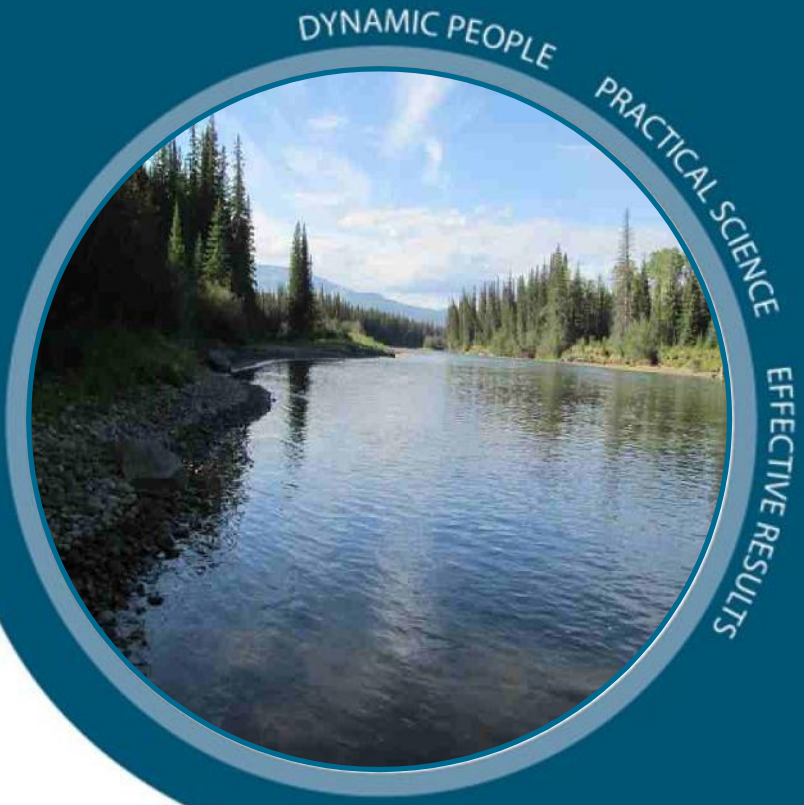
Appendix 8-D

HD Mining: Aquatic Life Baseline 2013

HD MINING: AQUATIC LIFE BASELINE 2013



PREPARED FOR

HD MINING INTERNATIONAL LTD
2288-1177 WEST HASTINGS STREET
VANCOUVER, BC
V6E 2K3

PREPARED BY

EDI ENVIRONMENTAL DYNAMICS INC.
301 GEORGE STREET
PRINCE GEORGE, BC V2L 1R4
250-562-5412

EDI CONTACT: RANDY MORRIS

EDI PROJECT NO.: 14-P-0025
DATE: JUNE 30, 2014

20 YEARS

EDI
ENVIRONMENTAL DYNAMICS INC.

EXECUTIVE SUMMARY

EDI Environmental Dynamics Inc. conducted the Aquatic Life Baseline Program for HD Mining International's Murray River Coal Mine Project. The project bisects the Murray River, located in northern British Columbia near Tumbler Ridge. The Aquatic Life Baseline Program involved sediment, benthic invertebrate, and periphyton sampling at 11 sites on the Murray River and its tributaries of M20 Creek, M19 Creek, and M17 Creek.

Sediment, benthic invertebrate and periphyton sampling methodology were based on field manuals from the BC and federal governments. Sediments were analyzed for particle size, metal concentration and organic content. Means and standard deviations were calculated for each site. Benthic invertebrates were identified to the lowest practicable taxonomic level and selections of abundance diversity metrics were calculated to represent community composition among sites. Periphyton was sampled and analyzed for both community composition (i.e., abundance and richness) and biomass (i.e., chlorophyll *a*).

The results are summarized and key points are presented for each component of the program: sediment, benthic invertebrates, and periphyton. Results in the analysis showed a relative high degree of variability among sites for sediment, benthic invertebrates, and periphyton. The wide variety of aquatic habitat types throughout the study area contributes to this variability. Sites were selected and sampling was conducted according to standard criteria designed to focus on sampling comparable habitat types.

AUTHORSHIP

This report was prepared by EDI Environmental Dynamics Inc. Staff who contributed to this project include:

Andrea Sterling, M.Sc. ..... Primary Author

Mark Racicot, B.Sc., R.B.Tech ..... Secondary Author

Cathy Mackay, M.Sc., R.P.Bio., P.Ag. ..... Senior Review

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

Since 2010, HD Mining International (HD Mining) has been completing an aquatic life baseline program for the proposed Murray River Coal Mine Project (the Project). The goal of this program is to establish baseline conditions that can be used as a reference for monitoring future aquatic conditions throughout the life cycle of the proposed mine. The baseline program includes sediment, periphyton, and benthic invertebrate baseline data collection. The program is intended to fulfill information requirements for the BC Environmental Assessment process.

Aquatic monitoring of stream sediments, periphyton, and benthic invertebrates provides an overall indication of water quality and site productivity. Benthic invertebrates respond to a wide variety of disturbances but not to all disturbances; therefore, it is recommended to have a balanced approach by including multiple biological components (Rosenburg and Resh 1993). Sediment and periphyton are both food sources of benthic invertebrates, which can collect impurities from their surrounding ecosystem either by deposition and adsorption (sediment) or by absorption alone (periphyton). Ingestion by benthic invertebrates is believed to be the primary cause of elevated metal levels in fish in and around contaminated sites (Biggs and Kilroy 2000; Meret 2003). Because stream sediments, periphyton, and benthic invertebrates are sensitive to changes in physical, chemical and biological conditions within the aquatic environment, they are useful indicators of change in ecological conditions.

The objective of the study design is to establish sites upstream and downstream from the Project footprint in order to detect and quantify potential impacts if they occur as a result of mine operations. Data collection follows the BACI (before-after control-impact) design, which can be used for meaningful statistical comparisons between pre-construction and operational or post-closure phases of the project. The aquatic life program was designed by EDI with input from BC Ministry of Environment. The study design was refined in 2012 to address the progression in facilities siting of the proposed mine project.

The Project is a proposed underground coal mine and its footprint includes clearing and grubbing areas, site grading and preparation areas, access construction, surface water management infrastructures, decline portals, laydown area, waste rock dump, coal stockpile conveyor, coal sample storage, coal truck loading facility, rail load out area, water control system, fuel storage, and electrical power source. The site is nearby existing transmission, rail, and all-season road infrastructures.

1.1 STUDY AREA

The study area is located in northeastern British Columbia, southeast of Tumbler Ridge and includes each watercourse that could be directly influenced upstream and downstream of the Project footprint. The watercourses that may be directly influenced are the Murray River and its tributaries: M17 Creek, M19 Creek and M20 Creek.

All sites with names preceded by "MR" are on the Murray River. Working from furthest upstream site down, MR-REF and MR-9 are located upstream of all current and proposed project activities. MR-3 is located approximately 250 m downstream of Twenty Creek which flows alongside the project south site. Water from the south portal is pumped into a sediment pond then discharged into a flat area for ground infiltration. Due to its proximity downstream of Twenty Creek, MR-3 could be used as a monitoring site to ensure that water discharged to ground does not negatively influence its surrounding aquatic environment.

M20-04 and M20-06 are located downstream and upstream, respectively, of the Project's north site settling pond outflow. MR-4 is located downstream of M20 Creek's confluence with the Murray River. MR-7b is situated downstream of both M17 and M19 Creek. This site represents the near-field site and is relatively close to the Project footprint. MR-6 was the far-field site on the Murray River. Table 1 provides information on the 11 stations sampled in 2013. Figure 1 shows all sample site locations.

Table 1. Sampling site locations and rationale for site selection for 2013.

Site	Location	UTM Zone 10		Site Type and Rationale
		Northing	Easting	
MR-REF	12 km upstream of MR-9	614254	6086757	Reference- Above project influence and other permitted projects.
MR-3	100m upstream of Murray FSR Bridge	625951	6097143	Reference- Murray River upstream near-field of M20 Creek input.
MR-4	200m downstream of M20 Creek	626408	6097722	Exposure- Downstream near-field of M20 Creek input
MR-6	150 m from Hwy 29 bridge over Murray R	625520	6109118	Exposure- Downstream of all proposed facilities.
MR-7b	3 km downstream of MR-4	626760	6100975	Exposure- Downstream near-field of project footprint.
MR-9	3.5 km upstream of MR-3	624294	6094146	Reference- Upstream of complete project footprint.
M17-02	250m upstream of confluence at Murray River on M17 Creek.	627038	6098308	Exposure- downstream of proposed facilities added Jun 2012
M19-01	300m upstream of M19 Creek bridge on the Murray FSR.	630433	6099185	Reference- upstream control site for M19 Cr.
M19-02	1.5 km upstream from Murray River confluence on M19 Creek.	627283	6100044	Exposure- Downstream of proposed facilities site on M19 Cr.
M20-04	400m upstream from River Rd. Bridge.	626265	6097901	Exposure- Directly downstream of pond discharge pipe into M20 Cr.
M20-06	500m upstream of M20-04	626293	6098024	Reference- Upstream control of pond discharge into M20 Cr.

Note: Site locations and names are consistent with the surface water quality program except that MR-7b is referred to as MR-7, and M17-02 is referred to as M17A. Exact locations were adjusted to sample riffle habitat for aquatic life.

615000 620000 625000 630000 635000

6110000 6105000 6100000 6095000 6090000 6085000

Pine River

Tumbler Ridge

29

MR6

Flatbed Creek

52

MR7b

M19-02

M19-01

M20-04

M20-06

M17-02

MR3

MR4

MR9

Murray River

MRREF

LEGEND

Aquatic Life Sites (2013)

- Benthic Community
- Benthic Tissue
- Periphyton Chlor a; Abundance; Tissue
- Sediment

Cutline/Seismic/Other

- Pit
- Building or Designated Area
- Pipeline
- Railways

Roads

- Gravel Road
- Paved Road
- Rough Road

- Streams
- 50K Canvec Waterbody
- HD Mine Surface Facility Boundary
- Potential Mine Surface Development Area

0 0.75 1.5 3
Kilometers

Scale: 1:100,000

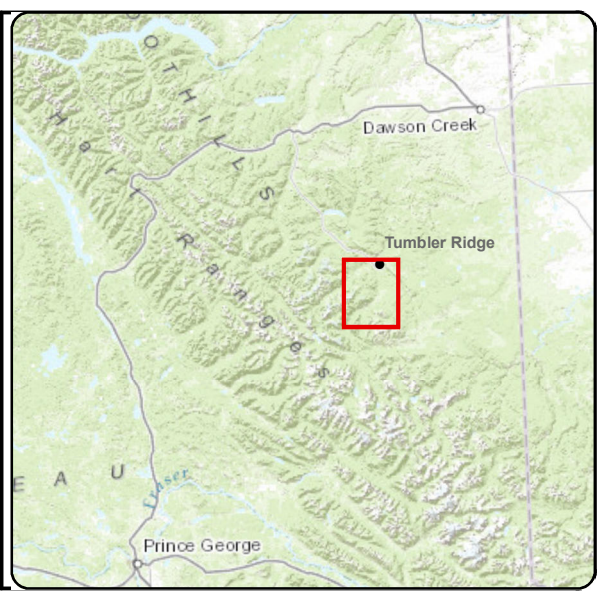
Original Map Size 11x17in

MURRAY RIVER

Figure 1. Aquatic Life Sites 2013

Drawn: D. Wiens	Datum/Projection: NAD 1983 UTM Zone 10N
Checked: M. Racicot	EDI Project No.: 14-P-0025
Date: 07/01/2014	Data Sources: Refer to References Section

EDI



Path: L:\PROJECTS\12-V-0073_Aquatics\Mapping\Aquatic_Life_20140107.mxd

1.2 STUDY RATIONALE

The purpose of the baseline program was to:

- collect baseline data that can be used to assess changes related to mine construction, production, and post-production phases; and
- collect baseline data on sediment that can assess, identify, and document any current anomalies in the current sediment bed loads.

The three components of the aquatic life baseline program were stream sediments, periphyton, and benthic invertebrates; each of these are discussed in turn below. Aquatic habitat information was also collected in order to account for habitat diversity among sample stations.

The sediment baseline program was developed to provide data on particle size, total organic carbon (TOC), metals, and polycyclic aromatic hydrocarbons (PAHs) outside and within the Project footprint. See below for a brief description of the importance of these parameters.

- **Particle size distribution** describes the physical properties of sediment, including the percentage of sand, silt and clay, which highly influences the chemical and biological characteristics of sediment at the site.
- **Total Organic Carbon (TOC)** affects the bioavailability and toxicity of metals and organic contaminants.
- **Metals** are naturally present in all sediments, but concentrations can be elevated by anthropogenic activities. Most metals tend to be associated with suspended solids which settle out in the sediments over time.
- **Polycyclic aromatic hydrocarbons (PAHs)** are a group of organic contaminants that form from the incomplete combustion of hydrocarbons, such as coal and gasoline.

Periphyton can be found on rock and other stable substrates in streams. It provides food to many aquatic invertebrates and purifies water by absorbing impurities such as metals. The periphyton baseline program was developed to provide data on chlorophyll *a* concentration, metals concentrations, and community metrics outside and within the Project footprint. See below for a brief description of the importance of these parameters.

- **Chlorophyll *a*** is a measure of periphyton biomass. Periphyton biomass is responsive to ecosystem changes, making chlorophyll *a* useful indicator of changes within the ecosystem.
- **Metals** and other impurities are absorbed by periphyton making them a useful indicator of ecosystem changes.

- **Community metrics** include diversity, richness, and biovolume of periphyton. These metrics are also responsive to ecosystem changes making them another useful indicator of ecosystem changes.

Benthic invertebrates are exposed to stream water and sediments, along with any contaminant within these mediums, throughout their lifecycle. Some species are more tolerant to the contaminants associated with mining and other anthropogenic activities than others, which can allow for the more tolerant species to become dominant in impacted areas (Maret et al. 2003). Benthic invertebrates are commonly used to assess ecological impact, which is why the Canadian Aquatic Biomonitoring Network (CABIN) was developed by Environment Canada. CABIN provides a standardized method for benthic invertebrate collection and data analysis. The benthic invertebrate sampling described in this report was completed using CABIN methods, which included metals concentration and community metrics (based on taxonomic identification). See below for a brief description of these parameters.

- **Metals** and other impurities are absorbed by benthic invertebrates making them a useful indicator of ecosystem changes.

- **Community metrics of benthic invertebrates** include diversity, richness, EPT richness, Hilsenoff Biotic Index (HBI), % Ephemeroptera, % Plecoptera, % Trichoptera, and % Diptera. These metrics are also responsive to ecosystem changes making them another useful indicator of ecosystem changes.

1.3 PREVIOUS STUDIES

Aquatic life sampling associated with Murray River Project began in 2010 by ERM (formerly Rescan), which is summarized in a technical report (Rescan 2010). The aquatic life sampling program was completed by EDI beginning in 2011. Additional sites were added in 2011 after consultation with BC Ministry of Environment (MOE). Also, as suggested by MOE, site names for the Murray River baseline program were changed in 2011 to match site names from the Hermann Mine baseline program completed between 2004 and 2006 (WCCC 2007) and the Teck Coal baseline program, which partly overlap with the Murray River Project. Synchronizing site names avoids confusion for agencies that review multiple projects. Sites M20-03 and M20-04 coincide with Hermann Mine aquatic life sampling sites. Other sites coincide with pre-existing water quality sites, and their names were changed in 2011 to match the existing site names. In 2012, one sample site location was changed and additional sites were added to this program to reflect restructured plans within the Murray River Project design. In 2013, MR-REF was added back into the program (also sampled in 2010). Table 2 provides a summary of aquatic life sampling to date for the Murray River Project.

Table 2. Summary of the Murray River Project aquatic life baseline program, 2010-2013.

Site Name	Benthic Invertebrate	Periphyton	Sediment
MR-REF	2010, 2013	2010, 2013	2010, 2013
MR-4 (Rescan 2010)[a]	2010	2010	2010
MR-3	2012, 2013	2012, 2013	2012, 2013
MR-4 [b]	2010, 2011, 2012, 2013	2010, 2011, 2012, 2013	2010, 2011, 2012, 2013
MR-9	2011, 2012, 2013	2011, 2012, 2013	2011, 2012, 2013
MR-7	2011	2011	2011
MR-7 b	2012, 2013	2012, 2013	2012, 2013
MR-6	2010, 2011, 2012, 2013	2010, 2011, 2012, 2013	2010, 2011, 2012, 2013
M20-03	2011	2011	2011
M20-05	2011	2011	2011
M20-04 [c]	2011, 2012, 2013	2011, 2012, 2013	2011, 2012, 2013
M20-06	2012, 2013	2012, 2013	2012, 2013
M19-01	2012, 2013	2012, 2013	2012, 2013
M19-02	2012, 2013	2012, 2013	2012, 2013
M17-02	2012, 2013	2012, 2013	2012, 2013
REFST-DS [d]	2010	2010	2010

Notes: a. MR-4 (2010) was located on Murray River upstream of M20 Creek confluence and downstream of Twenty Creek confluence
b. MR-4 was previously known as MR-5 by Rescan in 2010
c. M20-04 was previously known as M20-DS by Rescan in 2010 and is the same site location as Hermann Mine M20-04
d. REFST-DS is located on a tributary of the Murray River that enters the Murray upstream of MR-REF

2 METHODS

All 2013 field work was completed between August 27th and 30th. The specific field, laboratory, data analysis, and quality control methods are described below based on the type of data collected: aquatic habitat, stream sediment, periphyton, and benthic invertebrates.

2.1 AQUATIC HABITAT

At each site, the following habitat parameters were recorded for the stream reach, as per CABIN methodology.

- **General conditions**: Air temperature, water temperature, pH, specific conductivity and turbidity
- **Pebble count and embeddedness**: A minimum of 100 particles (i.e. pebbles) were randomly selected from the streambed. The intermediate axis of each particle was measured, as well as the depth of the substrate it was buried in (i.e. embedded).
- **Elevation and UTM coordinate**: Determined from a handheld GPS unit or topographic map (scale 1:50,000).
- **Channel morphology**: Features measured included stream gradient, wetted and bank full width, average water depth and velocity.
- **Reach data**: Habitat types, canopy coverage, vegetation, periphyton coverage category, surrounding land use.

2.2 STREAM SEDIMENT

2.2.1 FIELD SAMPLING

Field methodology in 2013 was consistent with 2012 sampling, with the addition of one reference site, and was also consistent with the Water and Air Baseline Monitoring Guiding Document for Mine Proponents and Operators (Ministry of Environment 2012).

In 2013, sediment samples for particle size, TOC, metals, and PAH analyses were collected at eleven sites. Samples were collected at each site within the wetted channel using a Teflon coated spoon for metals analysis and a stainless steel spoon for PAHs. Four replicate samples were taken at each site for metals and one composite sample was collected at each site for PAH/TOC. To avoid contamination between sites new nitrile gloves were worn at each site, the Teflon scoop was washed with 10% nitric acid then rinsed with deionized water, and the steel scoop was washed with acetone then rinsed with deionized water. Fine grained sediments were targeted during field collections because they bind contaminants more readily than larger size fractions. Finally, sediment texture, sediment colour, sediment smell, sample depth, and presence of organic debris were recorded at each site.

Metals samples were stored in sterile plastic ziplock bags and PAH/TOC samples were stored in glass jars then shipped to the laboratory within the specified holding period. All samples were stored at 4˚C.

2.2.2 LABORATORY ANALYSIS

All 2013 stream sediment particle size, total organic carbon, metals, and PAH analyses were conducted by Maxxam Analytics in Burnaby, BC.

Particle size analysis was conducted to assess comparability of samples based on their composition of particle size fractions. The portion of the sample with particles sized less than 0.063 mm (clay and silt) were analyzed for total metals by Inductively Coupled Plasma Mass Spectroscopy (ICPMS). PAH/ TOC samples were analyzed on whole samples (clay, silt, sand, and gravel). PAH analysis was completed on whole, wet samples to prevent alteration of organic compounds since sieving requires drying the sample. Percent moisture content was recorded.

2.2.3 DATA ANALYSIS

Results for replicate samples were averaged for each site and compared to the Canadian Council of Ministers of the Environment (CCME) Interim Sediment Quality Guidelines (ISQG) and the BC Ambient Water Quality Guidelines[1] (AWQG) (BC MOE 2006) for the Protection of Aquatic Life[2].

2.2.4 QUALITY ASSURANCE/QUALITY CONTROL

For quality assurance, a total of three split samples were collected among the 11 sites for PAH analysis and these occurred at MR-4 and MR-7b. All samples were stored in new containers (plastic bags for metals samples and glass jars for PAH/TOC samples). Also, sediment scoops were cleaned between sites. A Teflon scoop was used for metals samples, which was washed between sites with 10% nitric acid then rinsed with deionized water. A steel scoop was used for PAH/TOC samples, which was washed between sites with acetone then rinsed with deionized water. New nitrile gloves were worn at each site. See field methods for further details on sampling handling procedures.

Lab QA/QC was done according to the protocols of the lab: Maxxam Analytics. Tables containing relative percent difference (RDP) for total metals as well as lab blanks for total metals and PAHs can be found in Appendix A.

[1] http://www.env.gov.bc.ca/wat/wq/BCguidelines/working.html#table2

[2] http://ceqg-rcqe.ccme.ca/

2.3 PERIPHYTON

2.3.1 FIELD SAMPLING

In 2013, periphyton was sampled at eleven sites with the exception of the taxonomic sample, which was not collected at MR-REF. Samples were collected using a circular template (10 cm inside diameter) to isolate a uniform area on a rock or group of rocks. Periphyton was then scraped with a plastic brush and rinsed from this area into a plastic sample jar. The brush was rinsed with filtered water between samples and 10% nitric acid between sites. The following samples were collected:

- Chlorophyll *a* – 6 replicates (1 template each)
- Tissues – 1 composite sample (made from multiple templates)
- Taxonomic – 3 replicates (1 template each)

Chlorophyll *a* was analyzed as a surrogate variable for periphyton biomass. Biomass samples were placed and stored in a cooler until filtering. Each sample was filtered using a peristaltic pump with a membrane filter of 0.45µm pore size, folded inside a larger Whatman type paper filter. A magnesium carbonate solution ($MgCO_3$) was added to the periphyton at the end of filtering as a drying and stabilizing agent. Filtered samples were then wrapped in aluminium foil and stored at 4°C until shipment to the laboratory. Filtering was completed indoors at the end of each field day.

Tissue samples were stored in plastic containers, kept in a cooler with ice in the field, and were frozen at the end of each field day. Samples were then shipped to the laboratory within the specified holding period. Taxonomic samples were preserved with Lugol's solution and sent to a taxonomic laboratory for identification to the lowest taxonomic level.

2.3.2 LABORATORY AND DATA ANALYSIS

Periphyton samples were analysed at Maxxam Analytics for chlorophyll *a* and tissue metals concentrations. Six replicate samples were analyzed per site for chlorophyll *a* at the lab. These replicates were summarized as mean, standard deviation, minimum, and maximum. Single samples were analyzed for metals by the lab with the exception of MR-REF, for which four replicate samples were analyzed. Mean metals concentrations and standard deviations were calculated for MR-REF.

Periphyton taxonomy samples were identified and enumerated to the finest taxonomic level at Biologica Environmental Services Ltd in Victoria, BC. Three replicate periphyton samples per site were identified to the finest taxonomic level. The following mean community metrics were calculated from the replicated taxonomic identification data: total density, total richness, and total biovolume. Standard deviation was also calculated for these parameters.

2.3.3 QUALITY ASSURANCE/QUALITY CONTROL

For quality assurance, a spit sample was taken for tissue metals concentration samples at one site, and four replicate samples were taken at one site. No additional replication was completed for other chlorophyll *a* or taxonomy because they were replicated samples. Samples were stored in new plastic containers, kept at 4^0C, and promptly shipped to the lab within the specified holding period.

The circular template and plastic brush were rinsed with filtered water between samples at the same site and washed in 10% nitric acid then rinsed with deionized water between sites. Also, new nitrile gloves were worn at each site.

Lab QA/QC was done according to the protocols of the lab: Maxxam Analytics. Tables containing relative percent difference (RDP) for total metals and lab blanks for total metals and chlorophyll *a* and can be found in Appendix A.

2.4 BENTHIC INVERTEBRATES

2.4.1 FIELD SAMPLING

Benthic invertebrates were sampled following Canadian Aquatic Biomonitoring Network (CABIN) standard methods. Although not currently available, a CABIN reference model for the Peace Region is currently under development and is anticipated to be completed in the next several years. The CABIN sampling method was used for this project in anticipation of the Peace Region reference model completion. The CABIN system of biomonitoring uses invertebrate community data from a group of unimpaired reference sites to build a statistical reference model which a test site is compared against. Within the CABIN model, each test site is compared to reference sites housed within the CABIN database. The comparison is done using multivariate statistical analysis to determine if each test site statistically differs from the reference condition, in which case the site is considered impaired.

The current sampling design follows a before-after control-impact design (BACI, Smith 2002) where upstream control sites can be paired with downstream impact sites. It is intended that benthic, periphyton, sediment, and tissue samples will all be analyzed using the BACI design. The intention for future monitoring is to statistically compare pre-impact (before) data to post-impact (after) data using two-factor ANOVA.

Benthic invertebrate samples were collected at all 11 sites in riffle and glide areas of the streams. Sampling was conducted at water depths between 10 cm and 45 cm for a period of three minutes with a 400µm mesh, CABIN protocol kick net. Substrate and debris upstream of the kick net was disturbed by kicking and turning rocks over to dislodge invertebrates. After the three minutes, the kick net was removed from the stream and all invertebrates and debris in the net and collection cup were rinsed carefully into a sterile sample jar. Samples were preserved with a 10% buffered formalin solution, at a ratio of 1:3 parts formalin to water. A single sample was collected for metals concentration at each site and three sample replicates were collected at each site for community composition, moving in an upstream direction within the identified riffle or glide. Water depth and average water velocity were measured at each sample replicate location. In-situ water quality, substrate type and riparian vegetation were also recorded at each site.

2.4.2 LABORATORY ANALYSIS

Tissue samples were sent to Maxxam Analytics in Burnaby, BC for metals analysis. The lab analysed the M20-04 sample twice in order to calculate a relative percent difference (RPD) value. Taxonomic samples were sent to Cordillera Consulting for enumeration and identification to the lowest possible taxonomic level.

2.4.3 DATA ANALYSIS

Metals concentrations from tissue samples were reported as raw numbers (single sample per sample station).

A selection of metrics was chosen to represent community composition, proportion of pollution intolerant species, and overall productivity. These metrics were analyzed using data from each replicate sample. Mean and standard deviation statistics were calculated for each site.

Table 3. Metrics used to describe benthic invertebrate abundance, diversity and community similarity.

Metrics	Description
Total Density	The total number of individuals of all taxon categories collected at each site.
Taxa Richness	The average number of distinct taxa counted at each site. Distinct taxa include individuals identified only to order if there were no individuals identified to a lower level for that taxon (Rosenberg and Resh 1993).
EPT Richness	Measures the amount of pollution sensitive species (Ephemeroptera, Plecoptera and Trichoptera) that are present. This was calculated by counting the number of different taxa from each of these orders. High numbers typically indicate good water quality (Rosenberg and Resh 1993).
Hilsenhoff Biotic Index (HBI)	The sum of abundance weighted by assigned tolerance to organic pollution value for each taxon (Rosenberg and Resh 1993).
Ephemeroptera (%)	The abundance of Ephemeroptera divided by the total number of individuals in each sample, averaged among samples replicates (Karr and Chu 1999).
Plecoptera (%)	The abundance of Plecoptera divided by the total number of individuals in each sample, averaged among samples replicates (Karr and Chu 1999).
Trichoptera (%)	The abundance of Trichoptera divided by the total number of individuals in each sample, averaged among samples replicates (Karr and Chu 1999).
Diptera (%)	The abundance of Diptera divided by the total number of individuals in each sample, averaged among samples replicates (Karr and Chu 1999).

2.4.4 QUALITY ASSURANCE/QUALITY CONTROL

The kick net was back rinsed between samples and new nitrile gloves were used at each new sample site. Samples were stored in new plastic containers, kept in 70% ethanol, tissue samples were frozen, and samples were shipped to the respective labs within the specified holding period.

Due to the challenge of collecting sufficient sample volume required lab analysis, one composite sample was taken at each site and no replicates or split samples were collected for tissue metal concentrations. Maxxam

Analytics analysed M20-04 twice in order to calculate a relative percent difference (RPD). For most parameters RPD was outside of control limits due to a non-homogeneous sample. A lab blank was also competed for a full set of analytes. Maxxam Analytics reported that the overall quality control met acceptability criteria. Lab RPD and lab blank results are available in Appendix A.

Three replicate samples were collected for the community composition. From these three replicates a mean and standard deviation was calculated for each site.

3 RESULTS

Results are summarized and discussed below for each component of the 2013 baseline monitoring program: stream sediments, periphyton, and benthic invertebrates. Raw lab data for each component is provided in Appendix B, C, and D respectively. The aquatic habitat section briefly describes the sampling locations, site conditions, and which samples were collected at each site.

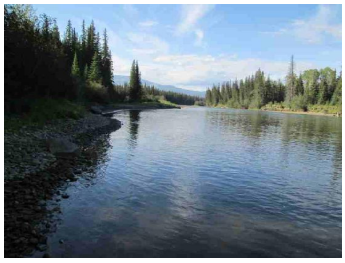
3.1 AQUATIC HABITAT

Samples were collected in the same sample locations as in 2012 and 2013 with the exception of MR-REF, which was not sampled in 2012. Water characteristics for each site are outlined below in Table 4. Descriptions of stream reach as well as a summary of the samples collected at each site are provided in Table 5.

Table 4. General site conditions for each aquatic life site sampled in August 2013.

Site	Air temp (ºC)	Water temp (ºC)	pH	Conductivity (µs/cm)	Dissolved oxygen (mg/L)	Turbidity (NTU)
MR-REF	13.1	12.8	8.09	196.9	8.78	1.42
MR-3	11.0	12.0	8.09	210.0	8.96	2.76
MR-4	11.0	12.0	7.97	231.4	8.72	3.18
MR-6	16.5	14.1	8.23	215.0	9.18	2.30
MR-7b	13.5	11.9	8.05	217.0	9.06	2.86
MR-9	16.2	13.8	8.13	208.2	8.94	3.71
M17-02	13.6	11.6	8.37	1076.0	9.16	1.68
M19-01	15.7	11.5	8.14	313.9	9.04	0.96
M19-02	18.0	12.8	7.94	352.2	7.78	0.63
M20-04	16.5	11.9	8.41	359.9	9.62	36.8
M20-06	17.0	12.1	8.41	360.5	9.35	40.5

Table 5. Site specific habitat data for each aquatic life site sampled in August 2013.

Site	Reach Data	Site	Reach Data
MR-REF 	Habitat Types: Riffle, straight run, pool/back eddy Canopy Coverage: 1-25% Dominant Streamside Vegetation: Coniferous trees	MR-3 	Habitat Types: Straight run. Canopy Coverage: 1-25% Dominant Streamside Vegetation: Coniferous trees
MR-4 	Habitat Types: Riffle, straight run and pool/back eddy Canopy Coverage: 1-25% Dominant Streamside Vegetation: Shrubs	MR-6 	Habitat Types: Riffle, straight run, pool/back eddy Canopy Coverage: 1-25% Dominant Streamside Vegetation: Deciduous trees
MR-7b 	Habitat Types: Straight run, pool/back eddy Canopy Coverage: 1-25% Dominant Streamside Vegetation: Coniferous trees	MR-9 	Habitat Types: Straight run, pool/back eddy Canopy Coverage: 0% Dominant Streamside Vegetation: Shrubs
M17-02 	Habitat Types: Riffle, straight run, pool/back eddy Canopy Coverage: 51-75% Dominant Streamside Vegetation: Shrubs	M19-01 	Habitat Types: Riffle, straight run, pool/back eddy Canopy Coverage: 26-50% Dominant Streamside Vegetation: Shrubs
M19-02 	Habitat Types: Riffle, straight run, pool/back eddy Canopy Coverage: 1-25% Dominant Streamside Vegetation: Deciduous trees	M20-04 	Habitat Types: Riffle, straight run, pool/back eddy Canopy Coverage: 1-25% Dominant Streamside Vegetation: Deciduous trees

Site	Reach Data	Site	Reach Data
M20-06 	Habitat Types: Riffle Canopy Coverage: 1-25% Dominant Streamside Vegetation: Deciduous trees		

3.2 STREAM SEDIMENT

The following 2013 baseline results from stream sediment analysis are outlined below in turn: total organic carbon and particle size, metals concentrations, and PAH concentrations.

3.2.1 TOTAL ORGANIC CARBON AND PARTICLE SIZE

Overall, total organic carbon (TOC) in the stream sediments was highest in MR-REF and the M17 Creek sites and lowest in the M20 creek sites.

Sand was the dominant particle size in the depositional zones sampled at 8 of the 11 sites with an average proportion of 47.3±9.5% across all sites (Table 6, Figure 2). The highest proportion of sand was found at M20-06, MR-4, and M19-01 with 61.3%, 59.0%, and 56.8% respectively. Silt was the dominant particle size at the remaining sites, MR-REF, MR-7b, and M20-04 with an average proportion of 37.4±8.5% across all sites. The highest proportion of silt was found at MR-REF, M20-04, and MR-7b with 54.5%, 46.7%, and 46.5% respectively. MR-9 had the highest proportion of clay with 26.3% and gravel was below detection limit for all sites.

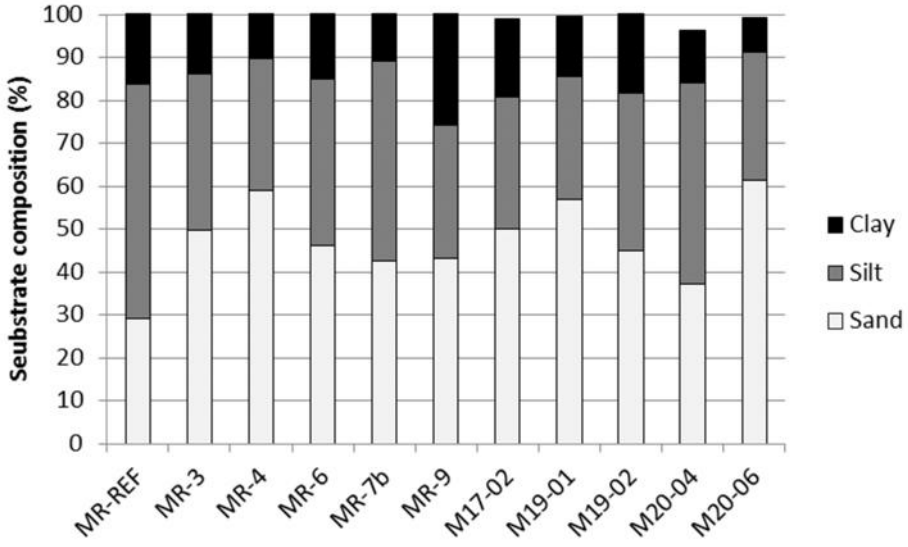


Figure 2. Stream sediment composition as percent of total for samples collected in August 2013.

Table 6. Physical and chemical properties for sediment samples collected in August 2013.

Site	Parameter	Statistics					
		Mean	Minimum	Maximum	Median	Standard Deviation	Standard Error
MR-REF	% Sand	29.3	14.0	44.0	29.5	12.4	6.2
	% Silt	54.5	40.0	66.0	56.0	11.5	5.8
	% Clay	16.3	12.0	20.0	16.5	3.3	1.7
	% Gravel[1]	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	% Moisture[2]	30.0	N/A	N/A	N/A	N/A	N/A
	Soluble (2:1) pH	8.3	8.2	8.4	8.3	0.1	0.03
	TOC (g/kg)	18.0	17.0	20.0	17.5	1.4	0.7
MR-3	% Sand	49.8	33.0	76.0	45.0	19.3	9.6
	% Silt	36.3	15.0	48.0	41.0	15.4	7.7
	% Clay	14.3	9.3	19.0	14.5	4.0	2.0
	% Gravel[1]	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	% Moisture[2]	35.0	N/A	N/A	N/A	N/A	N/A
	Soluble (2:1) pH	8.3	8.2	8.3	8.3	0.1	0.04
	TOC (g/kg)	15.8	13.0	17.0	16.5	1.9	1.0
MR-4	% Sand	59.0	51.0	82.0	51.5	15.3	7.7
	% Silt	30.8	12.0	39.0	36.0	12.6	6.3
	% Clay	10.6	5.3	13.0	12.0	3.6	1.8
	% Gravel[1]	<2.0[1]	<2.0	<2.0	<2.0	<2.0	<2.0
	% Moisture	23.5	23.0	24.0	23.5	0.7	0.4
	Soluble (2:1) pH	7.4	6.2	8.5	7.4	1.3	0.6
	TOC (g/kg)	12.8	11.0	14.0	13.0	1.5	0.8
MR-6	% Sand	46.3	43.0	52.0	45.0	3.9	2.0
	% Silt	38.8	31.0	43.0	40.5	5.3	2.7
	% Clay	15.0	12.0	17.0	15.5	2.2	1.1
	% Gravel[1]	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	% Moisture[2]	35.0	N/A	N/A	N/A	N/A	N/A
	Soluble (2:1) pH	7.9	6.6	8.4	8.3	0.9	0.4
	TOC (g/kg)	14.3	13.0	16.0	14.0	1.3	0.6
MR-7B	% Sand	42.5	15.0	56.0	49.5	18.9	9.5
	% Silt	46.5	34.0	74.0	39.0	18.8	9.4
	% Clay	11.2	9.7	13.0	11.0	1.4	0.7
	% Gravel[1]	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	% Moisture	36.2	28.0	39.0	38.0	4.1	2.1
	Soluble (2:1) pH	8.2	8.1	8.3	8.2	0.1	0.04
	TOC (g/kg)	13.3	12.0	15.0	13.0	1.3	0.6
MR-9	% Sand	43.3	36.0	48.0	44.5	5.3	2.6
	% Silt	30.8	26.0	37.0	30.0	4.6	2.3
	% Clay	26.3	21.0	31.0	26.5	4.3	2.1
	% Gravel[1]	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	% Moisture[2]	31.0	N/A	N/A	N/A	N/A	N/A
	Soluble (2:1) pH	7.8	6.4	8.3	8.3	0.9	0.5
	TOC (g/kg)	12.3	11.0	13.0	12.5	1.0	0.5

M17-02	% Sand	50.0	45.0	54.0	50.5	3.9	2.0
	% Silt	30.8	28.0	33.0	31.0	2.2	1.1
	% Clay	18.3	16.0	22.0	17.5	2.9	1.4
	% Gravel[3]	<2.0	<2.0	2.10	<2.0	<2.0	<2.0
	% Moisture[2]	37.0	N/A	N/A	N/A	N/A	N/A
	Soluble (2:1) pH	8.4	8.4	8.5	8.4	0.1	0.03
	TOC (g/kg)	16.3	15.0	18.0	16.0	1.3	0.6
M19-01	% Sand	56.8	41.0	71.0	57.5	14.1	7.1
	% Silt	28.8	20.0	35.0	30.0	7.1	3.5
	% Clay	14.1	7.5	24.0	12.4	8.0	4.0
	% Gravel[1]	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	% Moisture[2]	28.0	N/A	N/A	N/A	N/A	N/A
	Soluble (2:1) pH	8.0	7.7	8.2	8.1	0.2	0.1
	TOC (g/kg)	17.0	14.0	19.0	17.5	2.4	1.2
M19-02	% Sand	45.0	41.0	48.0	45.5	3.2	1.6
	% Silt	36.8	34.0	40.0	36.5	2.8	1.4
	% Clay	18.5	17.0	19.0	19.0	1.0	0.5
	% Gravel[1]	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	% Moisture[2]	41.0	N/A	N/A	N/A	N/A	N/A
	Soluble (2:1) pH	8.3	8.2	8.4	8.3	0.1	0.04
	TOC (g/kg)	18.5	18.0	19.0	18.5	0.6	0.3
M20-04	% Sand	37.3	29.0	44.0	39.0	7.6	4.4
	% Silt	46.7	35.0	55.0	50.0	10.4	6.0
	% Clay	12.2	9.6	15.0	12.0	2.7	1.6
	% Gravel[3]	<2.0	<2.0	8.8	<2.0	<2.0	<2.0
	% Moisture[2]	26.0	N/A	N/A	N/A	N/A	N/A
	Soluble (2:1) pH	8.3	8.2	8.4	8.3	0.1	0.1
	TOC (g/kg)	11.3	11.0	12.0	11.0	0.6	0.3
M20-06	% Sand	61.3	53.0	72.0	59.0	9.7	5.6
	% Silt	30.0	22.0	37.0	31.0	7.5	4.4
	% Clay	8.1	5.5	10.0	8.8	2.3	1.3
	% Gravel[1]	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	% Moisture[2]	28.0	N/A	N/A	N/A	N/A	N/A
	Soluble (2:1) pH	5.8	5.1	6.2	6.1	0.6	0.3
	TOC (g/kg)	11.3	10.0	12.0	12.0	1.2	0.7

[1] All replicate samples contained < 2.0 % gravel; therefore it was not possible to calculate mean, minimum, maximum, median, standard deviation, or standard error statistics.

[2] No replicate samples were collected; therefore it was not possible to calculate mean, minimum, maximum, median, standard deviation, or standard error statistics.

[3] All replicate samples contained < 2.0 % gravel except one sample; therefore it was not possible to calculate mean, minimum, median, standard deviation, or standard error statistics

3.2.2 METALS

There were some total metals exceedances for the stream sediments based on the Canadian Council or Ministers of the Environment (CCME) and BC Sediment Quality Guidelines (SQGs), which are the federally and provincially accepted guidelines respectively. There was a CCME SQG exceedance for arsenic at MR-REF and a BC SQG exceedance for iron at MR-9. Cadmium was in exceedance of the CCME SQG for all sites except the M19 Creek sites and Nickel was in exceedance of the BC SQG for all sites (Table 7, Figure 3). All other metal parameters were within the guidelines. For the majority of metal parameters, concentrations were highest at MR-REF compared to the other sites.

Table 7. Mean total metal concentrations (mg/kg) for sediment samples collected in August 2013. Results are reported as wet weight and standard deviations are presented in parentheses.

Total Metal (mg/kg)	Site												
	MR-REF	MR-3	MR-4	MR-6	MR-7B	MR-9	M17-02	M19-01	M19-02	M20-04	M20-06	BC SQG	CCME ISQG
Aluminum (Al)	7,618 (867)	8,113 (706)	6,713 (936)	7,453 (1,127)	6,603 (775)	10,115 (1,008)	7,683 (457)	6,335 (395)	6,033 (181)	5,533 (155)	5,343 (225)		
Antimony (Sb)	0.62 (0.07)	0.56 (0.05)	0.48 (0.07)	0.54 (0.06)	0.46 (0.03)	0.56 (0.02)	0.50 (0.04)	0.33 (0.03)	0.39 (0.01)	0.49 (0.03)	0.51 (0.02)		
Arsenic (As)	7.37 (1.00)	5.67 (0.43)	4.43 (0.37)	4.71 (0.54)	4.03 (0.54)	5.63 (0.41)	4.28 (0.47)	3.60 (0.25)	3.73 (0.05)	4.39 (0.19)	5.22 (0.33)	5.9	5.9
Barium (Ba)	177 (27)	159 (18)	206 (18)	151 (14)	141 (13)	164 (7)	309 (29)	202 (8)	210 (3)	464 (25)	546 (31)		
Beryllium (Be)[1]	0.59 (0.06)	0.54 (0.04)	0.44[4] (0.04)	0.51 (0.05)	0.55[5] (0.01)	0.51[4] (0.03)	0.49[4] (0.08)	<0.42	<0.48	<0.40	<0.40		
Bismuth (Bi)[2]	0.14 (0.02)	0.13 (0.01)	0.11[4] (0.01)	0.11 (0.02)	0.11[5] (0.01)	0.15 (0.02)	0.12 (0.01)	<0.10	0.10[4] (0.01)	<0.10	<0.10		
Cadmium (Cd)	0.783 (0.063)	0.856 (0.141)	0.791 (0.082)	0.806 (0.057)	0.781 (0.066)	0.740 (0.072)	0.706 (0.053)	0.496 (0.035)	0.510 (0.025)	0.674 (0.013)	0.679 (0.032)	0.6	0.6
Calcium (Ca)	43,950 (5,619)	50,050 (4,422)	47,375 (1,788)	49,575 (1,548)	51,525 (532)	61,075 (5,332)	31,550 (1,420)	16,658 (7,062)	22,175 (562)	41,400 (819)	38,600 (1,587)		
Chromium (Cr)	12.9 (1.1)	14.3 (0.8)	13.2 (2.1)	13.5 (1.0)	11.9 (0.9)	16.5 (1.1)	13.9 (1.1)	11.4 (0.3)	10.7 (0.3)	10.4 (0.2)	10.6 (1.1)	37.3	37.3
Cobalt (Co)	6.88 (0.60)	6.96 (0.69)	6.15 (0.61)	6.67 (0.77)	5.84 (0.55)	8.67 (0.78)	7.61 (0.46)	5.54 (0.23)	5.69 (0.13)	6.05 (0.23)	6.40 (0.26)		
Copper (Cu)	18.9 (2.6)	17.2 (1.5)	14.1 (1.7)	14.4 (1.8)	13.1 (1.4)	19.5 (1.5)	15.7 (1.1)	10.2 (0.3)	10.4 (0.1)	13.0 (0.3)	13.6 (0.7)	35.7	35.7
Iron (Fe)	20,625 (1,500)	18,550 (2,024)	15,550 (1,328)	16,525 (1,609)	15,375 (1,415)	21,675 (1,775)	16,850 (1,173)	15,100 (976)	15,150 (252)	14,633 (503)	15,533 (586)	21,200	
Lead (Pb)	12.1 (1.5)	10.5 (1.0)	8.67 (0.91)	8.90 (1.15)	8.08 (0.68)	11.80 (0.91)	9.28 (0.75)	7.53 (0.25)	7.59 (0.19)	8.23 (0.41)	8.88 (0.53)	35	35
Lithium (Li)	10.1 (0.7)	13.0 (1.4)	10.1 (1.7)	11.7 (1.8)	10.2 (1.1)	16.0 (1.9)	11.7 (0.8)	8.4 (0.2)	8.4 (0.4)	7.5 (0.3)	7.4 (0.2)		
Magnesium (Mg)	17,200 (2,292)	17,550 (1,739)	17,050 (574)	18,475 (780)	19,150 (480)	20,100 (1,619)	11,100 (245)	6,765 (2,571)	9,743 (245)	13,467 (115)	12,567 (569)		

Manganese (Mn)	250 (13)	348 (55)	295 (57)	346 (29)	276 (31)	373 (45)	267 (37)	212 (67)	267 (8)	241 (8)	260 (9)	460-1,100	
Mercury (Hg)	0.087 (0.014)	0.066[4] (0.004)	0.056[4] (0.003)	0.058[4] (0.011)	0.052[5] (0.001)	0.054[5] (0.002)	0.061 (0.005)	0.054[4] (0.001)	0.055[5] (0.005)	0.058 (0.002)	0.058 (0.007)	0.17	0.17
Molybdenum (Mo)	2.52 (0.34)	1.77 (0.22)	1.36 (0.14)	1.35 (0.14)	1.31 (0.11)	1.50 (0.07)	0.93 (0.11)	0.66 (0.10)	0.70 (0.02)	1.07 (0.04)	1.03 (0.05)		
Nickel (Ni)	27.4 (3.9)	25.7 (1.5)	22.0 (2.0)	22.4 (2.8)	20.4 (2.0)	26.8 (1.5)	25.0 (2.2)	17.9 (0.9)	16.9 (0.5)	19.3 (0.7)	19.8 (1.2)	16-75	
Phosphorus (P)	1,360 (101)	1,145 (24)	1,016 (47)	1,025 (62)	1,050 (8)	957 (45)	768 (25)	835 (18)	866 (18)	783 (32)	812 (11)		
Potassium (K)	1,625 (272)	1,370 (133)	1,120 (97)	1,141 (117)	1,040 (109)	1,493 (99)	1,165 (64)	769 (36)	907 (32)	941 (27)	958 (72)		
Selenium (Se)	1.00 (0.09)	0.72 (0.08)	0.62[4] (0.06)	0.65 (0.10)	0.61[4] (0.03)	0.58 (0.06)	0.73 (0.06)	0.61[5] (0.05)	0.58 (0.03)	0.55[6] (0.04)	0.59 (0.07)	2.0	
Silver (Ag)	0.262 (0.039)	0.206 (0.018)	0.168 (0.034)	0.182 (0.032)	0.156 (0.016)	0.158 (0.013)	0.170 (0.023)	0.169 (0.016)	0.169 (0.020)	0.182 (0.003)	0.212 (0.004)	0.5	
Sodium (Na)[3]	<100	<100	<102	<100	<100	<100	<100	<100	<100	<100	<100		
Strontium (Sr)	67.4 (4.2)	69.1 (2.6)	59.3 (3.2)	57.6 (3.8)	59.1 (3.5)	77.5 (6.0)	46.0 (2.7)	24.9 (5.7)	29.6 (0.6)	59.7 (1.1)	60.2 (0.9)		
Thallium (Tl)	0.220 (0.020)	0.216 (0.022)	0.179 (0.021)	0.201 (0.028)	0.193 (0.012)	0.199 (0.008)	0.178 (0.012)	0.112 (0.002)	0.119 (0.009)	0.119 (0.008)	0.132 (0.014)		
Tin (Sn)	0.29 (0.04)	0.28 (0.04)	0.30 (0.18)	0.22 (0.02)	0.28 (0.15)	0.25 (0.01)	0.24 (0.01)	0.21 (0.02)	0.20 (0.02)	0.18 (0.00)	0.19 (0.01)		
Titanium (Ti)	16.9 (2.7)	25.4 (3.6)	24.5 (8.0)	26.5 (2.3)	25.0 (3.1)	54.3 (13.1)	59.9 (2.4)	18.4 (2.7)	24.1 (3.8)	40.9 (0.8)	34.1 (2.4)		
Uranium (U)	1.144 (0.104)	0.968 (0.051)	0.885 (0.042)	0.836 (0.075)	0.846 (0.057)	0.970 (0.021)	0.705 (0.035)	0.627 (0.028)	0.586 (0.015)	0.725 (0.031)	0.762 (0.021)		
Vanadium (V)	32.6 (3.1)	31.6 (1.9)	27.7 (3.0)	30.2 (3.7)	27.9 (2.7)	32.0 (0.7)	25.9 (1.3)	21.3 (1.1)	20.4 (1.2)	21.4 (0.4)	20.5 (0.9)		
Zinc (Zn)	104.4 (7.7)	92.1 (8.5)	77.2 (7.8)	82.9 (10.5)	76.4 (3.1)	80.2 (1.2)	81.3 (5.1)	62.0 (5.5)	81.1 (1.5)	67.0 (3.4)	68.4 (2.2)	123	123
Zirconium (Zr)	1.12 (0.12)	1.22 (0.07)	1.11 (0.10)	1.08 (0.06)	1.10 (0.10)	1.89 (0.39)	1.53 (0.11)	1.00 (0.06)	1.02 (0.16)	1.50 (0.06)	1.34 (0.03)		

[1] All replicate samples at sites M19-01, M19-02, M20-04, and M20-06 contained <0.42 mg/kg, <0.48 mg/kg, <0.40 mg/kg, and <0.40 mg/kg respectively of beryllium; therefore it was not possible to calculate mean total metal concentrations and standard deviations for these sites.

[2] All replicate samples at sites M19-01, M20-04, and M20-06 contained <0.10 mg/kg of bismuth; therefore it was not possible to calculate mean total metal concentrations and standard deviations for these sites.

[3] All replicate samples contained < 102 mg/kg of sodium; therefore, it was not possible to calculate mean total metal concentrations and standard deviations.

[4] Only three of four replicate samples were used to calculate the mean total metal concentration and standard deviation. The remaining replicate sample had a total metal concentration less than a specific value.

[5] Only two of four replicate samples were used to calculate the mean total metal concentration and standard deviation. The remaining replicate samples had a total metal concentration less than a specific value.

[6] Only two of three replicate samples were used to calculate the mean total metal concentration and standard deviation. The remaining replicate sample had a total metal concentration less than a specific value.

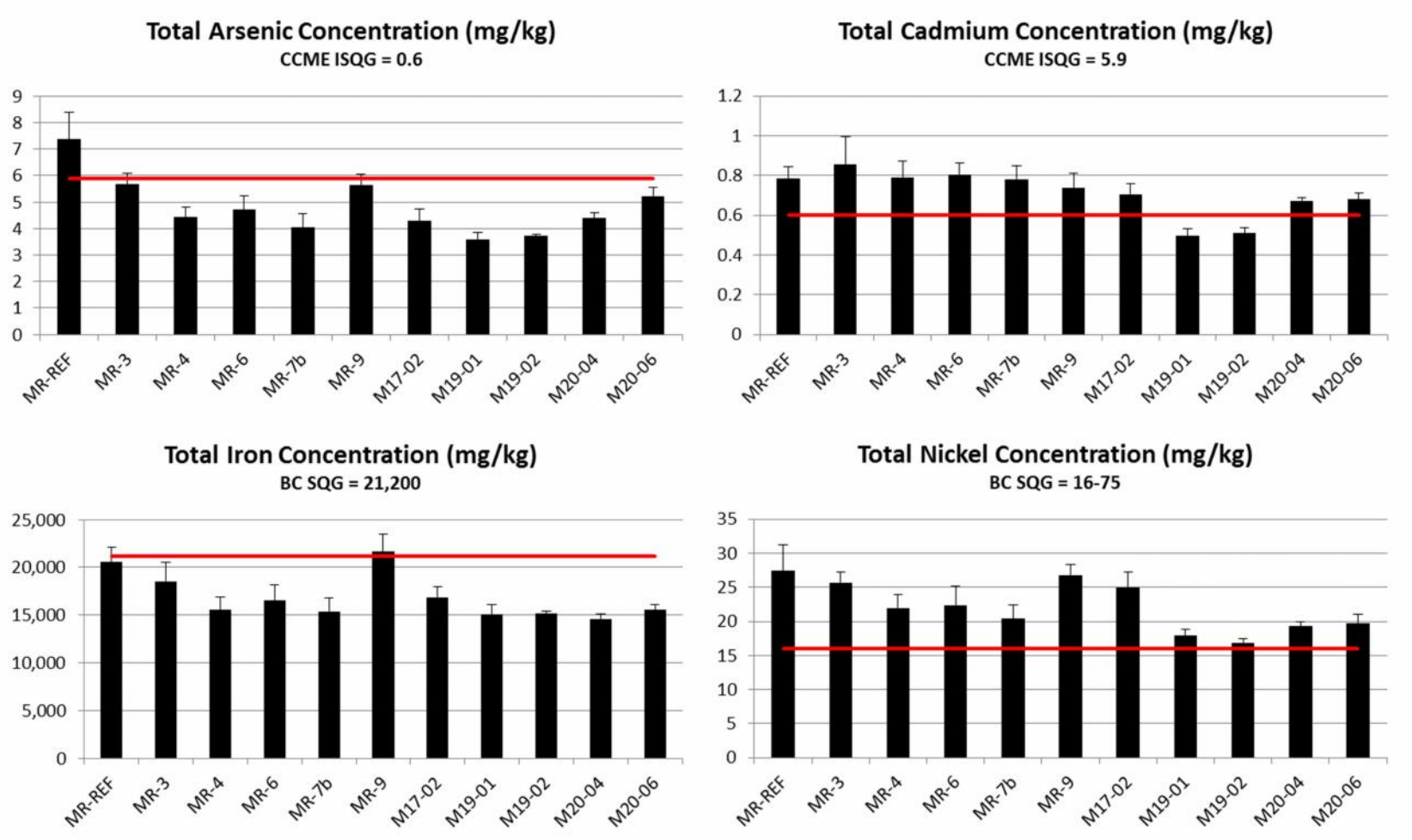


Figure 3. Total metals concentrations for cases where sediment guideline exceedances were detected.

3.2.3 POLYCYCLIC AROMATIC HYDROCARBONS

There were some PAH exceedances for the stream sediments based on the Canadian Council or Ministers of the Environment (CCME) guidelines, which are the federally accepted guidelines (Table 8). The guideline for Naphthalene was exceeded at M170-2, M19-02, and M20-06 while the guideline for Acenaphthene was exceeded at M19-02 and M20-06. Finally the guidelines for 2-Methyl-naphthalene and Phenanthrene were exceeded at all sites except M19-01.

Table 8. Polycyclic aromatic hydrocarbon (PAH) concentrations for sediment samples collected in August 2013. Results are reported as wet weight and standard deviations are presented in parentheses where applicable.

PAH (mg/kg)	Site											
	MR-REF	MR-3	MR-4[1]	MR-6	MR-7B[2]	MR-9	M17-02	M19-01	M19-02	M20-04	M20-06	CCME ISQG
Naphthalene	0.019	0.029	<0.010	0.020	0.029 (0.004)	0.029	0.042	0.006	0.077	0.026	0.051	0.0346
2-Methyl-naphthalene	0.029	0.052	0.024 (0.001)	0.042	0.053 (0.007)	0.047	0.130	0.012	0.230	0.093	0.160	0.0202
Acenaphthylene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	<0.005	<0.005	<0.005	0.00587
Acenaphthene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	<0.009[3]	<0.005	<0.007[3]	0.00671
Fluorene	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.013	0.001	0.020	0.012	0.018	0.111
Phenanthrene	0.057	0.081	0.047 (0.005)	0.058	0.071 (0.007)	0.069	0.080	0.017	0.130	0.095	0.130	0.0419
Anthracene	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.001	<0.010	<0.010	<0.010	
Fluoranthene	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.002	0.011	<0.010	0.011	
Pyrene	<0.010	0.012	<0.010	<0.010	0.012 (0.001)	0.013	0.014	0.005	0.022	0.014	0.020	0.053
Benzo(a)-anthracene	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.001	<0.010	<0.010	<0.010	0.0317
Chrysene	0.038	0.058	0.038 (0.002)	0.043	0.045 (0.004)	0.047	0.05	0.014	0.056	0.058	0.069	
Benzo(b)-fluoranthene	0.021	0.029	0.017 (0.001)	0.021	0.022 (0.003)	0.026	0.023	0.007	0.025	0.018	0.023	
Benzo(b&j)-fluoranthene	0.021	0.031	0.017 (0.000)	0.021	0.022 (0.003)	0.026	0.023	0.007	0.025	0.018	0.023	
Benzo(k)-fluoranthene	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.001	<0.010	<0.010	<0.010	
Benzo(a)pyrene	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.001	<0.010	<0.010	<0.010	0.0319
Indeno(1,2,3-cd)pyrene	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.002	<0.020	<0.020	<0.020	
Dibenz(a,h)-anthracene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	<0.005	<0.005	<0.005	0.00622

Benzo(g,h,i)-perylene	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.004	<0.020	<0.020	<0.020
Low Molecular Weight PAH`s	0.100	0.160	0.076 (0.004)	0.120	0.153 (0.015)	0.150	0.270	0.037	0.460	0.230	0.360
High Molecular Weight PAH`s	0.039	0.070	0.044 (0.007)	0.043	0.056 (0.004)	0.060	0.065	0.022	0.089	0.071	0.100
Total PAH	0.140	0.230	0.120 (0.014)	0.170	0.210 (0.023)	0.210	0.330	0.059	0.550	0.300	0.470
PAH (%)											
D10-ANTHRACENE (sur.)	130	115	104 (28)	112	115 (9)	127	124	79	126	119	116
D8-ACENAPHTHYLENE (sur.)	84	94	81 (4)	91	89 (4)	84	85	74	86	87	85
D8-NAPHTHALENE (sur.)	90	91	83 (5)	90	89 (1)	87	88	73	87	89	86
TERPHENYL-D14 (sur.)	92	103	90 (4)	101	97 (4)	92	94	79	94	94	91

[1] Two replicate samples were collected at site MR-4. Mean and standard deviation (in parentheses) were calculated for all PAH parameters that had two absolute values. If one or both PAH parameters were less than a specific value, the largest value was displayed in the table (e.g., <0.010).

[2] Six replicate samples were collected at site MR-7B. Mean and standard deviation (in parentheses) were calculated for all PAH parameters that had six absolute values. If one or more PAH parameters were less than a specific value, the largest value was displayed in the table (e.g., <0.005).

[3]Detection limit is higher than CCME guideline

3.3 PERIPHYTON

The 2013 baseline results from periphyton analysis are outlined below in turn: chlorophyll *a*, metals concentrations, and community metrics. Moisture content was 99.25±0.5 for MR-REF; 99% for MR-4, MR-7b, and MR-9; and 100% for all other samples.

3.3.1 CHLOROPHYLL A

Chlorophyll *a* concentrations were highest at M17-02 followed by MR-7b and MR-9 (Table 9, Figure 4). Concentrations were lowest at MR-6 (the furthest downstream site). The M20 Creek sites had moderate chlorophyll concentrations and the Murray River sites varied widely among sample sites (Table 9, Figure 4). Chlorophyll *a* was used as an indicator of biomass of autotrophic organisms. Sample variability was high among sites and within sites (see standard deviation in Figure 4), therefore it was difficult to draw comparisons among mean chlorophyll *a* concentrations. While primary productivity appeared to be higher in M17 Creek than some of the Murray River sites, this trend was not apparent for the other tributaries: M20 and M19 Creeks.

Table 9. Chlorophyll *a* concentration (µg/cm²) for periphyton samples collected in August 2013.

Site	Replicates	Min	Max	Mean	SD
MR-REF	6	0.491	1.120	0.792	0.259
MR-3	6	0.162	1.030	0.478	0.377
MR-4	6	0.259	1.230	0.635	0.393
MR-6	6	0.137	0.508	0.337	0.134
MR-7b	6	0.560	1.400	0.985	0.279
MR-9	6	0.632	1.550	0.956	0.342
M17-02	6	1.110	2.060	1.563	0.346
M19-01	6	0.201	0.440	0.293	0.090
M19-02	6	0.340	1.110	0.589	0.288
M20-04	6	0.082	1.050	0.459	0.418
M20-06	6	0.364	0.929	0.555	0.204

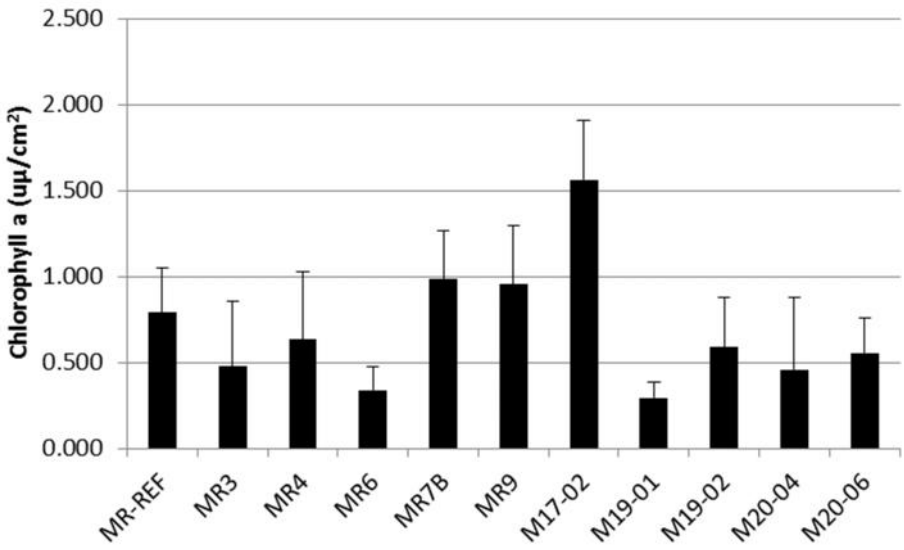


Figure 4. Mean chlorophyll *a* concentration (µg/cm²) for periphyton samples collected in August 2013. Error bars represent standard deviation.

3.3.2 PERIPHYTON METALS CONTENT

Overall periphyton metals concentrations were highest at M20-06 and M20-04 followed by MR-6 and MR-REF (Table 10). The stream sediments metals concentrations were also relatively high at MR-REF, but not at the M20 Creek sites or MR-6.

Table 10. Metals concentrations for periphyton samples collected in August 2013. Results are reported as dry weight tissue and standard deviations are presented in parentheses where applicable.

Total Metal (mg/kg)	Site										
	MR-REF	MR-3	MR-4	MR-6	MR-7B	MR-9	M17-02	M19-01	M19-02	M20-04	M20-06
Aluminum (Al)	5,253 (1,339)	5,740	5,490	6,750	4,460	5,200	5,740	2,950	5,330	6,840	6,520
Antimony (Sb)	0.228 (0.073)	0.117	0.233	0.258	0.183	0.180	0.212	0.169	0.323	0.232	0.339
Arsenic (As)	6.23 (1.86)	5.22	5.33	5.47	5.13	4.32	3.64	5.00	5.23	4.72	4.97
Barium (Ba)	221 (83)	141	228	211	169	162	654	238	199	316	421
Beryllium (Be)[1]	0.41 (0.13)	0.37	0.37	0.44	0.33	0.35	0.39	0.30	0.46	0.47	0.48
Bismuth (Bi)[2]	0.13 (0.00)	0.10	0.11	0.13	<0.10	<0.10	0.11	<0.10	0.12	0.11	0.14
Boron (B)	21.8 (8.6)	6.2	4.7	20.7	4.9	4.7	9.6	5.6	11.1	6.7	7.0
Cadmium (Cd)	0.683 (0.297)	0.520	0.937	0.827	0.859	0.675	1.140	0.497	0.838	0.741	0.930
Calcium (Ca)	35,400 (6,535)	50,000	40,800	40,600	58,500	55,300	71,900	11,900	17,200	30,500	56,600
Chromium (Cr)	8.79 (2.14)	9.85	10.10	11.10	8.58	9.78	9.70	5.30	10.20	11.90	10.70
Cobalt (Co)	7.94 (2.97)	6.96	9.55	10.50	7.64	6.12	6.76	4.76	8.43	10.10	14.60
Copper (Cu)	13.37 (4.18)	10.50	13.00	14.70	9.84	11.50	13.80	9.16	17.00	23.50	12.30
Iron (Fe)	16,608 (4,918)	16,000	15,700	17,000	14,100	13,200	12,000	12,600	18,200	18,900	16,300
Lead (Pb)	9.28 (2.61)	7.99	8.29	8.99	6.90	7.59	8.20	5.99	10.70	7.85	10.40
Magnesium (Mg)	13,170 (2,774)	16,100	15,000	10,900	20,200	16,500	7,960	3,640	5,710	10,000	20,000
Manganese (Mn)	822 (427)	611	862	948	820	465	426	386	353	236	422

Total Metal (mg/kg)	Site										
	MR-REF	MR-3	MR-4	MR-6	MR-7B	MR-9	M17-02	M19-01	M19-02	M20-04	M20-06
Mercury (Hg)	0.041 (0.005)	0.043	0.091	0.041	0.034	0.035	0.050	0.050	0.080	0.048	0.065
Molybdenum (Mo)	1.484 (0.434)	1.180	1.030	1.230	0.957	0.989	0.689	1.150	1.620	1.100	1.110
Nickel (Ni)	21.0 (6.4)	18.7	24.2	21.0	20.7	21.4	23.9	15.2	25.0	32.4	25.1
Phosphorus (P)	1,153 (295)	1,100	1,110	906	1040	1,020	1,030	1,200	885	1110	1,130
Potassium (K)	2,475 (1,239)	1,120	1,010	1,500	829	1,040	1,400	867	1,160	1,630	1,680
Selenium (Se)	0.915 (0.337)	0.597	0.869	0.986	0.621	0.725	1.420	0.952	1.340	1.900	2.200
Silver (Ag)	0.123 (0.047)	0.099	0.113	0.402	0.102	0.084	0.338	0.704	0.520	2.670	1.760
Sodium (Na)[3]	(78.5) 21.0	75	69	82	66	68	111	70	80	113	116
Strontium (Sr)	235.2 (115.4)	118.0	98.9	179.0	95.7	124.0	104.0	98.2	72.0	72.3	90.4
Thallium (Tl)	0.239 (0.066)	0.176	0.202	0.200	0.168	0.189	0.196	0.112	0.163	0.180	0.220
Tin (Sn)	0.24 (0.08)	0.32	0.19	0.33	0.13	0.16	0.31	0.22	0.30	0.55	0.57
Titanium (Ti)	34.7 (18.8)	31.3	13.4	25.5	14.6	15.6	28.2	5.4	15.3	24.1	22.8
Uranium (U)	0.828 (0.193)	0.872	0.810	0.697	0.794	0.819	0.814	0.774	0.519	0.692	0.702
Vanadium (V)	21.8 (5.9)	20.8	21.2	23.6	20.1	19.1	18.2	15.4	16.2	21.8	22.0
Zinc (Zn)	123.5 (61.2)	65.1	76.2	101.0	63.3	60.0	103.0	147.0	121.0	293.0	240.0

3.3.3 PERIPHYTON COMMUNITIES

Periphyton community metrics varied greatly between sites and were not consistent between metrics. Total density was highest at MR-9, M17-02, and MR-6; total richness was highest at M19-02, MR-9, and MR-7b; and total biovolume was highest at M19-01, M17-02, and M19-02. The variability between sites and within sites (see standard deviation in Table 11) was too high to draw any meaningful comparisons. Periphyton communities can be influenced by a number of factors including shade, water clarity, water velocity, and water quality (Azim et al. 2005).

Table 11. Periphyton community metrics including total density, total richness, and total biovolume.

Site	Total Density (cells/cm²)	Total Richness	Total Biovolume (um^3/cm^2)
MR-3	217,723 (117,244)	26 (6)	147,022 (67,608)
MR-4	124,153 (69,808)	33 (7)	51,536 (32,140)
MR-6	225,245 (136,197)	23 (5)	36,880 (12,104)
MR-7b	78,246 (31,277)	35 (5)	79,625 (2,726)
MR-9	235,098 (100,324)	35 (8)	32,341 (67,000)
M17-02	227,559 (69,126)	22 (4)	348,263 (56,451)
M19-01	148,890 (63,308)	21 (7)	476,246 (52,788)
M19-02	121,787 (28,007)	38 (6)	252,205 (115,986)
M20-04	52,417 (12,675)	20 (1)	60,850 (38,718)
M20-06	173,209 (177,285)	25 (3)	81,166 (16,370)

3.4 BENTHIC INVERTEBRATES

The 2013 baseline results from benthic invertebrate analyses are outlined below in turn: metals concentrations and community metrics (taxonomic composition).

3.4.1 TOTAL METALS

Total metals concentrations are reported as wet weights. Dry weight could not be calculated because moisture content was not measured for the 2013 benthic invertebrate samples. Wet weight selenium concentration was highest at M20-06 and MR-6. Overall, metals concentrations were highest at MR-3 followed by M20-04, MR-REF, and MR-6. Stream sediment samples also had relatively high metals concentrations at MR-REF and MR-3.

Table 12. Total metal concentrations (mg/kg) for benthic tissue samples collected in August 2013. Results are reported as wet weight.

Total Metal (mg/kg)	MR-REF	MR-3	MR-4	MR-6	MR-7B	MR-9	M17-02	M19-01	M19-02	M20-04	M20-06
Aluminum (Al)	113	427	143	99.6	96.9	154	31.2	119	115	185	113
Antimony (Sb)	0.015	0.083	0.0169	0.015	0.014	0.0131	0.0103	0.012	0.0134	0.023	0.018
Arsenic (As)	0.179	0.666	0.133	0.136	0.126	0.132	0.042	0.221	0.118	0.127	0.101
Barium (Ba)	28.4	28.6	5.59	6.31	5.27	25.9	8.85	8.9	12.3	14.7	14.1
Beryllium (Be)[1]	<0.020	<0.080	<0.060	<0.020	<0.020	<0.080	<0.020	<0.020	<0.020	<0.020	<0.020
Bismuth (Bi)[2]	<0.020	<0.080	<0.060	<0.020	<0.020	<0.080	<0.020	<0.020	<0.020	<0.020	<0.020
Cadmium (Cd)	1.16	2.1	<1.2	<0.40	0.71	<1.6	<0.40	<0.40	<0.40	<0.40	<0.40
Calcium (Ca)	0.646	1.9	1.13	0.657	0.351	0.456	0.138	0.206	0.402	0.320	0.376
Chromium (Cr)	1890	4300	1620	1860	1270	1270	363	1900	1110	1470	1370
Cobalt (Co)	0.223	0.85	0.27	0.193	0.181	0.23	0.066	0.271	0.242	0.452	0.224
Copper (Cu)	0.472	1.3	0.399	0.428	0.238	0.364	0.119	0.189	0.197	0.755	0.829
Iron (Fe)	5.07	6.17	5.34	9	6.25	2.37	3.85	2.53	4.17	3.64	3.84
Lead (Pb)	378	1550	354	324	389	337	94.6	698	399	415	296
Lithium (Li)	0.166	0.76	0.209	0.167	0.168	0.184	0.0651	0.276	0.19	0.305	0.245
Magnesium (Mg)	581	885	592	676	481	404	565	541	230	450	446
Manganese (Mn)	66.3	72.6	46.8	35.6	36.5	67.8	24.1	18.7	14.2	31.3	37.2
Mercury (Hg)	0.002	<0.0080	<0.0060	0.0023	<0.0020	<0.0080	<0.0020	0.0044	0.0086	0.004	0.0023
Molybdenum (Mo)	0.12	0.284	0.21	0.096	0.222	0.109	0.163	0.135	0.152	0.11	0.107
Nickel (Ni)	0.62	3.07	0.563	0.559	0.541	0.556	0.415	0.86	0.655	0.983	0.94
Phosphorus (P)	1,660	1,180	1,560	1,800	1,300	717	1,510	988	1,100	1,070	1,210
Potassium (K)	604	123	108	539	88.2	140	898	61.6	41.2	109	103
Selenium (Se)	0.645	0.631	0.953	1.09	0.705	0.267	1.02	0.592	0.793	0.915	1.12
Silver (Ag)	0.0231	0.036	0.027	0.0845	0.0377	0.022	0.0114	0.014	0.026	0.0188	0.0187
Sodium (Na)[3]	173	9.3	20.4	170	30.6	36.5	372	11.2	11.8	33.1	33.7
Strontium (Sr)	4.86	14.3	4.67	3.96	2.32	5.31	0.883	3.15	3.05	4.31	3.6
Thallium (Tl)	0.00718	0.0203	0.0052	0.00082	<0.00040	0.0075	<0.00040	<0.00040	<0.00040	0.00601	<0.00040
Tin (Sn)	<0.020	<0.080	<0.060	<0.020	<0.020	<0.080	<0.020	<0.020	<0.020	<0.020	0.056
Titanium (Ti)	2.26	7.44	2.35	1.7	1.08	2.8	0.78	0.97	1.18	4.15	1.68
Uranium (U)	0.0208	0.0941	0.0142	0.0182	0.0137	0.0197	0.0168	0.0258	0.0173	0.0254	0.0231
Vanadium (V)	0.445	2.25	0.51	0.383	0.334	0.54	0.11	0.653	0.458	0.665	0.408
Zinc (Zn)	95.3	46.1	76.4	102	67.4	41.1	52.9	26	37.8	36.4	52.5

3.4.2 COMMUNITY METRICS

The community metrics calculated included species diversity, species richness, EPT richness, Hilsenoff Biotic Index (HBI), % Ephemeroptera, % Plecoptera, % Trichoptera, and % Diptera. All of these metrics had wide within site and between site variation in 2013 (and previous years), therefore no discernable patterns could be detected between Murray River and its tributaries.

Table 13. Summary of benthic invertebrate metrics 2012. Mean statistic is shown for each site with standard deviation in parentheses.

Metric	MR-REF	MR-3	MR-4	MR-6	MR-7B	MR-9	M17-02	M19-01	M19-02	M20-04	M20-06
Total Density (corrected)	2225 (408)	2191.7 (666.3)	1651.3 (354.8)	2635.3 (638.4)	2972.3 (587)	2221.7 (683.2)	1771.7 (386.6)	1976.7 (1155.8)	3286.3 (1260.3)	2564 (409)	1411.7 (207.3)
Species Richness	33.3 (2.9)	36.7 (4.7)	44 (1)	34.7 (2.1)	44.7 (2.5)	47.3 (1.2)	41.3 (2.5)	34.7 (2.5)	39.3 (4.5)	47.7 (5.9)	40.7 (6.5)
EPT Richness	25 (3.6)	22.7 (1.5)	19 (1.7)	24.3 (3.1)	27.7 (2.5)	26.3 (1.5)	20 (1)	19.7 (3.2)	24.3 (2.3)	33.7 (2.9)	31.3 (5.5)
Hilsenhoff Biotic Index	0.7 (0.1)	1.2 (0.3)	4.6 (0.6)	1.3 (0.2)	1.7 (0.3)	2.4 (0.1)	2.9 (0.5)	2.1 (0.4)	1.4 (0.1)	2.9 (0.1)	3.7 (0.4)
% Ephemeroptera	75.9 (5.7)	68.6 (6.3)	26.4 (4.8)	70.4 (12.1)	65.8 (10)	52.8 (2.1)	19.1 (3)	62.2 (8.1)	59.2 (5.4)	43.8 (7.6)	46.8 (9)
% Plecoptera	14 (4.2)	8.4 (3.4)	3.1 (1.1)	11.1 (6.3)	9.4 (2.4)	8.9 (1.4)	46.6 (6.9)	9.4 (2.8)	25.2 (7.3)	28.6 (5.3)	19.8 (0.9)
% Trichoptera	2.5 (1.5)	5.8 (1.2)	2.8 (1.2)	10.1 (5.7)	5.4 (1.8)	4.7 (1.4)	5.8 (1.9)	12.9 (2.6)	2 (1.3)	4.6 (0.1)	4.4 (0.6)
% Diptera	4.5 (1.4)	11 (1.7)	44.2 (11)	4.9 (1)	13.9 (4.7)	17.2 (1.5)	16.2 (6.1)	8.3 (1.3)	9.2 (1.2)	21.5 (3.1)	27.8 (9.3)

4 REFERENCES

4.1 LITERATURE CITED

Azim, M.E., M.C.J. Verdegem, A.A. van Dam, and M.C.M. Beveridge (eds.). 2005. Periphyton: Ecology, Exploitation, and Management. CABI Publishing.

Biggs, B.J.F. and C. Kilroy. 2000. Stream Periphyton Monitoring Manual. National Institute of Water and Atmospheric Research, Christchurch, New Zealand. 224 pp. Accessed from <http://www.niwa.co.nz/freshwater/management-tools/ecological-monitoring/stream-periphyton-monitoring-manual>

British Columbia Ministry of Environment (BC MOE). 2012. Water and Air Resource Protection Guidelines for Mine Proponents and Operators: Baseline Monitoring. October 2012.

BC MOE. 2006. A compendium of working water quality guidelines for BC. Prepared by the Environmental Protection Division, August 2006. Accessed from <http://www.env.gov.bc.ca/wat/wq/BCguidelines/working.html#table2> on February 10, 2013.

Canadian Council of Ministers of the Environment (CCME). 1999. Canadian soil quality guidelines for the protection of environmental and human health: Chromium (total 1997) (VI 1999). In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg. Accessed from <http://ceqgrcqe.ccme.ca> on. February 10, 2013

Clark, M.J.R. (editor). 2003. British Columbia Field Sampling Manual. Water, Air and Climate Change Branch, BC Ministry of Water, Land and Air Protection, Victoria, BC, Canada. 312 pp.

Environment Canada. Canadian Aquatic Biomonitoring Network (CABIN). 2012. Accessed from http://www.ec.gc.ca/rcba-cabin/default.asp?lang=En&n=72AD8D96-1 on February 10, 2013.

Karr, J.R. and E.W. Chu. 1999. Restoring Life in Running Waters: Better Biological Monitoring. Island Press, Washington, DC.

Maret, T.R., D.J. Cain, D.E. MacCoy, and T.M. Short. 2003. Response of benthic invertebrate assemblages to metal exposure and bioaccumulation associated with hard-rock mining in northwestern streams, USA. Journal of the North American Benthnological Society 22(4): 598-620.

Rosenberg, D.M. and V.H. Resh. (eds) 1993. Freshwater Biomonitoring and Benthic Macroinvertebrates. Chapman and Hall, New York. 488 pp.

Smith, E.P. 2002. BACI Design. Encyclopedia of Environmetrics, Vol 1: 141-148.

Western Canadian Coal Corp (WCCC). 2007. Application for an Environmental Assessment Certificate for the Hermann Mine Project submitted by Western Canadian Coal to Bob Hart (EAO) February 2007.

4.2 SPATIAL DATA

1:50,000 CanVec topographic data from Government of Canada, Natural Resources Canada, Earth Sciences Sector, Centre for Topographic Information. Geogratis website (http://geogratis.cgdi.gc.ca).

1:20,000 TRIM positional files from the Land and Resource Data Warehouse (http://lrdw.ca). Copyright belongs to Her Majesty the Queen in Right of the Province of British Columbia.

Disclaimer:
Maps presented in this document are a geographical representation of known features. Although the data collected and presented herein has been obtained with the utmost attention to quality, this document is not an official land survey and should not be considered for spatial calculation. EDI Environmental Dynamics Inc. does not accept any liability for errors, omissions or inaccuracies in the data.

APPENDIX A.
QUALITY ASSURANCE/QUALITY CONTROL

Table 1. Relative Percent Difference from mean (RPD) for sediment total metals (1 of 3).

	M20-06-1	M20-06-2	M20-06-3	MR-REF-1	MR-REF-2	MR-REF-3	MR-REF-4	MR-3-1	MR-3-2	MR-3-3	MR-3-4	MR-4-1	MR-4-2	MR-4-3	MR-4-4
Aluminum	4.7	1.8	3.1	18.5	6.8	6.4	3.3	9.7	7.1	5.7	7.2	13.9	10.3	12.4	11.7
Antimony	3.2	0.7	2.6	16.7	0.8	8.6	5.5	13.3	3.5	1.8	6.9	1.1	16.4	1.1	17.1
Arsenic	7.0	2.9	4.5	19.3	3.7	13.9	1.1	11.3	6.0	0.1	4.5	2.4	4.6	5.2	13.3
Barium	5.4	0.2	6.0	**22.5**	4.6	14.8	0.4	4.8	14.9	9.6	2.2	7.4	3.7	1.3	13.6
Beryllium	BDL	BDL	BDL	12.2	13.1	1.3	1.3	9.3	2.3	5.3	7.2	6.3	9.5	BDL	3.9
Bismuth	BDL	BDL	BDL	17.1	1.8	17.6	1.8	16.7	7.4	0.0	7.4	3.0	3.0	5.7	BDL
Cadmium	5.3	3.6	1.8	1.2	8.2	4.1	10.1	19.4	4.0	15.3	12.1	1.4	12.6	0.0	12.8
Calcium	3.2	1.6	4.6	9.6	1.0	**20.2**	6.9	11.0	0.5	2.7	10.0	0.6	5.2	3.6	1.2
Chromium	10.7	8.9	2.9	13.7	6.4	2.7	3.4	6.9	0.2	7.1	0.5	19.4	0.2	5.3	18.0
Cobalt	4.5	2.7	1.9	10.9	1.8	10.0	2.1	15.8	6.5	2.4	5.4	0.4	9.2	4.2	14.6
Copper	6.0	2.7	3.5	19.9	0.9	14.1	2.0	8.8	7.6	6.9	7.0	3.4	11.5	5.7	15.9
Iron	4.2	1.5	2.8	8.7	1.3	8.7	2.1	17.3	2.9	8.5	4.0	0.3	8.9	2.2	11.9
Lead	6.6	2.5	4.5	18.0	2.4	13.1	0.0	14.3	4.7	0.9	7.3	5.6	10.5	6.0	12.6
Lithium	2.7	1.4	1.4	10.4	5.8	4.8	1.0	15.6	6.2	1.4	9.0	19.3	12.3	14.9	12.4
Magnesium	3.8	1.3	4.9	12.0	1.2	**20.5**	4.5	12.6	1.4	1.4	11.1	0.3	3.7	4.5	0.3
Manganese	3.9	1.8	2.2	7.3	1.0	4.1	3.7	**23.9**	15.3	0.5	4.1	**21.4**	2.5	3.3	**26.3**
Mercury	10.8	0.6	11.5	**26.0**	7.7	12.9	1.1	1.0	6.4	BDL	5.7	BDL	1.2	4.6	6.1
Molybdenum	4.7	4.0	1.0	**20.4**	2.2	12.5	2.9	17.0	8.3	3.9	10.3	5.4	7.5	1.8	16.4
Nickel	6.7	3.2	3.8	**21.9**	3.9	13.0	1.8	1.2	4.9	8.1	3.8	4.3	6.9	1.2	13.7
Phosphorus	1.5	0.7	0.8	9.2	2.2	8.5	2.2	2.2	1.3	1.3	2.2	4.3	3.3	2.3	5.6
Potassium	8.2	2.7	6.1	**26.1**	7.4	14.6	0.3	13.2	2.9	1.5	10.4	4.6	8.5	5.2	10.3
Selenium	12.7	5.2	8.8	7.3	6.8	8.6	9.4	17.5	10.0	6.1	0.7	1.1	8.7	10.7	BDL
Silver	1.1	2.2	1.1	**22.6**	4.4	13.8	1.0	12.3	4.4	1.8	8.5	3.3	**20.1**	6.6	**29.8**
Sodium	BDL	BDL	BDL	BDL	BDL	0.0	BDL	BDL	BDL	BDL	BDL	BDL	0.0	BDL	BDL
Strontium	1.6	0.7	1.0	9.7	2.7	2.7	3.6	4.6	4.1	1.6	1.8	4.5	5.8	3.1	4.9

Thallium	10.5	10.6	1.0	14.5	5.0	1.5	6.7	6.1	2.6	14.2	9.1	13.9	12.4	5.3	5.9
Tin	5.1	0.0	5.4	18.9	3.5	12.9	6.7	**21.1**	5.6	13.6	5.6	**62.8**	**25.6**	**39.2**	**44.1**
Titanium	3.9	4.5	7.9	13.4	10.3	**23.7**	4.1	**23.1**	10.3	1.8	7.8	**60.5**	**24.2**	15.5	2.1
Uranium	1.3	1.8	3.2	14.0	4.0	7.3	1.4	4.3	2.4	7.8	0.7	0.7	5.3	1.2	6.1
Vanadium	5.1	3.1	2.1	15.0	5.5	2.9	5.2	1.0	4.6	8.6	4.3	12.7	9.9	7.6	6.7
Zinc	3.4	2.8	0.7	7.7	0.4	9.6	2.3	14.1	1.5	8.0	3.3	6.7	3.5	4.3	16.1
Zirconium	0.2	1.7	2.0	3.4	15.1	4.3	9.1	8.3	5.0	2.6	0.2	4.6	12.7	6.5	2.7

Table 2. Relative Percent Difference from mean (RPD) for sediment total metals (2 of 3)

	MR-6-1	MR-6-2	MR-6-3	MR-6-4	MR-7B-1	MR-7B-2	MR-7B-3	MR-7B-4	MR-9-1	MR-9-2	MR-9-3	MR-9-4	M19-01-1	M19-01-2	M19-01-3	M19-01-4
Aluminum	0.4	17.4	18.5	4.0	1.2	9.6	8.6	15.0	3.4	10.2	13.0	4.7	1.5	2.0	8.0	6.9
Antimony	0.9	8.8	14.7	6.8	0.5	8.5	2.7	4.8	0.4	0.4	5.1	4.0	9.5	6.3	11.4	3.0
Arsenic	1.3	11.7	14.7	3.5	6.0	17.0	5.6	13.9	1.3	7.8	10.0	0.1	3.5	0.1	9.2	6.4
Barium	6.5	7.2	12.8	0.3	4.7	6.0	9.8	9.9	1.7	5.2	5.2	2.0	2.9	0.6	2.9	5.0
Beryllium	4.0	12.5	11.1	3.8	0.9	BDL	BDL	0.9	4.0	BDL	5.7	2.0	BDL	BDL	BDL	0.0
Bismuth	12.5	BDL	13.7	3.0	BDL	BDL	4.9	4.7	5.2	8.1	12.6	8.1	BDL	BDL	BDL	BDL
Cadmium	3.0	8.3	7.8	3.2	1.7	4.3	6.5	11.5	5.9	9.4	10.0	7.9	0.6	6.5	9.4	4.2
Calcium	0.4	4.3	1.5	3.0	0.2	0.4	0.8	1.5	10.6	3.3	3.5	9.7	**38.3**	**31.6**	**30.3**	**51.6**
Chromium	2.7	9.5	7.6	1.7	3.9	2.1	5.6	10.8	1.4	8.5	6.4	1.4	2.9	3.2	1.5	2.0
Cobalt	0.6	13.9	14.1	1.6	2.7	8.9	2.4	12.7	2.8	9.9	11.6	3.2	2.4	0.6	5.9	3.2
Copper	4.3	9.5	17.1	5.7	1.0	11.1	4.5	13.0	1.5	8.8	10.2	1.0	4.5	0.1	2.1	2.1
Iron	3.4	14.4	9.1	0.5	6.5	6.5	0.5	12.4	2.7	8.5	10.6	3.7	0.7	6.8	2.7	8.3
Lead	1.2	13.1	16.5	4.6	0.5	8.8	2.9	11.0	1.7	9.7	8.8	0.0	0.2	4.8	2.8	1.9
Lithium	4.2	19.7	17.2	5.3	1.2	9.5	5.3	14.3	4.5	11.8	15.5	6.1	1.8	1.8	3.0	2.9
Magnesium	2.8	5.4	1.5	3.8	1.3	2.3	0.3	3.5	8.8	1.5	1.0	10.4	**37.3**	**28.5**	**28.0**	**41.5**
Manganese	0.7	11.8	3.6	7.9	0.9	12.1	4.6	14.0	9.5	11.9	12.5	7.8	**40.1**	**22.7**	**24.5**	**22.5**
Mercury	9.0	BDL	**20.2**	14.8	1.0	BDL	BDL	1.0	2.8	BDL	2.8	BDL	2.5	1.2	BDL	1.2
Molybdenum	5.5	6.3	14.2	4.0	5.6	8.4	5.9	7.7	3.1	0.2	3.8	7.1	15.6	5.2	17.4	10.4
Nickel	4.0	8.7	16.9	6.3	1.8	9.9	5.1	11.9	2.3	6.2	5.7	3.3	3.4	0.0	7.0	4.0
Phosphorus	0.5	8.7	5.2	3.4	0.9	1.0	0.0	0.0	0.1	4.0	6.4	2.7	1.7	3.1	0.1	1.5
Potassium	0.1	13.7	11.5	0.8	1.0	3.0	11.1	13.4	1.2	7.0	9.3	0.5	3.1	5.8	4.4	1.4
Selenium	9.2	**23.8**	0.4	10.6	BDL	0.0	4.8	5.0	0.9	6.3	13.8	10.0	5.6	BDL	BDL	6.0
Silver	2.6	12.4	**21.4**	16.2	5.1	4.5	12.1	11.1	10.1	2.7	1.7	10.1	3.6	2.2	12.4	9.7
Sodium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Strontium	2.3	7.4	8.3	0.8	5.4	4.9	5.6	4.6	8.4	6.6	5.3	6.2	16.4	18.7	17.0	**27.3**
Thallium	0.2	11.3	17.9	9.1	4.6	0.1	4.1	8.1	2.4	3.7	4.3	3.2	1.8	0.9	2.6	1.8
Tin	0.0	14.6	12.8	0.0	**57.4**	**39.2**	**29.4**	**24.9**	3.9	3.9	8.3	0.0	1.2	8.8	3.7	10.3
Titanium	2.1	13.4	2.1	7.9	2.2	14.9	0.2	15.0	**25.8**	19.1	**20.8**	18.7	**22.4**	13.2	4.3	1.6
Uranium	4.4	7.5	12.1	1.4	6.3	5.4	6.4	4.9	3.1	1.6	1.6	0.2	6.9	2.6	2.6	1.3
Vanadium	1.4	11.6	15.8	4.8	2.3	5.7	10.0	12.0	1.6	1.6	2.8	0.5	6.6	3.5	2.1	4.8
Zinc	5.2	**20.7**	8.5	4.4	5.5	1.0	3.3	2.9	2.2	0.7	0.8	0.7	7.9	8.9	7.0	6.7
Zirconium	2.8	3.8	8.0	1.9	5.6	8.5	1.8	11.2	13.0	**20.9**	**24.3**	10.1	2.7	3.3	6.4	6.5

Table 3. Relative Percent Difference from mean (RPD) for sediment total metals (3 of 3)

	M19-02-1	M19-02-2	M19-02-3	M19-02-4	M17-02-1	M17-02-2	M17-02-3	M17-02-4	M20-04-1	M20-04-2	M20-04-3
Aluminum	3.1	0.7	1.4	3.9	2.4	8.3	1.6	4.8	2.3	3.2	0.8
Antimony	2.5	2.5	2.6	2.6	3.9	7.7	8.3	4.1	0.7	4.8	5.3
Arsenic	0.7	0.4	1.5	1.8	7.5	15.1	6.3	3.1	2.6	5.1	2.3
Barium	1.8	0.1	2.0	0.4	7.0	0.1	6.0	14.5	6.0	4.0	2.3
Beryllium	0.0	BDL	BDL	BDL	12.4	7.8	17.5	BDL	BDL	BDL	BDL
Bismuth	6.2	3.3	3.3	BDL	2.1	10.1	6.6	6.6	BDL	BDL	BDL
Cadmium	6.5	2.3	4.9	0.3	6.9	4.6	2.3	10.1	2.0	1.7	0.2
Calcium	3.2	2.6	1.2	0.6	5.7	0.5	1.4	5.0	0.5	1.7	2.2
Chromium	2.5	0.7	0.2	3.1	1.1	8.6	0.4	11.0	1.0	1.9	1.0
Cobalt	2.6	0.5	0.0	3.1	2.0	7.3	3.9	6.0	2.7	4.3	1.5
Copper	1.0	1.0	0.0	1.9	0.6	9.7	2.6	7.3	1.5	2.3	0.8
Iron	1.6	0.3	0.3	2.3	3.3	9.9	2.7	4.6	3.1	3.7	0.5
Lead	2.2	0.2	1.1	3.7	2.8	11.4	3.7	5.8	3.9	5.7	1.6
Lithium	2.1	2.1	3.2	7.7	5.7	8.6	0.4	3.9	3.1	0.4	3.5
Magnesium	2.6	2.5	1.6	1.8	2.7	0.9	1.8	1.8	1.0	0.5	0.5
Manganese	0.3	3.2	4.3	0.7	7.5	18.3	12.0	1.6	0.8	3.8	2.9
Mercury	6.2	6.6	BDL	BDL	3.7	11.9	5.5	3.7	2.3	4.5	2.3
Molybdenum	1.1	1.1	1.1	3.2	2.7	16.4	6.1	9.6	2.2	2.2	4.5
Nickel	0.7	1.9	1.9	4.7	3.0	9.8	3.4	10.6	2.9	4.4	1.4
Phosphorus	2.9	0.4	2.2	0.4	2.8	2.3	1.3	4.0	4.5	3.1	1.5
Potassium	5.2	2.2	1.7	1.4	2.2	7.0	0.4	5.7	3.1	2.4	0.7
Selenium	2.2	2.2	2.2	6.2	0.3	8.8	2.4	11.9	5.3	BDL	5.6
Silver	2.8	7.8	6.2	18.9	8.6	16.2	3.5	13.8	0.2	1.3	1.5
Sodium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Strontium	1.9	0.4	2.5	0.9	4.9	4.0	1.3	8.1	1.6	2.1	0.4
Thallium	7.3	5.2	5.7	8.8	5.2	9.6	2.3	2.8	3.6	8.5	4.4
Tin	1.2	12.7	1.2	11.8	2.1	6.2	6.6	2.2	0.0	0.0	0.0
Titanium	20.9	5.4	13.6	5.4	1.3	4.7	1.1	4.7	1.1	2.3	1.3
Uranium	0.3	2.5	1.2	3.3	3.3	4.5	1.6	6.5	3.6	4.8	1.1
Vanadium	7.5	3.5	0.5	5.0	2.9	6.5	0.2	4.1	2.0	0.3	1.7
Zinc	1.8	1.2	2.3	0.8	0.2	8.1	2.6	6.3	4.6	5.6	0.8
Zirconium	8.9	16.5	12.0	15.9	2.7	7.1	0.5	10.1	2.7	2.0	4.6

Table 4. Lab blanks for sediment total metals.

Total metals (mg/kg)	M20-06	MR-REF	MR-3
Aluminum	<100	<100	<100
Antimony	<0.10	<0.10	<0.10
Arsenic	<0.50	<0.50	<0.50
Barium	<0.10	<0.10	<0.10
Beryllium	<0.40	<0.40	<0.40
Bismuth	<0.10	<0.10	<0.10
Cadmium	<0.050	<0.050	<0.050
Calcium	<100	<100	<100
Chromium	<1.0	<1.0	<1.0
Cobalt	<0.30	<0.30	<0.30
Copper	<0.50	<0.50	<0.50
Iron	<100	<100	<100
Lead	<0.10	<0.10	<0.10
Lithium	<5.0	<5.0	<5.0
Magnesium	<100	<100	<100
Manganese	<0.20	<0.20	<0.20
Mercury	<0.050	<0.050	<0.050
Molybdenum	<0.10	<0.10	<0.10
Nickel	<0.80	<0.80	<0.80
Phosphorus	<10	<10	<10
Potassium	<100	<100	<100
Selenium	<0.50	<0.50	<0.50
Silver	<0.050	<0.050	<0.050
Sodium	<100	<100	<100
Strontium	<0.10	<0.10	<0.10
Thallium	<0.050	<0.050	<0.050
Tin	<0.10	<0.10	<0.10
Titanium	<1.0	<1.0	<1.0
Uranium	<0.050	<0.050	<0.050
Vanadium	<2.0	<2.0	<2.0
Zinc	<1.0	<1.0	<1.0
Zirconium	<0.50	<0.50	<0.50

Table 5. Lab blanks for sediment PAHs.

PAH (mg/kg)	MR-7b	M20-06
Naphthalene	<0.0010	<0.0010
2-Methylnaphthalene	<0.0010	<0.0010
Acenaphthylene	<0.00050	<0.00050
Acenaphthene	<0.00050	<0.00050
Fluorene	<0.0010	<0.0010
Phenanthrene	<0.0010	<0.0010
Anthracene	<0.0010	<0.0010
Fluoranthene	<0.0010	0.0012
Pyrene	<0.0010	<0.0010
Benzo(a)anthracene	<0.0010	<0.0010
Chrysene	<0.0010	0.001
Benzo(b)fluoranthene	<0.0010	0.0011
Benzo(b&j)fluoranthene	<0.0010	<0.0010
Benzo(k)fluoranthene	<0.0010	<0.0010
Benzo(a)pyrene	<0.0010	<0.0010
Indeno(1,2,3-cd)pyrene	<0.0020	<0.0020
Dibenz(a,h)anthracene	<0.00050	<0.00050
Benzo(g,h,i)perylene	<0.0020	<0.0020

Table 6. Relative Percent Difference (RPD) for periphyton total metals.

Total Metals (mg/kg)	MR-REF Replicate		
	1	2	3
Aluminum	-3.0	-0.8	3.7
Antimony	-12.8	1.6	9.9
Arsenic	-1.4	0.2	1.2
Barium	-9.6	10.2	-1.5
Beryllium	-6.5	BDL	6.1
Bismuth	0.0	BDL	BDL
Boron	-25.7	12.8	8.6
Cadmium	-6.5	-44.1	35.0
Calcium	6.4	-2.2	-4.6
Chromium	1.0	-2.6	1.5
Cobalt	-17.5	1.1	13.9
Copper	-7.0	-6.3	12.1
Iron	-3.8	8.1	-4.9
Lead	-5.6	5.9	-0.6
Magnesium	9.0	-10.4	0.5
Manganese	-26.0	-5.2	24.6
Mercury	-2.3	BDL	2.2
Molybdenum	-1.8	-9.3	10.1
Nickel	-4.1	-9.5	12.3
Phosphorus	1.5	-1.6	0.0
Potassium	-25.3	19.9	0.3
Selenium	-29.9	1.5	21.8
Silver	-10.4	16.3	-8.2
Sodium	-9.0	3.7	4.8
Strontium	-15.8	11.2	2.8
Thallium	-12.1	8.3	2.7
Tin	1.7	BDL	-1.8
Titanium	-19.1	17.9	-2.2
Uranium	3.2	0.2	-3.5
Vanadium	-0.1	-3.8	3.8
Zinc	-27.5	26.2	-6.2

Table 7. Lab blanks for periphyton total metals.

Total metals (mg/kg)	MR-REF
Aluminum	<1.0
Antimony	<0.0050
Arsenic	<0.050
Barium	<0.10
Beryllium	<0.10
Bismuth	<0.10
Boro	<2.0
Cadmium	<0.010
Calcium	<10
Chromium	<0.20
Cobalt	<0.020
Copper	<0.050
Iron	<10
Lead	<0.010
Magnesium	<10
Manganese	<0.10
Mercury	<0.010
Molybdenum	<0.050
Nickel	<0.050
Phosphorus	<10
Potassium	<10
Selenium	<0.050
Silver	<0.020
Sodium	<10
Strontium	<0.10
Thallium	<0.0020
Tin	<0.10
Titanium	<1.0
Uranium	<0.0020
Vanadium	<0.20
Zinc	<0.20

Table 8. Lab blanks for periphyton chlorophyll *a*.

Site	Chlorophyll a (µg/cm^2)
MR-9	<0.030
MR20-06	<0.030

Table 9. Relative percent difference (RPD) and lab blanks for benthic tissue samples.

Total metals (mg/kg)	RPD	Lab blank
Aluminum	63.4*	<0.20
Antimony	30.4	<0.0010
Arsenic	77.6*	<0.010
Barium	60.7 *	<0.020
Beryllium	NC	<0.020
Bismuth	NC	<0.020
Boro	NC	<0.40
Cadmium	40.3*	<0.0020
Calcium	34.7	<2.0
Chromium	68.8*	<0.040
Cobalt	35.9*	<0.0040
Copper	31.9	<0.010
Iron	85.9*	<2.0
Lead	55.8*	0.0025
Magnesium	33.7	<2.0
Manganese	1.9	<0.020
Mercury	NC	<0.0020
Molybdenum	27.6	<0.010
Nickel	57.0*	<0.010
Phosphorus	13.2	<2.0
Potassium	31.3	<2.0
Selenium	11.1	<0.010
Silver	NC	<0.0040
Sodium	1.2	<2.0
Strontium	33.9	<0.020
Thallium	55.8*	<0.00040
Tin	NC	<0.020
Titanium	10.8	<0.20
Uranium	64.2*	0.00041
Vanadium	54.6*	<0.040
Zinc	40.3*	<0.040

NC = not sufficient analyte detected for reliable calculation

***Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.**

APPENDIX B. RAW LAB DATA: STREAM SEDIMENT

Table 1. Stream sediment moisture content.

PHYSICAL TESTING (SEDIMENT)																		
Maxxam ID		HK5561	HK5562	HK5563	HK5564	HK5565	HK5566	HK5567	HK5568	HK5569	HK5570	HK5590	HK5591	HK5592	HK5593	HK5594	HK5595	HK5596
Sampling Date		30/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	28/08/2013	29/08/2013	27/08/2013	27/08/2013
COC Number		40773707	40773707	40773707	40773707	40773707	40773707	40773707	40773707	40773707	40773707	40773708	40773708	40773708	40773708	40773708	40773708	40773708
	UNITS	**MR-REF**	**MR-3**	**MR-4A**	**MR-4B**	**MR-6**	**MR-7B-1**	**MR-7B-2**	**MR-7B-A**	**MR-7B-B**	**MR-7B-C**	**MR-7B-D**	**MR-9**	**M17-02**	**M19-01**	**M19-02**	**M20-04**	**M20-06**
Physical Properties																		
Moisture	%	30	35	24	23	35	39	36	38	28	38	38	31	37	28	41	26	28

Table 2. Stream sediment physical properties.

RESULTS OF CHEMICAL ANALYSES OF SEDIMENT (1 of 2)

Maxxam ID		HK6247	HK6248	HK6249	HK6305	HK6306	HK6307	HK6308	HK6309	HK6310	HK6311	HK6312	HK6313	HK6314	HK6318	HK6319	HK6320	HK6321	HK6322	HK6323	HK6324	HK6324	HK6325
Sampling Date		27/08/2013	27/08/2013	27/08/2013	30/08/2013	30/08/2013	30/08/2013	30/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	29/08/2013	29/08/2013	29/08/2013
COC Number		40773713	40773713	40773713	40773709	40773709	40773709	40773709	40773709	40773709	40773709	40773709	40773709	40773709	40773710	40773710	40773710	40773710	40773710	40773710	40773710	40773710	40773710
	UNITS	**M20-06-1**	**M20-06-2**	**M20-06-3**	**MR-REF-1**	**MR-REF-2**	**MR-REF-3**	**MR-REF-4**	**MR-3-1**	**MR-3-2**	**MR-3-3**	**MR-3-4**	**MR-4-1**	**MR-4-2**	**MR-4-3**	**MR-4-4**	**MR-6-1**	**MR-6-2**	**MR-6-3**	**MR-6-4**	**MR-7B-1**	**MR-7B-1**	**MR-7B-2**
Parameter																							
Physical Properties																							
Soluble (2:1) pH	pH Units	6.15	6.08	5.07	8.33	8.35	8.24	8.27	8.31 (1)	8.18	8.33	8.18	8.47 (2)	6.18	8.43	6.35 (1)	8.29 (2)	6.55 (1)	8.35	8.27 (2)	8.31	8.31	8.17
% sand by hydrometer	%	72	59	53	32	27	14	44	76	52	33	38	82	51	51	52	43	45	52	45	54	54	45
% silt by hydrometer	%	22	31	37	51	61	66	40	15	35	48	47	12	39	37	35	41	43	31	40	35	35	43
Clay Content	%	5.5	8.8	10	17	12	20	16	9.3	14	19	15	5.3	11	13	13	15	12	17	16	11	11	13
Gravel	%	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Physical Properties																							
Texture	N/A	SANDY LOAM	SANDY LOAM	LOAM	SILT LOAM	SILT LOAM	SILT LOAM	LOAM	SANDY LOAM	LOAM	LOAM	LOAM	LOAMY SAND	LOAM	LOAM	LOAM	LOAM	LOAM	LOAM	LOAM	SANDY LOAM	SANDY LOAM	LOAM

RESULTS OF CHEMICAL ANALYSES OF SEDIMENT (2 of 2)

Maxxam ID		HK6326	HK6327	HK6350	HK6351	HK6352	HK6353	HK6354	HK6355	HK6356	HK6357	HK6358	HK6359	HK6383	HK6384	HK6385	HK6386	HK6387	HK6388	HK6389	HK6390	HK6391
Sampling Date		29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	27/08/2013	27/08/2013
COC Number		40773710	40773710	40773711	40773711	40773711	40773711	40773711	40773711	40773711	40773711	40773711	40773711	40773712	40773712	40773712	40773712	40773712	40773712	40773712	40773712	40773712
	UNITS	**MR-7B-3**	**MR-7B-4**	**MR-9-1**	**MR-9-2**	**MR-9-3**	**MR-9-4**	**M19-01-1**	**M19-01-2**	**M19-01-3**	**M19-01-4**	**M19-02-1**	**M19-02-2**	**M19-02-3**	**M19-02-4**	**M20-04-1**	**M17-02-1**	**M17-02-2**	**M17-02-3**	**M17-02-4**	**M20-04-2**	**M20-04-3**
Parameter																						
Physical Properties																						
Soluble (2:1) pH	pH Units	8.14	8.12	6.43	8.21 (1)	8.33	8.30	8.10 (2)	8.09	8.18	7.69 (2)	8.31	8.17	8.28	8.38	8.18	8.37	8.39	8.49	8.41	8.33	8.38
% sand by hydrometer	%	15	56	46	43	48	36	41	66	71	49	48	44	47	41	44	52	54	45	49	39	29
% silt by hydrometer	%	74	34	29	26	31	37	35	26	20	34	35	38	34	40	35	30	28	33	32	50	55
Clay Content	%	11	9.7	25	31	21	28	24	7.5	7.8	17	17	19	19	19	12	16	16	22	19	9.6	15
Gravel	%	<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	8.8	2.1	<2.0	<2.0	<2.0	<2.0	<2.0
Physical Properties																						
Texture	N/A	SILT LOAM	SANDY LOAM	LOAM	CLAY LOAM	LOAM	LOAM	LOAM	SANDY LOAM	SANDY LOAM	LOAM	LOAM	LOAM	LOAM	LOAM	LOAM	LOAM	SANDY LOAM	LOAM	LOAM	SILT LOAM	SILT LOAM

RDL = Reportable Detection Limit
EDL = Estimated Detection Limit
(1) Due to insufficient sample water:soil extration ratio has changed from 2:1 to 10:1 in order to analyse sample.
(2) Due to insufficient sample water:soil extration ratio has changed from 2:1 to 5:1 in order to analyse sample.

Table 3. Stream sediment total metals concentration.

ELEMENTS BY ATOMIC SPECTROSCOPY (SEDIMENT) (1 of 2)

Maxxam ID		HK6247	HK6248	HK6249	HK6305	HK6306	HK6307	HK6308	HK6309	HK6310	HK6311	HK6312	HK6313	HK6314	HK6318	HK6319	HK6320	HK6321	HK6322	HK6323	HK6324	HK6325
Sampling Date		27/08/2013	27/08/2013	27/08/2013	30/08/2013	30/08/2013	30/08/2013	30/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	29/08/2013	29/08/2013
COC Number		40773713	40773713	40773713	40773709	40773709	40773709	40773709	40773709	40773709	40773709	40773709	40773709	40773709	40773710	40773710	40773710	40773710	40773710	40773710	40773710	40773710
	UNITS	**M20-06-1**	**M20-06-2**	**M20-06-3**	**MR-REF-1**	**MR-REF-2**	**MR-REF-3**	**MR-REF-4**	**MR-3-1**	**MR-3-2**	**MR-3-3**	**MR-3-4**	**MR-4-1**	**MR-4-2**	**MR-4-3**	**MR-4-4**	**MR-6-1**	**MR-6-2**	**MR-6-3**	**MR-6-4**	**MR-7B-1**	**MR-7B-2**
Total Metals by ICPMS																						
Total Aluminum (Al)	mg/kg	5600	5250	5180	6330	8150	8120	7870	7360	8710	7660	8720	5840	7440	7600	5970	7420	6260	8970	7160	6680	6000
Total Antimony (Sb)	mg/kg	0.53	0.51	0.50	0.52	0.62	0.67	0.65	0.49	0.58	0.57	0.60	0.47	0.56	0.47	0.40	0.53	0.49	0.62	0.50	0.46	0.42
Total Arsenic (As)	mg/kg	5.60	5.07	4.99	6.07	7.65	8.47	7.29	5.06	6.02	5.66	5.93	4.54	4.64	4.67	3.88	4.65	4.19	5.46	4.55	4.28	3.40
Total Barium (Ba)	mg/kg	576	547	514	141	185	205	176	151	184	144	155	222	214	209	180	141	140	171	150	148	133
Total Beryllium (Be)	mg/kg	<0.40	<0.40	<0.40	0.52	0.67	0.58	0.58	0.59	0.55	0.51	0.50	0.41	0.48	<0.40	0.42	0.49	0.45	0.57	0.53	0.54	<0.40
Total Bismuth (Bi)	mg/kg	<0.10	<0.10	<0.10	0.12	0.14	0.17	0.14	0.11	0.14	0.13	0.14	0.11	0.11	0.12	<0.10	0.10	<0.10	0.13	0.11	<0.10	<0.10
Total Cadmium (Cd)	mg/kg	0.716	0.655	0.667	0.792	0.721	0.751	0.866	1.04	0.891	0.734	0.758	0.780	0.897	0.791	0.696	0.830	0.741	0.871	0.780	0.768	0.748
Total Calcium (Ca)	mg/kg	37400	38000	40400	48400	44400	35900	47100	55900	50300	48700	45300	47100	49900	45700	46800	49400	47500	50300	51100	51400	51300
Total Chromium (Cr)	mg/kg	11.8	9.7	10.3	11.2	13.7	13.2	13.3	15.3	14.3	13.3	14.2	16.0	13.2	12.5	11.0	13.9	12.3	14.6	13.3	11.4	11.6
Total Cobalt (Co)	mg/kg	6.70	6.23	6.28	6.17	7.01	7.61	6.74	5.94	7.43	7.13	7.35	6.12	6.74	6.41	5.31	6.63	5.80	7.68	6.56	5.68	5.34
Total Copper (Cu)	mg/kg	14.4	13.2	13.1	15.5	19.1	21.8	19.3	15.7	18.5	16.0	18.4	13.6	15.8	14.9	12.0	13.8	13.1	17.1	13.6	13.2	11.7
Total Iron (Fe)	mg/kg	16200	15300	15100	18900	20900	22500	20200	15600	19100	20200	19300	15500	17000	15900	13800	17100	14300	18100	16600	14400	14400
Total Lead (Pb)	mg/kg	9.48	8.66	8.49	10.1	12.4	13.8	12.1	9.10	11.0	10.6	11.3	8.19	9.63	9.20	7.64	8.79	7.80	10.5	8.50	8.04	7.40
Total Lithium (Li)	mg/kg	7.6	7.3	7.3	9.1	10.7	10.6	10.0	11.1	13.8	12.8	14.2	8.3	11.4	11.7	8.9	12.2	9.6	13.9	11.1	10.1	9.3
Total Magnesium (Mg)	mg/kg	12100	12400	13200	19400	17400	14000	18000	19900	17300	17300	15700	17100	17700	16300	17100	19000	17500	18200	19200	19400	19600
Total Manganese (Mn)	mg/kg	270	255	254	232	247	260	259	274	406	350	363	365	302	285	226	343	307	358	374	278	244
Total Mercury (Hg)	mg/kg	0.065	0.058	0.052	0.067	0.094	0.099	0.088	0.065	0.070	<0.050	0.062	<0.050	0.057	0.059	0.053	0.053	<0.050	0.071	0.050	0.052	<0.050
Total Molybdenum (Mo)	mg/kg	1.08	0.99	1.02	2.05	2.57	2.85	2.59	1.49	1.92	1.70	1.96	1.43	1.46	1.38	1.15	1.28	1.27	1.56	1.30	1.38	1.20
Total Nickel (Ni)	mg/kg	21.2	19.2	19.1	22.0	28.5	31.2	27.9	25.4	27.0	23.7	26.7	23.0	23.6	22.3	19.2	21.5	20.5	26.5	21.0	20.8	18.5
Total Phosphorus (P)	mg/kg	824	806	805	1240	1390	1480	1330	1170	1130	1160	1120	1060	1050	993	960	1020	940	1080	1060	1060	1040
Total Potassium (K)	mg/kg	1040	933	902	1250	1750	1880	1620	1200	1410	1350	1520	1070	1220	1180	1010	1140	995	1280	1150	1030	1010
Total Selenium (Se)	mg/kg	0.67	0.56	0.54	0.93	1.07	1.09	0.91	0.60	0.79	0.76	0.71	0.63	0.68	0.56	<0.50	0.71	0.51	0.65	0.72	<0.50	0.61
Total Silver (Ag)	mg/kg	0.210	0.217	0.210	0.209	0.274	0.301	0.265	0.182	0.215	0.202	0.224	0.162	0.205	0.179	0.124	0.187	0.161	0.226	0.155	0.148	0.163
Total Sodium (Na)	mg/kg	<100	<100	<100	<100	<100	102	<100	<100	<100	<100	<100	<100	102	<100	<100	<100	<100	<100	<100	<100	<100
Total Strontium (Sr)	mg/kg	61.2	59.8	59.6	61.2	69.3	69.3	69.9	66.0	72.0	68.0	70.3	56.7	62.9	61.2	56.5	56.3	53.5	62.6	58.1	62.4	56.3
Total Thallium (Tl)	mg/kg	0.147	0.119	0.131	0.190	0.231	0.223	0.235	0.229	0.210	0.187	0.236	0.156	0.203	0.189	0.169	0.200	0.179	0.240	0.183	0.184	0.193
Total Tin (Sn)	mg/kg	0.20	0.19	0.18	0.24	0.28	0.33	0.31	0.34	0.26	0.24	0.26	0.57	0.23	0.20	0.19	0.22	0.19	0.25	0.22	0.51	0.19
Total Titanium (Ti)	mg/kg	32.8	32.6	36.9	19.3	18.7	13.3	16.2	20.1	28.1	25.8	27.4	13.1	31.2	28.6	25.0	27.1	23.2	27.1	28.7	24.4	21.5
Total Uranium (U)	mg/kg	0.772	0.776	0.738	0.994	1.19	1.23	1.16	1.01	0.991	0.895	0.974	0.878	0.933	0.895	0.832	0.800	0.776	0.944	0.825	0.901	0.801
Total Vanadium (V)	mg/kg	21.6	19.9	20.1	28.0	34.4	33.5	34.3	31.3	33.1	29.0	33.0	24.4	30.6	29.9	25.9	29.8	26.9	35.4	28.8	28.5	26.3
Total Zinc (Zn)	mg/kg	70.8	66.5	67.9	96.7	104	115	102	80.0	93.5	99.8	95.2	82.6	80.0	80.6	65.7	87.3	67.3	90.2	86.6	72.3	75.7
Total Zirconium (Zr)	mg/kg	1.34	1.36	1.31	1.08	1.30	1.07	1.02	1.12	1.28	1.25	1.22	1.06	1.26	1.04	1.08	1.05	1.04	1.17	1.06	1.04	1.01

ELEMENTS BY ATOMIC SPECTROSCOPY (SEDIMENT) (2 of 2)

Maxxam ID		HK6326	HK6327	HK6350	HK6351	HK6352	HK6353	HK6354	HK6355	HK6356	HK6357	HK6358	HK6359	HK6383	HK6384	HK6385	HK6386	HK6387	HK6388	HK6389	HK6390	HK6391
Sampling Date		29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	27/08/2013	27/08/2013
COC Number		40773710	40773710	40773711	40773711	40773711	40773711	40773711	40773711	40773711	40773711	40773711	40773711	40773712	40773712	40773712	40773712	40773712	40773712	40773712	40773712	40773712
	UNITS	**MR-7B-3**	**MR-7B-4**	**MR-9-1**	**MR-9-2**	**MR-9-3**	**MR-9-4**	**M19-01-1**	**M19-01-2**	**M19-01-3**	**M19-01-4**	**M19-02-1**	**M19-02-2**	**M19-02-3**	**M19-02-4**	**M20-04-1**	**M17-02-1**	**M17-02-2**	**M17-02-3**	**M17-02-4**	**M20-04-2**	**M20-04-3**
Total Metals by ICPMS																						
Total Aluminum (Al)	mg/kg	6060	7670	9780	11200	8880	10600	6240	6460	5850	6790	6220	5990	6120	5800	5660	7500	8350	7560	7320	5360	5580
Total Antimony (Sb)	mg/kg	0.47	0.48	0.56	0.56	0.53	0.58	0.30	0.31	0.37	0.34	0.40	0.40	0.38	0.38	0.49	0.52	0.54	0.46	0.48	0.47	0.52
Total Arsenic (As)	mg/kg	3.81	4.63	5.70	6.08	5.09	5.63	3.48	3.60	3.95	3.38	3.75	3.71	3.78	3.66	4.50	3.97	4.98	4.02	4.15	4.17	4.49
Total Barium (Ba)	mg/kg	128	156	167	173	156	161	196	203	196	212	214	210	206	211	493	331	309	328	267	446	454
Total Beryllium (Be)	mg/kg	<0.40	0.55	0.49	<0.40	0.54	0.50	<0.40	<0.40	<0.40	0.42	0.48	<0.40	<0.40	<0.40	<0.40	0.43	0.45	0.58	<0.40	<0.40	<0.40
Total Bismuth (Bi)	mg/kg	0.10	0.11	0.14	0.16	0.13	0.16	<0.10	<0.10	<0.10	<0.10	0.11	0.10	0.10	<0.10	<0.10	0.12	0.13	0.11	0.11	<0.10	<0.10
Total Cadmium (Cd)	mg/kg	0.732	0.877	0.785	0.674	0.818	0.684	0.499	0.465	0.545	0.476	0.544	0.498	0.485	0.511	0.687	0.756	0.739	0.690	0.638	0.662	0.672
Total Calcium (Ca)	mg/kg	51100	52300	54900	63100	59000	67300	11300	22900	22600	9830	22900	21600	21900	22300	41200	33400	31700	31100	30000	40700	42300
Total Chromium (Cr)	mg/kg	11.2	13.2	16.3	18.0	15.5	16.3	11.1	11.8	11.6	11.2	11.0	10.8	10.7	10.4	10.3	14.0	15.1	13.9	12.4	10.6	10.3
Total Cobalt (Co)	mg/kg	5.70	6.63	8.43	9.57	7.72	8.95	5.41	5.51	5.88	5.37	5.84	5.72	5.69	5.52	6.21	7.77	8.19	7.32	7.17	5.79	6.14
Total Copper (Cu)	mg/kg	12.5	14.9	19.8	21.3	17.6	19.3	9.74	10.2	10.4	10.4	10.5	10.5	10.4	10.2	13.2	15.6	17.3	15.3	14.6	12.7	13.1
Total Iron (Fe)	mg/kg	15300	17400	21100	23600	19500	22500	15200	14100	14700	16400	15400	15200	15200	14800	15100	16300	18600	16400	16100	14100	14700
Total Lead (Pb)	mg/kg	7.85	9.02	11.6	13.0	10.8	11.8	7.52	7.18	7.75	7.68	7.76	7.61	7.68	7.32	8.56	9.02	10.4	8.94	8.76	7.77	8.36
Total Lithium (Li)	mg/kg	9.7	11.8	15.3	18.0	13.7	17.0	8.2	8.5	8.1	8.6	8.6	8.6	8.7	7.8	7.3	11.0	12.7	11.7	11.2	7.5	7.8
Total Magnesium (Mg)	mg/kg	19100	18500	18400	19800	19900	22300	4640	9010	8970	4440	10000	9500	9900	9570	13600	11400	11200	10900	10900	13400	13400
Total Manganese (Mn)	mg/kg	263	317	339	420	329	403	141	266	271	169	268	276	256	269	243	248	321	237	263	232	248
Total Mercury (Hg)	mg/kg	<0.050	0.051	0.055	<0.050	0.052	<0.050	0.053	0.055	<0.050	0.055	0.058	0.051	<0.050	<0.050	0.057	0.059	0.069	0.058	0.059	0.061	0.057
Total Molybdenum (Mo)	mg/kg	1.23	1.41	1.55	1.50	1.56	1.40	0.56	0.69	0.78	0.59	0.69	0.69	0.69	0.72	1.09	0.90	1.09	0.87	0.84	1.09	1.02
Total Nickel (Ni)	mg/kg	19.4	23.0	27.4	28.5	25.3	25.9	17.3	17.9	19.2	17.2	17.0	17.2	17.2	16.1	19.9	25.8	27.6	24.2	22.5	18.5	19.6
Total Phosphorus (P)	mg/kg	1050	1050	956	919	1020	931	849	809	834	847	891	862	847	862	819	790	786	758	738	759	771
Total Potassium (K)	mg/kg	931	1190	1510	1600	1360	1500	746	815	736	780	955	887	892	894	970	1140	1250	1170	1100	918	934
Total Selenium (Se)	mg/kg	0.64	0.58	0.58	0.54	0.66	0.52	0.64	<0.50	<0.50	0.57	0.57	0.57	0.57	0.62	0.58	0.73	0.80	0.75	0.65	<0.50	0.52
Total Silver (Ag)	mg/kg	0.138	0.174	0.175	0.154	0.161	0.143	0.175	0.165	0.149	0.186	0.174	0.183	0.180	0.140	0.182	0.156	0.200	0.176	0.148	0.184	0.179
Total Sodium (Na)	mg/kg	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Total Strontium (Sr)	mg/kg	55.9	61.9	71.2	82.8	73.5	82.4	21.1	30.0	29.5	18.9	30.2	29.5	28.9	29.9	60.7	48.3	47.9	45.4	42.4	58.5	60.0
Total Thallium (Tl)	mg/kg	0.185	0.209	0.204	0.192	0.208	0.193	0.110	0.113	0.115	0.110	0.128	0.113	0.126	0.109	0.123	0.169	0.196	0.174	0.173	0.109	0.124
Total Tin (Sn)	mg/kg	0.21	0.22	0.26	0.26	0.23	0.25	0.21	0.19	0.20	0.23	0.20	0.23	0.20	0.18	0.18	0.24	0.25	0.22	0.23	0.18	0.18
Total Titanium (Ti)	mg/kg	24.9	29.0	41.9	65.8	44.1	65.5	14.7	21.0	19.2	18.7	29.7	22.8	21.0	22.8	40.5	59.1	62.7	60.5	57.1	41.9	40.4
Total Uranium (U)	mg/kg	0.793	0.888	0.941	0.986	0.986	0.968	0.585	0.643	0.643	0.635	0.588	0.572	0.579	0.606	0.752	0.728	0.737	0.693	0.660	0.691	0.733
Total Vanadium (V)	mg/kg	25.2	31.4	32.5	32.5	31.1	31.8	19.9	22.0	20.8	22.3	22.0	19.7	20.5	19.4	21.8	25.1	27.6	25.9	24.8	21.3	21.0
Total Zinc (Zn)	mg/kg	79.0	78.7	81.9	79.6	79.5	79.6	67.1	56.7	57.8	66.3	82.6	82.1	79.3	80.5	70.1	81.5	88.2	79.2	76.3	63.3	67.5
Total Zirconium (Zr)	mg/kg	1.12	1.23	1.66	2.33	1.48	2.09	1.03	0.97	0.94	1.07	1.11	0.86	0.90	1.19	1.46	1.57	1.64	1.52	1.38	1.47	1.57

RDL = Reportable Detection Limit
EDL = Estimated Detection Limit

Table 4. Stream sediment PAH concentration.

SEMIVOLATILE ORGANICS BY GC-MS (SEDIMENT)														
Maxxam ID		HK5561	HK5563	HK5565	HK5567	HK5568	HK5569	HK5570	HK5590	HK5591	HK5593	HK5594	HK5595	HK5596
Sampling Date		30/08/2013	28/08/2013	28/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	28/08/2013	29/08/2013	27/08/2013	27/08/2013
COC Number		40773707	40773707	40773707	40773707	40773707	40773707	40773707	40773708	40773708	40773708	40773708	40773708	40773708
	UNITS	**MR-REF**	**MR-4A**	**MR-6**	**MR-7B-2**	**MR-7B-A**	**MR-7B-B**	**MR-7B-C**	**MR-7B-D**	**MR-9**	**M19-01**	**M19-02**	**M20-04**	**M20-06**
Calculated Parameters														
Index of Additive Cancer Risk(IARC)	N/A	0.22	0.14	0.23	0.26	0.25	0.22	0.21	0.21	0.26	<0.10	0.26	0.22	0.25
Benzo[a]pyrene equivalency	N/A	<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
Polycyclic Aromatics														
Naphthalene	mg/kg	0.019 (1)	0.0077	0.022 (1)	0.031 (1)	0.027 (1)	0.028 (1)	0.027 (1)	0.026 (1)	0.029 (1)	0.0060	0.077 (1)	0.026 (1)	0.051 (1)
2-Methylnaphthalene	mg/kg	0.029 (1)	0.024	0.042 (1)	0.057 (1)	0.050 (1)	0.051 (1)	0.047 (1)	0.047 (1)	0.047 (1)	0.012	0.23 (1)	0.093 (1)	0.16 (1)
Acenaphthylene	mg/kg	<0.0050 (1)	<0.00050	<0.0050 (1)	<0.0050 (1)	<0.0050 (1)	<0.0050 (1)	<0.0050 (1)	<0.0050 (1)	<0.0050 (1)	<0.00050	<0.0050 (1)	<0.0050 (1)	<0.0050 (1)
Acenaphthene	mg/kg	<0.0050 (1)	0.00066	<0.0050 (1)	<0.0050 (1)	<0.0050 (1)	<0.0050 (1)	<0.0050 (1)	<0.0050 (1)	<0.0050 (1)	<0.00050	<0.0090 (2)	<0.0050 (1)	<0.0070 (2)
Fluorene	mg/kg	<0.010 (1)	0.0032	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	0.0014	0.020 (1)	0.012 (1)	0.018 (1)
Phenanthrene	mg/kg	0.057 (1)	0.043	0.058 (1)	0.075 (1)	0.073 (1)	0.068 (1)	0.064 (1)	0.064 (1)	0.069 (1)	0.017	0.13 (1)	0.095 (1)	0.13 (1)
Anthracene	mg/kg	<0.010 (1)	<0.0010	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.0010	<0.010 (1)	<0.010 (1)	<0.010 (1)
Fluoranthene	mg/kg	<0.010 (1)	0.0046	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	0.0019	0.011 (1)	<0.010 (1)	0.011 (1)
Pyrene	mg/kg	<0.010 (1)	0.0062	<0.010 (1)	0.011 (1)	0.011 (1)	0.010 (1)	0.012 (1)	0.013 (1)	0.013 (1)	0.0051	0.022 (1)	0.014 (1)	0.020 (1)
Benzo(a)anthracene	mg/kg	<0.010 (1)	0.0013	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	0.0011	<0.010 (1)	<0.010 (1)	<0.010 (1)
Chrysene	mg/kg	0.038 (1)	0.036	0.043 (1)	0.047 (1)	0.046 (1)	0.042 (1)	0.041 (1)	0.042 (1)	0.047 (1)	0.014	0.056 (1)	0.058 (1)	0.069 (1)
Benzo(b)fluoranthene	mg/kg	0.021 (1)	0.017	0.021 (1)	0.024 (1)	0.023 (1)	0.021 (1)	0.018 (1)	0.019 (1)	0.026 (1)	0.0068	0.025 (1)	0.018 (1)	0.023 (1)
Benzo(b&j)fluoranthene	mg/kg	0.021 (1)	0.017	0.021 (1)	0.025 (1)	0.024 (1)	0.021 (1)	0.018 (1)	0.019 (1)	0.026 (1)	0.0068	0.025 (1)	0.018 (1)	0.023 (1)
Benzo(k)fluoranthene	mg/kg	<0.010 (1)	<0.0010	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.0010 (2)	<0.010 (1)	<0.010 (1)	<0.010 (1)
Benzo(a)pyrene	mg/kg	<0.010 (1)	<0.0010	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.010 (1)	<0.0010	<0.010 (1)	<0.010 (1)	<0.010 (1)
Indeno(1,2,3-cd)pyrene	mg/kg	<0.020 (1)	<0.0020	<0.020 (1)	<0.020 (1)	<0.020 (1)	<0.020 (1)	<0.020 (1)	<0.020 (1)	<0.020 (1)	<0.0020	<0.020 (1)	<0.020 (1)	<0.020 (1)
Dibenz(a,h)anthracene	mg/kg	<0.0050 (1)	0.0013	<0.0050 (1)	<0.0050 (1)	<0.0050 (1)	<0.0050 (1)	<0.0050 (1)	<0.0050 (1)	<0.0050 (1)	<0.00050	<0.0050 (1)	<0.0050 (1)	<0.0050 (1)
Benzo(g,h,i)perylene	mg/kg	<0.020 (1)	0.0028	<0.020 (1)	<0.020 (1)	<0.020 (1)	<0.020 (1)	<0.020 (1)	<0.020 (1)	<0.020 (1)	0.0042	<0.020 (1)	<0.020 (1)	<0.020 (1)
Low Molecular Weight PAH`s	mg/kg	0.10	0.079	0.12	0.16	0.15	0.15	0.14	0.14	0.15	0.037	0.46	0.23	0.36
High Molecular Weight PAH`s	mg/kg	0.039	0.049	0.043	0.058	0.057	0.052	0.053	0.055	0.060	0.022	0.089	0.071	0.10
Total PAH	mg/kg	0.14	0.13	0.17	0.22	0.21	0.20	0.19	0.19	0.21	0.059	0.55	0.30	0.47
Surrogate Recovery (%)														
D10-ANTHRACENE (sur.)	%	130	84	112	109	111	109	125	127	127	79	126	119	116
D8-ACENAPHTHYLENE (sur.)	%	84	78	91	91	91	90	82	85	84	74	86	87	85
D8-NAPHTHALENE (sur.)	%	90	79	90	89	89	88	86	89	87	73	87	89	86
TERPHENYL-D14 (sur.)	%	92	87	101	100	100	99	91	94	92	79	94	94	91

RDL = Reportable Detection Limit
EDL = Estimated Detection Limit
(1) RDL raised due to sample dilution.
(2) RDL raised due to sample matrix interference.

APPENDIX C. RAW LAB DATA: PERIPHYTON

Table 1. Periphyton moisture content.

PHYSICAL TESTING (TISSUE)															
Maxxam ID		HK6118	HK6119	HK6120	HK6121	HK6122	HK6123	HK6124	HK6125	HK6126	HK6133	HK6134	HK6240	HK6241	HK6242
Sampling Date		30/08/2013	28/08/2013	28/08/2013	28/08/2013	29/08/2013	29/08/2013	29/08/2013	28/08/2013	29/08/2013	27/08/2013	27/08/2013			
COC Number		40773703	40773703	40773703	40773703	40773703	40773703	40773703	40773703	40773703	40773704	40773704	40773703	40773703	40773703
	UNITS	**MR-REF**	**MR-3**	**MR-4**	**MR-6**	**MR-7B**	**MR-9**	**M17-02**	**M19-01**	**M19-02**	**M20-04**	**M20-06**	**MR-REF-REP1**	**MR-REF-REP2**	**MR-REF-REP3**
Physical Properties															
Moisture	%	100	100	99	100	99	99	100	100	100	100	100	99	99	99

RDL = Reportable Detection Limit
EDL = Estimated Detection Limit

Table 2. Periphyton chlorophyll *a* concentration.

RESULTS OF CHEMICAL ANALYSES OF WATER (1 of 4)																		
Maxxam ID		HK5816	HK5817	HK5818	HK5819	HK5820	HK5821	HK5822	HK5823	HK5824	HK5825	HK5826	HK5827	HK5828	HK5829	HK5830	HK5831	HK5832
Sampling Date		30/08/2013	30/08/2013	30/08/2013	30/08/2013	30/08/2013	30/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013
COC Number		40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705
	UNITS	**MR-REF/1**	**MR-REF/2**	**MR-REF/3**	**MR-REF/4**	**MR-REF/5**	**MR-REF/6**	**MR-3/1**	**MR-3/2**	**MR-3/3**	**MR-3/4**	**MR-3/5**	**MR-3/6**	**MR-4/1**	**MR-4/2**	**MR-4/3**	**MR-4/4**	**MR-4/5**
Parameter																		
Chlorophyll a	ug/cm2	0.543	0.491	0.94	0.668	0.99	1.12	0.261	0.209	0.162	0.88	0.324	1.03	1.02	0.431	1.23	0.489	0.259

RESULTS OF CHEMICAL ANALYSES OF WATER (2 of 4)																		
Maxxam ID		HK5833	HK5834	HK5835	HK5836	HK5837	HK5838	HK5839	HK5840	HK5841	HK5842	HK5843	HK5844	HK5845	HK5846	HK5847	HK5848	HK5849
Sampling Date		28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013
COC Number		40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705
	UNITS	**MR-4/6**	**MR-6/1**	**MR-6/2**	**MR-6/3**	**MR-6/4**	**MR-6/5**	**MR-6/6**	**MR-7B/1**	**MR-7B/2**	**MR-7B/3**	**MR-7B/4**	**MR-7B/5**	**MR-7B/6**	**MR-9/1**	**MR-9/2**	**MR-9/3**	**MR-9/4**
Parameter																		
Chlorophyll a	ug/cm2	0.382	0.283	0.137	0.455	0.508	0.364	0.277	0.93	0.99	1.14	1.40	0.560	0.89	1.15	0.90	1.55	0.76

RESULTS OF CHEMICAL ANALYSES OF WATER (3 of 4)																	
Maxxam ID		HK5850	HK5851	HK5852	HK5853	HK5854	HK5855	HK5856	HK5857	HK5858	HK5859	HK5860	HK5861	HK5862	HK5863	HK5864	HK5865
Sampling Date		29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	29/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	28/08/2013	29/08/2013	29/08/2013
COC Number		40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705	40773705
	UNITS	**MR-9/5**	**MR-9/6**	**M17-02/1**	**M17-02/2**	**M17-02/3**	**M17-02/4**	**M17-02/5**	**M17-02/6**	**M19-01/1**	**M19-01/2**	**M19-01/3**	**M19-01/4**	**M19-01/5**	**M19-01/6**	**M19-02/1**	**M19-02/2**
Parameter																	
Chlorophyll a	ug/cm2	0.632	0.741	1.11	1.70	1.30	1.44	2.06	1.77	0.350	0.217	0.299	0.440	0.201	0.252	1.11	0.412

RESULTS OF CHEMICAL ANALYSES OF WATER (4 of 4)																	
Maxxam ID		HK5866	HK5867	HK5868	HK5869	HK5875	HK5876	HK5877	HK5878	HK5879	HK5880	HK5881	HK5882	HK5883	HK5884	HK5885	HK5886
Sampling Date		29/08/2013	29/08/2013	29/08/2013	29/08/2013	27/08/2013	27/08/2013	27/08/2013	27/08/2013	27/08/2013	27/08/2013	27/08/2013	27/08/2013	27/08/2013	27/08/2013	27/08/2013	27/08/2013
COC Number		40773705	40773705	40773705	40773705	40773706	40773706	40773706	40773706	40773706	40773706	40773706	40773706	40773706	40773706	40773706	40773706
	UNITS	**M19-02/3**	**M19-02/4**	**M19-02/5**	**M19-02/6**	**M20-04/1**	**M20-04/2**	**M20-04/3**	**M20-04/4**	**M20-04/5**	**M20-04/6**	**M20-06/1**	**M20-06/2**	**M20-06/3**	**M20-06/4**	**M20-06/5**	**M20-06/6**
Parameter																	
Chlorophyll a	ug/cm2	0.618	0.340	0.670	0.386	0.244	1.05	0.082	0.127	0.917	0.335	0.574	0.929	0.408	0.591	0.364	0.465

RDL = Reportable Detection Limit
EDL = Estimated Detection Limit

Table 3. Periphyton total metals concentration.

ELEMENTS BY ATOMIC SPECTROSCOPY - DRY WT (TISSUE)															
Maxxam ID		HK6118	HK6119	HK6120	HK6121	HK6122	HK6123	HK6124	HK6125	HK6126	HK6133	HK6134	HK6240	HK6241	HK6242
Sampling Date		30/08/2013	28/08/2013	28/08/2013	28/08/2013	29/08/2013	29/08/2013	29/08/2013	28/08/2013	29/08/2013	27/08/2013	27/08/2013			
COC Number		40773703	40773703	40773703	40773703	40773703	40773703	40773703	40773703	40773703	40773704	40773704	40773703	40773703	40773703
	UNITS	**MR-REF**	**MR-3**	**MR-4**	**MR-6**	**MR-7B**	**MR-9**	**M17-02**	**M19-01**	**M19-02**	**M20-04**	**M20-06**	**MR-REF-REP1**	**MR-REF-REP2**	**MR-REF-REP3**
Total Metals by ICPMS															
Total Aluminum (Al)	mg/kg	3260	5740	5490	6750	4460	5200	5740	2950	5330	6840	6520	5740	5870	6140
Total Antimony (Sb)	mg/kg	0.124	0.177	0.233	0.258	0.183	0.180	0.212	0.169	0.323	0.232	0.339	0.231	0.267	0.290
Total Arsenic (As)	mg/kg	3.43	5.22	5.33	5.47	5.13	4.32	3.64	5.00	5.23	4.72	4.97	7.06	7.17	7.24
Total Barium (Ba)	mg/kg	101	141	228	211	169	162	654	238	199	361	421	237	289	257
Total Beryllium (Be)	mg/kg	0.26	0.37	0.37	0.44	0.33	0.35	0.39	0.30	0.46	0.47	0.48	0.45	<0.70	0.51
Total Bismuth (Bi)	mg/kg	<0.10	0.10	0.11	0.13	<0.10	<0.10	0.11	<0.10	0.12	0.11	0.14	0.13	<0.70	<0.20
Total Boron (B)	mg/kg	10.5	6.2	4.7	20.7	4.9	4.7	9.6	5.6	11.1	6.7	7.0	19.7	29	27.8
Total Cadmium (Cd)	mg/kg	0.437	0.520	0.937	0.827	0.859	0.675	1.14	0.497	0.838	0.741	0.930	0.717	0.489	1.09
Total Calcium (Ca)	mg/kg	26000	50000	40800	40600	58500	55300	71900	11900	17200	30500	56600	41100	37700	36800
Total Chromium (Cr)	mg/kg	5.59	9.85	10.1	11.1	8.58	9.78	9.70	5.30	10.2	11.9	10.7	9.95	9.6	10.0
Total Cobalt (Co)	mg/kg	3.85	6.96	9.55	10.5	7.64	6.12	6.76	4.76	8.43	10.1	14.6	7.81	9.41	10.7
Total Copper (Cu)	mg/kg	7.46	10.5	13.0	14.7	9.84	11.5	13.8	9.16	17.0	23.5	23.3	14.3	14.4	17.3
Total Iron (Fe)	mg/kg	9430	16000	15700	17000	14100	13200	12000	12600	18200	18900	16300	18300	20600	18100
Total Lead (Pb)	mg/kg	5.44	7.99	8.29	8.99	6.90	7.59	8.20	5.99	10.7	7.85	10.4	9.98	11.2	10.5
Total Magnesium (Mg)	mg/kg	9380	16100	15000	10900	20200	16500	7960	3640	5710	10000	20000	15800	13000	14500
Total Manganese (Mn)	mg/kg	267	611	862	948	820	465	426	386	353	236	422	775	956	1290
Total Mercury (Hg)	mg/kg	0.036	0.043	0.091	0.041	0.034	0.035	0.050	0.050	0.080	0.048	0.065	0.043	<0.070	0.045
Total Molybdenum (Mo)	mg/kg	0.867	1.18	1.03	1.23	0.957	0.989	0.689	1.15	1.62	1.10	1.11	1.66	1.54	1.87
Total Nickel (Ni)	mg/kg	12.1	18.7	24.2	21.0	20.7	21.4	23.9	15.2	25.0	32.4	25.1	23.0	21.8	27.1
Total Phosphorus (P)	mg/kg	711	1100	1110	906	1040	1020	1030	1200	885	1110	1130	1320	1280	1300
Total Potassium (K)	mg/kg	810	1120	1010	1500	829	1040	1400	867	1160	1630	1680	2350	3700	3040
Total Selenium (Se)	mg/kg	0.526	0.597	0.869	0.986	0.621	0.725	1.42	0.952	1.34	1.90	2.20	0.773	1.06	1.30
Total Silver (Ag)	mg/kg	0.057	0.099	0.113	0.402	0.102	0.084	0.338	0.704	0.520	2.67	1.76	0.130	0.17	0.133
Total Sodium (Na)	mg/kg	48	75	69	82	66	68	111	70	80	113	116	81	92	93
Total Strontium (Sr)	mg/kg	68.9	118	98.9	179	95.7	124	104	98.2	72.0	72.3	90.4	248	325	299
Total Thallium (Tl)	mg/kg	0.146	0.176	0.202	0.200	0.168	0.189	0.196	0.112	0.163	0.180	0.220	0.239	0.293	0.277
Total Tin (Sn)	mg/kg	0.14	0.32	0.19	0.33	0.13	0.16	0.31	0.22	0.30	0.55	0.57	0.29	<0.70	0.28
Total Titanium (Ti)	mg/kg	8.2	31.3	13.4	25.5	14.6	15.6	28.2	5.4	15.3	24.1	22.8	35.9	52.0	42.5
Total Uranium (U)	mg/kg	0.540	0.872	0.810	0.697	0.794	0.819	0.814	0.774	0.519	0.692	0.702	0.953	0.925	0.892
Total Vanadium (V)	mg/kg	13.1	20.8	21.2	23.6	20.1	19.1	18.2	15.4	16.2	21.8	22.0	24.7	23.8	25.7
Total Zinc (Zn)	mg/kg	46.9	65.1	76.2	101	63.3	60.0	103	147	121	293	240	113	194	140

RDL = Reportable Detection Limit
EDL = Estimated Detection Limit

Table 4. Periphyton taxonomic identification to lowest possible level (1 of 8).

Biologica Environmental Services Ltd. Periphyton determinations by Rhithron Associates, Inc.		BIOL14P001 MR20-04 Rep 1 8/27/2013			BIOL14P002 MR20-04 Rep 2 8/27/2013			BIOL14P003 MR20-04 Rep 3 8/27/2013			BIOL14P004 MR20-06 Rep 1 8/27/2013			BIOL14P005 MR20-06 Rep 2 8/27/2013			BIOL14P006 MR20-06 Rep 3 8/27/2013			BIOL14P007 MR19-01 Rep 1 8/28/2013			BIOL14P008 MR19-01 Rep 2 8/28/2013		
Portion	Taxon	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)
Algae	Bulbochaete																								
	Calothrix																								
	Closterium																								
	Cosmarium																								
	Heteroleibleinia																								
	Phormidium																								
	Stigeoclonium													3	1012	6137				244	164677	499151	210	55323	429597
	Tolypothrix																								
	Unknown Green Filament																								
Diatoms	Achnanthidium affine																								
	Achnanthidium deflexum	4	360	136	2	202	61				1	72	44	1	167	44									
	Achnanthidium minutissimum	287	25826	4486	424	42753	11264	41	2667	889	86	6186	1484	188	31403	3988	68	41147	1233	323	20312	4270	136	7641	3374
	Achnanthidium pyrenaicum	2	180	41				1	65	20				1	167	20									
	Achnanthidium rivulare																								
	Adlafia bryophila																			1	63	21			
	Adlafia minuscula																1	605	25	15	943	333			
	Adlafia suchlandtii	9	810	110	6	605	91	2	130	30	3	216	45	3	501	43				5	314	98	1	56	14
	Amphipleura pellucida																								
	Amphora copulata																								
	Amphora inariensis																								
	Amphora pediculus													2	334	110									
	Brachysira microcephala																								
	Caloneis bacillum	6	540	788				1	65	155	74	5323	9198	32	5345	4635	32	19363	4488	2	126	311			
	Cocconeis placentula				1	101	198	2	130	232										42	2641	5965	55	3090	4522
	Cocconeis placentula v. lineata	15	1350	3928	9	908	2371	260	16912	61885	4	288	789	13	2172	2929	37	22389	10753	3	189	478	3	169	565
	Cocconeis pseudolineata							3	195	579										5	314	848			
	Cymbella affinis				2	202	446																		
	Cymbella cistula																								
	Cymbella perparva																								
	Cymbella subturgidula																								
	Cymbopleura naviculiformis																								
	Cymbopleura rupicola																								
	Denticula tenuis																								
	Diatoma moniliformis	23	2070	3138	11	1109	2359	12	781	2629	1	72	158	8	1336	1666	210	127071	40047						
	Diatoma tenuis																								
	Didymosphenia geminata																								
	Diploneis marginestriata																								
	Diploneis oculata																								
	Discostella pseudostelligera																								
	Encyonema auerswaldii																								
	Encyonema minutum										1	72	30				2	1210	69						
	Encyonema prostratum										1	72	4127												
	Encyonema reichardtii										4	288	115							20	1258	773	1	56	37
	Encyonema silesiacum	18	1620	2852	6	605	1138	7	455	1085	9	647	1769	8	1336	1378	23	13917	3083						
	Encyonopsis cesatii																								
	Encyonopsis microcephala	2	180	58																					
	Encyonopsis subminuta																			2	126	45	1	56	26
	Eucocconeis flexella																								
	Eucocconeis laevis																								
	Fragilaria capucina																								
	Fragilaria capucina v. gracilis																								
	Fragilaria sepes																								
	Fragilaria tenera																								
	Fragilaria vaucheriae																						1	56	69
	Frustulia vulgaris										1	72	388												
	Gomphonema																			4	252	910			
	Gomphonema angustatum																			53	3333	5035	141	7922	10874
	Gomphonema kobayasii	4	360	347	9	908	1219	4	260	418	10	719	1459	2	334	241	4	2420	542						
	Gomphonema micropus				6	605	1096	2	130	454	7	503	1758	12	2004	2368	8	4841	935				2	112	454
	Gomphonema minusculum																								
	Gomphonema minutum				11	1109	1883	1	65	160	4	288	639	5	835	852	8	4841	929	22	1384	1683	7	393	1118
	Gomphonema olivaceoides	35	3150	2203	38	3832	2393	31	2016	1418	38	2733	2445	23	3842	1389	19	11497	1132						
	Gomphonema olivaceum	15	1350	4850	8	807	1789	13	846	2766	11	791	3033	20	3341	4747	26	15733	8053	3	189	760	3	169	760
	Gomphonema parvulum	8	720	1036				5	325	678	5	360	711							2	126	195	1	56	136
	Gomphonema pumilum				10	1008	1048	6	390	518							1	605	92						
	Gomphonema rhombicum																								
	Gomphonema truncatum																								
	Hannaea arcus																								
	Karayevia suchlandtii																								
	Luticola goeppertiana																								
	Mayamaea atomus													2	334	21	4	2420	37	2	126	22			
	Meridion circulare v. constrictum																			3	189	249			
	Navicula aitchelbee																								
	Navicula capitatoradiata																								
	Navicula cari										3	216	284	2	334	256									
	Navicula caterva	2	180	172																					
	Navicula cryptocephala																								
	Navicula cryptotenella																			4	252	420	4	225	431
	Navicula gregaria	2	180	231							16	1151	1823				2	1210	224						
	Navicula heimansioides																								
	Navicula libonensis																								
	Navicula menisculus																								
	Navicula radiosa																			1	63	540			
	Navicula schmassmannii																								
	Navicula seibigiana	2	180	80																					

Table 5. Periphyton taxonomic identification to lowest possible level (2 of 8).

Portion	Taxon	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)
	Navicula stroemii																								
	Navicula tripunctata							1	65	1260	6	432	6823	1	167	1192	2	1210	2267	2	126	2430	3	169	3577
	Navicula veneta																								
	Neidium ampliatum																								
	Neidium binodeformis																								
	Neidium dubium																								
	Nitzschia													4	668	147				2	126	102			
	Nitzschia acicularis																								
	Nitzschia angustata																								
	Nitzschia angustatula																								
	Nitzschia archibaldii				2	202	37																		
	Nitzschia dissipata	26	2340	5303	11	1109	1262	3	195	602	112	8056	22312	31	5178	8136	38	22994	6664	1	63	201	5	281	1032
	Nitzschia fonticola																								
	Nitzschia gracilis																						2	112	270
	Nitzschia heufleriana																								
	Nitzschia linearis																								
	Nitzschia linearis v. tenuis																								
	Nitzschia palea				2	202	97																		
	Nitzschia paleacea	3	270	97							1	72	33				6	3631	234	6	377	179	1	56	34
	Nitzschia perminuta																			1	63	41			
	Nitzschia pura										4	288	293	4	668	258									
	Nitzschia radicula																								
	Nupella																								
	Pinnularia																								
	Planothidium frequentissimum	1	90	61	5	504	318	6	390	343	2	144	123	17	2840	983	8	4841	561	11	692	728	2	112	123
	Planothidium lanceolatum													2	334	147									
	Reimeria sinuata	131	11788	13968	74	7462	3631	197	12814	28174	193	13882	22054	216	36080	20668	118	71402	13804	65	4088	8108	50	2809	5501
	Reimeria uniseriata																								
	Rhoicosphenia abbreviata							2	130	710	2	144	745	3	501	1565				1	63	373	3	169	901
	Rossithidium pusillum																								
	Sellaphora pupula																								
	Staurosira construens																								
	Staurosira construens v. venter																								
	Staurosirella leptostauron																								
	Staurosirella pinnata																								
	Surirella brebissonii																								
	Surirella brebissonii v. kuetzingii	5	450	961							2	144	404				2	1210	440						
	Surirella minuta																								
	Synedra ulna																1	605	880						
	Tryblionella apiculata																								
	TOTALS	600	53992	44844	637	64231	32701	600	39027	105005	601	43228	83085	603	101236	63920	620	375162	96491	845	202472	534266	632	79033	463415

Table 6. Periphyton taxonomic identification to lowest possible level (3 of 8).

Biologica Environmental Services Ltd. Periphyton determinations by Rhithron Associates, Inc.		BIOL14P009 MR19-01 Rep 3 8/28/2013			BIOL14P010 MR3 Rep 1 8/28/2013			BIOL14P011 MR3 Rep 2 8/28/2013			BIOL14P012 MR3 Rep 3 8/28/2013			BIOL14P013 MR4 Rep 1 8/28/2013			BIOL14P014 MR4 Rep 2 8/28/2013			BIOL14P015 MR4 Rep 3 8/28/2013			BIOL14P016 MR6 Rep 1 8/28/2013		
Portion	Taxon	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)
Algae	Bulbochaete							9	5627	3601	39	15404	15606												
	Calothrix																								
	Closterium				1	1157	9296																		
	Cosmarium				1	1157	4192	6	3752	25149	6	2370	25149										3	1694	12575
	Heteroleibleinia																								
	Phormidium							11	6878	438							26	17735	1034	12	3513	477			
	Stigeoclonium	200	110110	409140	29	33552	59325	33	20634	67508	81	31993	165702	3	800	6137									
	Tolypothrix																								
	Unknown Green Filament																								
Diatoms	Achnanthidium affine																						1	279	28
	Achnanthidium deflexum				6	3112	359	2	502	88				5	660	276				2	281	95	1	279	44
	Achnanthidium minutissimum	456	41842	7539	482	###	7824	385	96693	9258	499	57157	8246	418	55183	10005	445	138617	11459	436	61259	9451	441	123232	11214
	Achnanthidium pyrenaicum				9	4668	157				6	687	87	5	660	125	4	1246	100	7	984	125			
	Achnanthidium rivulare							2	502	75															
	Adlafia bryophila																								
	Adlafia minuscula																1	311	16	1	141	32			
	Adlafia suchlandtii	4	367	59																					
	Amphipleura pellucida				3	1556	2037	6	1507	3698				3	396	1719	5	1557	2378	1	141	622	1	279	674
	Amphora copulata																1	311	812						
	Amphora inariensis													1	132	180				2	281	359			
	Amphora pediculus																								
	Brachysira microcephala				3	1556	212	3	753	203	4	458	206	1	132	51				4	562	348	1	279	70
	Caloneis bacillum													1	132	139	2	623	279	2	281	261			
	Cocconeis placentula	19	1743	1635										1	132	210									
	Cocconeis placentula v. lineata	3	275	474										3	396	833									
	Cocconeis pseudolineata																								
	Cymbella affinis	1	92	275													3	934	1014	2	281	465	8	2236	3041
	Cymbella cistula													2	264	9616				2	281	5715			
	Cymbella perparva							1	251	924															
	Cymbella subturgidula																								
	Cymbopleura naviculiformis							2	502	636															
	Cymbopleura rupicola													4	528	1058									
	Denticula tenuis							1	251	45				2	264	109							1	279	46
	Diatoma moniliformis				2	1037	202	18	4521	2164	12	1375	1143	4	528	631	1	311	158	5	703	1017	6	1677	687
	Diatoma tenuis				3	1556	160	5	1256	280	1	115	48	3	396	192				1	141	50			
	Didymosphenia geminata													1	132	17624									
	Diploneis marginestriata																								
	Diploneis oculata																								
	Discostella pseudostelligera																								
	Encyonema auerswaldii													4	528	2860									
	Encyonema minutum				2	1037	123	2	502	59	2	229	48	4	528	164	3	934	90	5	703	142			
	Encyonema prostratum													3	396	13942	1	311	4716						
	Encyonema reichardtii	3	275	119																					
	Encyonema silesiacum							3	753	210	10	1145	2018	9	1188	1288	5	1557	775	2	281	172			
	Encyonopsis cesatii																								
	Encyonopsis microcephala							4	1005	76	4	458	80				8	2492	163	3	422	60	19	5309	455
	Encyonopsis subminuta				18	9337	449	49	12306	1383	18	2062	456	14	1848	367	11	3426	273	9	1265	286	5	1397	135
	Eucocconeis flexella																								
	Eucocconeis laevis				4	2075	186	6	1507	310	2	229	58	12	1584	586	11	3426	474	23	3232	967	2	559	110
	Fragilaria capucina																								
	Fragilaria capucina v. gracilis				7	3631	616	13	3265	718	4	458	198	5	660	152				17	2389	987			
	Fragilaria sepes																								
	Fragilaria tenera																								
	Fragilaria vaucheriae							9	2260	521	12	1375	784	17	2244	1144	11	3426	496	14	1967	798	5	1397	359
	Frustulia vulgaris																								
	Gomphonema																10	3115	2274						
	Gomphonema angustatum	82	7524	6135	8	4150	715																		
	Gomphonema kobayasii							1	251	103				3	396	420	2	623	302						
	Gomphonema micropus																			4	562	884			
	Gomphonema minusculum				33	17118	3371	62	15571	6953	13	1489	1272	28	3696	3000	63	19624	6219	17	2389	1779	91	25429	10580
	Gomphonema minutum	1	92	198	4	2075	862	2	502	320				4	528	639	4	1246	609						
	Gomphonema olivaceoides				2	1037	163	5	1256	531	2	229	152	3	396	296	1	311	83	12	1686	1106	10	2794	924
	Gomphonema olivaceum	3	275	1192				2	502	388															
	Gomphonema parvulum	1	92	134																					
	Gomphonema pumilum																								
	Gomphonema rhombicum													2	264	541									
	Gomphonema truncatum																								
	Hannaea arcus													1	132	98									
	Karayevia suchlandtii													1	132	21									
	Luticola goeppertiana																								
	Mayamaea atomus																								
	Meridion circulare v. constrictum																								
	Navicula aitchelbee																								
	Navicula capitatoradiata																								
	Navicula cari																								
	Navicula caterva				1	519	81																		
	Navicula cryptocephala																			5	703	520	1	279	182
	Navicula cryptotenella				2	1037	202				2	229	208	4	528	477									
	Navicula gregaria																								
	Navicula heimansioides																						1	279	171
	Navicula libonensis																								
	Navicula menisculus																			1	141	102			
	Navicula radiosa																								
	Navicula schmassmannii																								
	Navicula seibigiana																								

Table 7. Periphyton taxonomic identification to lowest possible level (4 of 8).

Biologica Environmental Services Ltd. Periphyton determinations by Rhithron Associates, Inc.		BIOL14P009 MR19-01 Rep 3 8/28/2013			BIOL14P010 MR3 Rep 1 8/28/2013			BIOL14P011 MR3 Rep 2 8/28/2013			BIOL14P012 MR3 Rep 3 8/28/2013			BIOL14P013 MR4 Rep 1 8/28/2013			BIOL14P014 MR4 Rep 2 8/28/2013			BIOL14P015 MR4 Rep 3 8/28/2013			BIOL14P016 MR6 Rep 1 8/28/2013		
Portion	Taxon	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)
	Navicula stroemii				2	1037	47																		
	Navicula tripunctata	1	92	1103										6	792	7345	1	311	1109						
	Navicula veneta																								
	Neidium ampliatum																								
	Neidium binodeformis																								
	Neidium dubium																								
	Nitzschia	2	184	74																					
	Nitzschia acicularis				2	1037	132				2	229	132												
	Nitzschia angustata																								
	Nitzschia angustatula																								
	Nitzschia archibaldii																								
	Nitzschia dissipata				2	1037	386	4	1005	670				7	924	1813	4	1246	677	4	562	1065			
	Nitzschia fonticola																								
	Nitzschia gracilis							2	502	179															
	Nitzschia heufleriana																								
	Nitzschia linearis													4	528	529									
	Nitzschia linearis v. tenuis																								
	Nitzschia palea																			2	281	97			
	Nitzschia paleacea	2	184	88																					
	Nitzschia perminuta							4	1005	154				2	264	90									
	Nitzschia pura				4	2075	345	4	1005	252	2	229	111				2	623	152	8	1124	579			
	Nitzschia radicula																								
	Nupella																			1	141	30			
	Pinnularia																								
	Planothidium frequentissimum																								
	Planothidium lanceolatum																								
	Reimeria sinuata	22	2019	2892	1	519	118	2	502	161	5	573	627	9	1188	1039	1	311	118	5	703	614	6	1677	376
	Reimeria uniseriata													2	264	670									
	Rhoicosphenia abbreviata																								
	Rossithidium pusillum																								
	Sellaphora pupula							1	251	121															
	Staurosira construens																								
	Staurosira construens v. venter																								
	Staurosirella leptostauron																								
	Staurosirella pinnata																			2	281	121			
	Surirella brebissonii																								
	Surirella brebissonii v. kuetzingii																								
	Surirella minuta																								
	Synedra ulna													2	264	2128				1	141	986			
	Tryblionella apiculata																								
	TOTALS	800	165165	431055	631	347095	91557	659	187581	127178	726	118492	222331	603	80011	88513	626	204634	35782	612	87814	30313	603	169356	41669

Table 8. Periphyton taxonomic identification to lowest possible level (5 of 8).

Biologica Environmental Services Ltd. Periphyton determinations by Rhithron Associates, Inc.		BIOL14P017 MR6 Rep 2 8/28/2013			BIOL14P018 MR6 Rep 3 8/28/2013			BIOL14P019 MR17-02 Rep 1 8/29/2013			BIOL14P020 MR17-02 Rep 2 8/29/2013			BIOL14P021 MR17-02 Rep 3 8/29/2013			BIOL14P022 MR19-02 Rep 1 8/29/2013			BIOL14P023 MR19-02 Rep 2 8/29/2013			BIOL14P024 MR19-02 Rep 3 8/29/2013		
Portion	Taxon	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)
Algae	Bulbochaete																								
	Calothrix																			30	11044	1541	114	38470	5856
	Closterium				1	1268	9296																		
	Cosmarium																								
	Heteroleibleinia																			2	736	132	36	12148	2378
	Phormidium										5	3140	199												
	Stigeoclonium							121	75382	247530	161	101111	329358	160	163933	327312	152	77868	310946	76	27978	155473	45	15185	92057
	Tolypothrix																								
	Unknown Green Filament							1	623	834				8	8197	6668				2	736	1667			
Diatoms	Achnanthidium affine	6	1259	194	2	1264	75																		
	Achnanthidium deflexum	1	210	44													24	3033	1025	26	3031	1107	28	1654	1184
	Achnanthidium minutissimum	486	101966	12406	398	251554	8739	480	88714	8551	383	53719	6184	394	88811	6779	140	17691	3076	223	25996	5331	254	15000	7503
	Achnanthidium pyrenaicum	5	1049	95	4	2528	96	4	739	81				2	451	44									
	Achnanthidium rivulare	2	420	78																					
	Adlafia bryophila																								
	Adlafia minuscula																								
	Adlafia suchlandtii																						1	59	15
	Amphipleura pellucida				2	1264	1133										7	885	5538	8	933	6379	2	118	1805
	Amphora copulata	2	420	1074																					
	Amphora inariensis																								
	Amphora pediculus	5	1049	239																3	350	92	1	59	61
	Brachysira microcephala	2	420	122	4	2528	254																1	59	92
	Caloneis bacillum							28	5175	3025	14	1964	1458	30	6762	3610									
	Cocconeis placentula							2	370	190	3	421	332				10	1264	1277	8	933	1171	10	591	802
	Cocconeis placentula v. lineata	1	210	249				7	1294	1164	44	6171	9491	10	2254	2462	6	758	1427	16	1865	4636	6	354	1225
	Cocconeis pseudolineata										4	561	740												
	Cymbella affinis				3	1896	1072										6	758	2906	4	466	1370			
	Cymbella cistula																								
	Cymbella perparva																								
	Cymbella subturgidula																			2	233	869			
	Cymbopleura naviculiformis																								
	Cymbopleura rupicola																								
	Denticula tenuis	1	210	47																					
	Diatoma moniliformis	4	839	248	4	2528	614	9	1663	1849	19	2665	2682	3	676	526	41	5181	7001	8	933	1175	37	2185	5820
	Diatoma tenuis	1	210	85																					
	Didymosphenia geminata																								
	Diploneis marginestriata																								
	Diploneis oculata																								
	Discostella pseudostelligera																								
	Encyonema auerswaldii				2	1264	1035																		
	Encyonema minutum				2	1264	60																		
	Encyonema prostratum																								
	Encyonema reichardtii																2	253	69				3	177	109
	Encyonema silesiacum	2	420	390													5	632	775	3	350	320	3	177	630
	Encyonopsis cesatii	2	420	132																					
	Encyonopsis microcephala	8	1678	169	6	3792	136																		
	Encyonopsis subminuta	10	2098	333	10	6320	225										2	253	56	1	117	27	2	118	58
	Eucocconeis flexella																								
	Eucocconeis laevis	7	1469	334	1	632	48																1	59	44
	Fragilaria capucina																								
	Fragilaria capucina v. gracilis	8	1678	320	2	1264	108										4	505	162				8	472	350
	Fragilaria sepes																								
	Fragilaria tenera																								
	Fragilaria vaucheriae	1	210	48	2	1264	137	2	370	259	1	140	96				1	126	69				1	59	80
	Frustulia vulgaris																								
	Gomphonema																								
	Gomphonema angustatum																			2	233	315	4	236	356
	Gomphonema kobayasii				2	1264	271													2	233	347	3	177	406
	Gomphonema micropus							2	370	454				1	225	250	2	253	440				2	118	325
	Gomphonema minusculum	15	3147	2013	129	81534	14414				2	281	209	2	451	157	210	26537	19659	168	19585	15207	130	7677	11362
	Gomphonema minutum																15	1895	1677	11	1282	3220	6	354	1057
	Gomphonema olivaceoides	13	2727	1200	10	6320	1249				6	842	640	1	225	81	12	1516	871	25	2914	3165	5	295	343
	Gomphonema olivaceum							2	370	507	8	1122	1871	10	2254	2766	15	1895	2627	9	1049	2938	15	886	3729
	Gomphonema parvulum										1	140	141							2	233	336	6	354	864
	Gomphonema pumilum																								
	Gomphonema rhombicum																			4	466	1343	4	236	1212
	Gomphonema truncatum																			1	117	457			
	Hannaea arcus																								
	Karayevia suchlandtii																								
	Luticola goeppertiana																								
	Mayamaea atomus																								
	Meridion circulare v. constrictum																			1	117	83			
	Navicula aitchelbee																								
	Navicula capitatoradiata													1	225	222									
	Navicula cari							2	370	204													2	118	227
	Navicula caterva							14	2587	1144	29	4067	2463	19	4283	1488	2	253	164	2	233	164			
	Navicula cryptocephala																5	632	641				1	59	140
	Navicula cryptotenella																9	1137	904	5	583	570	4	236	609
	Navicula gregaria										2	281	210	1	225	109									
	Navicula heimansioides																								
	Navicula libonensis																								
	Navicula menisculus																5	632	561	2	233	196			
	Navicula radiosa																						1	59	624
	Navicula schmassmannii																								
	Navicula seibigiana																								

Table 9. Periphyton taxonomic identification to lowest possible level (6 of 8).

Biologica Environmental Services Ltd. Periphyton determinations by Rhithron Associates, Inc.		BIOL14P017 MR6 Rep 2 8/28/2013			BIOL14P018 MR6 Rep 3 8/28/2013			BIOL14P019 MR17-02 Rep 1 8/29/2013			BIOL14P020 MR17-02 Rep 2 8/29/2013			BIOL14P021 MR17-02 Rep 3 8/29/2013			BIOL14P022 MR19-02 Rep 1 8/29/2013			BIOL14P023 MR19-02 Rep 2 8/29/2013			BIOL14P024 MR19-02 Rep 3 8/29/2013		
Portion	Taxon	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)
	Navicula stroemii																								
	Navicula tripunctata							12	2218	12968	8	1122	8155	20	4508	21938	4	505	6277				2	118	2802
	Navicula veneta																						2	118	167
	Neidium ampliatum																								
	Neidium binodeformis																						1	59	168
	Neidium dubium																			2	233	878			
	Nitzschia										2	281	102							2	233	55			
	Nitzschia acicularis																								
	Nitzschia angustata																								
	Nitzschia angustatula	2	420	118																					
	Nitzschia archibaldii				2	1264	40																		
	Nitzschia dissipata	2	420	476	2	1264	529	13	2403	2189	22	3086	3892	61	13750	8021	31	3917	5602	33	3847	6707	9	531	1988
	Nitzschia fonticola				2	1264	144																		
	Nitzschia gracilis																								
	Nitzschia heufleriana																2	253	1268						
	Nitzschia linearis							2	370	208										1	117	124			
	Nitzschia linearis v. tenuis																								
	Nitzschia palea										2	281	167				4	505	154	5	583	216	5	295	234
	Nitzschia paleacea	3	629	103							3	421	106				10	1264	310				3	177	111
	Nitzschia perminuta																						2	118	53
	Nitzschia pura				4	2528	251										4	505	304	6	699	304			
	Nitzschia radicula																						2	118	76
	Nupella																								
	Pinnularia																								
	Planothidium frequentissimum							11	2033	536	31	4348	1563	29	6537	1788	3	379	171	1	117	61	4	236	252
	Planothidium lanceolatum																								
	Reimeria sinuata	4	839	475	4	2528	479	7	1294	978	8	1122	966	14	3156	2021	14	1769	2300	7	816	852	20	1181	2038
	Reimeria uniseriata	5	1049	2003																					
	Rhoicosphenia abbreviata										1	140	616	2	451	745	1	126	205	5	583	1835	3	177	791
	Rossithidium pusillum																								
	Sellaphora pupula	2	420	117	1	632	81																		
	Staurosira construens																								
	Staurosira construens v. venter																2	253	77						
	Staurosirella leptostauron																						2	118	909
	Staurosirella pinnata																								
	Surirella brebissonii										1	140	1288												
	Surirella brebissonii v. kuetzingii							2	370	651	2	281	611												
	Surirella minuta							1	185	171	2	281	376												
	Synedra ulna				2	1264	5370										2	253	1628	2	233	1793	4	236	3078
	Tryblionella apiculata										2	281	394												
	TOTALS	600	125884	23114	601	380496	45858	722	186897	283492	766	188406	374311	768	307375	386987	752	153687	380168	710	110439	222459	795	101236	153989

Table 10. Periphyton taxonomic identification to lowest possible level (7 of 8).

		BIOL14P025				BIOL14P026			BIOL14P027			BIOL14P028			BIOL14P029			BIOL14P030		
		MR7b				MR7b			MR7b			MR9			MR9			MR9		
		Rep 1				Rep 2			Rep 3			Rep 1			Rep 2			Rep 3		
		8/29/2013				8/29/2013			8/29/2013			8/29/2013			8/29/2013			8/29/2013		
Portion	Taxon	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)
Algae	Bulbochaete																			
	Calothrix																			
	Closterium																			
	Cosmarium											1	425	4192						
	Heteroleibleinia																			
	Phormidium		10	2858	398	26	9109	1034										150	163022	5967
	Stigeoclonium																			
	Tolypothrix														60	50353	3056			
	Unknown Green Filament																			
Diatoms	Achnanthidium affine																			
	Achnanthidium deflexum	125	1	138	44	5	800	186										3	815	106
	Achnanthidium minutissimum	13609	474	65466	14360	492	78717	13023	391	80000	8361	488	163817	11417	459	124712	10624			
	Achnanthidium pyrenaicum	70				2	320	41	2	409	46	2	671	57	4	1087	74			
	Achnanthidium rivulare																			
	Adlafia bryophila																			
	Adlafia minuscula	54							3	614	50									
	Adlafia suchlandtii														1	336	17			
	Amphipleura pellucida	599	1	138	700				6	1228	3935	2	671	1397	5	1359	3493			
	Amphora copulata		1	138	308				1	205	467									
	Amphora inariensis																			
	Amphora pediculus	305	1	138	51	1	160	51												
	Brachysira microcephala		1	138	49	1	160	63	13	2660	803	9	3021	531	6	1630	440			
	Caloneis bacillum		2	276	532				4	818	1169	1	336	86	1	272	452			
	Cocconeis placentula	116																		
	Cocconeis placentula v. lineata																			
	Cocconeis pseudolineata																			
	Cymbella affinis								2	409	711									
	Cymbella cistula					2	320	7519												
	Cymbella perparva																			
	Cymbella subturgidula																			
	Cymbopleura naviculiformis																			
	Cymbopleura rupicola		1	138	640				3	614	561							2	543	471
	Denticula tenuis					1	160	68												
	Diatoma moniliformis	1157	4	552	582	5	800	572	6	1228	761							5	1359	484
	Diatoma tenuis								4	818	229							1	272	62
	Didymosphenia geminata																			
	Diploneis marginestriata		2	276	298															
	Diploneis oculata														1	336	142			
	Discostella pseudostelligera								1	205	14									
	Encyonema auerswaldii					2	320	2167							2	671	878	1	272	796
	Encyonema minutum		2	276	54				1	205	27	10	3357	346	4	1087	124			
	Encyonema prostratum	41064	11	1519	46815	9	1440	35229												
	Encyonema reichardtii	38																		
	Encyonema silesiacum	350	2	276	240				11	2251	1558	1	336	162	4	1087	452			
	Encyonopsis cesatii																			
	Encyonopsis microcephala		1	138	19				17	3478	334	2	671	43	4	1087	80			
	Encyonopsis subminuta	124	8	1105	218	1	160	27	36	7366	939	21	7049	607	9	2445	213			
	Eucocconeis flexella								1	205	249	1	336	277						
	Eucocconeis laevis		3	414	127	5	800	211	2	409	86	13	4364	690	6	1630	268			
	Fragilaria capucina	745	20	2762	1274	16	2560	1382	12	2455	642				5	1359	273			
	Fragilaria capucina v. gracilis	251							15	3069	490	2	671	70	2	543	65			
	Fragilaria sepes								1	205	21									
	Fragilaria tenera								1	205	36				2	543	100			
	Fragilaria vaucheriae	98	1	138	65				14	2864	1132	2	671	169	1	272	84			
	Frustulia vulgaris																			
	Gomphonema	682	2	276	455															
	Gomphonema angustatum																			
	Gomphonema kobayasii					2	320	405												
	Gomphonema micropus								4	818	1101	6	2014	1408	3	815	830			
	Gomphonema minusculum	868	2	276	208	4	640	405	6	1228	639	4	1343	581	8	2174	699			
	Gomphonema minutum					4	640	517				2	671	263	7	1902	1167			
	Gomphonema olivaceoides	188				6	960	390	6	1228	472	2	671	197	26	7064	2494			
	Gomphonema olivaceum	404							3	614	563	2	671	335	6	1630	1039			
	Gomphonema parvulum																			
	Gomphonema pumilum	124	2	276	63															
	Gomphonema rhombicum																			
	Gomphonema truncatum																			
	Hannaea arcus	229																		
	Karayevia suchlandtii																			
	Luticola goeppertiana	7838	22	3039	7510	18	2880	8520												
	Mayamaea atomus																			
	Meridion circulare v. constrictum																			
	Navicula aitchelbee	1443				1	160	313												
	Navicula capitatoradiata	224	2	276	446	2	320	425	1	205	232							1	272	179
	Navicula cari																			
	Navicula caterva																			
	Navicula cryptocephala		1	138	129															
	Navicula cryptotenella	77	2	276	177				7	1432	763							6	1630	792
	Navicula gregaria	111																		
	Navicula heimansioides																			
	Navicula libonensis	312																		
	Navicula menisculus																			
	Navicula radiosa								4	818	3299									
	Navicula schmassmannii	25																		
	Navicula seibigiana																			

Table 11. Periphyton taxonomic identification to lowest possible level (8 of 8).

		BIOL14P025	BIOL14P026			BIOL14P027			BIOL14P028			BIOL14P029			BIOL14P030		
		MR7b	MR7b			MR7b			MR9			MR9			MR9		
		Rep 1	Rep 2			Rep 3			Rep 1			Rep 2			Rep 3		
		8/29/2013	8/29/2013			8/29/2013			8/29/2013			8/29/2013			8/29/2013		
Portion	Taxon	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)	Count	Density (#/cm2)	Total Biovolume (um3/cm2)
	Navicula stroemii	196							9	1841	212				2	543	62
	Navicula tripunctata																
	Navicula veneta																
	Neidium ampliatum		1	138	745												
	Neidium binodeformis																
	Neidium dubium	658	2	276	1375	2	320	1178									
	Nitzschia	213							5	1023	195						
	Nitzschia acicularis	74															
	Nitzschia angustata								1	205	520						
	Nitzschia angustatula																
	Nitzschia archibaldii											2	671	39			
	Nitzschia dissipata	2058	9	1243	2165	1	160	119	5	1023	701	1	336	208	5	1359	746
	Nitzschia fonticola																
	Nitzschia gracilis																
	Nitzschia heufleriana																
	Nitzschia linearis								3	614	389	1	336	124	1	272	101
	Nitzschia linearis v. tenuis					2	320	439	2	409	459						
	Nitzschia palea		4	552	212							1	336	30			
	Nitzschia paleacea	96				2	320	74				2	671	67			
	Nitzschia perminuta																
	Nitzschia pura								2	409	99						
	Nitzschia radicula																
	Nupella																
	Pinnularia					2	320	3777									
	Planothidium frequentissimum	66	4	552	180	1	160	52	2	409	100						
	Planothidium lanceolatum																
	Reimeria sinuata	519	2	276	235	7	1120	898	4	818	366	15	5035	1691	3	815	308
	Reimeria uniseriata	485															
	Rhoicosphenia abbreviata																
	Rossithidium pusillum		1	138	43												
	Sellaphora pupula	655	3	414	500				1	205	163						
	Staurosira construens								4	818	195				6	1630	369
	Staurosira construens v. venter	191	5	691	287				4	818	116	4	1343	245	2	543	95
	Staurosirella leptostauron																
	Staurosirella pinnata	58				2	320	71									
	Surirella brebissonii																
	Surirella brebissonii v. kuetzingii																
	Surirella minuta																
	Synedra ulna					2	320	1712	1	205	985						
	Tryblionella apiculata																
	TOTALS	76499	610	85726	81506	626	105105	80870	622	127484	38379	660	251767	25133	750	326044	33511

APPENDIX D. RAW LAB DATA: BENTHIC INVERTEBRATES

Table 1. Benthic invertebrates total metals (wet weight).

ELEMENTS BY ATOMIC SPECTROSCOPY - WET WT (TISSUE)												
Maxxam ID		HL4540	HL4541	HL4542	HL4543	HL4544	HL4545	HL4546	HL4547	HL4548	HL4558	HL4559
Sampling Date		30/08/2013	28/08/2013	28/08/2013	28/08/2013	29/08/2013	29/08/2013	29/08/2013	28/08/2013	29/08/2013	27/08/2013	27/08/2013
COC Number		40773701	40773701	40773701	40773701	40773701	40773701	40773701	40773701	40773701	40773702	40773702
	UNITS	**MR-REF**	**MR-3**	**MR-4**	**MR-6**	**MR-7B**	**MR-9**	**M17-02**	**M19-01**	**M19-02**	**M20-04**	**M20-06**
Total Metals by ICPMS												
Total Aluminum (Al)	mg/kg	113	427	143	99.6	96.9	154	31.2	119	115	185 (1)	113
Total Antimony (Sb)	mg/kg	0.0149	0.0830	0.0169	0.0146	0.0140	0.0131	0.0103	0.0120	0.0134	0.0229	0.0180
Total Arsenic (As)	mg/kg	0.179	0.666	0.133	0.136	0.126	0.132	0.042	0.221	0.118	0.127 (1)	0.101
Total Barium (Ba)	mg/kg	28.4	28.6	5.59	6.31	5.27	25.9	8.85	8.90	12.3	14.7 (1)	14.1
Total Beryllium (Be)	mg/kg	<0.020	<0.080	<0.060	<0.020	<0.020	<0.080	<0.020	<0.020	<0.020	<0.020	<0.020
Total Bismuth (Bi)	mg/kg	<0.020	<0.080	<0.060	<0.020	<0.020	<0.080	<0.020	<0.020	<0.020	<0.020	<0.020
Total Boron (B)	mg/kg	1.16	2.1	<1.2	<0.40	0.71	<1.6	<0.40	<0.40	<0.40	<0.40	<0.40
Total Cadmium (Cd)	mg/kg	0.646	1.90	1.13	0.657	0.351	0.456	0.138	0.206	0.402	0.320 (1)	0.376
Total Calcium (Ca)	mg/kg	1890	4300	1620	1860	1270	1270	363	1900	1110	1470	1370
Total Chromium (Cr)	mg/kg	0.223	0.85	0.27	0.193	0.181	0.23	0.066	0.271	0.242	0.452 (1)	0.224
Total Cobalt (Co)	mg/kg	0.472	1.30	0.399	0.428	0.238	0.364	0.119	0.189	0.197	0.755 (1)	0.829
Total Copper (Cu)	mg/kg	5.07	6.17	5.34	9.00	6.25	2.37	3.85	2.53	4.17	3.64	3.84
Total Iron (Fe)	mg/kg	378	1550	354	324	389	337	94.6	698	399	415 (1)	296
Total Lead (Pb)	mg/kg	0.166	0.760	0.209	0.167	0.168	0.184	0.0651	0.276	0.190	0.305 (1)	0.245
Total Magnesium (Mg)	mg/kg	581	885	592	676	481	404	565	541	230	450	446
Total Manganese (Mn)	mg/kg	66.3	72.6	46.8	35.6	36.5	67.8	24.1	18.7	14.2	31.3	37.2
Total Mercury (Hg)	mg/kg	0.0020	<0.0080	<0.0060	0.0023	<0.0020	<0.0080	<0.0020	0.0044	0.0086	0.0040	0.0023
Total Molybdenum (Mo)	mg/kg	0.120	0.284	0.210	0.096	0.222	0.109	0.163	0.135	0.152	0.110	0.107
Total Nickel (Ni)	mg/kg	0.620	3.07	0.563	0.559	0.541	0.556	0.415	0.860	0.655	0.983 (1)	0.940
Total Phosphorus (P)	mg/kg	1660	1180	1560	1800	1300	717	1510	988	1100	1070	1210
Total Potassium (K)	mg/kg	604	123	108	539	88.2	140	898	61.6	41.2	109	103
Total Selenium (Se)	mg/kg	0.645	0.631	0.953	1.09	0.705	0.267	1.02	0.592	0.793	0.915	1.12
Total Silver (Ag)	mg/kg	0.0231	0.036	0.027	0.0845	0.0377	0.022	0.0114	0.0140	0.0260	0.0188 (1)	0.0187
Total Sodium (Na)	mg/kg	173	9.3	20.4	170	30.6	36.5	372	11.2	11.8	33.1	33.7
Total Strontium (Sr)	mg/kg	4.86	14.3	4.67	3.96	2.32	5.31	0.883	3.15	3.05	4.31	3.60
Total Thallium (Tl)	mg/kg	0.00718	0.0203	0.0052	0.00082	<0.00040	0.0075	<0.00040	<0.00040	<0.00040	0.00601 (1)	<0.00040
Total Tin (Sn)	mg/kg	<0.020	<0.080	<0.060	<0.020	<0.020	<0.080	<0.020	<0.020	<0.020	<0.020	0.056
Total Titanium (Ti)	mg/kg	2.26	7.44	2.35	1.70	1.08	2.80	0.78	0.97	1.18	4.15	1.68
Total Uranium (U)	mg/kg	0.0208	0.0941	0.0142	0.0182	0.0137	0.0197	0.0168	0.0258	0.0173	0.0254 (1)	0.0231
Total Vanadium (V)	mg/kg	0.445	2.25	0.51	0.383	0.334	0.54	0.110	0.653	0.458	0.665 (1)	0.408
Total Zinc (Zn)	mg/kg	95.3	46.1	76.4	102	67.4	41.1	52.9	26.0	37.8	36.4 (1)	52.5

RDL = Reportable Detection Limit
EDL = Estimated Detection Limit
(1) Duplicate RPD above control limit - Non-homogenous sample - Increased variability of results.

Table 2. Benthic invertebrates taxonomic identification to lowest possible level by Cordillera Consulting (1 of 5).

Site:	MR-3	MR-3	MR-3	MR-4	MR-4	MR-4	MR-6	MR-6	MR-6	MR-7b	MR-7b	MR-7b	MR-9	MR-9	MR-9	MR17-02	MR17-02	MR17-02	MR19-01	MR19-01	MR19-01	MR19-02	MR19-02	MR19-02	MR20-04	MR20-04	MR20-04	MR20-06	MR20-06	MR20-06	MR-REF	MR-REF	MR-REF
Sample:	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3
CC#:	CC14107	CC14107	CC14107	CC14107	CC14107	CC14107	CC14107	CC14107	CC14107	CC14108	CC14108	CC14108	CC14108	CC14108	CC14108	CC14108	CC14108	CC14108	CC14109	CC14109	CC14109	CC14109	CC14109	CC14109	CC14109	CC14109	CC14109	CC14109	CC14110	CC14110	CC14110	CC14110	CC14110
Phylum: Arthropoda																																	
Subphylum: Hexapoda																																	
| Class: Insecta																																	
| Order: Ephemeroptera						9																								5			
| Family: Ameletidae																																	
Ameletus	5	25	5	18	16	36				14	50		75	105	92				25	48	10	43		23	8	9	7	4	4	5	5	13	7
| Family: Baetidae	45		21	4	11						100	20			17		31			5			7	8									7
Acentrella sp.	50	17	53		11	9	14	10	47	105	100	150			8			4		62	20	57									21	40	93
Baetis bicaudatus			5											5		63	19	35		400	230	257	79	69	123	82	133	61	93	45			7
Baetis sp.	40	33	63	4		9	29	50	40	27		90	25	5	17	181	188	204			680		50	131	85	318	133	161	143	125	11	7	14
Baetis tricaudatus group	25	50	58	11	26	14	129	230	73	77	40	110	6		8	6							14	23	123	245	287	204	175	165	21	20	36
Callibaetis sp.																6																	
Diphetor hageni																						86	86	46									
| Family: Ephemerellidae	395	742	363	204	47	41	14		47	55	940	170	675	55	758				192	81	100	43	121	100	54	55	47	9	14	25	358	360	693
Drunella coloradensis																														10			
Drunella doddsii	10		21				43	20	33	114	40	40	6	15	17										15	9	20	4	11	15	37	47	64
Drunella grandis group	10	50	21	7	16	36			7	9	10	30	25	25	50			9				14									16	7	21
Ephemerella dorothea/excrucia		8		7	11	32		10		5	40		19	35	25																7	
Ephemerella sp.	10				358	345	143	530	307	268	50	850	169	470	300																5		
Serratella sp.		25								5	10	10																4		5		7	7
| Family: Heptageniidae	520	1208	658	7	16	14	1486	1500	707	764	570	460	88	155	175	194	69		88	167	570	2057	1171	1000	285	427	273	96	111	110	742	1087	993
Cinygmula sp.			11					10					13						67	76	20		21	8	8	9	7	4		10	5		
Epeorus deceptivus																			188	276		57			38	45	53	35	21	10			
Epeorus grandis group																									8		13	4					
Epeorus longimanus																										9	7	4					
Epeorus sp.																6					450		14	8	62	73	40	48	43	15			
Rhithrogena sp.	5	8		4				130		332		100	6	10	42									8	77	55	113	100	18	35	53	247	29
| Family: Leptophlebiidae				4	11		7											4		5	10	71	71	31									
| Order: Plecoptera	135	42	63			5	7	30	247	45	110	200	56	15	150	38	50	9			10	43	21	46	23	18		4		5	53	13	136
| Family: Capniidae	15	42			11	9		10	13	18		20	13	15	17	231	194		8	14	50	114	121	154	23	36	20	9		5	11	47	64
Capnia sp.													13	5	17			4															
| Family: Chloroperlidae		33							7	23		10			17				4	14	40			8	15		20	4	14	5	68	13	29
Paraperla sp.																			4														
Suwallia sp.					5		7	10				10					6				10		7			136	40	4	21	45	16	13	7
Sweltsa sp.	25		5			18	50	90	47	23	20	10	13	25	17	13	13	9	21	10	30		7		23	45	13			111	80	136
| Family: Leuctridae																		4			10	14			8		13	9					
Perlomyia sp.																		4									20						
| Family: Nemouridae																				5	50	286											
Zapada cinctipes															8	669	281	370	58	33	120	443	36	238	408	273	213	139	93	50			
Zapada columbiana																					10	14			23	9	7	4	18				
Zapada oregonensis group																	6								38	36	7	4	4	15			
Zapada sp.	10			4		18			20	5		10	6	5	8	44	238						64	123	108	273	73	70	57	105			
| Family: Perlidae					5		7		13																	9							
Claassenia sabulosa										5		10																					
Doroneuria sp.								10	7																								
Hesperoperla pacifica										5		20													8		7						
| Family: Perlodidae	35	33	63	14	16	14	36	50	27		140	70	50	20	33	106	69	57	17	19	20	171	43	54	31	27	13			10	21	7	29
Cultus sp.		8		4	5			10		5			6	15	17																5		
Isogenoides sp.									7	5	10																						
Isoperla sp.				4		14								15				4															
Megarcys sp.										5								17		5		43	7	8	23	9	7	13	7	5	5		
Skwala sp.		8				5	50	50	13	18	30	20	6	10	25							29	7	8							5	20	7
| Family: Taeniopterygidae					11			20	7	5	10			10		25						171	107	154	62	64	47	43	18	55	16	13	
Taenionema sp.																		65	4			29											

Table 3. Benthic invertebrates taxonomic identification to lowest possible level by Cordillera Consulting (2 of 5).

Site:	MR-3	MR-3	MR-3	MR-4	MR-4	MR-4	MR-6	MR-6	MR-6	MR-7b	MR-7b	MR-7b	MR-9	MR-9	MR-9	MR17-02	MR17-02	MR17-02	MR19-01	MR19-01	MR19-01	MR19-02	MR19-02	MR19-02	MR20-04	MR20-04	MR20-04	MR20-06	MR20-06	MR20-06	MR-REF	MR-REF	MR-REF
Sample:	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3
CC#:	CC141072	CC141073	CC141074	CC141075	CC141076	CC141077	CC141078	CC141079	CC141080	CC141081	CC141082	CC141083	CC141084	CC141085	CC141086	CC141087	CC141088	CC141089	CC141090	CC141091	CC141092	CC141093	CC141094	CC141095	CC141096	CC141097	CC141098	CC141099	CC141100	CC141101	CC141102	CC141103	CC141104
| **Order: Trichoptera**	10	8								9	10		6	10	8	6	6						14		8			4		5	11		
| **Family: Apataniidae**																																	
Apatania sp.	5	17												5		25	44	9	113	76	240	71	7	8		9	7	4	4				
| **Family: Brachycentridae**	25	75	21	4	21	5	7	20	40	18	20	30	44	65	50								7				7			5	16	7	50
Brachycentrus americanus							7		13		20	20			8																5		
Brachycentrus occidentalis														5																			
Brachycentrus sp.																				48													
Micrasema sp.																	6																
| **Family: Glossosomatidae**									40			20					13																7
Anagapetus sp.																6	6																
Glossosoma sp.	35	8					36	50	13	14						13	6	9	25	24	140					27	7	4	7	10			7
| **Family: Hydropsychidae**	25	25	32		16	5	21	80	100	18	30	10	6		17										8		13	9	11	5	5		14
Arctopsyche grandis	20	8	5				29	80	40	9	20		6		25	6										9		4			5	13	7
Hydropsyche sp.		8	16				7	60	100	23	40	30																					7
Parapsyche sp.																									8	9		4					
| **Family: Hydroptilidae**																																	
Hydroptila sp.				11	5												6																
| **Family: Lepidostomatidae**																																	
Lepidostoma sp.	5		5	21	26	23	7	10	13		100	40	6	15									7										
| **Family: Limnephilidae**	5		11												8			30	21			14	7				7						
Ecclisocosmoecus scylla																												4					
Ecclisomyia sp.																							7										
| **Family: Rhyacophilidae**																																	
Rhyacophila angelita group								10																		9							
Rhyacophila betteni group													6			19	44	35	4	10	40	29	29	8	15	9	7	9	4		5		
Rhyacophila brunnea/vemna gr			5								10	10	6					4		10					46		33	9	4	5			
Rhyacophila hyalinata group																													4				
Rhyacophila sp.																	6								8	36	7	13	11	25	5		7
| **Family: Uenoidae**																																	
Neothremma sp.																											7	4					
Oligophlebodes sp.																									23	27	7	4	7	5			
| **Order: Coleoptera**																							7										
| **Family: Amphizoidae**																																	
Amphizoa sp.																						14											
| **Family: Chrysomelidae**																			8	5													
| **Family: Dytiscidae**																																	
Oreodytes sp.				4	16																												
| **Subfamily: Hydroporinae**				4																													
| **Family: Elmidae**		8			5								6			38	62			5			14	8					4				
Heterlimnius corpulentus											10		6			57	69	109	33	24	100	157	50	53	8								
| **Family: Haliplidae**																																	
Brychius sp.						5																											
Haliplus sp.	5																																
| **Family: Hydrophilidae**																									8								

Table 4. Benthic invertebrates taxonomic identification to lowest possible level by Cordillera Consulting (3 of 5).

Site:	MR-3	MR-3	MR-3	MR-4	MR-4	MR-4	MR-6	MR-6	MR-6	MR-7b	MR-7b	MR-7b	MR-9	MR-9	MR-9	MR17-02	MR17-02	MR17-02	MR19-01	MR19-01	MR19-01	MR19-02	MR19-02	MR19-02	MR20-04	MR20-04	MR20-04	MR20-06	MR20-06	MR20-06	MR-REF	MR-REF	MR-REF
Sample:	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3
CC#:	CC14107	CC14107	CC14107	CC14107	CC14107	CC14107	CC14107	CC14107	CC14107	CC14108	CC14108	CC14108	CC14108	CC14108	CC14108	CC14108	CC14108	CC14108	CC14109	CC14109	CC14109	CC14109	CC14109	CC14109	CC14109	CC14109	CC14109	CC14109	CC14110	CC14110	CC14110	CC14110	CC14110
| **Order: Diptera**						5																	7										
| **Family: Athericidae**																																	
Atherix	5																																
| **Family: Ceratopogonidae**										5																							
Mallochohelea			5																														
Probezzia sp.																									15	9	33			5			
| **Family: Chironomidae**		8				586																											
| **Subfamily: Chironominae**																																	
| **Tribe: Chironomini**																																	
Paracladopelma sp.				4										10																			
Polypedilum sp.																	13																
Stictochironomus sp.				93										10																			
Zavrelia sp.									7																8								
| **Tribe: Tanytarsini**																																	
Cladotanytarsus sp.				36	16																												
Corynocera sp.												20																					
Micropsectra sp.				32	126	77					40	10	38	30	17	13	38	30	4	10		14			31	73	20	13	7	20	11	13	7
Paratanytarsus sp.					63																												
Rheotanytarsus sp.	5										30		19																				
Stempellinella sp.																	81	35	13			29											
Tanytarsus sp.	5			61	111	64																											
| **Subfamily: Diamesinae**																																	
| **Tribe: Boreoheptagyiini**																																	
Boreoheptagyia sp.																		4															
| **Tribe: Diamesini**																																	
Pagastia sp.			5																														
| **Subfamily: Orthocladiinae**																																	
Brillia sp.	10												19		8	6	13			5					15								
Cardiocladius sp.					5							10																					
Eukiefferiella sp.		17	5				14		13	91		30							21	14	40	71			69	118	47	35	39	205	21		
Heleniella sp.																13	13	13															
Heterotrissocladius sp.				57	42	50						20	38																				
Hydrobaenus sp.														5						5													
Krenosmittia sp.				71	121	155					50		69	5																	20		
Limnophyes sp.	10																																
Orthocladius complex		8	11	136	79	118	7	10		41		110	50	60	58								21	62	362	318	287	200	168	360		27	14
Parakiefferiella sp.														45	267			13															
Rheocricotopus sp.											90																						
Synorthocladius sp.											20																				7		
Thienemanniella						5																	14	8	8	9							
Tvetenia sp.	5		5					10			180	160			17	19	25	13	8	19		100	86	85					18				14
| **Tribe: Corynoneurini**																																	
Corynoneura sp.																6	13	9	8			14		8									
| **Tribe: Orthocladiini**																																	
Chaetocladius sp.														15		19																	
| **Subfamily: Prodiamesinae**																																	
Monodiamesa sp.														15																			
| **Subfamily: Tanypodinae**													6																				
| **Tribe: Pentaneurini**																																	
Larsia sp.																	13	4															
Thienemannimyia group				18	5	14								5									50	15									7
| **Family: Dixidae**																																	
Meringodixa chalonensis																											7						
| **Family: Empididae**		8										10					6			5			7					4					
Chelifera/ Metachela	20				5	23	14	30	13		20		19	10	58		6	9				14									26	13	7
Clinocera sp.																			4			29									5		
Hemerodromia sp.																						29											
Neoplasta sp.																									8								
Oreogeton sp.																		9	4						8		7						
Roederiodes sp				7	11	5				9	30	20	6	10	8	31	6	35			30		29	23	15				11	5			
| **Family: Psychodidae**																																	
Pericoma/Telmatoscopus sp.				11		5								5		44	169	61	8		10		7		8		7			5			
| **Family: Simuliidae**											20					6				5	10	14	7	15									
Prosimulium sp.																					130	43						13					
Simulium sp.			5				7		7	9	40							9	17	71			7	46	54	55	20	65	14	5			
| **Family: Tanyderidae**																																	
Protoplasa fitchii							7			9		10																					
| **Family: Tipulidae**	15	8	21								10		13		8																		
Antocha sp.															17																		
Dicranota sp.							7									25	6		4	10		14		8	8	9							
Hexatoma sp.	110	333	121	7	5	5	79	120	47	36	60	90	75	35	100	6			4						8	9	7			5	37	33	29
Rhabdomastix sp.											10																	4	4				
Tipula sp.																6																	

Table 5. Benthic invertebrates taxonomic identification to lowest possible level by Cordillera Consulting (4 of 5).

Site:	MR-3	MR-3	MR-3	MR-4	MR-4	MR-4	MR-6	MR-6	MR-6	MR-7b	MR-7b	MR-7b	MR-9	MR-9	MR-9	MR17-02	MR17-02	MR17-02	MR19-01	MR19-01	MR19-01	MR19-02	MR19-02	MR19-02	MR20-04	MR20-04	MR20-04	MR20-06	MR20-06	MR20-06	MR-REF	MR-REF	MR-REF
Sample:	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3
CC#:	CC14107	CC14107	CC14107	CC14107	CC14107	CC14107	CC14107	CC14107	CC14107	CC14108	CC14108	CC14108	CC14108	CC14108	CC14108	CC14108	CC14108	CC14108	CC14109	CC14109	CC14109	CC14109	CC14109	CC14109	CC14109	CC14109	CC14109	CC14109	CC14110	CC14110	CC14110	CC14110	CC14110
| Order: Hemiptera																																	
| Family: Corixidae				4																													
| Order: Lepidoptera																	6		8						8	9							
Subphylum: Chelicerata																																	
| Class: Arachnida																																	
| Order: Trombidiformes	40	8		4	11	5		20	7	9	30	30	19	10	17								7				4						
| Family: Aturidae																																	
Aturus					5													4															
Aturus sp.						9											6																
Brachypoda sp.					5	5							6																				
| Family: Feltriidae																																	
Feltria sp.				7		14					10	10	6		25			4															
| Family: Hydryphantidae																																	
Protzia sp.	5			4		5							6	5	25		6		4	10	20						4						
Wandesia sp.	5								7		10	20				6										7					7		
| Family: Hygrobatidae																																	
Atractides sp.	10	8	16					10			10						6						21										
Hygrobates sp.				54	16	45				5				40				4	8	5	20		14										
| Family: Lebertiidae																																	
Lebertia sp.	55	33	37	46	37	36	21	30	47	14	50	50	81	45	117	50	25	61	42	24	30	14	21	23	8		13	13		5	58	47	29
| Family: Oxidae																																	
Oxus sp.				7																													
| Family: Sperchontidae																																	
Sperchon sp.	35	33	58	7	32	9		40	33	32	80	60	38	25	83	19	6					14			8		20			30	11	13	29
Sperchonopsis sp.	5										10		6					4			20												
| Family: Torrenticolidae																																	
Testudacarus sp.			5	4	16	5			7		30	30	44	5	25																		
Torrenticola sp.															8																		
| Order: Sarcoptiformes																																	
| Family: Hydrozetidae				4			7										6		4							7							
Phylum: Mollusca																																	
| Class: Bivalvia																																	
| Order: Veneroida																																	
| Family: Pisidiidae							7																										
Pisidium sp.	5																																
| Class: Gastropoda																																	
| Order: Heterostropha																																	
| Family: Valvatidae																																	
Valvata sincera																		4		10													
Phylum: Annelida																																	
Subphylum: Clitellata																																	
| Class: Oligochaeta																																	
| Order: Lumbriculida																																	
| Family: Lumbriculidae							7																										
Lumbriculus sp.				4																													
| Order: Tubificida																																	
| Family: Enchytraeidae																																	
Enchytraeus								20						5								14			8								
| Family: Lumbricidae																			4														
| Family: Naididae																6																	
Nais sp.		8		168	326	59	7			9			200	80	158	6																	7
| Family: Tubificidae																																	
| Subfamily: Tubificinae imma				86	5	5								5		44	6	17															
Totals:	1815	2961	1799	1272	1707	1975	2320	3370	2216	2297	3360	3260	2120	1595	2950	2077	1901	1337	1045	1615	3270	4740	2501	2618	2460	3015	2217	1468	1182	1585	1806	2248	2621

Table 6. Benthic invertebrates taxonomic identification to lowest possible level by Cordillera Consulting (5 of 5).

Site:	MR-3	MR-3	MR-3	MR-4	MR-4	MR-4	MR-6	MR-6	MR-6	MR-7b	MR-7b	MR-7b	MR-9	MR-9	MR-9	MR17-02	MR17-02	MR17-02	MR19-01	MR19-01	MR19-01	MR19-02	MR19-02	MR19-02	MR20-04	MR20-04	MR20-04	MR20-06	MR20-06	MR20-06	MR-REF	MR-REF	MR-REF
Sample:	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3
CC#:	CC14107	CC14107	CC14107	CC14107	CC14107	CC14107	CC14107	CC14107	CC14107	CC14108	CC14108	CC14108	CC14108	CC14108	CC14108	CC14108	CC14108	CC14108	CC14109	CC14109	CC14109	CC14109	CC14109	CC14109	CC14109	CC14109	CC14109	CC14109	CC14110	CC14110	CC14110	CC14110	CC14110
Taxa present but not included:																																	
Phylum: Arthropoda																																	
| Class: Entognatha																																	
| Order: Collembola																		9							8		7						
Subphylum: Crustacea																																	
| Class: Ostracoda				4		5										275	313	217	42	57		14	43	23									
| Class: Copepoda				7																								4					
Phylum: Nemata	5	8	5									20				6									8		7			5	5	7	14
Phylum: Platyhelminthes																																	
| Class: Turbellaria									7	5						6		17						8	8	18	13	13					
Totals:	**5**	**8**	**5**	**11**	**0**	**5**	**0**	**0**	**7**	**5**	**0**	**20**	**0**	**0**	**0**	**287**	**313**	**243**	**42**	**57**	**0**	**14**	**43**	**31**	**24**	**18**	**27**	**17**	**0**	**5**	**5**	**7**	**14**