitsault Mine area consists of a total of 35 mining leases and 196 mineral claims occupying 8,286 hectares owned by Avanti. The majority of leases and claims are on provincial Crown lands.

The original Kitsault mine complex disturbed an area of about 587 hectares (excluding the town site and transportation/utility infrastructure). It included an open pit, two mine waste storage facilities (MWSF; Patsy and Clary), two low grade ore stockpiles, overburden stockpiles, the mill and concentrator buildings, the pit shop, service and haul roads, and settling pond at the base of the pit. The MWSFs and low grade ore stockpile have been resloped and revegetated and the concentrator mill has been dismantled and removed from the site pursuant to an Amended Permit Approving the Reclamation Program (Permit M-10) issued under the British Columbia *Mines Act* (1996). Reclamation commenced in 1996 and was completed in 2006. Measures to address potential acid drainage in the pit have been implemented in accordance with the approved reclamation program.

Avanti is proposing to re-develop the Kitsault deposit. The 2009 environmental and social baselines were tailored to an application for a permit under the *Mines Act* (1996). Avanti have subsequently decided to opt into the environmental approval process set out in the BC *Environmental Assessment Act* (BC EAA; 2002). The Project layout (Figure 1.1-2) on which the 2009 baseline studies were based included:

- an expansion of the current pit;
- construction of a new processing plant and related infrastructure;
- land disposal of tailings in a facility located to the northwest of the pit (Site 6);
- mine waste rock storage on top of or adjacent to existing facilities;
- construction of a wharf and accommodation on the foreshore of Alice Arm, southwest of Kitsault town;
- a diversion tunnel for non-contact water;
- a hydro-electric facility at the base of the tunnel.

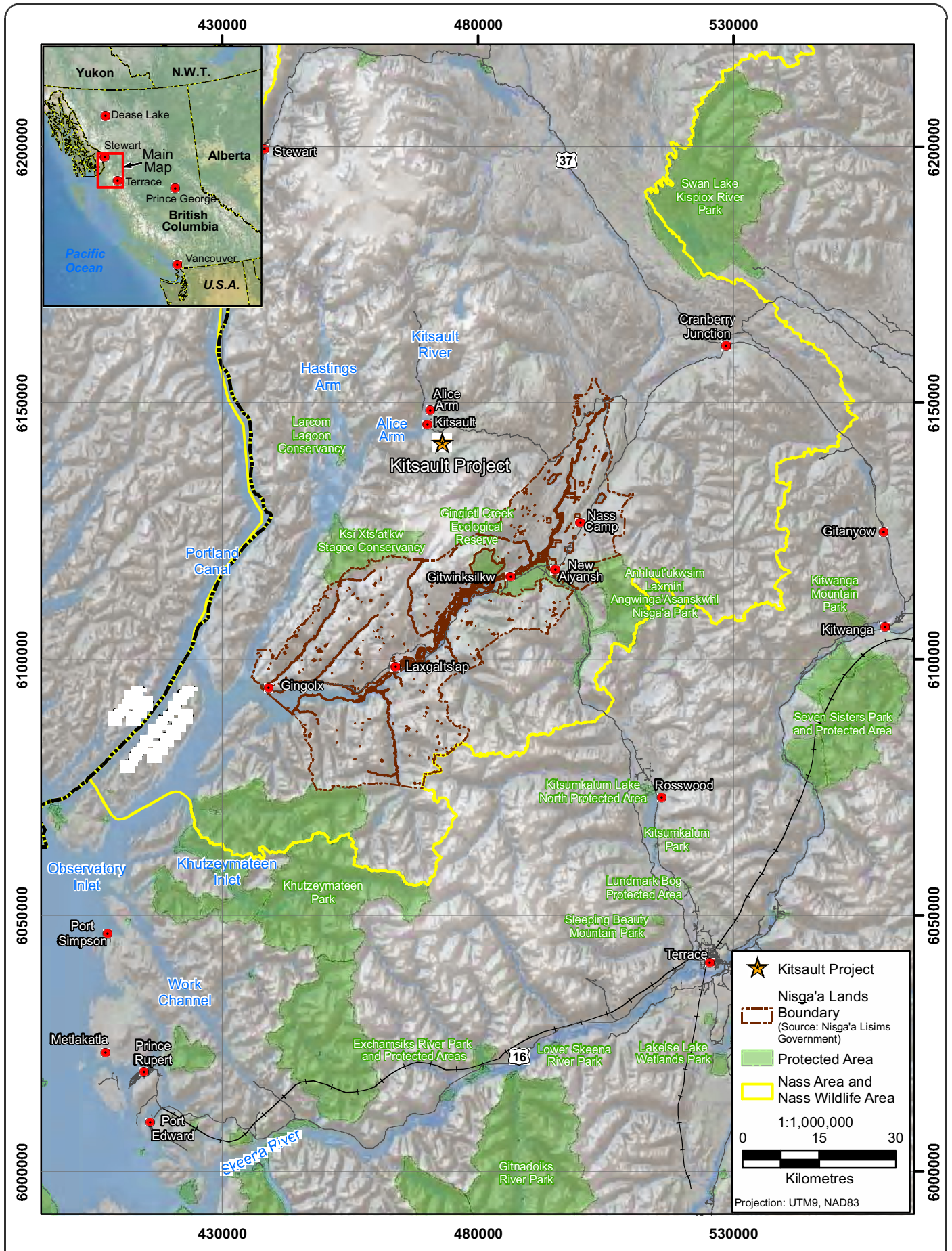


Figure 1.1-1

Kitsault Project Location

AVANTI MINING INC

Rescan Engineers & Scientists

PROJECT # 1003-001-01 GIS # KIT-15-026 March 15 2010

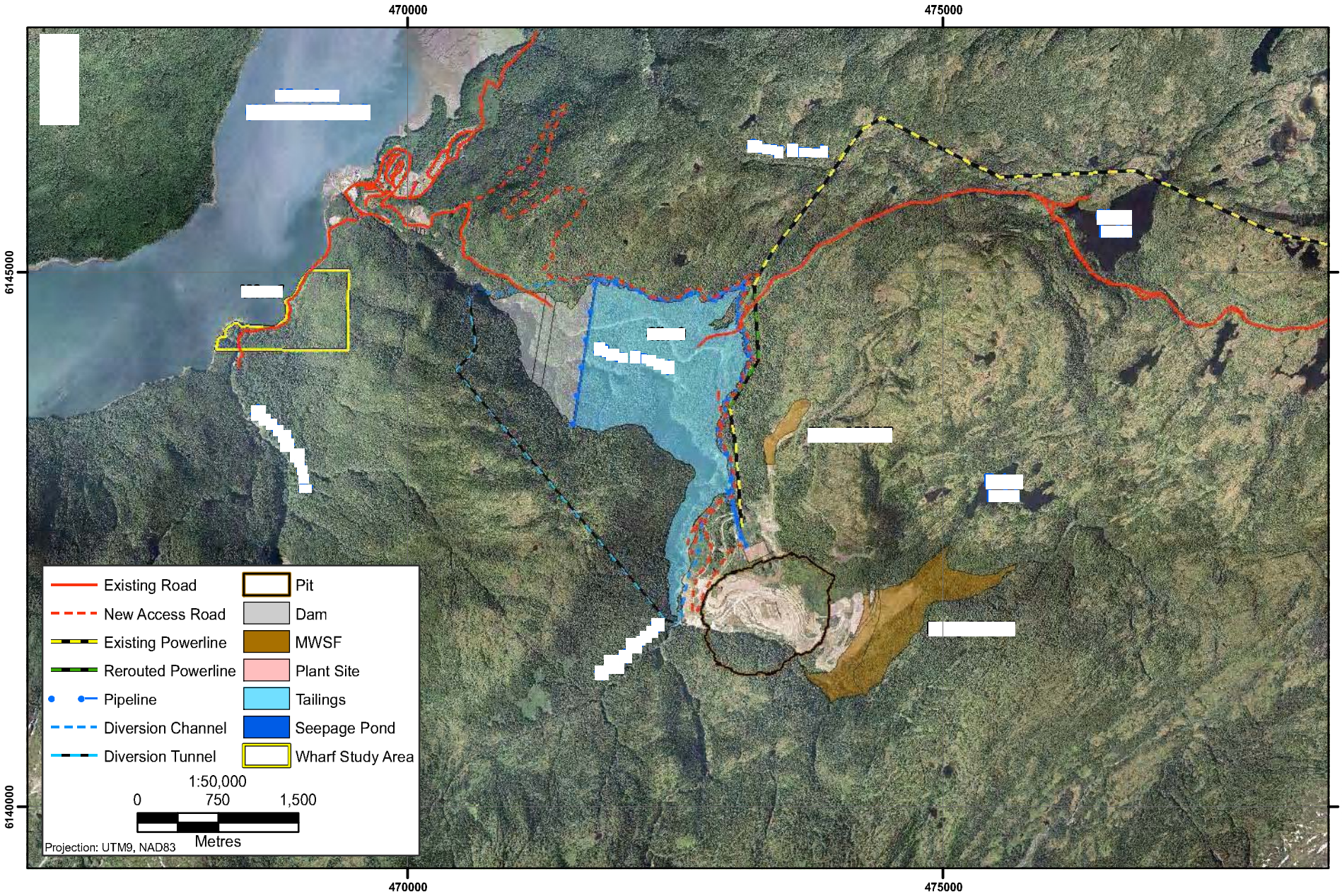


Figure 1.1-2

AVANTI MINING INC

Kitsault Project 2009 Baseline Layout

Figure 1.1-2

Rescan™ Engineers & Scientists

1.2 OBJECTIVES

This report presents the results of the 2009 baseline aquatics sampling program. This program was designed to provide an overview and characterize the freshwater aquatic resources within the Kitsault Project area, including water quality, sediment quality, and primary and secondary producers. Sampling locations were chosen based on the Project information available at the time.

The sampling program focused on selected receiving environments (sites downstream of Project activities) and reference sites including stream, lake, and wetland habitats. This baseline data will provide an understanding of the seasonal variation in surface water quality and a description of the other components of the freshwater environment before initiating any Project activities. These data are required for monitoring programs to determine if any significant changes to these sites result from Project activities.

2. Methods

2. Methods

2.1 STUDY DESIGN

Figure 2.1-1 presents the 2009 sampling locations for aquatic resources program. Table 2.1-1 lists the location of each site and the justification for inclusion in the baseline program. Monthly water quality sampling began in March 2009 at three stream sites (LC1, LC3, PC5) associated with Project activities and one reference stream (RC1). This was expanded to seven stream sites, four wetland sites, and Patsy Lake in August 2009. During this sampling period water quality, sediment quality, benthic invertebrates, zooplankton (Patsy Lake only), phytoplankton (lake and wetlands) and periphyton (streams) samples were collected.

Table 2.1-1. Site Location and Justification

	Site Name	Easting	Northing	Samples Collected	Site Justification
Streams	LC0	469505	6145510	1 time-WQ, SQ, peri, benthos	Downstream of TMF, town of Kitsault
	LC1	469807	6145404	Monthly WQ, SQ, peri, benthos	Downstream of TMF, upstream of town of Kitsault
	LC3	472361	6141535	Monthly WQ, peri, benthos	Upstream of confluence with Patsy Creek
	PC1	475150	6142666	Quarterly WQ, SQ, peri	Outflow of Patsy Lake
	PC2	474787	6142010	Quarterly WQ, peri, benthos	Adjacent to waste rock pile
	PC5	472380	6141598	Monthly WQ	Upstream of confluence with Lime Creek; adjacent to pit
	RC1	468445	6143737	Monthly WQ, SQ, peri, benthos	Reference site in adjacent watershed
Lake and Wetlands	Patsy Lake	475544	6143043	WQ, SQ, phyto, benthos, zoop	Within 3 Km of pit and waste rock
	WL2	473215	6141023	WQ, SQ, phyto, benthos	Wetland in close proximity to the pit
	WL3	473484	6140572	WQ, SQ, phyto, benthos	Wetland with moderate proximity to the pit
	WL4	468801	6138987	WQ, SQ, phyto, benthos	Reference wetland
	WL1	476762	6143279	WQ, SQ, phyto, benthos	Wetland adjacent to Patsy Lake

Note: WQ - Water Quality: SQ - Sediment Quality: Peri - Periphyton: Phyto - Phytoplankton: Benthos - Benthic Invertebrate

Although Patsy Lake and the wetland sites will not receive any direct discharge from the Project, they can be monitored for any potential impacts such as air transport of dust and associated particles. Potential impact stream sites were upstream (PC1 and PC2) or downstream (LC0, LC1, LC3 and PC5) of the pit and tailings dam, and a single reference stream (RC1) was situated in an adjacent watershed.

LC0 and LC1 are both on lower Lime Creek with LC1 just upstream of the dump site (on the northern shore) used by the town of Kitsault. LC0 is downstream of this dump site and the bridge that crosses Lime Creek. All other water samples from lower Lime Creek in 2009 were collected at LC1 in 2009, except during November when a water sample was collected at LCO and not LC1. LC0 was initially

added to the aquatics program to provide more data on the biological communities in Lime Creek (adding to the community data collected upstream at LC1).

PC1 and PC2 are upstream of the mine site but are within 2 km of the pit area. PC1 is at the mouth of Patsy Creek, about 50 m downstream of the outflow of Patsy Lake. The reference site RC1 is on lower Roundy Creek, approximately 600 m upstream from Alice Arm. LC3 is just upstream from the confluence of Lime and Patsy creeks. The May 22 water quality sample for LC3 was actually collected approximately 50 m downstream of the confluence because accessing the upstream site was hazardous during that site visit.

2.2 WATER QUALITY

One water sample was collected per site per sampling period using standardized methods (RISC 1997). Water samples were analyzed for general physio-chemical variables, anions, nutrients, total cyanide, total organic carbon (TOC), and total and dissolved metals at the lowest feasible detection limit by ALS Environmental Services (Vancouver, BC).

The sampling period for stream water quality sampling occurred either on a monthly or quarterly schedule depending on the site's proximity to Project activities. Monthly sampling occurred at RC1, LC1, LC3, and PC5, while quarterly sampling occurred at PC1 and PC2. Weekly (freshet) samples were also collected at RC1, LC1, LC3, and PC5.

At all stream sites, samples were collected by facing upstream and submersing sample bottles until filled. Preservatives were added for total metals (ultra-pure nitric acid), TOC (hydrochloric acid), and total cyanides (NaOH). No air bubbles were left in any of the bottles. A list of all analyzed water quality variables is presented (Table 2.2-1) along with the lowest method detection limits (MDL).

Water samples were also collected at wetland and lake sites once during August 2009. A shallow and deep (below the thermocline) water sample was collected from Patsy Lake. Preservation and analyses of water samples was identical to that done for stream water samples.

All water quality data are presented in appendices (listed in Section 3.1). The analyzed data were summarized for each variable by site. Some variables could not be measured reliably below a specified detection limit and are reported by the analytical laboratory as below that detection limit. When required for the purpose of statistical analyses and graphical presentation, these values (called non-detects) were replaced with half of the detection limit. Water quality results were screened against available Canadian Council of the Ministers of the Environment (CCME 1999) and BC Maximum (BC MOE 2006) guideline values for the protection of aquatic life.

2.3 PHYSICAL LIMNOLOGY

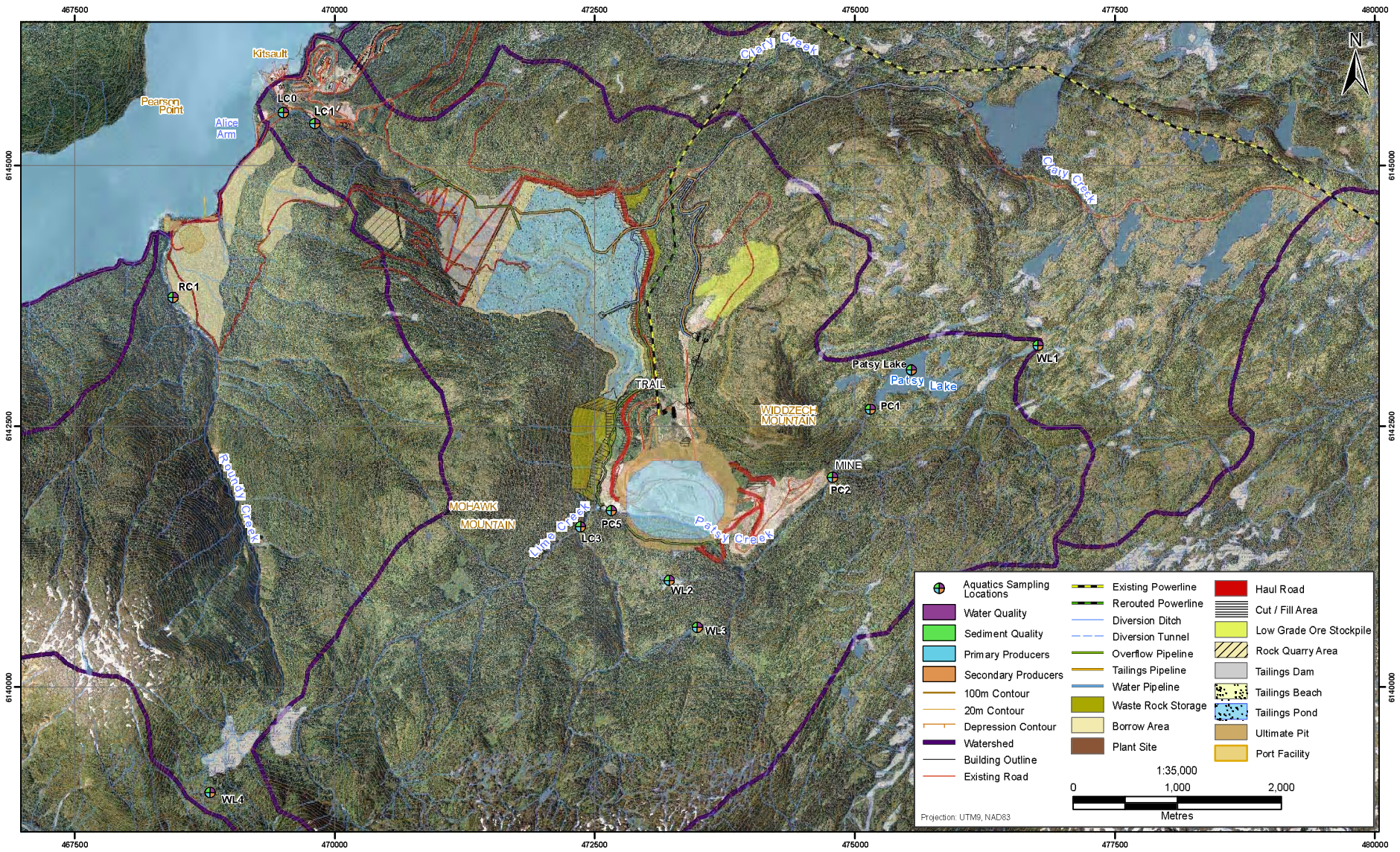
Physical limnology variables were measured at Patsy Lake in August 2009. These variables included Secchi depth, surface pH, and conductivity, as well as depth profiles of dissolved oxygen (DO) and temperature measured at the deepest point in the lake. Surface measurements of pH, conductivity, temperature, and DO were also taken at each of the four wetlands.

Secchi depth, a measure of water transparency, was determined using a standard 20-cm black and white Secchi disk. Using a measured line, the weighted Secchi disk was lowered over the shaded side of the boat until it was no longer visible in the water column. The disk was then slowly raised until it once again became visible, and the depth was recorded to the nearest 10 cm. This was recorded as the Secchi depth (Ds). The 1% (Z1%) and 0.1% (Z0.1%) euphotic zone depths were computed by first

PROJECT # 1003-001-20 GIS # KIT-01-006

DRAFT

January 5 2010



AVANTI MINING INC

Rescan Engineers & Scientists

Figure 2.1-1

Freshwater Aquatics Sampling Sites, Kitsault, 2009

Table 2.2-1. Water Quality Variables and Lowest Method Detection Limits, 2009

Variable	Units	Detection Limit
Physical/Dissolved Anions		
Colour	Cu	5
Conductivity	µS/cm	2
pH	pH	0.01
Total Suspended Solids	mg/L	3
Turbidity	NTU	0.1
Total Dissolved Solids	mg/L	10
Hardness	mg/L	0.5
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L	2
Alkalinity, Carbonate (as $CaCO_3$)	mg/L	2
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L	2
Total Alkalinity (as $CaCO_3$)	mg/L	2
Acidity	mg/L	1
Bromide	mg/L	0.05
Chloride	mg/L	0.5
Fluoride	mg/L	0.02
Sulphate	mg/L	0.5
Nutrients		
Ammonia Nitrogen	mg/L	0.005
Nitrate	mg/L	0.005
Nitrite	mg/L	0.001
Total Kjeldahl Nitrogen	mg/L	0.05
Total Nitrogen	mg/L	0.05
Total Phosphorus	mg/L	0.002
Cyanides		
Total Cyanide	mg/L	0.001
Total Metals		
Aluminum	mg/L	0.001
Antimony	mg/L	0.0001
Arsenic	mg/L	0.0001
Barium	mg/L	0.00005
Beryllium	mg/L	0.0005
Bismuth	mg/L	0.0005
Boron	mg/L	0.01
Cadmium	mg/L	0.000017
Calcium	mg/L	0.02
Chromium	mg/L	0.0005
Cobalt	mg/L	0.0001
Copper	mg/L	0.0001
Iron	mg/L	0.03
Lead	mg/L	0.00005
Lithium	mg/L	0.005
Magnesium	mg/L	0.005
Manganese	mg/L	0.00005
Mercury	mg/L	0.00001
Molybdenum	mg/L	0.00005
Nickel	mg/L	0.0005
Phosphorus	mg/L	0.3
Potassium	mg/L	0.05
Total Metals (cont'd)		
Selenium	mg/L	0.0001
Silicon	mg/L	0.05
Silver	mg/L	0.00001
Sodium	mg/L	2
Strontium	mg/L	0.0001
Thallium	mg/L	0.0001
Tin	mg/L	0.0001
Titanium	mg/L	0.01
Uranium	mg/L	0.00001
Vanadium	mg/L	0.001
Zinc	mg/L	0.001
Dissolved Metals		
Aluminum	mg/L	0.001
Antimony	mg/L	0.0001
Arsenic	mg/L	0.0001
Barium	mg/L	0.00005
Beryllium	mg/L	0.0005
Bismuth	mg/L	0.0005
Boron	mg/L	0.01
Cadmium	mg/L	0.000017
Calcium	mg/L	0.02
Chromium	mg/L	0.0005
Cobalt	mg/L	0.0001
Copper	mg/L	0.0001
Iron	mg/L	0.03
Lead	mg/L	0.00005
Lithium	mg/L	0.005
Magnesium	mg/L	0.005
Manganese	mg/L	0.00005
Mercury	mg/L	0.00001
Molybdenum	mg/L	0.00005
Nickel	mg/L	0.0005
Phosphorus	mg/L	0.3
Potassium	mg/L	0.05
Selenium	mg/L	0.0001
Silicon	mg/L	0.05
Silver	mg/L	0.00001
Sodium	mg/L	2
Strontium	mg/L	0.0001
Thallium	mg/L	0.0001
Tin	mg/L	0.0001
Titanium	mg/L	0.01
Uranium	mg/L	0.00001
Vanadium	mg/L	0.001
Zinc	mg/L	0.001
Organic Variables		
Total Organic Carbon	mg/L	0.5

calculating the proper light extinction coefficient (k) from Ds, then calculating the euphotic zone depth based on the appropriate light extinction coefficient. The 1% euphotic depth is the depth of the water column where 1% of the surface irradiance reaches. It represents the depth where the gross water column photosynthetic production is the equivalent of the gross water column respiration; thus, there is net production of carbon synthesis above this depth. It is often known as the compensation depth. This represents the depth where photosynthesis can occur. The 1% euphotic depths are calculated as follows:

Light extinction coefficient:

$$k\ (m^{-1}) = 1.7/D_s$$

where k is the light extinction coefficient for non-turbid waters (1.7; Parsons et al. 1984).

Euphotic Depth (1%):

$$Z_{1\%}\ (m^{-1}) = 4.6/k$$

Vertical depth profiles were measured using the YSI Model 85 meter and probe to determine the degree and position of lake stratification, if present. Both before and after conducting a profile, the membrane of the probe was checked for air bubbles. If air bubbles were present, the membrane was replaced and the profile was redone. After initial calibration, measurements were taken just below the surface and at 1 m intervals. The probe was lowered to a depth of 1 m above the sediment-water interface (as indicated by the depth sounder).

2.4 SEDIMENT QUALITY

Sediment was collected at four stream sites (LC0, LC1, PC1, and RC1) in August, 2009. Three composite samples were collected at each site, except for PC1 (one composite), because it was difficult to find suitable sediment deposits among the rocky substrate. It was impossible to collect sediments at some streams sites (PC2, PC5, and LC3) as the water level was low and the substrate was primarily large cobble and boulders. Methods for stream sediment sampling were standardized (RISC 1998) to collect multiple grab samples at stream stations. Replicate samples were collected at three distinct areas per site (different braids, or different stretches of the main channel), covering a total stretch of 50 to 250 m, depending on size and access to site. This resulted in three separate replicates per site. Sediment was spooned from the top 5 cm at depositional zones along the stream. It was pooled (excess water drained off) and manually homogenized for one minute. Sediment was then carefully spooned into clean, pre-labelled Whirl-Pak bags, sealed (no air bubbles), and kept cool in the dark until analysis could be completed by ALS Environmental Services (Vancouver, BC).

Sediments were also collected at one lake and four wetland sites. An Ekman sampler was used to collect bottom sediment from three distinct zones (replicate) in the lake or wetland. At each zone, three separate grabs were collected a minimum of 5 m apart and sediment was then pooled into one composite replicate. The top 4 cm of each Ekman grab sample was spooned off and deposited into a clean bowl and homogenized. The sediment was also photographed and the physical appearance (organics, homogeneity, and organisms) was noted.

Whole sediment samples were analyzed for pH, particle size, nutrients, organic, and inorganic carbon using the lowest feasible detection limit. Analysis of metals was completed on the <63 µm fraction of the sample, as this is more bioavailable to benthic organisms and has a greater affinity for metals and

other contaminants than the coarse sediment fraction. A list of sediment variables is presented in Table 2.1-2. Resulting non-detects were replaced by half of the detection limit for the purpose of analysis. Data are summarized by site and watershed, and are compared to the current working guidelines from the British Columbia Ministry of Environment (BC MOE 2006). These working guidelines are based on guidelines established in various Canadian (primarily the Canadian Council of the Ministers of the Environment or CCME; (1999)) and other North American jurisdictions. Working guidelines include the Lowest Effect Level (LEL), Severe Effect Level (SEL), Interim Sediment Quality Guideline (ISQG), and the Probable Effect Level (PEL).

Table 2.4-1. Sediment Quality Variables and Detection Limits, 2009

Variable	Units	Detection Limit (mg/kg dry weight)	Variable	Units	Detection Limit (mg/kg dry weight)
Physical Tests			**Total Metals (cont'd)**		
Particle Size	%	1	Lithium	mg/kg	2
			Magnesium	mg/kg	50
Nutrients			Manganese	mg/kg	1
Available Phosphate	mg/kg	1	Mercury	mg/kg	0.005
Total Nitrogen	%	0.02	Molybdenum	mg/kg	4
Total Metals			Nickel	mg/kg	5
Aluminum	mg/kg	50	Phosphorus	mg/kg	50
Antimony	mg/kg	10	Potassium	mg/kg	200
Arsenic	mg/kg	5	Selenium	mg/kg	0.5
Barium	mg/kg	1	Silver	mg/kg	2
Beryllium	mg/kg	0.5	Sodium	mg/kg	200
Bismuth	mg/kg	20	Strontium	mg/kg	0.5
Cadmium	mg/kg	0.5	Thallium	mg/kg	1
Calcium	mg/kg	50	Tin	mg/kg	5
Chromium	mg/kg	2	Titanium	mg/kg	50
Cobalt	mg/kg	2	Vanadium	mg/kg	2
Copper	mg/kg	1	Zinc	mg/kg	1
Iron	mg/kg	50	**Organic Variable**		
Lead	mg/kg	30	Total Organic Carbon	%	0.1

Wetland and lake sediment samples were analyzed for the same variables as stream sediment samples. Procedures for sample handling, transport, and comparison of data to guidelines were identical to those described for stream samples.

2.5 PRIMARY PRODUCERS

2.5.1 Periphyton

Periphyton sampling was conducted at each stream site in August 2009, and coincided with sediment and biological surveys. Samples were collected from three separate rocks per site using a toothbrush to gently scrape a known surface area, assisted by a rinse bottle. Three areas were sampled from each rock (forming a composite sample: one for taxonomic identification and enumeration; one for measurement of chlorophyll α biomass) to accurately characterize the periphyton coverage and community composition.

Taxonomic samples were stored in 250 mL plastic bottles and preserved in Lugol's iodine solution. Taxonomic identification and enumeration was conducted by G3 Consulting Ltd. (Vancouver, BC). For each sample, richness, evenness, and diversity (as Simpson's diversity index) were calculated and mean and standard error by site was determined.

Chlorophyll α samples were prepared by filtering the sample through a 0.45 µm filter. It was then folded in half, wrapped in aluminum foil, and frozen until analysis by ALS Environmental Services (Vancouver, BC). Biomass as chlorophyll α (mean ± SE) was plotted by site.

2.5.2 Phytoplankton

At lake and wetland sites phytoplankton communities were sampled for biomass (chlorophyll α) and taxonomic composition and enumeration. Two replicate 1 L plastic bottles were filled with water from 1 m below the surface. One bottle was used for biomass determination, and the other was used to determine taxonomic composition and enumeration.

The samples were kept cool and dark and transported back to camp. Known volumes of the 1 L samples for biomass determination were filtered onto 0.45 µm pore size filters using a hand pump and filter apparatus. The filters were carefully folded in half, wrapped in aluminum foil, and frozen. Samples were kept frozen and transported to ALS Environmental Services (Vancouver, BC) for analyses.

Taxonomic samples were preserved with Lugol's iodine solution, kept cool and dark, and transported to Fraser Environmental Services (Surrey, BC) for identification and enumeration.

2.6 SECONDARY PRODUCERS

2.6.1 Benthic Invertebrates

Benthic macroinvertebrate (benthos) communities were sampled at five stream sites concurrently with periphyton surveys in August, 2009. Stream benthos samples were collected using a Hess sampler with a surface area of 0.096 m^2 and a mesh size of 250 µm (Plate 2.6-1). At least five composite replicates were collected at each site. Each composite was composed of three pooled grab samples taken 5 to 10 m apart or located on separate braids of the stream. At one of the stream sites, LC1, seven replicate samples were collected in an effort to better characterize the community in Lime Creek. This lower portion of Lime Creek will be an important long-term monitoring site for the Project as it is directly downstream of the tailings management facility (TMF).

For each stream subsample, the Hess sampler was driven 10 cm into the substrate of an undisturbed riffle zone, facing upstream with the cod-end trailing downstream. Larger gravel and rocks inside the sampler were carefully cleaned of dirt and debris (washed into the sampler area water) and thrown away. The sediment was then stirred, scrubbed, and lifted up and dropped inside the Hess sampler, allowing the stream current to wash benthos into the cod-end. The mesh of the sampler was carefully washed and rinsed into the cod-end to capture all benthos contained in the sampler area. Once the three subsamples were collected, all contents were then carefully transferred to a clean 500 mL, pre-labelled plastic jar that was then filled with 10% buffered formalin. Replicate samples were preserved separately in plastic jars.

Taxonomic identification and enumeration was conducted by Environmental Research and Consulting (Summerland BC). Invertebrates were sorted and identified to the lowest possible taxonomic level (usually genus). Genus richness, evenness, Simpson's Diversity, and Bray-Curtis Similarity indices were

calculated for each sample. The density of Ephemeroptera/Plecoptera/Trichoptera (EPT), which are three important taxonomic groups generally associated with pristine stream environments, was also calculated for each site. Constant exposure to substrate and potential contaminants make benthic invertebrates important indicators of aquatic impacts and they are therefore an important feature of aquatic environmental effects monitoring programs (Environment Canada 2003).

Plate 2.6-1. Using Hess sampler at Roundy Creek site to collect benthos.

Benthos communities were also sampled at Patsy Lake and the four wetland sites concurrently with phytoplankton surveys. Replicate samples were collected with a standard Ekman grab at three zones within the site. Each replicate was composed of three grabs pooled together to form a composite sample. Ekman grabs were brought to the surface and contents were released into a 500 µm mesh sieve bucket. The bucket was one-third submersed in the water and spun until no silt clouds were produced in the surrounding water. The benthos that remained after three successful grabs were rinsed into a clean, pre-labelled 500-ml jar. Procedures for sample handling, preservation, transport, and analysis were identical to those described for the stream samples.

2.6.2 Zooplankton

Zooplankton communities were sampled for taxonomic composition and enumeration at Patsy Lake. Wetland sites were not sampled for zooplankton because they were all less than 1.5 m deep. Three separate zones were identified to provide three composite replicates per site. Each replicate sample was composed of three separate zooplankton hauls using a 0.3 m diameter (118 µm mesh) net. For each haul, the net was lowered to a known depth using a metered cable line. The net was then raised to the surface at a constant speed of approximately 0.5 m/s, and the contents of the cod-end were transferred into the same pre-labelled, clean, plastic jar with a 500 ml wide mouth and preserved with

buffered formalin. Sample jars were closed, agitated gently, and kept cool and dark until they could be transported to Biological Environmental Services (Victoria, BC) for taxonomic identification and enumeration. Data were analyzed for density, relative abundance, genus richness, diversity, and evenness. Zooplankton densities were normalized to number of organisms/m^3 by calculating the volume of water the zooplankton net filtered by using the depth of the haul and the diameter of the net opening.

2.7 DATA ANALYSIS

The number of organisms per sample was converted to density (organisms/m^2 for benthos, organisms/m^3 for zooplankton, cells/cm^2 for periphyton, and cells/L for phytoplankton) by dividing each sample by the area or volume sampled. All graphically represented data and the calculation of replicate means and standard errors were produced using SigmaPlot software (SYSTAT 2006). Genus richness, Pielou's Evenness, Simpson's Diversity Index, and Bray-Curtis Similarity were calculated using Primer (Clark and Gorley 2006). The results presented from the Bray-Curtis analysis are similarity values, not dissimilarity values, because similarity is interpreted more intuitively. Richness is defined as the number of separate genera present in a sample. In assessing genus richness, multiple species of the same genus were pooled together. For sites where the available data only occurred at higher taxonomic levels (e.g., Family or Order), a single genus was considered to be present in the sample. The Simpson Diversity Index was used to represent the diversity of each community and considers both richness and evenness.

Simpson's Index is calculated based on the formula:

$$1\text{-}D_s = 1 - \sum_{i=1}^{s} [\, n_i(n_i\text{-}1)] \,/\, [N(N\text{-}1)]$$

where n_i is the number of individuals in the i^{th} species and N is the total number of individuals. In this form, the index represents the probability that two individuals randomly selected from the sample will belong to different species. This index ranges from 0 to 1, with 1 representing infinite diversity and 0 no diversity.

2.8 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

2.8.1 Water Quality

A water quality assurance and quality control (QA/QC) program was included in the design of this study. The program included the use of duplicates, blanks, and chain of custody (COC) forms.

A separate set of water quality bottles for field and travel blanks were included as part of the field QA/QC program. The travel blank bottles were filled with distilled de-ionized water in the laboratory and remained closed throughout the field trip. This allowed assessment of contamination associated with the laboratory procedures. The field blank bottles were also filled with distilled de-ionized water, but were opened in the field at a random site for one minute and preserved as required for certain analyses. This allowed assessment of contamination associated with field sampling (airborne contamination, contamination of the lid/bottle, etc.) and preservation procedures. For lake water quality samples an equipment blank was collected from the Go-Flo sampler to assess potential equipment contamination during deep water sampling. Detailed analytical results for field, travel, and equipment blanks are presented in Appendix 3.1-3. The

frequency of detecting a concentration for a variable above the MDL was noted, indicating possible contamination.

A minimum of 10% of the water samples were randomly collected in duplicate to assess the magnitude and potential causes of variability between samples. For each pair of QA/QC field duplicates, the relative percent differences (RPD) were calculated,

where: $$RPD = 100 \mid rep1 - rep2 \mid /[(rep1 + rep2)/2]$$

The RPD between duplicates is a measure of the variability inherent in field sampling (environmental heterogeneity, sampler handling leading to contamination). Water quality variables where one or both values were less than five times the MDL were not included in the RPD calculations because variability this close to the MDL is considered too high, according to the BC Field Sampling Manual (BC MOE 2004). RPD values less than 20% were not considered notable. The BC provincial government suggests that any field duplicates with RPD values exceeding 20% should be noted and data should be interpreted accordingly. The results of RPD calculations were examined to detect patterns of high variation for multiple parameters within sample pairs, indicating possible contamination during field sampling.

Chemical analyses were conducted using the lowest possible detection limit. For some samples, detection limits were greater because of interference from high conductivity, high total suspended solids (TSS), or a high metal value. These samples were diluted in the laboratory to facilitate analysis and the result is a higher detection limit for those particular samples.

2.8.2 Sediment Quality

Triplicate samples were collected at each site for sediment sampling. At 10% of the sites, one sediment sample was split for QA/QC purposes to ensure that sample homogenization was thorough. The RPD was calculated between sediment duplicates to assess the degree of sediment sample homogenization.

2.8.3 Periphyton

Triplicate samples were collected at each site for periphyton sampling. Quality assurance and control for within-sample variability was maintained by routine re-analysis of 10% of all samples (Colin Schwindt, G3 Consulting, personal communication). The samples to be re-analyzed were selected at random using a random number generator. If re-counts were within 90% of the original counts, then the samples were considered acceptable. If re-counts differed from original counts by more than 10%, then an additional 10% of the samples were re-analyzed.

2.8.4 Phytoplankton

Triplicate samples were collected at each site for phytoplankton sampling. Phytoplankton QA/QC procedures included consistent sample concentration and sub-sampling techniques (Linde Looy, Fraser Environmental Services, personal communication). Precision was monitored by duplicate controls (i.e., the same taxonomist analyzes one sample in duplicate for 1 in every 10 samples). Accuracy is monitored by in-house confirmations (i.e., another taxonomist analyzes the sample in at least 1 in every 10 samples).

2.8.5 Benthic Invertebrates

Triplicate samples were collected at each lake/wetland site and five replicates at each stream site for benthos sampling. There are two aspects of QA/QC for invertebrates: sorting and sub-sampling (Jack Zloty, Environmental Research and Consulting, personal communication).

The processing of invertebrate samples involves the time-consuming removal of organisms from large amounts of debris. Inevitably, processing errors occur during this sorting phase regardless of processor diligence and must be estimated. Thus, the first QA/QC requirement of benthic invertebrate sample processing is to assess this sorting efficiency (i.e., the proportion of total organisms extracted from the sample upon sorting). High sorting efficiencies will ensure that endpoint calculations are reasonably reliable and without bias between samples.

The recommendation for assessing sorting efficiency is that at least 10% of all samples from each study are re-sorted and any organisms found on the second sort are enumerated. The criteria for an acceptable sort are that more than 90% of the total number of organisms is recovered during the initial sort. If more than 10% of the total number is found during the re-sort, then all the samples within that particular group of samples requires re-sorting. A further criterion requiring a re-sort is if an entire group of benthic invertebrates was not extracted from the debris (e.g., ostracods were not recognized and sorted), even if the missed organism constituted less than 10% of the total numbers. If the sorting efficiency was acceptable (>90%), then the re-sorted organisms were left out of any further analysis because they are not part of the complete sorting process.

The effect of sub-sampling on abundance estimates was examined on a minimum of 10% of the samples. If the error exceeded 20% for any group of samples, then all samples within that group of samples were completely sorted to assure the sub-sampling process did not compromise data integrity. That required that 10% of samples that have been sub-sampled are randomly selected and the remaining unsorted material was sorted in its entirety. The estimates were then compared to the actual counts from the sample and the accuracy of the estimates and the precision between subsamples were calculated.

2.8.6 Zooplankton

Triplicate samples were collected at each site for zooplankton sampling. Each sorter has 25% of their sorted samples re-examined by a qualified taxonomist as a quality control measure. Any new identified specimens are checked for consistency by the principal taxonomist.

3. Results

Rescan™
Engineers and Scientists

3. Results

3.1 STREAM WATER QUALITY

All data for stream water quality are provided in Appendix 3.1-1. All detection limits for these data are in Appendix 3.1-2.

3.1.1 General Variables and Nutrients

Key physical variables for the Kitsault streams are presented graphically and discussed below. Total suspended solids (TSS) and several anions and nutrients (bromide, chloride, nitrite, and total kjeldahl nitrogen) were below or close to the detection limits for the majority (>75%) of samples. Therefore, they are not graphed or discussed in detail. Within each graph, sites are shown from downstream to upstream on the x-axis and are grouped by watershed. If available, CCME and BC Maximum guidelines are indicated on figures.

Hardness levels (as $CaCO_3$) were generally greatest at each stream site during winter (March to April and October to December) (Figure 3.1-1). This may be a result of the greater contribution of groundwater to total stream flow in the winter months. Hardness ranged from relatively low concentrations upstream of the mine site (3.86 mg/L at PC1, late May) to 127 mg/L farther downstream (PC5, November). PC5 consistently had the hardest water of the stream sites.

Most pH values were near neutral and were within range of the CCME guideline of pH 6.5 to 9.0, except for several samples collected at PC1 (Figure 3.1-1). This site is located near Patsy Lake flows into the stream, which also had slightly acidic waters (Figure 3.2-1). Hence, slightly acidic waters may be a general feature of this upper watershed.

Similar to hardness concentrations, total dissolved solids (TDS) also were greatest during the winter months at each site and were lowest upstream of the mine site (PC1; <10 mg/L) and highest at PC5 (185 mg/L; November).

More than 80% of the 2009 total suspended solid (TSS) samples were below or close to the detection limit (3 mg/L) (Appendix 3.1-1). A couple of May and June samples from RC1 and LC1 had measurable TSS concentrations (between 15 and 20 mg/L) but the June 3 freshet sample (RC1) had a considerable TSS concentration (179 mg/L).

These elevated TSS levels correspond to the high turbidity observed at these sites (Figure 3.1-2). CCME or BC aquatic life guidelines are dependent on background TSS concentrations. Turbidity of most samples was below 0.5 NTU and the greatest turbidity was generally observed during the spring freshet period in May and June. RC1 had the greatest turbidity value, at 85 NTU (June 3).

In terms of dissolved anions, fluoride and sulphate concentrations followed a similar temporal pattern as TDS (Figure 3.1-3). Concentrations of each anion were greatest during the winter months, particularly at PC5 and LC1. The only fluoride concentrations that came close to available guidelines are the March, April, October, and November samples from PC5 (Figure 3.1-3). Because the analyzed hardness for these samples was greater than 50 mg/L, the BC guideline of 0.3 mg/L applies. All four of these samples were less than 0.25 mg/L. The BC guideline for hardness less than 50 mg/L is 0.2 mg/L (all samples in this category had fluoride concentrations well below 0.2 mg/L). Sulphate concentrations ranged from below

the detection limit (0.5 mg/L) at PC1 to 99.4 mg/L (November) at PC5. This November concentration at PC5 is just slightly below the BC Maximum guideline of 100 mg/L.

Most of the nitrogen in each stream exists as nitrate although in a few samples (approximately 9%) some contribution from total kjeldahl nitrogen (TKN) to the total nitrogen concentrations was evident (Appendix 3.1-1). Nitrate concentrations were greatest during the winter at all sites and, other than RC1, generally ranged between below detection (0.005 mg/L) to 0.08 mg/L (Figure 3.1-4). Concentrations at RC1 ranged from 0.02 mg/L (June 18) to 0.25 mg/L (December).

Total phosphorus (TP) concentrations were similar to the temporal and spatial pattern seen for turbidity values (Figure 3.1-4). Concentrations were generally greatest in May and June and were associated with freshet. Each site had samples that were below the detection limit (0.002 mg/L), mostly in the summer and winter months. The greatest concentration was 0.15 mg/L at RC1 (June 3). The detection limit for this sample was higher than other sites (0.02 mg/L) as a result of the elevated turbidity in the sample. No CCME or BC aquatic life guidelines exist for exceeding TP concentrations.

Total organic carbon (TOC) concentrations did not show a clear spatial or temporal pattern (although elevated levels were usually observed during freshet) (Figure 3.1-5) and ranged from just above the detection limit at LC3 (0.52 mg/L, July) to 6.1 mg/L at RC1 (May 22). No CCME or BC aquatic life guidelines exist for TOC.

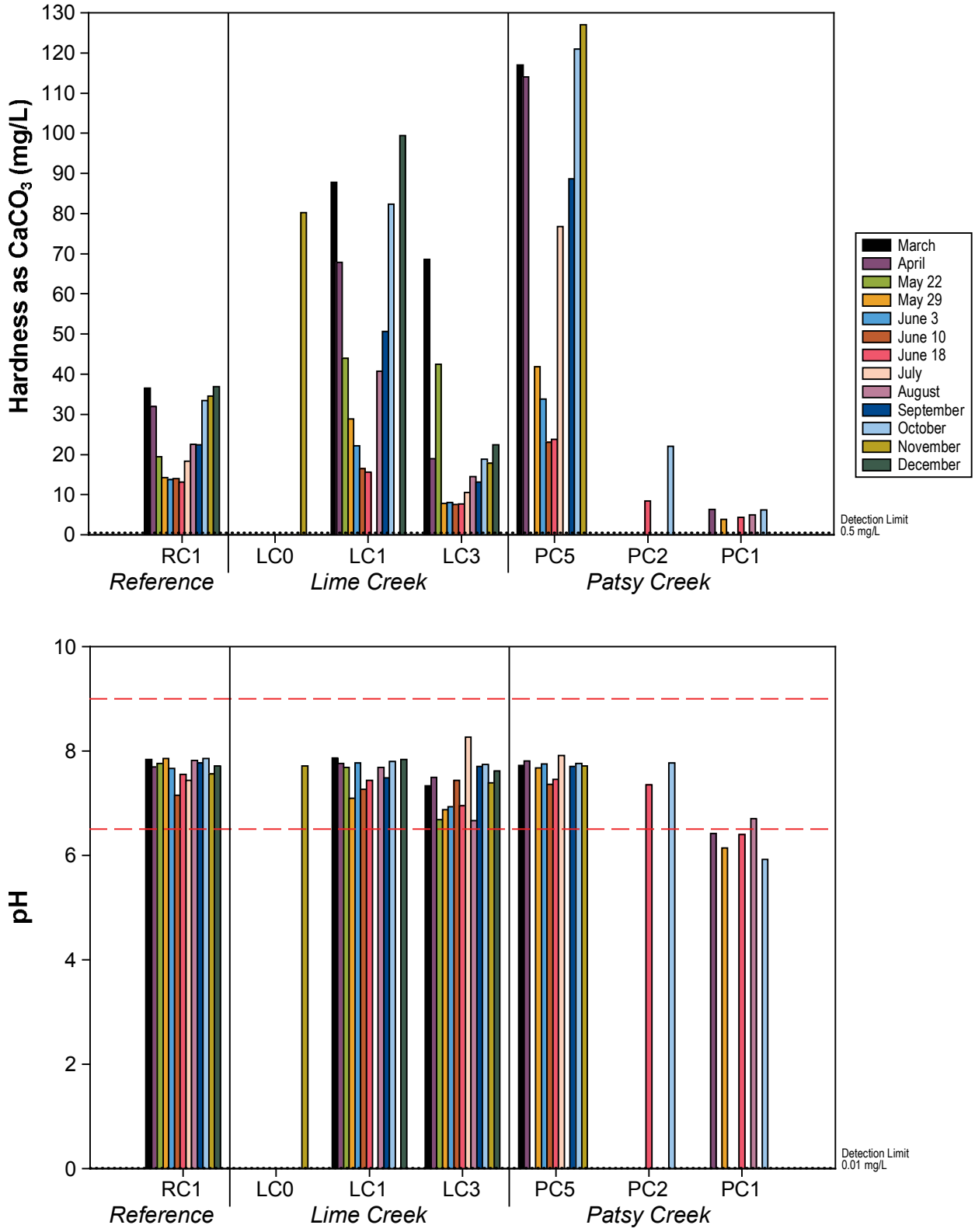
Total cyanide concentrations ranged from below the detection limit of 0.001 mg/L at most sites to 0.0051 mg/L (September) at LC1 (Figure 3.1-5). Most measurable concentrations were between 0.001 and 0.003 mg/L. The September sample from LC1 was the only one that exceeded the CCME guideline of 0.005 mg/L. All samples were well below the BC guideline of 0.01 mg/L.

3.1.2 Total and Dissolved Metals

Several metals, including some for which guidelines exist, had the majority (greater than 60%) of their concentrations close to or below detection limits (Appendix 3.1-1). No figures are presented for these metals but a comment is made if a sample was observed to have a relatively high concentration or exceed a guideline value. The remaining metals with guidelines were screened for exceedances and are discussed below. CCME and BC guidelines for total metals were used to screen both total and dissolved metal concentrations, except for dissolved aluminum, which has a specific BC guideline.

Several metals were observed to have their greatest concentrations at RC1 in early June. This coincided with peak flows during spring freshet (Rescan 2010).

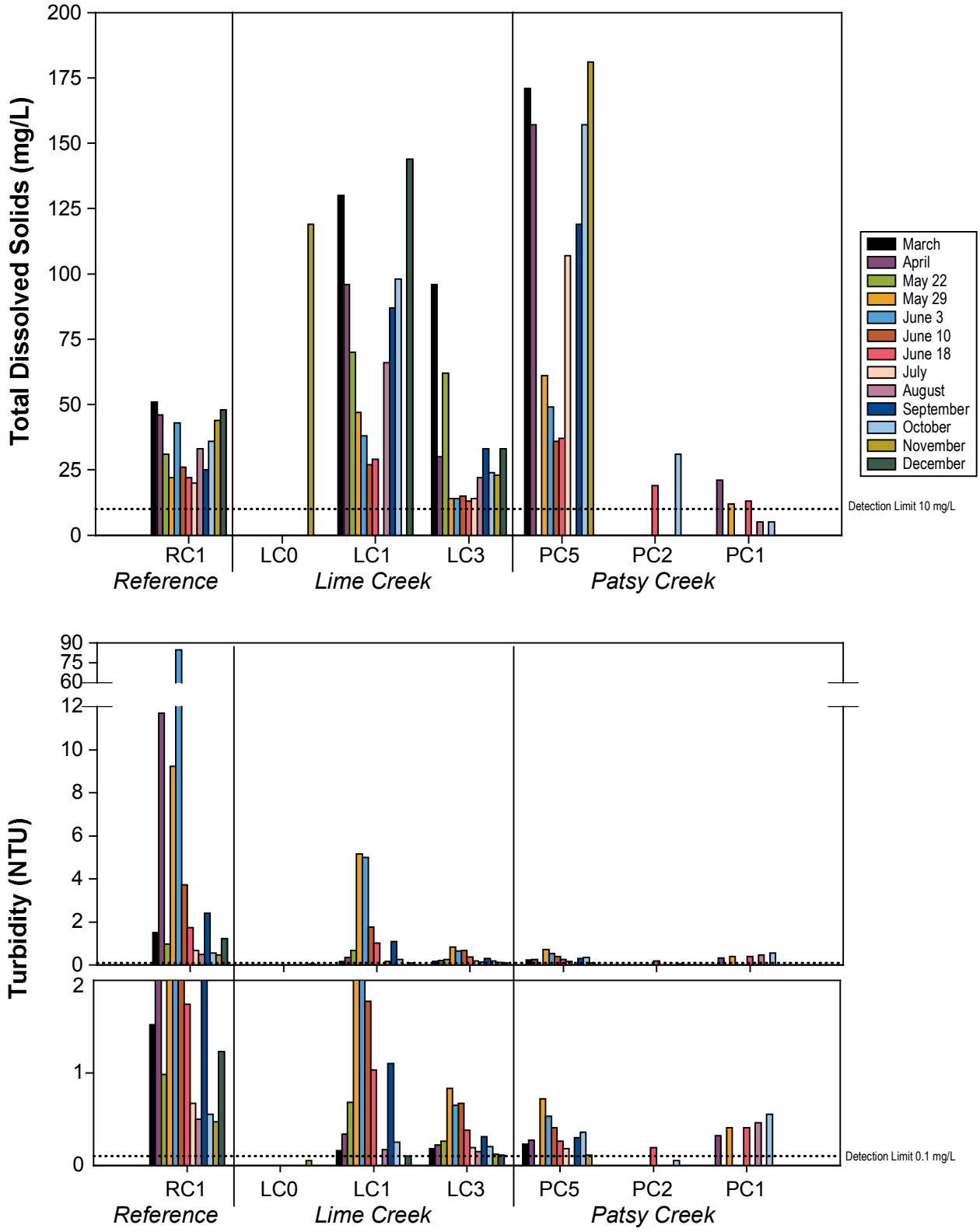
Total aluminum concentrations share similar temporal and spatial patterns as turbidity because they (Figure 3.1-6). Most samples had concentrations between 0.02 and 0.1 mg/L. The greatest concentration at each site was in late May or early June with the maximum concentration occurring at RC1 (1.1 mg/L, June 3). Each site had at least one sample that exceeded the CCME guideline except PC2. The CCME guideline 0.1 mg/L applies to all sites except PC1, since the pH at that site is <6.5. At PC1 the CCME guideline of 0.005 mg/L applies, resulting in all samples from that site exceeding the guideline value. Dissolved aluminum concentrations generally fell between 0.01 and 0.05 mg/L. The greatest concentration was 0.097 mg/L (June 3) at RC1, which was just below the BC guideline of 0.1 mg/L.



Note: Dotted line represents analytical detection limit.
Dashed red line represents CCME guideline (6.5 and 9.0).

Hardness and pH Values in Streams, Kitsault Project, 2009

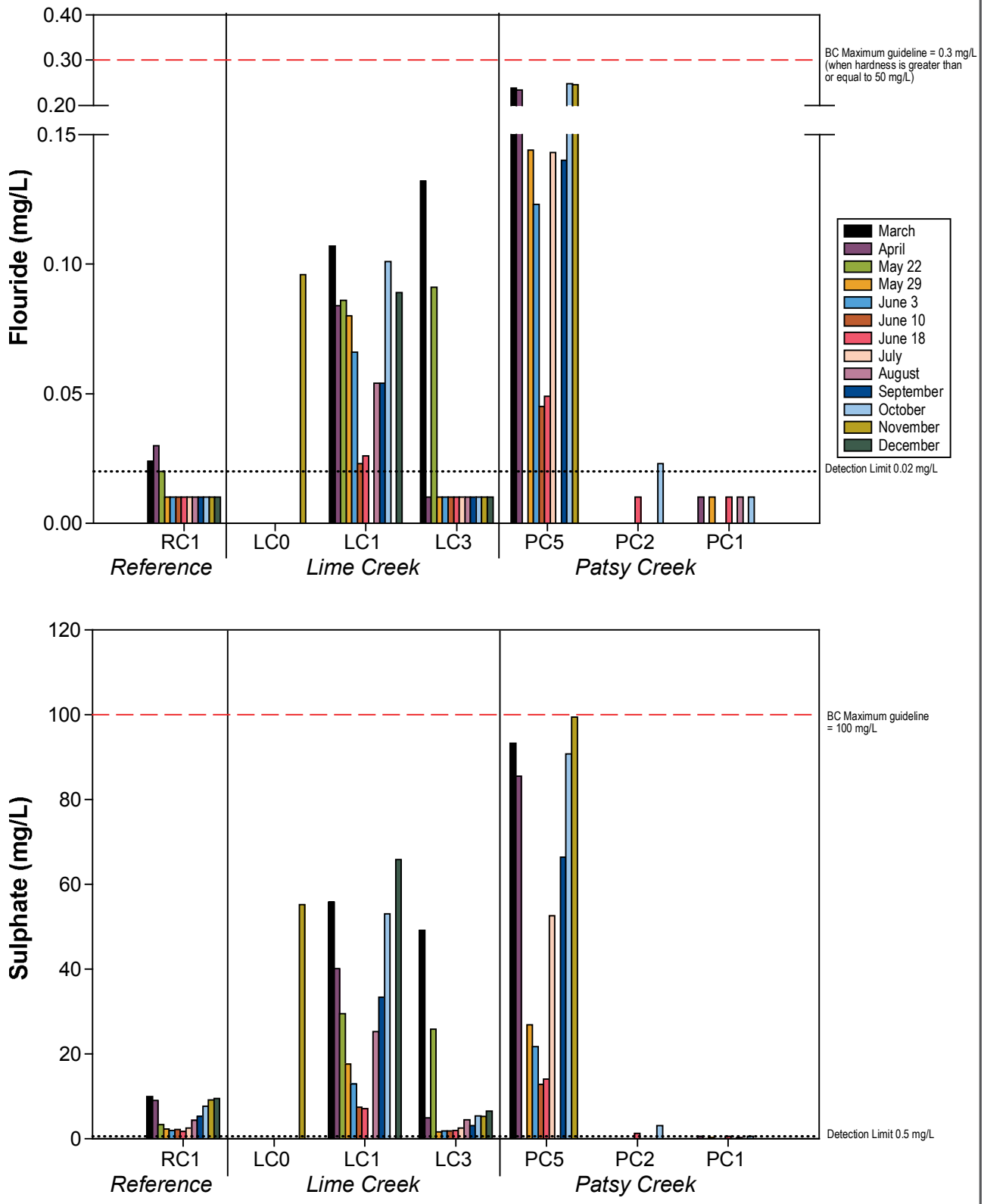
Figure 3.1-1



Notes: Dotted line represents analytical detection limit.
CCME and BC Maximum guideline for turbidity depends on background levels.

Total Dissolved Solids Concentrations and Turbidity in Streams, Kitsault Project, 2009

Figure 3.1-2



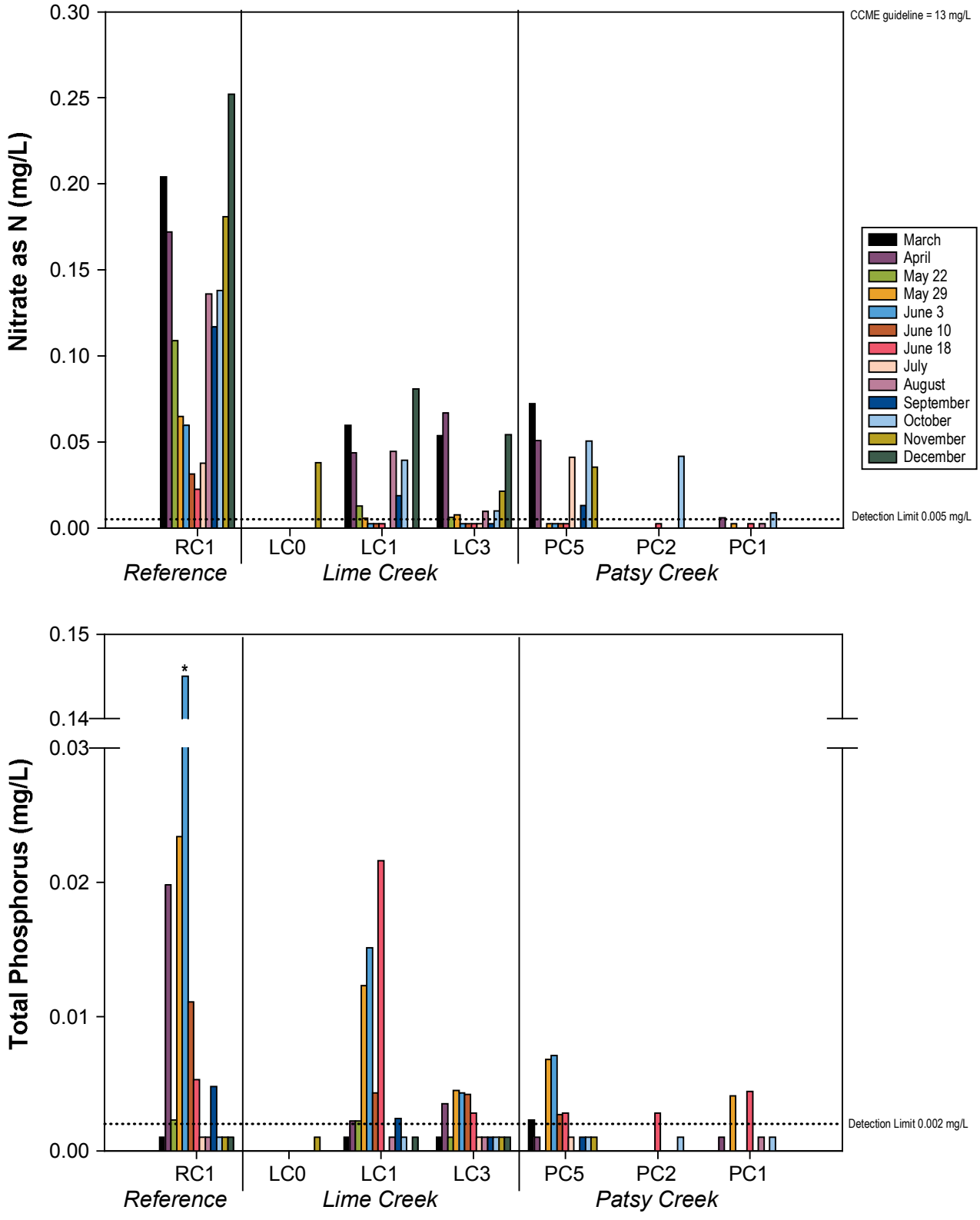
Notes: Dotted line represents analytical detection limit.
Dashed red line represents the BC Maximum guidelines.

Fluoride and Sulphate Concentrations in Streams, Kitsault Project, 2009

Figure 3.1-3

AVANTI MINING INC

Rescan™ Engineers & Scientists



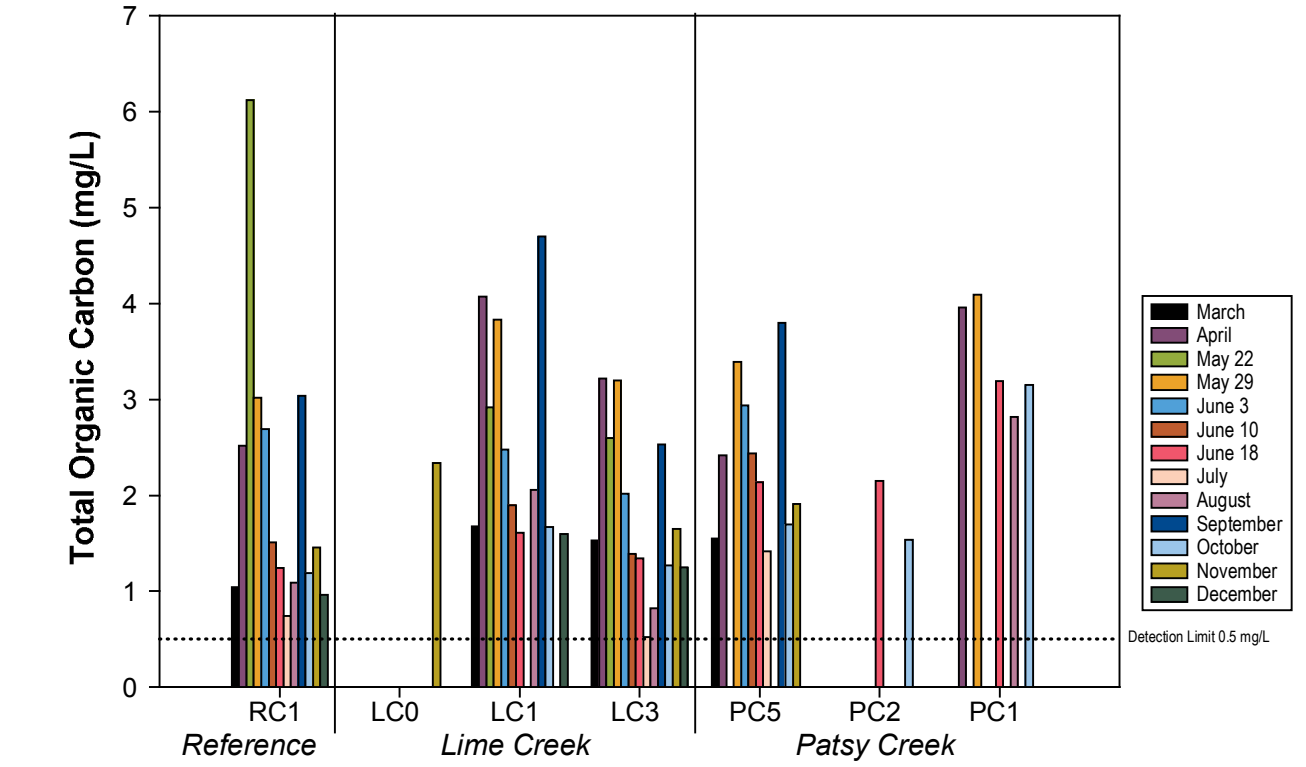
Notes: Dotted line represents analytical detection limit.
** indicates a detection limit of 0.02 mg/L for this sample.*
No CCME or BC guideline exists for Total Phosphorus.

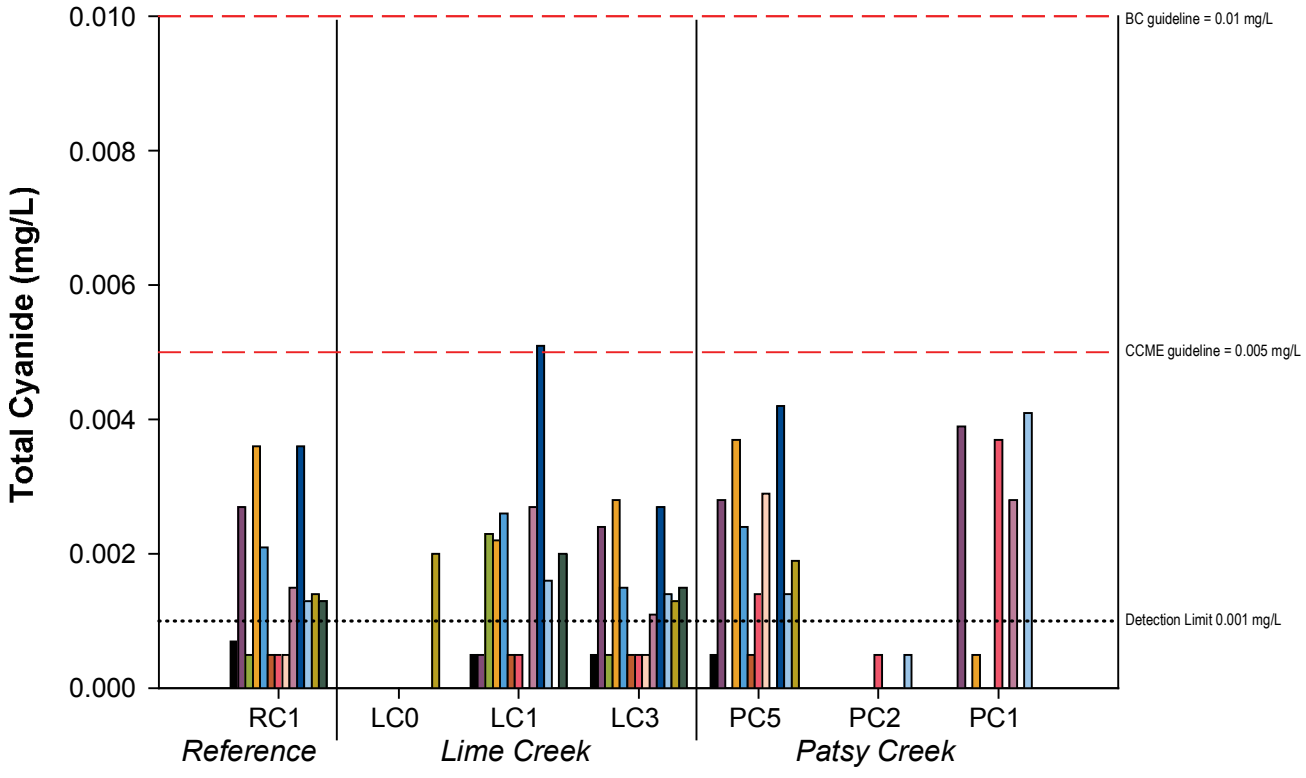
Nitrate and Total Phosphorus Concentrations in Streams, Kitsault Project, 2009

Figure 3.1-4

AVANTI MINING INC

Rescan™ Engineers & Scientists





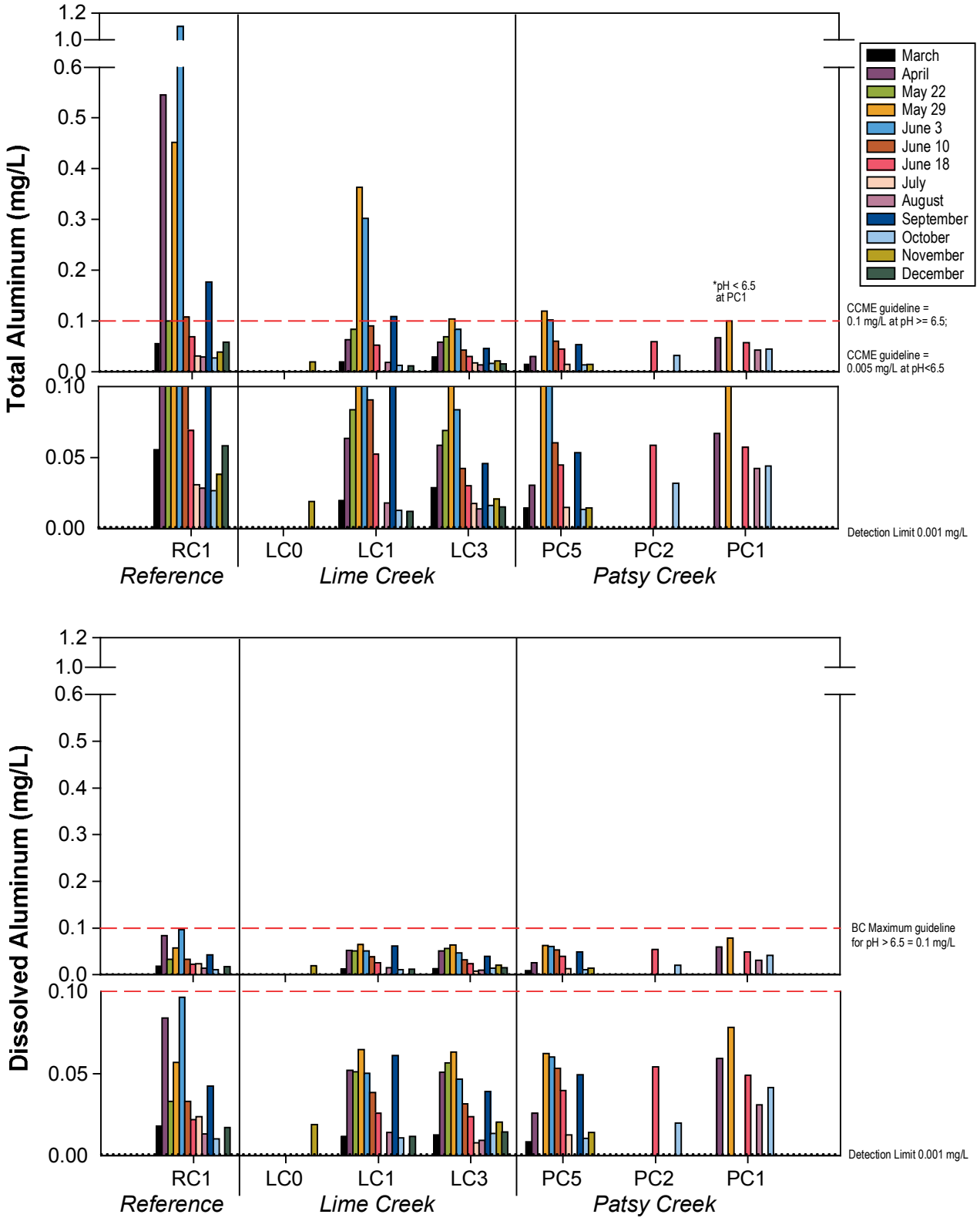
Notes: Dotted line represents analytical detection limit.
Dashed red line represents the CCME and BC guidelines.

Total Organic Carbon and Total Cyanide Concentrations in Streams, Kitsault Project, 2009

Figure 3.1-5

AVANTI MINING INC

Rescan™ Engineers & Scientists



Notes: Dotted line represents analytical detection limit.
Dashed red line represents the CCME and BC Maximum guidelines.

Total and Dissolved Aluminum Concentrations in Streams, Kitsault Project, 2009

Figure 3.1-6

AVANTI MINING INC

Rescan™ Engineers & Scientists

Total arsenic ranged from below the detection limit in several samples (0.0001 mg/L) to a high of 0.001 mg/L at RC1 (June 3) (Figure 3.1-7). LC3 usually had the greatest concentrations. No sample exceeded the BC Maximum and CCME guideline of 0.005 mg/L. Monthly dissolved arsenic concentrations were mainly highest at LC3 with the maximum concentration occurring during August (0.0006 mg/L).

The spatial and temporal pattern of total cadmium concentrations were similar to those observed for TDS, hardness and dissolved anions (Figure 3.1-8). Several samples from LC3, PC1, and PC2 were below the detection limit for total cadmium (0.00001 mg/L) and PC5 generally always had the greatest concentration each month with a maximum of 0.0005 mg/L (October). The BC Maximum guideline for total cadmium is hardness-dependent and the CCME guideline is 0.000017 mg/L. These guidelines were exceeded by several total/dissolved samples at each site (75% of samples for BC Maximum and 73%/70% of samples for CCME) except PC2.

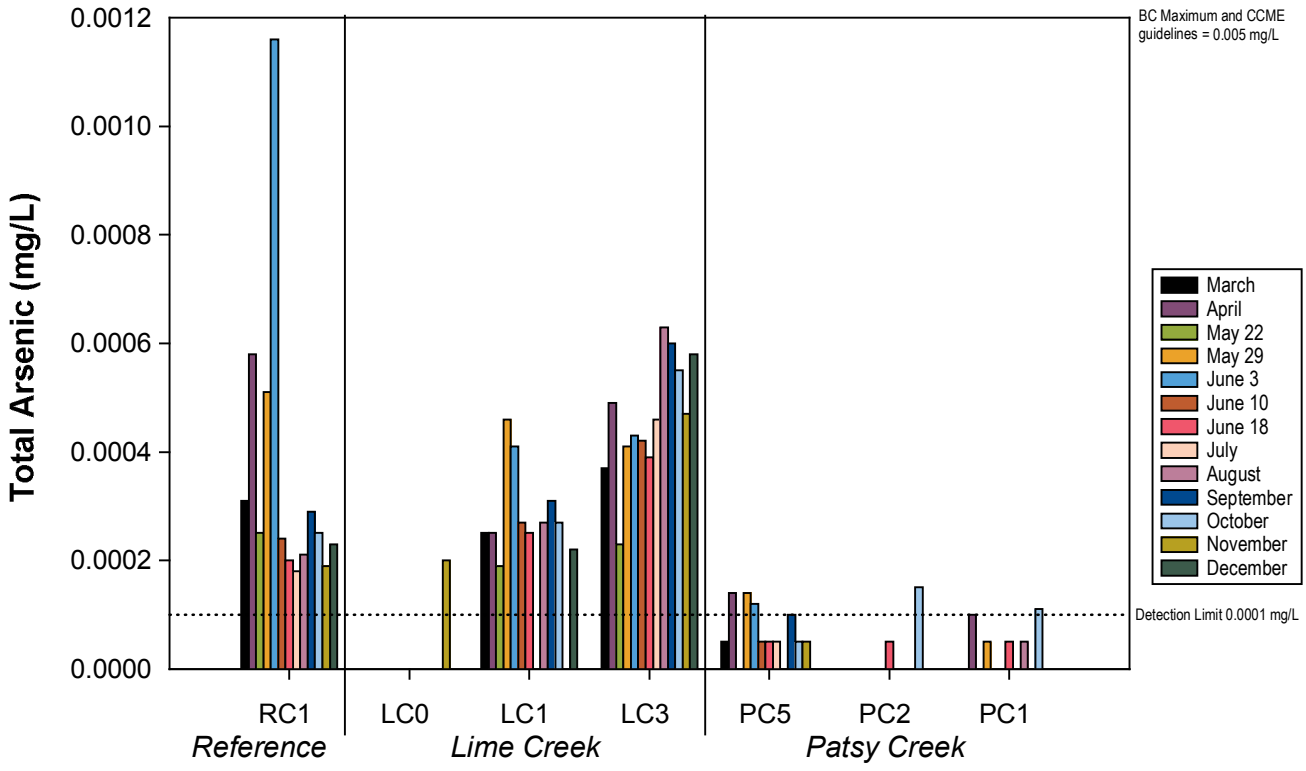
The majority (89%) of total chromium concentrations were below the detection limit (0.0005 mg/L). One sample (RC1, June 3) exceeded the CCME and BC Maximum working guideline (0.001 mg/L) with a concentration of 0.003 mg/L (Appendix 3.1-1). All dissolved chromium concentrations were below detection limits.

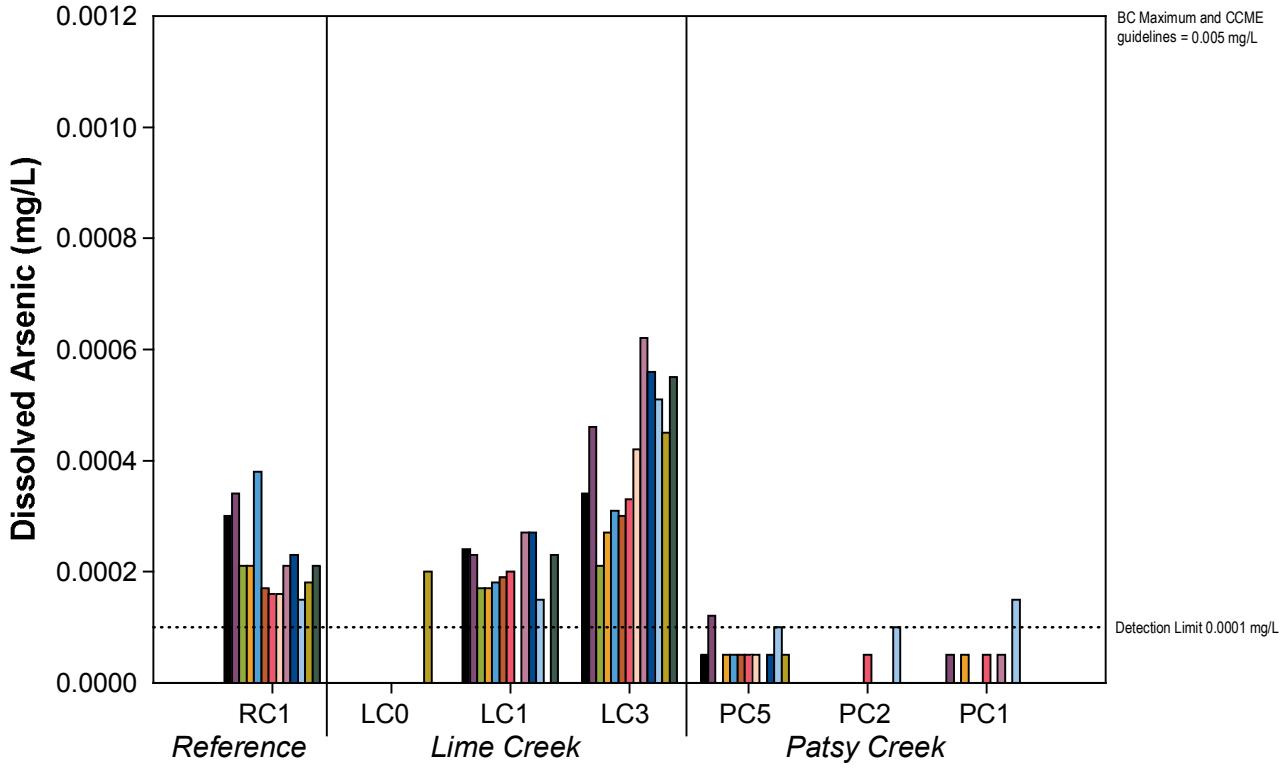
Total copper concentrations ranged from below detection limits at several sites to 0.004 at RC1 (June 3; Figure 3.1-9). The June 3rd sample from RC1 was the only sample that exceeded both the BC Maximum and the CCME guidelines, which depend on water hardness. The CCME guideline was also exceeded by one sample for LC1 (0.002 mg/L, May 29). No dissolved copper concentrations exceeded these guidelines. Elevated detection limits for copper (Appendix 3.1-2) only apply to the March and May 22 samples for total concentrations and October samples for dissolved concentrations. These particular samples were also found to have concentrations below their respective detection limits for those months.

Total iron concentrations ranged from below the detection limit at most sites to 2.6 mg/L (RC1, June 3) (Figure 3.1-10). The spatial and temporal pattern of total iron concentrations were similar to those observed for turbidity, TP and aluminum. The June 3 sample from RC1 exceeded the BC Maximum guideline (1 mg/L) and the CCME guideline (0.3 mg/L) was exceeded by three samples from RC1 and two samples from LC1 (April, May, and June). The majority of dissolved iron concentrations (Appendix 3.1-1) were below the detection limit (0.03 mg/L) and all measurable concentrations were less than 0.09 mg/L, which is well below the BC guideline for dissolved iron (0.35 mg/L).

Total lead concentrations ranged from below the detection limit at several sites to 0.0026 mg/L at LC1 (June 3) (Figure 3.1-11). RC1, LC1, and PC5 all had their greatest concentrations in the June 3rd samples. The BC Maximum and CCME guidelines are hardness-dependent. No sample exceeded the BC Maximum guideline while 9% of samples exceeded the CCME guideline (all from RC1, LC1, and PC5). Most dissolved lead concentrations were below the detection limit (0.0005 mg/L).

Manganese concentrations were usually highest during freshet similar to the trend for turbidity, TP and some metals (Figure 3.1-12). Most concentrations were below 0.05 mg/L, although considerably greater concentrations were observed at RC1 (0.21 mg/L, June 3) and PC1 (0.15 mg/L, October). The BC Maximum guideline is dependent on hardness and no CCME guideline is currently available. No sample exceeded the BC Maximum guideline. Most dissolved manganese samples were less than 0.006 mg/L with 0.12 mg/L (PC1, October) being the notable exception.





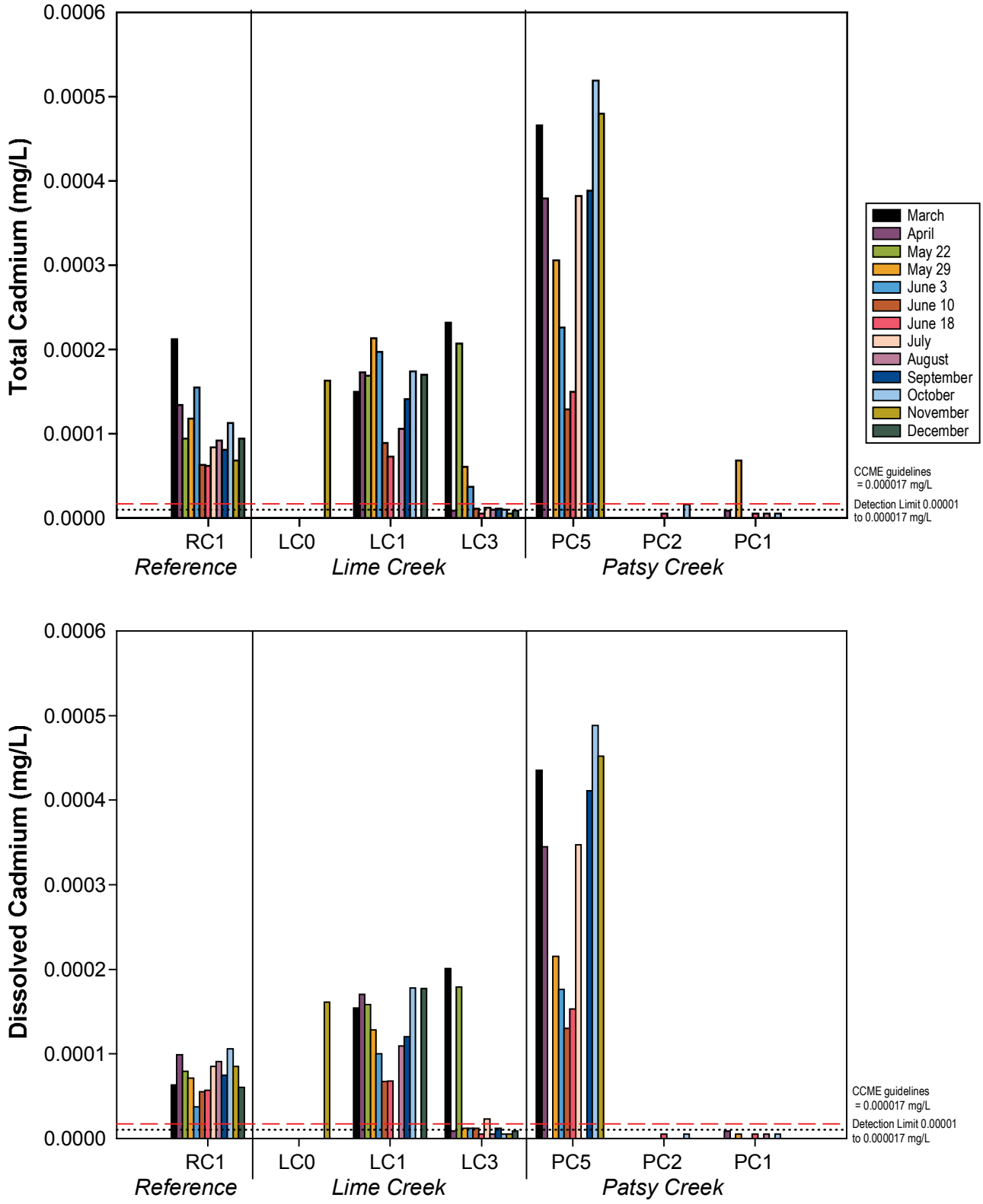
Notes: Dotted line represents analytical detection limit.

Total and Dissolved Arsenic Concentrations in Streams, Kitsault Project, 2009

Figure 3.1-7

AVANTI MINING INC

Rescan™ Engineers & Scientists



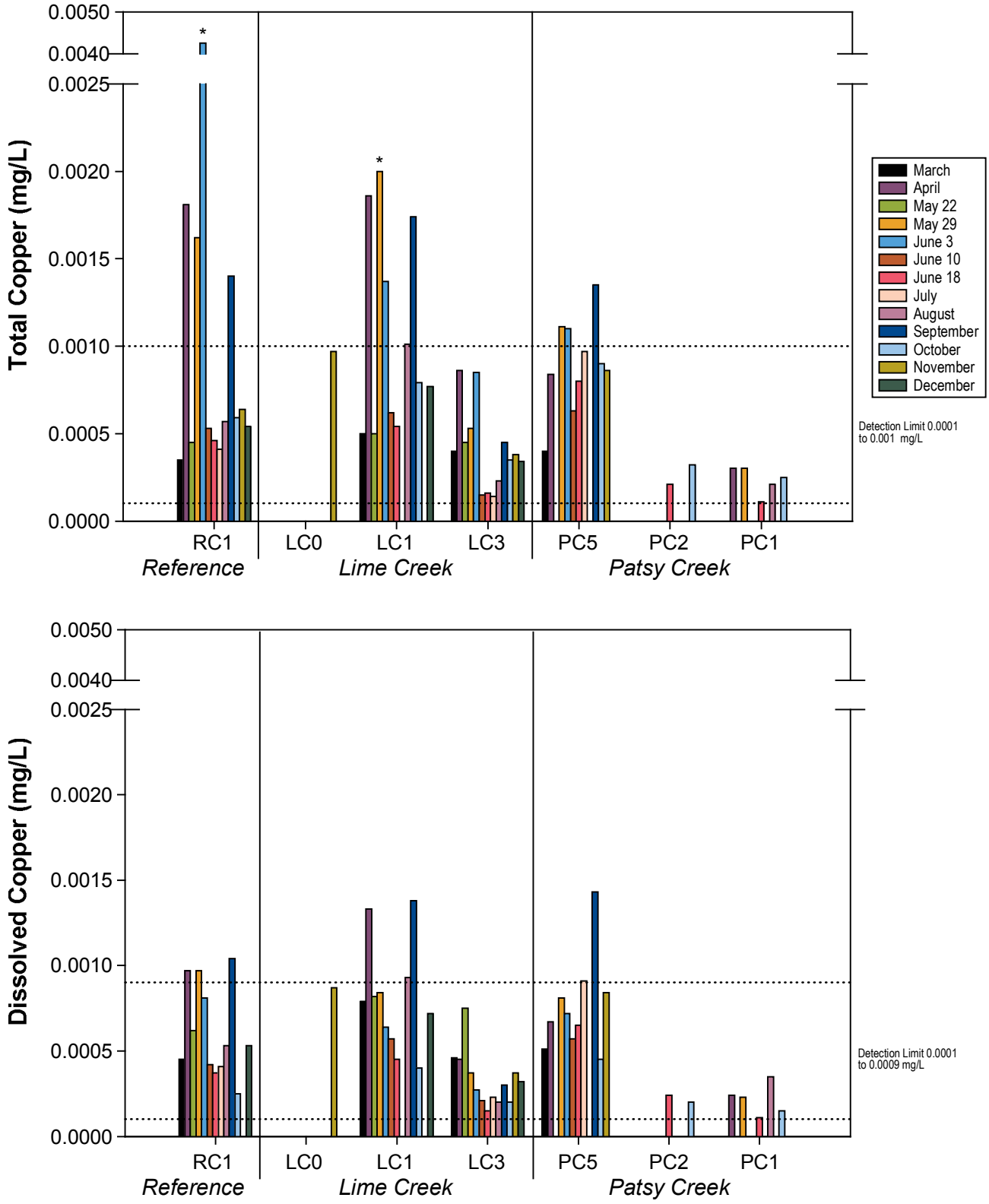
Notes: Dotted line represents analytical detection limit.
Dashed red line represents the CCME guideline.
BC Maximum guideline depends on hardness.

Total and Dissolved Cadmium Concentrations in Streams, Kitsault Project, 2009

Figure 3.1-8

AVANTI MINING INC

Rescan™ Engineers & Scientists



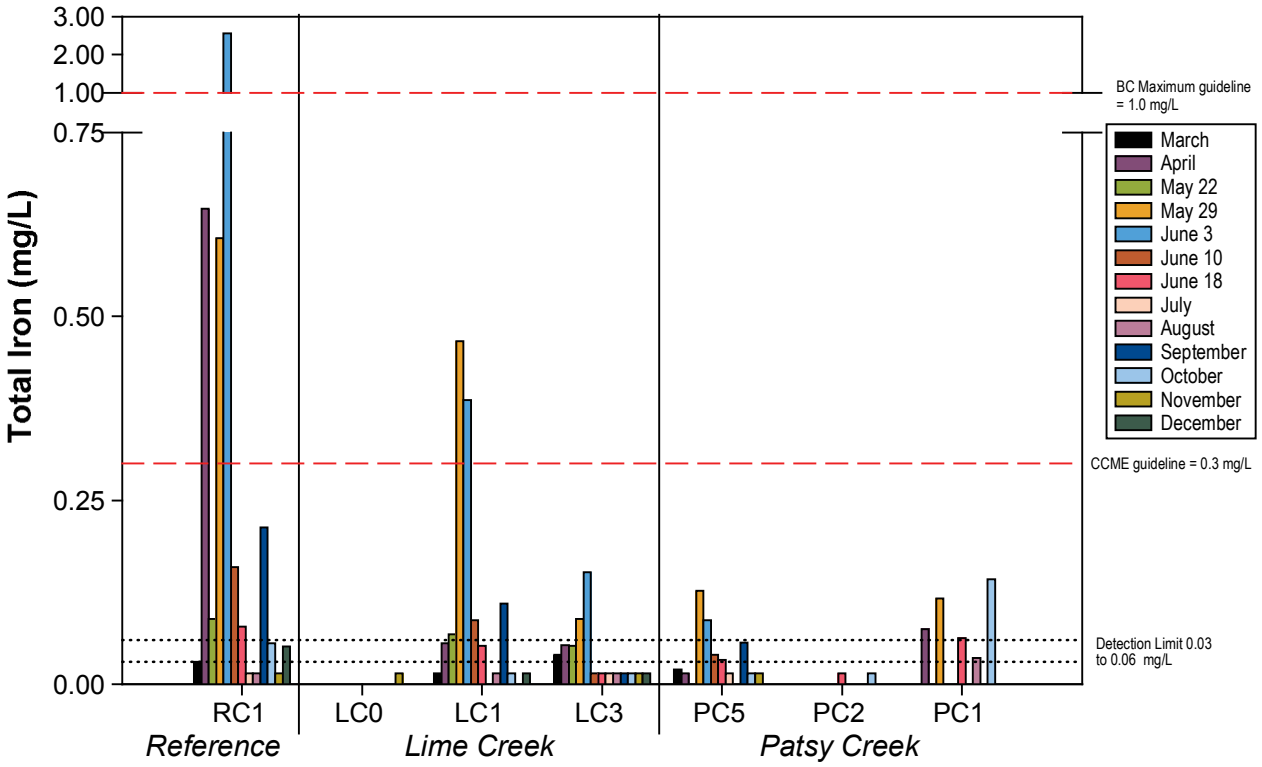
Notes: Dotted line represents analytical detection limit.
BC and CCME guidelines depend on hardness.
Lower detection limit applies to most samples.
** Indicates exceeded guideline.*

Total and Dissolved Copper Concentrations in Streams, Kitsault Project, 2009

Figure 3.1-9

AVANTI MINING INC

Rescan™ Engineers & Scientists



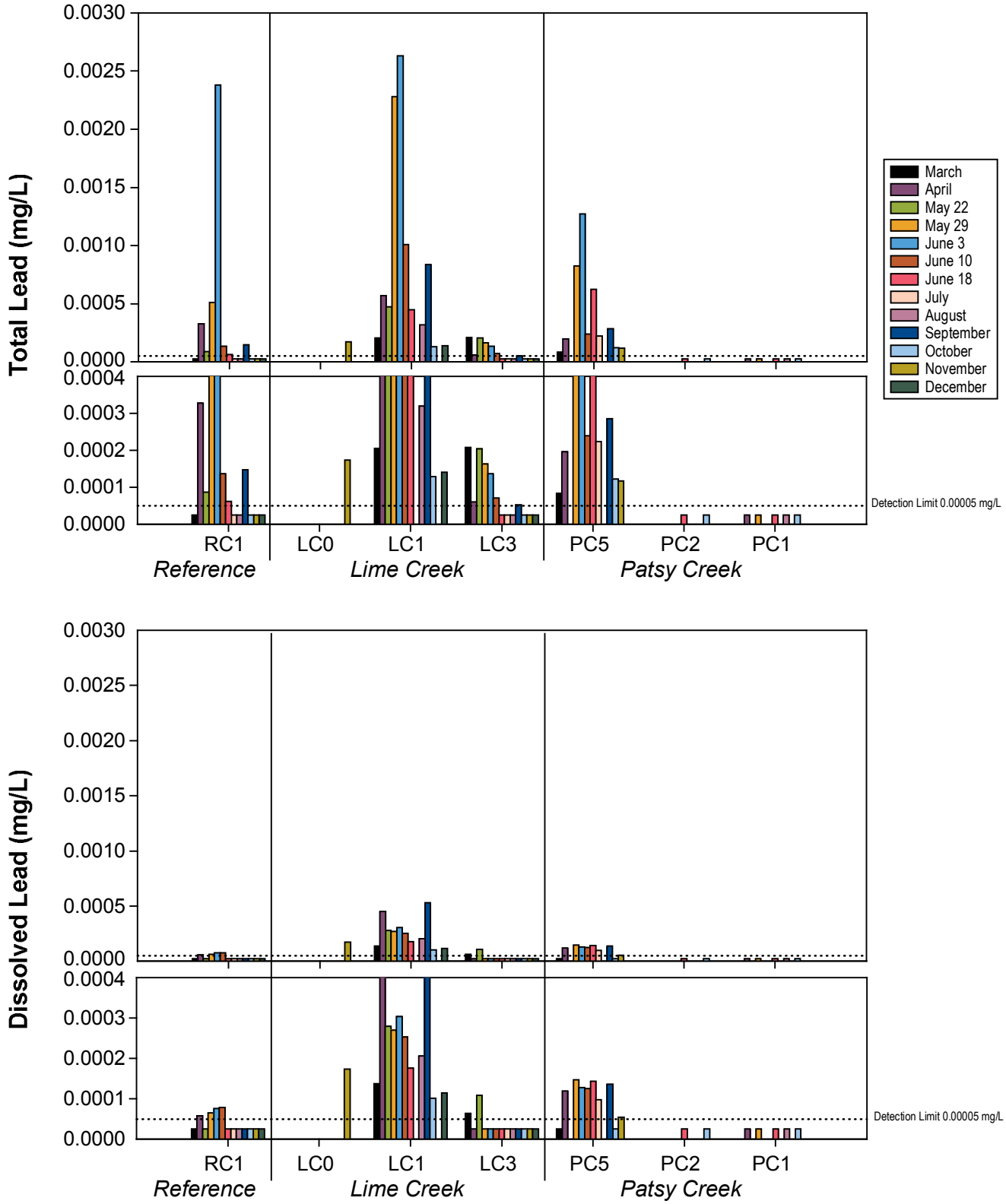
Notes: Dotted line represents analytical detection limit.
Dashed red line represents BC and CCME guidelines.

Total Iron Concentrations in Streams, Kitsault Project, 2009

Figure 3.1-10

AVANTI MINING INC

Rescan™ Engineers & Scientists



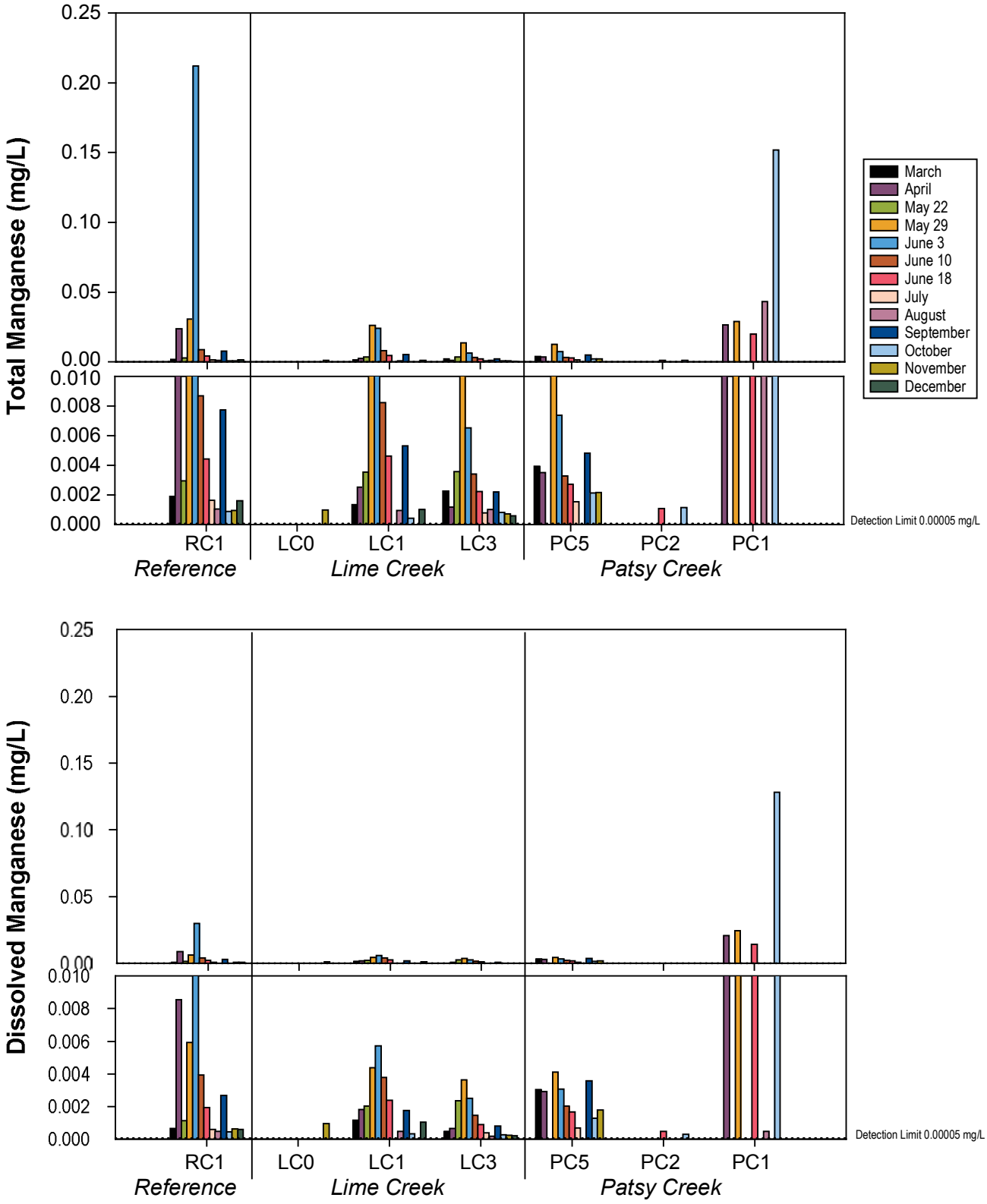
Notes: Dotted line represents analytical detection limit.
BC and CCME guidelines depend on hardness.

Total and Dissolved Lead Concentrations in Streams, Kitsault Project, 2009

Figure 3.1-11

AVANTI MINING INC

Rescan™ Engineers & Scientists



Notes: Dotted line represents analytical detection limit.
BC guideline depends on hardness.

Total and Dissolved Manganese Concentrations in Streams, Kitsault Project, 2009

Figure 3.1-12

AVANTI MINING INC

Rescan™ Engineers & Scientists

The spatial and temporal pattern of total molybdenum concentrations were similar to those observed for TDS, hardness, anions and nitrate. This is most visible at LC1 and PC5, where the greatest concentration occurred during the winter months (Figure 3.1-13). Total molybdenum ranged from below the detection limit (0.00005 mg/L) to 0.41 mg/L (PC5, October and November). The CCME guideline (0.073 mg/L) was exceeded by several samples (39%) in Lime Creek and PC5. Because the dissolved molybdenum concentrations are just slightly lower than the total concentrations (i.e., most of the molybdenum is in the dissolved form), the same percentage of samples (39%) exceeded the CCME guideline. All samples were well below the BC guideline (2 mg/L).

The majority of total nickel concentrations were less than or close to 0.001 mg/L and several samples at LC3 and PC1 were below the detection limit of 0.0005 mg/L (Figure 3.1-14). Peak concentrations of total nickel tended to occur in April, May, and early June were usually highest at LC1 and RC1. The maximum concentration was 0.005 mg/L (June 3) at RC1. Dissolved nickel was slightly lower than total concentrations at most sites and ranged from below the detection limit (0.0005 mg/L) to 0.0026 mg/L (April) at LC1. Total and dissolved nickel concentrations were well below the BC and CCME guidelines (range from 0.025 to 0.15 mg/L), which are hardness-dependent.

Selenium concentrations, both total (51% of samples) and dissolved (65% of samples) were often below their detection limit (0.0001 mg/L) (Figure 3.1-15). The greatest total and dissolved selenium concentrations were observed at LC1 in March, 0.00036 and 0.00025 mg/L respectively. No samples exceeded the BC guideline (0.002 mg/L) or the CCME guideline (0.001 mg/L) values.

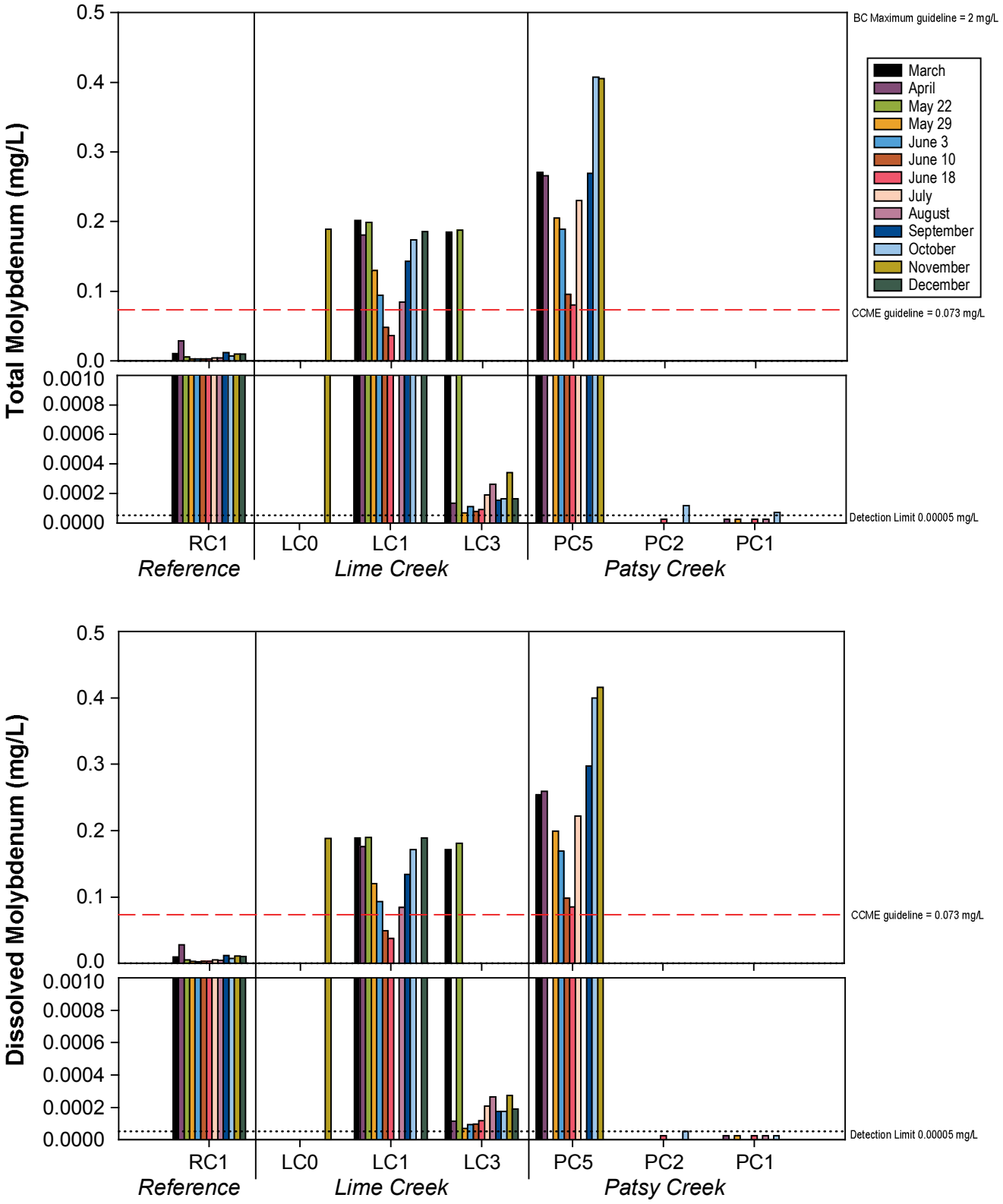
Uranium concentrations were generally low (below 0.0006 at most sites). All concentrations were well below the BC working guideline of 0.3 mg/L (Appendix 3.1-1), although some elevated concentrations were observed at PC5 during the winter months (0.001 to 0.002 mg/L).

Total and dissolved zinc concentrations ranged from below detection (0.001 mg/L) to 0.016 mg/L (March) and 0.013 mg/L (March), respectively at PC5 (Figure 3.1-16). The highest concentrations were observed at RC1 and LC1 during freshet and PC5 in winter. No sample exceeded the BC (hardness-dependent) or CCME (0.03 mg/L) guidelines.

Also provided in Appendix 3.1-1 are data from a site called "mine discharge." This site was identified in the early spring 2009 when collecting samples from stream sites. Because there was no information at the time regarding the contents of the pond and water was visibly flowing into Patsy Creek (Plate 3.1-1), a grab sample was collected and analyzed. The general quality of the water draining from this pond includes it being alkaline (total alkalinity of 118 mg/L) and very high dissolved solids (338 mg/L) and sulphates (150 mg/L). The concentrations of several metals (i.e., molybdenum and zinc) were also elevated.

3.2 LAKE AND WETLAND WATER QUALITY

All data for lake and wetland water quality are provided in Appendix 3.2-1 and all detection limits for these data are in Appendix 3.2-2.



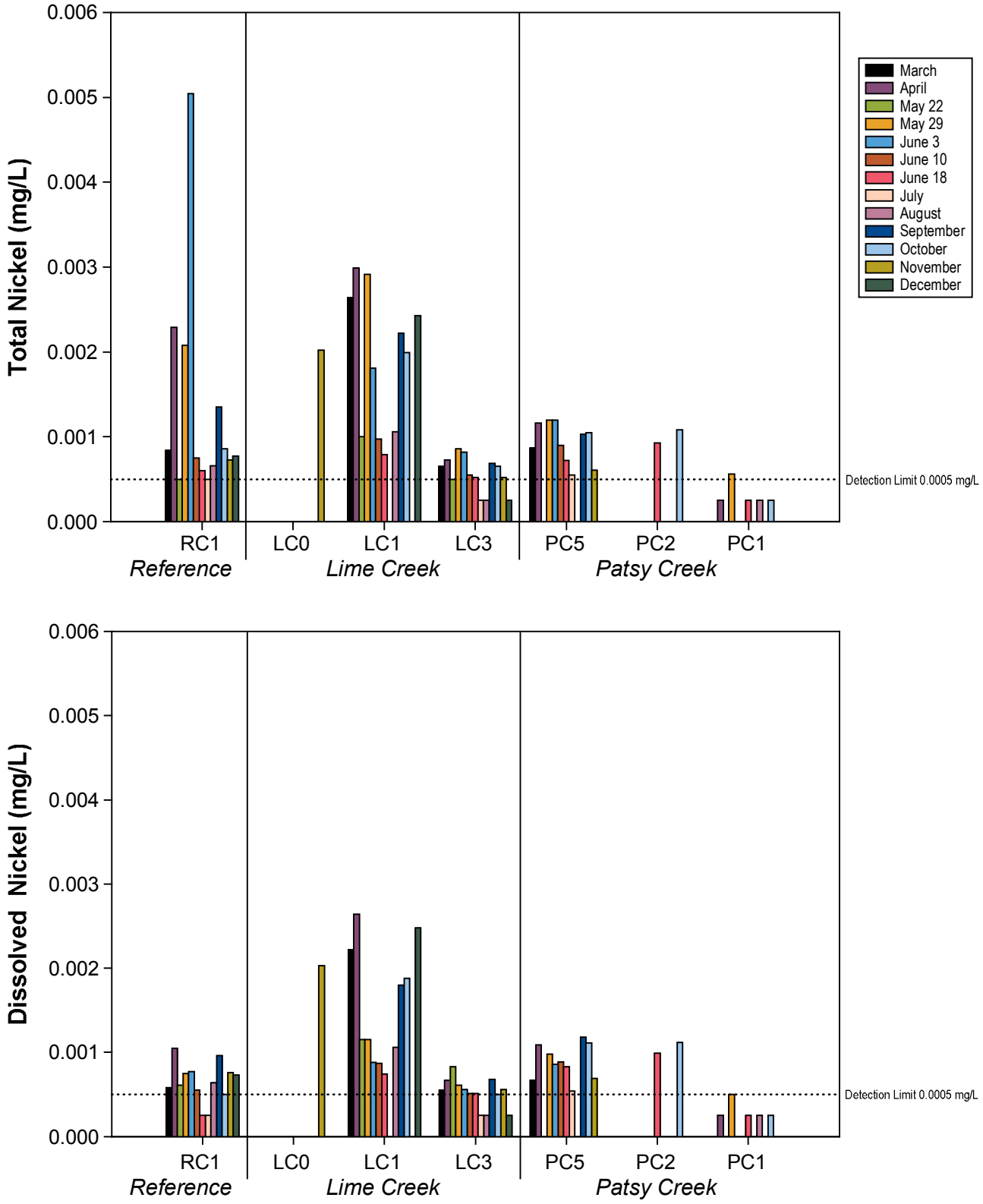
Notes: Dotted line represents analytical detection limit.
Dashed red line represents BC and CCME guidelines.

Total and Dissolved Molybdenum Concentrations in Streams, Kitsault Project, 2009

Figure 3.1-13

AVANTI MINING INC

Rescan™ Engineers & Scientists



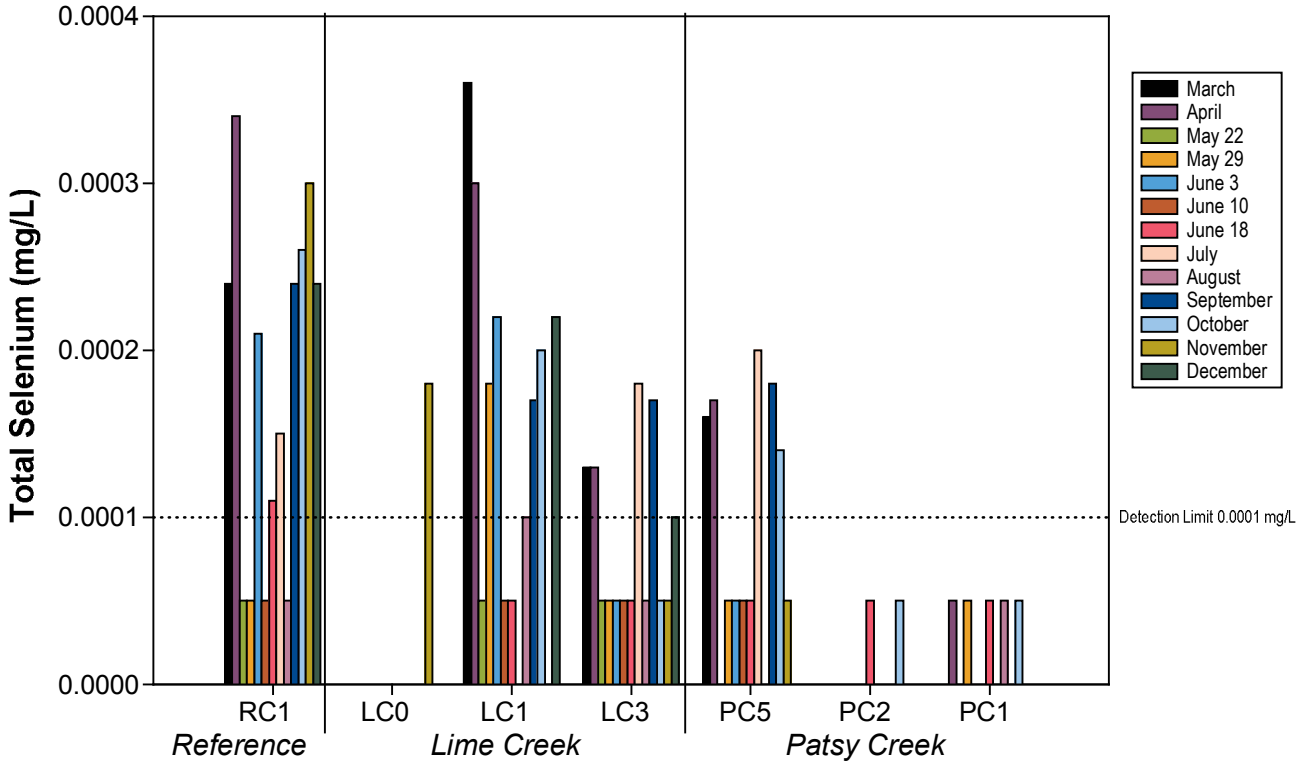
Notes: Dotted line represents analytical detection limit.
BC and CCME guidelines depend on hardness.

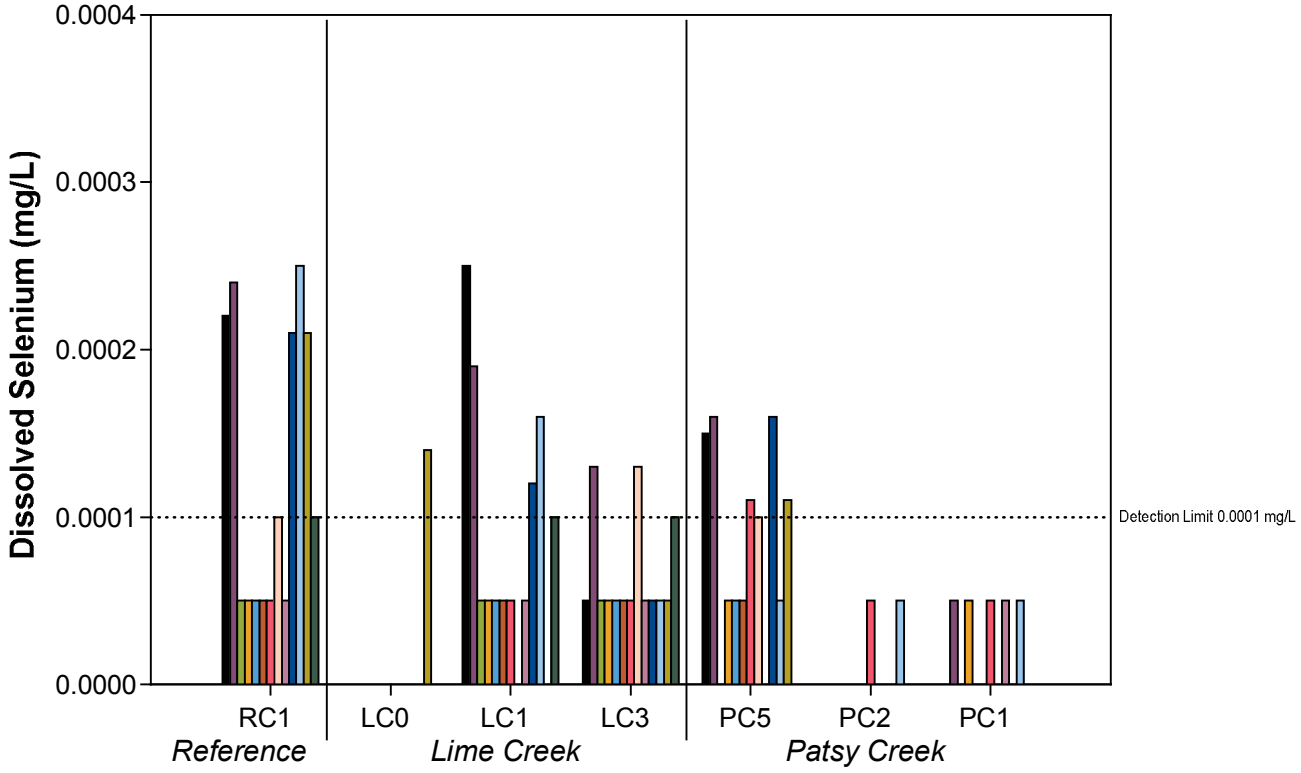
Total and Dissolved Nickel Concentrations in Streams, Kitsault Project, 2009

Figure 3.1-14

AVANTI MINING INC

Rescan™ Engineers & Scientists





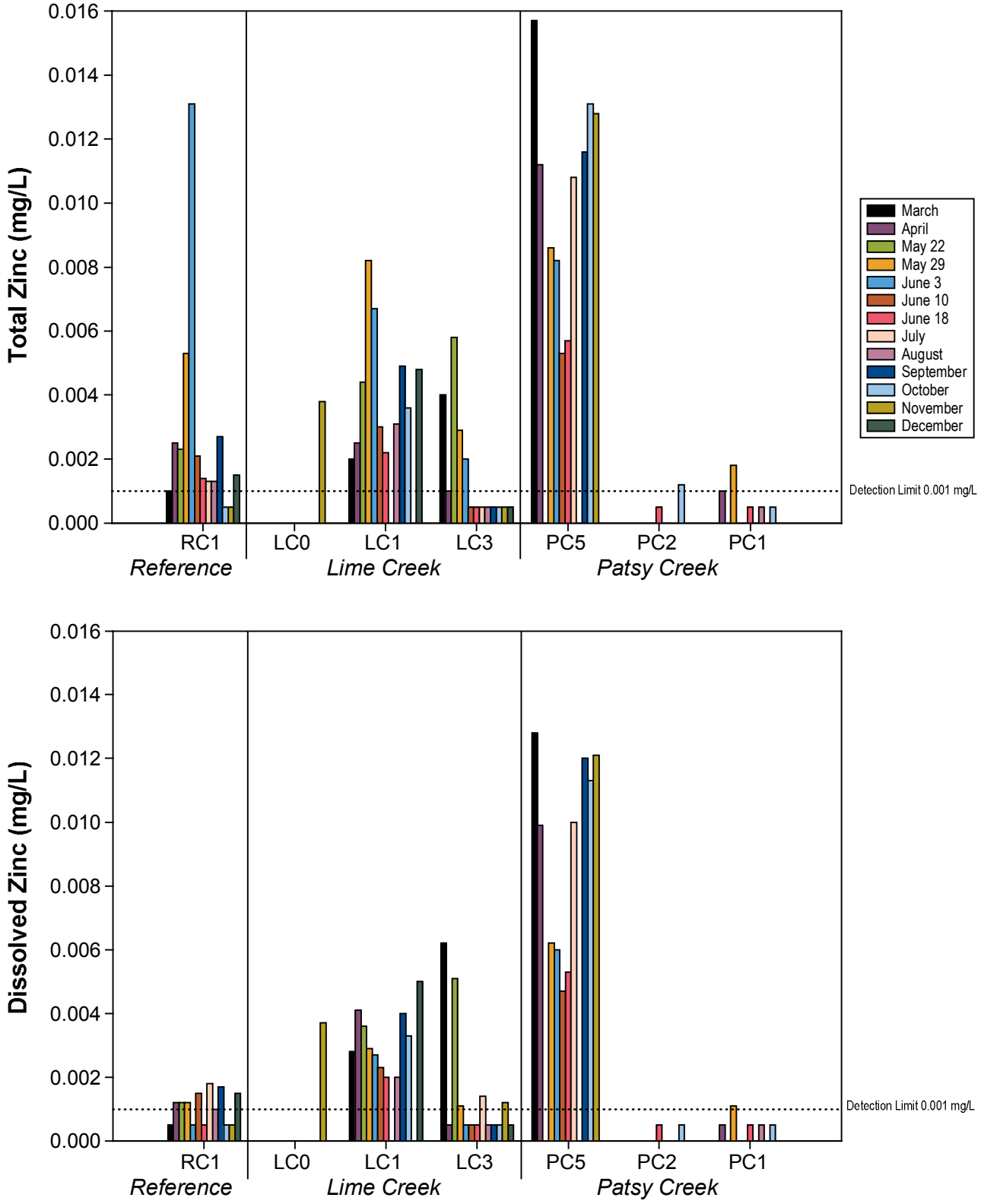
Notes: Dotted line represents analytical detection limit.
BC Maximum guideline = 0.002 mg/L; CCME guideline = 0.001 mg/L.

Total and Dissolved Selenium Concentrations in Streams, Kitsault Project, 2009

Figure 3.1-15

AVANTI MINING INC

Rescan™ Engineers & Scientists



Notes: Dotted line represents analytical detection limit.
BC Maximum guideline depends on hardness; CCME guideline = 0.03 mg/L.

Total and Dissolved Zinc Concentrations in Streams, Kitsault Project, 2009

Figure 3.1-16

AVANTI MINING INC

Rescan™ Engineers & Scientists

Plate 3.1-1. Drainage from mine site pond in May, 2009

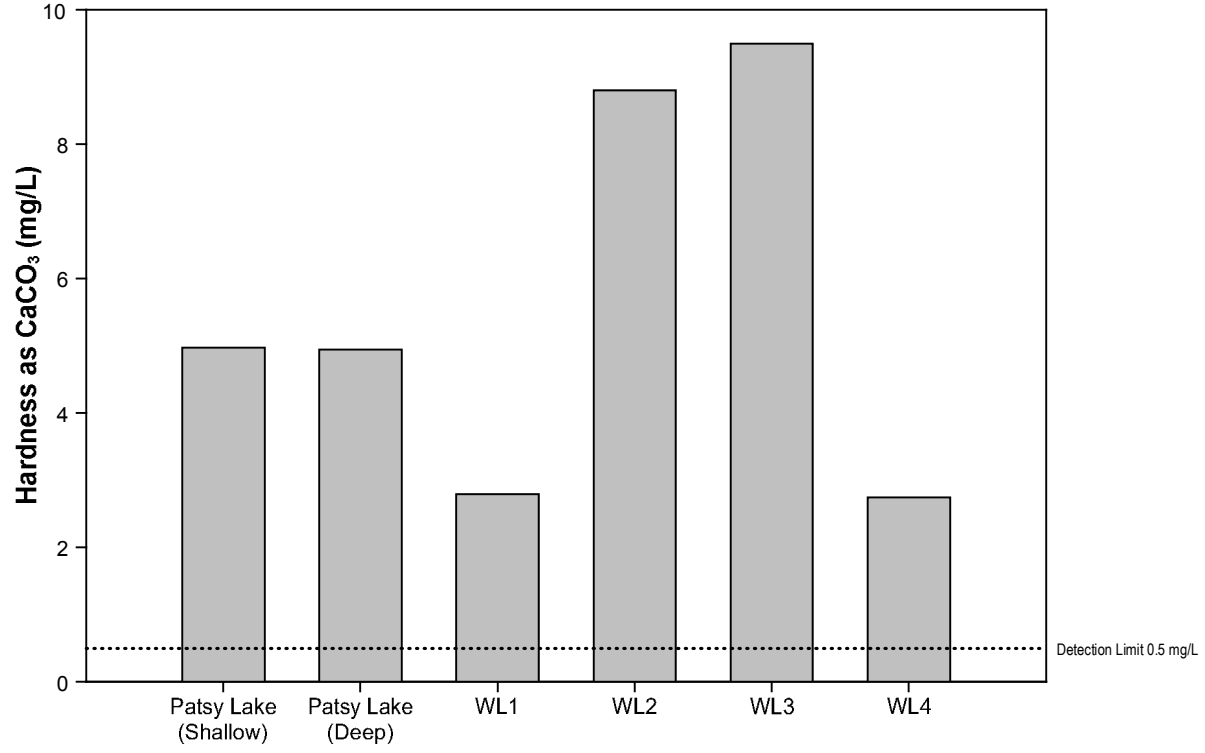
3.2.1 General Variables and Nutrients

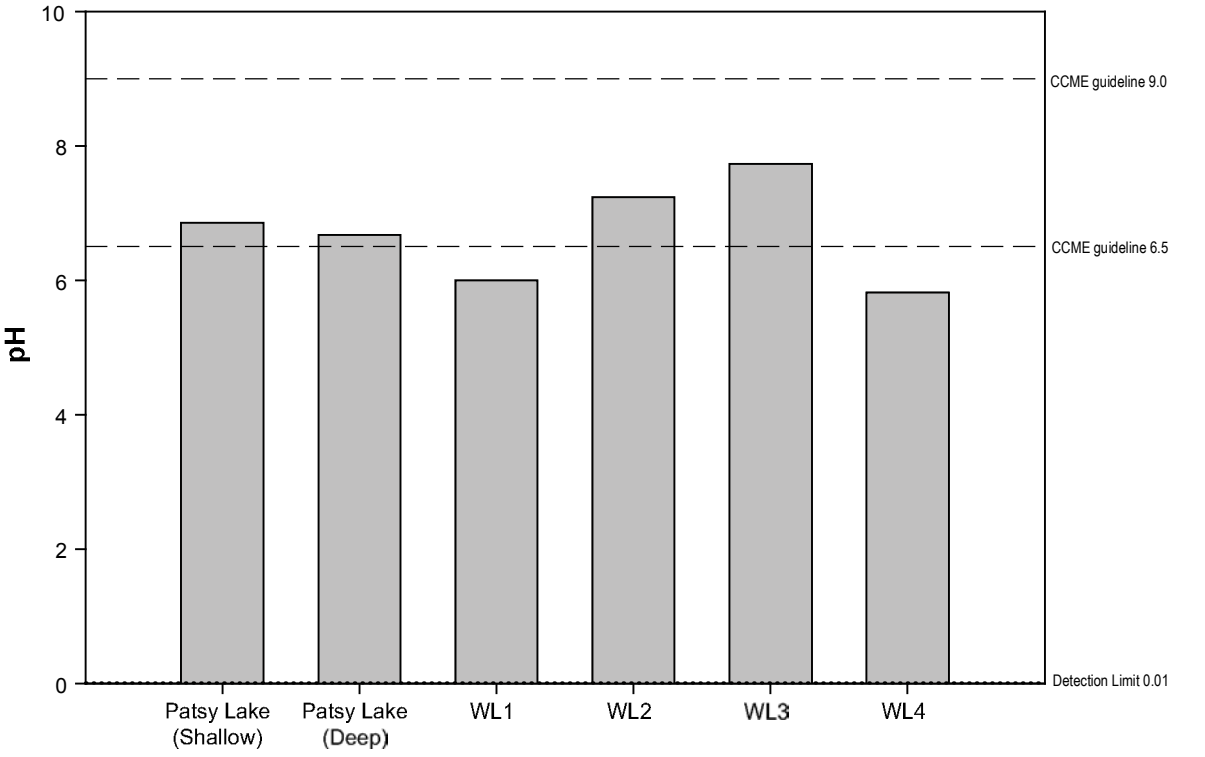
TSS and several anions and nutrients (bromide, chloride, fluoride, nitrate, nitrite, and sulphate) were at or below (and in the case of sulphate, just above detection in two samples) the detection limits for all samples. For this reason they are not discussed. If available, CCME and BC Maximum guidelines are indicated on figures. WL4 is considered the reference wetland for monitoring changes in water quality as it is located in the headwaters of an adjacent watershed.

Hardness levels (as $CaCO_3$) in Patsy Lake and Project wetlands ranged from 2.74 mg/L at WL4 to 9.49 mg/L at WL3 (Figure 3.2-1). WL2 and WL3 had the hardest water, while the lowest hardness was observed at WL1 and WL4. Correspondingly, the same sites also had the highest and lowest pH. The deep and shallow Patsy Lake samples were very similar. No BC or CCME aquatic life guidelines exist for hardness.

While the pH of WL2 and WL3 was just above neutral (7.24 and 7.64, respectively), all other lake and wetland sites tended towards a more acidic pH (Figure 3.2-1). WL1 and WL4, with a pH of less than or equal to 6, fell outside the range for the CCME guideline (pH 6.5 to 9.0).

Since all nitrate and nitrite concentrations were below detection limits, total nitrogen was primarily in the form of organic nitrogen at the lake and wetland sites. Total nitrogen concentrations ranged from below detection (0.005 mg/L) and Patsy Lake (shallow) to 0.24 mg/L at WL1 (Figure 3.2-2). No BC or CCME aquatic life guidelines exist for total nitrogen.





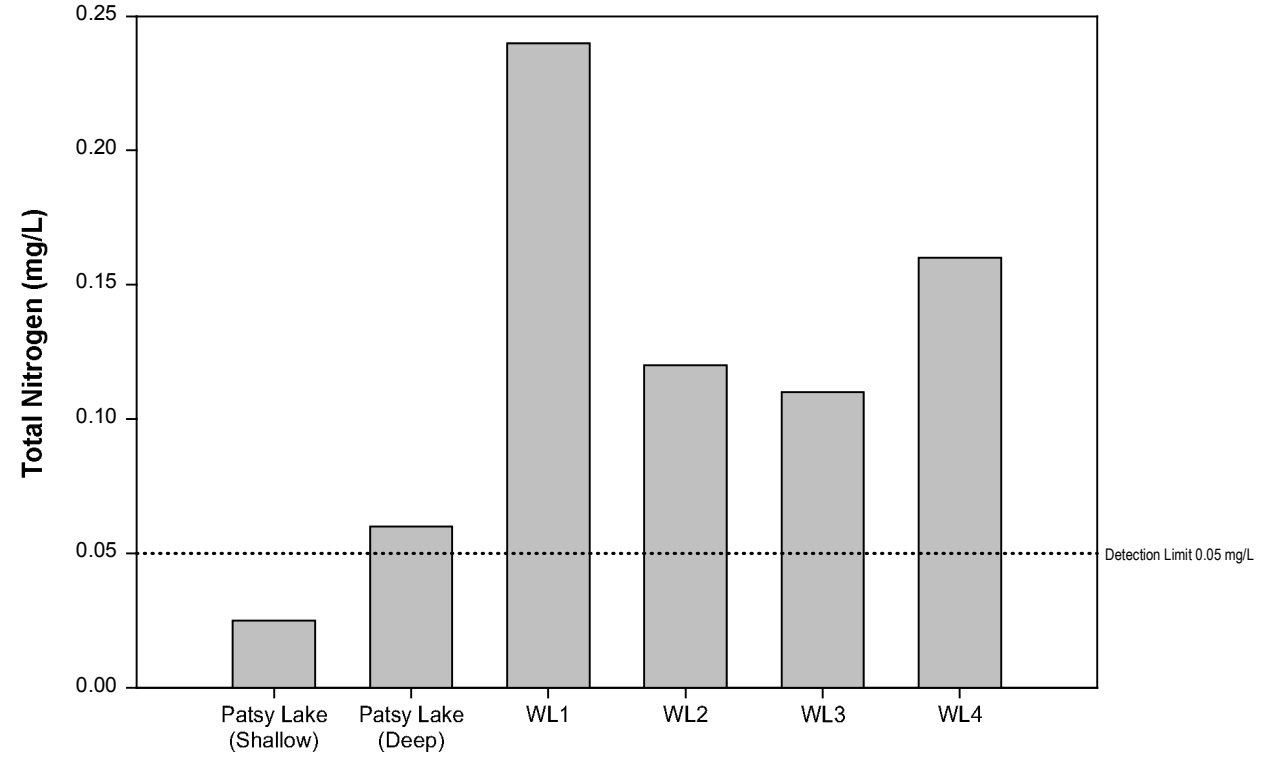
Note: Dotted line denotes detection limits.
Dashed line denotes CCME guideline values.

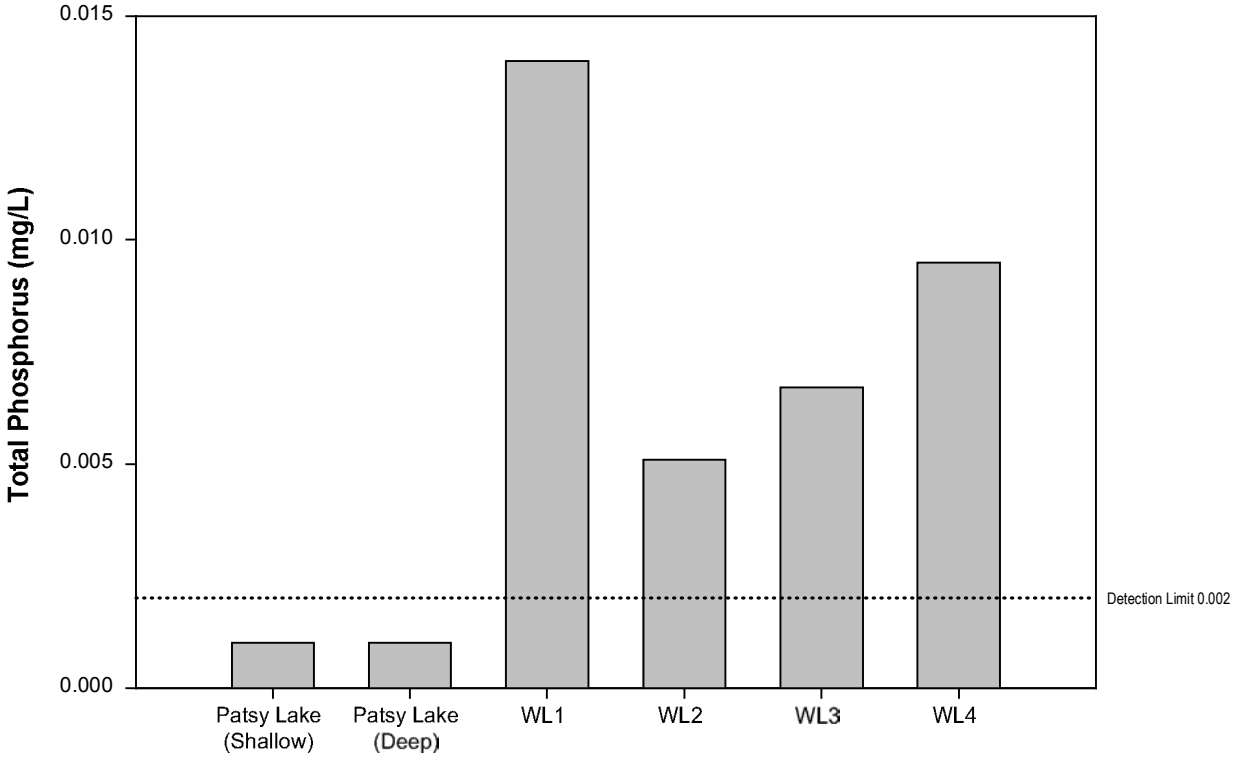
Hardness and pH Concentrations in Patsy Lake and Wetlands, August 2009

Figure 3.2-1

AVANTI MINING INC

Rescan™ Engineers & Scientists





Note: Dotted line denotes detection limits.

Total Nitrogen and Phosphorus Concentrations in Patsy Lake and Wetlands, August 2009

Figure 3.2-2

AVANTI MINING INC

Rescan™ Engineers & Scientists

Total phosphorus (TP) concentrations were also greatest at WL1 (0.014 mg/L) (Figure 3.2-2). Both Patsy Lake samples were below the detection limit of 0.002 mg/L. No CCME or BC aquatic life guidelines exist for exceeding TP concentrations.

Total organic carbon (TOC) concentrations were highest at WL1 and lowest at Patsy Lake (Figure 3.2-3). This corresponds to the areas that have the highest and lowest nutrient concentrations. In general, the TOC at wetland sites was greater than in Patsy Lake. No CCME or BC aquatic life guidelines exist for TOC.

Total cyanide concentrations were lowest in Patsy Lake (approximately 0.003 mg/L for shallow and deep samples) and greatest in WL2 (0.011 mg/L; Figure 3.2-3). Total cyanide at all four wetland sites exceeded the CCME guideline (0.005 mg/L) and WL2 exceeded the BC guideline (0.01 mg/L).

3.2.2 Total and Dissolved Metals

Several total and dissolved metals, including some for which guidelines exist, had the majority (greater than 60%) of concentrations close to or below detection limits (Appendix 3.2-1). Although no figure is provided for these metals, a comment was made if a sample was observed to have a relatively high concentration or exceeded a guideline value. The remaining metals with guidelines were screened for exceedances and are discussed below.

CCME and BC guidelines for total metals were used to screen both total and dissolved metal concentrations, except for dissolved aluminum, which has a specific BC guideline. Where measurable metal concentrations were available for the shallow and deep samples from Patsy Lake, the deep sample tended to have the greatest concentration.

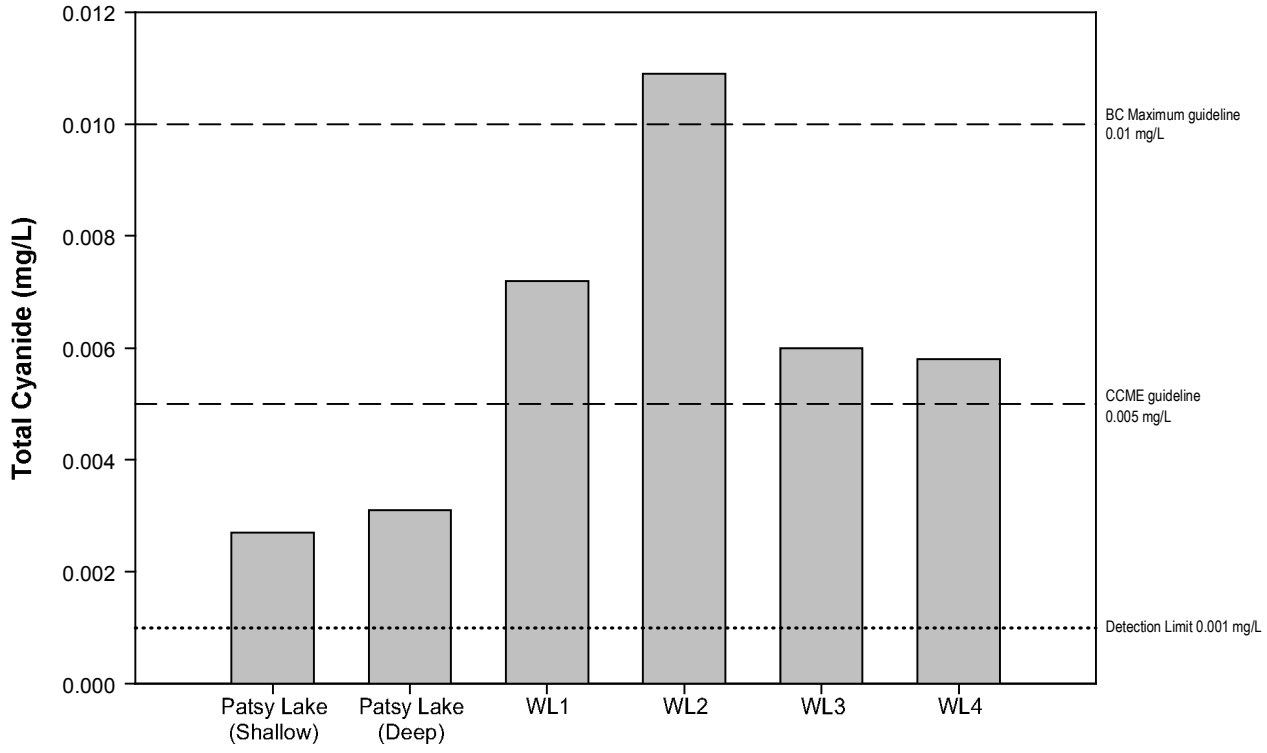
Total aluminum concentrations were slightly greater than dissolved aluminum concentrations observed at each site (Figure 3.2-4). Total concentrations ranged from 0.031 mg/L at WL4 to 0.096 mg/L at WL1. No site exceeded the CCME guideline of 0.1 mg/L (for pH > 6.5) but WL1 and WL4 both have a pH below 6.5. For these two sites, the CCME guideline of 0.005 mg/L for total aluminum applies, which both sites exceeded. Dissolved aluminum concentrations were all below the BC guideline of 0.1 mg/L (for pH > 6.5). The following formula:

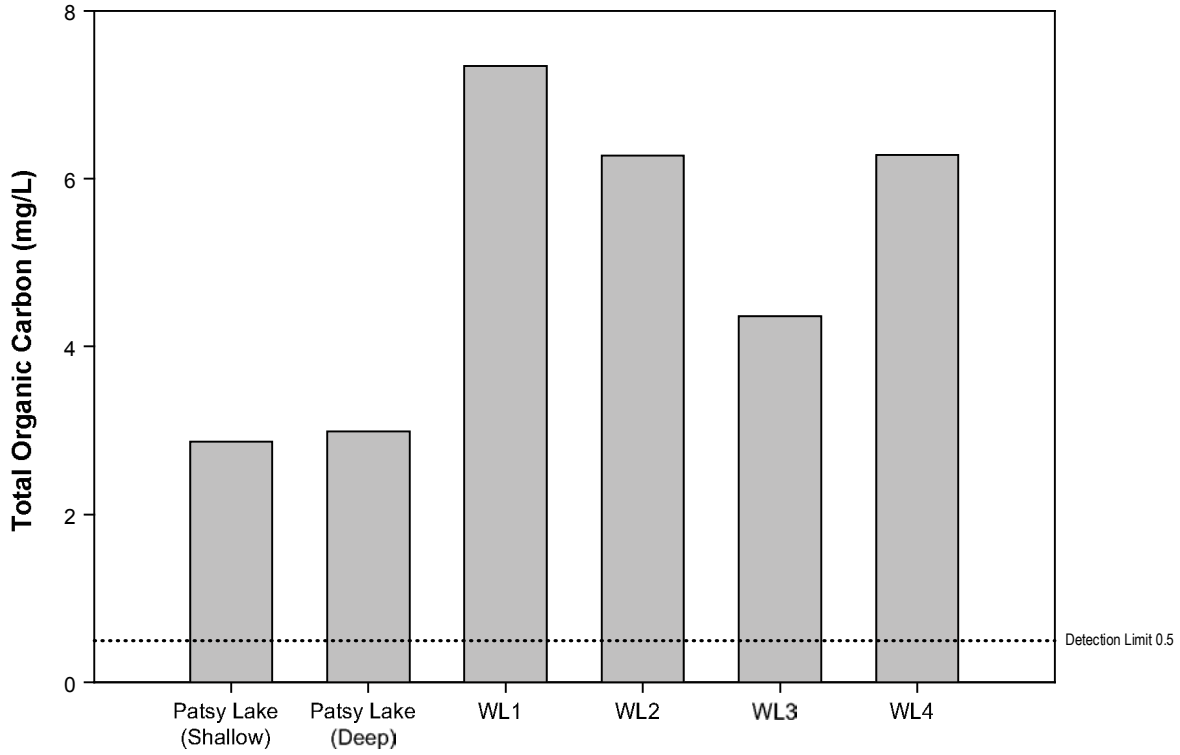
$$\text{Aluminum (dissolved)} = e^{(1.209 - 2.426\,(\text{pH}) + 0.286\,K)}\text{; where } K = (\text{pH})2$$

was used to calculate the BC guideline for WL1 and WL4 (pH <6.5) resulting in a guideline value of 0.047 mg/L. The dissolved aluminum concentration at WL1 (0.066 mg/L) exceeded this calculated guideline, whereas WL4 did not (0.022 mg/L).

Total and dissolved arsenic concentrations were far higher at the two hard water wetlands (WL2 and WL3) than other sites (Figure 3.2-5). Arsenic concentrations were below detection at Patsy Lake and just above the detection level at WL1 and WL4. The CCME and BC Maximum guidelines of 0.005 mg/L were not exceeded at any site.

Total and dissolved cadmium concentrations were below detection at all sites except WL2 (Appendix 3.2-1). Both the total and dissolved concentrations (0.000034 mg/L) at WL2 exceeded the CCME guideline of 0.000017 mg/L.





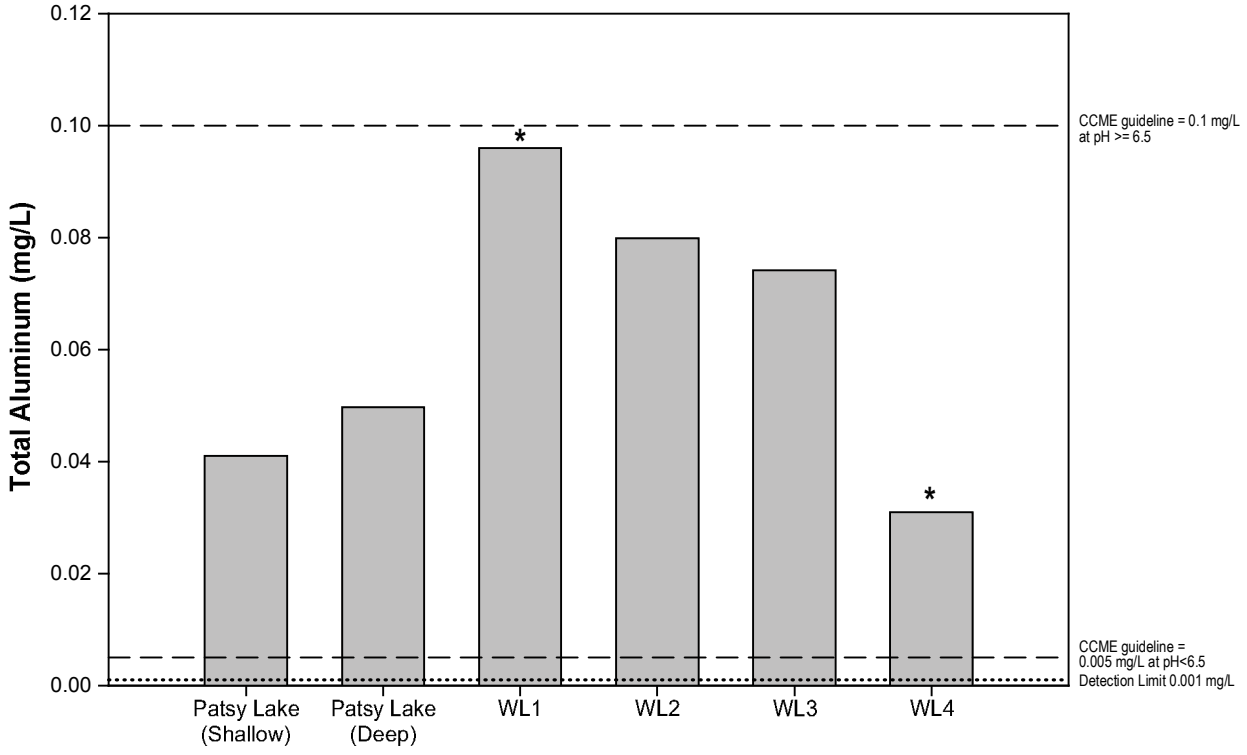
Note: Dotted line denotes detection limits.
Dashed line denotes guideline values.

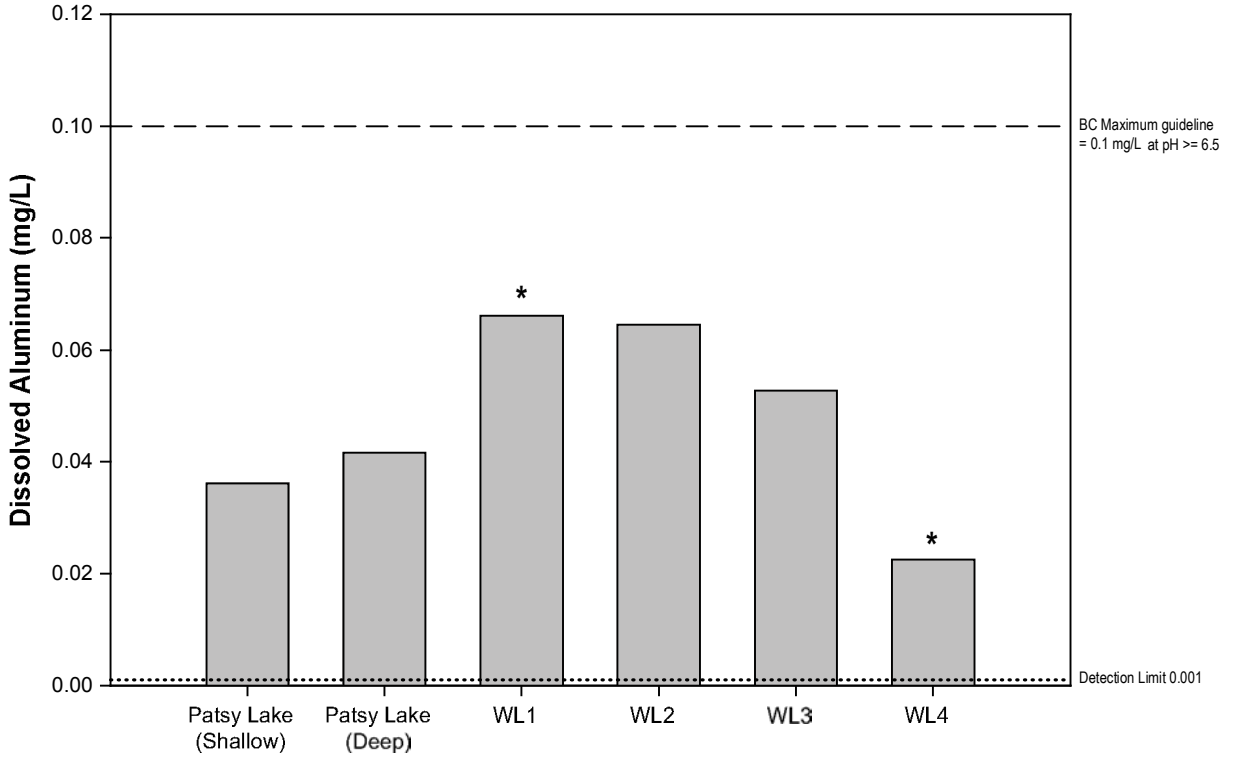
Figure 3.2-3

Total Cyanide and Total Organic Carbon Concentrations in Patsy Lake and Wetlands, August 2009

AVANTI MINING INC

Rescan™ Engineers & Scientists





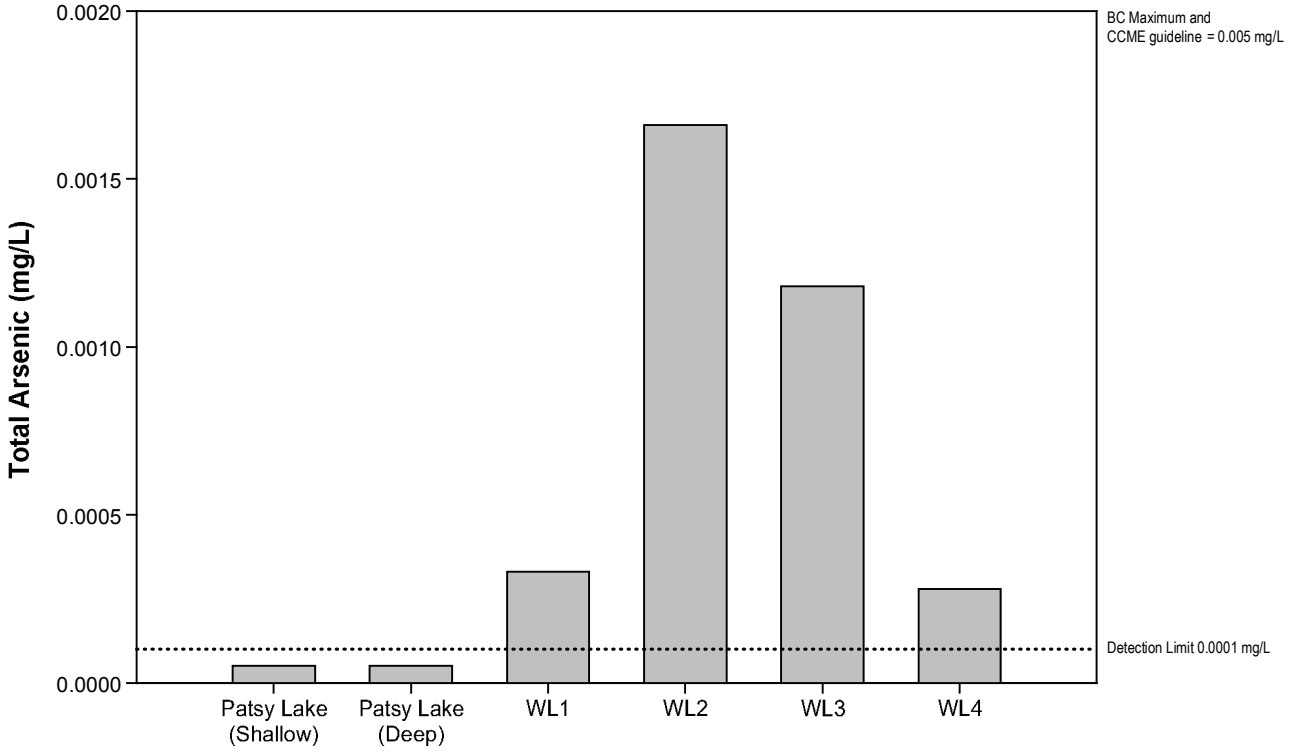
Note: Dotted line denotes detection limits.
Dashed line denotes guideline values.
** Site pH < 6.5*

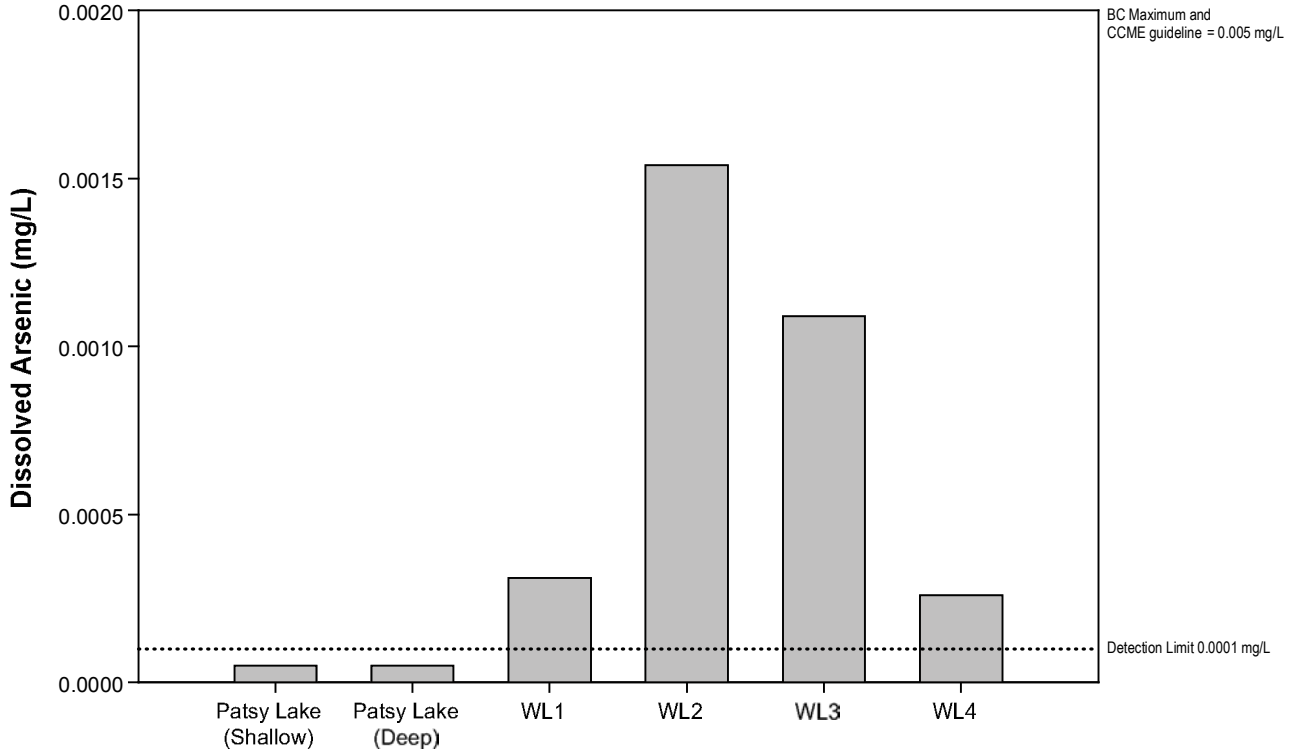
Total and Dissolved Aluminum Concentrations in Patsy Lake and Wetlands, August 2009

Figure 3.2-4

AVANTI MINING INC

Rescan™ Engineers & Scientists





Note: Dotted line denotes detection limits.
Dashed line denotes guideline values.

Total and Dissolved Arsenic Concentrations in Patsy Lake and Wetlands, August 2009

Figure 3.2-5

AVANTI MINING INC

Rescan™ Engineers & Scientists

In general, total and dissolved copper concentrations ranged from 0.0002 to 0.0005 mg/L (Figure 3.2-6). The primary exception was the dissolved concentration at WL1 (0.00066 mg/L), which was greater than the total concentration. Because both values are within ten times the detection limit (and the difference between the two values is less than two times the detection limit) this is likely the result of the variation inherent in the analysis of copper. The hardness-dependent BC and CCME guidelines were not exceeded at any site.

Concentrations of total iron and dissolved iron ranged from below the detection limits (0.03 mg/L) at Patsy Lake to 0.033 mg/L and 0.022 mg/L at WL2, respectively (Figure 3.2-7). All samples were below the BC guideline of 1.0 mg/L. The total iron concentration at WL2 was the only site to exceed the CCME guideline of 0.3 mg/L.

Most total and dissolved lead concentrations were close to or below the detection limit of 0.00005 mg/L (Appendix 3.2-1). All samples were below the hardness dependent BC and CCME guidelines.

Similar to arsenic and iron, manganese concentrations were greatest at WL2. By comparing total and dissolved concentrations of manganese (Figure 3.2-8) it can be seen that at wetland sites most manganese exists in the dissolved form. Concentrations of total manganese ranged from 0.0059 mg/L at Patsy Lake (shallow) to 0.2 mg/L at WL2. Dissolved manganese concentrations ranged from 0.0004 mg/L at Patsy Lake (shallow) to 0.15 mg/L at WL2. No sites exceeded BC Maximum guideline (hardness-dependent).

All total and dissolved molybdenum concentrations were close to or below the detection limit of 0.00005 mg/L (Appendix 3.2-1). All samples were below the hardness-dependent BC (2 mg/L) and CCME (0.073 mg/L) guidelines.

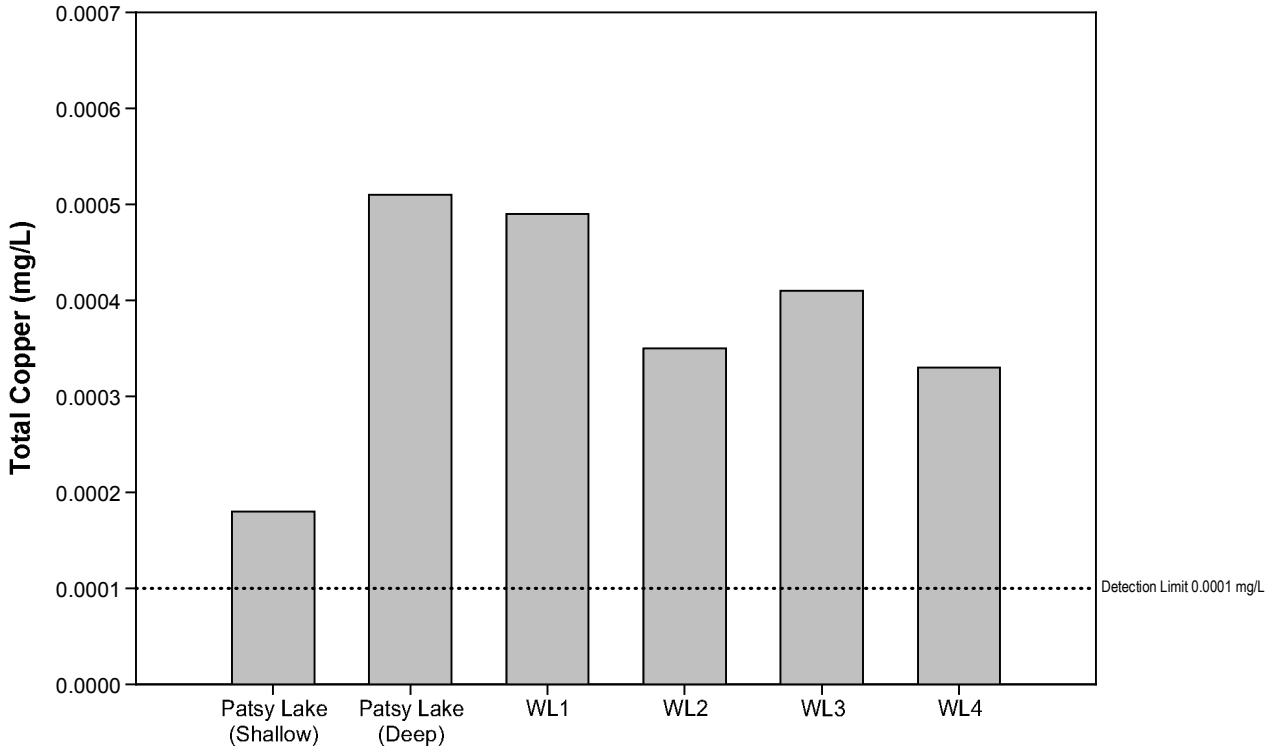
Nickel concentrations were all below or close to the detection limit (0.0005 mg/L) except for WL2, which had a concentration of 0.001 mg/L for total and dissolved nickel. Total and dissolved nickel concentrations were well below the hardness-dependent BC and CCME guidelines, which range from 0.025 to 0.15 mg/L.

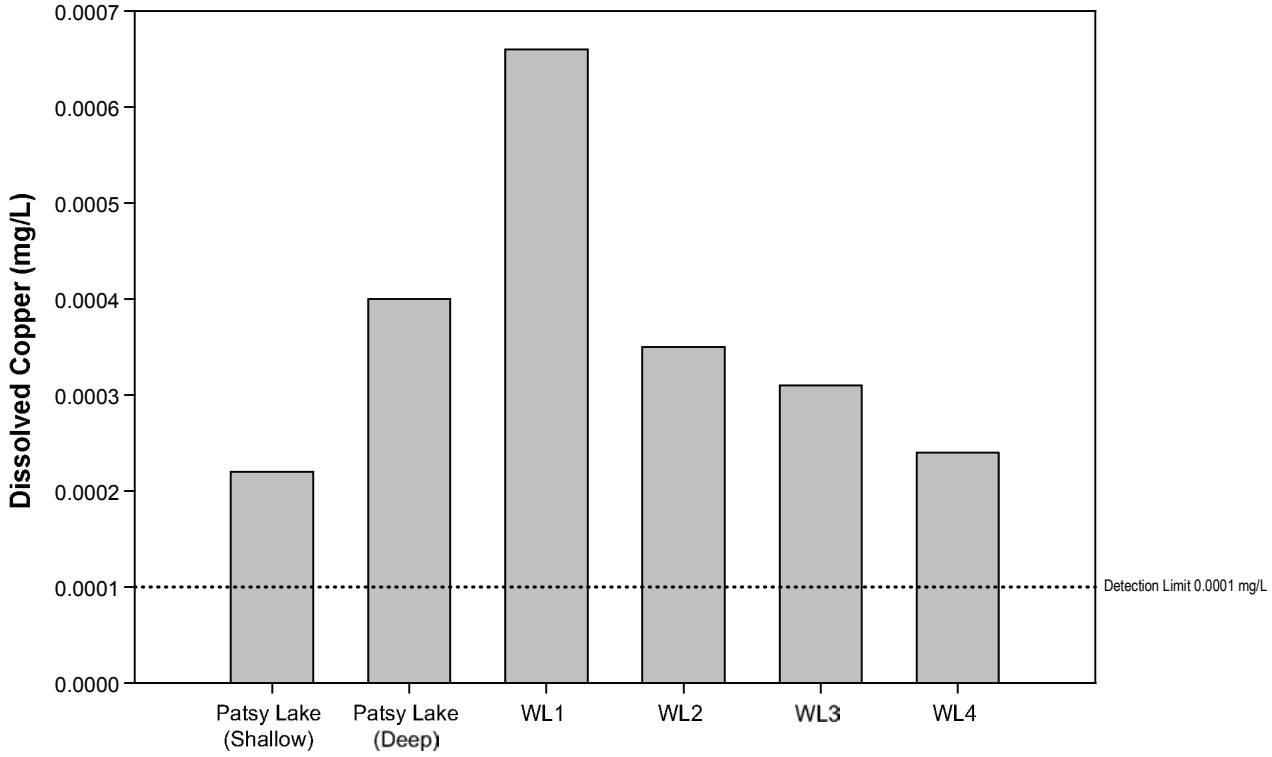
Total zinc concentrations ranged from below detection (0.001 mg/L) in Patsy Lake (shallow) to 0.005 mg/L in the deep Patsy lake sample (Figure 3.2-9). WL2 had the highest zinc concentration among wetland sites. All dissolved zinc concentrations were below detection. All samples were below the hardness dependent BC guidelines (which range from 0.03 to 0.5 mg/L) and the CCME guideline of 0.03 mg/L.

3.3 WATER QUALITY DATA QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

Field and travel blank data are presented in Appendix 3.3-1. Field blank data were all below detection limits, with the exception of nitrate in 1 (July) of 13 field blanks. However, no spike in nitrate was visible in July water samples and all nitrate concentrations were within the variation seen over time and all sites.

Four of the 13 travel blanks produced concentrations above detection limits. Nitrate (July and October blanks) and copper concentrations (November) were above detection. Several total metal concentrations (aluminum, calcium, magnesium, manganese, and strontium) were elevated in the May 29 travel blank. Because travel blanks are not opened during field work the travel blank for the May 29 trip may have been contaminated in the lab during preparation.





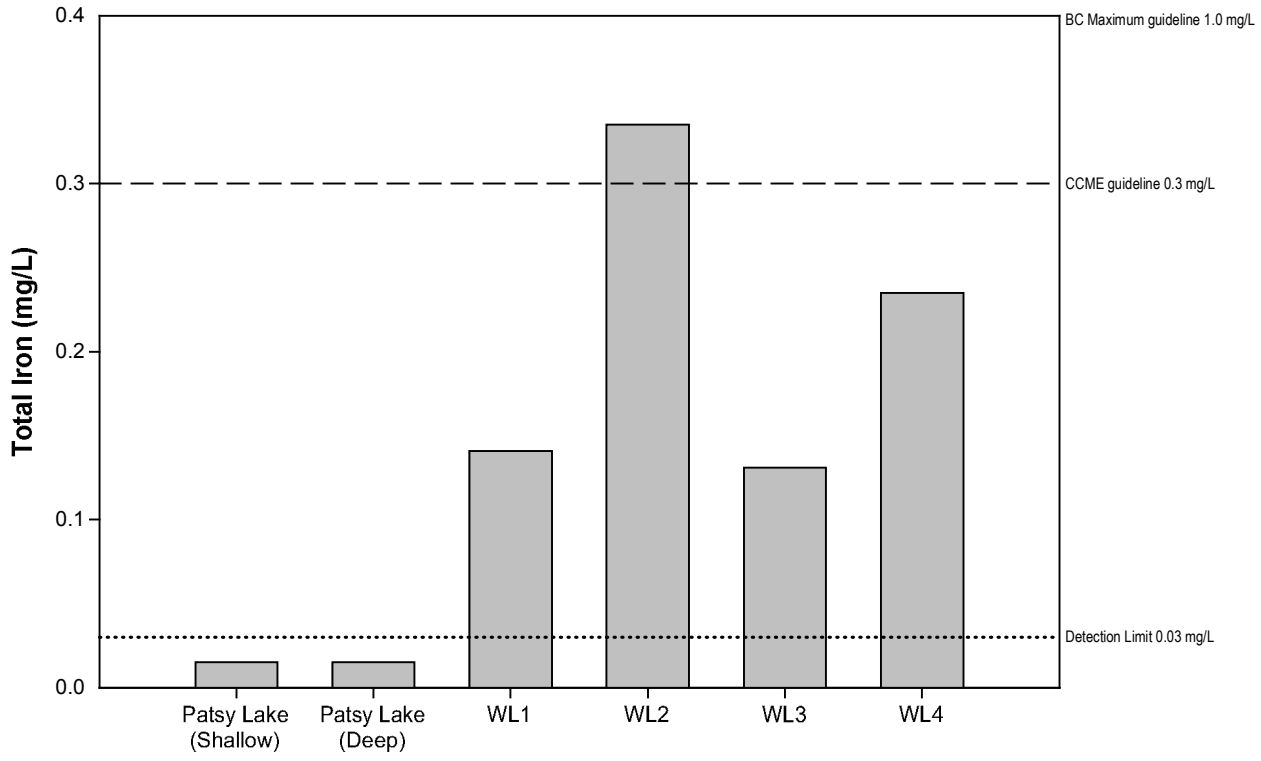
Note: Dotted line denotes detection limits.
BC and CCME guidelines depend on hardness.

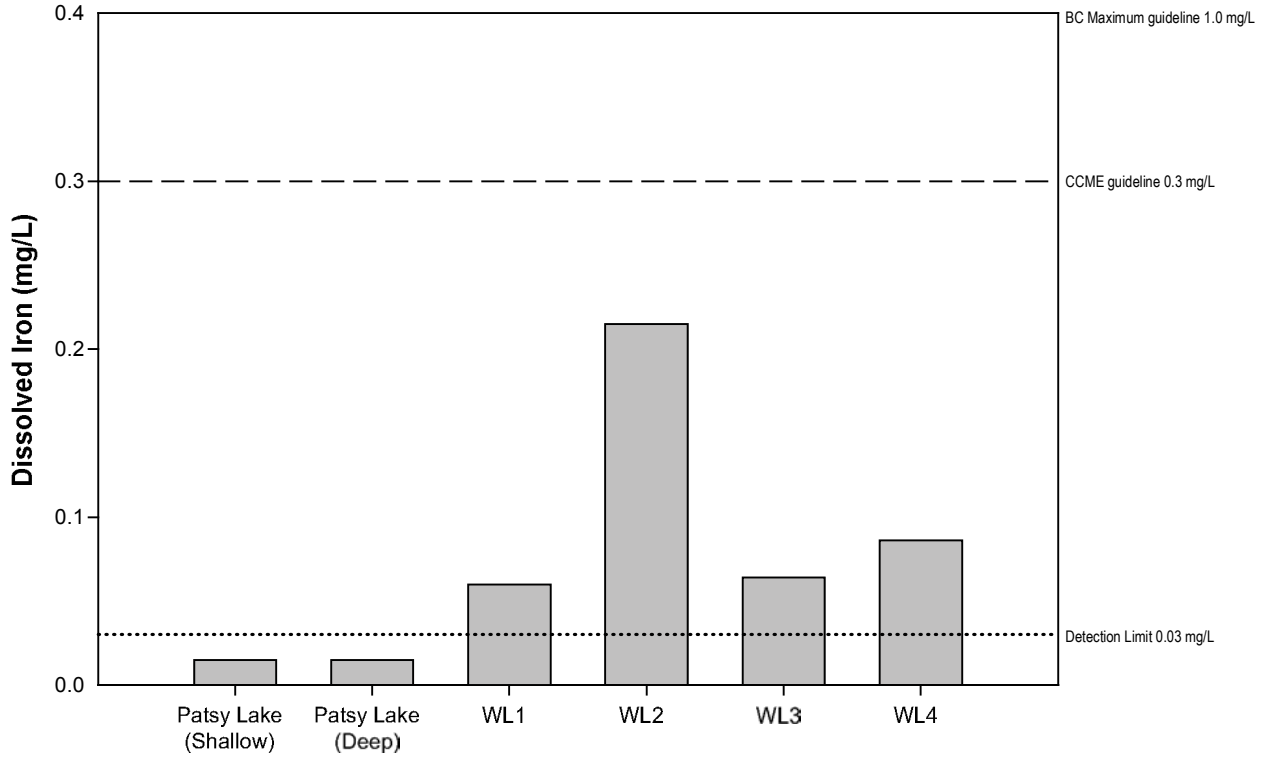
AVANTI MINING INC

Total and Dissolved Copper Concentrations in Patsy Lake and Wetlands, August 2009

Figure 3.2-6

Rescan™ Engineers & Scientists





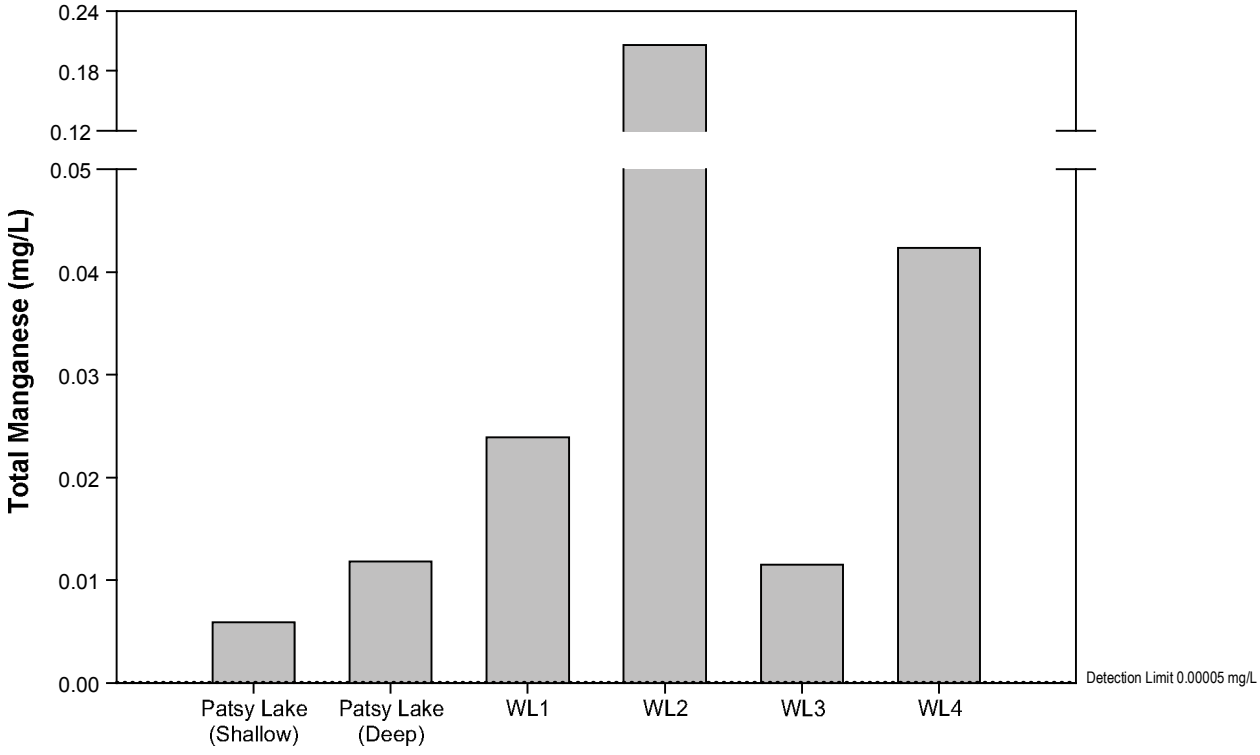
Note: Dotted line denotes detection limits.
Dashed line denotes guideline values.

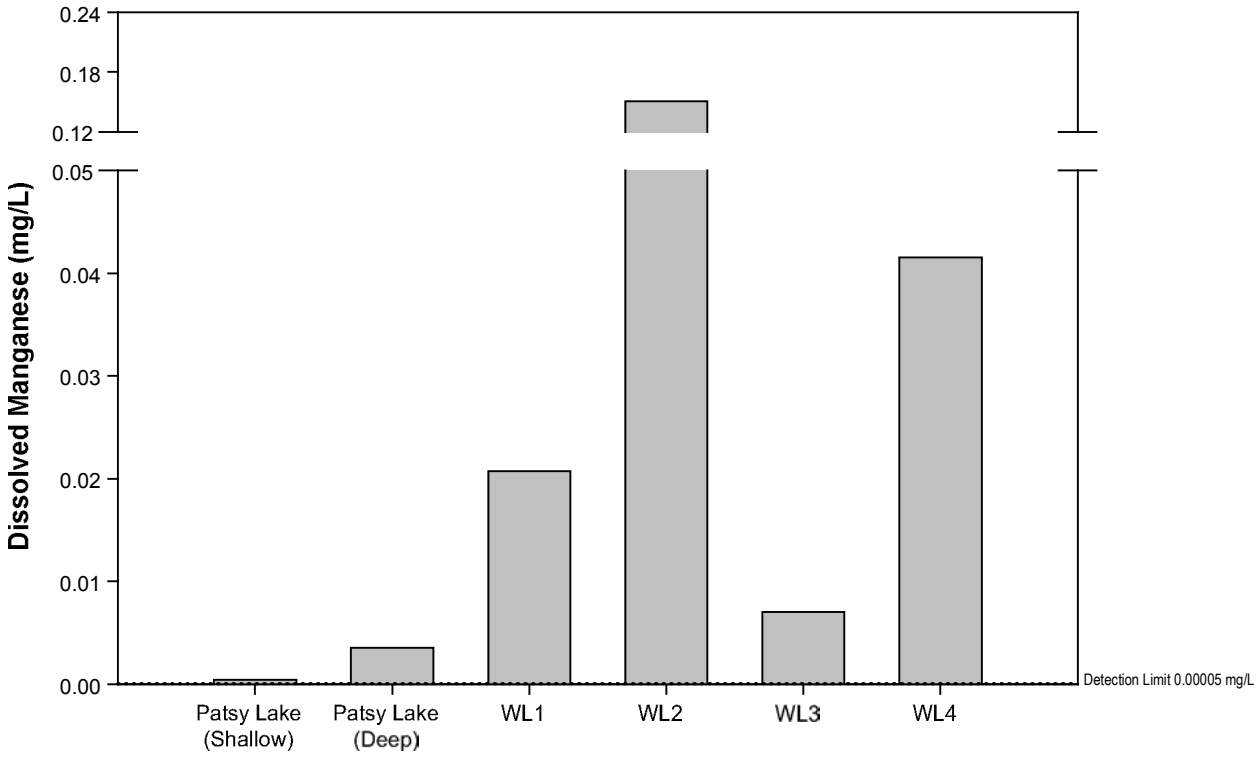
Total and Dissolved Iron Concentrations in Patsy Lake and Wetlands, August 2009

Figure 3.2-7

AVANTI MINING INC

Rescan™ Engineers & Scientists





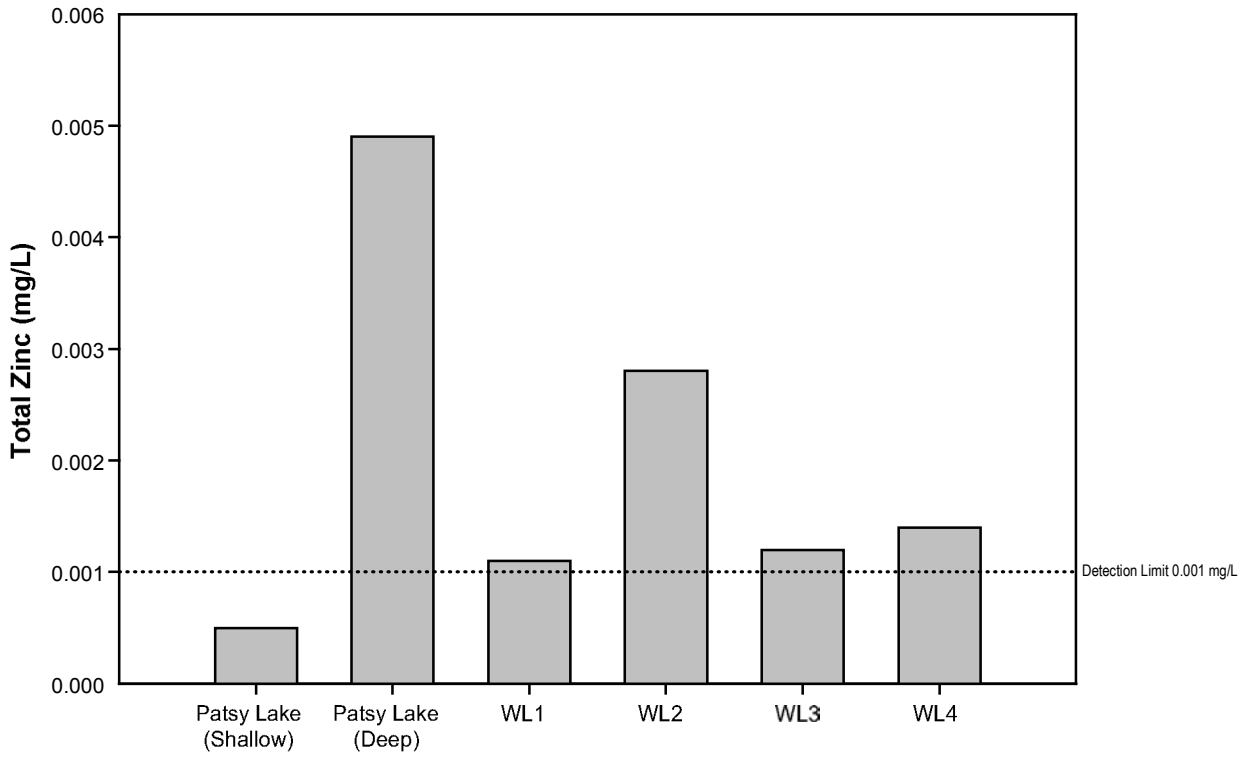
Note: Dotted line denotes detection limits.
BC Maxium guideline depends on hardness.

AVANTI MINING INC

Total and Dissolved Manganese Concentrations in Patsy Lake and Wetlands, August 2009

Figure 3.2-8

Rescan™ Engineers & Scientists



Note: Dotted line denotes detection limits.
BC guideline = depends on hardness; CCME guideline = 0.03 mg/L.

Total Zinc Concentrations in Patsy Lake and Wetlands, August 2009

Figure 3.2-9

AVANTI MINING INC

Rescan™ Engineers & Scientists

Equipment blank data (Appendix 3.3-1) were also collected for the Go-flow bottle used to sample at depth in Patsy Lake. All analyzed concentrations were below detection limits except barium, which was between five and six times greater than the detection limit of 0.00005 mg/L.

The relative percent difference (RPD) analysis of QA/QC field duplicate data for receiving environment streams are reported in Appendix 3.3-2. From March to December, 2009 12 duplicate pairs of samples were compared for each variable using the calculated RPD between the replicates as a measure of the variability inherent in field sampling (environmental heterogeneity). Approximately 53% (568 of 1,080 duplicate pairs) of analytical results within each duplicate pair were below or less than five times the MDL, and therefore RPD values were not calculated. Of the remaining results, only 4.3% (22 of 512 RPD calculations) were greater than the threshold of 20% indicated by provincial guidance.

3.4 LIMNOLOGY

Basic physical limnology variables were measured at Patsy Lake in August 2009 (Figure 3.4-1). Surface pH, conductivity, Secchi depth, and depth profiles of temperature and dissolved oxygen were measured at the lake. The maximum depth found at Patsy Lake was 23 m. Secchi depth (a measure of surface water transparency) was 3.8 m and surface pH was 7.88. Using the measured Secchi depth and the estimated light extinction coefficient, the euphotic zone depth to a 1% light level ($Z_{1\%}$) in Patsy Lake is 11.5 m, which is approximately the entire upper half of the water column.

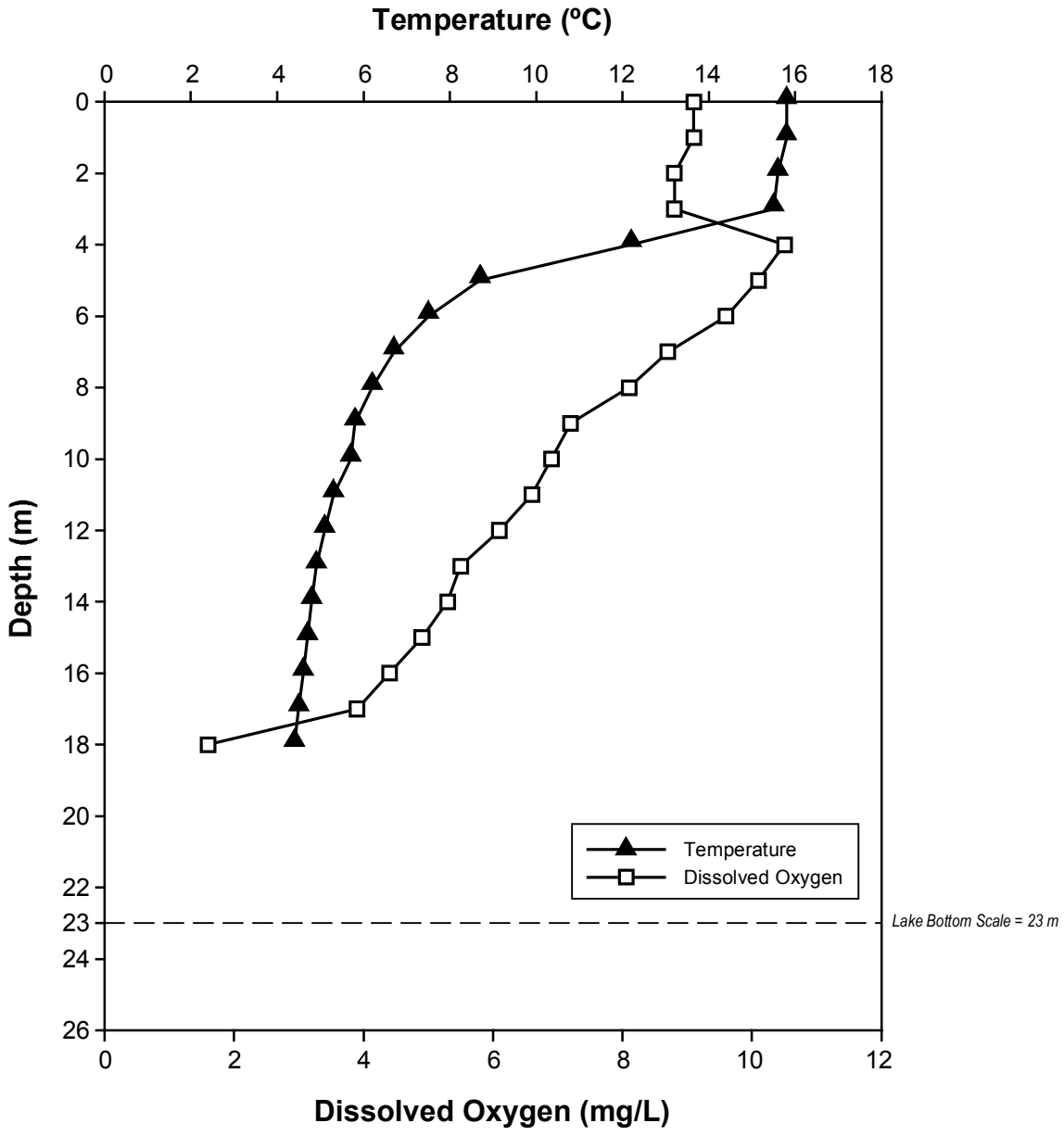
Patsy Lake was vertically stratified during the summer with a thermocline present at approximately 4 m, where the temperature dropped 6.5°C in less than 2 m of depth. Overall, temperature ranged from 15.8°C at the surface to 4.4°C at depth. Dissolved oxygen (DO) levels were highest at the thermocline (10.4 mg/L) but decreased with increasing depth. The total range of DO was from 10.4 to 2.0 mg/L. The lake is approach hypoxia (<30% DO) at a depth of approximately17 m.

3.5 STREAM SEDIMENT QUALITY

Sediment samples were difficult to collect at several stream sites because of the abundance of large cobble in most stream beds (Plate 3.5-1). Where possible, triplicate composite samples were collected from depositional zones (between the cobble and boulders) so the physical and chemical quality of stream sediments could be assessed. In the case of PC1, only one composite sample was collected as the sediment available was minimal. All original data are shown in Appendix 3.5-1. In the case where more than one detection limit was indicated on a figure, the higher detection limit generally occurred at PC1.

3.5.1 Particle Size

Where it was possible to collect suitable sediment quality samples, sand composed the dominant particle size (56 to 89%) at each site (Figure 3.5-1). Smaller proportions of silt (3 to 24%), gravel (5 to 30%), and clay (1 to 16%) composed the remainder of each site. RC1 had the largest proportions of clay (16%) and silt (21%), which can be explained by the large clay deposits that were observed about 50 m upstream from the sampling location (Plate 3.5-2). Outside of these depositional zones, all sites had a considerable proportion of large cobble and boulders.

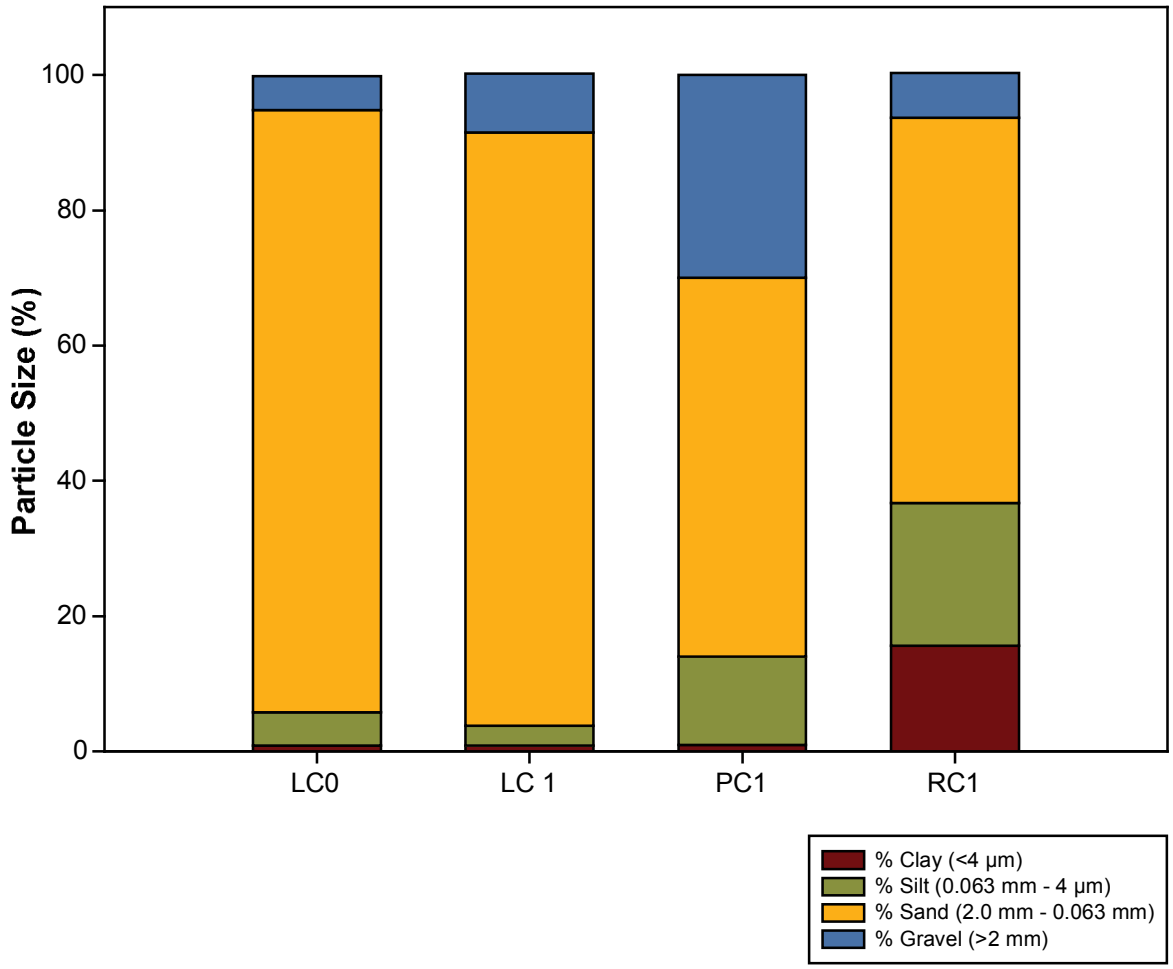


Dissolved Oxygen and Temperature Profiles at Patsy Lake, August 2009

Figure 3.4-1

AVANTI MINING INC

Rescan™ Engineers & Scientists



Particle Size Distribution of Stream Sediments, August 2009

Figure 3.5-1

AVANTI MINING INC

Rescan™ Engineers & Scientists

Plate 3.5-1. Example of substrate along LC1.

(a)

(b)

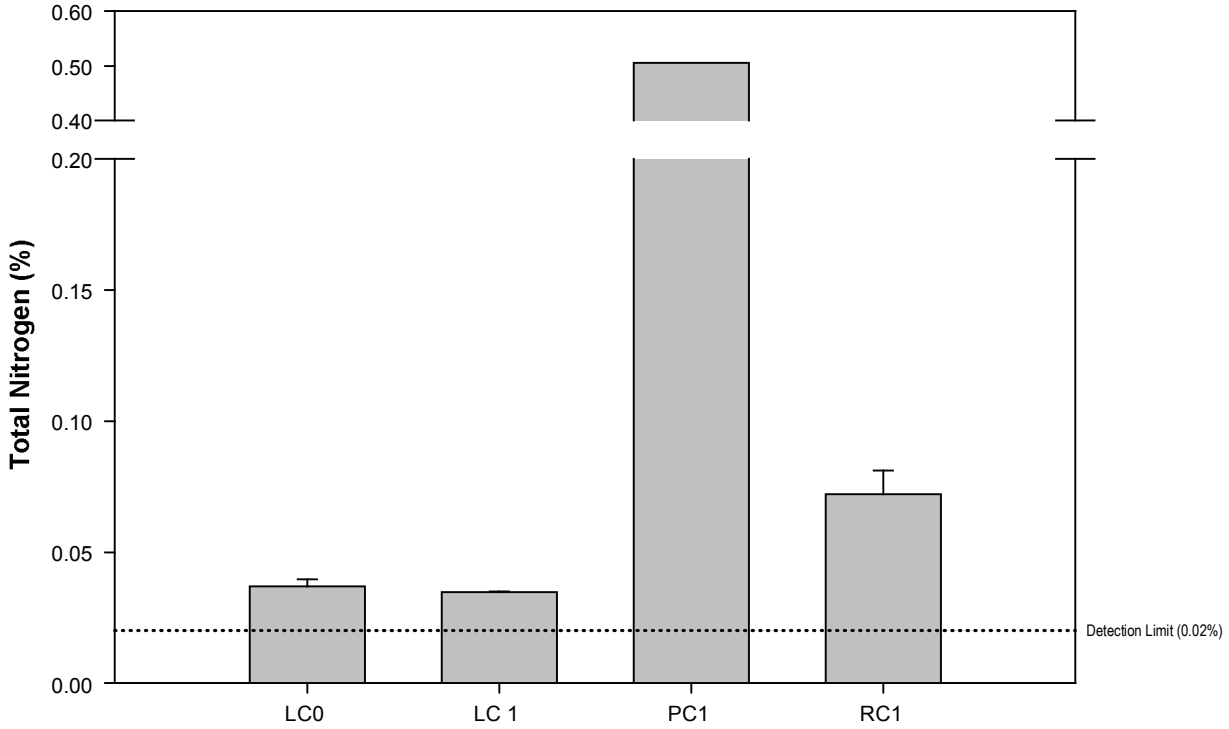
Plate 3.5-2. Red (a) and grey (b) clay deposits along shoreline upstream of RC1.

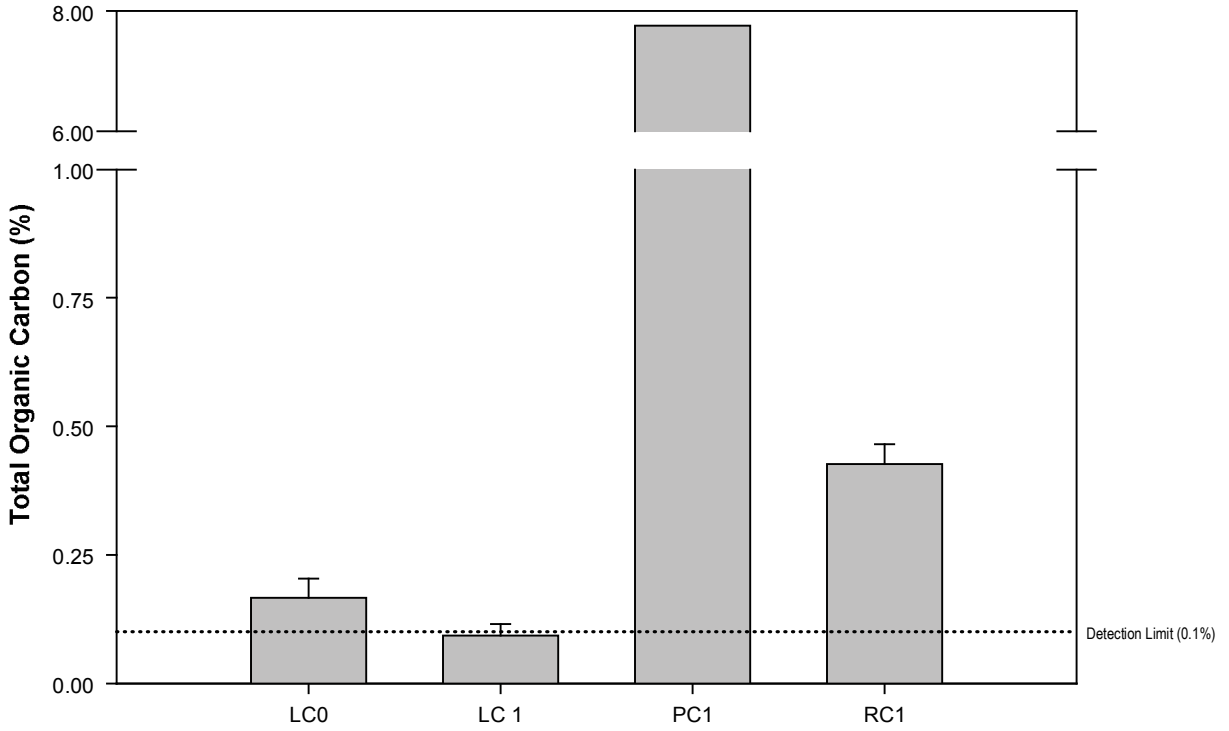
3.5.2 Nutrients and Total Organic Carbon (TOC)

Nutrient concentrations in stream sediments were generally low. Available phosphorus concentrations were either below (80% of samples) or close to the detection limit (1 mg/kg) and are not presented graphically for this reason.

Total nitrogen (TN) and TOC concentrations were substantially higher at PC1, downstream of Patsy Lake, than at all other stream sites (Figure 3.5-2). TN concentrations ranged from 0.03 (LC1) to 0.5 mg/L (PC1) and TOC concentrations ranged from 0.09 (LC1) to 7.76 mg/L (PC1). Although only one composite sample could be collected at PC1, the relatively high TN and TOC is likely a result of additions to the sediment from the dense vegetation surrounding the site (Plate 3.5-3).

Plate 3.5-3. Vegetation along the riparian zone of PC1.





Note: Error bars represent one standard error of the mean.
Dotted lines denote detection limits.

Total Nitrogen and Total Organic Carbon Concentrations in Stream Sediments, Kitsault Project, August 2009

Figure 3.5-2

AVANTI MINING INC

Rescan™ Engineers & Scientists

3.5.3 Total Metals

Analysis of total metal concentrations was completed on the <63 µm fraction (silts and clays) of the sediments sampled. This size fraction will often have greater concentrations than those observed in the whole sample as a result of the increased surface area being exposed to acid digestion during analysis. Most of the analyses used to derive the available guidelines for each metal are from whole sediment samples. For this reason a direct comparison between these metal concentrations and the guidelines may be misleading (i.e., a high concentration exceeding the guideline when a whole sediment sample from the same site may have been well below the guideline). However, the guidelines are applied in the figures and discussion below as they still serve to highlight which sites have high metal concentrations that are bioavailable to the benthic invertebrate communities.

Several metals analyzed were below detection limits in more than 50% of stream sediment samples (i.e., antimony, beryllium, bismuth, selenium, thallium, and tin). Metals that are compared to available guidelines are discussed below. Metals of interest for which no guidelines are available are first summarized briefly (without figures).

Aluminum concentrations ranged from 13,700 mg/kg (LC0) to 27,000 mg/kg (RC1). Manganese concentrations were generally near 1,000 mg/kg in each sample (the lowest was 964 mg/kg at LC0) with the notable exception of 124,000 mg/kg at PC1. PC1 also had considerably greater barium and cobalt concentrations (barium range was 180 to 529 mg/kg; PC1=2330 mg/kg; cobalt range was 19.8 to 33.7 mg/kg; PC1=520 mg/kg). Molybdenum concentrations ranged from below detection at RC1 to 507 mg/kg at LC0.

Of the 11 metals that have guidelines, 9 (all except mercury and selenium) exceeded guidelines at one or more sites. Of the samples with measurable concentrations of selenium (50%), all were well below the guideline value of 5 mg/kg.

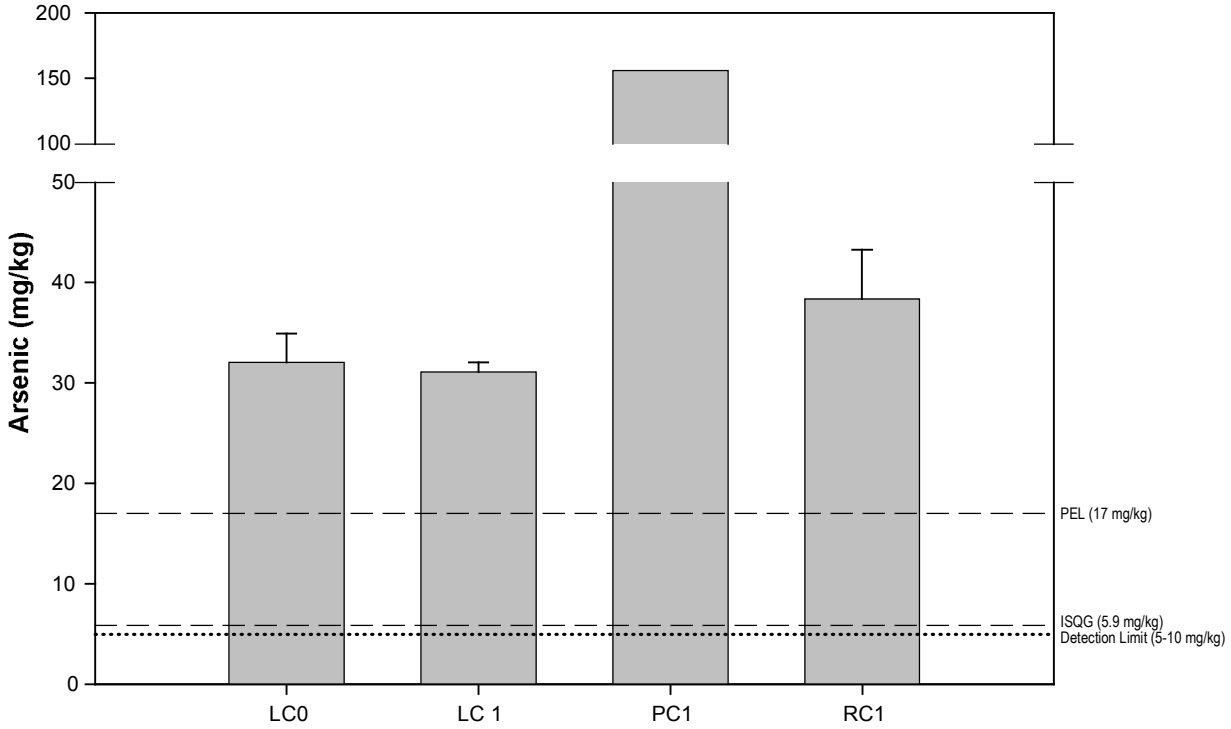
Average arsenic concentrations ranged from 31 mg/kg at LC1 to 156 mg/kg at PC1 (Figure 3.5-3). The concentration at PC1 was four times greater than the next greatest concentration 38 mg/kg at RC1. Stream arsenic concentrations far exceed the ISQG of 5.9 mg/kg and the PEL of 17 mg/kg.

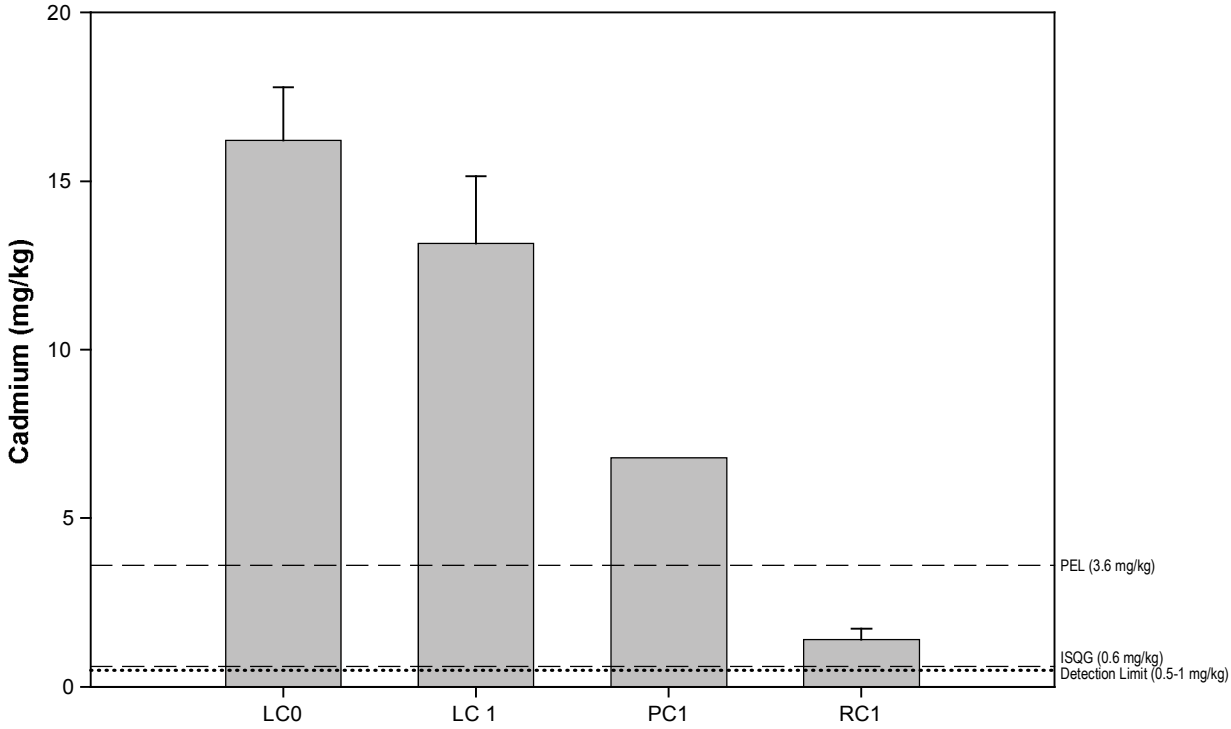
Average cadmium concentrations ranged from 1.4 mg/kg at RC1 to 16.2 mg/kg at LC0 (Figure 3.5-3). The ISQG of 0.6 mg/kg was exceeded by all sites, while LC0, LC1, and PC1 exceeded the PEL of 3.6 mg/kg. The cadmium concentration at LC0 exceeded the PEL guideline value by more than four times.

Average chromium concentrations ranged from 24.7 mg/kg (PC1) to 71.5 mg/kg (RC1), and all sites except PC1 exceeded the ISQG of 37.3 mg/kg (Figure 3.5-4). All sites were well below the PEL of 90 mg/kg.

Similar to chromium concentrations, average copper concentrations exceeded the ISQG (35.7 mg/kg) at all stream sites except PC1 (Figure 3.5-4). Concentrations ranged from 24.8 (PC1) to 111 mg/kg (LC0). All sites were well below the PEL of 197 mg/kg.

Iron concentrations were twice as high at PC1 than LC0, LC1, and RC1, which were all similar (Figure 3.5-5). The iron concentration at PC1 was 131,000 mg/kg. Both available guidelines, the LEL (21,200 mg/kg) and the SEL (43,766 mg/kg), were exceeded by all stream sites.





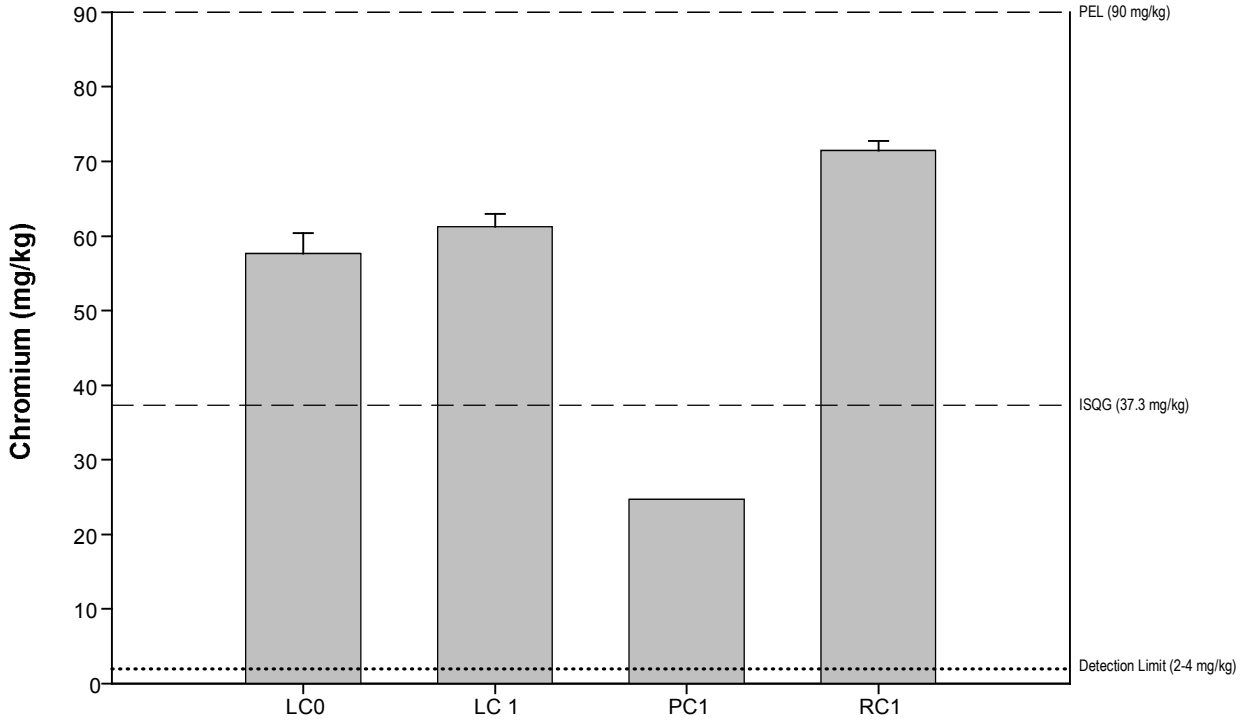
Note: Error bars represent one standard error of the mean.
Dotted lines denote lower detection limit.
Dashed lines denote guideline values.
Higher detection limit appies to PC1 only.

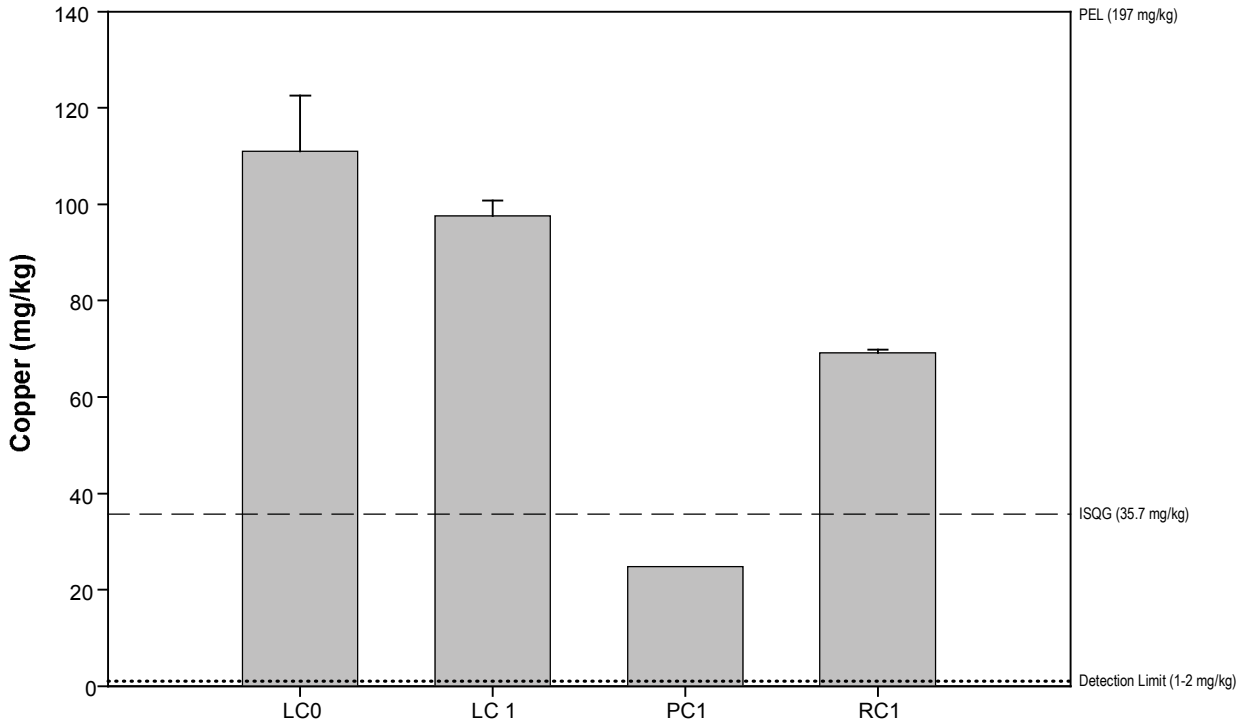
Arsenic and Cadmium Concentrations in Stream Sediments, Kitsault Project, August 2009

Figure 3.5-3

AVANTI MINING INC

Rescan™ Engineers & Scientists





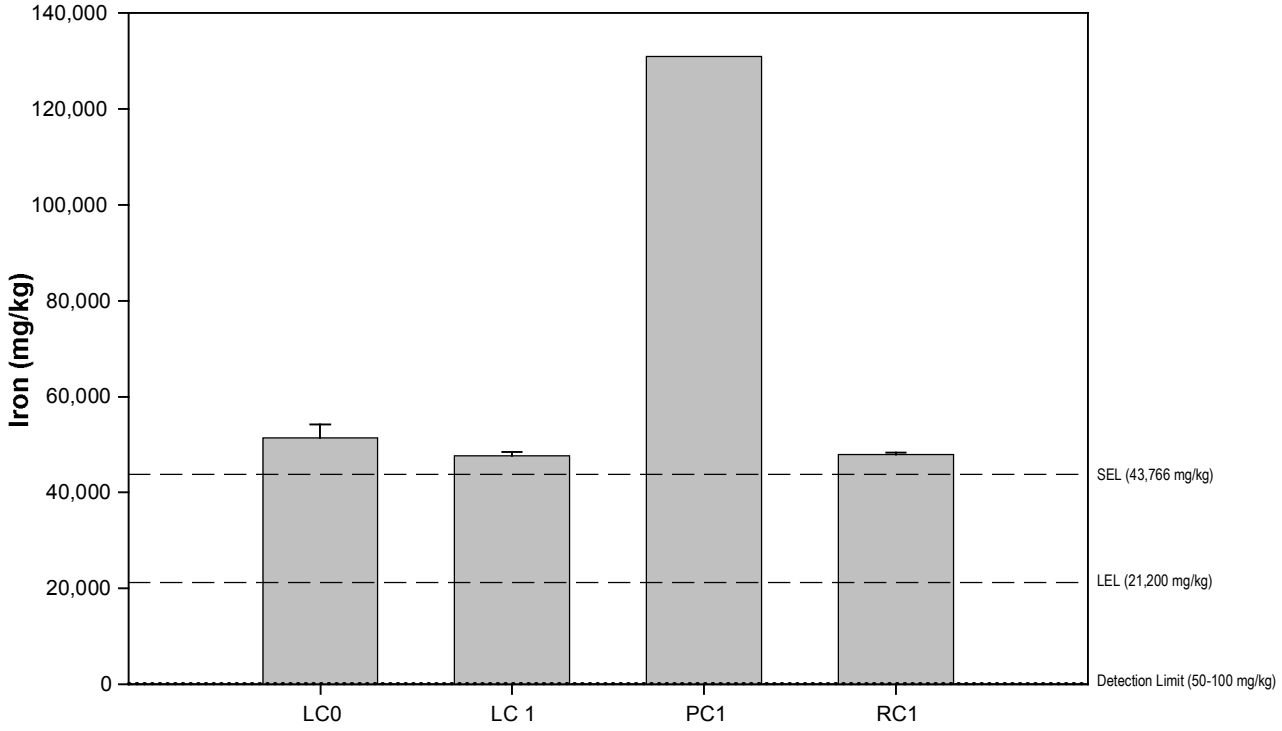
Note: Error bars represent one standard error of the mean.
Dotted lines denote lower detection limit.
Dashed lines denote guideline values.
Higher detection limit appies to PC1 only.

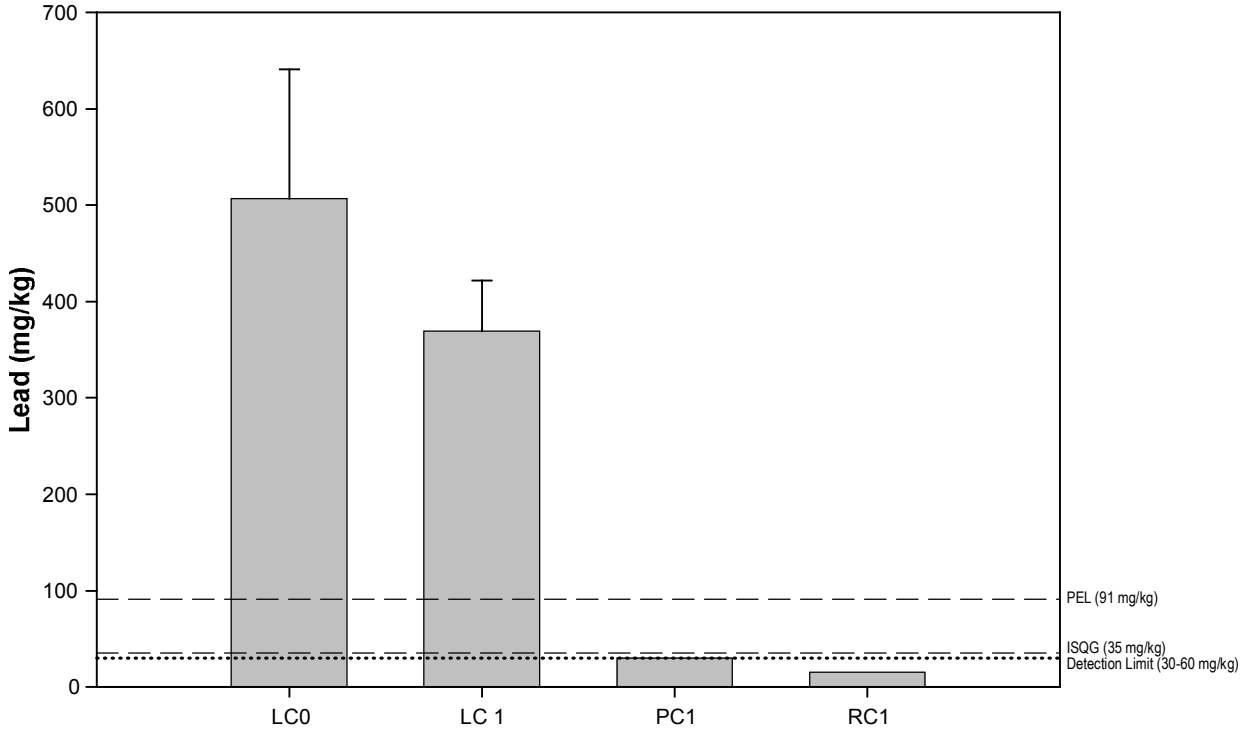
Chromium and Copper Concentrations in Stream Sediments, Kitsault Project, August 2009

Figure 3.5-4

AVANTI MINING INC

Rescan™ Engineers & Scientists





Note: Error bars represent one standard error of the mean.
Dotted lines denote lower detection limit.
Dashed lines denote guideline values.
Higher detection limit appies to PC1 only.

Iron and Lead Concentrations in Stream Sediments, Kitsault Project, August 2009

Figure 3.5-5

Average lead concentrations ranged from below the detection limits (RC1 and PC1) to 506 mg/kg at LC0 (Figure 3.5-5). The ISQG (35 mg/kg) and the PEL (91 mg/kg) were exceeded by at least four times at both Lime Creek sites.

All stream sites had mercury concentrations between 0.10 and 0.13 mg/kg (Figure 3.5-6). Neither the ISQG (0.17 mg/kg) nor the PEL (0.486 mg/kg) were exceeded by any stream site.

Like arsenic and iron, average nickel concentrations were similar (79 to 85 mg/kg) at all sites except PC1, where the concentration was considerably greater at 275 mg/kg (Figure 3.5-6). The LEL (16 mg/kg) and the SEL (75 mg/kg) were exceeded by all stream sites.

Generally, silver concentrations in sediments were close to or below detection limits, which is the case for PC1 and RC1 (Figure 3.5-7). However, average silver concentrations were far higher at the lower Lime Creek sites (LC0=11.5 mg/kg; LC1=8.3 mg/kg). Both of these sites exceed the only available guideline for silver, which is the Ontario sediment guideline (0.5 mg/kg).

Average zinc concentrations ranged between 175 mg/kg at RC1 to 586 mg/kg at LC0 (Figure 3.5-7). The ISQG of 123 mg/kg was exceeded by all sites and the PEL of 315 mg/kg was exceeded by all sites except RC1.

3.5.4 Quality Assurance and Quality Control (QA/QC)

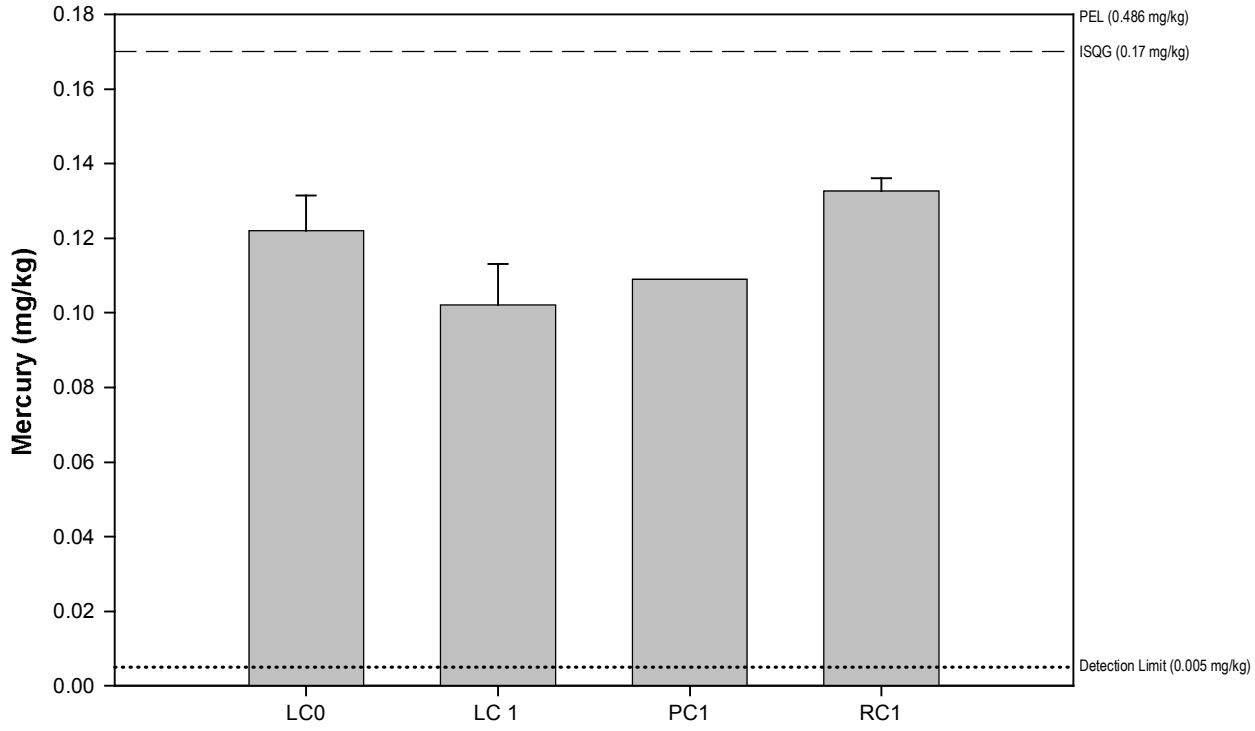
The RPD analyses of QA/QC field duplicates are reported in Appendix 3.5-2. Three duplicate pairs were compared using the RPD between the replicates as a measure of the variability inherent in field sampling (environmental heterogeneity). Approximately 26% of analytical results for stream duplicates were below or less than 5 times the MDL, and therefore RPD values were not calculated. Of the remaining results, only 2.3% (2 of 87 RPD calculations) were equal to or greater than the threshold of 20% indicated by provincial guidance, which indicates low heterogeneity of the samples.

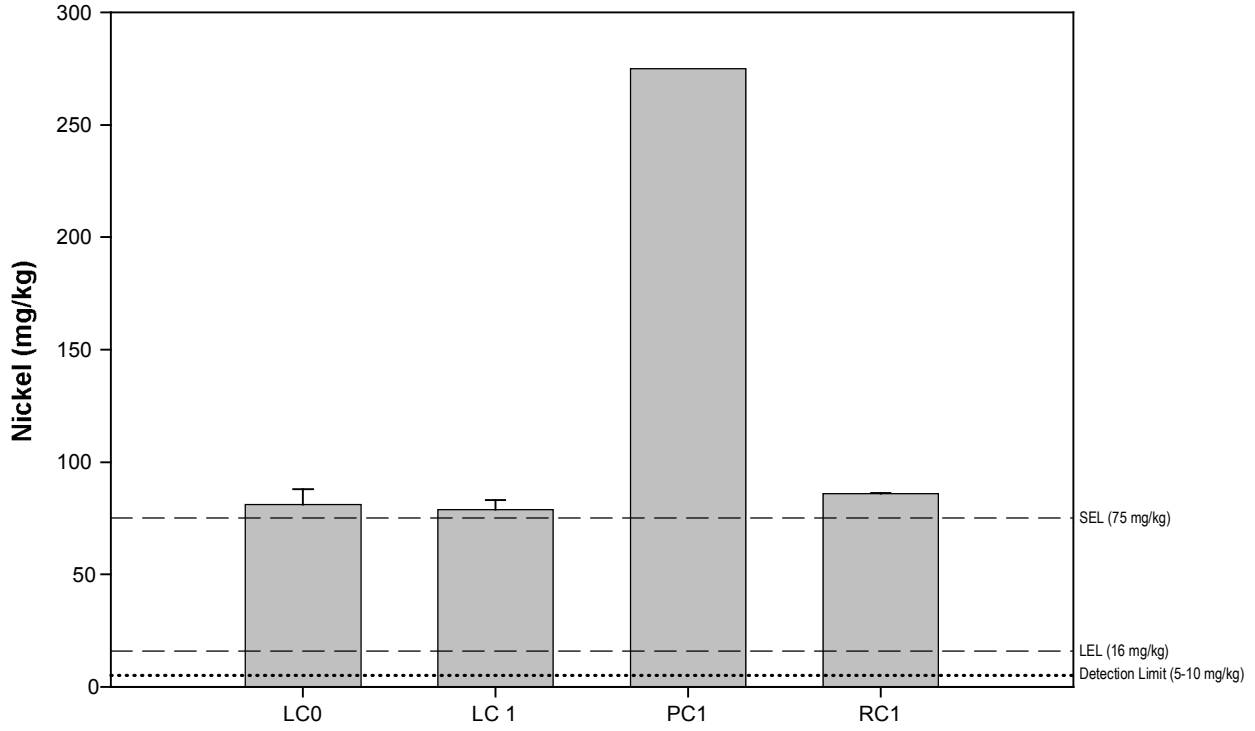
3.6 LAKE AND WETLAND SEDIMENT QUALITY

Triplicate composite samples were collected at each site. The primary visible difference between the lake and wetland sites was that the lake bottom was composed of relatively hard clays while all wetland sites contained substantial vegetation in the sediment. All original data are shown in Appendix 3.5-1.

3.6.1 Particle Size

Particle size distribution of sediments at Patsy Lake and the four wetlands sampled were largely (>90%) composed of silt and clay at each site (Figure 3.6-1). At most of the wetland sites these fines composed the substrate along with a dense matrix of vegetation (i.e., roots and grasses in various states of decomposition) (Plate 3.6-1). Proportions of silt ranged from 67% to 83%, clay from 14% to 30%, sand from 2% to 6%, and gravel from <1% to 2%.

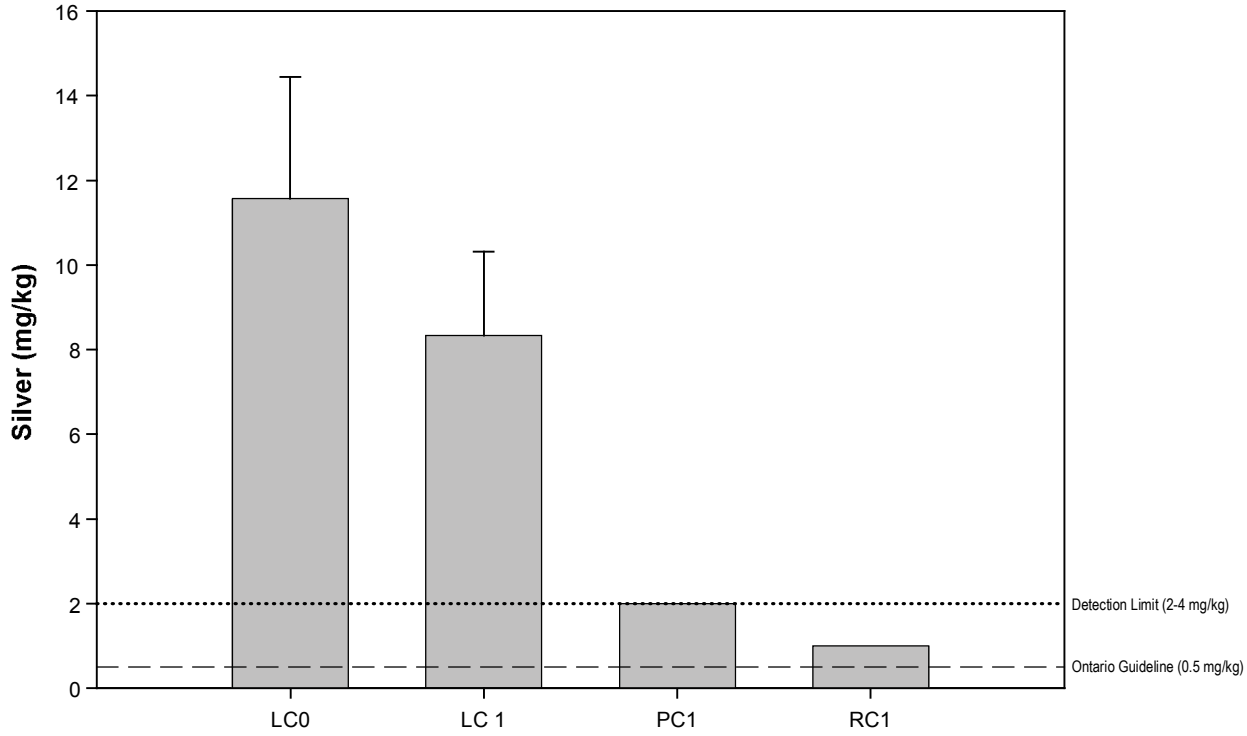


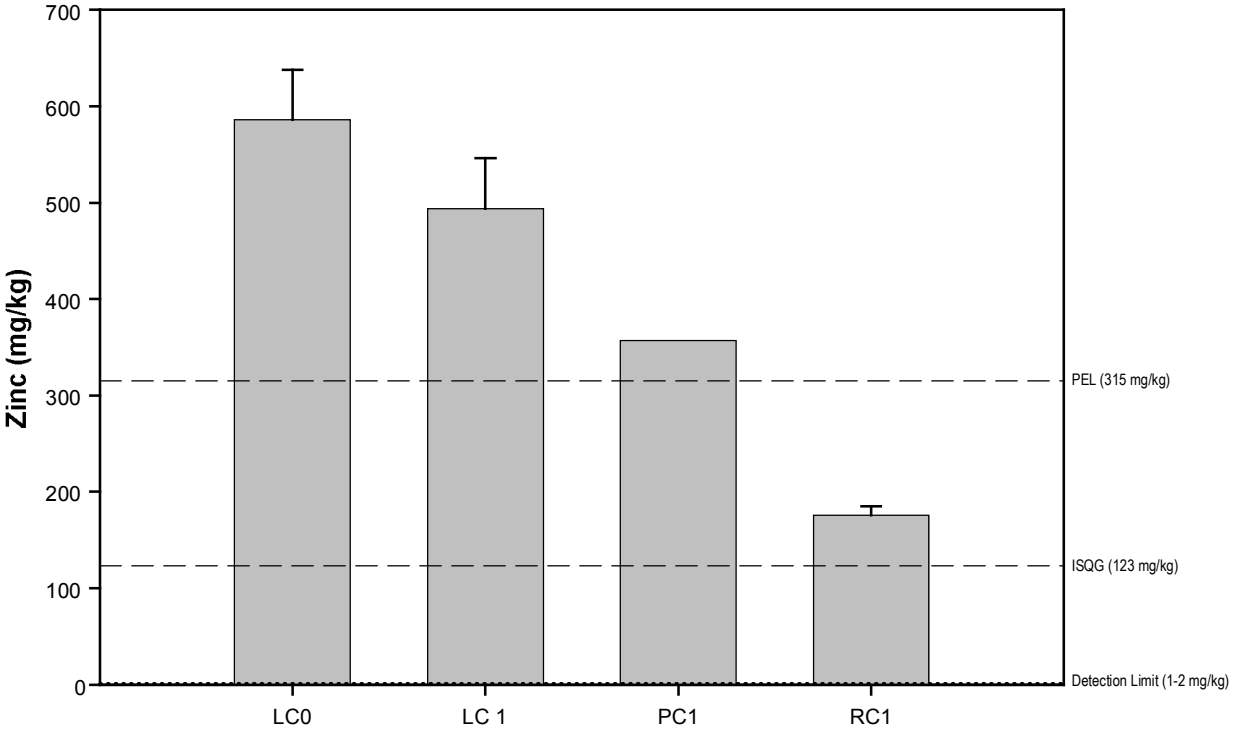


Note: Error bars represent one standard error of the mean.
Dotted lines denote lower detection limit.
Dashed lines denote guideline values.
Higher detection limit appies to PC1 only.

Mercury and Nickel Concentrations in Stream Sediments, Kitsault Project, August 2009

Figure 3.5-6

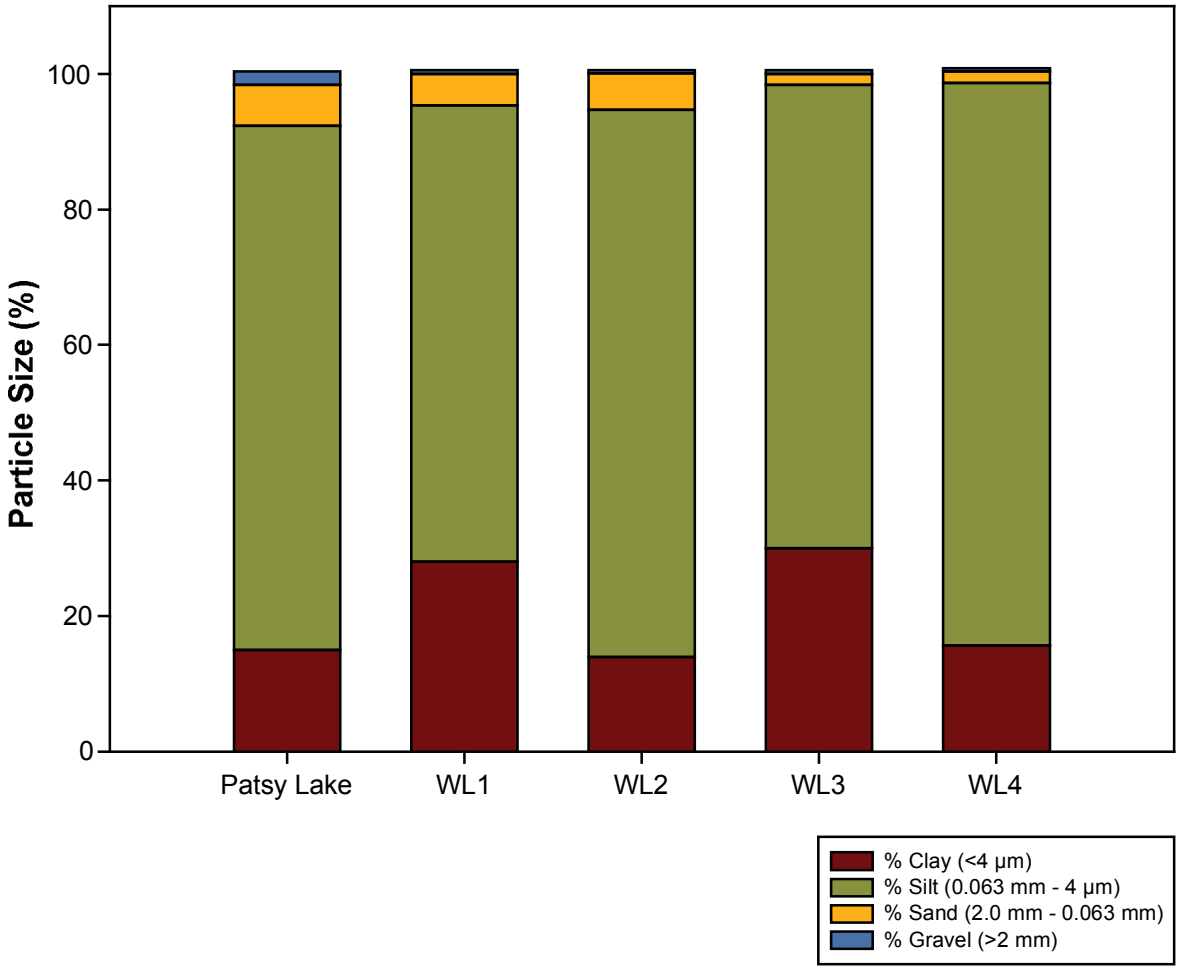




Note: Error bars represent one standard error of the mean.
Dotted lines denote lower detection limit.
Dashed lines denote guideline values.
Higher detection limit appies to PC1 only.

Silver and Zinc Concentrations in Stream Sediments, Kitsault Project, August 2009

Figure 3.5-7



Particle Size Distribution of Sediments in Patsy Lake and Wetlands, Kitsault Project, August 2009

Figure 3.6-1

AVANTI MINING INC

Rescan™ Engineers & Scientists

Plate 3.6-1. Mud flat with macrophytes at WL1.

3.6.2 Nutrients and Total Organic Carbon

Nutrient concentrations were relatively high at wetland sites. TOC and total nitrogen (TN) concentrations peaked at WL2 and WL4 (Figure 3.6-2). TN concentrations ranged from 0.9% at Patsy Lake to 2.2% at WL2 and WL4, while TOC ranged from 14% at Patsy Lake to 43% at WL4.

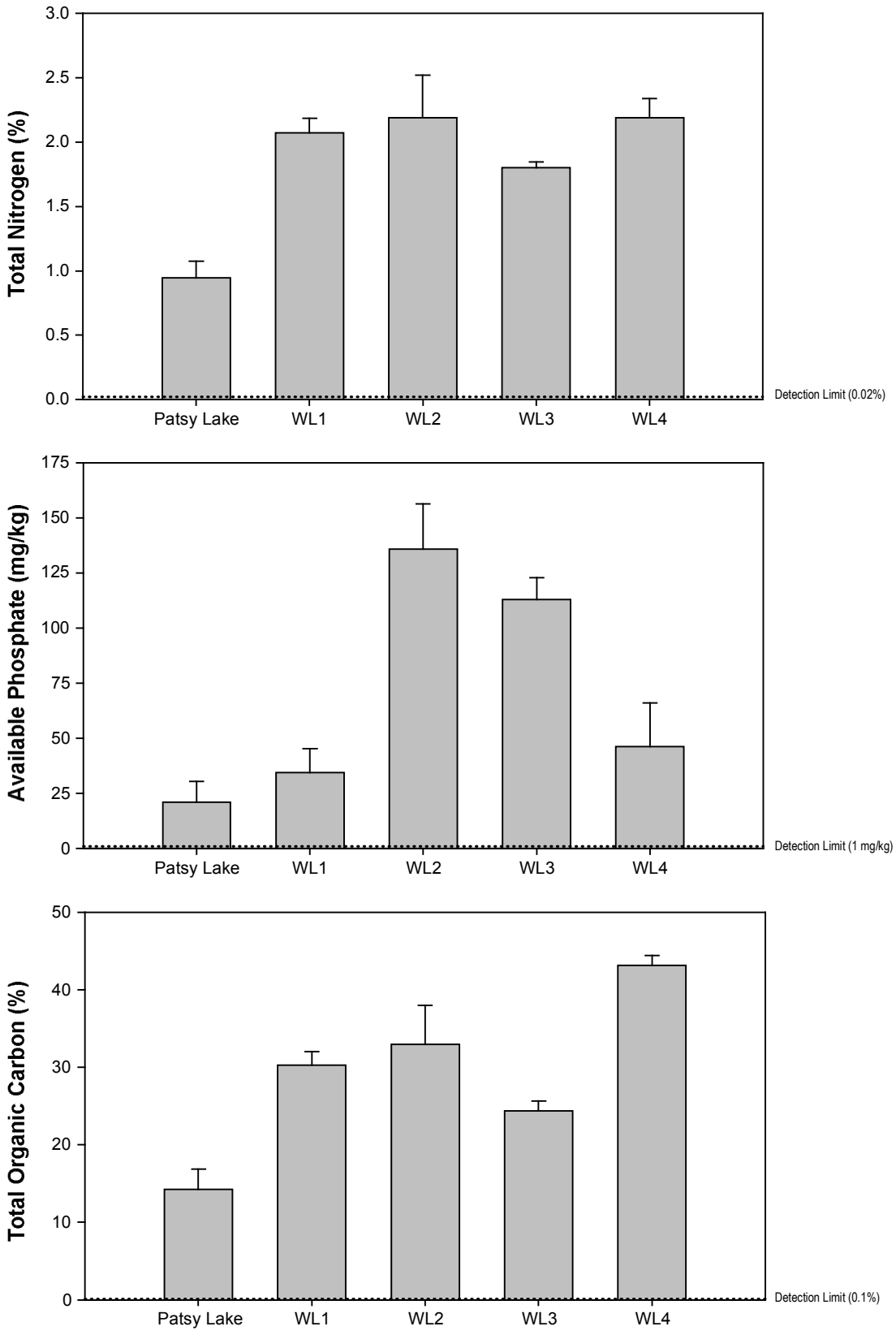
Available phosphate concentrations were below 50 mg/kg at all sites except for WL2 and WL3 (Figure 3.6-2). Concentrations at WL3 and WL2 were 113 mg/kg, and 136 mg/kg, respectively, while all other sites were below 50 mg/kg.

3.6.3 Total Metals

As described above for stream sediments, analysis of total metal concentrations was completed on the <63 µm fraction of the sediments collected from each lake and wetland site.

Several of the metals analyzed were below detection limits in more than 50% of lake and wetland samples (i.e., antimony, beryllium, bismuth, lead, selenium, silver, thallium, and tin). These are not discussed further. Metals with available guidelines are discussed in detail below and those for which no guidelines are available are briefly summarized.

Aluminum concentrations were four to ten times greater in Patsy Lake than other sites and 2,850 mg/kg (WL2) to 41,300 mg/kg (Patsy Lake). This pattern of considerably greater metal concentrations at Patsy Lake was also observed for cobalt (ranged from below detection to 65.5 mg/kg at Patsy Lake) and manganese (ranged from 105 mg/kg at WL2 to 42,700 mg/kg at Patsy Lake). Molybdenum concentrations ranged from below detection at WL1 to 150 mg/kg at WL2.



Note: Error bars represent one standard error of the mean.
Dotted lines denote detection limits.

Total Nitrogen, Available Phosphate and Total Organic Carbon Concentrations in Lake and Wetland Sediments, Kitsault Project, August 2009

Figure 3.6-2

AVANTI MINING INC

Rescan™ Engineers & Scientists

Of the 11 metals that have guidelines, 3 (lead, selenium and silver) generally occurred below detection limits. The remaining eight (discussed below) exceeded guidelines at one or more sites. Patsy Lake most often had the greatest metal concentrations among lake and wetland sites.

Average arsenic concentrations ranged from below the detection limit (5 mg/kg) at WL1 and WL4 to 36 mg/kg at Patsy Lake (Figure 3.6-3). The ISQG guideline of 5.9 mg/kg and the PEL of 17 mg/kg were exceeded by Patsy Lake, WL2, and WL3.

Similar to arsenic concentrations, average cadmium concentrations were below detection limits (0.5 mg/kg) at WL1 and WL4 (Figure 3.6-3). WL3 had the greatest concentration at 2.3 mg/kg. Patsy Lake, WL2, and WL3 each exceeded the ISQG of 0.6 mg/kg, and all sites were below the PEL of 3.6 mg/kg.

All wetland sites had average chromium concentrations between 7 and 25 mg/kg, the concentration at Patsy Lake was 43 mg/kg (Figure 3.6-4). Only Patsy Lake exceeded the ISQG of 37.3 mg/kg and all sites were well below the PEL of 90 mg/kg.

Similar to chromium, copper concentrations were greatest (51 mg/kg) at Patsy Lake, which exceeded the ISQG of 35.7 mg/kg (Figure 3.6-4). One sample at WL3 also exceeded the ISQG. Average concentrations at wetland sites ranged from 19.5 mg/kg (WL4) to 32 mg/kg (WL3). All sites were well below the PEL of 197 mg/kg.

As with several other metals, the concentration of iron at Patsy Lake was considerably greater than those observed at the wetland sites (Figure 3.6-5). All wetlands had average iron concentrations below 13,000 mg/kg, while the average concentration at Patsy Lake was over 95,000 mg/kg. The LEL (21,200 mg/kg) and the SEL guideline (43,766 mg/kg) were exceeded at Patsy Lake.

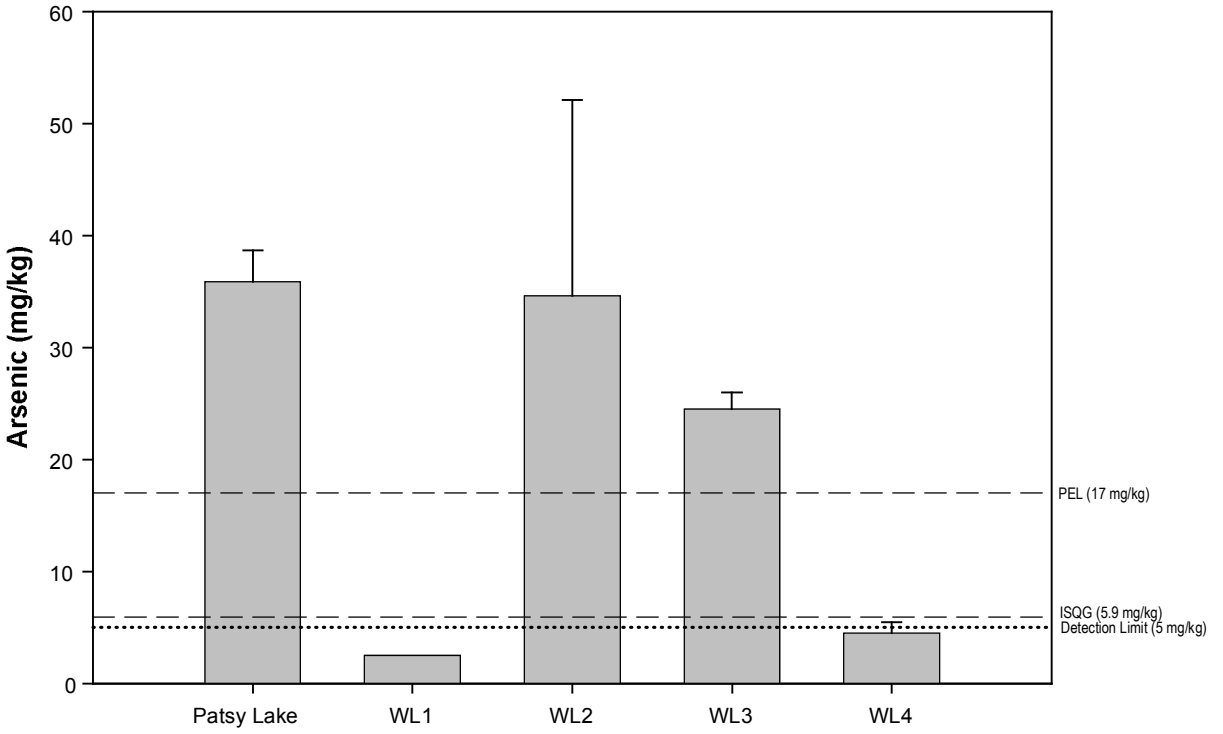
Average mercury concentrations were similar among wetland sites (ranged from 0.12 to 0.16 mg/kg) while Patsy Lake had an average concentration almost double that (0.30 mg/kg) (Figure 3.6-5). All samples from Patsy Lake and at least one sample from WL2, WL3, and WL4 exceeded the ISGQ of 0.17 mg/kg. All sites were well below the PEL of 0.486 mg/kg.

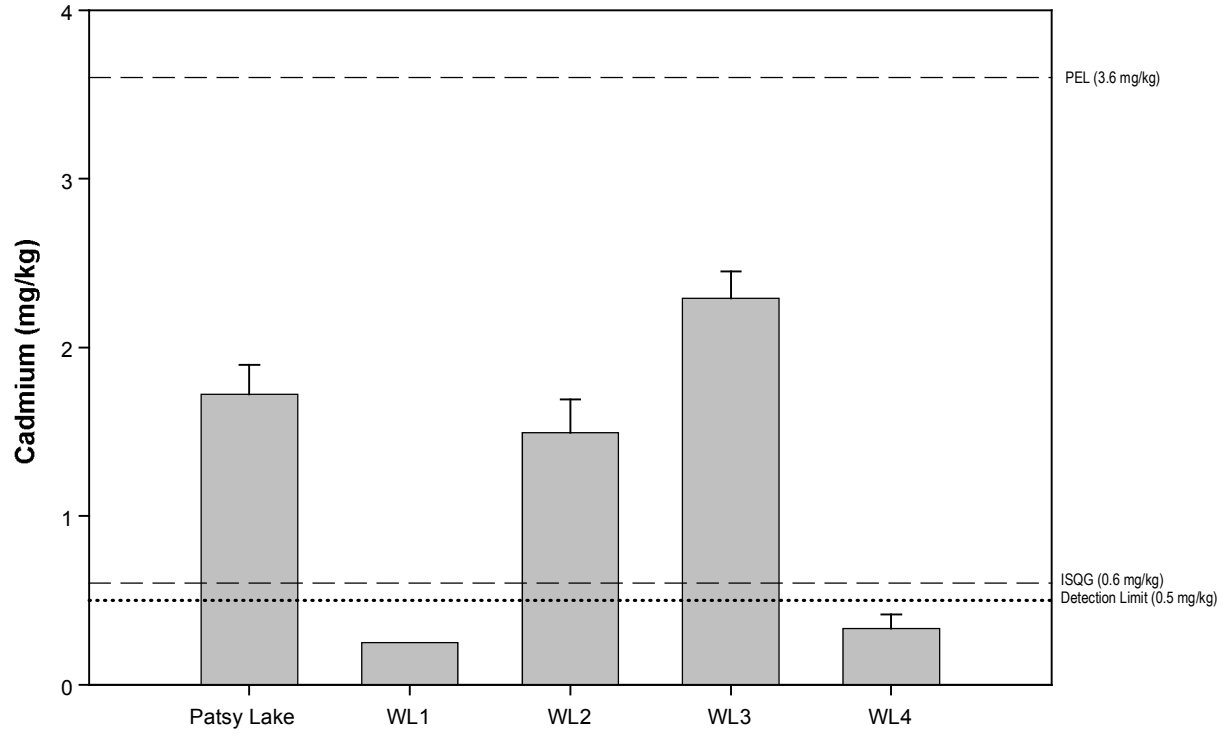
Average nickel concentrations ranged from 9 mg/kg at WL4 to 75 mg/kg at WL3 (Figure 3.6-6). All sites except WL4 exceeded the LEL of 16 mg/kg, while only WL3 exceeded the SEL of 75 mg/kg by a slim margin.

Average zinc concentrations ranged from 18 mg/kg at WL4 to 175 mg/kg at Patsy Lake (Figure 3.6-6). WL1, WL2, and WL4 were all well below the ISQG of 123 mg/kg. Patsy Lake and WL3 exceeded this guideline.

3.6.4 Quality Assurance and Quality Control (QA/QC)

The RPD analyses of QA/QC field duplicates are reported in Appendix 3.5-2. Three duplicate pairs of wetland samples were compared using the RPD between the replicates as a measure of the variability inherent in field sampling (environmental heterogeneity). The sample duplicates from wetland sediments appear to have more inherent heterogeneity than was observed for stream sediments. Approximately 39% of analytical results were below or less than 5 times the method detection limit MDL, therefore, RPD values were not calculated. Of the remaining results, 25% (18 of 71 RPD calculations) were equal to or greater than the threshold of 20% indicated by provincial guidance. Most of the RPD calculations that exceeded this threshold (13 of 18) occurred in the same duplicate pair. This may have resulted from this particular replicate not being sufficiently homogenized after collection from the site.

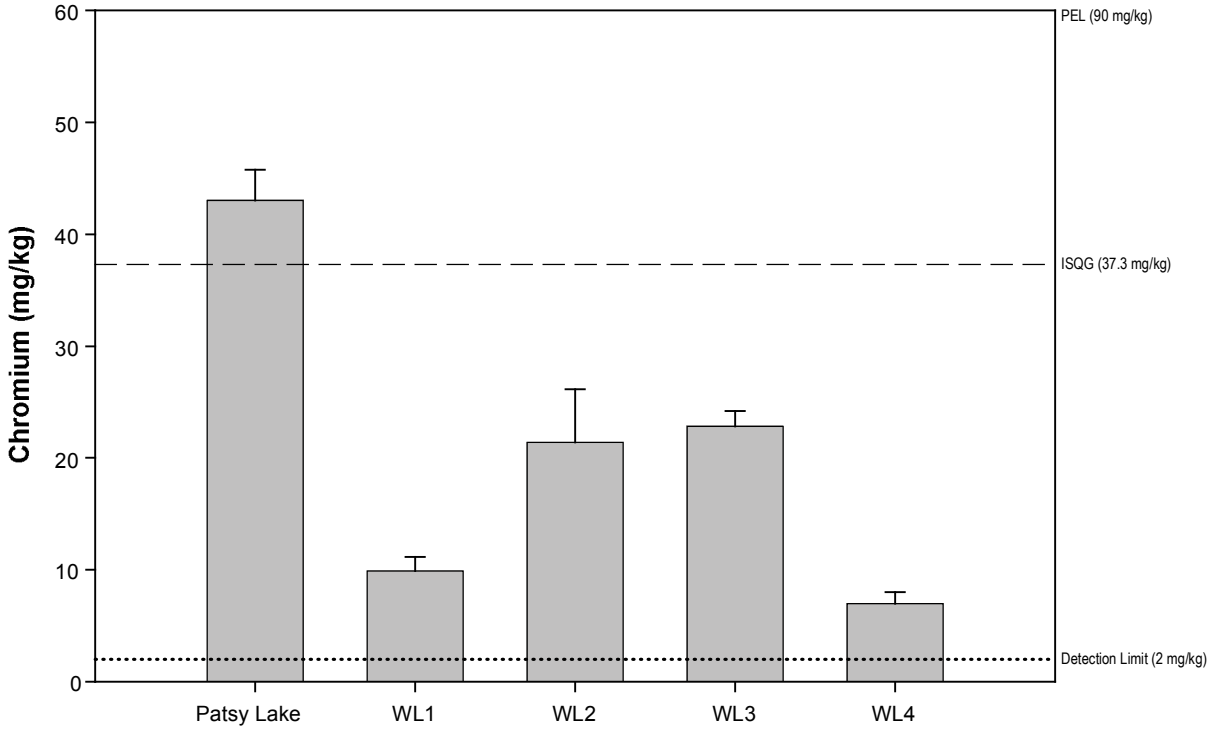


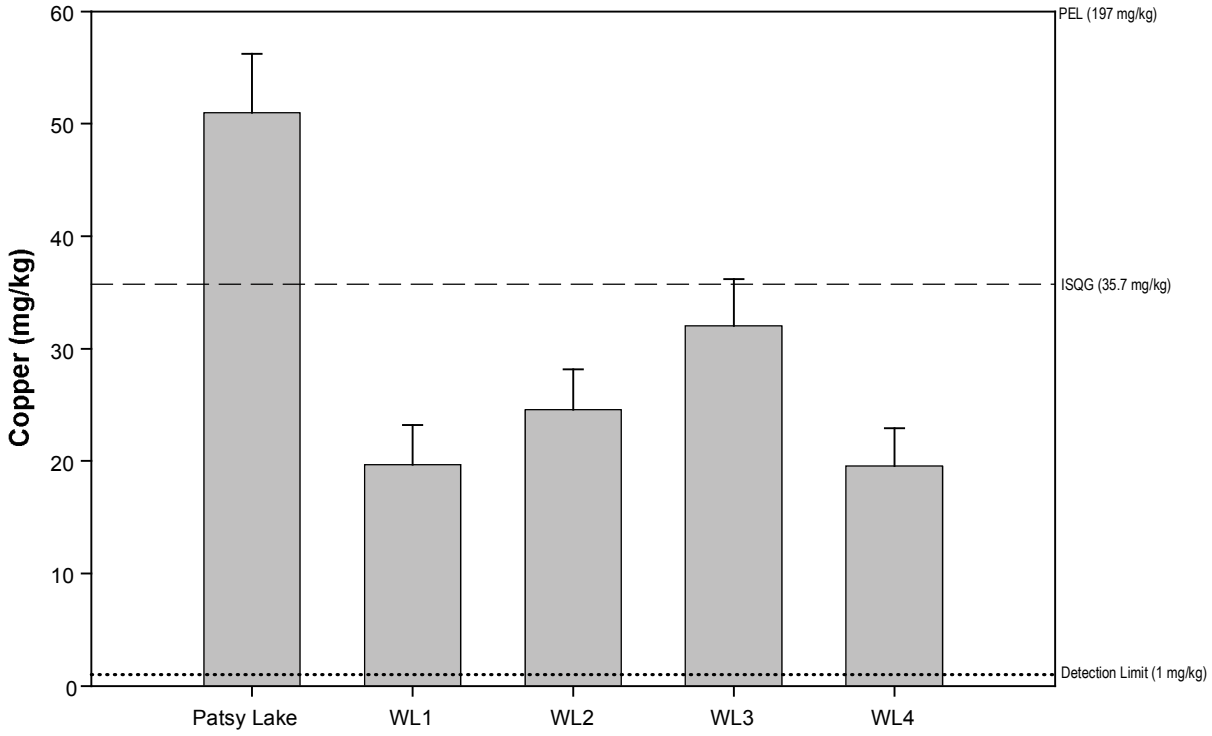


Note: Error bars represent one standard error of the mean.
Dotted lines denote detection limits.
Dashed lines denote guideline values.

Arsenic and Cadmium Concentration in Lake and Wetland Sediments, Kitsault Project, 2009

Figure 3.6-3





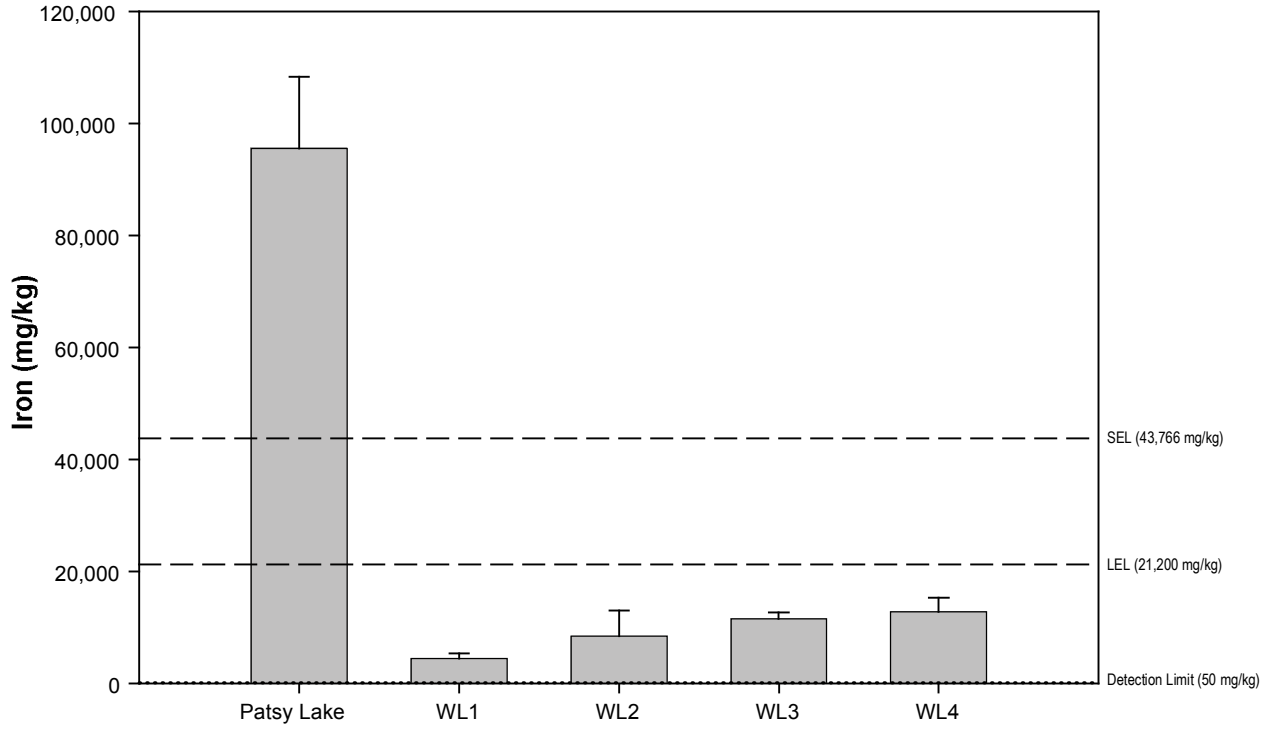
Note: Error bars represent one standard error of the mean.
Dotted lines denote detection limits.
Dashed lines denote guideline values.

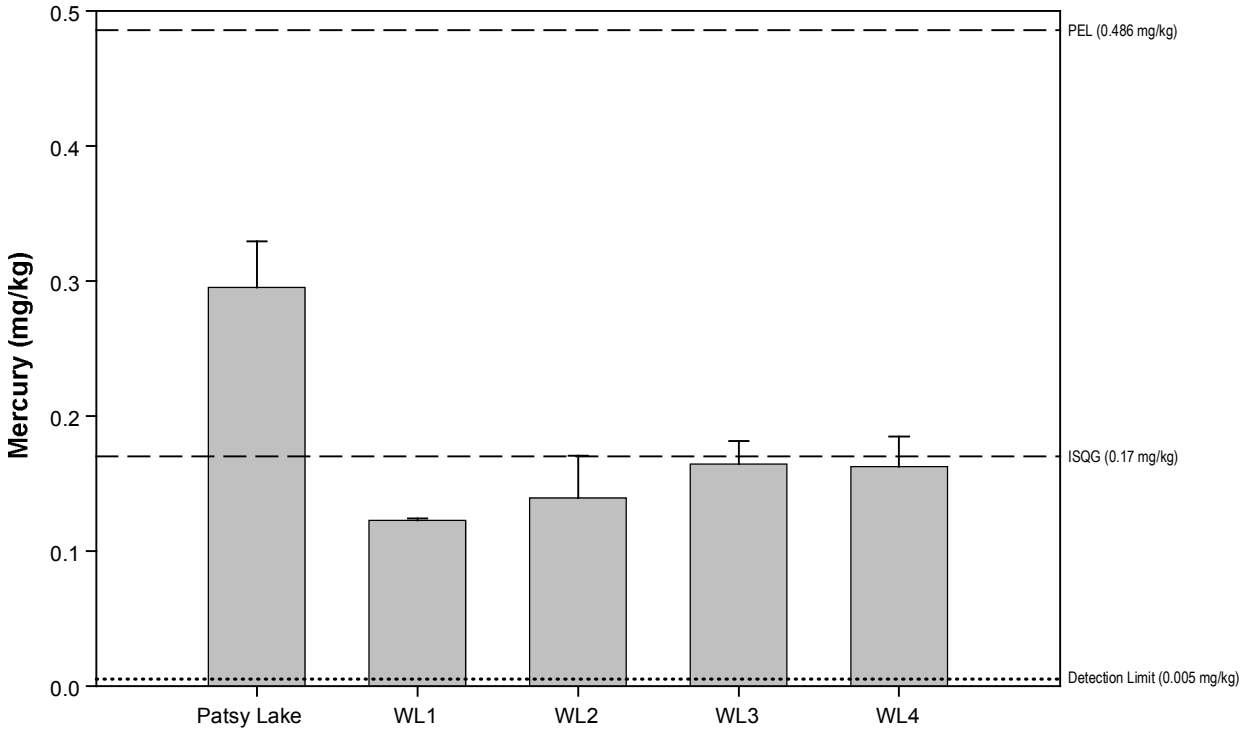
Chromium and Copper Concentrations in Lake and Wetland Sediments, Kitsault Project, 2009

Figure 3.6-4

AVANTI MINING INC

Rescan™ Engineers & Scientists





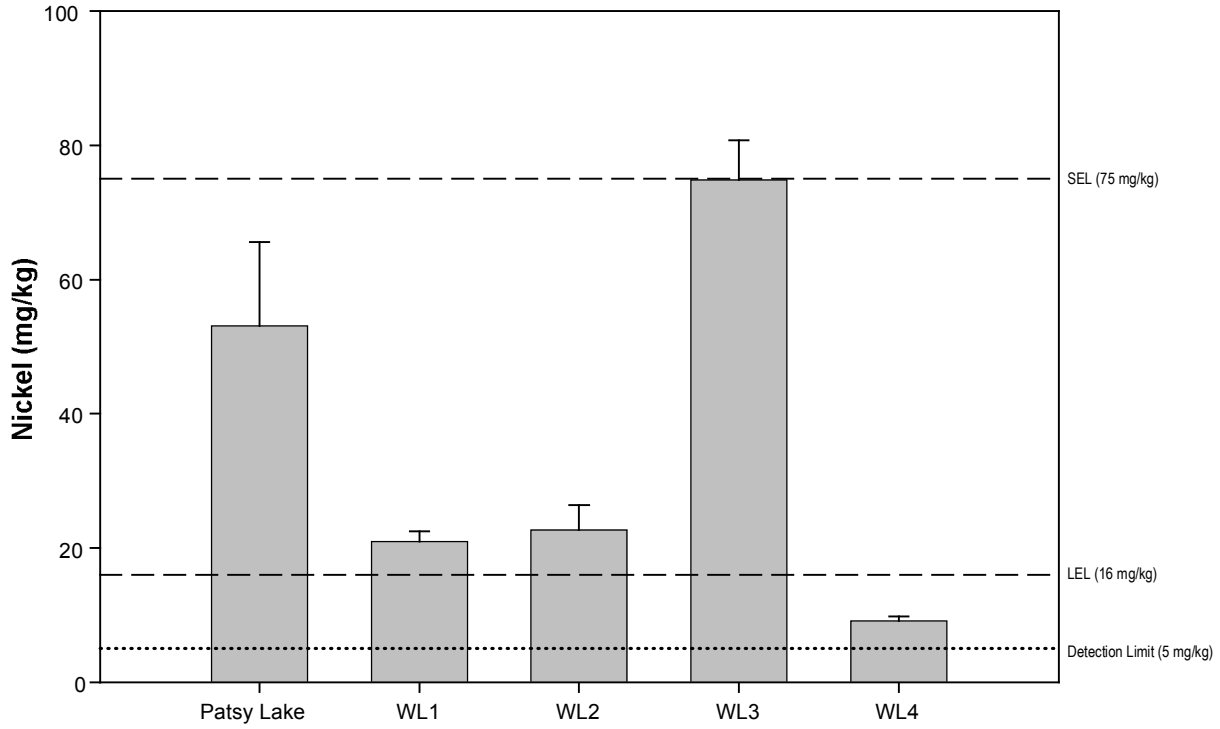
Note: Error bars represent one standard error of the mean.
Dotted lines denote detection limits.
Dashed lines denote guideline values.

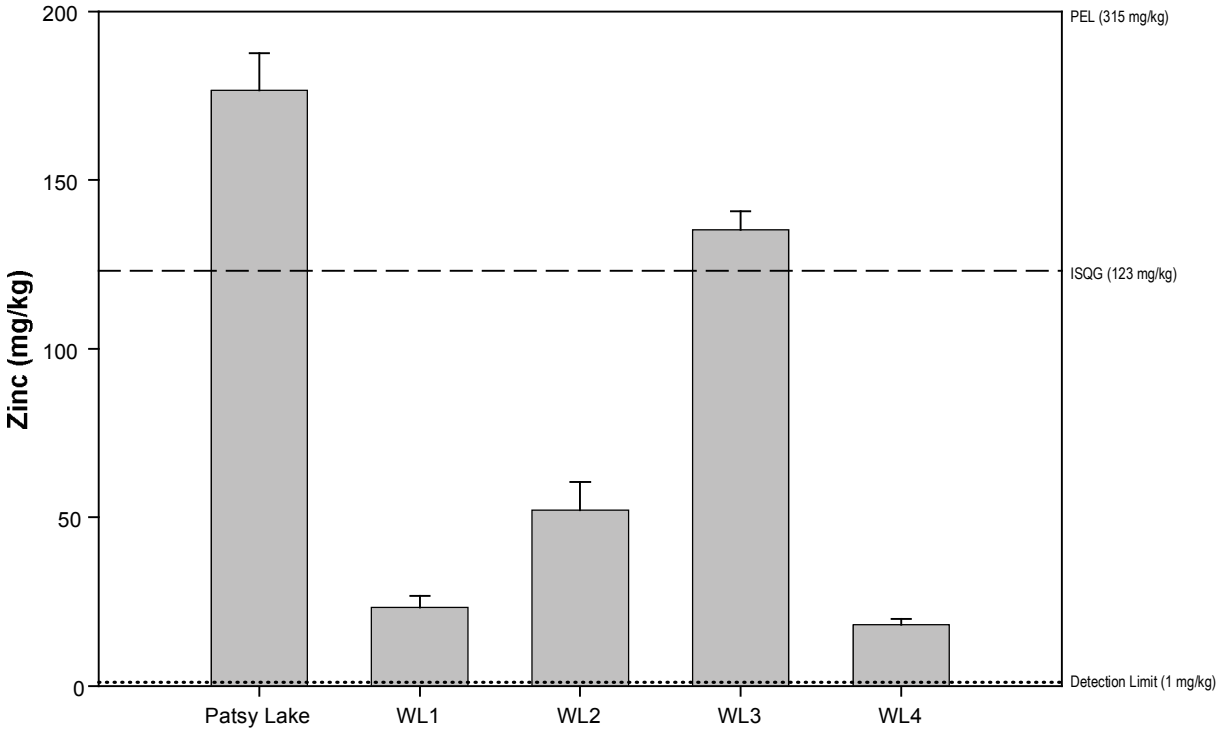
Iron and Mercury Concentrations in Lake and Wetland Sediments, Kitsault Project, 2009

Figure 3.6-5

AVANTI MINING INC

Rescan™ Engineers & Scientists





Note: Error bars represent one standard error of the mean.
Dotted lines denote detection limits.
Dashed lines denote guideline values.

Nickel and Zinc Concentrations in Lake and Wetland Sediments, Kitsault Project, August 2009

Figure 3.6-6

AVANTI MINING INC

Rescan™ Engineers & Scientists

3.7 PRIMARY PRODUCERS

3.7.1 Stream Periphyton

All stream periphyton taxonomic data collected in August 2009 can be found in Appendix 3.3-1 and biomass data (as chlorophyll α) are in Appendix 3.3-2.

3.7.1.1 Biomass and Density

Average periphyton biomass at stream sites ranged from 0.01 µg/cm^2 at PC1 to 0.44 µg/cm^2 at LC1 (Figure 3.7-1). With the exception of LC0, the stream sites lower in the watershed (LC1 and RC1) had considerably greater periphyton biomass than upper Patsy or Lime creeks. The BC aquatic life guideline for the maximum chlorophyll α concentrations in streams is 10 µg/cm^2, which is well above the concentrations in the Project area.

Average periphyton density ranged from 476,170 cells/cm^2 at LC3 to 1,741,865 cells/cm^2 at PC2 (Figure 3.7-1). The greatest contribution to the cell density found at PC2 and LC0 came from Cyanophyta species, *Chamaesiphon spp.*, and *Homoeothrix varians* respectively. These taxa were present in relatively high numbers compared to other taxa and did not show much of a presence at other sites.

3.7.1.2 Relative Abundance

All periphyton communities were primarily composed of Cyanophyta (52 to 98%) (Figure 3.7-2). The remaining proportions of each community were generally composed of Bacillariophyceae (<1 to 18%) and Chrysophyta (<1 to 22%). PC1 also had a considerable contribution from Chlorophyta (27%) and a small proportion of Rhodophyta (2%), making this site more taxonomically diverse.

3.7.1.3 Richness and Diversity Indices

Most stream sites had average periphyton genus richness between 10 and 22 taxa (Figure 3.7-3). Average richness at PC1 was noticeably greater with 35 taxa identified at this site. Because PC1 is located at the outflow of Patsy Lake, the nutrients available from this outflow may have contributed to the development of the periphyton community here.

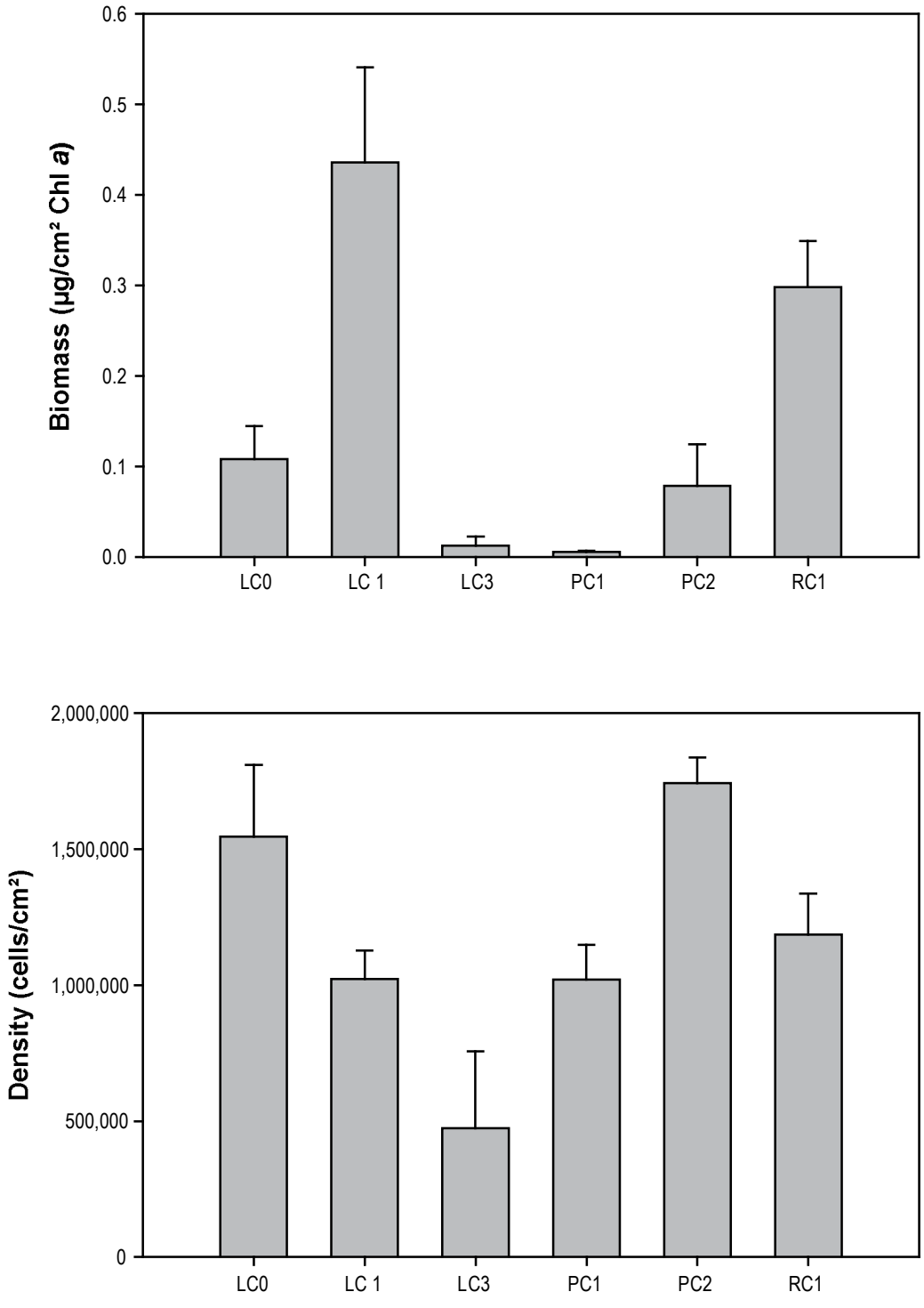
Simpson's diversity was similar across stream sites, ranging from 0.46 at PC2 to 0.65 at PC1 (Figure 3.7-3). Average evenness, which can range from 0 to 1, with 1 representing complete evenness, ranged from 0.27 at PC2 to 0.47 at PC1 (Figure 3.7-3).

3.7.2 Lake and Wetland Phytoplankton

In August 2009, phytoplankton samples were collected from Patsy Lake and four wetlands. All phytoplankton taxonomy data can be found in Appendix 3.7-3, while biomass data (as chlorophyll α) are in Appendix 3.7-4.

3.7.2.1 Biomass and Density

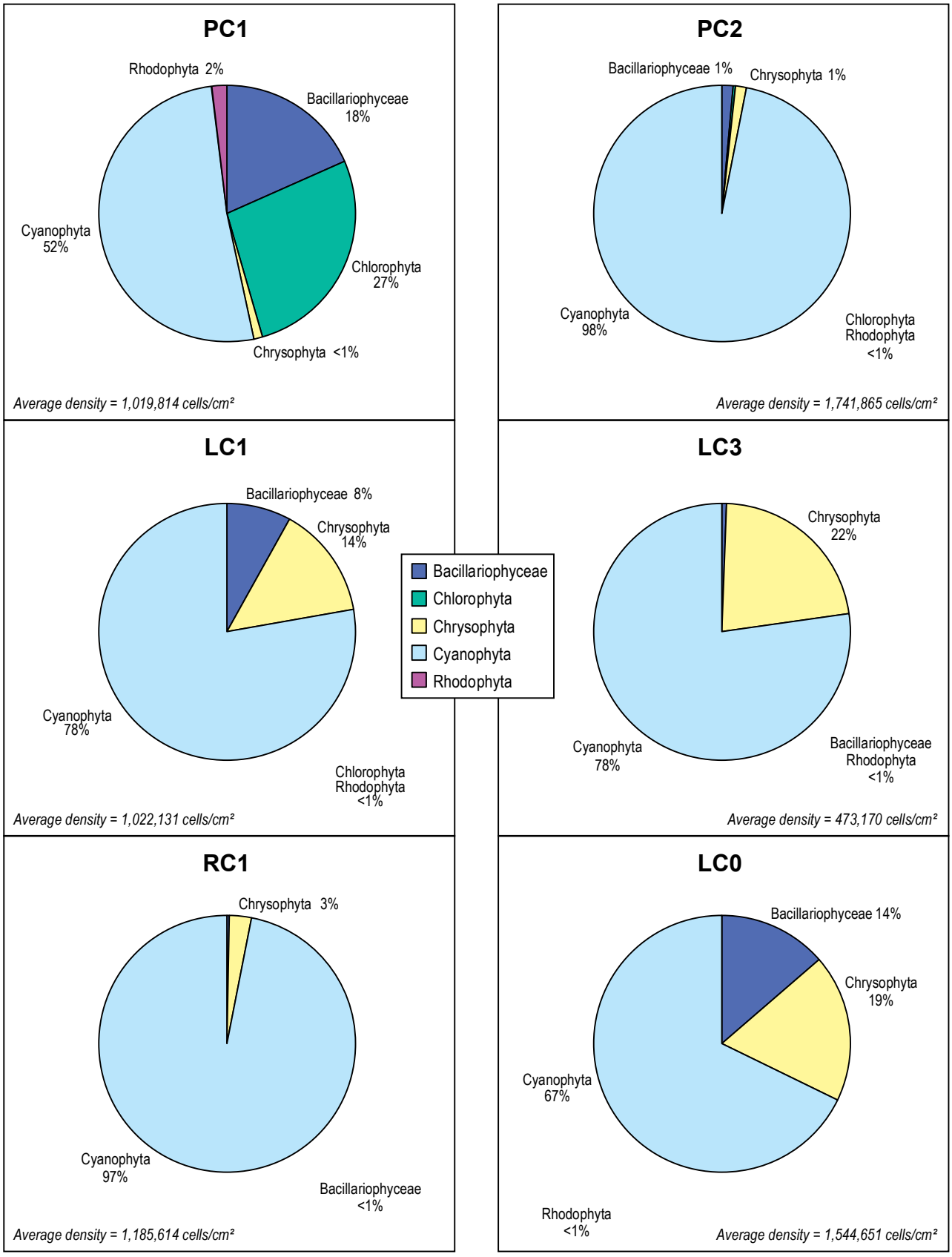
Average lake and wetland biomass ranged from 0.35 at Patsy Lake to 1.22 µg/L chlorophyll α at WL1 (Figure 3.7-4). Other than WL2, all wetland sites had at least 2.5 times higher biomass concentrations than Patsy Lake.



Note: Error bars represent one standard error of the mean.

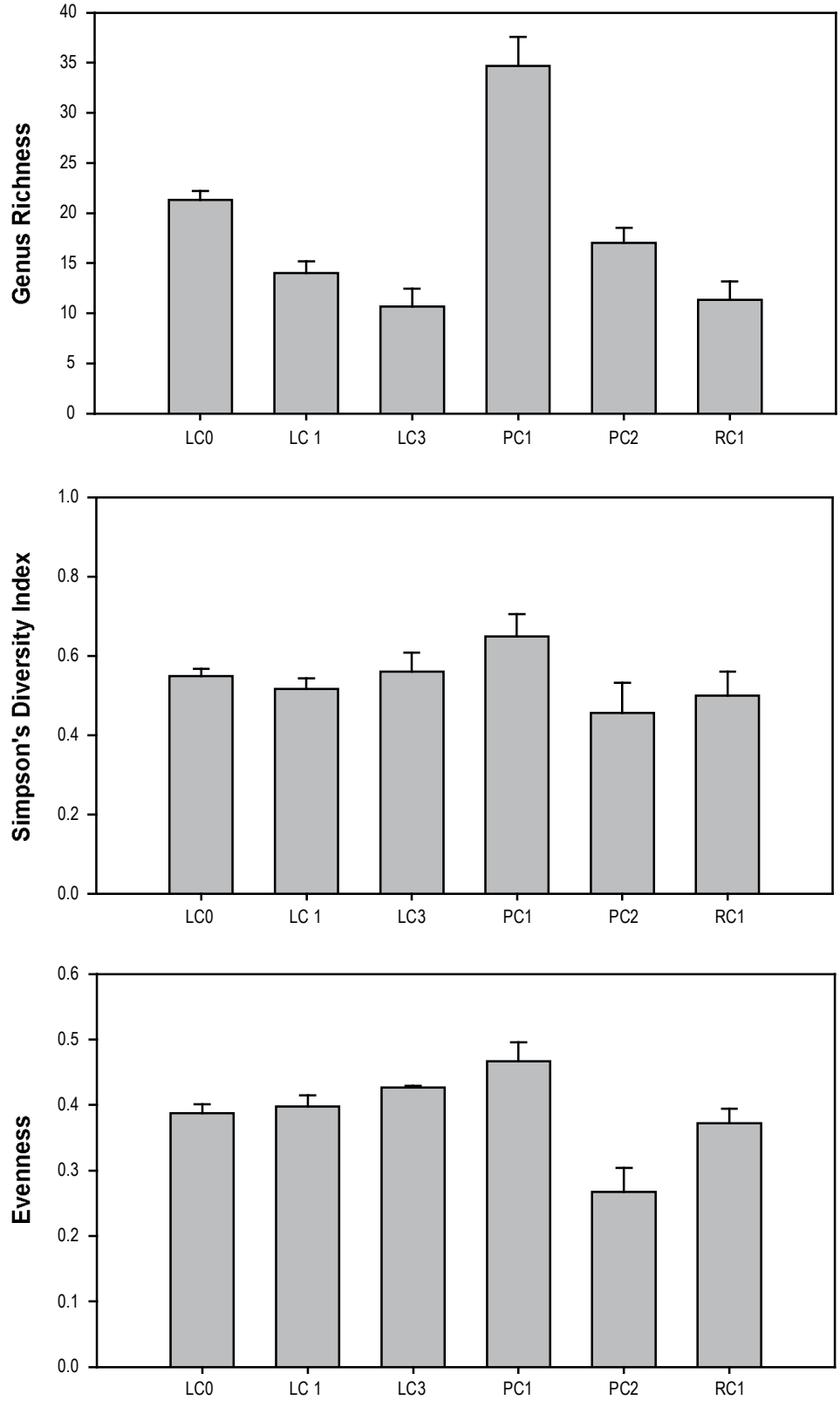
Periphyton Biomass and Density in Streams, Kitsault Project, August 2009

Figure 3.7-1



Taxonomic Composition of Stream Periphyton Communities, Kitsault Project, August 2009

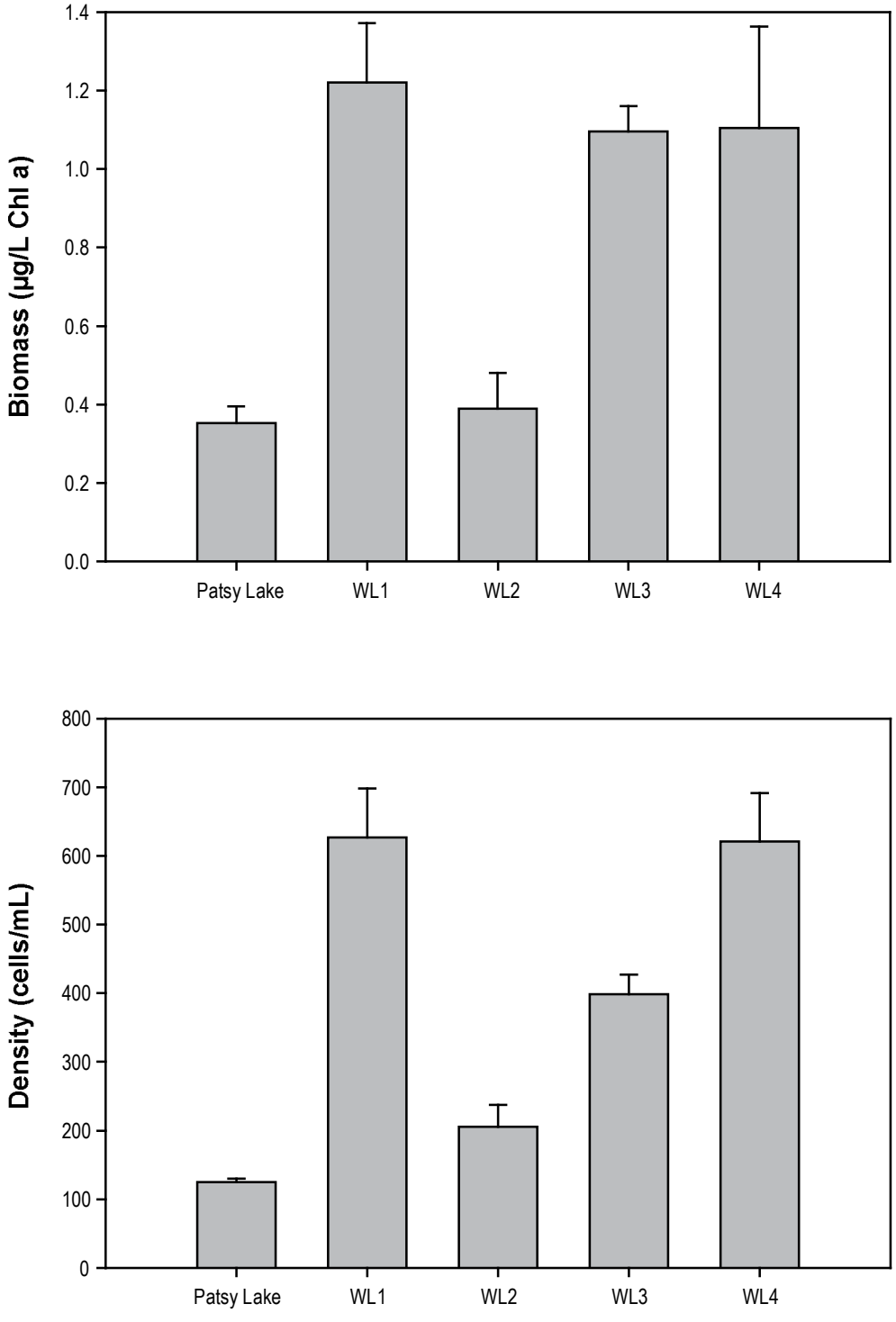
Figure 3.7-2



Note: Error bars represent one standard error of the mean.

Stream Periphyton Richness, Simpson's Diversity and Evenness, Kitsault Project, August 2009

Figure 3.7-3



Note: Error bars represent one standard error of the mean.

Phytoplankton Biomass and Density in Pasty Lake and Wetlands, Kitsault Project, August 2009

Figure 3.7-4

AVANTI MINING INC

Rescan™ Engineers & Scientists

Phytoplankton density was largely similar to biomass as the lowest cell density was observed in Patsy Lake (125 cells/ml) and the greatest density was observed at WL1 (627 cells/ml), although WL4 was very close behind with 621 cells/ml (Figure 3.7-4).

3.7.2.2 Relative Abundance

The structure of the phytoplankton communities in the lake and wetlands varied considerably between sites as no single taxonomic group dominated the community across sites (Figure 3.7-5).

Chlorophyta were the dominant taxa in Patsy Lake (66%) and WL4 (63%). Cyanophytes were most dominant (40%) at WL1 followed by chlorophytes (28%). WL2 was primarily composed of chrysophytes (74%), and cryptophytes (60%) composed the majority of the community at WL3. The remaining proportions of these communities were composed of Bacillariophyceae (3 to 7%), Pyrrhophyta (<1 to 7%), and Euglenophyta (<1%).

3.7.2.3 Richness and Diversity

Average lake and wetland phytoplankton richness ranged from 30 taxa at Patsy Lake to 53 taxa at WL4 (Figure 3.7-6). Genus diversity calculations using the Simpson diversity index, Patsy Lake and WL1 werethe most diverse sites (Figure 3.7-6). Average Simpson diversity ranged from 0.50 (WL2) to 0.87 (Patsy Lake and WL1). The diversity at Patsy Lake was relatively high (despite this site having the lowest taxa richness) as a result of the relatively even distribution of the individual cells among the identified taxa. The highest evenness was at Patsy Lake (0.72), with the lowest evenness at WL2 (0.41).

3.8 SECONDARY PRODUCERS

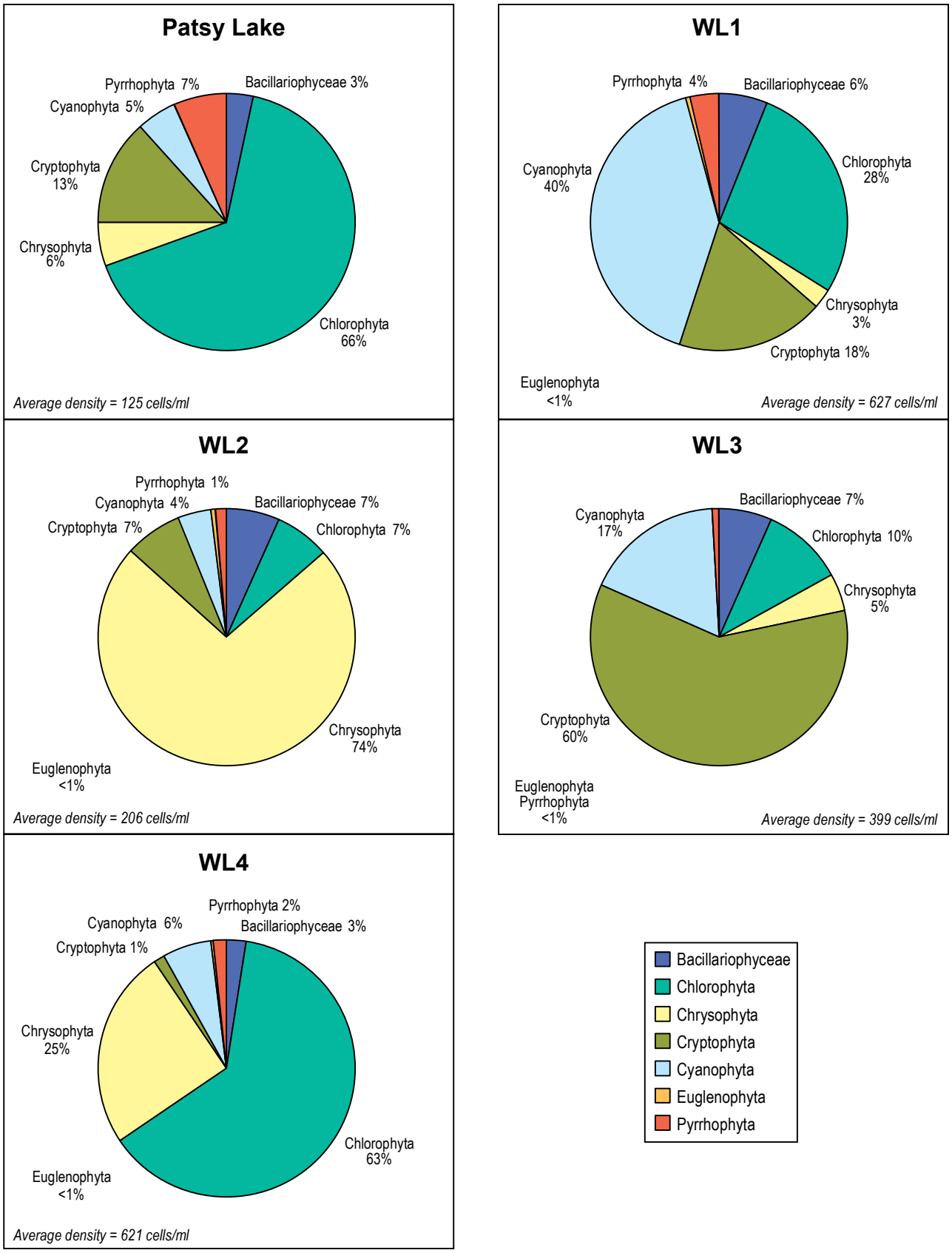
3.8.1 Stream Benthic Invertebrates

In August 2009, benthic invertebrate (benthos) communities were successfully sampled at five stream sites. All benthos taxonomic data can be found in Appendix 3.8-1.

3.8.1.1 Density and Relative Abundance

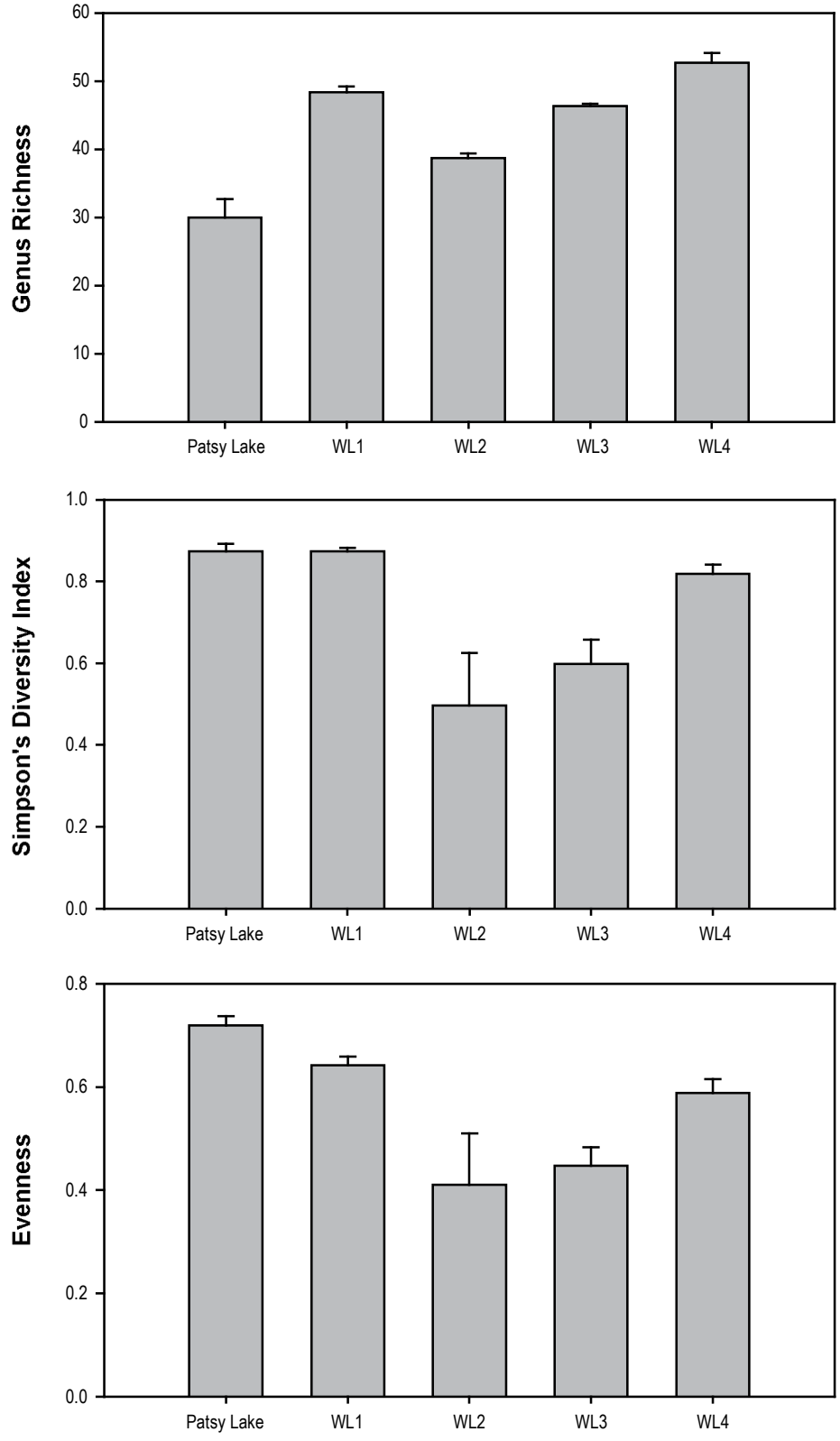
Density of secondary producers is related to the energy available from primary productivity and the grazing pressure from upper trophic level organisms. In addition to the energy transfer from in-stream primary producers (i.e., periphyton), energy from terrestrial primary producers (i.e., allocthanous inputs from overhanging vegetation and riparian shrubs and trees) can also provide considerable contributions to the benthos community at some sites.

The average density of benthic invertebrates ranged from 445 organisms/m^2 at LC1 to 3,909 organisms/m^2 at PC2 (Figure 3.8-1). The density of most samples fell below 1,500 organisms/m^2, where as four of the five samples from PC2 had densities over 3,300 organisms/m^2. It is possible that the dense riparian vegetation and the amount of woody debris at PC2 (Plate 3.8-1) contributed to the relatively high invertebrate densities.



Taxonomic Composition of Phytoplankton Communities, Kitsault Project, August 2009

Figure 3.7-5



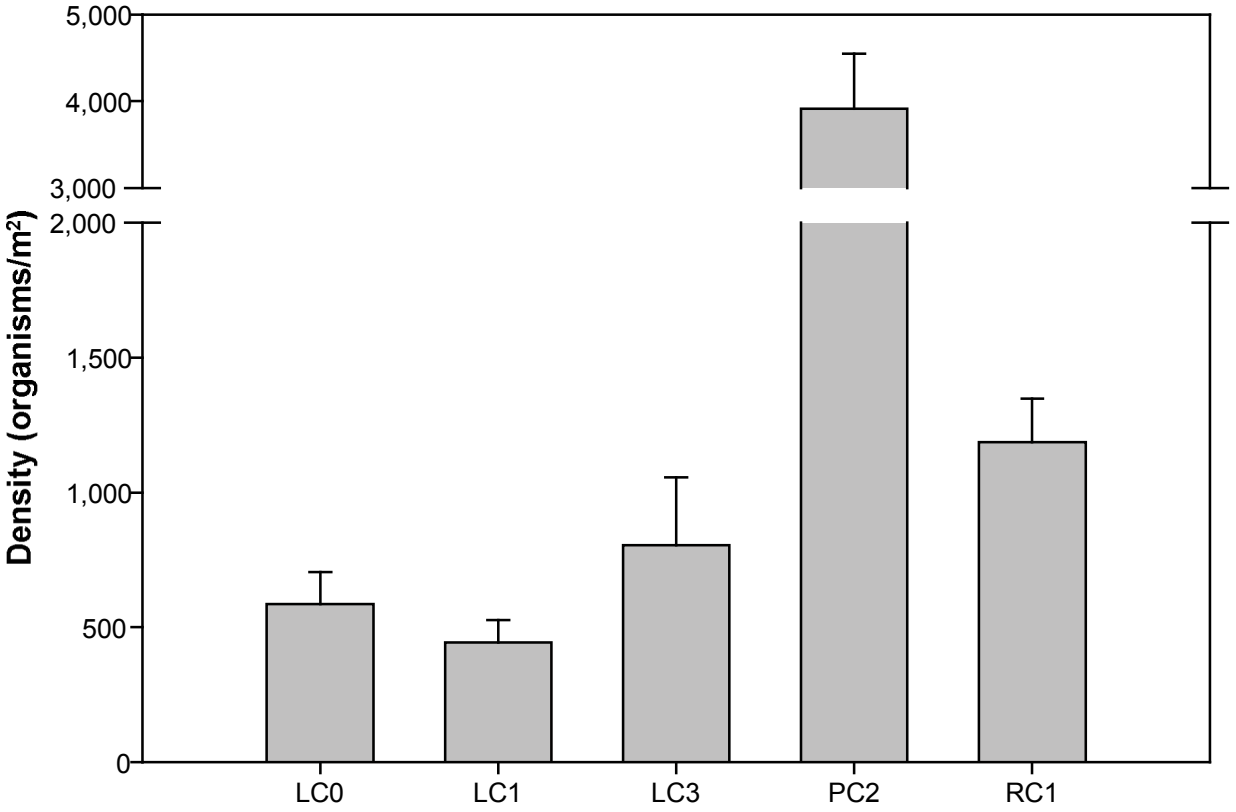
Note: Error bars represent one standard error of the mean.

Pasty Lake and Wetland Phytoplankton Richness, Simpson's Diversity and Evenness, Kitsault Project, August 2009

Figure 3.7-6

AVANTI MINING INC

Rescan™ Engineers & Scientists



Note: Error bars represent one standard error of the mean.

Benthic Invertebrate Density in Streams, Kitsault Project, August 2009

Figure 3.8-1

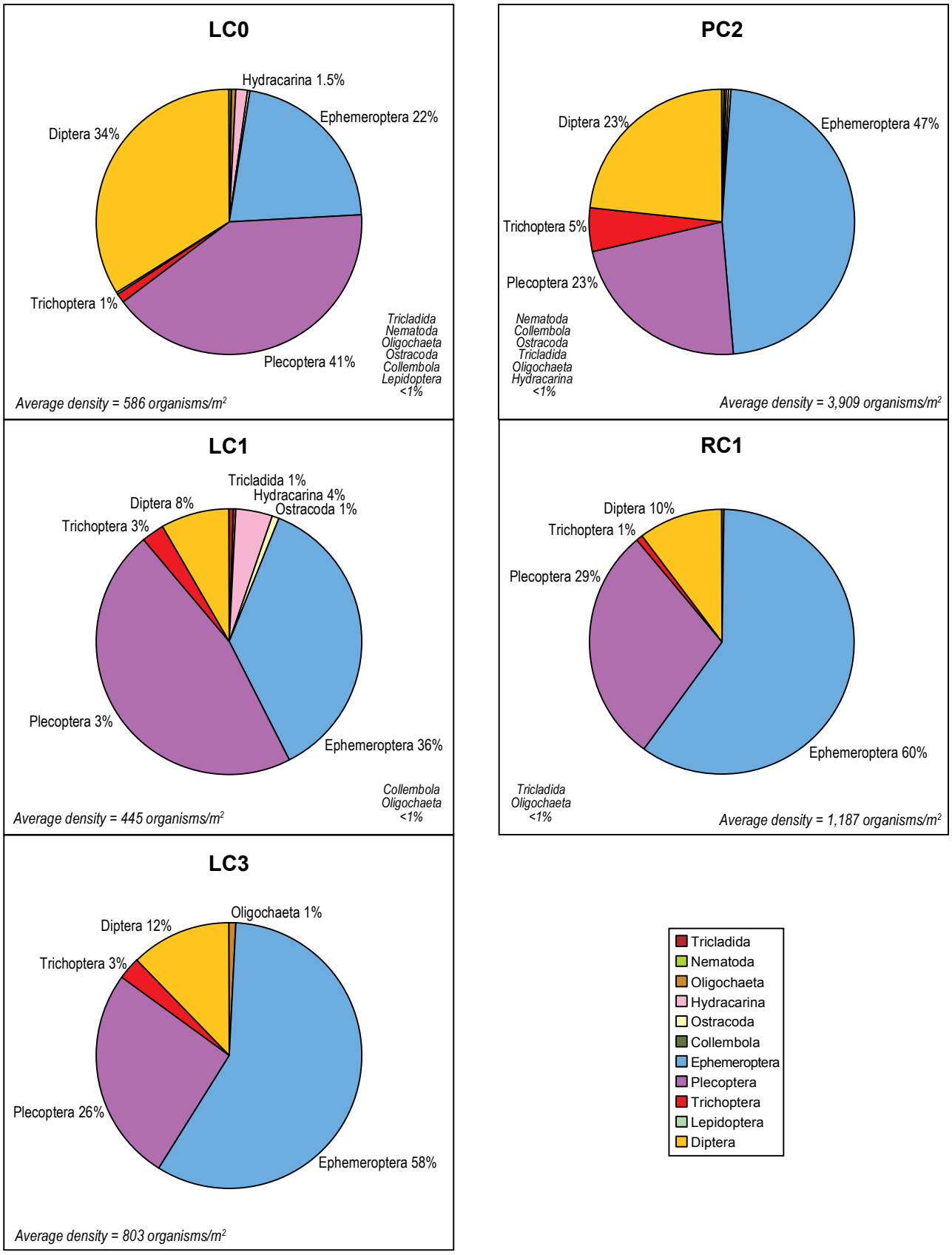
AVANTI MINING INC

Rescan™ Engineers & Scientists

Plate 3.8-1. Riparian Vegetation and large woody debris at PC2.

The most dominant taxonomic groups at each stream site were mayflies (Ephemeroptera), stoneflies (Plecoptera), and dipterans (Figures 3.8-2). The relative abundance of mayflies and stoneflies ranged from 22 to 60% and 23 to 46%, respectively. These two taxonomic groups composed the bulk of the stream benthos communities, but the dipterans (range from 8 to 34%) also made considerable contributions to LC0 and PC2. Eight taxonomic groups composed the remainder of these communities. These included individuals from Trichoptera (up to 5%), Hydracarina (up to 4%), Tricladida (up to 1%), Collembola (<1%), Lepidoptera (<1%), Nematoda (<1%), Oligochaeta (up to 1%), and Ostracoda (up to 1%).

Ephemeropteran, plectopteran, and trichopteran (EPT) taxa are known to be sensitive to environmental stress. For this reason, having a high proportion of these groups indicates relatively favourable environmental conditions. All sampled sites had relatively high proportions of EPT (between 63% and 89% of the community at these stream sites). The reference site, RC1, had the greatest average percent EPT (89%), while LC0 had the lowest.



Relative Abundance of Benthic Invertebrate Taxa at Stream Sites, Kitsault Project, August 2009

Figure 3.8-2

3.8.1.2 Richness, Diversity and Similarity Indices

Average genus richness was generally the same at each stream site with the exception of PC2 (Figure 3.8-3). Most sites had an average richness between 15 and 18 taxa, while the average richness of the PC2 benthos community was 33 taxa. As described above, the visibly increased habitat complexity from the large woody debris likely contributed to the increased density and diversity observed at PC2.

Average Simpson Diversity Index values were very similar at most sites and ranged from 0.79 at LC0 to 0.89 at PC2 (Figure 3.8-3). Average evenness values were also very similar between sites, ranges from 0.71 at LC0 to 0.76 at PC2 (Figure 3.8-3).

The Bray-Curtis similarity coefficient can be useful in determining site similarities based on the type and relative abundance of organisms present. The coefficient ranges from 0 to 100 with 0 being least similar, and 100 being most similar. The similarity matrix between all individual site samples (Appendix 3.8-2) contains the similarities in the benthic community for all site combinations to the median of the reference site (RC1).

Benthic invertebrate communities from each stream were compared to the median of RC1 to determine percent similarity to the reference (Environment Canada 2003). Figure 3.8-4 illustrates these comparisons along with the mean percent similarity of all sites to the reference site median. As would be expected the community at RC1 is most similar (85%) to its own median. Average similarity of all streams to the reference stream benthic community was reasonably high at 57.6%. Average similarity of individual streams to the median of RC1 ranged from 37% to 60% and LC3 was the only site to have a percent similarity to the median of RC1 greater than the average.

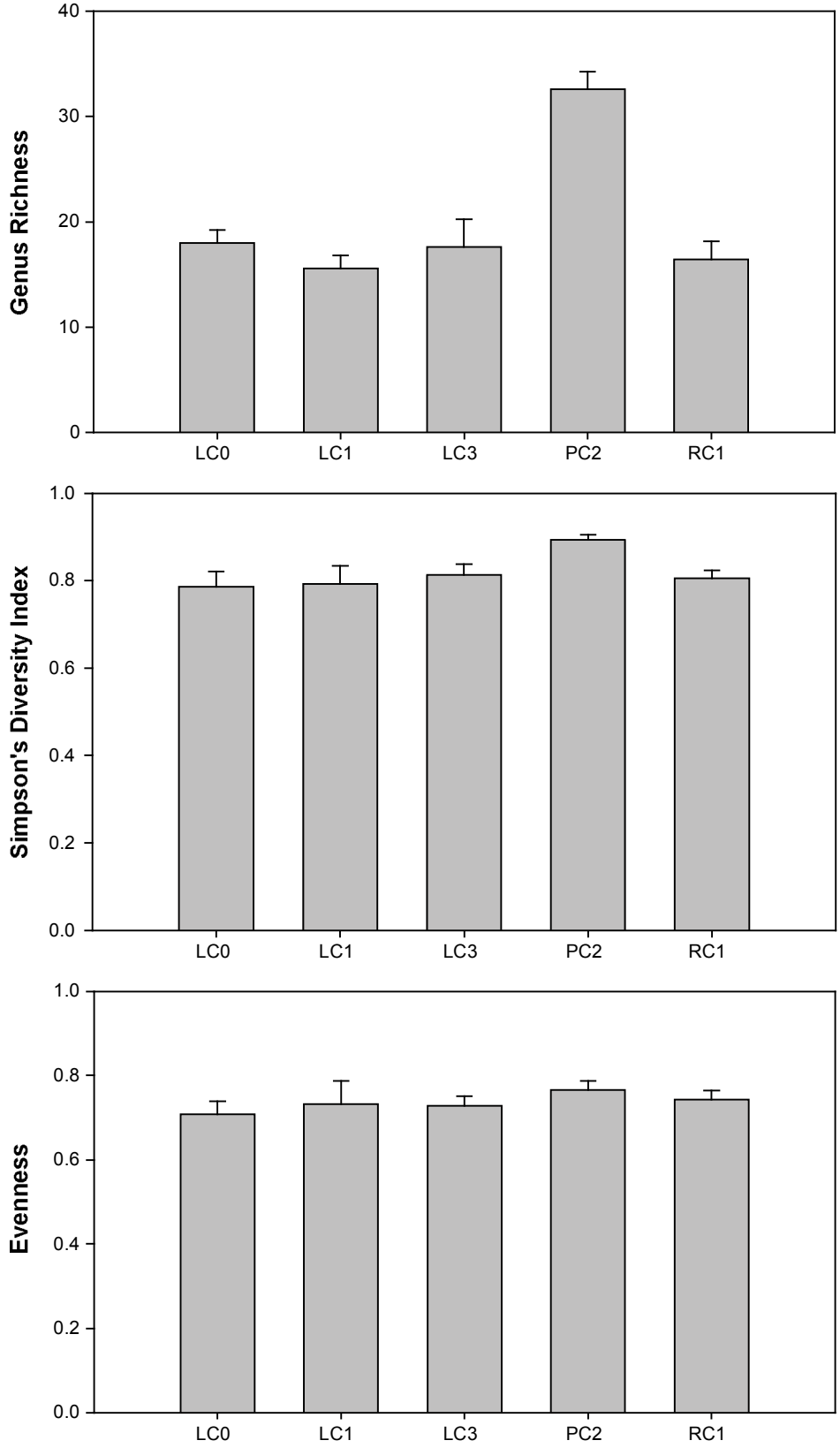
3.8.2 Lake and Wetland Benthic Invertebrates

Benthic invertebrate communities were also sampled at Patsy Lake and four wetland sites. All benthos taxonomic data can be found in Appendix 3.8-1.

3.8.2.1 Density and Relative Abundance

The average density of benthic invertebrates was more variable among lake and wetland sites than stream sites. Average density ranged from 230 organisms/m^2 at Patsy Lake to 6,538 organisms/m^2 at WL2 (Figure 3.8-5). Within site variation was relatively high at WL2 and WL3, indicating the patchy distribution of benthos at these wetlands. The previously described (Section 3.4) hypoxic conditions at Patsy Lake likely contributed to the low invertebrate densities.

The taxonomic groups composing the benthos communities were generally dominated by dipterans (48 to 91%), of which all individuals were from the chironomid family (Figure 3.8-6). Pelecypoda (small bivalves) and Oligochaeta (segmented worms) were also well represented in these communities (5 to 41% and 2 to 21%, respectively). The remaining taxonomic groups (Nematoda, Hirudinea, Hydracarina, Amphipoda, Trichoptera, Odonata, Coleoptera and Hemiptera) contributed less than 5% to the total number of organisms sampled.



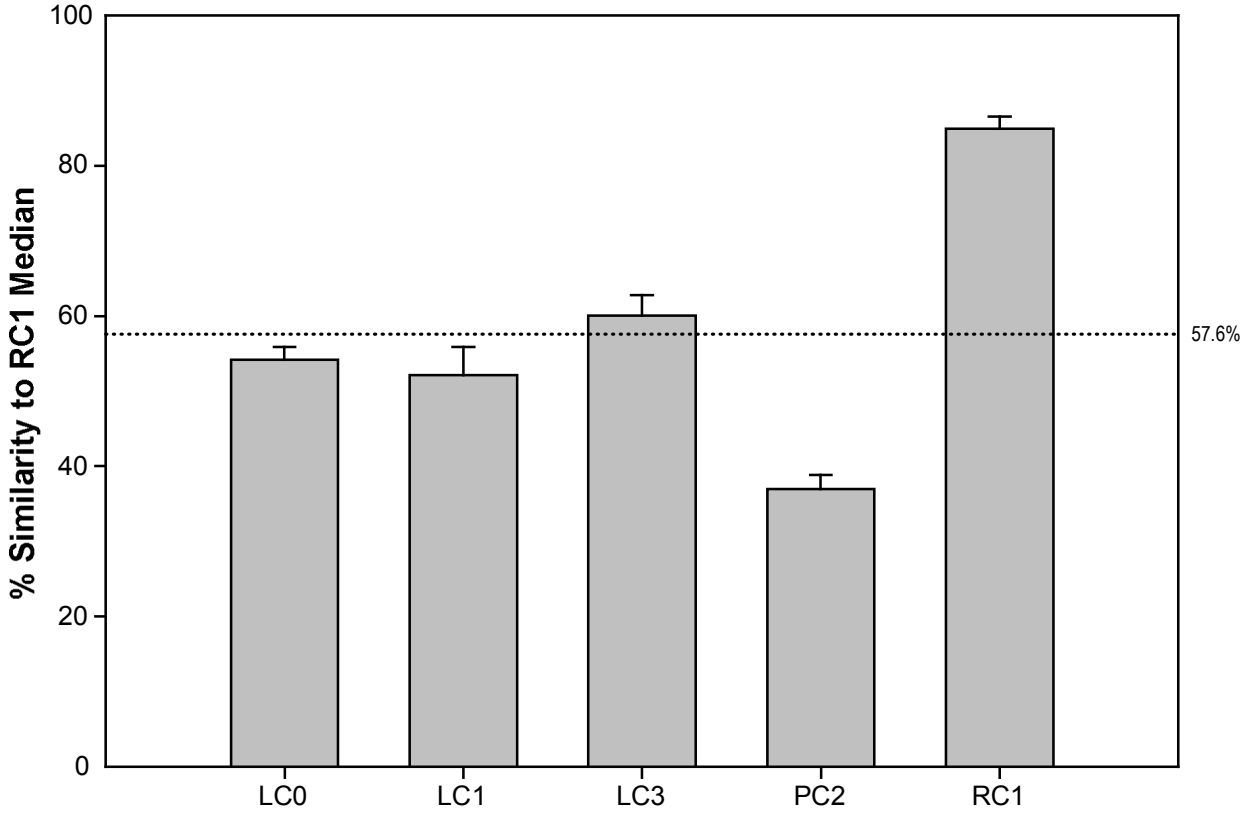
Note: Error bars represent one standard error of the mean.

Average Benthic Invertebrate Richness, Simpson's Diversity and Evenness in Streams, Kitsault Project, August 2009

Figure 3.8-3

AVANTI MINING INC

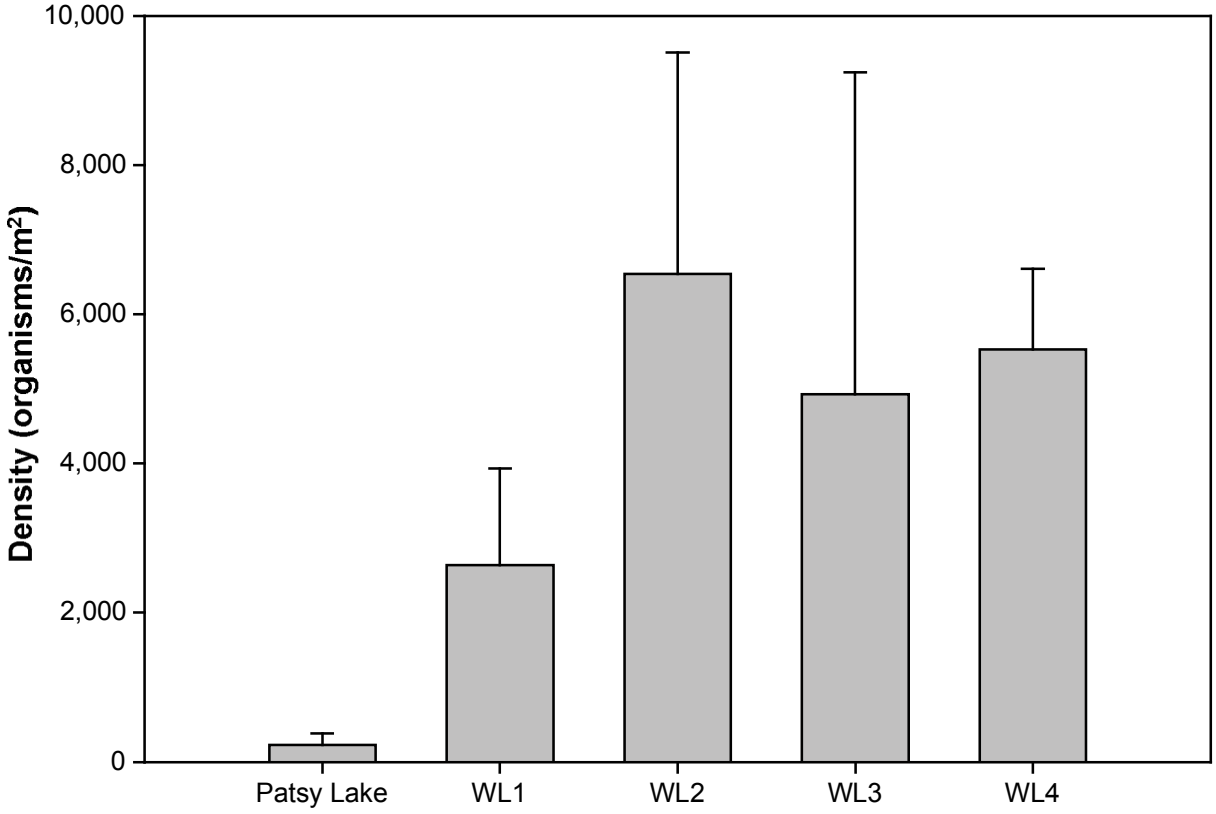
Rescan™ Engineers & Scientists



Note: Error bars represent one standard error of the mean.
Dotted line denotes mean similarity of all sites to the RC1 median.

Bray-Curtis Similarity for Stream Benthic Invertebrate Communities, Kitsault Project, August 2009

Figure 3.8-4



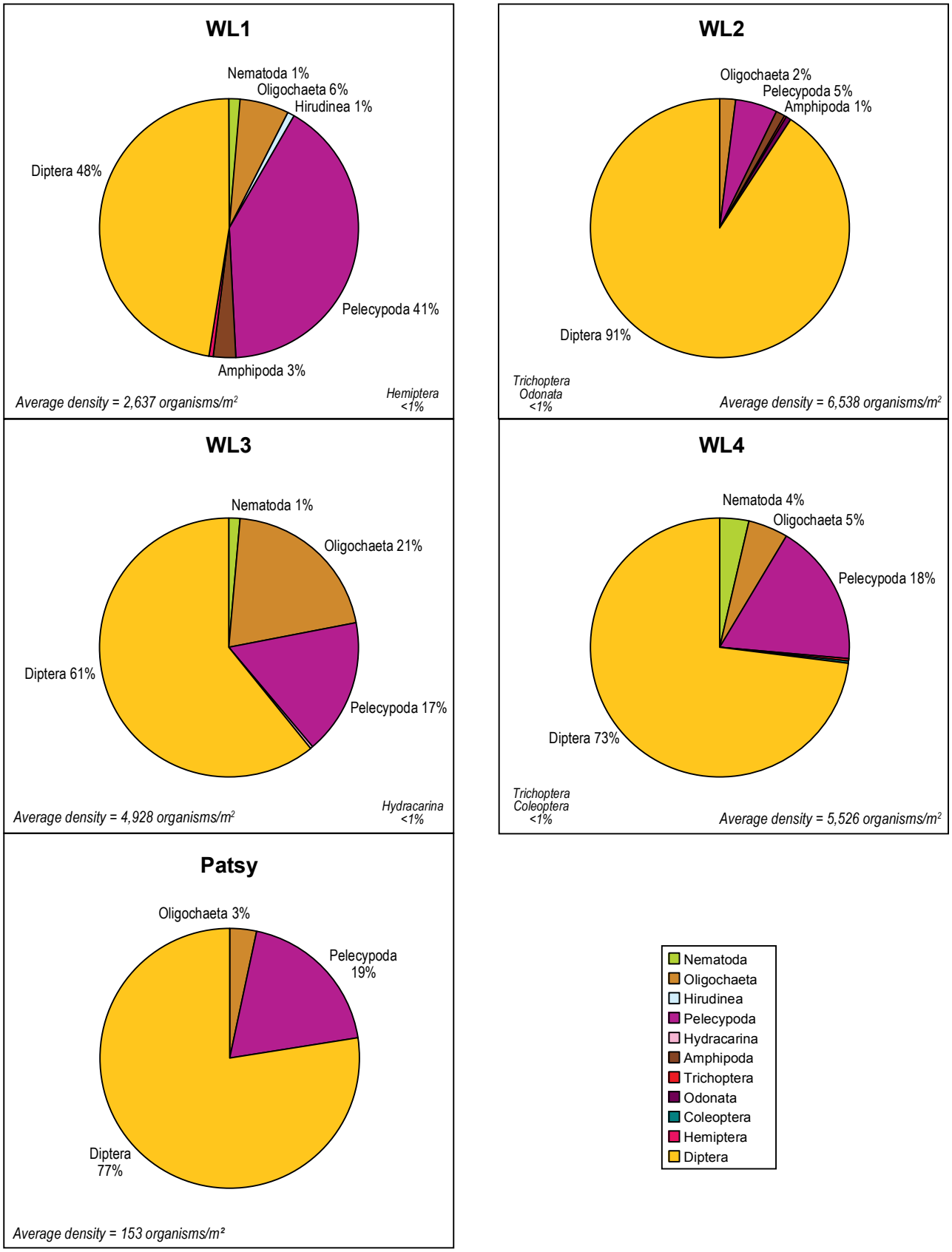
Note: Error bars represent one standard error of the mean.

Benthic Invertebrate Density in Patsy Lake and Wetlands, Kitsault Project, August 2009

Figure 3.8-5

AVANTI MINING INC

Rescan™ Engineers & Scientists



Relative Densities of Benthic Invertebrate Taxa at Lake and Wetland Sites, Kitsault Project, August 2009

Figure 3.8-6

WL2 was particularly interesting as more than 400 individuals from the *Propsilocerus* genus were identified at this site. This is the first description of this genus in North America. The six species that belong to this genus are known to occur in Europe and Asia.

3.8.2.2 Richness and Diversity Indices

As would be expected with such a low number of individuals collected, the taxa richness of Patsy Lake benthos is less than half that observed at other sites. Average genus richness ranged from 4 (Patsy Lake) to 15 (WL4) taxa (Figure 3.8-7).

At most sites the taxa were relatively evenly distributed among the identified taxa (i.e., and evenness value >0.70) (Figure 3.8-7). Evenness ranged from 0.64 (WL2) to 0.79 (Patsy Lake and WL1). The diversity of the benthic invertebrate communities was measured using the Simpson Diversity Index. Average Simpson Diversity Index values ranged from 0.67 at Patsy Lake to 0.82 at WL4 (Figure 3.8-7).

3.8.3 Zooplankton

The zooplankton community in Patsy Lake was sampled in August 2009. Zooplankton were not collected at any of the four wetland sites as they were <2 m, making a quantitative vertical haul difficult. All zooplankton taxonomy data can be found in Appendix 3.8-3, including volume of water column sampled for each of the three replicates for the site.

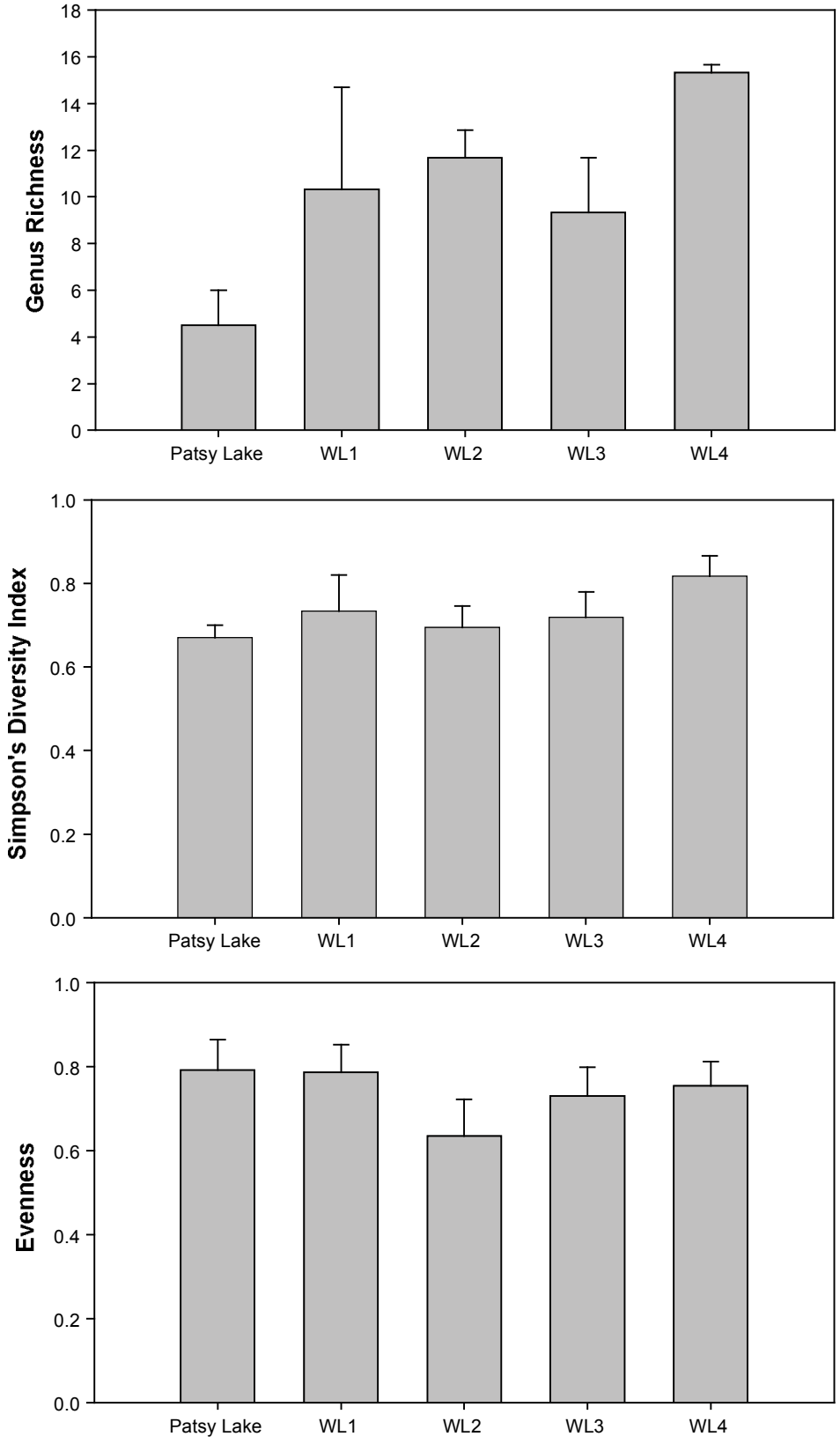
3.8.3.1 Density and Relative Abundance

The average density of zooplankton in Patsy Lake was 19,755 organisms/m^3 (Table 3.8-1). The bulk of the community was composed of Rotifera (80%) and cyclopoid copepods (16%) (Figure 3.8-8). Small proportions of the community consisted of calanoid copepods (2%), Holopedium (2%) and Daphnidae (<1%) and Chaoborus from the insect family. Within the Rotifera phylum identified in the samples, 97% were the species *Kellicottia longispina*.

A sub-sample of this community is visible in Plate 3.8-2. Here the few, large, long-bodied *Chaoborus* sp. can be seen among the soup of copepods, rotifers, and cladocerans.

3.8.3.2 Richness and Diversity Indices

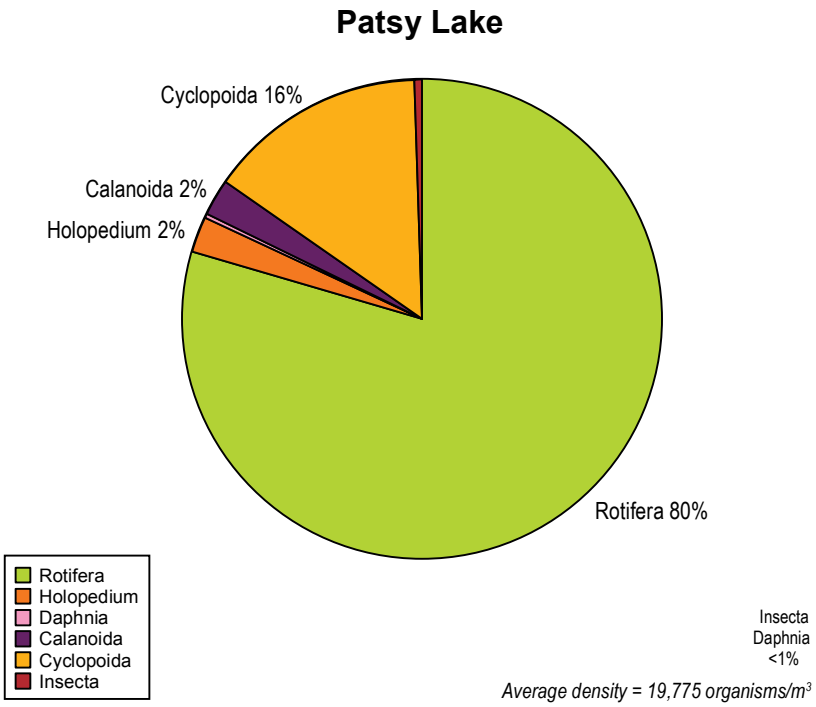
A total of nine genera were identified in each of the three replicates collected at Patsy Lake (Table 3.8-1). The diversity of the zooplankton community was relatively low (i.e., Simpson Diversity of 0.23) as was the taxa evenness (0.26).



Note: Error bars represent one standard error of the mean.

Average Benthic Invertebrate Richness, Simpson's Diversity and Evenness in Patsy Lake and Wetlands, Kitsault Project, August 2009

Figure 3.8-7



Average Density and Relative Abundance for Zooplankton in Patsy Lake, Kitsault Project, August 2009

Figure 3.8-8

Plate 3.8-2. Zooplankton sample from Patsy Lake.

Table 3.8-1. Mean Density, Richness, Diversity and Evenness of Zooplankton in Patsy Lake, 2009

		Density (organisms/m^3)		Genus Richness		Simpson Diversity Index		Evenness	
Site	n	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Patsy Lake	3	19,775	10,053	9	0	0.23	0.1	0.26	0.11

4. Summary

Rescan™
Engineers and Scientists

4. Summary

4.1 STREAM WATER QUALITY

Stream water hardness was generally greatest during winter and just downstream of the pit area (PC5). Most pH values had a tendency towards neutral and were within range of the CCME guideline of 6.5 to 9.0. However, several samples collected at PC1 had a pH below 6.5. Similar to hardness, total dissolved solids (TDS) also were greatest during the winter months at each site.

The majority of the total suspended solid (TSS) samples were close to or below the detection limit with the notable exception of RC1. Patterns of turbidity were similar to TSS with most samples below detection and the greatest turbidity observed at RC1. Dissolved anions (i.e., fluoride and sulphate) followed a similar temporal pattern as TDS with greatest concentrations during the winter months at each site, often peaking at PC5.

Stream nutrients, as nitrate and total phosphate, were generally greatest at the reference site RC1 and followed a similar temporal and spatial pattern to turbidity values. Total organic carbon (TOC) concentrations were more variable across samples but the greatest concentration was observed at RC1 (May).

Total cyanide concentrations were often below detection. Most measurable concentrations were between 0.001 and 0.003 mg/L and LC1 was the only site that exceeded the CCME guideline of 0.005 mg/L.

Several metals that followed the trends of either turbidity or dissolved solids concentrations. Based on the spatial and temporal patterns in their monthly concentrations total aluminum, copper, iron, and manganese were associated with stream turbidity in 2009. Metals that were more associated with TDS included cadmium, molybdenum, and zinc.

The greatest total metal concentrations often occurred at PC5 (adjacent to the pit) during low flow periods or at RC1 during freshet (early June). The BC Maximum guidelines were exceeded by cadmium, chromium, and copper, while the CCME guidelines were exceeded by aluminum, cadmium, chromium, copper, iron, lead, and molybdenum.

4.2 LAKE AND WETLAND WATER QUALITY

Total suspended solids, nutrients, and several anions were at or below the detection limits for all samples. Most site values for pH were within the CCME guidelines except for WL1 and WL4, which had a pH value that fell below 6.5. Nutrient concentrations (total nitrogen and phosphorus) were observed to be greatest at WL1.

Generally, total organic carbon (TOC) concentrations were greater in wetlands than in Patsy Lake, with WL1 have the greatest TOC. Naturally occurring total cyanide concentrations were relatively high as all four wetlands exceeded the CCME guideline and WL2 exceeded the BC Maximum guideline.

Several metal concentrations were close to or below analytical detection limits. Of those with measurable concentrations, many were observed to have greatest concentrations at WL1 (aluminum

and copper) or WL2 (arsenic, cadmium, iron, manganese, and nickel). WL1 exceeded the BC guideline for dissolved aluminum and WL2 exceeded the CCME guidelines for cadmium and iron.

4.3 LIMNOLOGY

The water column of Patsy Lake was thermally stratified at approximately 4 m. Temperature ranged from 15.8oC at the surface to 4.4oC at depth. Dissolved oxygen was from 10.4 to 2.0 mg/L and surface pH was 7.88.

4.4 STREAM SEDIMENT

Large boulders and cobble in many stream beds made it difficult to collect large volumes of sediment at several sites, especially PC1. Within stream depositional zones sediment particle size was composed primarily of sand at each site with considerable proportions of silt and clay at RC1.

Nutrient concentrations (available phosphorus and total nitrogen) in stream sediments were generally low. Total nitrogen (TN) and total organic carbon (TOC) concentrations were considerably greater in the single sample from PC1 than other stream sites.

Analysis of total metal concentrations was completed on the <63 µm fraction of the sediments sampled. Arsenic, iron, and nickel concentrations were considerably greater at PC1 than other sites, perhaps as a result of the low flow conditions at this site during sampling.

Of the 11 metals that have guidelines, 9 (except mercury and selenium) exceeded guidelines at one or more sites. The available ISQG and PEL guidelines for arsenic, cadmium, chromium, copper, and zinc were exceeded at most stream sites. These guidelines were also exceeded for lead in the two lower Lime Creek sites (LC0 and LC1). The available LEL and SEL guidelines for iron and nickel concentrations were exceeded at all stream sites.

4.5 LAKE AND WETLAND SEDIMENT

The primary difference between the lake and wetland sites was the lake bottom was composed of relatively hard clays while all wetland sediments contained substantial organic material. At each site 90% of the sediment was composed of silt and clay. Nutrient concentrations were generally greater at wetland sites than Patsy Lake.

Of the 11 metals that have guidelines 3 (lead, selenium, and silver) generally occurred below detection limits. In the case of almost all metals with measurable concentrations the sediments from Patsy Lake were observed to have the greatest concentrations. The available ISQG and PEL guidelines for arsenic and the ISQG guidelines for cadmium, chromium, copper, mercury, and zinc were exceeded primarily at Patsy Lake, WL2 and WL3. The LEL and the SEL guidelines for iron and nickel were also exceeded.

4.6 PRIMARY PRODUCERS

4.6.1 Stream Periphyton

Average periphyton biomass was greatest at LC1. Generally, the stream sites lower in the watershed had greater periphyton biomass than upper Patsy or Lime Creeks.

Average periphyton density was greatest at PC2. The greatest contribution to the cell density found in all communities came from Cyanophyta species and PC1 also had a considerable contribution from Chlorophyta. Average taxa richness and diversity was greatest at PC1.

4.6.2 Lake and Wetland Phytoplankton

Average biomass at all wetland sites was at least 2.5 times greater than Patsy Lake. Phytoplankton density was greatest at WL1 and WL4.

The structure of the phytoplankton community in the lake and wetlands varied considerably between sites because no taxonomic group dominated these communities. Chlorophyta were the dominant taxa in Patsy Lake and WL4. At WL1, cyanophytes were dominant; WL2 was primarily composed of chrysophytes. Cryptophytes composed the majority of the community at WL3.

Average lake and wetland phytoplankton richness was greatest at WL4. Genus diversity and evenness was highest in Patsy Lake and WL1.

4.7 SECONDARY PRODUCERS

4.7.1 Stream Benthic Invertebrates

The density of most samples fell below 1,500 organisms/m^2, whereas PC2 had an average density of 3,909 organisms/m^2. It is possible that the dense riparian vegetation and the amount of woody debris at this stream site contributed to the relatively high densities observed at PC2.

Ephemeroptera and Plecoptera, which often occur in large numbers in high quality habitat (i.e., minimal contaminants and high dissolved oxygen concentrations), were the dominant (between 63% and 89%) taxonomic groups at each stream site. Dipterans also made considerable contributions to the communities at LC0 and PC2.

Average genus richness at PC2 was approximately twice that observed at other stream sites. Diversity and evenness values were similar among sites but were greatest at PC2. Average Bray-Curtis similarity of all benthic communities to the reference stream (RC1) benthic community was reasonably high. The LC3 community was the only site to have a percent similarity (to the median of RC1) greater than the average.

4.7.2 Lake and Wetland Benthic Invertebrates

There was relatively high within and between site variability in benthic invertebrate density among lake and wetland sites. Average density was greatest at WL2 and within site variation was relatively high at WL2 and WL3, indicating a patchy distribution of benthos at these wetlands.

The lake and wetland benthos communities were generally dominated by dipterans, of which all individuals were from the chironomid family. More than 400 individuals from the *Propsilocerus* genus were identified at WL2. This is the first description of this genus in North America as the six species belonging to this genus are only known to occur in Europe and Asia.

Average taxa richness and diversity was greatest at WL4 with individuals relatively evenly distributed among the identified taxa at each site.

4.7.3 Zooplankton

The zooplankton community from Patsy Lake was sampled in August 2009. The richness and diversity of this community was relatively low with a total of nine genera identified. Contributing to this low diversity was the absence of relatively rare species and a high density (approximately 80% of total individuals) of a single rotifer species, *Kellicottia longispina*. The average density of zooplankton in the lake was 19,755 organisms/m^3.

References

Rescan™
Engineers and Scientists

References

1996. *Mines Act, RSBC*. C. 293.

2002. *Environmental Assessment Act, SBC*. C. 43.

BC MOE. 2004. *British Columbia field sampling manual: 2003 — For continuous monitoring and the collection of air, air-emission, water, wastewater, soil, sediment and biological samples*. http://www.env.gov.bc.ca/air/wamr/labsys/field_man_03.html (accessed March 2004).

BC MOE. 2006. *Ministry of the Environment, Environmental Protection Branch*. http://www.env.gov.bc.ca/wat/wq/BCguidelines/working http://www.env.gov.bc.ca/wat/wq/BCguidelines/approv_wq_guide/approved.html. (accessed August, 2006).

CCME. 1999. *Canadian environmental quality guidelines*. Winnipeg, MB: Canadian Council of Ministers of the Environment.

Clark, K. R. and R. N. Gorley. 2006. *PRIMER v6: User manual/gutorial*. Plymouth, UK: PRIMER-E.

Environment Canada. 2003. *Metal mining guidance document for aquatic environmental effects monitoring*. Ottawa, ON: Environment Canada. http://www.ec.gc.ca/eem/English/MetalMining/Guidance/default.cfm (accessed July 2003).

Looy, L. 2010. Manager, Fraser Environmental Services. Personal Communication, February 15, 2010.

Parsons, T. R., M. Takahashi, and B. Hargrave. 1984. Biological Oceanographic Processes. Oxford, UK: Pergamon Press.

Rescan. 2010. *Kitsault Project: Hydrology baseline report 2009*. Vancouver, BC: Prepared for Avanti Kitsault Mine Ltd. by Rescan Environmental Services Ltd.

RISC. 1997. *Freshwater biological sampling manual*. Victoria, BC: Province of British Columbia, Resources Information Standards Committee.

RISC. 1998. *Lake and stream bottom sediment sampling manual*. Victoria, BC: Province of British Columbia, Resources Information Standards Committee.

Schwindt, C. 2010. Biologist, G3 Consulting. Personal Communication, February 10, 2010.

SYSTAT. 2006. *SigmaPlot for Windows Version 10.0*. Systat Software Inc.

Zloty, J. 2010. Manager, Environmental Research and Consulting. Personal Communication, February 8, 2010.

Appendix 3.1-1

Stream Water Quality Data, 2009

Rescan™
Engineers and Scientists

Appendix 3.1-1. Stream Water Quality Data, 2009

Sample ID	PC5	RC1	LC1	LC3	LC3	PC1	PC5	LC1	RC1	LC1	LC3-DS	RC1	LC-1	RC-1
Date Sampled	21-MAR-09	21-MAR-09	21-MAR-09	21-MAR-09	22-APR-09	22-APR-09	22-APR-09	22-APR-09	22-APR-09	22-MAY-09	22-MAY-09	22-MAY-09	29-MAY-09	29-MAY-09
Time Sampled	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	11:00	11:00
ALS Sample ID	L745862-1	L745862-2	L745862-3	L745898-3	L756271-1	L756271-2	L756271-3	L756271-4	L756271-5	L767698-1	L767698-2	L767698-3	L771139-1	L771139-2
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Physical Tests														
Colour, True	<5.0	<5.0	<5.0	<5.0	17.8	22.2	10.9	24.5	11.8	19.3	15.4	12.4	23.8	19.2
Conductivity	261	81.8	195	161	44.0	15.2	258	154	74.0	108	97.0	44.8	69.9	32.4
Hardness (as CaCO3)	117	36.5	87.8	68.6	19.0	6.30	114	67.9	32.0	44.0	42.5	19.4	28.8	14.2
pH	7.72	7.84	7.86	7.33	7.49	6.42	7.81	7.76	7.69	7.68	6.68	7.76	7.09	7.85
Total Suspended Solids	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	12.0	<3.0	<3.0	<3.0	11.1	18.1
Total Dissolved Solids	171	51	130	96	30	21	157	96	46	70	62	31	47	22
Turbidity	0.23	1.52	0.16	0.18	0.22	0.32	0.27	0.34	11.7	0.68	0.26	0.98	5.16	9.23
Anions and Nutrients														
Acidity (as CaCO3)	3.8	3.2	3.4	3.7	1.3	1.5	1.4	1.2	1.2	2.8	4.4	2.5	3.1	2.1
Alkalinity, Bicarbonate (as CaCO3)	36.9	31.9	40.3	31.0	15.4	5.8	36.7	30.5	24.4	18.2	16.8	16.5	12.8	12.3
Alkalinity, Carbonate (as CaCO3)	<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 CaCO3)	<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 CaCO3)	36.9	31.9	40.3	31.0	15.4	5.8	36.7	30.5	24.4	18.2	16.8	16.5	12.8	12.3
Ammonia as N	<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
Bromide (Br)	<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)	1.44	0.66	1.00	0.72	<0.50	<0.50	0.87	0.72	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride (F)	0.238	0.024	0.107	0.132	<0.020	<0.020	0.234	0.084	0.030	0.086	0.091	0.020	0.080	<0.020
Nitrate (as N)	0.0722	0.204	0.0596	0.0539	0.0669	0.0061	0.0508	0.0438	0.172	0.0128	0.0062	0.109	0.0058	0.0649
Nitrite (as N)	<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	<0.050	<0.050	<0.050	<0.050	0.053	0.064	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.071	0.052
Total Nitrogen	0.09	0.22	0.05	0.05	0.120	0.070	0.080	0.070	0.210	0.050	<0.050	0.140	0.077	0.117
Total Phosphate as P	0.0023	<0.0020	<0.0020	<0.0020	0.0035	<0.0020	<0.0020	0.0022	0.0198	0.0022	<0.0020	0.0023	0.0123	0.0234
Sulfate (SO4)	93.3	9.88	55.8	49.2	4.88	0.52	85.5	40.1	8.95	29.5	25.8	3.36	17.6	2.33
Cyanides														
Cyanide, Total	<0.0010	<0.0014	<0.0010	<0.0010	0.0024	0.0039	0.0028	<0.0010	0.0027	0.0023	<0.0010	<0.0010	0.0022	0.0036
Organic / Inorganic Carbon														
Total Organic Carbon	1.55	1.04	1.68	1.53	3.22	3.96	2.42	4.07	2.52	2.92	2.60	6.12	3.83	3.02
Total Metals														
Aluminum (Al)-Total	0.0145	0.0556	0.0197	0.0288	0.0586	0.0670	0.0306	0.0635	0.545	0.0837	0.0690	0.100	0.363	0.452
Antimony (Sb)-Total	0.00021	<0.00010	0.00059	0.00022	<0.00010	<0.00010	0.00018	0.00030	<0.00010	0.00016	0.00012	<0.00010	0.00017	<0.00010
Arsenic (As)-Total	<0.00010	0.00031	0.00025	0.00037	0.00049	0.00010	0.00014	0.00025	0.00058	0.00019	0.00023	0.00025	0.00046	0.00051
Barium (Ba)-Total	0.0159	0.0136	0.0217	0.0128	0.00523	0.00428	0.0125	0.0159	0.0169	0.00888	0.00657	0.00638	0.0136	0.00981
Beryllium (Be)-Total	<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
Bismuth (Bi)-Total	<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)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)-Total	0.000466	0.000212	0.000150	0.000232	<0.000017	<0.000017	0.000379	0.000173	0.000134	0.000169	0.000207	0.000094	0.000213	0.000118
Calcium (Ca)-Total	36.8	13.6	31.1	23.1	7.20	2.44	33.1	22.1	11.8	14.2	13.0	7.39	9.82	5.50
Chromium (Cr)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00155	<0.00050	<0.00050	<0.00050	0.00116	0.00148
Cobalt (Co)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00032	<0.00010	<0.00010	<0.00010	0.00038	0.00038
Copper (Cu)-Total	<0.00080	<0.00070	<0.0010	<0.00080	0.00086	0.00030	0.00084	0.00186	0.00181	<0.0010	<0.00090	<0.00090	0.00200	0.00162
Iron (Fe)-Total	<0.040	<0.060	<0.030	0.040	0.053	0.075	<0.030	0.056	0.646	0.068	0.052	0.089	0.466	0.606
Lead (Pb)-Total	0.000083	<0.000050	0.000205	0.000208	0.000060	<0.000050	0.000196	0.000571	0.000328	0.000474	0.000204	0.000086	0.00228	0.000512
Lithium (Li)-Total	<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)-Total	8.20	1.31	4.30	4.11	0.443	0.171	8.91	3.51	1.40	2.90	2.79	0.861	2.15	0.794
Manganese (Mn)-Total	0.00392	0.00187	0.00134	0.00224	0.00118	0.0264	0.00350	0.00250	0.0236	0.00354	0.00355	0.00294	0.0263	0.0309
Mercury (Hg)-Total	<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)-Total	0.271	0.0105	0.202	0.185	0.000133	<0.000050	0.266	0.181	0.0290	0.199	0.188	0.00576	0.130	0.00304
Nickel (Ni)-Total	0.00087	0.00084	0.00264	0.00065	0.00073	<0.00050	0.00116	0.00299	0.00229	<0.0020	<0.0010	<0.0010	0.00291	0.00208
Phosphorus (P)-Total	<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)-Total	0.739	0.622	0.562	0.437	0.126	0.081	0.757	0.414	0.624	0.386	0.347	0.403	0.428	0.400
Selenium (Se)-Total	0.00016	0.00024	0.00036	0.00013	0.00013	<0.00010	0.00017	0.00030	0.00034	<0.00010	<0.00010	<0.00010	0.00018	<0.00010
Silicon (Si)-Total	1.95	2.25	1.90	1.66	1.30	0.811	1.77	1.71	2.76	1.25	1.12	1.37	1.45	1.63
Silver (Ag)-Total	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000020	<0.000010

Appendix 3.1-1. Stream Water Quality Data, 2009

Sample ID	PC5	RC1	LC1	LC3	LC3	PC1	PC5	LC1	RC1	LC1	LC3-DS	RC1	LC-1	RC-1
Sodium (Na)-Total	3.0	<2.0	2.1	<2.0	<2.0	<2.0	2.2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Strontium (Sr)-Total	0.608	0.0585	0.343	0.331	0.0420	0.0157	0.491	0.270	0.0545	0.184	0.198	0.0347	0.125	0.0274
Thallium (Tl)-Total	<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)-Total	<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)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.020	<0.010	<0.010	<0.010	0.012	0.013
Uranium (U)-Total	0.00208	0.000135	0.000779	0.000990	0.000013	<0.000010	0.00175	0.000602	0.000225	0.000405	0.000606	0.000196	0.000320	0.000158
Vanadium (V)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0017	<0.0010	<0.0010	<0.0010	<0.0010	0.0012
Zinc (Zn)-Total	0.0157	<0.0020	<0.0040	<0.0080	<0.0020	<0.0020	0.0112	<0.0050	<0.0050	0.0044	0.0058	0.0023	0.0082	0.0053
Dissolved Metals														
Aluminum (Al)-Dissolved	0.0083	0.0182	0.0118	0.0127	0.0509	0.0591	0.0259	0.0520	0.0839	0.0510	0.0563	0.0330	0.0646	0.0568
Antimony (Sb)-Dissolved	0.00019	<0.00010	0.00057	0.00021	<0.00010	<0.00010	0.00017	0.00030	<0.00010	0.00015	0.00011	<0.00010	0.00012	<0.00010
Arsenic (As)-Dissolved	<0.00010	0.00030	0.00024	0.00034	0.00046	<0.00010	0.00012	0.00023	0.00034	0.00017	0.00021	0.00021	0.00017	0.00021
Barium (Ba)-Dissolved	0.0149	0.0127	0.0207	0.0119	0.00490	0.00402	0.0119	0.0154	0.0103	0.00812	0.00622	0.00552	0.00673	0.00471
Beryllium (Be)-Dissolved	<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
Bismuth (Bi)-Dissolved	<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)-Dissolved	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)-Dissolved	0.000435	0.000063	0.000154	0.000201	<0.000017	<0.000017	0.000345	0.000170	0.000099	0.000158	0.000179	0.000079	0.000128	0.000071
Calcium (Ca)-Dissolved	34.3	12.7	28.6	21.3	6.90	2.26	31.5	21.6	10.9	13.3	12.6	6.63	8.60	4.85
Chromium (Cr)-Dissolved	<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
Cobalt (Co)-Dissolved	<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)-Dissolved	0.00051	0.00045	0.00079	0.00046	0.00045	0.00024	0.00067	0.00133	0.00097	0.00082	0.00075	0.00062	0.00084	0.00097
Iron (Fe)-Dissolved	<0.030	<0.030	<0.030	<0.030	0.048	0.051	<0.030	0.041	0.059	0.037	0.035	<0.030	0.052	0.048
Lead (Pb)-Dissolved	<0.000050	<0.000050	0.000138	0.000064	<0.000050	<0.000050	0.000119	0.000449	0.000058	0.000280	0.000109	<0.000050	0.000270	0.000065
Lithium (Li)-Dissolved	<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)-Dissolved	7.62	1.19	3.95	3.75	0.423	0.161	8.51	3.40	1.14	2.61	2.67	0.698	1.77	0.514
Manganese (Mn)-Dissolved	0.00305	0.000674	0.00116	0.000492	0.000652	0.0206	0.00291	0.00183	0.00853	0.00204	0.00237	0.00113	0.00439	0.00592
Mercury (Hg)-Dissolved	<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)-Dissolved	0.254	0.00973	0.189	0.171	0.000115	<0.000050	0.259	0.176	0.0278	0.190	0.181	0.00525	0.120	0.00274
Nickel (Ni)-Dissolved	0.00067	0.00058	0.00222	0.00055	0.00067	<0.00050	0.00109	0.00264	0.00105	0.00115	0.00083	0.00061	0.00115	0.00075
Phosphorus (P)-Dissolved	<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)-Dissolved	0.672	0.555	0.510	0.393	0.112	0.074	0.726	0.395	0.461	0.326	0.331	0.311	0.282	0.272
Selenium (Se)-Dissolved	0.00015	0.00022	0.00025	<0.00010	0.00013	<0.00010	0.00016	0.00019	0.00024	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)-Dissolved	1.91	2.24	1.95	1.71	1.33	0.820	1.80	1.74	1.87	1.22	1.15	1.35	0.975	1.08
Silver (Ag)-Dissolved	<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)-Dissolved	2.9	<2.0	2.0	<2.0	<2.0	<2.0	2.2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Strontium (Sr)-Dissolved	0.560	0.0536	0.322	0.308	0.0403	0.0152	0.467	0.262	0.0499	0.175	0.189	0.0324	0.114	0.0244
Thallium (Tl)-Dissolved	<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)-Dissolved	<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)-Dissolved	<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)-Dissolved	0.00192	0.000129	0.000725	0.000895	<0.000010	<0.000010	0.00167	0.000589	0.000206	0.000362	0.000541	0.000180	0.000248	0.000128
Vanadium (V)-Dissolved	<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
Zinc (Zn)-Dissolved	0.0128	<0.0010	0.0028	0.0062	<0.0010	<0.0010	0.0099	0.0041	0.0012	0.0036	0.0051	0.0012	0.0029	0.0012
Aggregate Organics														
COD	<20	<20	<20	<20	26	<20	<20	21	<20	36	<20	81	<20	<20

Appendix 3.1-1. Stream Water Quality Data, 2009

Sample ID	LC-3	PC-5	PC-1	MINE DISCHARGE	RC-1	LC-1	LC-3	PC-5	RC-1 REP1	LC-1	PC-5	LC-3	RC-1
Date Sampled	29-MAY-09	29-MAY-09	29-MAY-09	29-MAY-09	03-JUN-09	03-JUN-09	03-JUN-09	03-JUN-09	10-JUN-09	10-JUN-09	10-JUN-09	10-JUN-09	18-JUN-09
Time Sampled	11:30	11:30	12:20	12:00	10:30	10:40	11:00	11:00	10:00	10:20	10:30	10:35	13:00
ALS Sample ID	L771139-3	L771139-4	L771139-5	L771139-7	L773249-1	L773249-2	L773249-4	L773249-5	L777432-1	L777432-3	L777432-4	L777432-5	L780931-1
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Physical Tests													
Colour, True	19.2	22.2	28.1	<5.0	13.6	16.9	12.7	19.4	8.6	12.3	21.5	8.1	5.2
Conductivity	18.5	98.0	10.2	508	37.0	56.7	19.1	82.7	29.7	37.1	52.9	17.5	31.0
Hardness (as CaCO3)	7.79	41.9	3.85	269	13.8	22.2	8.06	33.8	14.0	16.5	23.1	7.51	13.1
pH	6.87	7.67	6.14	8.01	7.66	7.77	6.93	7.75	7.15	7.26	7.36	7.44	7.55
Total Suspended Solids	<3.0	<3.0	<3.0	<3.0	179	15.0	16.5	3.0	5.9	3.4	<3.0	<3.0	4.0
Total Dissolved Solids	14	61	12	338	43	38	14	49	26	27	36	15	22
Turbidity	0.83	0.72	0.41	0.18	84.9	5.01	0.65	0.53	3.74	1.77	0.41	0.67	1.74
Anions and Nutrients													
Acidity (as CaCO3)	2.0	2.5	2.6	3.2	3.0	2.4	1.6	1.9	1.8	1.9	1.9	1.7	1.5
Alkalinity, Bicarbonate (as CaCO3)	6.6	16.4	3.3	118	13.0	11.8	6.8	14.7	11.8	9.7	10.8	6.0	12.2
Alkalinity, Carbonate (as CaCO3)	<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 CaCO3)	<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 CaCO3)	6.6	16.4	3.3	118	13.0	11.8	6.8	14.7	11.8	9.7	10.8	6.0	12.2
Ammonia as N	<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
Bromide (Br)	<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)	<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
Fluoride (F)	<0.020	0.144	<0.020	1.16	<0.020	0.066	<0.020	0.123	<0.020	0.023	0.045	<0.020	<0.020
Nitrate (as N)	0.0077	<0.0050	<0.0050	0.0082	0.0598	<0.0050	<0.0050	<0.0050	0.0315	<0.0050	<0.0050	<0.0050	0.0226
Nitrite (as N)	<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	0.052	0.060	0.070	<0.050	<0.050	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Nitrogen	0.060	0.060	0.070	<0.050	0.109	0.050	<0.050	<0.050	0.050	<0.050	<0.050	<0.050	<0.050
Total Phosphate as P	0.0045	0.0068	0.0041	<0.0020	0.145	0.0151	0.0043	0.0071	0.0111	0.0043	0.0027	0.0042	0.0053
Sulfate (SO4)	1.55	26.8	<0.50	150	1.95	12.9	1.75	21.7	2.18	7.36	12.8	1.76	1.71
Cyanides													
Cyanide, Total	0.0028	0.0037	<0.0010	<0.0010	0.0021	0.0026	0.0015	0.0024	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon													
Total Organic Carbon	3.20	3.39	4.09	0.89	2.69	2.48	2.02	2.94	1.51	1.90	2.44	1.39	1.24
Total Metals													
Aluminum (Al)-Total	0.104	0.119	0.0998	0.0066	1.10	0.302	0.0837	0.102	0.108	0.0906	0.0604	0.0424	0.0693
Antimony (Sb)-Total	<0.00010	0.00012	<0.00010	0.00117	0.00019	0.00015	<0.00010	0.00011	<0.00010	0.00012	<0.00010	<0.00010	<0.00010
Arsenic (As)-Total	0.00041	0.00014	<0.00010	<0.00010	0.00116	0.00041	0.00043	0.00012	0.00024	0.00027	<0.00010	0.00042	0.00020
Barium (Ba)-Total	0.00375	0.00741	0.00364	0.0144	0.0365	0.0138	0.00361	0.00698	0.00566	0.00798	0.00565	0.00279	0.00546
Beryllium (Be)-Total	<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
Bismuth (Bi)-Total	<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)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)-Total	0.000061	0.000306	0.000068	0.00146	0.000155	0.000197	0.000037	0.000226	0.000063	0.000089	0.000129	0.000011	0.000062
Calcium (Ca)-Total	3.22	12.8	1.58	76.9	10.6	7.16	3.12	11.1	4.78	5.39	7.06	2.70	4.59
Chromium (Cr)-Total	<0.00050	<0.00050	<0.00050	<0.00050	0.00303	0.00092	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)-Total	<0.00010	<0.00010	<0.00010	<0.00010	0.00150	0.00021	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)-Total	0.00053	0.00111	0.00030	0.00046	0.00426	0.00137	0.00085	0.00110	0.00053	0.00062	0.00063	0.00015	0.00046
Iron (Fe)-Total	0.089	0.127	0.117	<0.030	2.56	0.386	0.152	0.087	0.159	0.087	0.040	<0.030	0.078
Lead (Pb)-Total	0.000163	0.000824	<0.000050	0.000077	0.00238	0.00263	0.000136	0.00127	0.000136	0.00101	0.000239	0.000070	0.000062
Lithium (Li)-Total	<0.0050	<0.0050	<0.0050	0.0064	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)-Total	0.236	3.05	0.125	16.1	1.32	1.39	0.232	2.44	0.550	0.819	1.39	0.199	0.511
Manganese (Mn)-Total	0.0137	0.0127	0.0289	0.00742	0.212	0.0241	0.00651	0.00737	0.00869	0.00824	0.00328	0.00340	0.00441
Mercury (Hg)-Total	<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)-Total	0.000067	0.205	<0.000050	3.36	0.00269	0.0943	0.000112	0.189	0.00268	0.0482	0.0960	0.000079	0.00273
Nickel (Ni)-Total	0.00086	0.00120	0.00056	<0.00050	0.00504	0.00181	0.00082	0.00120	0.00075	0.00097	0.00090	0.00055	0.00060
Phosphorus (P)-Total	<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)-Total	0.145	0.396	0.130	1.62	0.598	0.312	0.088	0.313	0.260	0.176	0.174	0.067	0.262
Selenium (Se)-Total	<0.00010	<0.00010	<0.00010	0.00033	0.00021	0.00022	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011
Silicon (Si)-Total	0.778	1.10	0.639	1.43	3.54	1.50	0.781	1.09	1.15	0.893	0.920	0.693	1.09
Silver (Ag)-Total	<0.000010	0.000013	<0.000010	<0.000010	0.000014	0.000019	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010

Appendix 3.1-1. Stream Water Quality Data, 2009

Sample ID	LC-3	PC-5	PC-1	MINE DISCHARGE	RC-1	LC-1	LC-3	PC-5	RC-1 REP1	LC-1	PC-5	LC-3	RC-1
Sodium (Na)-Total	<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
Strontium (Sr)-Total	0.0185	0.199	0.00947	1.97	0.0477	0.0914	0.0197	0.182	0.0242	0.0688	0.126	0.0173	0.0231
Thallium (Tl)-Total	<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)-Total	<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)-Total	<0.010	<0.010	<0.010	<0.010	0.045	0.017	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Total	0.000013	0.000664	<0.000010	0.0106	0.000257	0.000245	0.000021	0.000544	0.000164	0.000117	0.000277	0.000018	0.000153
Vanadium (V)-Total	<0.0010	<0.0010	<0.0010	<0.0010	0.0044	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)-Total	0.0029	0.0086	0.0018	0.0394	0.0131	0.0067	0.0020	0.0082	0.0021	0.0030	0.0053	<0.0010	0.0014
Dissolved Metals													
Aluminum (Al)-Dissolved	0.0631	0.0622	0.0782	0.0072	0.0965	0.0503	0.0466	0.0600	0.0330	0.0384	0.0530	0.0314	0.0219
Antimony (Sb)-Dissolved	<0.00010	0.00010	<0.00010	0.00114	0.00017	0.00011	<0.00010	<0.00010	<0.00010	0.00012	<0.00010	<0.00010	<0.00010
Arsenic (As)-Dissolved	0.00027	<0.00010	<0.00010	<0.00010	0.00038	0.00018	0.00031	<0.00010	0.00017	0.00019	<0.00010	0.00030	0.00016
Barium (Ba)-Dissolved	0.00295	0.00614	0.00316	0.0148	0.00958	0.00700	0.00313	0.00571	0.00458	0.00636	0.00538	0.00263	0.00475
Beryllium (Be)-Dissolved	<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
Bismuth (Bi)-Dissolved	<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)-Dissolved	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)-Dissolved	0.000012	0.000215	<0.000010	0.00156	0.000037	0.000100	0.000012	0.000176	0.000055	0.000067	0.000130	0.000012	0.000057
Calcium (Ca)-Dissolved	2.79	12.2	1.37	80.1	4.77	6.83	2.88	9.89	4.76	5.29	6.97	2.69	4.47
Chromium (Cr)-Dissolved	<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
Cobalt (Co)-Dissolved	<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)-Dissolved	0.00037	0.00081	0.00023	0.00038	0.00081	0.00064	0.00027	0.00072	0.00042	0.00057	0.00057	0.00021	0.00037
Iron (Fe)-Dissolved	0.043	0.046	0.089	<0.030	0.086	0.033	<0.030	0.031	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Dissolved	<0.000050	0.000147	<0.000050	<0.000050	0.000076	0.000304	<0.000050	0.000128	0.000078	0.000253	0.000125	<0.000050	<0.000050
Lithium (Li)-Dissolved	<0.0050	<0.0050	<0.0050	0.0061	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)-Dissolved	0.198	2.78	0.102	16.7	0.450	1.25	0.209	2.20	0.513	0.796	1.38	0.196	0.474
Manganese (Mn)-Dissolved	0.00363	0.00411	0.0243	0.00739	0.0297	0.00572	0.00250	0.00306	0.00393	0.00379	0.00202	0.00145	0.00195
Mercury (Hg)-Dissolved	<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)-Dissolved	0.000070	0.199	<0.000050	3.44	0.00222	0.0927	0.000094	0.169	0.00288	0.0488	0.0982	0.000096	0.00287
Nickel (Ni)-Dissolved	0.00061	0.00098	0.00050	0.00054	0.00077	0.00088	0.00056	0.00086	0.00055	0.00087	0.00089	0.00051	<0.00050
Phosphorus (P)-Dissolved	<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)-Dissolved	0.114	0.359	0.095	1.68	0.232	0.200	0.074	0.259	0.255	0.171	0.182	0.070	0.249
Selenium (Se)-Dissolved	<0.00010	<0.00010	<0.00010	0.00046	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)-Dissolved	0.770	1.07	0.629	1.42	1.17	0.893	0.715	1.01	0.977	0.803	0.894	0.680	1.01
Silver (Ag)-Dissolved	<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)-Dissolved	<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
Strontium (Sr)-Dissolved	0.0169	0.193	0.00845	2.04	0.0225	0.0878	0.0176	0.160	0.0244	0.0669	0.126	0.0169	0.0233
Thallium (Tl)-Dissolved	<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)-Dissolved	<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)-Dissolved	<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)-Dissolved	<0.000010	0.000587	<0.000010	0.0107	0.000142	0.000177	0.000015	0.000443	0.000148	0.000105	0.000276	0.000014	0.000134
Vanadium (V)-Dissolved	<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
Zinc (Zn)-Dissolved	0.0011	0.0062	0.0011	0.0379	<0.0010	0.0027	<0.0010	0.0060	0.0015	0.0023	0.0047	<0.0010	<0.0010
Aggregate Organics													
COD	<20	22	<20	<20	22	<20	<20	<20	<20	<20	<20	<20	<20

Appendix 3.1-1. Stream Water Quality Data, 2009

Sample ID	LC-1	LC-3	PC-5	PC-6	PC-2	PC-1	RC1-REP1	PC-5	LC-3	PC1	LC1	LC3	RC1
Date Sampled	18-JUN-09	18-JUN-09	18-JUN-09	18-JUN-09	18-JUN-09	18-JUN-09	20-JUL-09	20-JUL-09	20-JUL-09	19-AUG-09	20-AUG-09	20-AUG-09	20-AUG-09
Time Sampled	13:10	13:25	13:30	14:00	13:50	14:10	00:00	00:00	00:00	00:00	00:00	00:00	00:00
ALS Sample ID	L780931-2	L780931-3	L780931-4	L780931-5	L780931-6	L780931-7	L795552-1	L795552-3	L795552-4	L809281-1	L809281-4	L809281-9	L809281-10
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Physical Tests													
Colour, True	7.6	5.6	12.3	10.5	13.1	17.8	<5.0	5.8	<5.0	10.8	8.0	<5.0	<5.0
Conductivity	38.6	18.5	59.4	10.4	21.0	11.8	37.8	173	24.1	12.7	103	34.7	50.8
Hardness (as CaCO3)	15.6	7.68	23.8	4.19	8.44	4.41	18.3	76.8	10.6	5.02	40.8	14.5	22.5
pH	7.44	6.95	7.45	6.78	7.35	6.40	7.43	7.91	8.26	6.70	7.68	6.66	7.82
Total Suspended Solids	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	29	13	37	11	19	13	20	107	14	<10	66	22	33
Turbidity	1.03	0.38	0.26	0.27	0.19	0.41	0.67	0.18	0.19	0.46	0.17	0.15	0.50
Anions and Nutrients													
Acidity (as CaCO3)	1.5	1.3	1.5	1.4	1.5	2.0	4.2	3.9	<1.0	2.5	2.7	3.3	2.7
Alkalinity, Bicarbonate (as CaCO3)	9.8	6.1	11.3	3.7	8.2	3.9	14.6	24.0	6.7	4.2	18.6	10.5	18.9
Alkalinity, Carbonate (as CaCO3)	<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 CaCO3)	<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 CaCO3)	9.8	6.1	11.3	3.7	8.2	3.9	14.6	24.0	6.7	4.2	18.6	10.5	18.9
Ammonia as N	<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
Bromide (Br)	<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)	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.57	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride (F)	0.026	<0.020	0.049	<0.020	<0.020	<0.020	<0.020	0.143	<0.020	<0.020	0.054	<0.020	<0.020
Nitrate (as N)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0377	0.0413	<0.0050	<0.0050	0.0445	0.0097	0.136
Nitrite (as N)	<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	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.060	<0.050	<0.050	<0.050
Total Nitrogen	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.060	0.070	<0.050	0.060	0.070	<0.050	0.130
Total Phosphate as P	0.0216	0.0028	0.0028	0.0037	0.0028	0.0044	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Sulfate (SO4)	7.09	1.91	14.0	0.57	1.22	0.51	2.48	52.6	2.51	<0.50	25.2	4.42	4.38
Cyanides													
Cyanide, Total	<0.0010	<0.0010	0.0014	<0.0010	<0.0010	0.0037	<0.0010	0.0029	<0.0010	0.0028	0.0027	0.0011	0.0015
Organic / Inorganic Carbon													
Total Organic Carbon	1.61	1.34	2.14	1.81	2.15	3.19	0.74	1.42	0.52	2.82	2.06	0.82	1.09
Total Metals													
Aluminum (Al)-Total	0.0526	0.0301	0.0448	0.0493	0.0589	0.0574	0.0308	0.0149	0.0179	0.0424	0.0181	0.0139	0.0287
Antimony (Sb)-Total	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00028	0.00013	<0.00010	0.00041	0.00019	<0.00010
Arsenic (As)-Total	0.00025	0.00039	<0.00010	<0.00010	<0.00010	<0.00010	0.00018	<0.00010	0.00046	<0.00010	0.00027	0.00063	0.00021
Barium (Ba)-Total	0.00857	0.00275	0.00678	0.00270	0.00445	0.00312	0.00709	0.0235	0.00326	0.00326	0.0231	0.00450	0.0109
Beryllium (Be)-Total	<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
Bismuth (Bi)-Total	<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)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)-Total	0.000073	<0.000010	0.000150	<0.000010	<0.000010	<0.000010	0.000084	0.000382	0.000012	<0.000010	0.000106	0.000010	0.000092
Calcium (Ca)-Total	5.07	2.58	7.04	1.43	3.11	1.58	5.81	22.2	3.82	1.71	13.0	5.12	7.32
Chromium (Cr)-Total	<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
Cobalt (Co)-Total	<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)-Total	0.00054	0.00016	0.00080	0.00010	0.00021	0.00011	0.00041	0.00097	0.00014	0.00021	0.00101	0.00023	0.00057
Iron (Fe)-Total	0.052	<0.030	0.033	<0.030	<0.030	0.063	<0.030	<0.030	<0.030	0.036	<0.030	<0.030	<0.030
Lead (Pb)-Total	0.000448	<0.000050	0.000623	<0.000050	<0.000050	<0.000050	<0.000050	0.000223	<0.000050	<0.000050	0.000320	<0.000050	<0.000050
Lithium (Li)-Total	<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)-Total	0.724	0.196	1.38	0.135	0.166	0.120	0.686	5.26	0.286	0.130	1.97	0.344	0.796
Manganese (Mn)-Total	0.00462	0.00221	0.00270	0.00339	0.00106	0.0200	0.00161	0.00154	0.000749	0.0433	0.000922	0.00101	0.00102
Mercury (Hg)-Total	<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)-Total	0.0365	0.000091	0.0801	<0.000050	<0.000050	<0.000050	0.00466	0.230	0.000190	<0.000050	0.0846	0.000262	0.00407
Nickel (Ni)-Total	0.00079	0.00052	0.00072	<0.00050	0.00093	<0.00050	0.00050	0.00055	<0.00050	<0.00050	0.00106	<0.00050	0.00066
Phosphorus (P)-Total	<0.30	<0.30	5.50	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Total	0.155	0.064	8.16	<0.050	<0.050	<0.050	0.353	0.530	0.120	0.054	0.334	0.121	0.452
Selenium (Se)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00015	0.00020	0.00018	<0.00010	0.00010	<0.00010	<0.00010
Silicon (Si)-Total	0.879	0.730	1.00	0.671	0.959	0.620	1.12	1.50	0.731	0.545	1.34	0.957	1.39
Silver (Ag)-Total	<0.000010	<0.000010	0.000342	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010

Appendix 3.1-1. Stream Water Quality Data, 2009

Sample ID	LC-1	LC-3	PC-5	PC-6	PC-2	PC-1	RC1-REP1	PC-5	LC-3	PC1	LC1	LC3	RC1
Sodium (Na)-Total	<2.0	<2.0	11.1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Strontium (Sr)-Total	0.0575	0.0166	0.117	0.0103	0.0165	0.0105	0.0309	0.466	0.0242	0.0122	0.165	0.0332	0.0390
Thallium (Tl)-Total	<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)-Total	<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)-Total	<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)-Total	0.000100	0.000016	0.000281	<0.000010	<0.000010	<0.000010	0.000116	0.000520	0.000010	<0.000010	0.000117	<0.000010	0.000110
Vanadium (V)-Total	<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
Zinc (Zn)-Total	0.0022	<0.0010	0.0057	<0.0010	<0.0010	<0.0010	0.0013	0.0108	<0.0010	<0.0010	0.0031	<0.0010	0.0013
Dissolved Metals													
Aluminum (Al)-Dissolved	0.0259	0.0239	0.0395	0.0438	0.0539	0.0489	0.0239	0.0127	0.0078	0.0308	0.0143	0.0092	0.0134
Antimony (Sb)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00028	0.00015	<0.00010	0.00041	0.00018	<0.00010
Arsenic (As)-Dissolved	0.00020	0.00033	<0.00010	<0.00010	<0.00010	<0.00010	0.00016	<0.00010	0.00042	<0.00010	0.00027	0.00062	0.00021
Barium (Ba)-Dissolved	0.00734	0.00278	0.00679	0.00263	0.00439	0.00303	0.00679	0.0229	0.00326	0.00281	0.0226	0.00462	0.0109
Beryllium (Be)-Dissolved	<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
Bismuth (Bi)-Dissolved	<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)-Dissolved	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)-Dissolved	0.000068	<0.000010	0.000153	<0.000010	<0.000010	<0.000010	0.000085	0.000347	0.000023	<0.000010	0.000109	<0.000010	0.000091
Calcium (Ca)-Dissolved	5.05	2.74	7.18	1.45	3.10	1.57	6.14	22.0	3.79	1.79	13.1	5.21	7.63
Chromium (Cr)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00074	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)-Dissolved	<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)-Dissolved	0.00045	0.00015	0.00065	0.00014	0.00024	0.00011	0.00041	0.00091	0.00023	0.00035	0.00093	0.00020	0.00053
Iron (Fe)-Dissolved	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Dissolved	0.000176	<0.000050	0.000143	<0.000050	<0.000050	<0.000050	<0.000050	0.000098	<0.000050	<0.000050	0.000206	<0.000050	<0.000050
Lithium (Li)-Dissolved	<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)-Dissolved	0.719	0.204	1.43	0.136	0.168	0.119	0.709	5.29	0.288	0.132	1.96	0.363	0.835
Manganese (Mn)-Dissolved	0.00240	0.000917	0.00167	0.000924	0.000472	0.0140	0.000600	0.000693	0.000391	0.000478	0.000483	0.000187	0.000491
Mercury (Hg)-Dissolved	<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)-Dissolved	0.0374	0.000116	0.0849	<0.000050	<0.000050	<0.000050	0.00544	0.222	0.000207	<0.000050	0.0843	0.000265	0.00440
Nickel (Ni)-Dissolved	0.00074	0.00051	0.00083	<0.00050	0.00099	<0.00050	<0.00050	0.00054	<0.00050	<0.00050	0.00106	<0.00050	0.00064
Phosphorus (P)-Dissolved	<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)-Dissolved	0.147	0.071	0.193	<0.050	<0.050	0.051	0.371	0.534	0.134	0.062	0.340	0.125	0.474
Selenium (Se)-Dissolved	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	0.00010	0.00010	0.00013	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)-Dissolved	0.837	0.713	0.983	0.654	0.970	0.609	1.11	1.47	0.712	0.528	1.30	0.959	1.33
Silver (Ag)-Dissolved	<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)-Dissolved	<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
Strontium (Sr)-Dissolved	0.0565	0.0172	0.121	0.0103	0.0166	0.0109	0.0317	0.450	0.0232	0.0123	0.163	0.0339	0.0396
Thallium (Tl)-Dissolved	<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)-Dissolved	<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)-Dissolved	<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)-Dissolved	0.000092	0.000014	0.000272	<0.000010	<0.000010	<0.000010	0.000097	0.000504	<0.000010	<0.000010	0.000110	<0.000010	0.000102
Vanadium (V)-Dissolved	<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
Zinc (Zn)-Dissolved	0.0020	<0.0010	0.0053	<0.0010	<0.0010	<0.0010	0.0018	0.0100	0.0014	<0.0010	<0.0040	<0.0010	<0.0020
Aggregate Organics													
COD	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20

Appendix 3.1-1. Stream Water Quality Data, 2009

Sample ID	LC1	RC1	LC3	PC5	RC-1	LC-1	LC-3	PC-5	PC-2	PC-1	RC1-ROUNDY CK	PC5-PATSY CK
Date Sampled	22-SEP-09	22-SEP-09	22-SEP-09	22-SEP-09	21-OCT-09	21-OCT-09	21-OCT-09	21-OCT-09	21-OCT-09	21-OCT-09	19-NOV-09	19-NOV-09
Time Sampled	19:00	19:00	19:00	19:00	11:05	11:30	11:45	11:50	12:15	12:30	12:00	12:00
ALS Sample ID	L822952-1	L822952-3	L822952-4	L822952-5	L832725-1	L832725-2	L832725-4	L832725-5	L832725-6	L832725-7	L842206-1	L842206-2
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Physical Tests												
Colour, True	27.0	13.1	13.6	16.2	<5.0	<5.0	<5.0	<5.0	<5.0	15.5	<5.0	<5.0
Conductivity	120	52.9	30.3	202	76.1	186	45.5	273	57.7	15.6	76.0	279
Hardness (as CaCO3)	50.7	22.4	13.1	88.6	33.4	82.3	18.9	121	22.1	6.24	34.6	127
pH	7.48	7.77	7.70	7.70	7.85	7.80	7.74	7.76	7.77	5.92	7.56	7.71
Total Suspended Solids	3.5	<3.0	<3.0	6.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	87	25	33	119	36	98	24	157	31	<10	44	181
Turbidity	1.10	2.40	0.31	0.30	0.55	0.25	0.20	0.36	<0.10	0.55	0.47	0.11
Anions and Nutrients												
Acidity (as CaCO3)	3.2	1.9	1.7	2.6	1.8	2.1	1.6	2.3	1.9	2.0	3.2	1.7
Alkalinity, Bicarbonate (as CaCO3)	20.3	18.2	9.3	27.1	25.2	29.7	13.0	33.9	21.6	5.8	26.5	33.8
Alkalinity, Carbonate (as CaCO3)	<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 CaCO3)	<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 CaCO3)	20.3	18.2	9.3	27.1	25.2	29.7	13.0	33.9	21.6	5.8	26.5	33.8
Ammonia as N	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Bromide (Br)	<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)	<0.50	<0.50	<0.50	<0.50	1.19	1.50	1.21	1.74	1.69	<0.50	0.54	0.86
Fluoride (F)	0.054	<0.020	<0.020	0.140	<0.020	0.101	<0.020	0.248	0.023	<0.020	<0.020	0.246
Nitrate (as N)	0.0189	0.117	<0.0050	0.0132	0.138	0.0395	0.0099	0.0505	0.0416	0.0088	0.181	0.0355
Nitrite (as N)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0021	<0.0010	<0.0010
Total Kjeldahl Nitrogen	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Nitrogen	0.050	0.120	<0.050	<0.050	0.140	0.050	<0.050	0.070	0.050	<0.050	0.210	0.060
Total Phosphate as P	0.0024	0.0048	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Sulfate (SO4)	33.4	5.26	3.02	66.4	7.64	53.0	5.32	90.7	3.05	0.51	9.09	99.4
Cyanides												
Cyanide, Total	0.0051	0.0036	0.0027	0.0042	0.0013	0.0016	0.0014	0.0014	<0.0010	0.0041	0.0014	0.0019
Organic / Inorganic Carbon												
Total Organic Carbon	4.70	3.04	2.53	3.80	1.19	1.67	1.27	1.70	1.54	3.15	1.46	1.91
Total Metals												
Aluminum (Al)-Total	0.109	0.177	0.0459	0.0534	0.0270	0.0130	0.0165	0.0136	0.0322	0.0443	0.0384	0.0146
Antimony (Sb)-Total	0.00023	<0.00010	0.00013	0.00016	<0.00010	0.00044	0.00013	0.00027	<0.00010	<0.00010	<0.00010	0.00024
Arsenic (As)-Total	0.00031	0.00029	0.00060	0.00010	0.00025	0.00027	0.00055	<0.00010	0.00015	0.00011	0.00019	<0.00010
Barium (Ba)-Total	0.0181	0.00972	0.00429	0.0148	0.0133	0.0254	0.00523	0.0214	0.00904	0.00466	0.0118	0.0187
Beryllium (Be)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Total	<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)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)-Total	0.000141	0.000081	0.000011	0.000388	0.000113	0.000174	0.000010	0.000519	0.000016	<0.000010	0.000068	0.000480
Calcium (Ca)-Total	17.0	7.80	4.66	24.1	11.7	25.9	6.96	35.8	7.39	2.03	11.6	36.8
Chromium (Cr)-Total	<0.00050	0.00054	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)-Total	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)-Total	0.00174	0.00140	0.00045	0.00135	0.00059	0.00079	0.00035	0.00090	0.00032	0.00025	0.00064	0.00086
Iron (Fe)-Total	0.110	0.213	<0.030	0.057	0.056	<0.030	<0.030	<0.030	<0.030	0.143	<0.030	<0.030
Lead (Pb)-Total	0.000835	0.000147	0.000052	0.000286	<0.000050	0.000129	<0.000050	0.000122	<0.000050	<0.000050	<0.000050	0.000117
Lithium (Li)-Total	<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)-Total	2.88	0.862	0.323	5.48	1.64	5.54	0.617	10.5	0.499	0.150	1.24	8.33
Manganese (Mn)-Total	0.00530	0.00773	0.00220	0.00482	0.000860	0.000409	0.000820	0.00213	0.00113	0.152	0.000929	0.00215
Mercury (Hg)-Total	<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)-Total	0.143	0.0122	0.000154	0.269	0.00720	0.174	0.000164	0.407	0.000116	0.000072	0.0101	0.405
Nickel (Ni)-Total	0.00222	0.00135	0.00069	0.00103	0.00086	0.00199	0.00065	0.00105	0.00108	<0.00050	0.00073	0.00061
Phosphorus (P)-Total	<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)-Total	0.387	0.380	0.124	0.499	0.522	0.483	0.184	0.738	0.079	<0.050	0.444	0.671
Selenium (Se)-Total	0.00017	0.00024	0.00017	0.00018	0.00026	0.00020	<0.00010	0.00014	<0.00010	<0.00010	0.00030	<0.00010
Silicon (Si)-Total	1.62	1.77	1.14	1.54	1.55	1.57	1.25	1.66	1.73	0.636	1.75	1.70
Silver (Ag)-Total	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010

Appendix 3.1-1. Stream Water Quality Data, 2009

Sample ID	LC1	RC1	LC3	PC5	RC-1	LC-1	LC-3	PC-5	PC-2	PC-1	RC1-ROUNDY CK	PC5-PATSY CK
Sodium (Na)-Total	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.1	2.4	<2.0	<2.0	<2.0
Strontium (Sr)-Total	0.220	0.0413	0.0290	0.435	0.0724	0.430	0.0432	0.860	0.0443	0.0149	0.0597	0.727
Thallium (Tl)-Total	<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)-Total	<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)-Total	<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)-Total	0.000319	0.000206	0.000017	0.00124	0.000114	0.000400	<0.000010	0.00170	<0.000010	<0.000010	0.000161	0.00226
Vanadium (V)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)-Total	0.0049	0.0027	<0.0010	0.0116	<0.0010	0.0036	<0.0010	0.0131	0.0012	<0.0010	<0.0010	0.0128
Dissolved Metals												
Aluminum (Al)-Dissolved	0.0610	0.0423	0.0392	0.0491	0.0101	0.0107	0.0135	0.0105	0.0199	0.0416	-	0.0141
Antimony (Sb)-Dissolved	0.00022	<0.00010	0.00013	0.00017	<0.00010	0.00040	0.00013	0.00026	<0.00010	<0.00010	<0.00010	0.00023
Arsenic (As)-Dissolved	0.00027	0.00023	0.00056	<0.00010	<0.00030	<0.00030	0.00051	<0.00020	<0.00020	<0.00030	0.00018	<0.00010
Barium (Ba)-Dissolved	0.0161	0.00842	0.00437	0.0158	0.0128	0.0251	0.00514	0.0210	0.00887	0.00460	0.0115	0.0189
Beryllium (Be)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<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)-Dissolved	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)-Dissolved	0.000120	0.000075	0.000012	0.000411	0.000106	0.000178	<0.000010	0.000488	<0.000010	<0.000010	0.000085	0.000452
Calcium (Ca)-Dissolved	15.9	7.66	4.71	26.0	10.9	24.4	6.62	32.8	7.96	2.23	11.8	37.2
Chromium (Cr)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)-Dissolved	<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)-Dissolved	0.00138	0.00104	<0.00060	0.00143	<0.00050	<0.00080	<0.00040	<0.00090	<0.00040	<0.00030	-	0.00084
Iron (Fe)-Dissolved	0.046	<0.030	<0.030	0.045	<0.030	<0.030	<0.030	<0.030	<0.030	0.063	<0.030	<0.030
Lead (Pb)-Dissolved	0.000531	<0.000050	<0.000050	0.000136	<0.000050	0.000101	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000054
Lithium (Li)-Dissolved	<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)-Dissolved	2.68	0.796	0.320	5.77	1.52	5.20	0.578	9.59	0.539	0.163	1.24	8.33
Manganese (Mn)-Dissolved	0.00175	0.00268	0.000801	0.00359	0.000442	0.000340	0.000274	0.00129	0.000299	0.128	0.000644	0.00179
Mercury (Hg)-Dissolved	<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)-Dissolved	0.134	0.0118	0.000174	0.297	0.00725	0.171	0.000175	0.400	0.000052	<0.000050	0.0106	0.416
Nickel (Ni)-Dissolved	0.00180	0.00096	0.00068	0.00118	<0.0010	0.00188	<0.0010	0.00111	0.00112	<0.00050	0.00076	0.00069
Phosphorus (P)-Dissolved	<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)-Dissolved	0.349	0.347	0.128	0.538	0.476	0.446	0.175	0.662	0.108	0.054	0.443	0.678
Selenium (Se)-Dissolved	0.00012	0.00021	<0.00010	0.00016	0.00025	0.00016	<0.00010	<0.00010	<0.00010	<0.00010	0.00021	0.00011
Silicon (Si)-Dissolved	1.53	1.61	1.11	1.51	1.53	1.55	1.25	1.64	1.72	0.666	1.69	1.64
Silver (Ag)-Dissolved	<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)-Dissolved	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	2.4	<2.0	<2.0	<2.0
Strontium (Sr)-Dissolved	0.205	0.0407	0.0290	0.470	0.0693	0.417	0.0418	0.826	0.0449	0.0156	0.0592	0.742
Thallium (Tl)-Dissolved	<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)-Dissolved	<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)-Dissolved	<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)-Dissolved	0.000297	0.000191	0.000015	0.00133	0.000110	0.000413	<0.000010	0.00181	<0.000010	<0.000010	0.000163	0.00229
Vanadium (V)-Dissolved	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)-Dissolved	0.0040	0.0017	<0.0010	0.0120	<0.0010	0.0033	<0.0010	0.0113	<0.0010	<0.0010	<0.0010	0.0121
Aggregate Organics												
COD	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20		

Appendix 3.1-1. Stream Water Quality Data, 2009

Sample ID	LC3-UPPER LIME CK	LCO-LOWER LIME CK	LC-1	LC-3	RC-1
Date Sampled	19-NOV-09	19-NOV-09	21-DEC-09	21-DEC-09	21-DEC-09
Time Sampled	12:00	12:00	11:58	11:20	11:37
ALS Sample ID	L842206-3	L842206-4	L850374-1	L850374-2	L850374-3
Matrix	Water	Water	Water	Water	Water
Physical Tests					
Colour, True	<5.0	<5.0	<5.0	<5.0	<5.0
Conductivity	41.4	185	216	50.2	81.1
Hardness (as CaCO3)	17.9	80.2	99.4	22.4	36.9
pH	7.39	7.71	7.84	7.62	7.71
Total Suspended Solids	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	23	119	144	33	48
Turbidity	0.12	<0.10	0.10	0.11	1.23
Anions and Nutrients					
Acidity (as CaCO3)	1.5	1.6	1.7	1.4	1.6
Alkalinity, Bicarbonate (as CaCO3)	13.5	30.8	38.6	15.9	27.4
Alkalinity, Carbonate (as CaCO3)	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as CaCO3)	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as CaCO3)	13.5	30.8	38.6	15.9	27.4
Ammonia as N	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Bromide (Br)	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	<0.50	0.72	0.79	<0.50	<0.50
Fluoride (F)	<0.020	0.096	0.089	<0.020	<0.020
Nitrate (as N)	0.0214	0.0379	0.0810	0.0543	0.252
Nitrite (as N)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	<0.050	<0.050	<0.050	<0.050	<0.050
Total Nitrogen	0.050	0.070	0.110	0.070	0.280
Total Phosphate as P	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Sulfate (SO4)	5.21	55.2	65.8	6.47	9.43
Cyanides					
Cyanide, Total	0.0013	0.0020	0.0020	0.0015	0.0013
Organic / Inorganic Carbon					
Total Organic Carbon	1.65	2.34	1.60	1.25	0.96
Total Metals					
Aluminum (Al)-Total	0.0211	0.0192	0.0121	0.0155	0.0584
Antimony (Sb)-Total	0.00011	0.00031	0.00047	0.00015	<0.00010
Arsenic (As)-Total	0.00047	0.00020	0.00022	0.00058	0.00023
Barium (Ba)-Total	0.00460	0.0202	0.0250	0.00530	0.0137
Beryllium (Be)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)-Total	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)-Total	<0.000010	0.000163	0.000170	<0.000017	0.000094
Calcium (Ca)-Total	6.55	25.5	30.8	8.01	12.0
Chromium (Cr)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)-Total	0.00038	0.00097	0.00077	0.00034	0.00054
Iron (Fe)-Total	<0.030	<0.030	<0.030	<0.030	0.051
Lead (Pb)-Total	<0.000050	0.000173	0.000140	<0.000050	<0.000050
Lithium (Li)-Total	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)-Total	0.438	4.29	5.10	0.522	1.36
Manganese (Mn)-Total	0.000690	0.000981	0.00101	0.000568	0.00159
Mercury (Hg)-Total	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Total	0.000341	0.189	0.186	0.000165	0.00996
Nickel (Ni)-Total	0.00052	0.00202	0.00243	<0.00050	0.00077
Phosphorus (P)-Total	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Total	0.111	0.426	0.489	0.139	0.483
Selenium (Se)-Total	<0.00010	0.00018	0.00022	<0.00020	0.00024
Silicon (Si)-Total	1.36	1.71	1.79	1.50	1.93
Silver (Ag)-Total	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010

Appendix 3.1-1. Stream Water Quality Data, 2009

Sample ID	LC3-UPPER LIME CK	LCO-LOWER LIME CK	LC-1	LC-3	RC-1
Sodium (Na)-Total	<2.0	<2.0	2.0	<2.0	<2.0
Strontium (Sr)-Total	0.0391	0.346	0.425	0.0494	0.0646
Thallium (Tl)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Total	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Total	0.000010	0.000608	0.000782	<0.000010	0.000172
Vanadium (V)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)-Total	<0.0010	0.0038	0.0048	<0.0010	0.0015
Dissolved Metals					
Aluminum (Al)-Dissolved	0.0204	0.0189	0.0116	0.0145	0.0171
Antimony (Sb)-Dissolved	0.00010	0.00031	0.00047	0.00015	<0.00010
Arsenic (As)-Dissolved	0.00045	0.00020	0.00023	0.00055	0.00021
Barium (Ba)-Dissolved	0.00458	0.0200	0.0249	0.00534	0.0134
Beryllium (Be)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)-Dissolved	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)-Dissolved	<0.000010	0.000161	0.000177	<0.000017	0.000060
Calcium (Ca)-Dissolved	6.48	25.1	31.5	8.09	12.5
Chromium (Cr)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)-Dissolved	0.00037	0.00087	0.00072	0.00032	0.00053
Iron (Fe)-Dissolved	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Dissolved	<0.000050	0.000173	0.000115	<0.000050	<0.000050
Lithium (Li)-Dissolved	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)-Dissolved	0.433	4.25	5.02	0.525	1.39
Manganese (Mn)-Dissolved	0.000245	0.000958	0.00104	0.000211	0.000619
Mercury (Hg)-Dissolved	0.000014	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.000274	0.188	0.189	0.000191	0.0101
Nickel (Ni)-Dissolved	0.00056	0.00203	0.00248	<0.00050	0.00073
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	0.114	0.418	0.495	0.143	0.486
Selenium (Se)-Dissolved	<0.00010	0.00014	<0.00020	<0.00020	<0.00020
Silicon (Si)-Dissolved	1.34	1.70	1.78	1.45	1.75
Silver (Ag)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)-Dissolved	<2.0	<2.0	<2.0	<2.0	<2.0
Strontium (Sr)-Dissolved	0.0395	0.349	0.429	0.0501	0.0655
Thallium (Tl)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Dissolved	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Dissolved	0.000010	0.000602	0.000802	<0.000010	0.000160
Vanadium (V)-Dissolved	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)-Dissolved	0.0012	0.0037	0.0050	<0.0010	0.0015
Aggregate Organics					
COD					

Appendix 3.1-2

Stream Water Quality Analytical Detection Limits, 2009

Rescan™
Engineers and Scientists

Appendix 3.1-2. Stream Water Quality Analytical Detection Limits, 2009

Sample ID	PC5	RC1	LC1	LC3	LC3	PC1	PC5	LC1	RC1	LC1	LC3-DS	RC1	LC-1	RC-1	LC-3
Date Sampled	21-MAR-09	21-MAR-09	21-MAR-09	21-MAR-09	22-APR-09	22-APR-09	22-APR-09	22-APR-09	22-APR-09	22-MAY-09	22-MAY-09	22-MAY-09	29-MAY-09	29-MAY-09	29-MAY-09
Time Sampled	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	11:00	11:00	11:30
ALS Sample ID	L745862-1	L745862-2	L745862-3	L745898-3	L756271-1	L756271-2	L756271-3	L756271-4	L756271-5	L767698-1	L767698-2	L767698-3	L771139-1	L771139-2	L771139-3
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Physical Tests															
Colour, True	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Conductivity	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Hardness (as CaCO3)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
pH	0.01	0.01	0.01	0.01	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total Suspended Solids	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Total Dissolved Solids	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Turbidity	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Anions and Nutrients															
Acidity (as CaCO3)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Alkalinity, Bicarbonate (as CaCO3)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Alkalinity, Carbonate (as CaCO3)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Alkalinity, Hydroxide (as CaCO3)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Alkalinity, Total (as CaCO3)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Ammonia as N	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Bromide (Br)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Chloride (Cl)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Fluoride (F)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Nitrate (as N)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Nitrite (as N)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Total Kjeldahl Nitrogen	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Total Nitrogen	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Total Phosphate as P	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Sulfate (SO4)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Cyanides															
Cyanide, Total	0.001	0.0014	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Organic / Inorganic Carbon															
Total Organic Carbon	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total Metals															
Aluminum (Al)-Total	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Antimony (Sb)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Arsenic (As)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Barium (Ba)-Total	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Beryllium (Be)-Total	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Bismuth (Bi)-Total	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Boron (B)-Total	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cadmium (Cd)-Total	0.000017	0.000017	0.000017	0.000017	0.000017	0.000017	0.000017	0.000017	0.000017	0.000017	0.000017	0.000017	0.00001	0.00001	0.00001
Calcium (Ca)-Total	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Chromium (Cr)-Total	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Cobalt (Co)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Copper (Cu)-Total	0.0008	0.0007	0.0010	0.0008	0.0001	0.0001	0.0001	0.0001	0.0001	0.001	0.0009	0.0009	0.0001	0.0001	0.0001
Iron (Fe)-Total	0.04	0.06	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Lead (Pb)-Total	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Lithium (Li)-Total	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Magnesium (Mg)-Total	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Manganese (Mn)-Total	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Mercury (Hg)-Total	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum (Mo)-Total	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Nickel (Ni)-Total	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.002	0.001	0.001	0.0005	0.0005	0.0005
Phosphorus (P)-Total	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
Potassium (K)-Total	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Selenium (Se)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Silicon (Si)-Total	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Silver (Ag)-Total	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001

Appendix 3.1-2. Stream Water Quality Analytical Detection Limits, 2009

Sample ID	PC5	RC1	LC1	LC3	LC3	PC1	PC5	LC1	RC1	LC1	LC3-DS	RC1	LC-1	RC-1	LC-3
Sodium (Na)-Total	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Strontium (Sr)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Thallium (Tl)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Tin (Sn)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Titanium (Ti)-Total	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Uranium (U)-Total	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Vanadium (V)-Total	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zinc (Zn)-Total	0.001	0.002	0.004	0.008	0.002	0.002	0.001	0.005	0.005	0.001	0.001	0.001	0.001	0.001	0.001
Dissolved Metals															
Aluminum (Al)-Dissolved	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Antimony (Sb)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Arsenic (As)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Barium (Ba)-Dissolved	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Beryllium (Be)-Dissolved	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Bismuth (Bi)-Dissolved	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Boron (B)-Dissolved	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cadmium (Cd)-Dissolved	0.000017	0.000017	0.000017	0.000017	0.000017	0.000017	0.000017	0.000017	0.000017	0.000017	0.000017	0.000017	0.00001	0.00001	0.00001
Calcium (Ca)-Dissolved	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Chromium (Cr)-Dissolved	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Cobalt (Co)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Copper (Cu)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Iron (Fe)-Dissolved	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Lead (Pb)-Dissolved	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Lithium (Li)-Dissolved	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Magnesium (Mg)-Dissolved	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Manganese (Mn)-Dissolved	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Mercury (Hg)-Dissolved	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum (Mo)-Dissolved	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Nickel (Ni)-Dissolved	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Phosphorus (P)-Dissolved	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
Potassium (K)-Dissolved	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Selenium (Se)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Silicon (Si)-Dissolved	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Silver (Ag)-Dissolved	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Sodium (Na)-Dissolved	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Strontium (Sr)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Thallium (Tl)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Tin (Sn)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Titanium (Ti)-Dissolved	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Uranium (U)-Dissolved	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Vanadium (V)-Dissolved	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zinc (Zn)-Dissolved	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

Appendix 3.1-2. Stream Water Quality Analytical Detection Limits, 2009

Sample ID	PC-5	PC-1 REP 1	MINE DISCHARGE	RC-1	LC-1	LC-3	PC-5	RC-1	LC-1	LC-3	PC-5	PC-2	PC-1	RC1
Date Sampled	29-MAY-09	29-MAY-09	29-MAY-09	03-JUN-09	03-JUN-09	03-JUN-09	03-JUN-09	18-JUN-09	18-JUN-09	18-JUN-09	18-JUN-09	18-JUN-09	18-JUN-09	20-JUL-09
Time Sampled	11:30	12:20	12:00	10:30	10:40	11:00	11:00	13:00	13:10	13:25	13:30	13:50	14:10	00:00
ALS Sample ID	L771139-4	L771139-5	L771139-7	L773249-1	L773249-2	L773249-4	L773249-5	L780931-1	L780931-2	L780931-3	L780931-4	L780931-6	L780931-7	L795552-1
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Physical Tests														
Colour, True	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Conductivity	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Hardness (as CaCO3)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
pH	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total Suspended Solids	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Total Dissolved Solids	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Turbidity	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Anions and Nutrients														
Acidity (as CaCO3)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Alkalinity, Bicarbonate (as CaCO3)	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Alkalinity, Carbonate (as CaCO3)	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Alkalinity, Hydroxide (as CaCO3)	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Alkalinity, Total (as CaCO3)	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Ammonia as N	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Bromide (Br)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Chloride (Cl)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Fluoride (F)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Nitrate (as N)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Nitrite (as N)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Total Kjeldahl Nitrogen	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Total Nitrogen	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Total Phosphate as P	0.002	0.002	0.002	0.02	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Sulfate (SO4)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Cyanides														
Cyanide, Total	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Organic / Inorganic Carbon														
Total Organic Carbon	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total Metals														
Aluminum (Al)-Total	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Antimony (Sb)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Arsenic (As)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Barium (Ba)-Total	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Beryllium (Be)-Total	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Bismuth (Bi)-Total	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Boron (B)-Total	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cadmium (Cd)-Total	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Calcium (Ca)-Total	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Chromium (Cr)-Total	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Cobalt (Co)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Copper (Cu)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Iron (Fe)-Total	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Lead (Pb)-Total	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Lithium (Li)-Total	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Magnesium (Mg)-Total	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Manganese (Mn)-Total	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Mercury (Hg)-Total	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum (Mo)-Total	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Nickel (Ni)-Total	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Phosphorus (P)-Total	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
Potassium (K)-Total	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Selenium (Se)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Silicon (Si)-Total	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Silver (Ag)-Total	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001

Appendix 3.1-2. Stream Water Quality Analytical Detection Limits, 2009

Sample ID	PC-5	PC-1 REP 1	MINE DISCHARGE	RC-1	LC-1	LC-3	PC-5	RC-1	LC-1	LC-3	PC-5	PC-2	PC-1	RC1
Sodium (Na)-Total	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Strontium (Sr)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Thallium (Tl)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Tin (Sn)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Titanium (Ti)-Total	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Uranium (U)-Total	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Vanadium (V)-Total	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zinc (Zn)-Total	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Dissolved Metals														
Aluminum (Al)-Dissolved	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Antimony (Sb)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Arsenic (As)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Barium (Ba)-Dissolved	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Beryllium (Be)-Dissolved	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Bismuth (Bi)-Dissolved	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Boron (B)-Dissolved	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cadmium (Cd)-Dissolved	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Calcium (Ca)-Dissolved	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Chromium (Cr)-Dissolved	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Cobalt (Co)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Copper (Cu)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Iron (Fe)-Dissolved	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Lead (Pb)-Dissolved	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Lithium (Li)-Dissolved	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Magnesium (Mg)-Dissolved	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Manganese (Mn)-Dissolved	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Mercury (Hg)-Dissolved	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum (Mo)-Dissolved	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Nickel (Ni)-Dissolved	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Phosphorus (P)-Dissolved	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
Potassium (K)-Dissolved	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Selenium (Se)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Silicon (Si)-Dissolved	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Silver (Ag)-Dissolved	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Sodium (Na)-Dissolved	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Strontium (Sr)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Thallium (Tl)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Tin (Sn)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Titanium (Ti)-Dissolved	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Uranium (U)-Dissolved	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Vanadium (V)-Dissolved	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zinc (Zn)-Dissolved	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

Appendix 3.1-2. Stream Water Quality Analytical Detection Limits, 2009

Sample ID	PC-5	LC-3	PC1	LC1	LC3	RC1	LC1	RC1	LC3	PC5	RC-1	LC-1	LC-3	PC-5	PC-2
Date Sampled	20-JUL-09	20-JUL-09	19-AUG-09	20-AUG-09	20-AUG-09	20-AUG-09	22-SEP-09	22-SEP-09	22-SEP-09	22-SEP-09	21-OCT-09	21-OCT-09	21-OCT-09	21-OCT-09	21-OCT-09
Time Sampled	00:00	00:00	00:00	00:00	00:00	00:00	19:00	19:00	19:00	19:00	11:05	11:30	11:45	11:50	12:15
ALS Sample ID	L795552-3	L795552-4	L809281-1	L809281-4	L809281-9	L809281-10	L822952-1	L822952-3	L822952-4	L822952-5	L832725-1	L832725-2	L832725-4	L832725-5	L832725-6
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Physical Tests															
Colour, True	5	5	5	5	5	5	5	5	5	5	5.0	5.0	5.0	5.0	5.0
Conductivity	2	2	2	2	2	2	2	2	2	2	2.0	2.0	2.0	2.0	2.0
Hardness (as CaCO3)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.50	0.50	0.50	0.50	0.50
pH	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.10	0.10	0.10	0.10	0.10
Total Suspended Solids	3	3	3	3	3	3	3	3	3	5	3.0	3.0	3.0	3.0	3.0
Total Dissolved Solids	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Turbidity	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.10	0.10	0.10	0.10	0.10
Anions and Nutrients															
Acidity (as CaCO3)	1	1	1	1	1	1	1	1	1	1	1.0	1.0	1.0	1.0	1.0
Alkalinity, Bicarbonate (as CaCO3)	2	2	2	2	2	2	2	2	2	2	2.0	2.0	2.0	2.0	2.0
Alkalinity, Carbonate (as CaCO3)	2	2	2	2	2	2	2	2	2	2	2.0	2.0	2.0	2.0	2.0
Alkalinity, Hydroxide (as CaCO3)	2	2	2	2	2	2	2	2	2	2	2.0	2.0	2.0	2.0	2.0
Alkalinity, Total (as CaCO3)	2	2	2	2	2	2	2	2	2	2	2.0	2.0	2.0	2.0	2.0
Ammonia as N	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.0050	0.0050	0.0050	0.0050	0.0050
Bromide (Br)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.050	0.050	0.050	0.050	0.050
Chloride (Cl)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.50	0.50	0.50	0.50	0.50
Fluoride (F)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.020	0.020	0.020	0.020	0.020
Nitrate (as N)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.0050	0.0050	0.0050	0.0050	0.0050
Nitrite (as N)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.0010	0.0010	0.0010	0.0010	0.0010
Total Kjeldahl Nitrogen	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.050	0.050	0.050	0.050	0.050
Total Nitrogen	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.050	0.050	0.050	0.050	0.050
Total Phosphate as P	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.0020	0.0020	0.0020	0.0020	0.0020
Sulfate (SO4)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.50	0.50	0.50	0.50	0.50
Cyanides															
Cyanide, Total	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.0010	0.0010	0.0010	0.0010	0.0010
Organic / Inorganic Carbon															
Total Organic Carbon	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.50	0.50	0.50	0.50	0.50
Total Metals															
Aluminum (Al)-Total	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.0010	0.0010	0.0010	0.0010	0.0010
Antimony (Sb)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00010	0.00010	0.00010	0.00010	0.00010
Arsenic (As)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00010	0.00010	0.00010	0.00010	0.00010
Barium (Ba)-Total	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.000050	0.000050	0.000050	0.000050	0.000050
Beryllium (Be)-Total	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.00050	0.00050	0.00050	0.00050	0.00050
Bismuth (Bi)-Total	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.00050	0.00050	0.00050	0.00050	0.00050
Boron (B)-Total	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.010	0.010	0.010	0.010	0.010
Cadmium (Cd)-Total	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.000010	0.000010	0.000010	0.000010	0.000010
Calcium (Ca)-Total	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.020	0.020	0.020	0.020	0.020
Chromium (Cr)-Total	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.00050	0.00050	0.00050	0.00050	0.00050
Cobalt (Co)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00010	0.00010	0.00010	0.00010	0.00010
Copper (Cu)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00010	0.00010	0.00010	0.00010	0.00010
Iron (Fe)-Total	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.030	0.030	0.030	0.030	0.030
Lead (Pb)-Total	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.000050	0.000050	0.000050	0.000050	0.000050
Lithium (Li)-Total	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.0050	0.0050	0.0050	0.0050	0.0050
Magnesium (Mg)-Total	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.0050	0.0050	0.0050	0.0050	0.0050
Manganese (Mn)-Total	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.000050	0.000050	0.000050	0.000050	0.000050
Mercury (Hg)-Total	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.000010	0.000010	0.000010	0.000010	0.000010
Molybdenum (Mo)-Total	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.000050	0.000050	0.000050	0.000050	0.000050
Nickel (Ni)-Total	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.00050	0.00050	0.00050	0.00050	0.00050
Phosphorus (P)-Total	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.30	0.30	0.30	0.30	0.30
Potassium (K)-Total	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.050	0.050	0.050	0.050	0.050
Selenium (Se)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00010	0.00010	0.00010	0.00010	0.00010
Silicon (Si)-Total	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.050	0.050	0.050	0.050	0.050
Silver (Ag)-Total	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.000010	0.000010	0.000010	0.000010	0.000010

Appendix 3.1-2. Stream Water Quality Analytical Detection Limits, 2009

Sample ID	PC-5	LC-3	PC1	LC1	LC3	RC1	LC1	RC1	LC3	PC5	RC-1	LC-1	LC-3	PC-5	PC-2
Sodium (Na)-Total	2	2	2	2	2	2	2	2	2	2	2.0	2.0	2.0	2.0	2.0
Strontium (Sr)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00010	0.00010	0.00010	0.00010	0.00010
Thallium (Tl)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00010	0.00010	0.00010	0.00010	0.00010
Tin (Sn)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00010	0.00010	0.00010	0.00010	0.00010
Titanium (Ti)-Total	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.010	0.010	0.010	0.010	0.010
Uranium (U)-Total	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.000010	0.000010	0.000010	0.000010	0.000010
Vanadium (V)-Total	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.0010	0.0010	0.0010	0.0010	0.0010
Zinc (Zn)-Total	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.0010	0.0010	0.0010	0.0010	0.0010
Dissolved Metals															
Aluminum (Al)-Dissolved	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.0010	0.0010	0.0010	0.0010	0.0010
Antimony (Sb)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00010	0.00010	0.00010	0.00010	0.00010
Arsenic (As)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00030	0.00030	0.00010	0.00020	0.00020
Barium (Ba)-Dissolved	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.000050	0.000050	0.000050	0.000050	0.000050
Beryllium (Be)-Dissolved	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.00050	0.00050	0.00050	0.00050	0.00050
Bismuth (Bi)-Dissolved	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.00050	0.00050	0.00050	0.00050	0.00050
Boron (B)-Dissolved	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.010	0.010	0.010	0.010	0.010
Cadmium (Cd)-Dissolved	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.000010	0.000010	0.000010	0.000010	0.000010
Calcium (Ca)-Dissolved	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.020	0.020	0.020	0.020	0.020
Chromium (Cr)-Dissolved	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.00050	0.00050	0.00050	0.00050	0.00050
Cobalt (Co)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00010	0.00010	0.00010	0.00010	0.00010
Copper (Cu)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0006	0.0001	0.00050	0.00080	0.00040	0.00090	0.00040
Iron (Fe)-Dissolved	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.030	0.030	0.030	0.030	0.030
Lead (Pb)-Dissolved	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.000050	0.000050	0.000050	0.000050	0.000050
Lithium (Li)-Dissolved	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.0050	0.0050	0.0050	0.0050	0.0050
Magnesium (Mg)-Dissolved	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.0050	0.0050	0.0050	0.0050	0.0050
Manganese (Mn)-Dissolved	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.000050	0.000050	0.000050	0.000050	0.000050
Mercury (Hg)-Dissolved	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.000010	0.000010	0.000010	0.000010	0.000010
Molybdenum (Mo)-Dissolved	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.000050	0.000050	0.000050	0.000050	0.000050
Nickel (Ni)-Dissolved	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0010	0.00050	0.0010	0.00050	0.00050
Phosphorus (P)-Dissolved	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.30	0.30	0.30	0.30	0.30
Potassium (K)-Dissolved	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.050	0.050	0.050	0.050	0.050
Selenium (Se)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00010	0.00010	0.00010	0.00010	0.00010
Silicon (Si)-Dissolved	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.050	0.050	0.050	0.050	0.050
Silver (Ag)-Dissolved	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.000010	0.000010	0.000010	0.000010	0.000010
Sodium (Na)-Dissolved	2	2	2	2	2	2	2	2	2	2	2.0	2.0	2.0	2.0	2.0
Strontium (Sr)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00010	0.00010	0.00010	0.00010	0.00010
Thallium (Tl)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00010	0.00010	0.00010	0.00010	0.00010
Tin (Sn)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00010	0.00010	0.00010	0.00010	0.00010
Titanium (Ti)-Dissolved	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.010	0.010	0.010	0.010	0.010
Uranium (U)-Dissolved	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.000010	0.000010	0.000010	0.000010	0.000010
Vanadium (V)-Dissolved	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.0010	0.0010	0.0010	0.0010	0.0010
Zinc (Zn)-Dissolved	0.001	0.001	0.001	0.004	0.001	0.002	0.001	0.001	0.001	0.001	0.0010	0.0010	0.0010	0.0010	0.0010

Appendix 3.1-2. Stream Water Quality Analytical Detection Limits, 2009

Sample ID	PC-1	RC1-ROUNDY CK	PC5-PATSY CK	LC3-UPPER LIME CK	LCO-LOWER LIME CK	LC-1	LC-3	RC-1
Date Sampled	21-OCT-09	19-NOV-09	19-NOV-09	19-NOV-09	19-NOV-09	21-DEC-09	21-DEC-09	21-DEC-09
Time Sampled	12:30	12:00	12:00	12:00	12:00	11:58	11:20	11:37
ALS Sample ID	L832725-7	L842206-1	L842206-2	L842206-3	L842206-4	L850374-1	L850374-2	L850374-3
Matrix	Water	Water	Water	Water	Water	Water	Water	Water
Physical Tests								
Colour, True	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Conductivity	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Hardness (as CaCO3)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
pH	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Total Suspended Solids	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Total Dissolved Solids	10	10	10	10	10	10	10	10
Turbidity	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Anions and Nutrients								
Acidity (as CaCO3)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Alkalinity, Bicarbonate (as CaCO3)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Alkalinity, Carbonate (as CaCO3)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Alkalinity, Hydroxide (as CaCO3)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Alkalinity, Total (as CaCO3)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ammonia as N	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
Bromide (Br)	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Chloride (Cl)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Fluoride (F)	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
Nitrate (as N)	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
Nitrite (as N)	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
Total Kjeldahl Nitrogen	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Total Nitrogen	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Total Phosphate as P	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020
Sulfate (SO4)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Cyanides								
Cyanide, Total	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
Organic / Inorganic Carbon								
Total Organic Carbon	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Total Metals								
Aluminum (Al)-Total	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
Antimony (Sb)-Total	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Arsenic (As)-Total	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Barium (Ba)-Total	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050
Beryllium (Be)-Total	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Bismuth (Bi)-Total	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Boron (B)-Total	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Cadmium (Cd)-Total	0.000010	0.000010	0.000010	0.000010	0.000010	0.000017	0.000017	0.000017
Calcium (Ca)-Total	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
Chromium (Cr)-Total	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Cobalt (Co)-Total	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Copper (Cu)-Total	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Iron (Fe)-Total	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Lead (Pb)-Total	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050
Lithium (Li)-Total	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
Magnesium (Mg)-Total	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
Manganese (Mn)-Total	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050
Mercury (Hg)-Total	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010
Molybdenum (Mo)-Total	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050
Nickel (Ni)-Total	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Phosphorus (P)-Total	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Potassium (K)-Total	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Selenium (Se)-Total	0.00010	0.00010	0.00010	0.00010	0.00010	0.00020	0.00020	0.00020
Silicon (Si)-Total	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Silver (Ag)-Total	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010

Appendix 3.1-2. Stream Water Quality Analytical Detection Limits, 2009

Sample ID	PC-1	RC1-ROUNDY CK	PC5-PATSY CK	LC3-UPPER LIME CK	LCO-LOWER LIME CK	LC-1	LC-3	RC-1
Sodium (Na)-Total	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Strontium (Sr)-Total	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Thallium (Tl)-Total	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Tin (Sn)-Total	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Titanium (Ti)-Total	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Uranium (U)-Total	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010
Vanadium (V)-Total	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
Zinc (Zn)-Total	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
Dissolved Metals								
Aluminum (Al)-Dissolved	0.0010	-	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
Antimony (Sb)-Dissolved	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Arsenic (As)-Dissolved	0.00030	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Barium (Ba)-Dissolved	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050
Beryllium (Be)-Dissolved	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Bismuth (Bi)-Dissolved	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Boron (B)-Dissolved	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Cadmium (Cd)-Dissolved	0.000010	0.000010	0.000010	0.000010	0.000010	0.000017	0.000017	0.000017
Calcium (Ca)-Dissolved	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
Chromium (Cr)-Dissolved	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Cobalt (Co)-Dissolved	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Copper (Cu)-Dissolved	0.00030	-	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Iron (Fe)-Dissolved	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Lead (Pb)-Dissolved	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050
Lithium (Li)-Dissolved	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
Magnesium (Mg)-Dissolved	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
Manganese (Mn)-Dissolved	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050
Mercury (Hg)-Dissolved	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010
Molybdenum (Mo)-Dissolved	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050
Nickel (Ni)-Dissolved	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Phosphorus (P)-Dissolved	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Potassium (K)-Dissolved	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Selenium (Se)-Dissolved	0.00010	0.00010	0.00010	0.00010	0.00010	0.00020	0.00020	0.00020
Silicon (Si)-Dissolved	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Silver (Ag)-Dissolved	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010
Sodium (Na)-Dissolved	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Strontium (Sr)-Dissolved	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Thallium (Tl)-Dissolved	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Tin (Sn)-Dissolved	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Titanium (Ti)-Dissolved	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Uranium (U)-Dissolved	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010
Vanadium (V)-Dissolved	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
Zinc (Zn)-Dissolved	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010

Appendix 3.2-1

Lake and Wetland Water Quality Data, 2009

Rescan™
Engineers and Scientists

Appendix 3.2-1. Lake and Wetland Water Quality Data, 2009

Sample ID	PATSY DEEP	PATSY SHALLOW	WL1	WL2	WL3	WL4
Date Sampled	19-AUG-09	19-AUG-09	20-AUG-09	20-AUG-09	20-AUG-09	20-AUG-09
Time Sampled	00:00	00:00	00:00	00:00	00:00	00:00
ALS Sample ID	L809281-2	L809281-3	L809281-5	L809281-6	L809281-7	L809281-8
Physical Tests						
Colour, True	13.8	11.9	27.7	27.8	20.5	29.8
Conductivity	12.9	12.4	7.9	20.4	21.9	5.9
Hardness (as CaCO3)	4.94	4.97	2.79	8.80	9.49	2.74
pH	6.67	6.85	6.00	7.24	7.73	5.82
Total Suspended Solids	<3.0	3.0	<3.0	<3.0	3.0	3.0
Total Dissolved Solids	16	16	20	23	21	16
Turbidity	0.56	0.43	2.45	652	0.96	1.52
Anions and Nutrients						
Acidity (as CaCO3)	2.4	2.1	2.5	4.0	2.3	2.9
Alkalinity, Bicarbonate (as CaCO3)	4.2	4.5	<2.0	6.8	8.3	<2.0
Alkalinity, Carbonate (as CaCO3)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as CaCO3)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as CaCO3)	4.2	4.5	<2.0	6.8	8.3	<2.0
Ammonia as N	<0.0050	0.0052	0.0327	0.0075	0.0099	0.0066
Bromide (Br)	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride (F)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Nitrate (as N)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	0.060	<0.050	0.240	0.120	0.110	0.160
Total Nitrogen	0.060	<0.050	0.240	0.120	0.110	0.160
Total Phosphate as P	<0.0020	<0.0020	0.0140	0.0051	0.0067	0.0095
Sulfate (SO4)	<0.50	<0.50	<0.50	0.65	0.69	<0.50
Cyanides						
Cyanide, Total	0.0031	0.0027	0.0072	0.0109	0.0060	0.0058
Organic / Inorganic Carbon						
Total Organic Carbon	2.99	2.87	7.34	6.27	4.36	6.28
Total Metals						
Aluminum (Al)-Total	0.0497	0.0410	0.0960	0.0799	0.0741	0.0309
Antimony (Sb)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)-Total	<0.00010	<0.00010	0.00033	0.00166	0.00118	0.00028
Barium (Ba)-Total	0.0135	0.00292	0.00425	0.00797	0.00449	0.00237
Beryllium (Be)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)-Total	<0.000010	<0.000010	<0.000010	0.000034	0.000010	<0.000010
Calcium (Ca)-Total	1.73	1.69	1.11	3.14	3.78	1.02
Chromium (Cr)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)-Total	<0.00010	<0.00010	<0.00010	0.00026	<0.00010	<0.00010
Copper (Cu)-Total	0.00051	0.00018	0.00049	0.00035	0.00041	0.00033
Iron (Fe)-Total	<0.030	<0.030	0.141	0.335	0.131	0.235
Lead (Pb)-Total	0.000360	<0.000050	0.000058	<0.000050	0.000050	0.000058
Lithium (Li)-Total	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)-Total	0.128	0.125	0.0944	0.339	0.173	0.0849
Manganese (Mn)-Total	0.0118	0.00586	0.0239	0.206	0.0115	0.0423
Mercury (Hg)-Total	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Total	<0.000050	<0.000050	<0.000050	0.000059	0.000056	<0.000050
Nickel (Ni)-Total	<0.00050	<0.00050	<0.00050	0.00086	0.00126	<0.00050
Phosphorus (P)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Total	0.057	0.053	<0.050	0.062	0.054	<0.050
Selenium (Se)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)-Total	0.556	0.533	0.143	0.783	0.161	0.116
Silver (Ag)-Total	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)-Total	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

(continued)

Appendix 3.2-1. Lake and Wetland Water Quality Data, 2009 (completed)

Sample ID	PATSY DEEP	PATSY SHALLOW	WL1	WL2	WL3	WL4
Strontium (Sr)-Total	0.0124	0.0119	0.00632	0.0279	0.0251	0.00692
Thallium (Tl)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)-Total	0.00037	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Total	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)-Total	0.0049	<0.0010	0.0011	0.0028	0.0012	0.0014
Dissolved Metals						
Aluminum (Al)-Dissolved	0.0416	0.0362	0.0661	0.0645	0.0528	0.0225
Antimony (Sb)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)-Dissolved	<0.00010	<0.00010	0.00031	0.00154	0.00109	0.00026
Barium (Ba)-Dissolved	0.0131	0.00295	0.00357	0.00768	0.00432	0.00203
Beryllium (Be)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)-Dissolved	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)-Dissolved	<0.000010	<0.000010	<0.000010	0.000037	<0.000010	<0.000010
Calcium (Ca)-Dissolved	1.76	1.78	0.982	3.00	3.53	0.964
Chromium (Cr)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)-Dissolved	<0.00010	<0.00010	<0.00010	0.00013	<0.00010	<0.00010
Copper (Cu)-Dissolved	0.00040	0.00022	0.00066	0.00035	0.00031	0.00024
Iron (Fe)-Dissolved	<0.030	<0.030	0.060	0.215	0.064	0.086
Lead (Pb)-Dissolved	0.000098	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)-Dissolved	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)-Dissolved	0.131	0.132	0.0812	0.316	0.164	0.0799
Manganese (Mn)-Dissolved	0.00355	0.000407	0.0207	0.151	0.00703	0.0415
Mercury (Hg)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050	0.000052	<0.000050
Nickel (Ni)-Dissolved	<0.00050	<0.00050	0.00058	0.00085	0.00109	<0.00050
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	0.058	0.066	<0.050	0.064	<0.050	<0.050
Selenium (Se)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)-Dissolved	0.530	0.513	0.105	0.773	0.160	0.069
Silver (Ag)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)-Dissolved	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Strontium (Sr)-Dissolved	0.0124	0.0122	0.00581	0.0270	0.0245	0.00680
Thallium (Tl)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)-Dissolved	0.00032	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Dissolved	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)-Dissolved	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)-Dissolved	<0.0060	<0.0020	<0.0030	<0.0030	<0.0020	<0.0020
Aggregate Organics						
COD	<20	<20	29	20	25	24

Appendix 3.2-2

Lake and Wetland Water Quality Analytical Detection Limits, 2009

Rescan™
Engineers and Scientists

Appendix 3.2-2. Lake and Wetland Water Quality Analytical Detection Limits, 2009

Sample ID	PATSY DEEP	PATSY SHALLOW	WL1	WL2	WL3	WL4
Date Sampled	19-AUG-09	19-AUG-09	20-AUG-09	20-AUG-09	20-AUG-09	20-AUG-09
Time Sampled	00:00	00:00	00:00	00:00	00:00	00:00
ALS Sample ID	L809281-2	L809281-3	L809281-5	L809281-6	L809281-7	L809281-8
Matrix	Water	Water	Water	Water	Water	Water
Physical Tests						
Colour, True	5	5	5	5	5	5
Conductivity	2	2	2	2	2	2
Hardness (as CaCO3)	0.5	0.5	0.5	0.5	0.5	0.5
pH	0.1	0.1	0.1	0.1	0.1	0.1
Total Suspended Solids	3	3	3	3	3	3
Total Dissolved Solids	10	10	10	10	10	10
Turbidity	0.1	0.1	0.1	0.1	0.1	0.1
Anions and Nutrients						
Acidity (as CaCO3)	1	1	1	1	1	1
Alkalinity, Bicarbonate (as CaCO3)	2	2	2	2	2	2
Alkalinity, Carbonate (as CaCO3)	2	2	2	2	2	2
Alkalinity, Hydroxide (as CaCO3)	2	2	2	2	2	2
Alkalinity, Total (as CaCO3)	2	2	2	2	2	2
Ammonia as N	0.005	0.005	0.005	0.005	0.005	0.005
Bromide (Br)	0.05	0.05	0.05	0.05	0.05	0.05
Chloride (Cl)	0.5	0.5	0.5	0.5	0.5	0.5
Fluoride (F)	0.02	0.02	0.02	0.02	0.02	0.02
Nitrate (as N)	0.005	0.005	0.005	0.005	0.005	0.005
Nitrite (as N)	0.001	0.001	0.001	0.001	0.001	0.001
Total Kjeldahl Nitrogen	0.05	0.05	0.05	0.05	0.05	0.05
Total Nitrogen	0.05	0.05	0.05	0.05	0.05	0.05
Total Phosphate as P	0.002	0.002	0.002	0.002	0.002	0.002
Sulfate (SO4)	0.5	0.5	0.5	0.5	0.5	0.5
Cyanides						
Cyanide, Total	0.001	0.001	0.001	0.001	0.001	0.001
Organic / Inorganic Carbon						
Total Organic Carbon	0.5	0.5	0.5	0.5	0.5	0.5
Total Metals						
Aluminum (Al)-Total	0.001	0.001	0.001	0.001	0.001	0.001
Antimony (Sb)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Arsenic (As)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Barium (Ba)-Total	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Beryllium (Be)-Total	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Bismuth (Bi)-Total	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Boron (B)-Total	0.01	0.01	0.01	0.01	0.01	0.01
Cadmium (Cd)-Total	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Calcium (Ca)-Total	0.02	0.02	0.02	0.02	0.02	0.02
Chromium (Cr)-Total	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Cobalt (Co)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Copper (Cu)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Iron (Fe)-Total	0.03	0.03	0.03	0.03	0.03	0.03
Lead (Pb)-Total	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Lithium (Li)-Total	0.005	0.005	0.005	0.005	0.005	0.005
Magnesium (Mg)-Total	0.005	0.005	0.005	0.005	0.005	0.005
Manganese (Mn)-Total	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Mercury (Hg)-Total	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum (Mo)-Total	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Nickel (Ni)-Total	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Phosphorus (P)-Total	0.3	0.3	0.3	0.3	0.3	0.3
Potassium (K)-Total	0.05	0.05	0.05	0.05	0.05	0.05
Selenium (Se)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Silicon (Si)-Total	0.05	0.05	0.05	0.05	0.05	0.05
Silver (Ag)-Total	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001

(continued)

Appendix 3.2-2. Lake and Wetland Water Quality Analytical Detection Limits, 2009

Sample ID	PATSY DEEP	PATSY SHALLOW	WL1	WL2	WL3	WL4
Sodium (Na)-Total	2	2	2	2	2	2
Strontium (Sr)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Thallium (Tl)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Tin (Sn)-Total	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Titanium (Ti)-Total	0.01	0.01	0.01	0.01	0.01	0.01
Uranium (U)-Total	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Vanadium (V)-Total	0.001	0.001	0.001	0.001	0.001	0.001
Zinc (Zn)-Total	0.001	0.001	0.001	0.001	0.001	0.001
Dissolved Metals						
Aluminum (Al)-Dissolved	0.001	0.001	0.001	0.001	0.001	0.001
Antimony (Sb)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Arsenic (As)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Barium (Ba)-Dissolved	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Beryllium (Be)-Dissolved	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Bismuth (Bi)-Dissolved	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Boron (B)-Dissolved	0.01	0.01	0.01	0.01	0.01	0.01
Cadmium (Cd)-Dissolved	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Calcium (Ca)-Dissolved	0.02	0.02	0.02	0.02	0.02	0.02
Chromium (Cr)-Dissolved	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Cobalt (Co)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Copper (Cu)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Iron (Fe)-Dissolved	0.03	0.03	0.03	0.03	0.03	0.03
Lead (Pb)-Dissolved	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Lithium (Li)-Dissolved	0.005	0.005	0.005	0.005	0.005	0.005
Magnesium (Mg)-Dissolved	0.005	0.005	0.005	0.005	0.005	0.005
Manganese (Mn)-Dissolved	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Mercury (Hg)-Dissolved	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum (Mo)-Dissolved	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Nickel (Ni)-Dissolved	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Phosphorus (P)-Dissolved	0.3	0.3	0.3	0.3	0.3	0.3
Potassium (K)-Dissolved	0.05	0.05	0.05	0.05	0.05	0.05
Selenium (Se)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Silicon (Si)-Dissolved	0.05	0.05	0.05	0.05	0.05	0.05
Silver (Ag)-Dissolved	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Sodium (Na)-Dissolved	2	2	2	2	2	2
Strontium (Sr)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Thallium (Tl)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Tin (Sn)-Dissolved	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Titanium (Ti)-Dissolved	0.01	0.01	0.01	0.01	0.01	0.01
Uranium (U)-Dissolved	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Vanadium (V)-Dissolved	0.001	0.001	0.001	0.001	0.001	0.001
Zinc (Zn)-Dissolved	0.006	0.002	0.003	0.003	0.002	0.002
Aggregate Organics						
COD	20	20	20	20	20	20

Appendix 3.3-1

Water Quality Field, Travel and Equipment Blank Data, 2009

Rescan™
Engineers and Scientists

Appendix 3.3-1. Water Quality Field, Travel and Equipment Blank Data, 2009

Sample ID	TRAVEL BLANKS	FIELD BLANKS	TRAVEL BLANKS	FIELD BLANKS	FIELD BLANK	TRAVEL BLANK	FIELD BLANK (PREP NOV 08)	TRAVEL BLANK (PREP NOV 08)	FIELD BALNKS (OPENED@ LC-3)	TRAVEL BLANKS (UNOPENED)	FIELD BLANK	TRAVEL BLANK	FIELD BLANKS
Date Sampled	21-MAR-09	21-MAR-09	22-APR-09	22-APR-09	22-MAY-09	22-MAY-09	29-MAY-09		03-JUN-09	03-JUN-09	10-JUN-09	10-JUN-09	18-JUN-09
Time Sampled	00:00	00:00	00:00	00:00	00:00	00:00	12:20		11:00	00:00	10:45	10:45	14:30
ALS Sample ID	L745898-1	L745898-2	L756271-7	L756271-8	L767698-4	L767698-5	L771139-8	L771139-9	L773249-6	L773249-7	L777432-6	L777432-7	L780931-9
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Physical Tests													
Colour, True	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Conductivity	4.8	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Hardness (as CaCO3)	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	2.58	<0.50	<0.50	<0.50	<0.50	<0.50
pH	5.30	5.65	5.59	5.57	5.50	5.58	5.62	5.60	5.68	5.63	5.58	5.60	5.79
Total Suspended Solids	<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	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Turbidity	<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
Anions and Nutrients													
Acidity (as CaCO3)	1.7	1.7	1.2	1.2	<1.0	1.6	<1.0	<1.0	<1.0	2.7	1.7	1.6	1.4
Alkalinity, Bicarbonate (as CaCO3)	<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 CaCO3)	<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 CaCO3)	<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 CaCO3)	<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
Ammonia as N	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0126	0.0110	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Bromide (Br)	<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)	<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
Fluoride (F)	<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
Nitrate (as N)	<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
Nitrite (as N)	<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	<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
Total Nitrogen	<0.05	<0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Phosphate as P	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Sulfate (SO4)	1.00	<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	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-
Organic / Inorganic Carbon													
Total Organic Carbon	<0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	0.56	<0.50	<0.50	<0.50	<0.50	<0.50
Total Metals													
Aluminum (Al)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0018	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Antimony (Sb)-Total	<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)-Total	<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
Barium (Ba)-Total	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000056	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Beryllium (Be)-Total	<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
Bismuth (Bi)-Total	<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)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)-Total	<0.000017	<0.000017	<0.000017	<0.000017	<0.000017	<0.000017	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)-Total	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	1.02	<0.020	<0.020	0.027	<0.020	<0.020
Chromium (Cr)-Total	<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
Cobalt (Co)-Total	<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)-Total	<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
Iron (Fe)-Total	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Total	<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)-Total	<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)-Total	<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
Manganese (Mn)-Total	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000206	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Mercury (Hg)-Total	<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)-Total	<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)-Total	<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
Phosphorus (P)-Total	<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)-Total	<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)-Total	<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)-Total	<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)-Total	<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)-Total	<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
Strontium (Sr)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00061	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Thallium (Tl)-Total	<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)-Total	<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)-Total	<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)-Total	<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)-Total	<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
Zinc (Zn)-Total	<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

(continued)

Appendix 3.3-1. Water Quality Field, Travel and Equipment Blank Data, 2009 (completed)

Sample ID	TRAVEL BLANKS	FIELD BLANK	TRAVEL BLANK	FIELD BLANK	TRAVEL BLANK	FIELD BLANK	TRAVEL BLANK	FIELD BLANK	TRAVEL BLANK	TRAVEL BLANK	FIELD BLANK	TRAVEL BLANK	FIELD BLANK	EQUIPMENT BLANK
Date Sampled	18-JUN-09	20-JUL-09	20-JUL-09			22-SEP-09	22-SEP-09	21-OCT-09	21-OCT-09	19-NOV-09	19-NOV-09			
Time Sampled	14:30	00:00	00:00			19:00	19:00	12:30	00:00	12:00	12:00			
ALS Sample ID	L780931-10	L795552-5	L795552-6	L809281-12	L809281-13	L822952-6	L822952-7	L832725-8	L832725-9	L842206-6	L842206-7	L850374-5	L850374-6	L793429-1
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Physical Tests														
Colour, True	**<5.0**	**<5.0**	**<5.0**	**<5.0**	**<5.0**	**<5.0**	**<5.0**	**<5.0**	**<5.0**	**<5.0**	**<5.0**	**<5.0**	**<5.0**	
Conductivity	**<2.0**	**<2.0**	6.8	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**	
Hardness (as CaCO3)	**<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**	<0.50
pH	5.70	5.61	4.77	5.63	5.56	5.63	5.61	5.67	5.63	5.66	5.78	5.51	5.44	
Total Suspended Solids	**<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	**<10**	**<10**	**<10**	**<10**	**<10**	**<10**	**<10**	**<10**	**<10**	**<10**	**<10**	**<10**	**<10**	
Turbidity	**<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**	
Anions and Nutrients														
Acidity (as CaCO3)	1.5	**<1.0**	2.3	1.8	1.8	1.4	1.5	1.1	1.3	1.6	1.7	1.1	1.3	
Alkalinity, Bicarbonate (as CaCO3)	**<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 CaCO3)	**<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 CaCO3)	**<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 CaCO3)	**<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**	
Ammonia as N	**<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**	
Bromide (Br)	**<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)	**<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**	
Fluoride (F)	**<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**	
Nitrate (as N)	**<0.0050**	0.0126	0.279	**<0.0050**	**<0.0050**	**<0.0050**	**<0.0050**	**<0.0050**	0.0165	**<0.0050**	**<0.0050**	**<0.0050**	**<0.0050**	
Nitrite (as N)	**<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	**<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**	
Total Nitrogen	**<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**	
Total Phosphate as P	**<0.0020**	**<0.0020**	**<0.0020**	**<0.0020**	**<0.0020**	**<0.0020**	**<0.0020**	**<0.0020**	**<0.0020**	**<0.0020**	**<0.0020**	**<0.0020**	**<0.0020**	
Sulfate (SO4)	**<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**	
Cyanides														
Cyanide, Total	-	**<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	**<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)-Total	**<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
Antimony (Sb)-Total	**<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)-Total	**<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
Barium (Ba)-Total	**<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**	0.00348
Beryllium (Be)-Total	**<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
Bismuth (Bi)-Total	**<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)-Total	**<0.010**	**<0.010**	**<0.010**	**<0.010**	**<0.010**	**<0.010**	**<0.010**	**<0.010**	**<0.010**	**<0.010**	**<0.010**	**<0.010**	**<0.010**	<0.010
Cadmium (Cd)-Total	**<0.000010**	**<0.000010**	**<0.000010**	**<0.000010**	**<0.000010**	**<0.000010**	**<0.000010**	**<0.000010**	**<0.000010**	**<0.000010**	**<0.000010**	**<0.000017**	**<0.000017**	<0.000010
Calcium (Ca)-Total	**<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**	<0.020
Chromium (Cr)-Total	**<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
Cobalt (Co)-Total	**<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)-Total	**<0.00010**	**<0.00010**	**<0.00010**	**<0.00010**	**<0.00010**	**<0.00010**	**<0.00010**	**<0.00010**	**<0.00010**	0.00083	**<0.00010**	**<0.00010**	**<0.00010**	<0.00010
Iron (Fe)-Total	**<0.030**	**<0.030**	**<0.030**	**<0.030**	**<0.030**	**<0.030**	**<0.030**	**<0.030**	**<0.030**	**<0.030**	**<0.030**	**<0.030**	**<0.030**	<0.030
Lead (Pb)-Total	**<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)-Total	**<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)-Total	**<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
Manganese (Mn)-Total	**<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
Mercury (Hg)-Total	**<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)-Total	**<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)-Total	**<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
Phosphorus (P)-Total	**<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)-Total	**<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
Selenium (Se)-Total	**<0.00010**	**<0.00010**	**<0.00010**	**<0.00010**	**<0.00010**	**<0.00010**	**<0.00010**	**<0.00010**	**<0.00010**	**<0.00010**	**<0.00010**	**<0.00020**	**<0.00020**	<0.00010
Silicon (Si)-Total	**<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
Silver (Ag)-Total	**<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)-Total	**<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
Strontium (Sr)-Total	**<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
Thallium (Tl)-Total	**<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)-Total	**<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)-Total	**<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)-Total	**<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)-Total	**<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
Zinc (Zn)-Total	**<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

Appendix 3.3-2

Calculated Relative Percent Difference for Water Quality Duplicates, 2009

Rescan™
Engineers and Scientists

Appendix 3.3-2. Calcualted Relative Percent Difference for Water Quality Duplicates, 2009

Sample ID Date Sampled	LC3 21*MAR*09	LC3 21*MAR*09	RPD %	LC1 22*APR*09	LC1 22*APR*09	RPD %	PC1 29*MAY*09	PC1 29*MAY*09	RPD %	LC1 03*JUN*09	LC1 03*JUN*09	RPD %
Physical Tests												
Colour, True	**<5.0**	**<5.0**	*	24.5	24.2	1	28.1	27.5	2	16.9	16.2	4
Conductivity	161	190	17	154	154	0	10.2	10.0	2	56.7	56.7	0
Hardness (as CaCO3)	68.6	79.7	15	67.9	66.1	3	3.85	3.80	1	22.2	22.7	2
pH	7.33	7.80	6	7.76	7.75	0	6.14	6.09	1	7.77	7.81	1
Total Suspended Solids	**<3.0**	**<3.0**	*	**<3.0**	**<3.0**	*	**<3.0**	**<3.0**	*	15.0	16.0	6
Total Dissolved Solids	96	118	**21**	96	96	0	12	11	9	38	33	14
Turbidity	0.18	0.18	0	0.34	0.34	0	0.41	0.43	5	5.01	4.96	1
Anions and Nutrients												
Acidity (as CaCO3)	3.7	3.5	6	1.2	1.3	8	2.6	2.8	7	2.4	1.9	*
Alkalinity, Bicarbonate (as CaCO3)	31.0	30.2	3	30.5	31.4	3	3.3	3.3	0	11.8	11.8	0
Alkalinity, Carbonate (as CaCO3)	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*
Alkalinity, Hydroxide (as CaCO3)	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*
Alkalinity, Total (as CaCO3)	31.0	30.2	3	30.5	31.4	3	3.3	3.3	0	11.8	11.8	0
Ammonia as N	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*
Bromide (Br)	**<0.050**	**<0.050**	*	**<0.050**	**<0.050**	*	**<0.050**	**<0.050**	*	**<0.050**	**<0.050**	*
Chloride (Cl)	0.72	0.88	*	0.72	0.72	0	**<0.50**	**<0.50**	*	**<0.50**	**<0.50**	*
Fluoride (F)	0.132	0.165	**22**	0.084	0.083	1	**<0.020**	**<0.020**	*	0.066	0.067	2
Nitrate (as N)	0.0539	0.0584	8	0.0438	0.0445	2	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*
Nitrite (as N)	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*
Total Kjeldahl Nitrogen	**<0.050**	**<0.050**	*	**<0.050**	**<0.050**	*	0.070	0.080	13	0.050	0.050	0
Total Nitrogen	0.05	0.06	18	0.070	0.070	0	0.070	0.080	13	0.050	0.050	0
Total Phosphate as P	**<0.0020**	**<0.0020**	*	0.0022	**<0.0020**	*	0.0041	0.0040	2	0.0151	0.0114	*
Sulfate (SO4)	49.2	61.5	**22**	40.1	40.0	0	**<0.50**	**<0.50**	*	12.9	13.0	1
Cyanides												
Cyanide, Total	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*	**<0.0010**	0.0039	*	0.0026	0.0024	8
Organic / Inorganic Carbon												
Total Organic Carbon	1.53	1.52	1	4.07	4.01	1	4.09	4.24	4	2.48	2.51	1
Total Metals												
Aluminum (Al)*Total	0.0288	0.0240	18	0.0635	0.0621	2	0.0998	0.0919	8	0.302	0.411	**31**
Antimony (Sb)*Total	0.00022	0.00024	9	0.00030	0.00028	7	**<0.00010**	**<0.00010**	*	0.00015	0.00016	6
Arsenic (As)*Total	0.00037	0.00029	*	0.00025	0.00026	4	**<0.00010**	**<0.00010**	*	0.00041	0.00047	14
Barium (Ba)*Total	0.0128	0.0140	9	0.0159	0.0151	5	0.00364	0.00333	9	0.0138	0.0165	18
Beryllium (Be)*Total	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*
Bismuth (Bi)*Total	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*
Boron (B)*Total	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*
Cadmium (Cd)*Total	0.000232	0.000283	**20**	0.000173	0.000166	4	0.000068	**<0.000010**	*	0.000197	0.000228	15
Calcium (Ca)*Total	23.1	25.0	8	22.1	22.0	0	1.58	1.48	7	7.16	7.93	10
Chromium (Cr)*Total	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	0.00092	0.00121	*
Cobalt (Co)*Total	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	0.00021	0.00027	*
Copper (Cu)*Total	**<0.00080**	0.00058	*	0.00186	0.00143	*	0.00030	0.00031	3	0.00137	0.00166	19
Iron (Fe)*Total	0.040	**<0.030**	*	0.056	0.056	0	0.117	0.116	1	0.386	0.476	**21**
Lead (Pb)*Total	0.000208	0.000221	6	0.000571	0.000575	1	**<0.000050**	**<0.000050**	*	0.00263	0.00384	**37**
Lithium (Li)*Total	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*
Magnesium (Mg)*Total	4.11	4.67	13	3.51	3.32	6	0.125	0.116	7	1.39	1.55	11
Manganese (Mn)*Total	0.00224	0.00174	**25**	0.00250	0.00220	13	0.0289	0.0273	6	0.0241	0.0266	10
Mercury (Hg)*Total	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*
Molybdenum (Mo)*Total	0.185	0.224	19	0.181	0.175	3	**<0.000050**	0.000086	*	0.0943	0.108	14
Nickel (Ni)*Total	0.00065	**<0.00050**	*	0.00299	0.00315	5	0.00056	0.00057	2	0.00181	0.00218	19
Phosphorus (P)*Total	**<0.30**	**<0.30**	*	**<0.30**	**<0.30**	*	**<0.30**	**<0.30**	*	**<0.30**	**<0.30**	*
Potassium (K)*Total	0.437	0.460	5	0.414	0.444	7	0.130	0.116	11	0.312	0.376	19

Appendix 3.3-2. Calcualted Relative Percent Difference for Water Quality Duplicates, 2009

Sample ID Date Sampled	LC3 21*MAR*09	LC3 21*MAR*09	RPD %	LC1 22*APR*09	LC1 22*APR*09	RPD %	PC1 29*MAY*09	PC1 29*MAY*09	RPD %	LC1 03*JUN*09	LC1 03*JUN*09	RPD %
Selenium (Se)*Total	0.00013	**<0.00010**	*	0.00030	0.00037	*	**<0.00010**	**<0.00010**	*	0.00022	0.00010	*
Silicon (Si)*Total	1.66	1.81	9	1.71	1.74	2	0.639	0.627	2	1.50	1.63	8
Silver (Ag)*Total	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	0.000019	0.000021	10
Sodium (Na)*Total	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*
Strontium (Sr)*Total	0.331	0.391	17	0.270	0.268	1	0.00947	0.00883	7	0.0914	0.103	12
Thallium (Tl)*Total	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*
Tin (Sn)*Total	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*
Titanium (Ti)*Total	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	0.017	0.018	6
Uranium (U)*Total	0.000990	0.00119	18	0.000602	0.000600	0	**<0.000010**	**<0.000010**	*	0.000245	0.000256	4
Vanadium (V)*Total	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*	**<0.0010**	0.0011	*
Zinc (Zn)*Total	**<0.0080**	0.0086	*	**<0.0050**	0.0046	*	0.0018	0.0015	18	0.0067	0.0085	*
Dissolved Metals												
Aluminum (Al)*Dissolved	0.0127	0.0094	**30**	0.0520	0.0510	2	0.0782	0.0785	0	0.0503	0.0533	6
Antimony (Sb)*Dissolved	0.00021	0.00022	5	0.00030	0.00029	3	**<0.00010**	**<0.00010**	*	0.00011	0.00012	9
Arsenic (As)*Dissolved	0.00034	0.00025	31	0.00023	0.00025	8	**<0.00010**	**<0.00010**	*	0.00018	0.00019	5
Barium (Ba)*Dissolved	0.0119	0.0135	13	0.0154	0.0149	3	0.00316	0.00309	2	0.00700	0.00673	4
Beryllium (Be)*Dissolved	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*
Bismuth (Bi)*Dissolved	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*
Boron (B)*Dissolved	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*
Cadmium (Cd)*Dissolved	0.000201	0.000273	**30**	0.000170	0.000151	12	**<0.000010**	0.000013	*	0.000100	0.000112	11
Calcium (Ca)*Dissolved	21.3	24.5	14	21.6	21.1	2	1.37	1.35	1	6.83	6.98	2
Chromium (Cr)*Dissolved	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*
Cobalt (Co)*Dissolved	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*
Copper (Cu)*Dissolved	0.00046	0.00049	6	0.00133	0.00135	1	0.00023	0.00031	*	0.00064	0.00071	10
Iron (Fe)*Dissolved	**<0.030**	**<0.030**	*	0.041	0.042	2	0.089	0.087	2	0.033	0.033	0
Lead (Pb)*Dissolved	0.000064	0.000074	14	0.000449	0.000459	2	**<0.000050**	**<0.000050**	*	0.000304	0.000377	**21**
Lithium (Li)*Dissolved	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*
Magnesium (Mg)*Dissolved	3.75	4.52	19	3.40	3.27	4	0.102	0.101	1	1.25	1.28	2
Manganese (Mn)*Dissolved	0.000492	0.000617	**23**	0.00183	0.00167	9	0.0243	0.0239	2	0.00572	0.00585	2
Mercury (Hg)*Dissolved	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*
Molybdenum (Mo)*Dissolved	0.171	0.225	**27**	0.176	0.171	3	**<0.000050**	**<0.000050**	*	0.0927	0.0966	4
Nickel (Ni)*Dissolved	0.00055	0.00051	8	0.00264	0.00300	13	0.00050	**<0.00050**	*	0.00088	0.00098	11
Phosphorus (P)*Dissolved	**<0.30**	**<0.30**	*	**<0.30**	**<0.30**	*	**<0.30**	**<0.30**	*	**<0.30**	**<0.30**	*
Potassium (K)*Dissolved	0.393	0.451	14	0.395	0.418	6	0.095	0.089	7	0.200	0.215	7
Selenium (Se)*Dissolved	**<0.00010**	**<0.00010**	*	0.00019	0.00017	11	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*
Silicon (Si)*Dissolved	1.71	1.76	3	1.74	1.78	2	0.629	0.652	4	0.893	0.887	1
Silver (Ag)*Dissolved	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*
Sodium (Na)*Dissolved	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*
Strontium (Sr)*Dissolved	0.308	0.379	**21**	0.262	0.256	2	0.00845	0.00848	0	0.0878	0.0911	4
Thallium (Tl)*Dissolved	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*
Tin (Sn)*Dissolved	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*
Titanium (Ti)*Dissolved	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*
Uranium (U)*Dissolved	0.000895	0.00113	**23**	0.000589	0.000569	3	**<0.000010**	**<0.000010**	*	0.000177	0.000181	2
Vanadium (V)*Dissolved	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*
Zinc (Zn)*Dissolved	0.0062	0.0079	*	0.0041	0.0041	0	0.0011	**<0.0010**	*	0.0027	0.0030	11

Results are expressed as milligrams per litre except where noted.

Values in bold are the detection limit.

RPD = Relative Percent Difference relative to mean (in %).

** Denotes that RPD was not calculated due to one or more values being <5 times the detection limit.*

Shaded values indicate a greater than 20% difference.

Appendix 3.3-2. Calcualted Relative Percent Difference for Water Quality Duplicates, 2009

Sample ID Date Sampled	RC1 10*JUN*09	RC1 10*JUN*09	RPD %	PC1 18*JUN*09	PC1 18*JUN*09	RPD %	RC1 20*JUL*09	RC1 20*JUL*09	RPD %	RC1 20*AUG*09	RC1 20*AUG*09	RPD %
Physical Tests												
Colour, True	8.6	8.7	1	17.8	16.7	6	**<5.0**	**<5.0**	*	**<5.0**	**<5.0**	*
Conductivity	29.7	28.7	3	11.8	11.7	1	37.8	38.5	2	50.8	52.0	2
Hardness (as CaCO3)	14.0	13.8	1	4.41	4.47	1	18.3	17.2	6	22.5	21.8	3
pH	7.15	6.93	3	6.40	6.51	2	7.43	8.02	8	7.82	7.84	0
Total Suspended Solids	5.9	5.9	0	**<3.0**	**<3.0**	*	**<3.0**	5.9	*	**<3.0**	**<3.0**	*
Total Dissolved Solids	26	22	17	13	13	0	20	27	*	33	29	13
Turbidity	3.74	4.02	7	0.41	0.65	*	0.67	0.58	14	0.50	0.48	4
Anions and Nutrients												
Acidity (as CaCO3)	1.8	2.6	*	2.0	2.1	5	4.2	2.8	*	2.7	2.5	8
Alkalinity, Bicarbonate (as CaCO3)	11.8	11.0	7	3.9	3.9	0	14.6	14.6	0	18.9	19.1	1
Alkalinity, Carbonate (as CaCO3)	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*
Alkalinity, Hydroxide (as CaCO3)	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*
Alkalinity, Total (as CaCO3)	11.8	11.0	7	3.9	3.9	0	14.6	14.6	0	18.9	19.1	1
Ammonia as N	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*
Bromide (Br)	**<0.050**	**<0.050**	*	**<0.050**	**<0.050**	*	**<0.050**	**<0.050**	*	**<0.050**	**<0.050**	*
Chloride (Cl)	**<0.50**	**<0.50**	*	**<0.50**	**<0.50**	*	**<0.50**	**<0.50**	*	**<0.50**	**<0.50**	*
Fluoride (F)	**<0.020**	**<0.020**	*	**<0.020**	**<0.020**	*	**<0.020**	**<0.020**	*	**<0.020**	**<0.020**	*
Nitrate (as N)	0.0315	0.0315	0	**<0.0050**	**<0.0050**	*	0.0377	0.0388	3	0.136	0.135	1
Nitrite (as N)	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*
Total Kjeldahl Nitrogen	**<0.050**	**<0.050**	*	**<0.050**	**<0.050**	*	**<0.050**	**<0.050**	*	**<0.050**	**<0.050**	*
Total Nitrogen	0.050	**<0.050**	*	**<0.050**	**<0.050**	*	0.060	0.060	0	0.130	0.120	8
Total Phosphate as P	0.0111	0.0104	7	0.0044	0.0032	*	**<0.0020**	**<0.0020**	*	**<0.0020**	**<0.0020**	*
Sulfate (SO4)	2.18	2.18	0	0.51	0.52	2	2.48	2.56	3	4.38	4.37	0
Cyanides												
Cyanide, Total	**<0.0010**	**<0.0010**	*	0.0037	**<0.0010**	*	**<0.0010**	**<0.0010**	*	0.0015	0.0019	*
Organic / Inorganic Carbon												
Total Organic Carbon	1.51	1.48	2	3.19	3.33	4	0.74	0.68	8	1.09	1.14	4
Total Metals												
Aluminum (Al)*Total	0.108	0.276	**88**	0.0574	0.0564	2	0.0308	0.0299	3	0.0287	0.0254	12
Antimony (Sb)*Total	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*
Arsenic (As)*Total	0.00024	0.00026	8	**<0.00010**	**<0.00010**	*	0.00018	0.00018	0	0.00021	0.00020	5
Barium (Ba)*Total	0.00566	0.00731	**25**	0.00312	0.00307	2	0.00709	0.00703	1	0.0109	0.0107	2
Beryllium (Be)*Total	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*
Bismuth (Bi)*Total	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*
Boron (B)*Total	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*
Cadmium (Cd)*Total	0.000063	0.000066	5	**<0.000010**	**<0.000010**	*	0.000084	0.000082	2	0.000092	0.000090	2
Calcium (Ca)*Total	4.78	4.87	2	1.58	1.54	3	5.81	5.69	2	7.32	7.10	3
Chromium (Cr)*Total	**<0.00050**	0.00096	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*
Cobalt (Co)*Total	**<0.00010**	0.00015	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*
Copper (Cu)*Total	0.00053	0.00072	*	0.00011	0.00011	0	0.00041	0.00039	5	0.00057	0.00056	2
Iron (Fe)*Total	0.159	0.282	*	0.063	0.061	3	**<0.030**	**<0.030**	*	**<0.030**	**<0.030**	*
Lead (Pb)*Total	0.000136	0.000168	*	**<0.000050**	**<0.000050**	*	**<0.000050**	**<0.000050**	*	**<0.000050**	**<0.000050**	*
Lithium (Li)*Total	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*
Magnesium (Mg)*Total	0.550	0.636	15	0.120	0.116	3	0.686	0.667	3	0.796	0.757	5
Manganese (Mn)*Total	0.00869	0.0119	**31**	0.0200	0.0185	8	0.00161	0.00139	15	0.00102	0.000995	2
Mercury (Hg)*Total	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*
Molybdenum (Mo)*Total	0.00268	0.00295	10	**<0.000050**	**<0.000050**	*	0.00466	0.00474	2	0.00407	0.00403	1
Nickel (Ni)*Total	0.00075	0.00110	*	**<0.00050**	**<0.00050**	*	0.00050	**<0.00050**	*	0.00066	0.00062	6
Phosphorus (P)*Total	**<0.30**	**<0.30**	*	**<0.30**	**<0.30**	*	**<0.30**	**<0.30**	*	**<0.30**	**<0.30**	*
Potassium (K)*Total	0.260	0.305	16	**<0.050**	**<0.050**	*	0.353	0.346	2	0.452	0.429	5

Appendix 3.3-2. Calcualted Relative Percent Difference for Water Quality Duplicates, 2009

Sample ID Date Sampled	RC1 10*JUN*09	RC1 10*JUN*09	RPD %	PC1 18*JUN*09	PC1 18*JUN*09	RPD %	RC1 20*JUL*09	RC1 20*JUL*09	RPD %	RC1 20*AUG*09	RC1 20*AUG*09	RPD %
Selenium (Se)*Total	**<0.00010**	0.00023	*	**<0.00010**	**<0.00010**	*	0.00015	0.00011	*	**<0.00010**	**<0.00010**	*
Silicon (Si)*Total	1.15	1.35	16	0.620	0.620	0	1.12	1.10	2	1.39	1.38	1
Silver (Ag)*Total	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*
Sodium (Na)*Total	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*
Strontium (Sr)*Total	0.0242	0.0260	7	0.0105	0.0106	1	0.0309	0.0309	0	0.0390	0.0385	1
Thallium (Tl)*Total	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*
Tin (Sn)*Total	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*
Titanium (Ti)*Total	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*
Uranium (U)*Total	0.000164	0.000185	12	**<0.000010**	**<0.000010**	*	0.000116	0.000115	1	0.000110	0.000105	5
Vanadium (V)*Total	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*
Zinc (Zn)*Total	0.0021	0.0038	*	**<0.0010**	**<0.0010**	*	0.0013	0.0013	0	0.0013	0.0013	0
Dissolved Metals												
Aluminum (Al)*Dissolved	0.0330	0.0320	3	0.0489	0.0493	1	0.0239	0.0107	**76**	0.0134	0.0127	5
Antimony (Sb)*Dissolved	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*
Arsenic (As)*Dissolved	0.00017	0.00017	0	**<0.00010**	**<0.00010**	*	0.00016	0.00017	6	0.00021	0.00020	5
Barium (Ba)*Dissolved	0.00458	0.00459	0	0.00303	0.00314	4	0.00679	0.00673	1	0.0109	0.0108	1
Beryllium (Be)*Dissolved	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*
Bismuth (Bi)*Dissolved	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*
Boron (B)*Dissolved	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*
Cadmium (Cd)*Dissolved	0.000055	0.000057	4	**<0.000010**	**<0.000010**	*	0.000085	0.000071	18	0.000091	0.000085	7
Calcium (Ca)*Dissolved	4.76	4.67	2	1.57	1.59	1	6.14	5.79	6	7.63	7.41	3
Chromium (Cr)*Dissolved	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*
Cobalt (Co)*Dissolved	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*
Copper (Cu)*Dissolved	0.00042	0.00043	2	0.00011	0.00015	*	0.00041	0.00053	*	0.00053	0.00051	4
Iron (Fe)*Dissolved	**<0.030**	**<0.030**	*	**<0.030**	**<0.030**	*	**<0.030**	**<0.030**	*	**<0.030**	**<0.030**	*
Lead (Pb)*Dissolved	0.000078	**<0.000050**	*	**<0.000050**	**<0.000050**	*	**<0.000050**	**<0.000050**	*	**<0.000050**	**<0.000050**	*
Lithium (Li)*Dissolved	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*
Magnesium (Mg)*Dissolved	0.513	0.507	1	0.119	0.120	1	0.709	0.676	5	0.835	0.807	3
Manganese (Mn)*Dissolved	0.00393	0.00422	7	0.0140	0.0136	3	0.000600	0.000623	4	0.000491	0.000485	1
Mercury (Hg)*Dissolved	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*
Molybdenum (Mo)*Dissolved	0.00288	0.00289	0	**<0.000050**	**<0.000050**	*	0.00544	0.00474	14	0.00440	0.00431	2
Nickel (Ni)*Dissolved	0.00055	0.00056	2	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	0.00064	0.00064	0
Phosphorus (P)*Dissolved	**<0.30**	**<0.30**	*	**<0.30**	**<0.30**	*	**<0.30**	**<0.30**	*	**<0.30**	**<0.30**	*
Potassium (K)*Dissolved	0.255	0.255	0	0.051	0.055	8	0.371	0.358	4	0.474	0.455	4
Selenium (Se)*Dissolved	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	0.00010	0.00012	18	**<0.00010**	**<0.00010**	*
Silicon (Si)*Dissolved	0.977	0.969	1	0.609	0.614	1	1.11	1.06	5	1.33	1.33	0
Silver (Ag)*Dissolved	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*
Sodium (Na)*Dissolved	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*
Strontium (Sr)*Dissolved	0.0244	0.0241	1	0.0109	0.0110	1	0.0317	0.0306	4	0.0396	0.0392	1
Thallium (Tl)*Dissolved	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*
Tin (Sn)*Dissolved	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*
Titanium (Ti)*Dissolved	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*
Uranium (U)*Dissolved	0.000148	0.000146	1	**<0.000010**	**<0.000010**	*	0.000097	0.000096	1	0.000102	0.000101	1
Vanadium (V)*Dissolved	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*
Zinc (Zn)*Dissolved	0.0015	**<0.0010**	*	**<0.0010**	**<0.0010**	*	0.0018	0.0014	*	**<0.0020**	0.0013	*

Results are expressed as milligrams per litre except where noted.

Values in bold are the detection limit.

RPD = Relative Percent Difference relative to mean (in %).

** Denotes that RPD was not calculated due to one or more values being <5 times the detection limit.*

Shaded values indicate a greater than 20% difference.

Appendix 3.3-2. Calcualted Relative Percent Difference for Water Quality Duplicates, 2009

Sample ID Date Sampled	LC1 22*SEP*09	LC1 22*SEP*09	RPD %	LC1 21*OCT*09	LC1 21*OCT*09	RPD %	LC0 19*NOV*09	LC0 19*NOV*09	RPD %	RC1 21*DEC*09	RC1 21*DEC*09	RPD %
Physical Tests												
Colour, True	27.0	26.5	2	**<5.0**	**<5.0**	*	**<5.0**	**<5.0**	*	**<5.0**	**<5.0**	*
Conductivity	120	121	1	186	187	1	185	186	1	81.1	81.1	0
Hardness (as CaCO3)	50.7	48.2	5	82.3	82.5	0	80.2	81.7	2	36.9	35.3	4
pH	7.48	7.70	3	7.80	7.82	0	7.71	7.72	0	7.71	7.71	0
Total Suspended Solids	3.5	**<3.0**	*	**<3.0**	**<3.0**	*	**<3.0**	**<3.0**	*	**<3.0**	**<3.0**	*
Total Dissolved Solids	87	71	**20**	98	99	1	119	116	3	48	50	4
Turbidity	1.10	0.87	**23**	0.25	0.16	*	**<0.10**	0.11	*	1.23	1.31	6
Anions and Nutrients												
Acidity (as CaCO3)	3.2	2.4	*	2.1	2.0	5	1.6	1.6	0	1.6	1.6	0
Alkalinity, Bicarbonate (as CaCO3)	20.3	20.3	0	29.7	29.6	0	30.8	30.5	1	27.4	28.5	4
Alkalinity, Carbonate (as CaCO3)	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*
Alkalinity, Hydroxide (as CaCO3)	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*
Alkalinity, Total (as CaCO3)	20.3	20.3	0	29.7	29.6	0	30.8	30.5	1	27.4	28.5	4
Ammonia as N	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*
Bromide (Br)	**<0.050**	**<0.050**	*	**<0.050**	**<0.050**	*	**<0.050**	**<0.050**	*	**<0.050**	**<0.050**	*
Chloride (Cl)	**<0.50**	**<0.50**	*	1.50	1.50	0	0.72	0.72	0	**<0.50**	**<0.50**	*
Fluoride (F)	0.054	0.056	4	0.101	0.101	0	0.096	0.098	2	**<0.020**	**<0.020**	*
Nitrate (as N)	0.0189	0.0196	4	0.0395	0.0390	1	0.0379	0.0377	1	0.252	0.253	0
Nitrite (as N)	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*
Total Kjeldahl Nitrogen	**<0.050**	**<0.050**	*	**<0.050**	**<0.050**	*	**<0.050**	**<0.050**	*	**<0.050**	**<0.050**	*
Total Nitrogen	0.050	0.060	18	0.050	0.050	0	0.070	0.070	0	0.280	0.270	4
Total Phosphate as P	0.0024	**<0.0020**	*	**<0.0020**	**<0.0020**	*	**<0.0020**	**<0.0020**	*	**<0.0020**	**<0.0020**	*
Sulfate (SO4)	33.4	33.4	0	53.0	53.0	0	55.2	55.0	0	9.43	9.39	0
Cyanides												
Cyanide, Total	0.0051	0.0029	*	0.0016	0.0019	17	0.0020	0.0014	*	0.0013	0.0015	14
Organic / Inorganic Carbon												
Total Organic Carbon	4.70	4.69	0	1.67	1.61	4	2.34	2.25	4	0.96	0.99	3
Total Metals												
Aluminum (Al)*Total	0.109	0.109	0	0.0130	0.0124	5	0.0192	0.0190	1	0.0584	0.0541	8
Antimony (Sb)*Total	0.00023	0.00022	4	0.00044	0.00043	2	0.00031	0.00031	0	**<0.00010**	**<0.00010**	*
Arsenic (As)*Total	0.00031	0.00032	3	0.00027	0.00027	0	0.00020	0.00021	5	0.00023	0.00023	0
Barium (Ba)*Total	0.0181	0.0173	5	0.0254	0.0254	0	0.0202	0.0203	0	0.0137	0.0138	1
Beryllium (Be)*Total	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*
Bismuth (Bi)*Total	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*
Boron (B)*Total	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*
Cadmium (Cd)*Total	0.000141	0.000152	8	0.000174	0.000171	2	0.000163	0.000179	9	0.000094	0.000095	1
Calcium (Ca)*Total	17.0	16.2	5	25.9	26.3	2	25.5	25.3	1	12.0	12.3	2
Chromium (Cr)*Total	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*
Cobalt (Co)*Total	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*
Copper (Cu)*Total	0.00174	0.00168	4	0.00079	0.00082	4	0.00097	0.00086	12	0.00054	0.00058	7
Iron (Fe)*Total	0.110	0.111	1	**<0.030**	**<0.030**	*	**<0.030**	**<0.030**	*	0.051	0.052	2
Lead (Pb)*Total	0.000835	0.000783	6	0.000129	0.000128	1	0.000173	0.000177	2	**<0.000050**	**<0.000050**	*
Lithium (Li)*Total	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*
Magnesium (Mg)*Total	2.88	2.76	4	5.54	5.62	1	4.29	4.29	0	1.36	1.36	0
Manganese (Mn)*Total	0.00530	0.00507	4	0.000409	0.000415	1	0.000981	0.000980	0	0.00159	0.00158	1
Mercury (Hg)*Total	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*
Molybdenum (Mo)*Total	0.143	0.137	4	0.174	0.175	1	0.189	0.191	1	0.00996	0.00987	1
Nickel (Ni)*Total	0.00222	0.00207	7	0.00199	0.00198	1	0.00202	0.00195	4	0.00077	0.00074	4
Phosphorus (P)*Total	**<0.30**	**<0.30**	*	**<0.30**	**<0.30**	*	**<0.30**	**<0.30**	*	**<0.30**	**<0.30**	*
Potassium (K)*Total	0.387	0.381	2	0.483	0.488	1	0.426	0.425	0	0.483	0.481	0

Appendix 3.3-2. Calcualted Relative Percent Difference for Water Quality Duplicates, 2009

Sample ID Date Sampled	LC1 22*SEP*09	LC1 22*SEP*09	RPD %	LC1 21*OCT*09	LC1 21*OCT*09	RPD %	LC0 19*NOV*09	LC0 19*NOV*09	RPD %	RC1 21*DEC*09	RC1 21*DEC*09	RPD %
Selenium (Se)*Total	0.00017	0.00023	*	0.00020	0.00019	5	0.00018	**<0.00010**	*	0.00024	0.00027	12
Silicon (Si)*Total	1.62	1.55	4	1.57	1.57	0	1.71	1.71	0	1.93	1.93	0
Silver (Ag)*Total	0.000010	0.000010	0	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*
Sodium (Na)*Total	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*
Strontium (Sr)*Total	0.220	0.210	5	0.430	0.436	1	0.346	0.346	0	0.0646	0.0650	1
Thallium (Tl)*Total	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*
Tin (Sn)*Total	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*
Titanium (Ti)*Total	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*
Uranium (U)*Total	0.000319	0.000306	4	0.000400	0.000395	1	0.000608	0.000621	2	0.000172	0.000171	1
Vanadium (V)*Total	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*
Zinc (Zn)*Total	0.0049	0.0048	2	0.0036	0.0036	0	0.0038	0.0038	0	0.0015	0.0014	7
Dissolved Metals												
Aluminum (Al)*Dissolved	0.0610	0.0573	6	0.0107	0.0114	6	0.0189	0.0180	5	0.0171	0.0164	4
Antimony (Sb)*Dissolved	0.00022	0.00022	0	0.00040	0.00041	2	0.00031	0.00030	3	**<0.00010**	**<0.00010**	*
Arsenic (As)*Dissolved	0.00027	0.00025	8	**<0.00030**	**<0.00030**	*	0.00020	0.00020	0	0.00021	0.00021	0
Barium (Ba)*Dissolved	0.0161	0.0155	4	0.0251	0.0250	0	0.0200	0.0203	1	0.0134	0.0135	1
Beryllium (Be)*Dissolved	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*
Bismuth (Bi)*Dissolved	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*
Boron (B)*Dissolved	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*
Cadmium (Cd)*Dissolved	0.000120	0.000113	6	0.000178	0.000187	5	0.000161	0.000154	4	0.000060	0.000064	6
Calcium (Ca)*Dissolved	15.9	15.1	5	24.4	24.4	0	25.1	25.7	2	12.5	11.9	5
Chromium (Cr)*Dissolved	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*	**<0.00050**	**<0.00050**	*
Cobalt (Co)*Dissolved	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*
Copper (Cu)*Dissolved	0.00138	0.00136	1	**<0.00080**	**<0.00080**	*	0.00087	0.00088	1	0.00053	0.00047	12
Iron (Fe)*Dissolved	0.046	0.044	4	**<0.030**	**<0.030**	*	**<0.030**	**<0.030**	*	**<0.030**	**<0.030**	*
Lead (Pb)*Dissolved	0.000531	0.000421	**23**	0.000101	0.000096	5	0.000173	0.000147	16	**<0.000050**	**<0.000050**	*
Lithium (Li)*Dissolved	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*	**<0.0050**	**<0.0050**	*
Magnesium (Mg)*Dissolved	2.68	2.58	4	5.20	5.22	0	4.25	4.24	0	1.39	1.35	3
Manganese (Mn)*Dissolved	0.00175	0.00165	6	0.000340	0.000314	8	0.000958	0.000899	6	0.000619	0.000611	1
Mercury (Hg)*Dissolved	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*
Molybdenum (Mo)*Dissolved	0.134	0.128	5	0.171	0.172	1	0.188	0.195	4	0.0101	0.0100	1
Nickel (Ni)*Dissolved	0.00180	0.00172	5	0.00188	0.00202	7	0.00203	0.00208	2	0.00073	0.00069	6
Phosphorus (P)*Dissolved	**<0.30**	**<0.30**	*	**<0.30**	**<0.30**	*	**<0.30**	**<0.30**	*	**<0.30**	**<0.30**	*
Potassium (K)*Dissolved	0.349	0.327	7	0.446	0.446	0	0.418	0.426	2	0.486	0.471	3
Selenium (Se)*Dissolved	0.00012	**<0.00010**	*	0.00016	0.00017	6	0.00014	0.00014	0	**<0.00020**	0.00025	*
Silicon (Si)*Dissolved	1.53	1.53	0	1.55	1.53	1	1.70	1.66	2	1.75	1.75	0
Silver (Ag)*Dissolved	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*	**<0.000010**	**<0.000010**	*
Sodium (Na)*Dissolved	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*	**<2.0**	**<2.0**	*
Strontium (Sr)*Dissolved	0.205	0.197	4	0.417	0.416	0	0.349	0.350	0	0.0655	0.0647	1
Thallium (Tl)*Dissolved	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*
Tin (Sn)*Dissolved	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*	**<0.00010**	**<0.00010**	*
Titanium (Ti)*Dissolved	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*	**<0.010**	**<0.010**	*
Uranium (U)*Dissolved	0.000297	0.000284	4	0.000413	0.000410	1	0.000602	0.000623	3	0.000160	0.000161	1
Vanadium (V)*Dissolved	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*	**<0.0010**	**<0.0010**	*
Zinc (Zn)*Dissolved	0.0040	0.0036	11	0.0033	0.0032	3	0.0037	0.0037	0	0.0015	0.0014	7

Results are expressed as milligrams per litre except where noted.

Values in bold are the detection limit.

RPD = Relative Percent Difference relative to mean (in %).

** Denotes that RPD was not calculated due to one or more values being <5 times the detection limit.*

Shaded values indicate a greater than 20% difference.

Appendix 3.5-1

Stream, Lake and Wetland Sediment Data, 2009

Rescan™
Engineers and Scientists

Appendix 3.5-1. Stream, Lake and Wetland Sediment Data, 2009

Sample ID	LC 1 - A	LC 1 - B	LC 1 - C	RC1 - A	RC1 - B	RC1 - C	PC1	LC0 - A	LC0 - B	LC0 - C	LCO DUP - A	LCO DUP - B	LCO DUP - C
Date Sampled	16-AUG-09	16-AUG-09	16-AUG-09	17-AUG-09	17-AUG-09	17-AUG-09	17-AUG-09	18-AUG-09	18-AUG-09	18-AUG-09	18-AUG-09	18-AUG-09	18-AUG-09
Time Sampled	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00
ALS Sample ID	L810445-1	L810445-2	L810445-3	L810445-4	L810445-5	L810445-6	L810445-7	L810445-8	L810445-9	L810445-10	L810445-11	L810445-12	L810445-13
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Physical Tests													
pH	7.11	7.06	7.10	7.98	8.03	8.18	6.17	7.03	7.15	7.28	7.29	7.15	7.20
Particle Size													
% Gravel (>2mm)	7.0	10.0	9.0	2.0	1.0	17.0	30.0	8.0	4.0	3.0	7.0	4.0	19.0
% Sand (2.0mm - 0.063mm)	91.0	86.0	86.0	75.0	70.0	26.0	56.0	88.0	92.0	87.0	90.0	93.0	73.0
% Silt (0.063mm - 4um)	2.0	3.0	4.0	16.0	19.0	28.0	13.0	3.0	3.0	9.0	3.0	3.0	7.0
% Clay (<4um)	<1.0	1.0	1.0	7.0	11.0	29.0	1.0	1.0	<1.0	1.0	<1.0	1.0	1.0
Leachable Anions & Nutrients													
Total Nitrogen by LECO	0.035	0.034	0.035	0.061	0.065	0.090	0.505	0.035	0.034	0.042	0.041	0.035	0.048
Organic / Inorganic Carbon													
CaCO3 Equivalent	1.78	1.77	6.91	3.49	3.30	4.59	3.85	1.71	2.17	2.57	2.10	2.28	1.99
Inorganic Carbon	0.131	0.117	0.705	0.297	0.283	0.383	0.320	0.125	0.154	0.188	0.144	0.176	0.151
Total Carbon by Combustion	0.3	0.2	0.2	0.7	0.7	0.9	8.1	0.3	0.3	0.4	0.2	0.2	0.4
Total Organic Carbon	0.12	0.11	<0.10	0.37	0.41	0.50	7.76	0.14	0.12	0.24	<0.10	<0.10	0.25
Plant Available Nutrients													
Cation Exchange Capacity	1.31	1.60	1.66	2.95	3.18	5.13	25.2	1.31	1.83	2.15	1.41	1.68	2.13
Available Phosphate-P	1.4	<1.0	<1.0	<1.0	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Metals													
Aluminum (Al)	20400	17000	16500	22300	23700	27000	18500	16500	17000	13700	16500	17200	14400
Antimony (Sb)	<10	<10	<10	<10	<10	<10	<20	<10	<10	13	<10	<10	12
Arsenic (As)	30.4	33.0	29.9	45.0	41.4	28.8	156	28.9	29.6	37.7	30.4	30.4	36.4
Barium (Ba)	529	461	421	180	197	227	2330	481	395	250	464	383	230
Beryllium (Be)	0.58	<0.50	<0.50	0.56	0.65	0.66	<1.0	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Bismuth (Bi)	<20	<50	<40	<20	<20	<20	<40	<40	<40	<80	<40	<40	<90
Cadmium (Cd)	9.13	15.1	15.2	1.86	1.56	0.79	6.8	15.6	13.8	19.2	15.7	13.9	19.8
Calcium (Ca)	9580	9420	9500	12100	11100	16000	6680	9960	10100	9210	10100	9960	9370
Chromium (Cr)	64.6	59.6	59.6	72.0	69.0	73.4	24.7	57.6	62.5	52.8	59.8	61.3	52.1
Cobalt (Co)	22.7	22.3	21.9	21.7	21.1	19.8	520	22.5	21.7	33.7	22.2	22.3	35.0
Copper (Cu)	91.9	103	97.9	69.8	67.9	69.9	24.8	101	97.9	134	103	101	142
Iron (Fe)	46000	48500	48500	48800	47900	47100	131000	48500	48600	57100	48900	49500	60100
Lead (Pb)	263	419	425	<30	<30	<30	<60	395	351	774	387	380	840
Lithium (Li)	29.0	24.4	23.4	30.9	32.5	37.7	11.8	22.5	23.9	19.0	22.5	24.1	20.1
Magnesium (Mg)	14200	12300	12100	15900	16100	17100	2050	11800	12700	10000	11800	12700	10300
Manganese (Mn)	1450	1080	1080	1350	1310	1390	124000	1200	1120	964	1070	1060	984
Mercury (Hg)	0.0802	0.111	0.115	0.135	0.126	0.137	0.109	0.118	0.108	0.140	0.119	0.111	0.149
Molybdenum (Mo)	390	507	475	6.2	5.4	<4.0	13.9	396	473	493	393	520	545
Nickel (Ni)	87.3	74.6	74.8	85.7	84.9	86.8	275	72.7	76.8	94.2	75.7	76.8	81.5
Phosphorus (P)	1550	2010	2050	1350	1310	1210	1270	2170	1970	2430	2250	1960	2510
Potassium (K)	3070	2600	2460	2650	2990	3840	780	2370	2490	1860	2330	2620	2060
Selenium (Se)	<3.0	1.96	2.00	<2.0	<3.0	0.97	1.48	<3.0	<2.0	3.25	<3.0	<3.0	3.97
Silver (Ag)	4.4	10.7	9.9	<2.0	<2.0	<2.0	<4.0	8.9	8.5	17.3	9.5	9.4	19.2
Sodium (Na)	400	450	440	510	540	530	<400	450	410	430	460	430	450
Strontium (Sr)	80.3	73.2	70.6	66.8	63.5	80.9	97.5	74.5	68.1	59.1	75.7	69.4	61.4
Thallium (Tl)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Thallium (Tl)	<50	<50	<50	<50	<50	<50	<100	<50	<50	<50	<50	<50	<50
Tin (Sn)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Titanium (Ti)	1210	1030	998	917	846	520	318	1060	1040	863	1050	1080	927
Vanadium (V)	66.2	56.8	55.3	77.3	76.8	80.0	5.2	56.3	57.9	48.3	56.0	58.7	52.9
Zinc (Zn)	389	539	553	190	179	158	357	559	513	686	556	514	704

Appendix 3.5-1. Stream, Lake and Wetland Sediment Data, 2009

Sample ID	PATSYL - A	PATSYL - B	PATSYL - C	WL1 - A	WL1 - B	WL1 - C	WL2 - A	WL2 - B	WL2 - C	WL3 - A	WL3 - B	WL3 - C	WL4 - A
Date Sampled	18-AUG-09	18-AUG-09	18-AUG-09	20-AUG-09	20-AUG-09	20-AUG-09	20-AUG-09	20-AUG-09	20-AUG-09	20-AUG-09	20-AUG-09	20-AUG-09	20-AUG-09
Time Sampled	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00
ALS Sample ID	L810445-14	L810445-15	L810445-16	L810445-17	L810445-18	L810445-19	L810445-20	L810445-21	L810445-22	L810445-23	L810445-24	L810445-25	L810445-26
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Physical Tests													
pH	5.79	5.85	5.88	5.55	5.25	5.04	5.58	4.86	4.41	5.79	5.79	6.01	4.90
Particle Size													
% Gravel (>2mm)	<1.0	<1.0	5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
% Sand (2.0mm - 0.063mm)	10.0	3.0	5.0	3.0	2.0	9.0	7.0	5.0	4.0	1.0	2.0	2.0	2.0
% Silt (0.063mm - 4um)	69.0	78.0	85.0	72.0	66.0	64.0	74.0	85.0	83.0	69.0	70.0	66.0	82.0
% Clay (<4um)	21.0	20.0	5.0	25.0	32.0	27.0	19.0	10.0	13.0	30.0	28.0	32.0	17.0
Leachable Anions & Nutrients													
Total Nitrogen by LECO	1.05	0.684	1.10	2.27	2.07	1.87	1.70	2.05	2.82	1.87	1.81	1.73	1.99
Organic / Inorganic Carbon													
CaCO3 Equivalent	4.05	6.91	6.47	4.73	5.58	4.73	19.4	11.6	6.73	3.90	4.75	4.26	4.78
Inorganic Carbon	0.234	0.589	0.438	0.295	0.391	0.304	1.24	0.725	0.335	0.226	0.339	0.287	0.270
Total Carbon by Combustion	16.9	9.5	17.6	32.2	27.1	32.5	24.9	35.2	41.2	26.8	22.3	24.9	43.4
Total Organic Carbon	16.6	8.89	17.2	31.9	26.7	32.2	23.6	34.5	40.8	26.5	22.0	24.6	43.1
Plant Available Nutrients													
Cation Exchange Capacity	-	58.6	-	-	-	65.8	15.5	56.7	75.0	75.1	69.0	72.0	101
Available Phosphate-P	33.2	2.1	27.5	37.1	51.9	14.2	116	177	114	96.5	131	111	64.1
Metals													
Aluminum (Al)	40600	29300	41300	6430	5570	8960	8920	3740	2850	12000	12500	14500	3530
Antimony (Sb)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Arsenic (As)	38.1	30.3	39.2	<5.0	<5.0	<5.0	69.6	19.1	15.1	25.4	21.6	26.5	<5.0
Barium (Ba)	175	387	140	137	116	85.6	140	151	69.1	92.7	106	110	184
Beryllium (Be)	2.31	1.45	2.22	<0.50	<0.50	<0.50	0.51	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Bismuth (Bi)	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cadmium (Cd)	1.37	1.92	1.87	<0.50	<0.50	<0.50	1.87	1.41	1.20	2.35	1.99	2.53	0.50
Calcium (Ca)	8000	2190	5660	6300	3600	2950	4570	5500	1220	9670	8350	9500	7690
Chromium (Cr)	40.4	40.3	48.4	9.9	7.7	12.1	30.6	14.7	18.8	21.5	21.4	25.6	7.6
Cobalt (Co)	19.5	65.5	22.3	2.1	<2.0	<2.0	8.4	2.1	<2.0	5.5	4.8	8.2	2.8
Copper (Cu)	53.0	58.9	41.0	17.7	26.5	14.9	18.8	23.8	31.1	39.6	25.3	31.1	22.0
Iron (Fe)	84200	81400	121000	6210	2960	3890	17400	4510	3250	10100	10700	13700	9280
Lead (Pb)	<30	<30	<30	<30	<30	<30	33	<30	<30	<30	<30	<30	<30
Lithium (Li)	8.7	17.9	10.8	3.4	3.3	5.3	5.2	2.0	<2.0	8.7	10.2	10.5	<2.0
Magnesium (Mg)	2050	4660	2500	821	784	977	1710	939	316	2150	2890	2920	615
Manganese (Mn)	2020	42700	2290	268	133	152	2240	473	105	310	287	444	598
Mercury (Hg)	0.334	0.227	0.324	0.124	0.120	0.124	0.0992	0.118	0.201	0.177	0.130	0.186	0.160
Molybdenum (Mo)	24.6	10.8	11.6	<4.0	<4.0	<4.0	40.7	83.6	150	7.3	21.9	25.5	12.6
Nickel (Ni)	38.9	77.9	42.4	22.4	17.7	22.6	29.9	20.6	17.6	76.2	64.0	84.3	10.0
Phosphorus (P)	3320	2440	4670	762	535	467	1690	1210	1000	1410	1340	1500	973
Potassium (K)	660	1100	760	420	470	460	1000	840	450	560	890	750	410
Selenium (Se)	<3.0	<2.0	<3.0	<2.0	<2.0	<2.0	<2.0	<4.0	<2.0	<4.0	<3.0	<3.0	<2.0
Silver (Ag)	<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
Sodium (Na)	<200	<200	<200	<200	<200	<200	<200	230	<200	<200	<200	<200	<200
Strontium (Sr)	62.4	22.4	68.4	41.5	27.1	20.6	50.4	60.8	18.8	59.0	54.4	58.1	68.3
Thallium (Tl)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Thallium (Tl)	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Tin (Sn)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Titanium (Ti)	193	204	206	101	115	149	105	68.2	45.2	79.1	101	103	61.8
Vanadium (V)	39.1	26.5	42.1	9.1	9.1	13.9	16.2	7.4	15.1	18.8	20.8	25.3	7.9
Zinc (Zn)	180	156	194	28.7	24.0	16.8	67.9	48.9	39.6	138	125	143	17.6

Appendix 3.5-1. Stream, Lake and Wetland Sediment Data, 2009

Sample ID	WL4 - B	WL4 - C	WL4 DUP - A	WL4 DUP - B	WL4 DUP - C
Date Sampled	20-AUG-09	20-AUG-09	20-AUG-09	20-AUG-09	20-AUG-09
Time Sampled	00:00	00:00	00:00	00:00	00:00
ALS Sample ID	L810445-27	L810445-28	L810445-29	L810445-30	L810445-31
Matrix	Soil	Soil	Soil	Soil	Soil
Physical Tests					
pH	4.93	4.86	4.98	5.00	5.02
Particle Size					
% Gravel (>2mm)	<1.0	<1.0	<1.0	<1.0	<1.0
% Sand (2.0mm - 0.063mm)	2.0	1.0	1.0	2.0	2.0
% Silt (0.063mm - 4um)	81.0	86.0	81.0	85.0	88.0
% Clay (<4um)	17.0	13.0	18.0	13.0	11.0
Leachable Anions & Nutrients					
Total Nitrogen by LECO	2.48	2.10	2.09	2.47	2.15
Organic / Inorganic Carbon					
CaCO3 Equivalent	5.10	4.79	5.53	5.71	5.45
Inorganic Carbon	0.314	0.337	0.355	0.317	0.377
Total Carbon by Combustion	41.2	45.7	44.1	41.4	44.7
Total Organic Carbon	40.9	45.4	43.8	41.1	44.3
Plant Available Nutrients					
Cation Exchange Capacity	102	103	93.5	-	106
Available Phosphate-P	67.8	6.6	52.3	76.1	10.7
Metals					
Aluminum (Al)	3880	2980	2350	3510	2820
Antimony (Sb)	<10	<10	<10	<10	<10
Arsenic (As)	5.4	5.5	<5.0	5.9	5.6
Barium (Ba)	214	188	130	202	163
Beryllium (Be)	<0.50	<0.50	<0.50	<0.50	<0.50
Bismuth (Bi)	<20	<20	<20	<20	<20
Cadmium (Cd)	<0.50	<0.50	<0.50	<0.50	<0.50
Calcium (Ca)	5340	8430	5520	4940	7970
Chromium (Cr)	8.4	5.0	6.5	7.1	3.7
Cobalt (Co)	4.6	4.1	<2.0	4.0	3.6
Copper (Cu)	23.8	12.8	15.2	19.4	10.3
Iron (Fe)	11600	17500	6380	10700	15400
Lead (Pb)	<30	<30	<30	<30	<30
Lithium (Li)	<2.0	<2.0	<2.0	<2.0	<2.0
Magnesium (Mg)	927	462	416	863	405
Manganese (Mn)	864	669	432	799	613
Mercury (Hg)	0.202	0.125	0.112	0.184	0.117
Molybdenum (Mo)	16.1	7.6	9.6	14.0	6.9
Nickel (Ni)	9.5	7.8	7.5	8.5	6.2
Phosphorus (P)	1580	951	674	1510	802
Potassium (K)	660	340	290	650	290
Selenium (Se)	<2.0	<2.0	<2.0	<2.0	<2.0
Silver (Ag)	<2.0	<2.0	<2.0	<2.0	<2.0
Sodium (Na)	<200	<200	<200	<200	<200
Strontium (Sr)	56.9	59.3	48.9	53.7	54.2
Thallium (Tl)	<1.0	<1.0	<1.0	<1.0	<1.0
Thallium (Tl)	<50	<50	<50	<50	<50
Tin (Sn)	<5.0	<5.0	<5.0	<5.0	<5.0
Titanium (Ti)	105	40.8	37.0	86.6	38.1
Vanadium (V)	10.0	4.6	4.7	9.7	3.2
Zinc (Zn)	21.2	15.6	12.0	16.5	14.5

Appendix 3.5-2

Relative Percent Difference Calculations for Sediment Duplicates

Rescan™
Engineers and Scientists

Appendix 3.5-2. Relative Percent Difference Calculations for Sediment Duplicates

	Duplicate Samples for Stream Sediments								Duplicate Samples for Wetland Sediments							
Sample ID	**LC0**	**LCO DUP - A**	**RPD**	**LC0**	**LCO DUP - B**	**RPD**	**LC0**	**LCO DUP - C**	**RPD**	**WL4**	**WL4 DUP - A**	**RPD**	**WL4**	**WL4 DUP - B**	**RPD**	**WL4**	**WL4 DUP - C**	**RPD**
Date Sampled	**18-AUG-09**			**18-AUG-09**			**18-AUG-09**			**20-AUG-09**			**20-AUG-09**			**20-AUG-09**		
pH	7.03	7.29	**4**	7.15	7.15	**0**	7.28	7.2	**1**	4.9	4.98	**2**	4.93	5	**1**	4.86	5.02	**3**
Total Nitrogen by LECO	0.035	0.041	**16**	0.034	0.035	**3**	0.042	0.048	**13**	1.99	2.09	**5**	2.48	2.47	**0**	2.1	2.15	**2**
CaCO3 Equivalent	1.71	2.1	*	2.17	2.28	*	2.57	1.99	*	4.78	5.53	**15**	5.1	5.71	**11**	4.79	5.45	**13**
Inorganic Carbon	0.125	0.144	**14**	0.154	0.176	**13**	0.188	0.151	**22**	0.27	0.355	*	0.314	0.317	**1**	0.337	0.377	**11**
Total Carbon by Combustion	0.3	0.2	*	0.3	0.2	*	0.4	0.4	*	43.4	44.1	**2**	41.2	41.4	**0**	45.7	44.7	**2**
Total Organic Carbon	0.14	<0.10	*	0.12	<0.10	*	0.24	0.25	**4**	43.1	43.8	**2**	40.9	41.1	**0**	45.4	44.3	**2**
Cation Exchange Capacity	1.31	1.41	**7**	1.83	1.68	**9**	2.15	2.13	**1**	101	93.5	**8**	102	-	*	103	106	**3**
Available Phosphate-P	<1.0	<1.0	*	<1.0	<1.0	*	<1.0	<1.0	*	64.1	52.3	**20**	67.8	76.1	**12**	6.6	10.7	**47**
Aluminum (Al)	16500	16500	**0**	17000	17200	**1**	13700	14400	**5**	3530	2350	**40**	3880	3510	**10**	2980	2820	**6**
Antimony (Sb)	<10	<10	*	<10	<10	*	13	12	**8**	<10	<10	*	<10	<10	*	<10	<10	*
Arsenic (As)	28.9	30.4	**5**	29.6	30.4	**3**	37.7	36.4	**4**	<5.0	<5.0	*	5.4	5.9	**9**	5.5	5.6	**2**
Barium (Ba)	481	464	**4**	395	383	**3**	250	230	**8**	184	130	**34**	214	202	**6**	188	163	**14**
Beryllium (Be)	<0.50	<0.50	*	<0.50	<0.50	*	<0.50	<0.50	*	<0.50	<0.50	*	<0.50	<0.50	*	<0.50	<0.50	*
Bismuth (Bi)	<40	<40	*	<40	<40	*	<80	<90	*	<20	<20	*	<20	<20	*	<20	<20	*
Cadmium (Cd)	15.6	15.7	**1**	13.8	13.9	**1**	19.2	19.8	**3**	0.5	<0.50	*	<0.50	<0.50	*	<0.50	<0.50	*
Calcium (Ca)	9960	10100	**1**	10100	9960	**1**	9210	9370	**2**	7690	5520	**33**	5340	4940	**8**	8430	7970	**6**
Chromium (Cr)	57.6	59.8	**4**	62.5	61.3	**2**	52.8	52.1	**1**	7.6	6.5	**16**	8.4	7.1	**17**	5	3.7	**30**
Cobalt (Co)	22.5	22.2	**1**	21.7	22.3	**3**	33.7	35	**4**	2.8	<2.0	*	4.6	4	**14**	4.1	3.6	**13**
Copper (Cu)	101	103	**2**	97.9	101	**3**	134	142	**6**	22	15.2	**37**	23.8	19.4	**20**	12.8	10.3	**22**
Iron (Fe)	48500	48900	**1**	48600	49500	**2**	57100	60100	**5**	9280	6380	**37**	11600	10700	**8**	17500	15400	**13**
Lead (Pb)	395	387	**2**	351	380	**8**	774	840	**8**	<30	<30	*	<30	<30	*	<30	<30	*
Lithium (Li)	22.5	22.5	**0**	23.9	24.1	**1**	19	20.1	**6**	<2.0	<2.0	*	<2.0	<2.0	*	<2.0	<2.0	*
Magnesium (Mg)	11800	11800	**0**	12700	12700	**0**	10000	10300	**3**	615	416	**39**	927	863	**7**	462	405	**13**
Manganese (Mn)	1200	1070	**11**	1120	1060	**6**	964	984	**2**	598	432	**32**	864	799	**8**	669	613	**9**
Mercury (Hg)	0.118	0.119	**1**	0.108	0.111	**3**	0.14	0.149	**6**	0.16	0.112	**35**	0.202	0.184	**9**	0.125	0.117	**7**
Molybdenum (Mo)	396	393	**1**	473	520	**9**	493	545	**10**	12.6	9.6	*	16.1	14	**14**	7.6	6.9	**10**
Nickel (Ni)	72.7	75.7	**4**	76.8	76.8	**0**	94.2	81.5	**14**	10	7.5	*	9.5	8.5	**11**	7.8	6.2	*
Phosphorus (P)	2170	2250	**4**	1970	1960	**1**	2430	2510	**3**	973	674	**36**	1580	1510	**5**	951	802	**17**
Potassium (K)	2370	2330	**2**	2490	2620	**5**	1860	2060	**10**	410	290	*	660	650	**2**	340	290	**16**
Selenium (Se)	<3.0	<3.0	*	<2.0	<3.0	*	3.25	3.97	**20**	<2.0	<2.0	*	<2.0	<2.0	*	<2.0	<2.0	*
Silver (Ag)	8.9	9.5	**7**	8.5	9.4	**10**	17.3	19.2	**10**	<2.0	<2.0	*	<2.0	<2.0	*	<2.0	<2.0	*
Sodium (Na)	450	460	**2**	410	430	**5**	430	450	**5**	<200	<200	*	<200	<200	*	<200	<200	*
Strontium (Sr)	74.5	75.7	**2**	68.1	69.4	**2**	59.1	61.4	**4**	68.3	48.9	**33**	56.9	53.7	**6**	59.3	54.2	**9**
Thallium (Tl)	<1.0	<1.0	*	<1.0	<1.0	*	<1.0	<1.0	*	<1.0	<1.0	*	<1.0	<1.0	*	<1.0	<1.0	*
Thallium (Tl)	<50	<50	*	<50	<50	*	<50	<50	*	<50	<50	*	<50	<50	*	<50	<50	*
Tin (Sn)	<5.0	<5.0	*	<5.0	<5.0	*	<5.0	<5.0	*	<5.0	<5.0	*	<5.0	<5.0	*	<5.0	<5.0	*
Titanium (Ti)	1060	1050	**1**	1040	1080	**4**	863	927	**7**	61.8	37	**50**	105	86.6	**19**	40.8	38.1	**7**
Vanadium (V)	56.3	56	**1**	57.9	58.7	**1**	48.3	52.9	**9**	7.9	4.7	*	10	9.7	**3**	4.6	3.2	*
Zinc (Zn)	559	556	**1**	513	514	**0**	686	704	**3**	17.6	12	**38**	21.2	16.5	**25**	15.6	14.5	**7**

** indicates that the RPD was not calculated since one or both of the values were below or less than 5x the detection limit.*

RPD- Relative percent difference

Shading indicates a RPD > 20.

Appendix 3.7-1

Stream Periphyton Data, 2009

Rescan™
Engineers and Scientists

Appendix 3.7-1. Stream Periphyton Data, 2009

Units = cells/cm^2											
FES Sample Number			**090387**	**090388**	**090389**	**090390**	**090391**	**090392**	**090393**	**090394**	**090395**
Sampling Station				**PC1**			**LC1**			**PC2**	
Sample Replicate			**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**
Sampling Date				**15-Aug-05**			**15-Aug-05**			**16-Aug-05**	
Area Sampled (cm^2)			**7.065**	**7.065**	**7.065**	**21.195**	**21.195**	**21.195**	**21.195**	**21.195**	**21.195**
Phylum	Order										
Bacillariophycae	Centrales	*Cyclotella* sp.			<217.6						
		Melosira sp.	<317.4						<40.7		
	Pennales	*Achnanthes minutissima*	91,020.0	17,589.6	21,932.3	100,279.2	52,356.0	34,403.6	55,876.2	198.3	11,025.2
		Achnanthes spp.	12,300.0	4,397.4	3,374.2	2,387.6			315.7	76.8	769.2
		Anomoeoneis spp.	9,840.0	8,794.8	6,748.4	<40.0					
		Caloneis spp.	2,539.2		1,305.6						
		Ceratoneis arcus				3,012.0	907.2	52.4		<25.6	33.1
		Cymbella cf. cestaii	1,904.4	283.6	<217.6						
		Cymbella cistula				40.0			<40.7	<25.6	<33.1
		Cymbella lunata	24,600.0	21,987.0	18,558.1						
		Cymbella minuta	2,539.2	1,701.6	<217.6	40.0	<29.3		162.8	<25.6	331.0
		Cymbella sinuata					<29.3	104.8	<40.7	25.6	132.4
		Cymbella spp.	634.8	283.6	870.4	<40.0					
		Diatoma elongatum				20,294.6	7,853.4	26.2			
		Diatoma hiemale									
		Diatoma mesodon				240.0	58.6	<26.2	<40.7	<25.6	66.2
		Epithemia sp.							<40.7		
		Eunotia spp.	41,820.0	10,993.5	32,054.9	<40.0	<29.3		81.4	<25.6	529.6
		Fragilaria montana									
		Fragilaria vaucheriae		283.6	435.2	720.0	351.6	78.6	40.7	<25.6	165.5
		Fragilaria spp.	1,269.6			903.6	234.4			<25.6	99.3
		Frustulia sp.	34,440.0	32,980.5	10,122.6						
		Gomphonema angustatum /parvulum	1,904.4	1,701.6	870.4	560.0	703.2	52.4	122.1	25.6	66.2
		Gomphonema truncatum			<217.6		<29.3				<33.1
		Gomphonema spp.	1,269.6	1,134.4	1,305.6	480.0	234.4	1,016.0	325.6	<25.6	264.8
		Meridion circulare				<40.0			<40.7	<25.6	<33.1
		Navicula spp.	3,808.8	2,268.8	33,742.0				<40.7		<33.1
		Nitzschia spp.	<317.4		217.6						
		Pinnularia spp.		1,134.4	<217.6						
		Stauroneis sp.			<217.6						
		Stenopterobia sp.			<217.6						
		Synedra incisa	634.8	283.6		80.0					
		Synedra ulna				<40.0	<29.3				
		Synedra spp.	24,600.0	26,384.4	16,871.0	10,744.2	11,343.8	314.4	40.7	<25.6	132.4
		Tabellaria fenestrata	317.4	283.6	1,740.8						
		Tabellaria flocculosa	6,982.8	6,239.2	9,139.2						
		Tetracyclus sp.			<217.6						
		UID girdle view	317.4								
Chlorophyta	Chaetophorales	UID Chaetophorales				<40.0			<40.7		
	Chlorococcales	*Ankistrodesmus spp.*	<317.4	283.6	<217.6					<25.6	
		Characium sp.									
		Pediastrum spp.	<317.4	<283.6	<217.6						
		Scenedesmus spp.		<283.6	<217.6						
		Tetraedron sp.	<317.4	<283.6							
	Oedogoniales	*Bulbochaete sp.*	<317.4	<283.6							
		Oedogonium spp.	<317.4	<283.6	<217.6						
	Ulothricales	*Geminella sp.*	1,269.6								
		Microspora sp.	5,713.2	6,806.4					976.8	153.6	8,076.4
		Radiofilum conjunctivum	696,180.0	79,153.2	6,963.2						
		Ulothrix zonata									
		Ulothrix spp.					<29.3				

Appendix 3.7-1. Stream Periphyton Data, 2009

Units = cells/cm^2											
FES Sample Number			**090387**	**090388**	**090389**	**090390**	**090391**	**090392**	**090393**	**090394**	**090395**
Sampling Station				**PC1**			**LC1**			**PC2**	
Sample Replicate			**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**
Sampling Date				**15-Aug-05**			**15-Aug-05**			**16-Aug-05**	
Area Sampled (cm^2)			**7.065**	**7.065**	**7.065**	**21.195**	**21.195**	**21.195**	**21.195**	**21.195**	**21.195**
	Zygnematales	*Arthrodesmus sp.*			<217.6						
		Closterium spp.	<317.4	1,134.4	217.6						
		Cosmarium spp.	1,269.6	1,701.6	1,740.8						
		Euastrum spp.	<317.4	<283.6	217.6						
		Hyalotheca sp.	5,078.4	<283.6	870.4						
		Mougeotia spp.	2,539.2	2,268.8	10,444.8						
		Netrium sp.			<217.6						
		Penium sp.			<217.6						
		Roya sp.		283.6	870.4						
		Staurastrum spp.	<283.6	<283.6	217.6						
		Zygnema sp.		<283.6	652.8						
Chlorophyta		UID Chlorophyta colonial							<40.7		
		UID Chlorophyta filamentous	<317.4			<40.0					
		UID Chlorophyta unicellular	4,920.0			301.2		52.4	81.4		
Chrysophyta	Chromulinales	*Hydrurus sp*. cells*				191,008.0	218,150.0	17,201.8	42,514.5	26,715.5	1,282.0
	Rhizochloridales	*Stichogloea sp.*		2,268.8	2,611.2						
Chrysophyta		UID Chrysophyta cyst	9,840.0	8,794.8	6,748.4	602.4	226.8	52.4	1,578.5	198.3	33.1
		UID Chrysophyta unicellular									
Cyanophyta	Chamaesiphonales	*Chamaesiphon spp.*		4,537.6		5,120.4	30,541.0	195,475.0	702,096.6	1,464,009.4	1,126,811.4
		Clastidium spp.				8,356.6	34,031.4	76,626.2	8,502.9		9,867.0
	Chroococcales	*Aphanothece sp.*		20,419.2	10,444.8						
		UID Chroococcales		13,192.2							
	Nostocales	*Anabaena/Nostoc sp.*							<40.7		
		Calothrix sp.?									
		Tolypothrix sp.		<283.6	<217.6						
		Tolypothrix sp?									
	Oscillatoriales	*Homoeothrix varians*				606,450.4	869,109.6	555,149.0	738,537.6	311,426.4	704,503.8
		Lyngbya spp.	56,580.0	494,707.5	342,481.3						
		Oscillatoria spp.		171,498.6	177,145.5						
		Pseudoanabaena sp.	3,808.8	35,179.2	20,245.2				162.8		
		Pseudoanabaena spp.				3,915.6					
		Spirulina sp.									
		UID Oscillatoriales	41,820.0	171,498.6	11,809.7	400.0	146.5	<26.2	<40.7		463.4
Rhodophyta	Nemalionales	*Audouinella sp.*	9,522.0		1,305.6		87.9	<26.2	<40.7	<25.6	926.8
		UID colonial		<283.6	<217.6				1,894.2		<33.1
		UID unicellular	12,300.0	24,185.7	10,122.6	2387.6	453.6	406.4	2,429.4	198.3	769.2

UID = unidentified due to lack of size and / or missing morphological characters.
cf. = (confertim = close together) = possibly for species
? = possibly for genus

* No intact thallus seen. Some small bits of thallus, but mostly individual cells and some smaller cells in deteriorating colonies.

Synonyms:
Cymbella lunata = Cymbella gracilis
Diatoma mesodon = Diatoma hiemale var. mesodon

Appendix 3.7-1. Stream Periphyton Data, 2009

Units = cells/cm^2											
FES Sample Number			**090396**	**090397**	**090398**	**090399**	**090400**	**090401**	**090402**	**090403**	**090404**
Sampling Station				**LC3**			**RC1**			**LC0**	
Sample Replicate			**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**
Sampling Date				**16-Aug-05**			**16-Aug-05**			**17-Aug-05**	
Area Sampled (cm^2)			**21.195**	**21.195**	**21.195**	**21.195**	**21.195**	**21.195**	**21.195**	**21.195**	**21.195**
Phylum	Order										
Bacillariophycae	Centrales	*Cyclotella* sp.									
		Melosira sp.									
	Pennales	*Achnanthes minutissima*	<13.0	4,523.6	57.6	3,187.5	2,844.8	2,779.7	55,008.0	70,021.2	201,190.0
		Achnanthes spp.		210.4	14.4		91.6		1,528.0	79.6	713.1
		Anomoeoneis spp.					<22.9		<25.3	<39.8	
		Caloneis spp.			<14.4						
		Ceratoneis arcus		<13.6	14.4	<24.2	<22.9	<18.9	4,897.5	23,736.0	8,230.5
		Cymbella cf. cestaii									
		Cymbella cistula			<14.4				151.8	<39.8	92.1
		Cymbella lunata									
		Cymbella minuta			<14.4	<24.2	45.8	<18.9	<25.3	<39.8	92.1
		Cymbella sinuata		54.4		24.2	22.9	<18.9	50.6	<39.8	30.7
		Cymbella spp.									<30.7
		Diatoma elongatum							28,268.0	80,702.4	76,818.0
		Diatoma hiemale									<30.7
		Diatoma mesodon		<13.6	<14.4		<22.9		101.2	318.4	368.4
		Epithemia sp.									
		Eunotia spp.								<39.8	<30.7
		Fragilaria montana									<30.7
		Fragilaria vaucheriae				<24.2	<22.9		979.5	1,850.4	1,426.2
		Fragilaria spp.	<13.0						391.8	3,700.8	3,327.8
		Frustulia sp.									
		Gomphonema angustatum /parvulum		13.6		48.4	45.8	<18.9	1,567.2	4,934.4	2,852.4
		Gomphonema truncatum									
		Gomphonema spp.		1,367.6	<14.4	145.2	68.7	<18.9	783.6	7,401.6	1,663.9
		Meridion circulare								<39.8	<30.7
		Navicula spp.							25.3		
		Nitzschia spp.	<13.0								<30.7
		Pinnularia spp.					<22.9		<25.3		
		Stauroneis sp.									
		Stenopterobia sp.									
		Synedra incisa							25.3	238.8	30.7
		Synedra ulna							227.7	796.0	491.2
		Synedra spp.	13.0		14.4		<22.9	<18.9	3,918.0	20,175.6	22,862.5
		Tabellaria fenestrata									
		Tabellaria flocculosa							<25.3	<39.8	
		Tetracyclus sp.			<14.4						
		UID girdle view									
Chlorophyta	Chaetophorales	UID Chaetophorales									
	Chlorococcales	*Ankistrodesmus spp.*								<39.8	
		Characium sp.								<39.8	
		Pediastrum spp.									
		Scenedesmus spp.									
		Tetraedron sp.									
	Oedogoniales	*Bulbochaete sp.*									
		Oedogonium spp.									
	Ulothricales	*Geminella sp.*									
		Microspora sp.								<39.8	
		Radiofilum conjunctivum									
		Ulothrix zonata							<25.3		
		Ulothrix spp.							126.5		184.2

Appendix 3.7-1. Stream Periphyton Data, 2009

Units = cells/cm^2											
FES Sample Number			**090396**	**090397**	**090398**	**090399**	**090400**	**090401**	**090402**	**090403**	**090404**
Sampling Station				**LC3**			**RC1**			**LC0**	
Sample Replicate			**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**
Sampling Date				**16-Aug-05**			**16-Aug-05**			**17-Aug-05**	
Area Sampled (cm^2)			**21.195**	**21.195**	**21.195**	**21.195**	**21.195**	**21.195**	**21.195**	**21.195**	**21.195**
	Zygnematales	*Arthrodesmus sp.*									
		Closterium spp.									
		Cosmarium spp.		<13.6				<18.9			
		Euastrum spp.									
		Hyalotheca sp.									
		Mougeotia spp.									
		Netrium sp.									
		Penium sp.									
		Roya sp.									
		Staurastrum spp.									
		Zygnema sp.									
Chlorophyta		UID Chlorophyta colonial				<24.2					
		UID Chlorophyta filamentous							<25.3		
		UID Chlorophyta unicellular								<39.8	
Chrysophyta	Chromulinales	*Hydrurus sp.* cells*	88,849.0	16,600.9	209,498.4	41,841.2	32,157.4	20,271.6	218,504.0	339,424.8	307,272.0
	Rhizochloridales	*Stichogloea sp.*									
Chrysophyta		UID Chrysophyta cyst		54.4					391.8	318.4	30.7
		UID Chrysophyta unicellular			<14.4						
Cyanophyta	Chamaesiphonales	*Chamaesiphon spp.*	8,884.9	108,513.2	349,450.2	115,424.0	786,830.0	507,916.2	32,852.0	34,417.2	34,751.0
		Clastidium spp.	3,090.4	1,214.7	23,182.2	79,354.0	67,051.6	52,931.4	32,852.0	17,802.0	7,316.0
	Chroococcales	*Aphanothece sp.*									
		UID Chroococcales	<13.0								
	Nostocales	*Anabaena/Nostoc sp.*			<14.4						
		Calothrix sp.?							<25.3	<39.8	<30.7
		Tolypothrix sp.									
		Tolypothrix sp?									<30.7
	Oscillatoriales	*Homoeothrix varians*	119,753.0	25,103.8	458,492.2	838,826.8	592,517.2	412,189.2	629,536.0	1,243,766.4	1,088,255.0
		Lyngbya spp.							<25.3	955.2	1,596.4
		Oscillatoria spp.									
		Pseudoanabaena sp.					<22.9		2,546.7	796.0	184.2
		Pseudoanabaena spp.									
		Spirulina sp.					<22.9		253.0	<39.8	
		UID Oscillatoriales							759.0	636.8	<30.7
Rhodophyta	Nemalionales	*Audouinella sp.*			<14.4				1,214.4	636.8	92.1
		UID colonial									
		UID unicellular	100.4	105.2	223.2	<24.2		<18.9	1,528.0	2,373.6	<30.7

UID = unidentified due to lack of size and / or missing morphological characters.
cf. = (confertim = close together) = possibly for species
? = possibly for genus

* No intact thallus seen. Some small bits of thallus, but mostly individual cells and some smaller cells in deteriorating colonies.

Synonyms:
Cymbella lunata = Cymbella gracilis
Diatoma mesodon = Diatoma hiemale var. mesodon

Appendix 3.7-2

Stream Chlorophyll α Data, 2009

Rescan™
Engineers and Scientists

Appendix 3.7-2. Stream Chlorophyll *a* Data, 2009

Stream Site	Chlorophyll *a* (µg)	Total Area Sampled(cm^2)	µg/cm^2
LC1 - A	3.7	21.195	0.17457
LC1 - B	2.16	21.195	0.10191
LC1 - C	1.02	21.195	0.04812
PC2 - A	7	21.195	0.33027
PC2 - B	13.7	21.195	0.64638
PC2 - C	7	21.195	0.33027
RC1 - A	0.05	21.195	0.00236
RC1 - B	0.043	21.195	0.00203
RC1 - C	0.698	21.195	0.03293
LC3 - A	0.142	21.195	0.00670
LC3 - B	0.036	21.195	0.00170
LC3 - C	0.155	21.195	0.00731
PC1 - A	0.273	7.065	0.03864
PC1 - B	0.193	7.065	0.02732
PC1 - C	1.2	7.065	0.16985
LC0- A	5.47	21.195	0.25808
LC0- B	5.02	21.195	0.23685
LC0- C	8.46	21.195	0.39915

Appendix 3.7-3

Lake and Wetland Phytoplankton Data, 2009

Rescan™
Engineers and Scientists

Appendix 3.7-3. Lake and Wetland Phytoplankton Data, 2009

Units = cells / mL								
FES Sample Number			090405	090406	090407	090408	090409	090410
Sampling Station				Patsy Lake			WL1	
Sample Replicate			A	B	C	A	B	C
Sampling Date				19-Aug-09			20-Aug-09	
Phylum	Order	Genera and Species						
Bacillariophycae	Centrales	*Cyclotella*		<1.4		<1.4		<1.4
		Melosira cf. italica	<1.4		<1.4			
		Melosira						
	Pennales	*Achnanthes minutissima*		<1.4	<1.4	8.4	7.0	4.2
		Achnanthes						
		Achnanthes ?						
		Amphora						
		Asterionella formosa						
		Ceratoneis				<1.4	<1.4	<1.4
		Cocconeis placentula						
		Cocconeis						
		Cymatopleura						
		Cymbella	<1.4		<1.4	4.2	1.4	7.0
		Diatoma		<1.4			<1.4	
		Epithemia						
		Eunotia				<1.4	<1.4	<1.4
		Fragilaria	<1.4	<1.4	<1.4	5.6	5.6	8.4
		Frustulia	<1.4			2.8	5.6	<1.4
		Gomphonema	<1.4		<1.4			
		Navicula	<1.4	<1.4	<1.4	15.4	8.4	19.6
		Neidium						
		Nitzschia						
		Pinnularia						
		Pleurosigma / Gyrosigma						
		Stauroneis				<1.4		<1.4
		Surirella						
		Synedra				<1.4	<1.4	<1.4
		Tabellaria fenestrata						
		Tabellaria flocculosa		<1.4				
		UID	<1.4	1.4	<1.4	5.6	7.0	8.4
Chlorophyta	Chlorococcales	*Ankistrodesmus*		<1.4		<1.4	<1.4	2.8
		Botryococcus braunii	44.8	<1.4	28.0	33.6	89.6	<1.4
		Closteriopsis				1.4	<1.4	<1.4
		Crucigenia quadrata	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
		Crucigenia rectangularis		<1.4		<1.4	<1.4	11.2
		Crucigenia tetrapedia	<1.4	11.2	5.6	50.4	78.4	28.0
		Dictyosphaerium				22.4	<1.4	
		Elakatothrix gelatinosa	1.4	<1.4	<1.4	<1.4	<1.4	<1.4
		Nephrocytium		<1.4		<1.4	<1.4	<1.4
		Oocystis	2.8	2.8	5.6	11.2	<1.4	22.4
		Oocystis ?				15.4	21.0	18.2
		Pediastrum tetras		<1.4		<1.4	<1.4	<1.4
		Pediastrum						
		Quadrigula closterioides	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
		Scenedesmus		<1.4		5.6	<1.4	11.2
		Schroederia						
		Selenastrum minutum	15.4	11.2	11.2			
		Selenastrum						
		Sphaerocystis schroeteri				<1.4	11.2	<1.4
		Tetraedron minimum					<1.4	
		Tetraedron						

Appendix 3.7-3. Lake and Wetland Phytoplankton Data, 2009

Units = cells / mL								
FES Sample Number			090405	090406	090407	090408	090409	090410
Sampling Station				Patsy Lake			WL1	
Sample Replicate			A	B	C	A	B	C
Sampling Date				19-Aug-09			20-Aug-09	
	Oedogoniales	*Bulbochaete*						
		Oedogonium		<1.4				<1.4
		Oedogonium ?		<1.4		7.0	<1.4	
		UID			<1.4			
	Tetrasporales	*Gloeocystis ampla*	25.2	23.8	33.6		<1.4	
	Ulothricales	*Ulothrix ?*						
		Ulothrix						
	Volvocales	*Chlamydomonas*		<1.4				
		Chlamydomonas ?	<1.4		<1.4			
		Eudorina						
		Pandorina morum						
		UID	<1.4	<1.4	<1.4			
	Zygnematales	*Arthrodesmus*	<1.4		<1.4	<1.4	<1.4	<1.4
		Bambusina						
		Closterium				<1.4	<1.4	<1.4
		Cosmarium		1.4	<1.4	5.6	7.0	4.2
		Cylindrocystis				1.4	2.8	<1.4
		Desmidium ?						
		Euastrum				<1.4	<1.4	2.8
		Gonatozygon		<1.4		<1.4	<1.4	<1.4
		Hyalotheca						
		Mougeotia				<1.4	<1.4	<1.4
		Mougeotia ?		<1.4				
		Netrium						
		Netrium ?						
		Pleurotaenium				<1.4	<1.4	<1.4
		Spirogyra ?						
		Spondylosium planum				5.6	4.2	9.8
		Spondylosium						
		Staurastrum				1.4	1.4	<1.4
		Triploceras ?						
		Xanthidium ?	<1.4	1.4	2.8	<1.4	<1.4	<1.4
		Zygnema ?	<1.4					
		UID	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
Chrysophyta	Mischococcales	*Characiopsis ?*						
	Ochromonadales	*Chrysosphaerella longispina* ***						
		Dinobryon	4.2	7.0	4.2	<1.4	<1.4	<1.4
		Mallomonas	<1.4	<1.4	<1.4	<1.4		<1.4
		Mallomonas ?						
		Synura ? ****				15.4	2.8	25.2
	Rhizochrysidales	*Diceras phaseolus*	1.4	<1.4	1.4	<1.4	<1.4	
	Vaucheriales	*Vaucheria ?*						
Cryptophyta	Cryptomonadales	*Chroomonas acuta*	11.2	16.8	14.0			
		Cryptomonas ovata / erosa	<1.4	2.8	1.4	117.6	82.6	147.0
		Cryptomonas	<1.4	<1.4	1.4			
Cyanophyta	Chamaesiphonales	*Chamaesiphon sp.* *						<1.4
	Chroococcales	*Agmenellum tenuissima*	<1.4	11.2	<1.4	67.2	89.6	67.2
		Agmenellum						
		Anacystis elachista				28.0	140.0	<1.4
		Anacystis cf. limneticus				<1.4	<1.4	<1.4
		Anacystis		<1.4	<1.4	<1.4		<1.4
		Gomphosphaeria				<1.4	<1.4	<1.4

Appendix 3.7-3. Lake and Wetland Phytoplankton Data, 2009

Units = cells / mL								
FES Sample Number			**090405**	**090406**	**090407**	**090408**	**090409**	**090410**
Sampling Station				**Patsy Lake**			**WL1**	
Sample Replicate			**A**	**B**	**C**	**A**	**B**	**C**
Sampling Date				**19-Aug-09**			**20-Aug-09**	
	Nostocales	*Anabaena cf. flos-aquae*						
		*Anabaena **		<1.4	<1.4			
		*Anabaena ? **	<1.4			5.6	<1.4	
		*Aphanizomenon flos-aquae **						
		*Aphanizomenon ? **						
		Nostoc						
		Nostoc ?					<1.4	
		UID						
	Oscillatoriales	*Lyngbya limnetica ***		<1.4	<1.4	130.2	144.2	84.0
		Lyngbya				<1.4	<1.4	<1.4
		Oscillatoria tenuis				<1.4	<1.4	<1.4
		Oscillatoria		<1.4	<1.4			<1.4
		Phormidium mucicola						
		UID						
Euglenophyta	Euglenales	*Euglena*					<1.4	<1.4
		Phacus						
		Phacus ?						
		Trachelomonas				2.8	2.8	2.8
Pyrrhophyta	Dinokontae	*Gymnodinium ?*	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
		Peridinium cf. inconspicuum	9.8	4.2	8.4	21	29.4	15.4
		Peridinium / Glenodinium						
		UID				<1.4		<1.4
UID filamentous algae								
UID branched filamentous algae								<1.4
UID colonial algae								

* Note : no or few gonidia and / or heterocysts observed

** Note : *Lyngbya limnetica / Homeothrix varians*

*** Note : spines are faint

**** Note : maybe *Chrysosphaerella longispina* , but spines not apparent

Note : Unidentified flagellates observed but not counted.

UID = unidentified due to lack of size and / or missing morphological characters.

Appendix 3.7-3. Lake and Wetland Phytoplankton Data, 2009

Units = cells / mL											
FES Sample Number			090411	090412	090413	090414	090415	090416	090417	090418	090419
Sampling Station				WL2			WL3			WL4	
Sample Replicate			A	B	C	A	B	C	A	B	C
Sampling Date				20-Aug-09			20-Aug-09			20-Aug-09	
Phylum	Order	Genera and Species									
Bacillariophycae	Centrales	*Cyclotella*						<1.4			
		Melosira cf. italica			<1.4						<1.4
		Melosira	<1.4	<1.4		<1.4	<1.4	<1.4			<1.4
	Pennales	*Achnanthes minutissima*									
		Achnanthes	<1.4	1.4	<1.4						1.4
		Achnanthes ?		<1.4			<1.4				
		Amphora				<1.4	<1.4				
		Asterionella formosa							4.2	<1.4	4.2
		Ceratoneis	<1.4	1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
		Cocconeis placentula									
		Cocconeis									
		Cymatopleura					<1.4				
		Cymbella	<1.4	1.4	<1.4	7.0	1.4	9.8	4.2	<1.4	2.8
		Diatoma		<1.4				<1.4			<1.4
		Epithemia									
		Eunotia	<1.4	1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
		Fragilaria	2.8	<1.4	<1.4	<1.4	<1.4	<1.4	2.8	<1.4	<1.4
		Frustulia	2.8	4.2	7.0	2.8	<1.4	1.4	1.4		<1.4
		Gomphonema				<1.4	<1.4	1.4		<1.4	
		Navicula	<1.4	1.4	<1.4	11.2	<1.4	14.0	2.8	2.8	5.6
		Neidium				<1.4	<1.4	<1.4	<1.4		<1.4
		Nitzschia									
		Pinnularia		<1.4		<1.4	<1.4	<1.4			
		Pleurosigma / Gyrosigma	<1.4	<1.4	<1.4		<1.4			<1.4	
		Stauroneis	<1.4			4.2	<1.4	2.8		<1.4	<1.4
		Surirella									
		Synedra				<1.4		1.4		<1.4	<1.4
		Tabellaria fenestrata									
		Tabellaria flocculosa	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4		
		UID	4.2	1.4	2.8	5.6	1.4	12.6	2.8	2.8	1.4
Chlorophyta	Chlorococcales	*Ankistrodesmus*	<1.4	<1.4	<1.4	1.4	2.8	1.4	<1.4	<1.4	<1.4
		Botryococcus braunii	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	218.4	224.0	190.4
		Closteriopsis	1.4	<1.4	<1.4			<1.4		11.2	<1.4
		Crucigenia quadrata						<1.4			
		Crucigenia rectangularis				<1.4	<1.4	11.2			
		Crucigenia tetrapedia				<1.4	5.6	<1.4	22.4	16.8	22.4
		Dictyosphaerium									<1.4
		Elakatothrix gelatinosa				8.4	5.6	7.0	<1.4	7.0	2.8
		Nephrocytium							<1.4		<1.4
		Oocystis				<1.4	<1.4	5.6	44.8	53.2	39.2
		Oocystis ?	2.8	<1.4	<1.4						
		Pediastrum tetras				<1.4	<1.4		5.6	11.2	16.8
		Pediastrum				<1.4		<1.4			<1.4
		Quadrigula closterioides	<1.4	<1.4	<1.4	<1.4	<1.4		5.6	<1.4	<1.4
		Scenedesmus				5.6	5.6	5.6	8.4	5.6	5.6
		Schroederia									
		Selenastrum minutum				<1.4	<1.4				
		Selenastrum									<1.4
		Sphaerocystis schroeteri	<1.4			<1.4	11.2	<1.4			
		Tetraedron minimum	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
		Tetraedron		<1.4		1.4	1.4	1.4			<1.4

Appendix 3.7-3. Lake and Wetland Phytoplankton Data, 2009

Units = cells / mL										
FES Sample Number			090411	090412	090413	090414	090415	090416	090417	090418	090419
Sampling Station				WL2			WL3			WL4	
Sample Replicate			A	B	C	A	B	C	A	B	C
Sampling Date				20-Aug-09			20-Aug-09			20-Aug-09	
	Oedogoniales	*Bulbochaete*	<1.4	<1.4	<1.4	<1.4		<1.4	<1.4	<1.4	
		Oedogonium	<1.4	<1.4	<1.4		4.2		18.2	<1.4	9.8
		Oedogonium ?		<1.4		<1.4		<1.4	<1.4		
		UID									
	Tetrasporales	*Gloeocystis ampla*									
	Ulothricales	*Ulothrix ?*	<1.4								
		Ulothrix								<1.4	
	Volvocales	*Chlamydomonas*									
		Chlamydomonas ?									
		Eudorina									
		Pandorina morum									
		UID		<1.4	<1.4			<1.4	<1.4	<1.4	<1.4
	Zygnematales	*Arthrodesmus*	<1.4	1.4	<1.4				<1.4	<1.4	<1.4
		Bambusina							<1.4	<1.4	<1.4
		Closterium	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	2.8	<1.4	<1.4
		Cosmarium	<1.4	1.4	<1.4	2.8	1.4	2.8	8.4	2.8	<1.4
		Cylindrocystis	<1.4		<1.4				39.2	16.8	46.2
		Desmidium ?							<1.4		
		Euastrum	<1.4	2.8	<1.4	<1.4	<1.4		<1.4	2.8	2.8
		Gonatozygon							2.8	<1.4	<1.4
		Hyalotheca				<1.4	<1.4	<1.4	<1.4		
		Mougeotia	<1.4	<1.4	<1.4			<1.4	5.6	2.8	<1.4
		Mougeotia ?	<1.4			<1.4					
		Netrium								<1.4	<1.4
		Netrium ?					<1.4		<1.4		
		Pleurotaenium							2.8	<1.4	<1.4
		Spirogyra ?								<1.4	
		Spondylosium planum	<1.4	<1.4	<1.4			<1.4	28.0	30.8	<1.4
		Spondylosium							<1.4		
		Staurastrum	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	1.4	2.8	1.4
		Triploceras ?							<1.4	<1.4	<1.4
		Xanthidium ?							<1.4	<1.4	
		Zygnema ?									
		UID	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
Chrysophyta	Mischococcales	*Characiopsis ?*									<1.4
	Ochromonadales	*Chrysosphaerella longispina* ***	210.0	71.4	161.0						<1.4
		Dinobryon	<1.4	<1.4	<1.4	16.8	11.2	21.0	109.2	134.4	112.0
		Mallomonas			<1.4	<1.4	<1.4	<1.4			<1.4
		Mallomonas ?							86.8	16.8	<1.4
		Synura ? ****		1.4						2.8	
	Rhizochrysidales	*Diceras phaseolus*	<1.4	2.8	1.4	<1.4	1.4	<1.4	<1.4	<1.4	<1.4
	Vaucheriales	*Vaucheria ?*									
Cryptophyta	Cryptomonadales	*Chroomonas acuta*									
		Cryptomonas ovata / erosa	9.8	16.8	16.8	239.4	254.8	226.8	11.2	8.4	<1.4
		Cryptomonas		<1.4	<1.4				<1.4		<1.4
Cyanophyta	Chamaesiphonales	*Chamaesiphon sp.* *							<1.4		<1.4
	Chroococcales	*Agmenellum tenuissima*				<1.4	<1.4	11.2	<1.4	<1.4	<1.4
		Agmenellum							<1.4		<1.4
		Anacystis elachista	<1.4	<1.4	<1.4	28.0	<1.4	84.0	<1.4	<1.4	
		Anacystis cf. limneticus				<1.4	<1.4	<1.4			<1.4
		Anacystis	<1.4			<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
		Gomphosphaeria		<1.4	<1.4		<1.4		<1.4		

Appendix 3.7-3. Lake and Wetland Phytoplankton Data, 2009

Units = cells / mL										
FES Sample Number			090411	090412	090413	090414	090415	090416	090417	090418	090419
Sampling Station				WL2			WL3			WL4	
Sample Replicate			A	B	C	A	B	C	A	B	C
Sampling Date				20-Aug-09			20-Aug-09			20-Aug-09	
	Nostocales	*Anabaena cf. flos-aguae*									
		*Anabaena **	<1.4				<1.4			8.4	
		*Anabaena ? **		<1.4	<1.4	14.0	33.6	21.0	<1.4		
		*Aphanizomenon flos-aquae **									
		*Aphanizomenon ? **							<1.4	<1.4	
		Nostoc							<1.4		
		Nostoc ?				<1.4	<1.4	<1.4	<1.4	<1.4	
		UID								<1.4	
	Oscillatoriales	*Lyngbya limnetica ***	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4			<1.4
		Lyngbya		<1.4			<1.4		16.8		<1.4
		Oscillatoria tenuis	<1.4		<1.4			<1.4	28.0	<1.4	<1.4
		Oscillatoria	<1.4	14.0	<1.4	<1.4	<1.4		36.4		11.2
		Phormidium mucicola									
		UID									
Euglenophyta	Euglenales	*Euglena*	<1.4	<1.4	<1.4				<1.4		<1.4
		Phacus									
		Phacus ?									
		Trachelomonas				<1.4	<1.4	<1.4			<1.4
Pyrrhophyta	Dinokontae	*Gymnodinium ?*		<1.4		2.8	<1.4	2.8	4.2	7.0	1.4
		Peridinium cf. inconspicuum	<1.4	2.8	<1.4	<2.8		<1.4	7.0	7.0	<1.4
		Peridinium / Glenodinium	1.4	1.4	1.4			<1.4	1.4	1.4	2.8
		UID				1.4	1.4		2.8		<1.4
UID filamentous algae			<1.4	<1.4			<1.4		<1.4		<1.4
UID branched filamentous algae							<1.4		<1.4	<1.4	<1.4
UID colonial algae							<1.4				

* Note : no or few gonidia and / or heterocysts observed

** Note : *Lyngbya limnetica / Homeothrix varians*

*** Note : spines are faint

**** Note : maybe *Chrysosphaerella longispina* , but spines not apparent

Note : Unidentified flagellates observed but not counted.

UID = unidentified due to lack of size and / or missing morphological characters.

Appendix 3.7-4

Lake and Wetland Chlorophyll α Data, 2009

Rescan™
Engineers and Scientists

Appendix 3.7-4. Lake and Wetland Chlorophyll a Data, 2009

Lake or Wetland Site	Chlorophyll *a* (ug)	Volume filtered (L)	ug/L
Patsy Lake	0.147	0.5	0.2940
Patsy Lake	0.164	0.5	0.3280
Patsy Lake	0.218	0.5	0.4360
WL1	0.676	0.5	1.3520
WL1	0.695	0.5	1.3900
WL1	0.23	0.25	0.9200
WL2	0.254	0.5	0.5080
WL2	0.106	0.5	0.2120
WL2	0.225	0.5	0.4500
WL3	0.53	0.5	1.0600
WL3	0.61	0.5	1.2200
WL3	0.505	0.5	1.0100
WL4	0.781	0.5	1.5620
WL4	0.543	0.5	1.0860
WL4	0.334	0.5	0.6680

Appendix 3.8-1

Benthic Invertebrate Data from Kitsault Streams, Wetlands and Patsy Lake, 2009

Rescan™
Engineers and Scientists

Appendix 3.8-1. Benthic Invertebrate Data from Kitsault Streams, Wetlands and Patsy Lake, 2009

Major Taxon	Family	Subfamily/Tribe	Genus/Species	LC3					RC1					PC2					LC0					LC1						Patsy Lake			WL1			WL2			WL3			WL4		
				A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	F	G	A	B	C	A	B	C	A	B	C	A	B	B	A	B	C
Tricladida	Planariidae		*Polycelis coronata*						1		1				1			2					1				3	1	1																	
Nematoda															2		5	2		1		1											8							14		2	38	1
Oligochaeta	Enchytraeidae					8			1	4				1	2	10	4		1				2										24							144		14	3	
Oligochaeta	Lumbricidae					2																																						
Oligochaeta	Lumbriculidae																4																		8	1					2	5	3		7	4
Oligochaeta	Naididae																		1			1								1						8										
Oligochaeta	Tubificidae					1									1															1						1		16	3	49		2	6	20
Hirudinea	Glossiphoniidae		*Helobdella stagnalis*																												5													
Pelecypoda	Sphaeriidae		*Pisidium*																											4	56	12	36	8	20		9	129	27	20	75	23
Pelecypoda	Sphaeriidae		*Sphaerium*																													3												
Pelecypoda	Sphaeriidae (d)																													2	86	16	8	16	24		1	4		8	68	4
Hydracarina														4		8		2	3	3	2	2	2	18	8	5	1	3	5															
Ostracoda														4	8				2				1		2		1	2	1	1														
Amphipoda	Gammaridae		*Gammarus lacustris*																												15			3	14	1								
Collembola																		4	1						1																			
Ephemeroptera	Ameletidae		*Ameletus* sp.				1							4	9			6				1			1																			
Ephemeroptera	Ameletidae		*Ameletus similior*		1									5	8	9	40	10							1																			
Ephemeroptera	Baetidae		*Callibaetis*																																						1				
Ephemeroptera	Baetidae		*Baetis*	18	41	38	23	35	91	109	183	116	72	94	171	55	40	14	23	5	6	3	6	8	8	9	4	19	13	27														
Ephemeroptera	Ephemerellidae		*Caudatella*					1																																				
Ephemeroptera	Ephemerellidae		*Drunella coloradensis*	1		1				5	7	2	3	1	9	1																												
Ephemeroptera	Ephemerellidae		*Drunella doddsi*	3	5	30	7	15	5	9	17	10	12	394	52	204	126	12	3			3	2		4	2		4	1	2														
Ephemeroptera	Ephemerellidae (d)			8			2	1	1		4		20	24	33	72	12		4		3		1			2																	
Ephemeroptera	Heptageniidae		*Cyrigmula*		9	6	2	1	12	10	8	21	19	17	5	4	40	26				1	1	1	5	2	2	3	1	3														
Ephemeroptera	Heptageniidae		*Epeorus*	24	18	46	20	25	23	54	60	37	20	71	12	86	29	4	30	8	12	3	12	12	29	20	6	24	36	40														
Ephemeroptera	Heptageniidae		*Heptagenia*												1																													
Ephemeroptera	Heptageniidae		*Rhithrogena*	65	84	97	16	17	11	13	19	18	22	129	14	115	160	112	23	10	5	6	5	3	4	1	2	8	1	5														
Ephemeroptera	Heptageniidae (d)				1	4		1	6					88	8	16	12	2	3				2	4			6			2														
Ephemeroptera	Leptophlebiidae		*Paraleptophlebia*		1	1								60	87	38	96	28							1																			
Ephemeroptera	Leptophlebiidae (d)						1									8			1																										
Plecoptera	Capniidae			4	2	8		2					8	82	72	40	84	4	1		1	1	1			3		4	1	2														
Plecoptera	Chloroperlidae		*Kathroperla perdita*											2	2	3	4	18																										
Plecoptera	Chloroperlidae		*Sweltsa*		1	5								1	10	16	23	25			1		1																				
Plecoptera	Chloroperlidae		*Suwallia*		1				9	5	3	5	6	1					3	2	3	2	1	3		4	3	4	2	4														
Plecoptera	Chloroperlidae (d)			6	8	12	1	1	30	9	13	7	2	22	13	18			23		4	5	7	5	3	9	2	13	3	17														
Plecoptera	Leuctridae		*Despaxia augusta*		2	2				1				18	14	8	39																										
Plecoptera	Leuctridae		*Paraleuctra*	2	12	24	3		3	5				46	50	19	154	17	8	8	4	2	1		1	5		1	1	3														
Plecoptera	Leuctridae (d)								1					8														1																
Plecoptera	Nemouridae		*Zapada*	14	11	82	5	12	15	27	52	10	18	73	114	39	177	24	11	11	8	5	5		2	3		1	2	5														
Plecoptera	Perlidae		*Hesperoperla pacifica*		1										7	5	1																										
Plecoptera	Perlidae (d)													4			8																										
Plecoptera	Perlodidae		*Isoperla*											2																													
Plecoptera	Perlodidae		*Megarcys*	3		5		1	2	6	2	1	2	2	1		2	3	3		1								1	1														
Plecoptera	Perlodidae (d)														1											1																		
Plecoptera	Taeniopterygidae		*Taeniionema*	5	2	20	41	4	20	95	73	34	29						88	47	27	16	41	3	65	22	3	18	102	92														
Trichoptera - pupa					1				3					1		2	4	1			3																							
Trichoptera	Brachycentridae		*Micrasema*												9																													
Trichoptera	Glossosomatidae		*Glossosoma*											4		2	4																											
Trichoptera	Hydropsychidae		*Parapsyche*	1		1		1			2					1																											
Trichoptera	Lepidostomatidae		*Lepidostoma*			1																																					
Trichoptera	Limnephilidae (d)														1			2																										
Trichoptera	Philopotamidae		*Wormaldia*															2																										
Trichoptera	Phryganeidae		*Banksiola crotchi*																																						1			
Trichoptera	Polycentropodidae		*Polycentropus*																																							3	1	
Trichoptera	Rhyacophilidae		*Rhyacophila*	3	2	17	4	1			6		1	51	119	23	49	9	6							1	22		1															
Trichoptera	Uenoidae		*Neothremma*											1			8																											
Lepidoptera	Noctuidae																			1																									
Odonata-Anisoptera	Cordulidae		*Somatochlora*																																1									
Odonata-Anisoptera	Libellulidae		*Leucorrhinia* sp.																																	9							
Coleoptera	Dytiscidae (d)																																						1				
Coleoptera	Dytiscidae		*Agabus*																																						1	1	
Hemiptera	Corixidae (d)																														1	2											
Diptera	Empididae		Genus #1										1																															
Diptera	Empididae		*Neoplasta*															2																										
Diptera	Empididae		*Oreogeton*			1				1				6											1		1																	
Diptera	Empididae		*Wiedemannia*											2																														
Diptera	Chaoboridae		*Chaoborus*																																1						1		2	
Diptera	Ceratopogonidae	Ceratopogoninae	*Bezzia / Palpomyia*																										1		9				4	9								
Diptera	Ceratopogonidae	Ceratopogoninae	*Probezzia*																																			2	24	3					
Diptera	Ceratopogonidae	Dasyheleinae	*Dasyhelea*																												2													
Diptera	Simulidae		*Prosimulium/Helodon*																									1																
Diptera	Tipulidae		*Dicranota*			1				2	1		3																														
Diptera	Tipulidae		*Hexatoma/Limnophila*																					1																				
Diptera	Chironomidae - Pupa			16		33	1	1	10	20	8		4	87	25	32	64	42	9	2	1	3	3	3	4	4	2	6	1	1														
Diptera	Chironomidae	Chironomini	*Chironomus*																												3	14		1			4	4		1	4		8	13	223
Diptera	Chironomidae	Chironomini	*Cryptochironomus*																															3										2
Diptera	Chironomidae	Chironomini	*Dicrotendipes*																															8	4					8			4
Diptera	Chironomidae	Chironomini	*Microtendipes*																															12	44		1	18	49	1	27		50	54	30
Diptera	Chironomidae	Chironomini	*Pagastiella*																															14			274	28	4					5	
Diptera	Chironomidae	Chironomini	*Polypedilum*																															46									6	3	2
Diptera	Chironomidae	Chironomini	*Sergentia*																												1													
Diptera	Chironomidae	Chironomini	*Tribelos*																																						28	19	30
Diptera	Chironomidae	Tanytarsini	*Cladotanytarsus*																												16									8	473	17			
Diptera	Chironomidae	Tanytarsini	*Micropsectra*														5	4												2														
Diptera	Chironomidae	Tanytarsini	*Paratanytarsus*																																	8	8							
Diptera	Chironomidae	Tanytarsini	*Stempellinella*			4			1					8	8		4		1	1				2	2	4		1		1													
Diptera	Chironomidae	Tanytarsini	*Tanytarsus*												8																4		8	12					1	24		4	39	4
Diptera	Chironomidae	Orthocladiinae (d)												4	17		4	2	2	2	4	9	2			1																	
Diptera	Chironomidae	Orthocladiinae	*Brillia*	1					2	4	4			20				4			1		1																				
Diptera	Chironomidae	Orthocladiinae	*Corynoneura*			8			5	12		4		33	27	64	116	72					2	1																			
Diptera	Chironomidae	Orthocladiinae	*Eukiefferiella*					1	12	12	12	4	16	20		8	4		6	1	5	3	2	3	1	6	1																	
Diptera	Chironomidae	Orthocladiinae	*Heterotrissocladius*																											1														
Diptera	Chironomidae	Orthocladiinae	*Krenosmittia*			8								1	1	8	20	2			1							1															
Diptera	Chironomidae	Orthocladiinae	*Parametriocnemus*		1	12								12				2																										
Diptera	Chironomidae	Orthocladiinae	*Paraphaenocladius*											12	8		8	8																										
Diptera	Chironomidae	Orthocladiinae	*Parorthocladius*		1				2					1	64	16	44	4																										
Diptera	Chironomidae	Orthocladiinae	*cf. Platysmittia*											4		8		2																										
Diptera	Chironomidae	Orthocladiinae	*Propsilocerus* sp. nov.																															442										
Diptera	Chironomidae	Orthocladiinae	*Psectrocladius*																												4			24	34	72					16	19	12
Diptera	Chironomidae	Orthocladiinae	*Rheocricotopus*		5	13			1	4						8												1															
Diptera	Chironomidae	Orthocladiinae	*Thienemanniella*				1							1	1		8																											
Diptera	Chironomidae	Orthocladiinae	*Tvetenia*	4	1	24	1	2	2	5	16		5	25	188	8	72	20	5	13	3	3	1		6	4		1	5	6														
Diptera	Chironomidae	Orthocladiinae	*Cricotopus/Orthocladius*						2					6	49		4		41	28	36	76	17	1		1																		
Diptera	Chironomidae	Tanypodinae (d)												1	2	2	4																											
Diptera	Chironomidae	Tanypodinae	*Ablabesmyia*																												7	5	8	4	8							18	9	19
Diptera	Chironomidae	Tanypodinae	*Procladius*											2																2	32	2	25	29	129	31	2	8	3	48	63	87
Diptera	Chironomidae	Tanypodinae	*Thienemanniella* gr.														8																											
Diptera	Chironomidae	Diamesinae	*Diamesa*																							1																		
Diptera	Chironomidae	Diamesinae	*Pagastia*											3	1																													
Diptera	Chironomidae	Diamesinae	*Protanypus*																											1														
Diptera	Chironomidae	Diamesinae	*Pseudodiamesa*															2																										
Diptera	Chironomidae	Podonominae	*Boreochlus*																1	1																								
Terrestrial							2	1				4	4	4	1		5	2	3	5	1		2	5	1	6	2	6	1														
			Total	**178**	**211**	**515**	**131**	**123**	**271**	**412**	**491**	**273**	**267**	**1446**	**1235**	**957**	**1495**	**497**	**306**	**150**	**131**	**149**	**118**	**74**	**151**	**137**	**36**	**125**	**179**	**215**	**5**	**26**	**0**	**353**	**88**	**93**	**839**	**292**	**193**	**30**	**915**	**53**	**229**	**423**	**467**

(d) - small or damaged; cannot be ID below this level

Genus #1 - this is an undescribed Epidid belonging to a new genus

Propsilocerus sp. nov. - new species and first record of the genus Propsilocerus in North America

Appendix 3.8-2

Bray-Curtis Similarity Matrix for all Stream Sites

Rescan™
Engineers and Scientists

Appendix 3.8-2. Bray-Curtis Similarity Matrix for all Stream Sites

	LC3	LC3	LC3	LC3	LC3	RC1	RC1	RC1	RC1	RC1	RC1 median	PC2	PC2	PC2	PC2
LC3															
LC3	68.8291639														
LC3	55.4745426	62.0211099													
LC3	66.8869709	67.4848717	47.8344231												
LC3	77.3378322	64.3059144	50.6562035	69.0942741											
RC1	57.1562075	58.5961508	51.1884007	60.4051724	60.225805										
RC1	52.1925808	54.7927666	61.4043635	57.4821405	56.07065	76.8756002									
RC1	56.0809406	49.8069273	58.4408105	59.3874923	61.852864	68.2616202	78.8705241								
RC1	54.6138378	56.1579716	48.8638202	66.7592481	68.6691461	76.6781924	75.7611756	73.2658498							
RC1	63.832138	60.2959702	54.537087	65.1517051	72.5098749	73.4395216	72.9960234	74.7258531	79.9814705						
RC1 median	59.5889746	54.8709021	53.5775759	64.16293	68.1706705	82.1023422	84.651767	81.829448	90.5879434	85.6485109					
PC2	33.5590737	43.8886808	58.6734734	30.4590705	31.6496765	41.2987248	44.6667696	44.4535226	37.205482	41.333327	40.65760587				
PC2	27.8089401	35.9123019	49.6316149	28.7475893	29.2541347	38.0331733	36.9527753	39.900818	31.0370463	33.1916558	33.24497298	67.3788502			
PC2	40.0052669	51.4895793	64.4509457	34.3180081	38.3350541	40.4468151	47.7142365	44.5611504	36.9579304	41.4479552	40.62757937	72.725434	59.3448442		
PC2	30.5496585	38.3054177	53.5494983	26.7642071	28.7728892	33.3521186	34.8413102	34.2730202	29.8589876	33.5847328	31.54658273	71.1089588	69.9709756	67.8074775	
PC2	45.0177508	50.0624708	54.0418323	35.529401	35.7064745	39.2847206	39.9663778	39.7805788	34.875407	39.8593701	38.72361982	55.2201049	51.0949788	61.3191784	58.4445165
LC0	61.7223035	54.1042444	50.6264527	65.238186	57.8407468	61.1390649	62.5017361	61.2188938	57.9763759	61.990629	60.4265723	39.6896837	36.0687744	38.9583289	32.1337707
LC0	49.6405053	42.2198815	36.7065246	56.8593484	45.5387671	54.0318931	49.6043571	48.5372374	47.6307	48.3287458	51.62117717	26.5660387	27.2753519	25.5819887	22.1993643
LC0	52.7901951	45.6239736	37.4240145	56.4371498	52.1816823	56.3402944	48.8058527	45.5280414	53.003151	55.6123668	53.59113609	27.7890786	27.2587432	28.0088911	22.3642135
LC0	48.2025609	42.7948366	32.5706192	54.5445366	47.4347218	54.271592	45.3403065	40.5555756	48.0471651	47.3619404	50.63736655	25.6293806	27.6780732	26.6362283	21.6108809
LC0	49.9512003	48.2005337	36.3342442	65.4956371	54.2102995	57.3089085	48.8432331	47.4578334	56.5341608	53.4390547	54.67013279	27.1900932	26.5840574	27.2857122	21.0658165
LC1	35.0654575	34.0730822	24.8812864	42.5284981	43.6150229	45.4244846	35.3810353	32.7746955	43.0794692	39.2998102	39.48231067	20.0831604	15.684936	21.6689885	15.5819735
LC1	52.5830994	49.649496	43.7802878	69.6876048	55.3421853	52.2123007	54.7467909	53.8824823	54.5848031	54.6327516	55.61203142	31.0038689	25.5554748	33.3526573	24.183588
LC1	58.1944059	49.6322184	47.1537761	63.713065	56.9850114	60.0012877	51.2751322	51.7144113	54.2620018	61.3457915	55.75926327	34.5323486	28.6254303	35.7282891	28.310921
LC1	32.5584803	33.1731016	20.2598815	42.8060348	42.4282314	35.5552377	32.1513381	30.2189845	41.028028	36.9817373	37.17489198	15.4030584	11.0391512	14.7756165	9.69024641
LC1	62.7198825	56.0132152	44.7489226	69.7049653	63.2534466	60.2074097	48.857973	50.7787858	57.7618593	61.336252	55.84683144	29.9215829	27.257549	31.8748039	23.3379051
LC1	54.4242651	45.9057023	39.5964197	62.9807845	54.5819181	54.0492234	58.8622796	55.3323565	55.8063712	54.4004108	56.78539271	25.0486424	208285631	28.0476364	18.4636272
LC1	59.9416113	53.4892589	47.2687329	70.1131541	61.6807738	62.9238339	64.914813	62.3051912	64.0553693	62.8475185	64.41760471	29.7362381	27.468324	30.8748298	24.46245

Note: Shading indicates the percent similarity to the median for RC1.

(continued)

Appendix 3.8-2. Bray-Curtis Similarity Matrix for all Stream Sites (completed)

	PC2	LC0	LC0	LC0	LC0	LC0	LC1	LC1	LC1	LC1	LC1	LC1	LC1
LC3													
LC3													
LC3													
LC3													
LC3													
RC1													
RC1													
RC1													
RC1													
RC1													
RC1 median													
PC2													
PC2													
PC2													
PC2													
PC2													
LC0	38.1467114												
LC0	31.1663049	71.2708354											
LC0	29.25792	70.87063	76.2208578										
LC0	31.9480802	62.4856477	69.4149022	73.7056839									
LC0	29.6416843	65.1565647	70.2073203	79.8771739	73.9139386								
LC1	16.2990691	44.7172766	48.5570957	53.6675304	45.9868613	54.5234724							
LC1	32.8495205	66.9912009	58.2671857	53.8740809	52.4374811	64.9707363	52.5167375						
LC1	32.9706377	66.7857715	58.6916759	68.3864952	58.4479604	64.4926372	58.5657236	65.9615857					
LC1	15.5094116	34.9731389	42.8829276	47.3867121	44.1572952	53.4249822	66.5827318	49.8675565	46.9213399				
LC1	34.2564984	61.4677674	52.536714	58.8260876	54.1214112	67.1921584	52.9819938	69.3881636	69.2437891	52.1703545			
LC1	27.6368782	66.1875872	56.2052344	60.2624023	51.3397558	69.6925362	47.8808449	72.7213944	67.1861815	47.7585524	70.0343764		
LC1	31.0481844	71.7528539	57.3894928	59.7324328	53.410684	66.7754591	42.8543037	69.9169005	66.0459524	43.1431611	73.0000856	82.8104606	

Appendix 3.8-3

Zooplankton Community Data for Patsy Lake, 2009

Rescan™
Engineers and Scientists

Appendix 3.8-3. Zooplankton Community Data for Patsy Lake, 2009

Location		Patsy Lake				
Date		15-Aug-09				
Replicate		A	B	C		
Volume filtered (m^3)		2.333	2.015	4.241		
Sample Number		090267	090268	090269	**Mean**	**%**
Species/group	**Stage**					
ROTIFERA						
Kellicottia longispina		32576.1	5657.6	7616.1	**15283.26**	**77.29**
Conochilus sp.	colony	514.4	545.9	235.8	**432.02**	**2.18**
CLADOCERA						
Holopedium gibberum		814.4	436.7	174.5	**475.20**	**2.40**
Daphnia rosea	juv	30.0	64.5	94.3	**62.95**	**0.32**
Daphnia rosea	F	0.0	29.8	3.5	**11.10**	**0.06**
Daphnia middendorffiana		0.0	0.0	0.9	**0.31**	**0.00**
COPEPODA						
Calanoida						
Aglaodiaptomus leptopus	M	11.6	2.0	0.9	**4.83**	**0.02**
Aglaodiaptomus leptopus	F	5.6	4.5	1.9	**3.98**	**0.02**
Hesperodiaptomus kenai	M	38.1	178.7	54.2	**90.35**	**0.46**
Hesperodiaptomus kenai	F	27.0	168.7	47.2	**80.97**	**0.41**
Diaptomidae	V	25.7	49.6	11.8	**29.05**	**0.15**
Diaptomidae	IV	12.9	39.7	11.8	**21.45**	**0.11**
Diaptomidae	III	42.9	69.5	4.7	**39.02**	**0.20**
Diaptomidae	II	12.9	59.6	11.8	**28.07**	**0.14**
Diaptomidae	I	12.9	109.2	14.1	**45.40**	**0.23**
Unidentified Calanoida	nauplius	0.0	347.4	37.7	**128.37**	**0.65**
Cyclopoida						
Cyclops scutifer	M	0.0	0.0	0.2	**0.08**	**0.00**
Cyclops scutifer	F	1.7	79.4	4.0	**28.38**	**0.14**
Unidentified Cyclopoida	copepodite	4.3	19.9	4.7	**9.62**	**0.05**
Unidentified Cyclopoida	nauplius	5572.2	496.3	2664.5	**2910.99**	**14.72**
INSECTA		0.0	0.0	0.0	**0.00**	**0.00**
Chaoborus sp.	L	124.3	119.1	25.9	**89.78**	**0.45**
Total Densities		39826.83	8477.92	11020.75	**19775.17**	**100.00**

Note for volume calculations: net radius=15 cm; haul A-11 m; haul B-9.5 m; haul C-20 m.

Unit: organisms/m^3