CMD 25-H9.REF7 CNSC Staff Submission

Reference Package 7 for CMD 25-H9 CNSC Staff Submission on Denison Mines Licence Application to Prepare Site and Construct the Wheeler River Project

Classification	Unclassified
Type of CMD	References
CMD Number	CMD 25-H9.REF7
Original CMD	CMD 25-H9
Public hearing date	08 December 2025
PDF e-DOC #	7605582
Summary	This document contains documents related to the Environmental Assessment process, as posted to the Canadian Impact Assessment Registry, to be placed on the Record for the proceeding.
Actions required	There are no actions requested of the Commission. This CMD is in support of the actions and recommendations set out in CNSC staff CMD 25-H9.

CMD 25-H9.REF7 Soumission par le personnel de la CCSN

Références liées 7 au CMD 25-H9 Soumission par le personnel de la CCSN la demande de Denison Mines visant à prépare le site du projet de Wheeler River et à entamer les activités de construction

Classification	Choisir un niveau de classification
Type de CMD	Références
Numéro de CMD	CMD 25-H9.REF7
CMD Original	CMD 25-H9
Date de l'audience	08 décembre 2025
Numéro e-Doc du PDF	7605582
Résumé	Ce document contient des documents liés au processus d'évaluation environnementale, tels que publiés dans le Registre canadien d'évaluation d'impact, à verser au dossier de l'instance.
Mesures requises	Aucune mesure n'est requise de la Commission. Le présent CMD appuie les mesures et les recommandations énoncées dans le CMD CMD 25-H9 du personnel de la CCSN.

CMD 25-H9.REF7

Reference Package 7 for CMD 25-H9 CNSC Staff Submission on Denison Mines Licence Application to Prepare Site and Construct the Wheeler River Project

Signed by:

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Dana Beaton
Director General, DERPA

Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

Powering
PEOPLE, PARTNERSHIPS
AND PASSION.

2011 – 2019 BASELINE HYDROLOGY SUMMARY REPORT - WHEELER RIVER PROJECT, DENISON MINES

Report prepared for:

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Ref. 19-2589
25 March 2020

2011 – 2019 BASELINE HYDROLOGY SUMMARY REPORT - WHEELER RIVER PROJECT, DENISON MINES

Fei Luo, PhD
Project Manager

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Project Principal and Reviewer

EXECUTIVE SUMMARY

The Denison Mines Corp. (Denison) Wheeler River Project (Project) is located in north central Saskatchewan, in the eastern portion of the Athabasca Basin. It is situated approximately 35 kilometres northeast of Cameco Corporation's Key Lake Operation and 35 kilometres southwest of Cameco Corporation's McArthur River Operation. Hydrology baseline studies in the Project area are required to support feasibility engineering studies, technical assessments and environmental approvals processes. EcoMetrix Incorporated (EcoMetrix) was retained by Denison to implement hydrology baseline studies over the period 2016 through 2019 and to synthesize this more recent data with existing hydrological information for the study area. The current understanding of hydrological conditions in the study area based on the full hydrological data set is provided herein.

Project Site Setting

The Project site is located in the Athabasca Plain Ecoregion that extends south from Lake Athabasca to Cree Lake. The area is characterized as a morainal plain, with southwest trending drumlins and eskers and glaciofluvial outwash areas overlying Athabasca sandstones. Numerous interconnected lakes occur in the area, along with low-lying, poorly drained areas of muskeg. The area is in the subarctic climate zone with long, usually cold winters, and short, cool to mild summers. The ice-covered season extends from late October to late April or early May. Precipitation in the Project area is low throughout the year, and mostly occurs in the warmer months.

The Project area lies within the Wheeler River watershed, which is part of the Churchill River Basin. Surface water from the Project site is drained by two sub-basins of the Wheeler River, the Icelander River drainage and the Williams Lake drainage. Both drainages flow generally south into the northwest portion of Russell Lake. The estimated drainage areas of the Icelander River and the Williams Lake drainages are 371 km^2 and 78 km^2, respectively. Downstream of Russell Lake, the Wheeler River flows into the Geikie River, which subsequently discharges to Wollaston Lake.

2011 to 2014 Hydrological Characterization Program

Golder Associates (Golder) surveyed and summarized the hydrological characteristics of the Project site over the period 2011 to 2014. Water elevation survey locations were established at nine stream stations and eleven lake stations. Manual flow measurements were performed at each of the nine stream stations, and automated stream elevation instruments (level data loggers) were installed at all stream stations. Rating curves were established for each station based on the manual stream discharge measurements to permit estimation of hydrographic profiles for each location. The hydrological data collected during this period indicated that the average daily streamflow at the most downstream location in the Icelander River and the Williams Lake drainage areas ranged from 0.84 to

3.13 m^3/s and 0.067 to 1.5 m^3/s, respectively. Lake and pond surface water elevations ranged from 520.42 masl in the headwater lake of the Icelander River drainage to 488.24 masl at Russell Lake.

2016 to 2019 Hydrological Characterization Program

Hydrological surveys conducted between 2016 and 2019 built on the hydrological baseline work completed from 2011 to 2014. In addition to the previously established hydrometric stations, seven new stream stations and four new lake and pond stations were established. The scope of the 2016 to 2019 program included: the measurement of water level elevations at thirteen lakes and two ponds within the study area; the collection of manual streamflow measurements at seventeen watercourses to validate existing rating curves or establish rating curves for new monitoring locations; and, the installation of continuous streamflow monitoring equipment at eight stream locations in 2016 and elevation data loggers at two lake locations in 2018 and 2019. Six field programs were completed from fall 2016 to summer 2019 to capture seasonal flow conditions in spring, summer and fall. One winter field program was completed between March 15 and 19, 2018, to assess ice cover in the area and to gain a better understanding of winter baseflow conditions.

Key Hydrological Characteristics of the Study Area

Over the entire monitoring program (2011 to 2019), lake and pond surface water elevations ranged from 520.86 masl in the Icelander River drainage area headwater lake LA-8 to 487.99 masl at Russell Lake. In the Icelander River basin, water level elevations at the stream stations ranged from 520.84 masl at SA-11 to 492.55 masl at the most downstream station SA-1. In Williams River drainage area, water levels at stream stations ranged from 519.24 masl at SB-4, to 488.34 masl at the most downstream station. The hydrological data collected also indicated that the average daily streamflow at the most downstream location in the Icelander River and the Williams Lake drainage areas ranged from 0.655 to 3.23 m^3/s and 0.067 to 1.5 m^3/s, respectively.

Currently, continuous monitoring equipment is installed in stream stations SA-1, SA-4, SA-5, SA-6, SA-8, SA-9, SA-10, and SA-11, and lake station LA-1. For SA-1, SA-4, SA-5, SA-6 and SA-11, the water level data can be used to estimate stream flow using established rating curve relationships. Rating curves have not yet been established at other stations, as more manual stream measurements are needed over the range of expected flows to adequately characterize the relationship between stage and discharge.

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1.0 INTRODUCTION

EcoMetrix Incorporated (EcoMetrix) was retained by Denison Mines Corp. (Denison) to undertake hydrological baseline studies over the period 2016 through 2019 at the Wheeler River Project (Project) site that is located in the eastern portion of the Athabasca Basin region in northern Saskatchewan. Hydrology baseline studies in the Project area are required to support feasibility design and engineering studies, technical assessments and environmental approvals processes. The information collected over the period 2016 through 2019 has been synthesized with existing hydrological information in order to characterize the current understanding of hydrological conditions in the study area.

The Wheeler River hydrology baseline project started in 2011. Golder Associated Ltd. (Golder) collected and analyzed field data from 2011 through 2014 (Golder, 2014; see Appendix D). This current report builds on the earlier hydrological survey work, documents and analyzes all hydrologic data collected to date, serving as an updated hydrology baseline report for the Project. To avoid repetition, discussion about study design and monitoring methods presented herein focuses on the monitoring efforts started from 2016 and extending through 2019.

1.1 Site Location and General Area Description

The Project is located in north central Saskatchewan, in the south-eastern portion of the Athabasca Basin region (**Figure 1-1**). It is situated approximately 35 kilometres (km) northeast of Cameco Corporation’s Key Lake Operation and 35 km southwest of Cameco’s McArthur River Operation. Access to the Project site is by the provincial highway system to the Key Lake mill, then by the ore haul road between the Key Lake and McArthur River operations that leads to the eastern part of the property.

The Project site is located in the Athabasca Plain Ecoregion which extends south from Lake Athabasca to Cree Lake (ESWG, 1996). The area in which the Project is located is characterized as a morainal plain, with southwest trending drumlins and eskers and glaciofluvial outwash areas overlying Athabasca sandstones. Numerous interconnected lakes occur in the area, along with low-lying, poorly drained areas of muskeg.

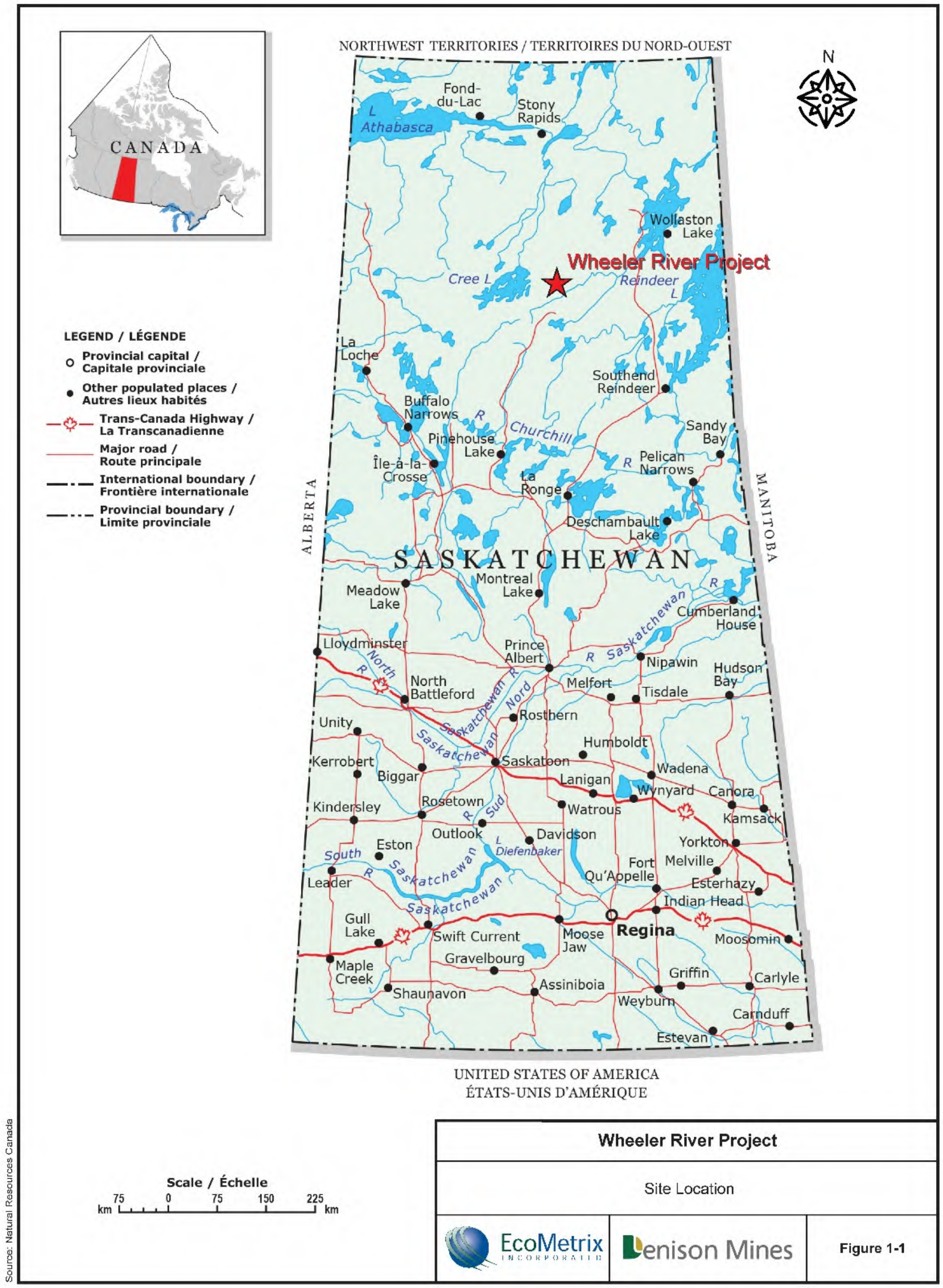

Figure 1-1: Location of the Wheeler River Project Site in north central Saskatchewan

1.2 Climate and Weather

Regional climatic characteristics are a function of various conditions, such as proximity to large bodies of water, altitude, and latitude. The Project site is in the subarctic climate zone that extends across mid and high latitude areas across the entirety of the country excluding coastal areas in the west. The subarctic climate zone is characterized by long, usually cold winters, and short, cool to mild summers. Precipitation in subarctic climates is typically low on an annual basis and precipitation occurs mostly in the warmer months in areas not influenced by coastal climate effects.

On a more local scale, climate conditions, such as temperature, precipitation, evaporation and other processes play a crucial role in the hydrological cycle. Historical climate data collected by Environment Canada and Climate Change (ECCC) weather stations near Key Lake are appropriate to characterize general climate and weather conditions for the Project site. There are three weather stations in the vicinity of Key Lake, though climate norm data were only available for Climate Station 4063755, and therefore data for this station were used to represent the Project site[1]. Data from Station 4063755 were not available subsequent to September 2018. Climate data collected at Station 4063753, situated approximately 1 km from Station 4063755, was used to represent the 2019 climate data for the Project site. Daily average monthly air temperatures are shown below in **Table 1-1**. On average, January is the coldest month and six months have average daily temperatures below 0°C. July is the warmest month with an average daily temperature of 16.3°C. The annual average daily temperature for the Key Lake Station is -2.3°C.

Table 1-1: Temperature norms (daily average per month, °C) reported for the Key Lake Weather Station

Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Avg
-22.3	-18.7	-11.7	-1.9	6.5	13.3	16.3	14.7	8.0	0.0	-11.8	-19.5	-2.3

Precipitation is the primary input of surface water and as such, it provides important context for observed flow characteristics. **Figure 1-2** presents the precipitation record for the period 2011 through 2019, as well as historical averages for comparison. The data are presented on the basis of hydrological years that run from October 1 of one year to September 30 of the following year.

Total annual precipitation for the period 2011 through 2019 was on average 473 mm, similar to the total annual average precipitation reported for the period 1981 through 2010

[1] http://climate.weather.gc.ca/historical_data/search_historic_data_e.html

(483 mm). On average, precipitation is the greatest through the warmer months of the year (June, July, August) and relatively low during winter months extending into early spring.

Yearly observations for the period of 2011 through 2019 are provided below in **Section 1.3**, along with observations of local hydrology, as the precipitations significantly impact discharge in the monitoring station.

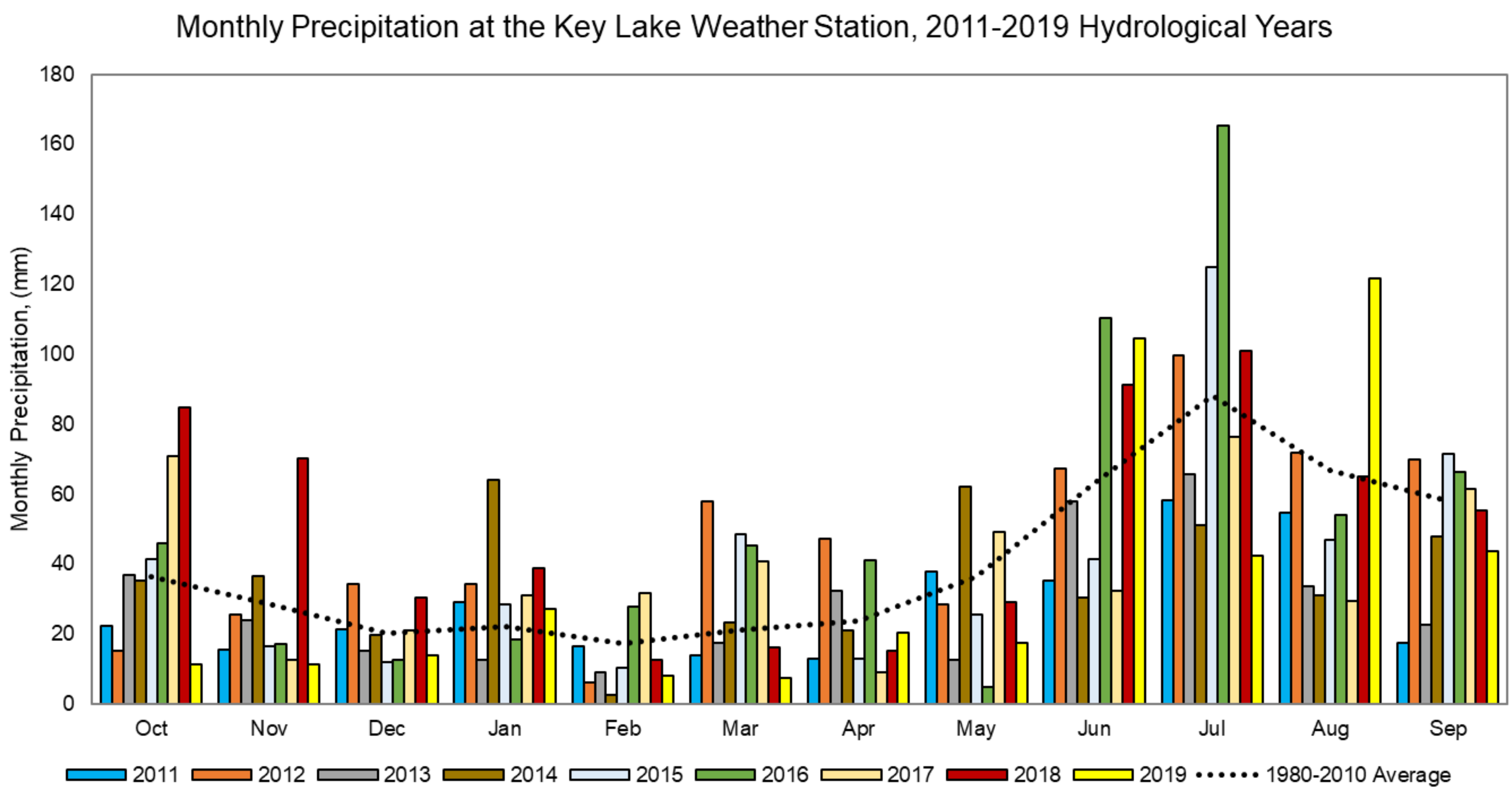

Figure 1-2: Key Lake Monthly Precipitation for Hydrological Years between 2011-2019 (ECCC, 2019).

1.3 Regional Hydrology

The Project site lies within the Wheeler River watershed, which is part of the Churchill River Basin. The Water Survey of Canada operates a hydrometric station on the Wheeler River downstream of Russell Lake (Station 06DA005). The station is located about 25 km east of the Project site and records flows from a contributing drainage area of 3,030 square kilometres (km^2). The hydrometric station has been in operation from 1973 to the present. Both real time and historical discharge and water level data are available in five minutes intervals. Although the drainage area of the hydrometric station is much larger than the drainage areas that are associated with surface water features on and around the Project site, as well as the Project site as a whole, the flow data collected at the station are relevant at the Project site level. The surface water features on the Project site are tributaries of the Wheeler River and land use on the Project site is characteristic of land use within the larger geographical area.

The mean monthly discharge rates at the Wheeler River for the period 2011 through 2019 are presented in **Figure 1-3**. Data corresponding to the period 1981 through 2010 are also presented in **Figure 1-3** for comparison. The data are presented on the basis of hydrological years that run from October 1 of one year to September 30 of the following year. It is noted that only provisional data are available for 2018 and 2019.

The annual average monthly discharge for the period 2011 through 2019 is on the order of 15 m^3/s, about 8% lower than the period 1981 through 2010. Average monthly flows for the period 2011 through 2019 ranged from 11.9 m^3/s in March to 19.6 m^3/s in June. The seasonal hydrograph for the river is represented by relatively low flows through the fall and winter, freshet-dominated flows that appear in May, peak in June and wane in July.

Yearly observations for period 2011 through 2019 are provided below, along with observations of annual precipitations:

- During the 2011 hydrological year (Oct 2010 to Sep 2011), the discharge at the Wheeler River monitoring station was slightly below the historical average throughout the winter (October–March) and remained well below average during the spring freshet (May and June), as well as the remainder of the summer and early fall. During this time, flows ranged from 58 percent (%) (September) to 82% (April) of the 1973-2009 normal. This observation may be in response to the low precipitation, as the precipitation during the 2011 hydrological year was less than average during most months, except January, May, and July. The low precipitation throughout most of the winter may have contributed to a smaller snowpack and a reduced spring freshet. Low summer and early fall precipitation may have also contributed to lower than normal flows during these periods.

- Precipitation during the 2012 hydrological year (Oct 2011 to Sep 2012) fluctuated around the 1981-2010 historical average, except in October and February when it was less than 50% of historical average, and in March and April when the precipitation was higher than twice the historical average. The discharge in the first half of the hydrological year did not correspond to the precipitation

- Precipitation during the 2013 hydrological year (Oct 2012-Sep 2013) was generally below the 1981-2010 historical average, except in April. This precipitation pattern contributed to a lower flow in the study area throughout the hydrological year of 2013, except between Oct to Dec 2012. The additional precipitation that was seen in April did not translate into higher river flows.

- During the late fall and winter of the 2014 hydrological year (Oct 2013-Mar 2014), the discharge at the Wheeler River monitoring station was well below normal. This did not correspond to the precipitation level, as the cumulative precipitation during this period of time was slightly higher than 1981-2010 historical normal, and in January 2014, snow fall was more than two times normal. Flows in the spring (April-May 2014) increased to almost the historical normal discharge, which may be a result from the May precipitation, which was 1.5 times compared to the historical average. It was a dry summer and early fall in the 2014 hydrological year; in contrast, the discharge in June and July 2014 surpassed the historical average, while it fell below average in the following two months.

- During the 2015 hydrological year, discharge was consistently less than the historical average. Peak discharge in May was 15.4 m^3/s, 30% below the historical average. Flows remained more than 30% below average during June to September. This flow pattern may be because the precipitation was near or below historical average in most months of this hydrological year. The snowfall in March exceeded the historical average by 130%, which may be the reason for increased discharge in April, despite low precipitation in that month. In July and September 2015, the precipitation was 40% and 23% above historical average, respectively; however, no increase in discharge was observed.

- Precipitation in the 2016 hydrological year (Oct 2015-Sep 2016) fluctuated around the 1981-2010 historical average from October to March, with the cumulative precipitation 15% above the historical average. In response, the late fall 2015 to winter 2016 discharge was below historical level, and the freshet-dominant flow in May 2016 increased to near the historical level, despite the precipitation was only 13% of the historical normal. Heavy rainfalls were observed at the monitoring station in June and July 2016, which could have been the reason for increased discharge from June to September to near or above the historical average.

- During the first quarter of 2017 hydrological year, the flow was above the 1981-2010 historical average, likely in response to the high amount of precipitation in the summer of 2016 and the above-historical-average rainfall in early fall 2016. The precipitation was all higher than average in the next quarter. However, the discharge data were not available from the hydrometric station in this period of time. From May to September, the monthly discharge rates in Wheeler River were all slightly above the historical average, despite the precipitation in the summer was lower than the historical average.

- During the first six months of the 2018 hydrological year, discharge in the Wheeler River was slightly above the historical average level, possibly corresponds to the high precipitation in the first quarter 2018 (50% above the historical average). From April through June, the discharge rate was similar to the historical average level, and slightly above average between July and September.

- During the 2019 hydrological year, despite the low precipitation in the first six months, the Wheeler River discharge was slightly above the historical average. The river discharge slowly decreased during the winter months, similar to the temporal trend in previous years. The discharge started to increase in May during the spring freshet and reached a peak of 24.9 m^3/s in September. The increased discharge over the summer and early fall corresponded to the high precipitation in June and August, which was more than 1.5 and 2 times, respectively, compared to the historical average.

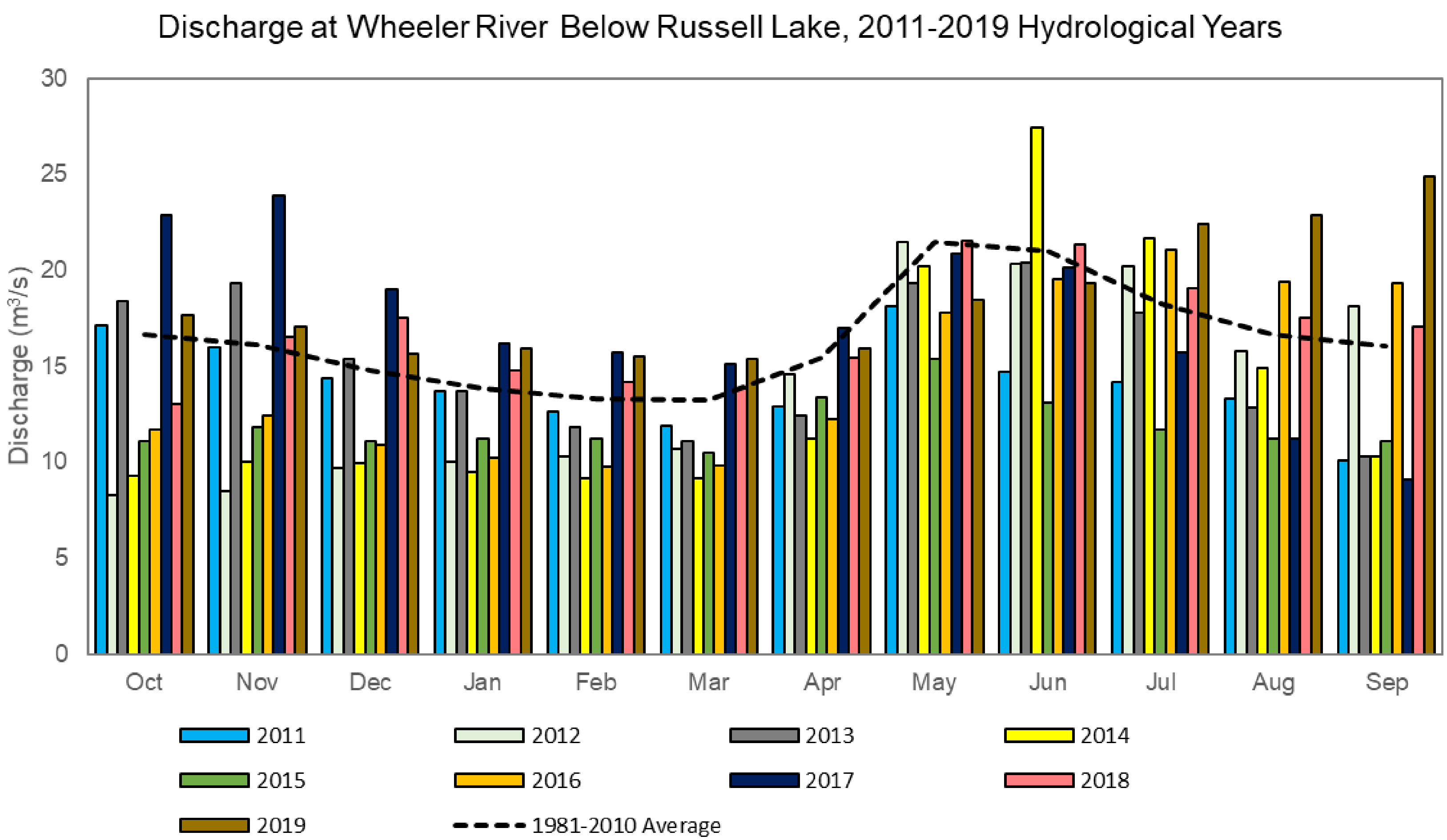

Figure 1-3: Wheeler River mean monthly discharge for the hydrological years between 2011 and 2019. (WSC 2019a, b).

1.4 Local Hydrology

As indicated above, the Project site lies within the Wheeler River watershed. Surface water from the Project area is drained by two sub-basins of the Wheeler River, the Icelander River drainage and the Williams Lake drainage (**Figure 1-4**). Both drainages flow generally south into the northwest portion of Russell Lake. The estimated drainage areas of the Icelander River drainage and the Williams Lake drainage are 371 km^2 and 78 km^2, respectively (**Appendix D**). Downstream of Russell Lake, the Wheeler River flows into the Geikie River which subsequently discharges to Wollaston Lake.

Hydrological information has been collected at the site by Denison since 2011. Details associated with the hydrological baseline program are described in **Section 3.0**.

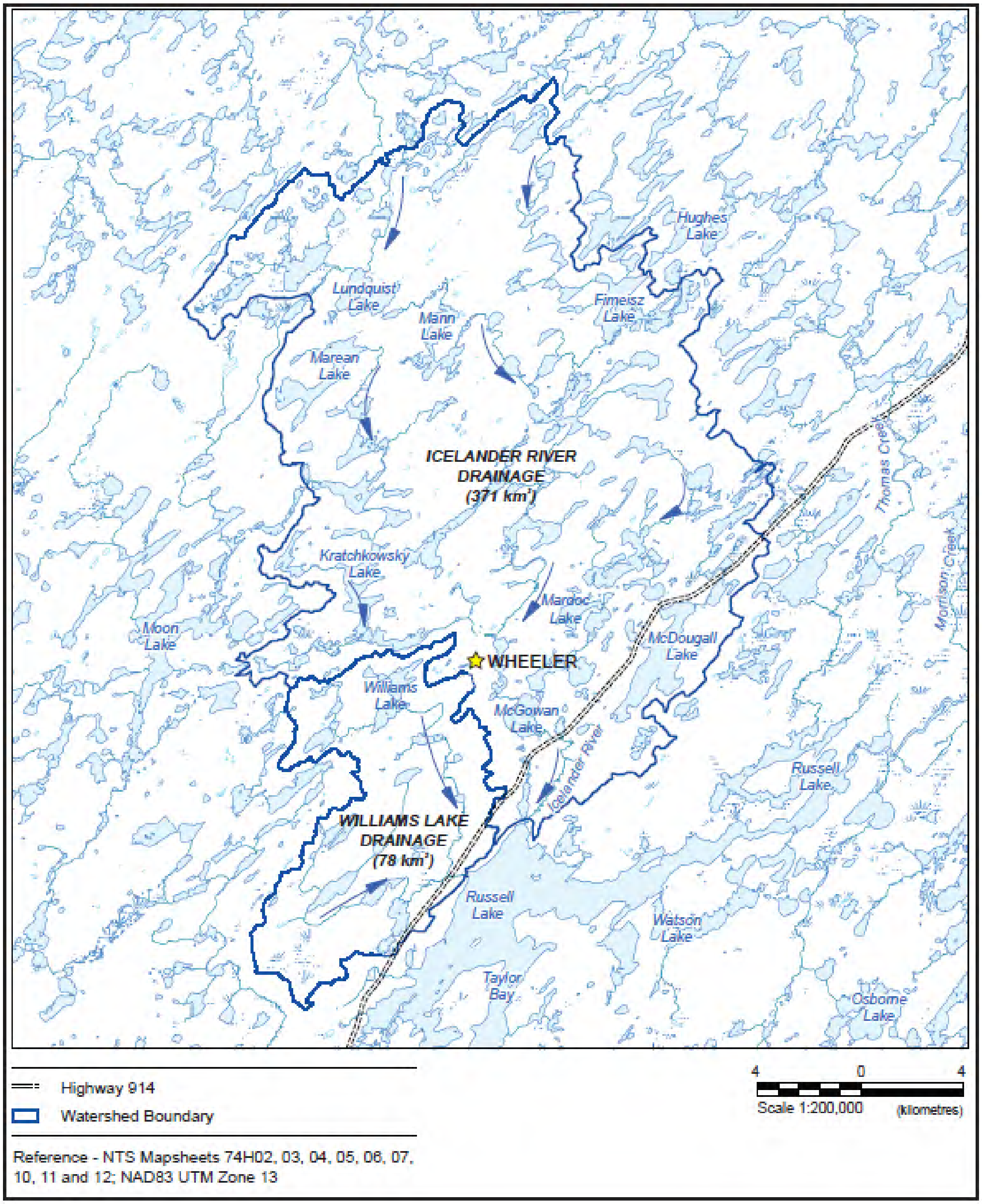

Figure 1-4: Overview of the local drainage areas, Wheeler River Project.

2.0 SCOPE OF THE HYDROLOGY BASELINE PROGRAM

Hydrology monitoring surveys were undertaken at the Project site between 2011 and 2014. The report associated with these efforts is provided as Appendix D of this current report (Golder, 2014). The data associated with the hydrological surveys completed at that time have been integrated with the data collected by EcoMetrix between 2016 and 2019 to provide a characterization of existing hydrologic conditions on the Project site over the entire period of record.

The Hydrology survey that was completed between 2016 and 2019 is described below. Other aquatic work completed between 2016 and 2019, including bathymetry, aquatic habitat characterization, stream morphology identification, etc., is provided in EcoMetrix (2020). The scope of the 2016 to 2019 hydrology program included: the measurement of water level elevations at thirteen lakes and two ponds within the study area; the collection of manual streamflow measurements at seventeen watercourses to validate existing rating curves or to establish rating curves for new monitoring locations; and, the installation of continuous streamflow monitoring equipment at eight stream locations and two lake locations in 2018. Four field programs were completed from fall 2016 to summer 2018 to capture seasonal flow conditions in spring, summer and fall. One additional winter field program was completed between March 15 and 19, 2018, to assess ice cover in the area and to gain a better understanding of winter baseflow conditions.

All monitoring activities that have been completed to date for which results are presented in this baseline study report are presented in **Table 2-1.** Corresponding monitoring locations in both streams and lakes are shown in **Figure 2-1**.

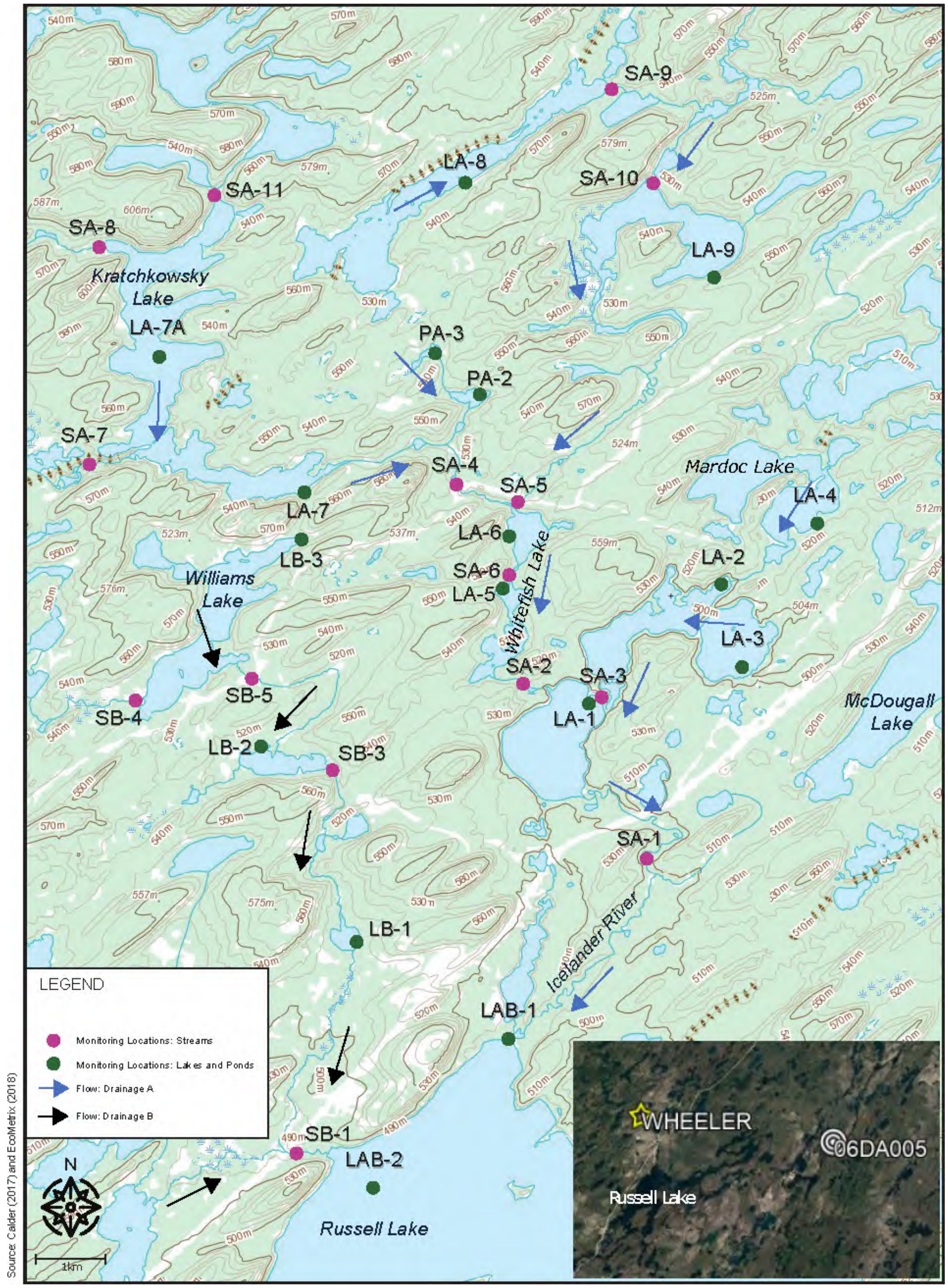

Figure 2-1: Hydrometric Monitoring Locations at Wheeler River Drainage. The location of the WSC hydrometric station 06DA005 downstream of Russell Lake is shown in the inset. Note: LA-5 and LA-6 are recognized as one waterbody (Whitefish Lake) by a local resident.

Table 2-1: Hydrology monitoring stations and monitoring activities

Station Name	Location (UTM NAD 83)	Instantaneous Discharge Measurements	Continuous Water Level Recording	Staff Gauge	Elevation Survey
Lake Level Monitoring Sites					
McGowan Lake (LA-1)	13 V 479399 6373215	-	-2019	2011, 2012, 2013	2011, 2012, 2013, 2014, 2016, 2018, 2019
LA-2	13 V 480852 6375164	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014, 2016
LA-3	13 V 481477 6373989	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014, 2016
Mardoc Lake (LA-4)	13 V 481989 6376180	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014, 2016
Whitefish Lake (LA-5)	13 V 477830 6374521	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014, 2016
Whitefish Lake (LA-6)	13 V 477763 6375274	-		2011, 2012, 2013	2011, 2012, 2013, 2014, 2016, 2018, 2019
Kratchkowsky Lake (LA-7)	13 V 474851 6375402	-	2012, 2013	2011, 2012, 2013	2011, 2012, 2013, 2014, 2016, 2017
LA-8	13 V 476253 6379929		-	-	2016, 2017
LA-9	13 V 479732 6379231		-	-	2016, 2017
PA-2	13 V 477082 6377227		-	-	2016
PA-3	13 V 476460 6377650		-	-	2016
LAB-1	13 V 478705 6368323	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014, 2016
LB-1	13 V 476598 6369377	-	-	2011, 2012, 2013	2011, 2012, 2013, 2016
LB-2	13 V 474882 6371871	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014, 2016
Williams Lake (LB-3)	13 V 474925 6374767	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014, 2016

Station Name	Location (UTM NAD 83)	Instantaneous Discharge Measurements	Continuous Water Level Recording	Staff Gauge	Elevation Survey
Stream Discharge Monitoring Sites					
SA-1	13 V 480368 6371123	2011, 2012, 2013, 2014, 2016, 2017, 2018, 2019	2011, 2012, 2013, 2014, 2016, 2017, 2018, 2019	-	2011, 2012, 2013, 2014, 2016, 2017, 2018, 2019
SA-2	13 V 478524 6373216	2011, 2012, 2013, 2014, 2016, 2019	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014, 2016, 2019
SA-3	13 V 479415 6373234	2011, 2012, 2013, 2014, 2016, 2019	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014, 2016, 2019
Kratchowsky Creek Outlet (RC-1)	13 V 475468 6375987	2016, 2018, 2019	-		2016, 2019
SA-4	13V 476926 6375868	2011, 2012, 2013, 2014, 2016, 2017, 2018, 2019	2012, 2013, 2014, 2016, 2017, 2018, 2019	-	2011, 2012, 2013, 2014, 2016, 2017, 2018, 2019
SA-5	13 V 477804 6375716	2011, 2012, 2013, 2014	2012, 2013, 2014, 2019	-	2011, 2012, 2013, 2014
	13 V 477822 6375737	2016, 2017, 2018, 2019	2016, 2017, 2018, 2019		2016, 2017, 2018, 2019
SA-6	13 V 477861 6374749	2011, 2012, 2013, 2014	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014
	13 V 477863 6374742	2016, 2017, 2018, 2019	2016, 2017, 2018, 2019	-	2016, 2017, 2018, 2019
SA-7	Not recorded	2016	-	-	-
SA-8	13 V 471579 6378303	2016, 2017, 2018	2016, 2017, 2018, 2019	-	2016, 2017, 2018
	13V 471542 6378314	2019	2019	-	2019
SA-9	13 V 478226 6381589	2016, 2017, 2019	2016, 2017, 2018, 2019	-	2016, 2017, 2019
SA-10	13 V 479003 6380421	2016, 2017, 2019	2016, 2017, 2018, 2019	-	2016, 2017, 2019
SA-11	13 V 473026 6379260	2016, 2017, 2019	2016, 2017, 2018, 2019	-	2016, 2017, 2018, 2019
SB-1	13 V 476041 6366362	2011, 2012, 2013, 2014, 2016	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014, 2016
SB-3	13 V 475866 6371655	2011, 2012, 2013, 2014, 2016	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014, 2016
SB-4	13 V 472952 6372222	2011, 2012, 2013, 2014, 2016	2012, 2013, 2014	-	2011, 2012, 2013, 2014, 2016
SB-5	13 V 474615 6372695	2016	-	-	2016

2.1 2016 to 2019 Water Elevation Surveys

Water elevation surveys were undertaken between September 09 and 22, 2016; May 30 and June 1, 2017; March 15 and 18, 2018; June 29 and July 3, 2018, July 4 and 6, 2019 and August 28 and September 1, 2019. Where possible, water elevations at previously established stations were referenced to geodetic benchmarks established by Golder. A description of how the geodetic elevations and benchmarks were established is described in **Appendix D**.

New locations (Lake and pond stations: LA-8, LA-9, PA-2 and PA-3; Stream stations: SA-8, SA-9, SA-10, SA-11, and SB-5) were referenced to temporary benchmarks, each with an assumed elevation of 100 masl, and subsequently converted to geodetic elevations using new benchmarks established in May 2017. The survey results of the all benchmarks used for this project are presented in **Appendix A.**

2.2 2016 to 2019 Instantaneous Flow Measurements

Between 2016 and 2019, streamflow measurements were taken at seventeen locations within the study area using the mid-section method detailed in in **Appendix E** and **Appendix F**. The mid-section method involves measuring the channel area and water velocities of a stream at a cross section. The channel is divided into a number of vertical subsections, adequate to characterize the irregular geometry of the channel. The depth and average velocity are measured at each subsection and are applied to a sub-area whose width extends half way to the preceding and following observation points. The area of each subsection is determined by directly measuring width and depth. The average water velocity in each sub-section is estimated using the measured velocity at selected locations in the vertical. The total discharge within the stream is the sum of the individual subsection discharges.

2.3 2016 to 2019 Continuous Water Level Recording

Eight temporary streamflow monitoring stations (SA-1, SA-4, SA-5, SA-6, SA-8, SA-9, SA-10, and SA-11) were installed in the fall of 2016. The streamflow monitoring stations were established to obtain information on local watercourse flow characteristics. The location of each flow station is presented in **Table 2-1**.

The Solinst Level data logger instrumentation measures absolute pressure, and therefore compensation is required for atmospheric pressure fluctuations. Barometric pressure compensation is achieved using an additional device (e.g., Barologger) to measure barometric pressure. A barologger was installed and deployed adjacent the SA-4 station.

The data collected from the barologger were used to apply barometric pressure compensation to data collected from the Solinst Level data logger instrumentation.

Level data loggers were installed by Golder in 2013 and left in place at SA-1, SA-6, SB-1, and SB-4. In the fall of 2016, level data loggers were located and retrieved at SB-1 and SA-6; however, no level data loggers were not found at SB-4 and SA-1. The logger at SA-6 was redeployed at the same location, and the logger at SB-1 was redeployed at SA-1. As no instantaneous stream data was recorded between April 2014 to September 2016 to validate the continuous flow measurement, the level data logger data collected during this time period was not presented in this report.

Recorded data from the level data loggers deployed in the fall of 2016 at streams SA-1, SA-4, SA-5, SA-6, SA-8, SA-9, SA10, SA-11 and the site barologger at SA-4 were retrieved in the spring of 2017, and all level data loggers were re-deployed after data downloading. Data were downloaded again in the summer of 2018 and 2019. Most level data loggers were re-deployed, except the logger at SA-6, which was replaced in 2019 due to battery life, and the logger at SA-8 that was moved upstream to mitigate influence of backwater from the Kratchowsky Lake In July 2018, level data loggers were installed in McGowan Lake (LA-1) and Whitefish Lake (LA-6). In early October 2018, the level data logger was dislodged from McGowan Lake by ice, and hence was removed. The logger was re-installed to LA-1 in August 2019. The level data logger installed in LA-6 was not located during the 2019 survey.

Barometric compensation for the 2016 to 2019 field program was completed using the barologger at SA-4, with any gaps filled using transformed data from the Key Lake Climate Station (Climate ID = 4063757) at 57°15'23.000" N, 105°37'03.000" W. The Key Lake Climate Station has an hourly barometric pressure record. The data were linearly interpolated to 15-minute intervals to develop the barometric compensation for the level data logger data.

2.4 Rating Curve Development and Validation

Rating curves are used to transform results from level data loggers installed in water courses to discharge rates. Golder (2014) presented rating curves for the stream stations SA-1, SA-2, SA-3, SA-4, SA-5, SA-6, SB-1, SB-3, and SB-4, and the lake stations McGowan Lake (LA-1), LA-2, Whitefish Lake (LA-5, LA-6), Kratchkowsky Lake (LA-7) and LB-2. The manual flow measurements taken as part of the 2016 to 2019 field program were graphed along with Golder's measurements and rating curves were reviewed for suitability for use with the new installations. For lake stations, discharge at the outlet stream was used to correlate to the water elevation. In 2019, the monitored stream discharge was greater at a few locations within the Icelander River Drainage (Appendix B), and therefore, rating curves were adjusted accordingly. Rating curves are presented for each hydrometric station within the Icelander River Drainage in **Appendix C**.

Based on the data, manual measurements at SA-1, SA-2, SA-3, SA-4, and SA-6 between 2011 and 2019 appear to fit within stage-discharge relationships, despite a few outliers (shown in **Appendix C**). In 2016, the SA-5 hydrometric station was installed upstream of the 2011-2014 monitoring location, with similar channel width and gradient. The rating curve for SA-5 was shifted upstream based on the five manual flow measurements taken between 2016 and 2019 (**Appendix C**).

Stage-discharge curves established by Golder (2014, **Appendix D**) were validated or adjusted incorporating the most recent monitoring data. The curves were used to process hydrographs to reflect discharge at stream stations within each open water season. As the emphasis of this report is on the long-term discharge of streams, all flow rates were averaged for each day of monitoring and presented in **Appendix C**.

For stream stations SA-8, SA-9, and SA-10, the manual flow measurements obtained to date were not sufficient to develop a reliable rating curve for conversion from level to flow, as more high/low extreme flow conditions needed to be captured to reduce uncertainty. For these flow stations, water elevation results are presented in **Appendix C**. A preliminary stage-discharge relationship was developed at SA-11.

2.5 2018 Measurement of Ice Thickness

Ice thickness in McGowan Lake (LA-1), Whitefish Lake (LA-6) and Kratchkowsky Lake (LA-7) was measured between March 15 and 18, 2018, at the deepest point of the lake. An ice auger was used to drill through the ice and thickness was measured using a measuring tape.

3.0 EXISTING HYDROLOGICAL CONDITIONS

A description of existing hydrological conditions at the Project site in consideration of all baseline data collected to date is provided below. For the stream monitoring stations this includes consideration of the stream monitoring locations, stream discharge data, the relationship of local (measured) to regional hydrology for select locations and the effects of ice on local stream flows. For lake monitoring locations, this includes lake elevations and ice cover.

3.1 Streams

3.1.1 Stream Monitoring Locations

The following presents a discussion of the physical features and monitoring characteristics observed at each site.

3.1.1.1 Icelander River Drainage

SA-1

SA-1 is located close to the outlet of Icelander River drainage area at Russell Lake. It is the most downstream monitoring station in Icelander River drainage area with an estimated upstream area of approximately 371 km^2. The monitoring station is located at the transition between an upstream low gradient meandering channel section and a downstream higher gradient riffle channel section. The stream substrate is comprised of boulders, cobble, gravel, and sand, and is approximately 15 m wide at the cross-section. Although the banks are well defined and stable with shrubs and moss, the left bank has a notable floodplain vegetated with shrubs and black spruce. SA-1 has a good cross-section and monitoring station. The station is in a low gradient section immediately upstream of a high gradient section. SA-1 produces a good stage- discharge relationship and accurate hydrograph. The logger left by Golder in 2014 was not located in the 2016 site visit, and was presumed to be lost. The level data logger retrieved from SB-1 was installed in this station. A level data logger is currently in place at SA-1.

SA-2

Streamflow monitoring station SA-2 flows into the northwest end of McGowan Lake. The monitoring station at SA-2 is located several meters downstream of the transition between an upstream meandering channel and a downstream riffle section. The monitoring site has a cross-section width of approximately 11 m, and is relatively shallow with high velocity flow. The stream is generally steep with vertical banks and high velocities. The substrate of SA-2 is primarily composed of boulders and cobble, with well-defined and stable vertical banks vegetated with shrubs and trees. SA-2 produces a fair stage-discharge relationship as shown in Appendix C. The two outliers correspond to 2016 and July 2019 measurements that were taken in a different stream cross section. The rest of the measurements fit well to the established stage-discharge relationship. No continuous flow monitoring has been conducted at SA-2 since 2014.

SA-3

Streamflow monitoring station SA-3 flows from LA-2 to McGowan Lake (LA-1). The entire stream length has a sandy and silty bottom with well-defined vertical banks vegetated with shrubs, willows and jack pine. The monitoring station is located near the middle of the stream length and has a cross-sectional width of approximately 11 m. SA-3 produces a good stage-discharge relationship and therefore relatively accurate hydrograph. Due to the proximity to LA-1, flow/water levels at this station are believed to be affected by the water level at the lake, especially during the high flow conditions in 2019. No logger was installed at this location in monitoring program since 2014.

SA-4

The stream discharge monitoring station SA-4 drains Kratchkowsky Lake, and is to the east of SA-5 and flows into the northwest end of LA-6. The monitoring site is located upstream of the existing temporary bridge and a fast flowing and narrow channel section. The channel has a cross-section width of approximately 6 m. The channel substrate is composed of large angular cobble and boulders. SA-4 produces a good stage-discharge relationship, and hence an accurate hydrograph. A level data logger and a barologger are currently in place at SA-4.

SA-5

Station SA-5 is to the east of SA-4 and flows into the northwest end of LA-6. The monitoring station originally established by Golder was located downstream of a small temporary bridge in a straight and relatively steep section of the stream. The new flow station established in 2016 by EcoMetrix is in a similar location slightly upstream of the Golder station. The substrate at the cross-section is primarily boulders and small cobble overlain sand. The stream has a width of approximately 8 m and has stable vertical organic banks vegetated with shrubs. The new continuous flow station was installed on a straight run downstream of the removed bridge crossing in 2016. The level data logger is still in place, and the level data have been retrieved annually to monitor continuous flow conditions. Manual stream measurements at SA-5 have yielded a reasonable stage-discharge relationship.

SA-6

Streamflow monitoring Station SA-6 is in the channel that drains from LA-6 and is upstream of LA-5. It is recognized by local resident as a narrow connecting LA-5 and LA-6 (the south and north basins of Whitefish Lake), rather than a stream. It is a wide sandy-bottomed stream with vertical banks. Flow in this stream is deep and slow. Although the right bank is well defined, high, and vegetated with trees, sand, and moss, the left bank is low lying with muskeg, shrubs and black spruce. The continuous monitoring station was installed approximately halfway between LA-6 and LA-5 and is currently active. The cross-section has a width of approximately 14 m. Manual stream measurements at SA-6 have yielded a fair stage-discharge relationship. The level data logger was replaced in 2019 due to battery life.

SA-7

SA-7 is a narrow marshy stream that flows into Kratchkowsky Lake. The stream channel has vertical, undercut banks. Flow in the stream is slow and deep. The gradient at the location is low and it is within the backwater area associated with the lake inlet and therefore water elevations there are influenced by the lake. SA-7 was originally identified for continuous water level monitoring. However, considering the flow condition, no logger was installed at this location. Elevation benchmark was not established, and instantaneous flow was monitored only once in September 2016. This station was replaced by SA-11.

SA-8

Streamflow station SA-8 is located in an inlet channel at the northwestern end of Kratchkowsky Lake. It is a meandering, narrow sandy bottom stream with deep banks. Some areas of the bank are undercut. The continuous monitoring station was installed in a relatively straight, faster flowing section of the channel immediately upstream of the lake in September 2016. In 2019, it was noted that this station is subject to backwater effects owing to its proximity to the lake, and therefore the station was moved upstream (**Appendix F**). A rating curve has yet to be established for this station – more manual measurements that include high and low flow events are needed to establish a reliable elevation-discharge relationship.

SA-9

SA-9 was initially located at the outlet of LA-8 that is accessible by an existing ATV trail. The stream channel in this section is shallow and relatively narrow. The stream substrate is comprised mainly of sand, gravel, and cobble. The monitoring station was located in a pool upstream of the road crossing. Stream banks are shallow and the surrounding land is relatively flat. The area has recently been impacted by a forest fire, so this station is at greater risk of trees/debris falling into the channel and impacting existing flow characteristics. Although level data logger data has been available since September 2016, the stage and discharge data collected from this site are not yet sufficient to establish a reliable rating curve.

SA-10

SA-10 is located in a wide sandy bottom stream channel that flows into the northwest part of LA-9. The stream banks are vertical and the water is deep and slow-moving. The continuous monitoring station was located in a relatively straight section of the channel with wadable depths in 2016, at the time of installation. More stage and discharge data are required to establish a reliable rating curve.

SA-11

SA-11 is located at the northern-most inlet to Kratchkowsky Lake, and serves as a replacement station for SA-7. The stream substrate is comprised primarily of gravel and cobbles. The stream channel here is braided, though the monitoring station was located in an unbraided section immediately upstream of the lake. A level data logger was installed in September 2016, and is still recording continuous water level data. A preliminary stage and discharge relationship was developed in 2019 (**Appendix E**).

RC-1

Stream station RC-1 is situated immediately downstream of Kratchkowsky Lake. The stream banks were stable and the channel was meandering. The canopy was mostly dense with some partly open areas. Instream cover was diverse, afforded by boulders, deep pools, aquatic macrophytes, logs and trees, and undercut banks. Substrates were comprised of cobble, boulder, gravel and sand. Aquatic vegetation included sedges and burreed. Slight algae growth and sediment were observed overlying the substrate. This station encompasses the stream reach in the vicinity of the proposed mine road crossing. Discharge measurements have been recorded, but no level data logger has been installed at this location.

3.1.1.2 Williams Lake Drainage

SB-1

SB-1 is located close to the outlet of the Williams Lake drainage at Russell Lake. The monitoring station is located immediately upstream of the culverts at the McArthur River haul road. The stream in this area is marshy with a thick organic base. The stream bottom in the immediate vicinity of the monitoring station has been altered as result of the road crossing and consists sand, gravel and boulders. Signs of beaver activity were observed both upstream and downstream of the monitoring location during work completed in 2016-2018. The rating curve associated with SB-1 shows a relatively weak stage-discharge relationship, likely the result of stream morphology at this location. The level data logger installed in 2014 was retrieved from this location in 2016, and no continuous flow monitoring has been conducted since then.

SB-3

SB-3 is located in the outlet channel of LB-2. The stream substrate is comprised of organics, sand, cobbles and boulders. The banks are nearly vertical with moss and shrubs, and the width is approximately 3 m. Manual stream measurements at SB-3 have yielded a good stage-discharge relationship. Continuous flow monitoring was conducted between 2011 and 2014.

SB-4

SB-4 is located in an inlet channel of Williams Lake. The stream banks are shallow and poorly defined. The bottom of the stream consists of large angular cobbles and boulders. At the Golder continuous flow station, the width of the stream was approximately 5 m. Manual stream measurements at SB-4 have yielded a fair stage-discharge relationship and hydrograph between 2012 and 2014, according to Golder (2014). It is to EcoMetrix' understanding that continuous monitoring equipment was left at this location; however, the logger was not found and was assumed to be lost. No level data logger was installed at SB-4 since 2016.

SB-5

SB-5 is located at the outlet of Williams Lake. The stream substrate is composed of sand, gravel and cobbles. Gauging was conducted in a relatively straight section of the channel downstream of the camp road crossing and upstream of a low gradient pool and braid. SB-5 is accessible by road. No level data logger was installed at SB-5.

3.1.2 Stream Stage and Discharge

Stage and discharge measurements made between 2016 and 2019 were compiled in combination with results from 2011-2014 as appropriate and are presented in **Appendix B**. Detailed information associated with the monitoring completed between 2016 and 2019 that was largely focused in the Icelander River drainage, including station maps, updated flow and elevation measurements and rating curves (if established or updated), continuous flow measurements (if applicable); and, photographic records are provided in **Appendix C**.

The average monthly discharge from stream stations during the open water season in 2011, 2012, 2013, 2017, 2018 and 2019 are presented in **Figure 3-1**. It is apparent from the graph that the intra-annual flow pattern at each stream station is consistent with the flow pattern at the Wheeler River station. Stream discharge is highest during the freshet, with flows decreasing throughout the summer and into the fall and winter baseflow periods. Comments concerning flows measured in each monitoring year are provided below.

In 2011, the highest observed flows were in the spring during level data logger installation by Golder (2014). The spring peak flow rate was likely not captured at any site. The flow receded throughout May and June. At all sites a secondary peak was observed during July and early August, which corresponds to relatively high rainfall, although the monthly mean discharges were still lower than May. Flows receded again until September and remained static for the balance of the monitoring season.

The stream flows were considerably higher in 2012 monitoring season than those observed in 2011, especially in Stream SA-1. The spring peak discharge rate, which occurred shortly after the first discharge measurement, was approximately captured at all sites. Discharge peaked in mid-May, and remained high till August, responsive to the increasing precipitation in June and July. At SA-1, peak flow in July exceeded the spring peak flow rate. At most sites, flow rates reached seasonal lows in late August before rising again during September and October, and stayed at the level lower than the discharges measured in spring.

In 2013, discharge peaked in late June instead of May in earlier years, and steadily receded after the peak, until moderate runoff responses occurred in late August and early September. Flows receded to seasonal lows in late September and remain static till end of the open water season.

Although level data logger data was retrieved from SB-1 and SA-6 in 2014 and 2015, no instantaneous flow data were available during this time period to validate the logger data. Therefore, no hydrograph or monthly mean flow data are presented between winter 2014 to fall 2016.

In fall 2016, the discharge level exceeded previously reported spring peak in most streams, possibly in response to the high precipitation in summer and fall 2016, which exceeded the precipitation level during the spring.

In 2017, spring peaks occurred in mid-May, and they were approximately captured. At most sites, flows receded in the summer and reach the seasonal low in Mid-September. In late October, flows have recovered to almost the similar level as measured in the spring, likely due to the precipitation level that was higher than normal.

In 2018, spring peak flows occurred in Mid-May, and the discharge at most stations remained relatively high till early July, when discharge decreased at most of the stations, and increased again in mid- to late July. Discharge level at most stations receded in August till end of the open water season, corresponding to lower precipitation during these months.

To date, the level data logger data were collected till the end of August, 2019. There was no apparent spring peak, likely because of the low precipitation over the winter. Flow receded slightly in Late May and early June, and increased to its seasonal high flow in late June to early July, likely corresponds to high precipitation in late June.

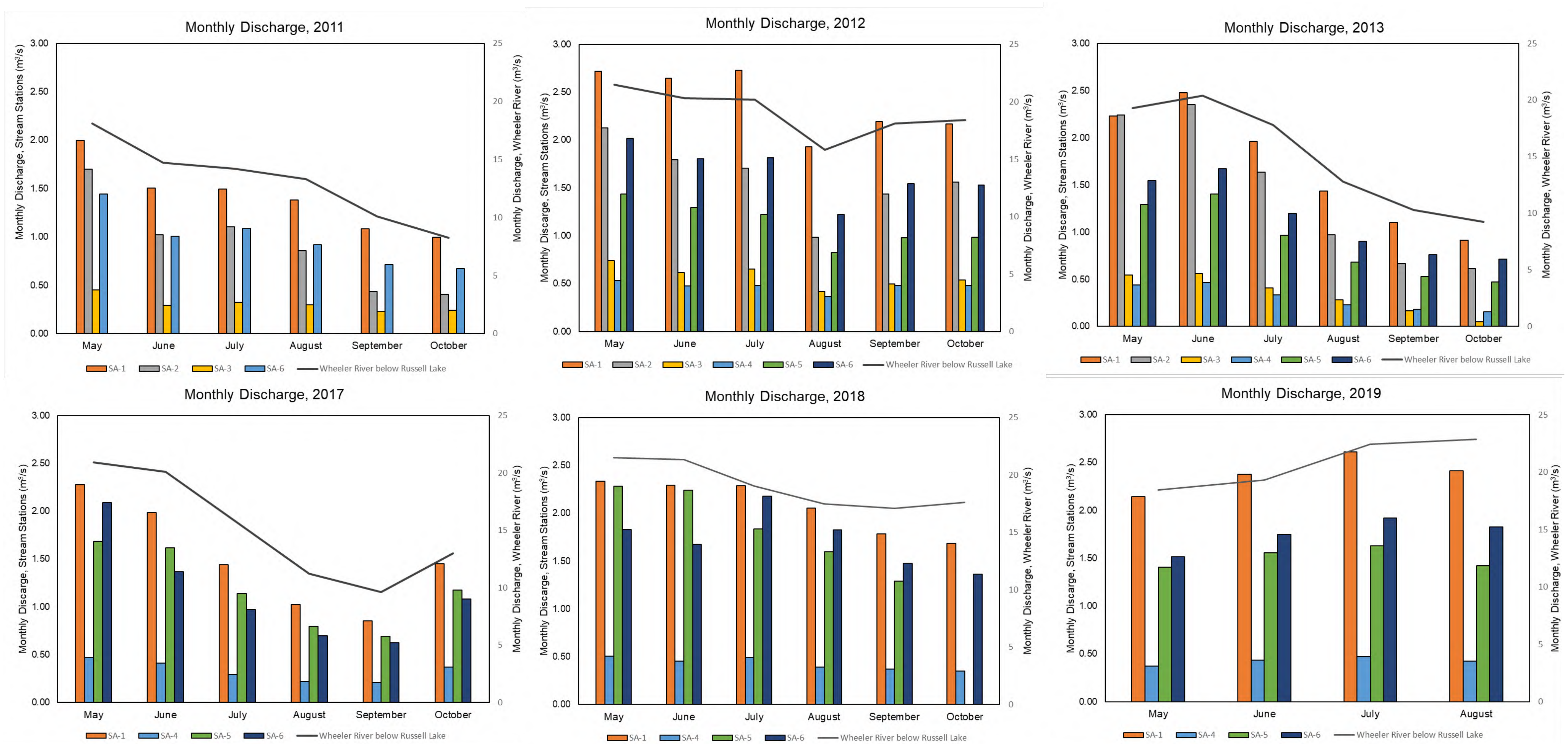

Figure 3-1: Monthly mean discharge at stream stations in the Wheeler River drainage area where level data logger was installed. A Canada Hydrometric Station is installed at Wheeler River downstream of Russell Lake (06DA005). Note: 1) Early ice-up was observed in SA-5 in October 2018, and therefore, the discharge in SA-5 was not plotted for this month; 2) Continuous discharge monitoring was updated to the last field trip in August 28-September 1, 2019.

3.1.3 Relationship to Regional Hydrology

Although the drainage area of the Water Survey of Canada (WSC, 2018a and 2018b) hydrometric station on the Wheeler River (3,030 km^2) is much larger than the drainage area associated with the site (371 km^2), these drainage areas are similar in terms of climate and geography. As shown in **Figure 3-1**, the flow patterns of at least a few stream stations are consistent with the flow pattern of the Wheeler River station at the WSC hydrometric station 06DA005. Therefore, a scaled relationship between flows at the WSC station 06DA005 and the project area could be established to project flows at the project area.

Golder (2014) provided examples of relationships between discharge for a subset of survey stations (SA-1, SB-3, SB-1) and WSC station 06DA005 using data measured between 2011 to 2013 (**Appendix D**). Such relationships can be developed for specific survey locations in the project area for the purpose of hindcasting and/or forecasting flows or developing site-specific flow statistics to support future project work, such as waste assimilative capacity assessments to support licensing. In this application, the flow data associated with WSC station 06DA005 and can be used to derive a watershed area adjusted low flow condition (7Q20) to assess the potential influence of mine site drainage on local receiving waters.

3.1.4 Effect of ice formation on discharge ratings

The formation of ice in stream channels affects stream flow and its measurement. Surface ice for example, changes streamflow from open-channel flow (i.e., flow having a free surface) to closed-conduit flow (i.e., flow not having a free surface). Under surface ice frictional resistance is increased because a water-ice interface replaces the water-air interface, hydraulic radius is decreased because of the additional wetted perimeter of the ice, and the cross-sectional area is decreased to a degree by the thickness of the ice (Rantz, 1982). As a result, the stream stage will therefore increase for a given discharge as the formation of surface ice causes a backwater effect. In these instances, an existing stage-discharge relationship that has been developed based on information collected in the ice-free season may not accurately represent winter flow conditions.

Rantz, (1982) describe three methods by which it is possible to compensate open-water discharge for ice effects. One such method is the discharge-ratio method whereby the open-water daily discharge is multiplied by a variable factor (K) to give the corrected discharge during periods of ice cover. The variable factor K, which varies from 0 to 1, is derived as the ratio of observed ice-covered discharge to the open-water rated discharge corresponding to the observed stage - K therefore varies with time and is a specific to each time a winter flow measurement is collected at each sampling location. The greater the ice cover the lower the K value. Golder (2014) calculated K for various stream survey locations in the project area in March 2014. These K values ranged from 0.3 to 0.8.

3.2 Lakes

3.2.1 Lake Elevation Measurements

The stages of McGowan Lake (LA-1), LA-2, LA-3, Mardoc Lake (LA-4), Whitefish Lake (LA-5 and LA-6), Kratchkowsky Lake (LA-7), LAB-1, LB-1, LB-2, and Williams Lake were measured during each site visit from 2011 to 2014, and in fall 2016. The compiled data are presented in **Appendix B, Table B-2**. In 2016, new survey stations were established at LA-8, LA-9, PA-2, and PA-3. The elevations of McGowan Lake and LA-6 were surveyed in 2018 and 2019. A summary of geodetic water level observed in all site visit are presented in **Table 3-1**. The difference between the minimum and maximum water levels were typically on the order of 0.4 m.

Table 3-1: Lake Water Level Summary during open water conditions, 2011-2019

Station	Minimum Measured Water Level (masl)	Maximum Measured Water Level (masl)
McGowan Lake (LA-1)	494.194	494.515
LA-2	494.467	494.654
LA-3	494.439	494.649
Mardoc Lake (LA-4)	498.507	498.649
LA-5	499.949	500.076
LA-6	499.943	500.118
Kratchkowsky Lake (LA-7)	520.424	520.536
LA-8	520.8	520.86
LA-9	514.25	514.28
LB-1	503.66	504.079
LB-2	510.392	510.573
Williams Lake (LB-3)	518.356	518.58
LAB-1	487.994	488.382
PA2	510.46	510.46
PA3	510.36	510.36

Based on the Wheeler River Project Provincial Technical Proposal and Federal Project Description, the anticipated mine water discharge location is the north basin of Whitefish Lake (LA-6;Denison, 2019). LA-6 drains through SA-6 to LA-5 as the only outlet, and as indictive above the stream reach represented by SA-6 is considered as a lake narrowing connecting two basins of Whitefish Lake (LA-5 and LA-6) by a local resident. The elevation of SA-6 correlates well with LA-6 (Appendix C, Appendix F) and therefore, level data logger installed in SA-6 is sufficient to represent the continuous discharge from LA-6.

The stage-discharge relationship established by Golder (2014) for McGowan Lake was validated with data collected in 2016 to 2019 (Appendix C), where discharge in SA-1 was measured to represent the discharge at McGowan Lake. This relationship can be used to calculate continuous discharge at LA-1 using the level data logger installed in August 2019.

3.2.2 Ice Thickness Measurements

Ice thickness has been measured at Project site lakes in March/April 2014 and again in March of 2018. This time of the year would generally be considered to be the period of maximum ice development, though year-to-year variability would be expected.

In 2014, ice thickness on study areas lakes was in the range of 0.70 m to 0.97 m with an average thickness of 0.83 m. Ice thickness values measured for McGowan Lake, LA-6, and Kratchkowsky Lake in March 2018 were 0.70, 0.71, and 0.70 m, respectively.

4.0 References

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Appendix A Ground Survey Results: Elevations of Benchmark at Each Monitoring Station

Table A-1 Information about benchmarks at each hydrometric station for elevation survey

Benchmark	Type	Northing (m)	Easting (m)	Elevation (m)
LA-2 BM1	Rebar	6375172.712	480842.634	497.339
LA-2 BM2	Rebar	6375174.795	480846.484	497.064
LA-2 BM3	Rebar	6375171.611	480846.491	496.34
LA-3 BM1	Rock	6373997.35	481487.807	496.134
LA-3 BM2	Rock	6373994.256	481487.899	496.034
LA-3 BM3	Rock	6373997.038	481478.058	494.831
Mardoc Lake (LA-4) BM1	Rebar	6376186.639	481994.794	500.365
Mardoc Lake (LA-4) BM2	Rebar	6376189.113	481991.522	500.252
Mardoc Lake (LA-4) BM3	Rebar	6376187.971	481988.774	499.699
LA-5 BM1	Rebar	6374540.225	477831.352	501.366
LA-5 BM2	Rebar	6374541.11	477824.823	501.014
LA-5 BM3	Rebar	6374538.032	477835.822	501.023
LA-6 BM1	Rebar	6375257.733	477749.298	502.388
LA-6 BM2	Rebar	6375254.317	477756.381	502.08
Kratchowsky Lake (LA-7) BM1	Rock	6375365.152	474859.273	522.374
Kratchowsky Lake (LA-7) BM2	Rock	6375370.136	474856.009	522.067
Kratchowsky Lake (LA-7) BM3	Rock	6375373.196	474852.454	521.8
LA-8 BM1	Rock	6379895.581	476250.738	523.991
LA-9 BM1	Rock	6379225.363	479725.394	515.312
PA-2 BM1	Rock	6377199.994	477105.453	511.303
PA-3 BM1	Rock	6377659.01	476450.79	517.851
LAB-1 BM1	Rebar	6368332.435	478695.192	489.243
LAB-1 BM2	Rebar	6368331.85	478688.921	489.745
LAB-1 BM3	Rebar	6368334.674	478697.583	489.597
LB-1 BM1	Rebar	6369366.788	476603.997	505.231
LB-1 BM2	Rebar	6369370.293	476602.209	505.04
LB-1 BM3	Rebar	6369363.85	476597.929	505.073
LB-2 BM1	Rebar	6371898.916	474903.385	511.767
LB-2 BM2	Rebar	6371901.778	474906.357	511.819
LB-2 BM3	Rebar	6371904.723	474900.057	511.806
Williams Lake (LB-3) BM1	Rebar	6374839.646	474884.439	520.159
Williams Lake (LB-3) BM2	Rebar	6374831.436	474893.291	519.42
Williams Lake (LB-3) BM3	Rebar	6374834.862	474895.379	520.021
SA-1 BM1	Rebar	6371129.601	480327.636	496.123
SA-1 BM2	Rock	6371125.303	480328.743	495.576
SA-1 BM3	Rebar	6371123.762	480357.257	494.361
SA-2 BM1	Rock	6373258.113	478533.16	498.369
SA-2 BM2	Rock	6373258.391	478529.59	498.354
SA-3/LA-1 BM1	Rebar	6373226.219	479403.75	495.714

Table A-1 Information about benchmarks at each hydrometric station for elevation survey

Benchmark	Type	Northing (m)	Easting (m)	Elevation (m)
SA-3/LA-1 BM2	Rebar	6373227.014	479408.484	495.55
SA-3/LA-1 BM3	Rebar	6373222.211	479402.381	495.616
SA-4 BM1	Rebar	6375855.114	476914.695	507.772
SA-4 BM2	Rock	6375853.025	476915.57	508.373
SA-5 BM1	Rebar	6375723.54	477791.074	502.58
SA-5 BM2	Rock	6375739.656	477807.701	502.045
SA-6 BM1	Rebar	6374757.968	477848.597	503.32
SA-6 BM2	Rebar	6374752.648	477849.463	503.205
SA-6 BM3	Rebar	6374746.296	477855.608	502.021
SA-8 TBM1	Nail	471581	6378307	521.17
SA-8 TBM2	Nail	471578	6378301	521.15
SA-8 TBM3	Nail	471586	6378314	521.13
SA-9 TBM1	Nail	478230	6381587	521.14
SA-9 TBM2	Nail	478231	6381591	520.86
SA-9 TBM3	Rock	478216	6381592	521.59
SA-10 TBM1	Nail	478999	6380421	515.01
SA-10 TBM2	Nail	479000	6380405	515.56
SA-10 TBM3	Nail	478997	6380406	515.8
SA-11 TBM1	Nail	473017	6379260	521.286
SA-11 TBM2	Rock	473018	6379272	521.025
SA-11 TBM3	Nail	473032	6379260	521.176
SB-1 BM1	Culvert	6366351.011	476038.945	489.602
SB-1 BM2	Culvert	6366355.284	476042.54	489.414
SB-1 BM3	Rock	6366375.139	476028.439	489.217
SB-3 BM1	Rebar	6371642.428	475847.211	511.473
SB-3 BM2	Rock	6371638.405	475838.409	511.897
SB-4 BM1	Rock	6372197.891	472953.818	520.307
SB-4 BM2	Rock	6372197.46	472955.741	520.205
SB-4 BM3	Rock	6372197.402	472957.726	520.305
SB-5 BM1	Nail	6372738.116	474631.507	518.673

Appendix B Stage and Discharge Measurement

Table B-1: Stream Elevation and Instantaneous Discharge Measurements

Location	Date	Elevation (Masl)	Discharge (m^3/s)	Source
Icelander River (SA-1)	14-May-11	492.714	2.307	Golder (2014)
	29-Jul-11	492.648	1.75	
	28-Oct-11	492.562	0.973	
	5-May-12	492.711	2.293	
	6-Aug-12	492.695	2.031	
	23-Oct-12	492.721	2.575	
	20-May-13	492.705	2.358	
	14-Aug-13	492.587	1.28	
	18-Oct-13	492.554	0.887	
	30-Mar-14	492.869	1.203	
	17-Sep-16	492.71	2.34	Calder (2017)
	31-May-17	492.72	2.43	
	2-Jul-19	494.043*	2.41	This report
	5-Jul-19	492.744	3.06	MWSI (2019)
	30-Aug-19	492.733	2.78	
SA-2	12-May-11	496.727	1.649	Golder (2014)
	30-Jul-11	496.698	1.387	
	27-Oct-11	496.667	0.809	
	8-May-12	496.748	2.008	
	8-Aug-12	*496.689*	1.305	
	24-Oct-12	496.734	2.03	
	21-May-13	496.727	1.842	
	14-Aug-13	496.66	0.863	
	16-Oct-13	496.641	0.741	
	24-Mar-14	496.805	1.18	
	16-Sep-16	496.46	2.24	Calder (2017)
	5-Jul-19	496.773	2.2095	MWSI (2019)
	30-Aug-19	496.748	1.9537	
SA-3	13-May-11	494.459	0.476	Golder (2014)
	29-Jul-11	494.392	0.37	
	28-Oct-11	494.322	0.239	
	4-May-12	494.473	0.528	
	5-Aug-12	494.443	0.478	
	23-Oct-12	494.487	0.578	
	20-May-13	494.482	0.564	
	14-Aug-13	494.344	0.255	
	16-Oct-13	494.243	0.051	
	24-Mar-14	494.248	0.362	
	16-Sep-16	494.43	0.44	Calder (2017)
	5-Jul-19	494.541	0.6219	MWSI (2019)
	30-Aug-19	494.506	0.5474	

Table B-1: Stream Elevation and Instantaneous Discharge Measurements

Location	Date	Elevation (Masl)	Discharge (m^3/s)	Source
SA-4	11-May-11	506.357	0.483	Golder (2014)
	30-Jul-11	506.314	0.335	
	31-Oct-11	506.31	0.199	
	4-May-12	506.348	0.466	
	5-Aug-12	506.329	0.361	
	22-Oct-12	506.367	0.497	
	19-May-13	506.369	0.519	
	13-Aug-13	506.277	0.276	
	17-Oct-13	506.249	0.206	
	23-Mar-14	506.381	0.33	
	10-Sep-16	506.35	0.49	Calder (2017)
	30-May-17	506.37	0.58	
	29-Jun-18	506.357	0.4845	This report
	4-Jul-19	506.387	0.6336	MWSI (2019)
	29-Aug-19	506.374	0.59	
SA-5	12-May-11	500.708	1.1	Golder (2014)
	30-Jul-11	500.668	0.858	
	29-Oct-11	500.609	0.476	
	4-May-12	500.717	1.111	
	5-Aug-12	500.684	1.026	
	22-Oct-12	500.718	1.269	
	19-May-13	500.726	1.381	
	13-Aug-13	500.629	0.616	
	17-Oct-13	500.622	0.507	
	23-Mar-14	500.798	0.886	
	9-Sep-16	500.9	1.27	Calder (2017)
	21-Sep-16	500.91	1.58	
	30-May-17	500.92	1.95	
	30-Jun-18	500.89	1.6567	This report
	4-Jul-19	500.955	1.6137	MWSI (2019)
	29-Aug-19	500.927	1.3589	
SA-6	13-May-11	500.084	1.631	Golder (2014)
	30-Jul-11	500.034	1.303	
	27-Oct-11	499.956	0.717	
	6-May-12	500.098	1.957	
	5-Aug-12	500.061	1.476	
	22-Oct-12	500.102	1.851	
	19-May-13	500.077	1.54	
	13-Aug-13	499.992	0.842	
	17-Oct-13	499.969	0.798	
	23-Mar-14	500.081	1.173	
	11-Sep-16	500.07	1.98	Calder (2017)
	31-May-17	500.08	1.77	
	30-Jun-18	500.125	1.56	This report
	4-Jul-19	500.125	2.27	MWSI (2019)
	29-Aug-19	500.11	2.02	
SA-7	15-Sep-16	No BM set	0.04	Calder (2017)

Table B-1: Stream Elevation and Instantaneous Discharge Measurements

Location	Date	Elevation (Masl)	Discharge (m^3/s)	Source
SA-8	15-Sep-16	520.6	0.01	Calder (2017)
	19-Sep-16	520.62	0.04	
	30-May-17	520.54	0.04	
	3-Jul-19	520.57	0.056	This report
	31-Aug-19	99.455**	0.0443	MWSI (2019)
SA-9	18-Sep-16	520.52	0.18	Calder (2017)
	1-Jun-17	520.49	0.16	
	31-Aug-19	520.55	0.1457	MWSI (2019)
SA-10	18-Sep-16	514.35	1.55	Calder (2017)
	31-May-17	514.31	1.22	
	31-Aug-19	514.34	1.31	MWSI (2019)
SA-11	19-Sep-16	520.73	0.42	Calder (2017)
	30-May-17	520.71	0.31	
	2-Jul-18	520.84	Not Measured	This report
	31-Aug-19	520.71	0.31	MWSI (2019)
Kratchowsky Creek Outlet (RC-1)	14-Sep-16	520.3	0.58	Calder (2017)
	15-Mar-18	-	0.2303	This report
	6-Jul-19	-	0.6041	MWSI (2019)
	1-Sep-19	520.56	0.5514	
SB-1	14-May-11	488.486	0.517	Golder (2014)
	31-Jul-11	489.027	0.186	
	30-Oct-11	488.418	0.217	
	3-May-12	488.524	0.644	
	6-Aug-12	488.522	0.358	
	23-Oct-12	488.599	0.578	
	18-May-13	488.484	0.547	
	12-Aug-13	488.335	0.158	
	19-Oct-13	488.85	0.277	
	27-Mar-14	488.823	0.289	
	17-Sep-16	488.55	0.64	Calder (2017)
SB-3	11-May-11	510.465	0.187	Golder (2014)
	31-Jul-11	510.406	0.109	
	30-Oct-11	510.389	0.082	
	5-May-12	510.506	0.235	
	8-Aug-12	510.456	0.136	
	21-Oct-12	510.517	0.255	
	20-May-13	510.476	0.209	
	14-Aug-13	510.421	0.107	
	17-Oct-13	510.414	0.08	
	25-Mar-14	510.423	0.09	
	11-Sep-16	510.47	0.2	Calder (2017)
SB-4	15-May-11	519.134	0.074	Golder (2014)
	1-Aug-11	518.964	0.008	
	30-Oct-11	519.07	0.018	
	5-May-12	519.219	0.109	
	6-Aug-12	519.144	0.032	
	21-Oct-12	519.245	0.099	
	21-May-13	519.185	0.114	
	15-Aug-13	519.074	0.007	
	17-Oct-13	519.115	0.036	
	11-Sep-16	519.21	0.12	Calder (2017)
SB-5	14-Sep-16	518.33	0.14	

* This may be an anomalous observation and therefore is not used in establishing stage-discharge curve.

** Referenced to local benchmark after moving measurement location.

Table B-2: Lake and Pond Surface Water Level Elevations

Location	Date	Elevation (m) (Arbitrary Datum)	Elevation (Masl)	Source
McGowan Lake (LA-1)	13-May-11	98.725	494.439	Golder (2014)
	29-Jul-11	98.613	494.327	
	28-Oct-11	98.504	494.218	
	4-May-12	98.709	494.423	
	5-Aug-12	98.672	494.386	
	23-Oct-12	98.734	494.448	
	21-May-13	98.726	494.44	
	14-Aug-13	98.551	494.265	
	16-Oct-13	98.48	494.194	
	25-Mar-14	98.584	494.298	
	16-Sep-16		494.39	Calder (2017)
	2-Jul-18	98.62	494.344	This report
	5-Jul-19		494.515	MWSI (2019)
	30-Aug-19		494.476	
LA-2	13-May-11	97.269	494.615	Golder (2014)
	30-Jul-11	97.256	494.602	
	29-Oct-11	97.203	494.549	
	4-May-12	97.264	494.61	
	6-Aug-12	97.274	494.62	
	23-Oct-12	97.308	494.654	
	20-May-13	97.278	494.624	
	13-Aug-13	97.197	494.543	
	16-Oct-13	97.121	494.467	
	26-Mar-14	97.236	494.582	
	13-Sep-16		494.58	Calder (2017)
LA-3	13-May-11	98.427	494.561	Golder (2014)
	30-Jul-11	98.433	494.567	
	29-Oct-11	98.427	494.561	
	4-May-12	98.472	494.606	
	6-Aug-12	98.456	494.59	
	23-Oct-12	98.485	494.619	
	20-May-13	98.459	494.593	
	13-Aug-13	98.387	494.521	
	16-Oct-13	98.305	494.439	
	26-Mar-14	98.515	494.649	
	18-Sep-16		494.57	Calder (2017)
Mardoc Lake (LA-4)	29-Jul-11	98.284	498.649	Golder (2014)
	30-Oct-11	98.152	498.517	
	4-May-12	98.223	498.588	
	5-Aug-12	98.248	498.613	
	6-Aug-12	98.257	498.622	
	23-Oct-12	98.262	498.627	
	20-May-13	98.259	498.624	
	13-Aug-13	98.164	498.529	
	16-Oct-13	98.142	498.507	
	27-Mar-14	98.249	498.614	
	13-Sep-16		498.62	Calder (2017)

Table B-2: Lake and Pond Surface Water Level Elevations

Location	Date	Elevation (m) (Arbitrary Datum)	Elevation (Masl)	Source
Whitefish Lake, South Basin (LA-5)	13-May-11	98.706	500.05	Golder (2014)
	31-Jul-11	98.67	500.014	
	27-Oct-11	98.605	499.949	
	6-May-12	98.73	500.074	
	5-Aug-12	98.693	500.037	
	22-Oct-12	98.728	500.072	
	21-May-13	98.729	500.073	
	13-Aug-13	98.625	499.969	
	17-Oct-13	98.606	499.95	
	23-Mar-14	98.732	500.076	
	12-Sep-16		500.06	Calder (2017)
Whitefish Lake, North Basin (LA-6)	13-May-11	97.675	500.063	Golder (2014)
	31-Jul-11	97.64	500.028	
	27-Oct-11	97.555	499.943	
	6-May-12	97.7	500.088	
	5-Aug-12	97.67	500.058	
	22-Oct-12	97.704	500.092	
	19-May-13	97.7	500.088	
	13-Aug-13	97.585	499.973	
	17-Oct-13	97.559	499.947	
	23-Mar-14	97.67	500.058	
	12-Sep-16	-	500.07	Calder (2017)
	30-Jun-18	97.718	500.106	This report
	29-Aug-19	-	500.118	MWSI (2019)
Kratchowsky Lake (LA-7)	29-Jul-11	98.108	520.482	Golder (2014)
	31-Oct-11	98.05	520.424	
	6-May-12	98.149	520.523	
	8-Aug-12	98.108	520.482	
	21-Oct-12	98.162	520.536	
	24-May-13	98.157	520.531	
	13-Aug-13	98.083	520.457	
	16-Oct-13	98.066	520.44	
	27-Mar-14	98.128	520.502	
	12-Sep-16	-	520.53	Calder (2017)
	30-May-17	-	520.53	
LA-8	20-Jan-00	-	520.86	Calder (2017)
	1-Jun-17	-	520.8	
LA-9	13-Sep-16	-	514.25	Calder (2017)
	31-May-17	-	514.28	
LAB-1	16-May-11	98.991	488.219	Golder (2014)
	1-Aug-11	98.891	488.119	
	30-Oct-11	98.776	488.004	
	9-May-12	99	488.228	
	6-Aug-12	98.939	488.167	
	23-Oct-12	98.987	488.215	
	21-May-13	99.005	488.233	
	12-Aug-13	98.879	488.107	
	19-Oct-13	98.766	487.994	
	25-Mar-14	99.154	488.382	
	22-Sep-16	-	488.26	Calder (2017)

Table B-2: Lake and Pond Surface Water Level Elevations

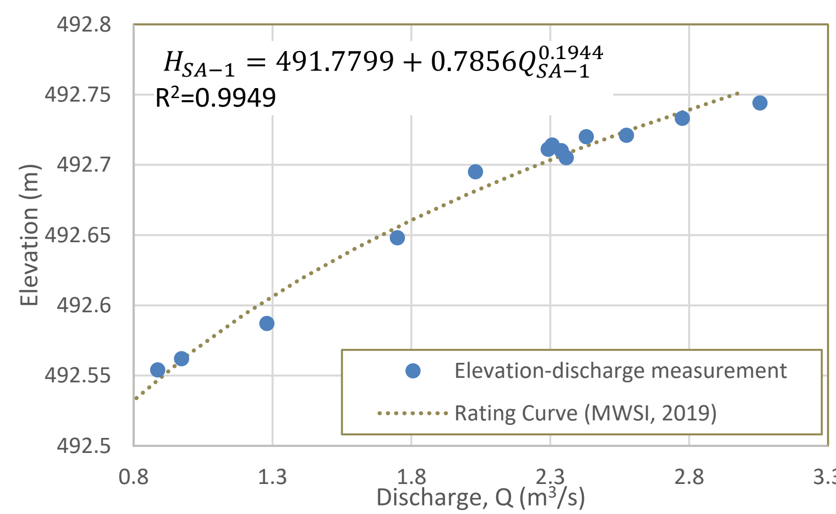
Location	Date	Elevation (m) (Arbitrary Datum)	Elevation (Masl)	Source
LB-1	14-May-11	98.666	503.902	Golder (2014)
	1-Aug-11	98.807	504.043	
	30-Oct-11	98.648	503.884	
	6-May-12	98.636	503.872	
	6-Aug-12	98.651	503.887	
	21-Oct-12	98.617	503.853	
	19-May-13	98.843	504.079	
	14-Aug-13	98.509	503.745	
	17-Oct-13	98.471	503.707	
	11-Sep-16		503.66	Calder (2017)
LB-2	14-May-11	98.767	510.523	Golder (2014)
	29-Jul-11	98.689	510.445	
	30-Oct-11	98.636	510.392	
	5-May-12	98.771	510.527	
	6-Aug-12	98.745	510.501	
	21-Oct-12	98.817	510.573	
	21-May-13	98.756	510.512	
	14-Aug-13	98.699	510.455	
	17-Oct-13	98.651	510.407	
	25-Mar-14	98.777	510.533	
	11-Sep-16	-	510.54	Calder (2017)
Williams Lake (LB-3)	15-May-11	98.365	518.519	Golder (2014)
	29-Jul-11	98.284	518.438	
	29-Oct-11	98.203	518.356	
	5-May-12	98.361	518.515	
	5-Aug-12	98.37	518.524	
	21-Oct-12	98.426	518.58	
	19-May-13	98.38	518.534	
	13-Aug-13	98.278	518.432	
	17-Oct-13	98.233	518.387	
	25-Mar-14	98.233	518.463	
	11-Sep-16	-	518.57	Calder (2017)
PA-2	15-Sep-16	-	510.46	Calder (2017)
PA-3	15-Sep-16	-	517.36	Calder (2017)

Appendix C Summary of Hydrometric Monitoring Stations in the Icelander River Drainage Area

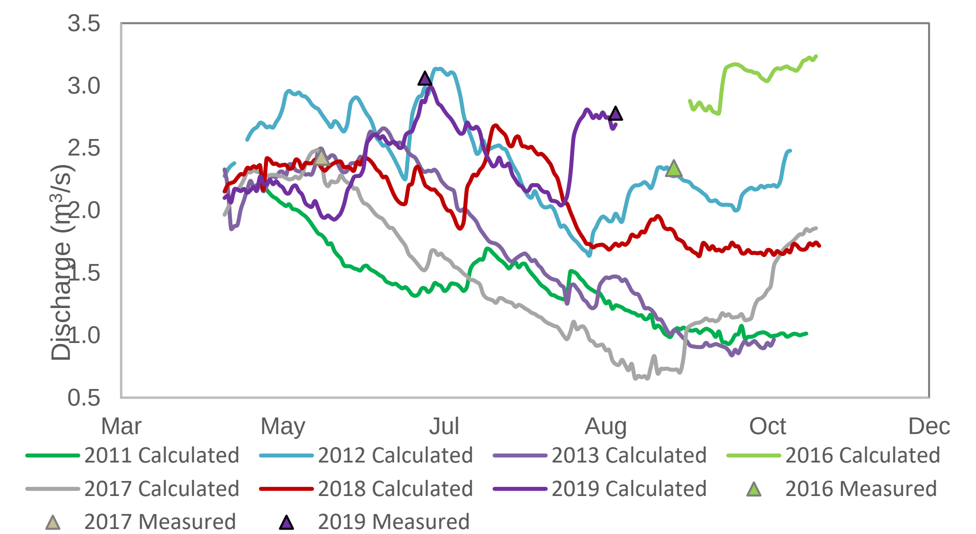
Appendix C: Summary of Hydrometric Monitoring Stations in the Icelander River Drainage Area

Station ID	SA-1	**Periods of continuous recording**	2011-2014, 2016-2019
GPS Coordinates	13 V 480368 6371123	**Instrument deployed**	Solinst levelogger, Serial number 1062051.
Access	By road	**Active measurement**	Continuous flow monitoring
Periods of monitoring	2011-2014, 2016-2019	**Comments**	SA-1 produces good stage and discharge relationship and accurate hydrograph. The stage-discharge relationship was modified in 2019 to fit new high discharge observed in 2019.
Measurements	Elevation, instantaneous discharge, continuous discharge		

Map: SA-1 hydrometric monitoring station.



Stage – Discharge Curve



Continuous flow monitoring, 2011-14 and 2016-2019 open water season

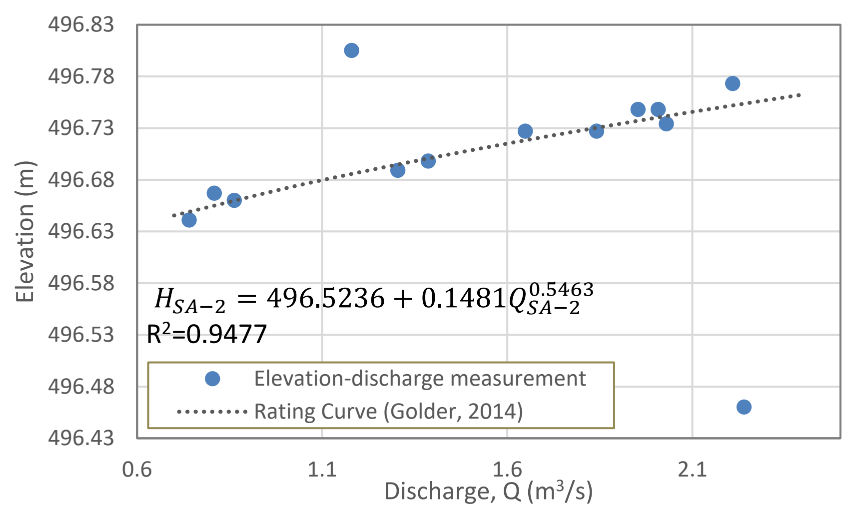
SA-1 facing downstream, May 2017.

SA-1 facing upstream, July 2018.

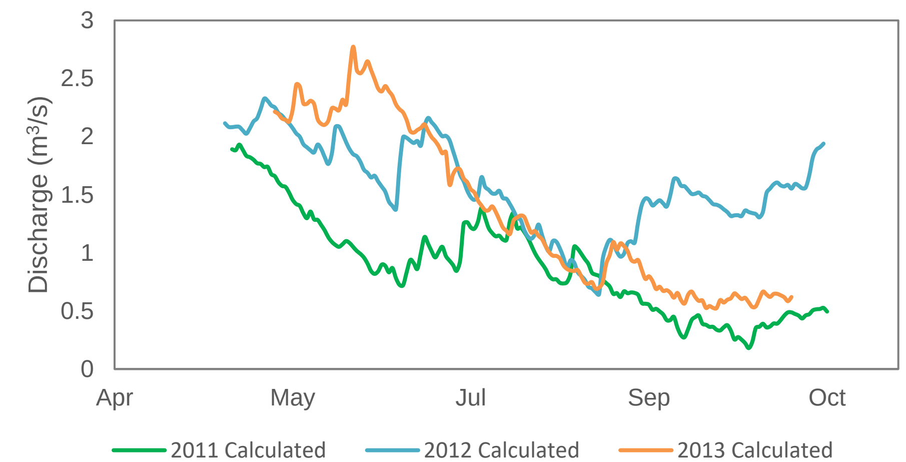
SA-1 facing downstream, July 2018.

Station ID	SA-2	**Periods of continuous recording**	2011-2013
GPS Coordinates	13 V 478524 6373216	**Instrument deployed**	N.A.
Access	By boat	**Active measurement**	N.A.
Periods of monitoring	2011-2014, 2016-2019	**Comments**	No continuous monitoring device is installed since 2014. Two outliers were observed in the stage-discharge curve as different cross section was used in 2016 and 2017. These two data points were not used to validate the stage-discharge relationship.
Measurements	Elevation, instantaneous discharge		

Map: SA-2 hydrometric monitoring station.



Stage – Discharge Curve



Continuous flow monitoring, 2011-2013 open water season

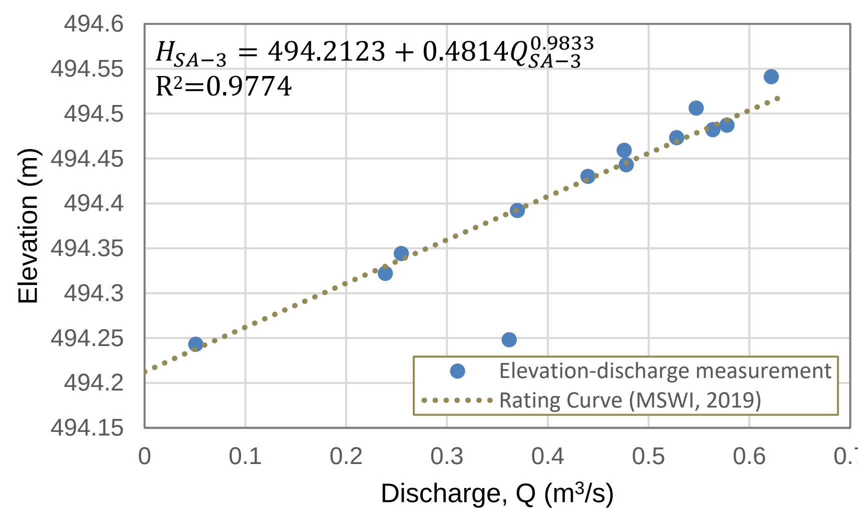
SA-2 facing upstream, May 2017.

SA-2 facing downstream, May 2017.

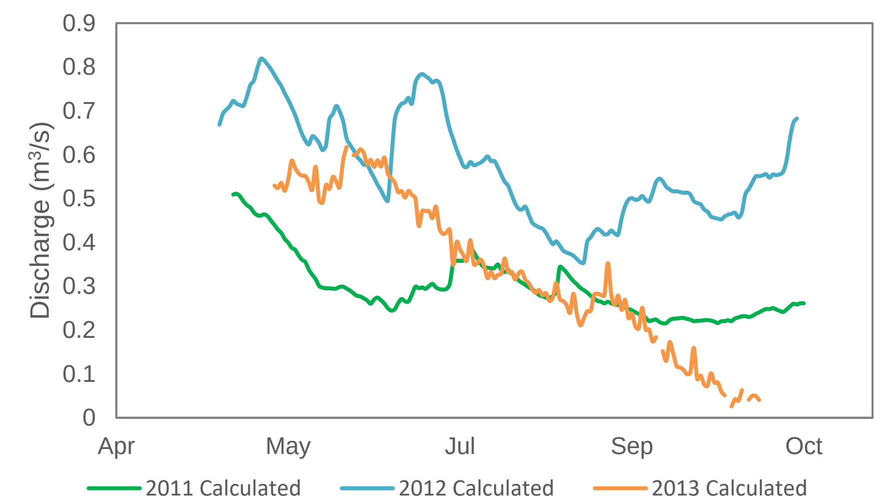
SA-2 facing upstream, March 2018.

Station ID	SA-3	Periods of continuous recording	2011-2013
GPS Coordinates	13 V 479415 6373234	Instrument deployed	N.A.
Access	By boat	Active measurement	N.A.
Periods of monitoring	2011-2014, 2016-2019	Comments	SA-3 produces good stage and discharge relationship. No continuous flow monitoring device was installed after 2014. The stage-discharge relationship was updated in 2019 with more recent monitoring data to expand the discharge range.
Measurements	Elevation, instantaneous discharge		

Map: SA-3 hydrometric monitoring station.



Stage – Discharge Curve



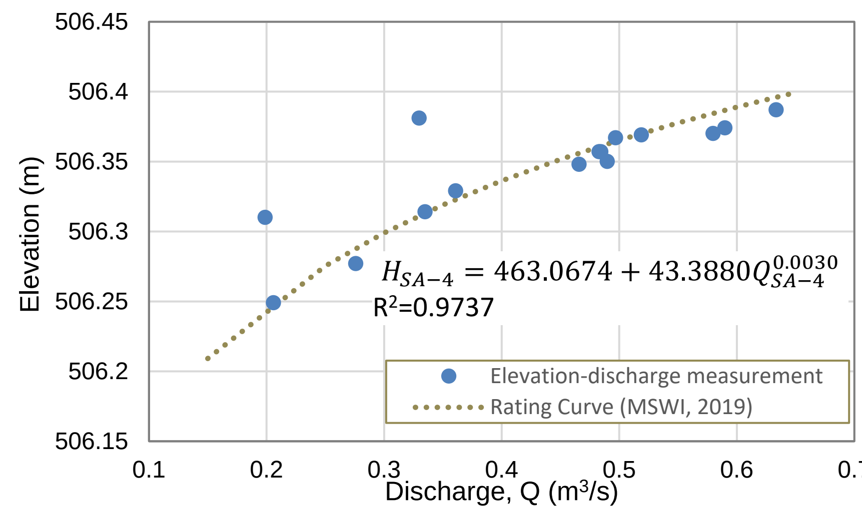
Continuous flow monitoring, 2011-2013 open water season

SA-3 facing upstream, September 2016.

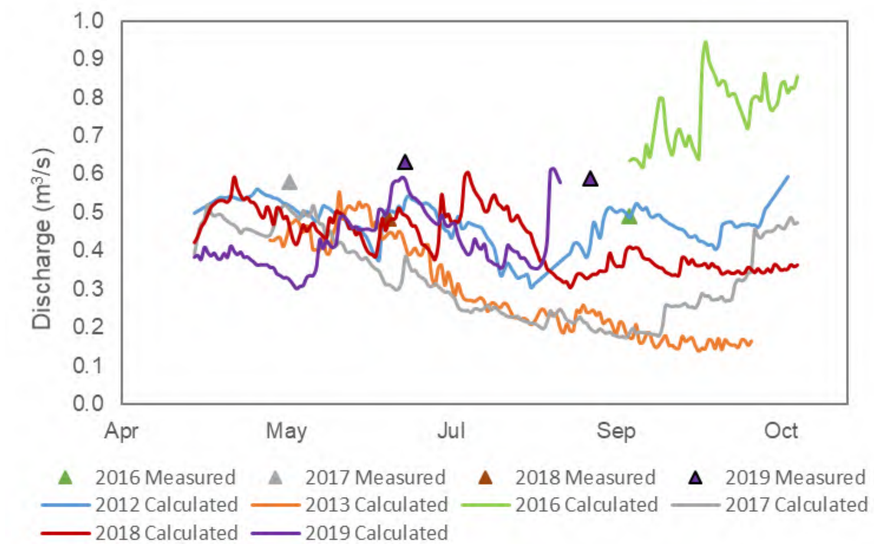
SA-3 facing downstream, September 2016.

Station ID	SA-4	**Periods of continuous recording**	2012-2014, 2016-2019
GPS Coordinates	13V 476926 6375868	**Instrument deployed**	Solinst levelogger, Serial number 2065001; Solinst barologger, serial number 2064922.
Access	By road	**Active measurement**	Continuous flow measurement
Periods of monitoring	2011-2014, 2016-2019	**Comments**	SA-4 produces a good stage-discharge relationship and hence an accurate hydrograph.
Measurements	Elevation, instantaneous discharge, continuous discharge		

Map: SA-4 hydrometric monitoring station.



Stage – Discharge Curve



Continuous flow monitoring, 2012-2014 and 2016-2019 open water season

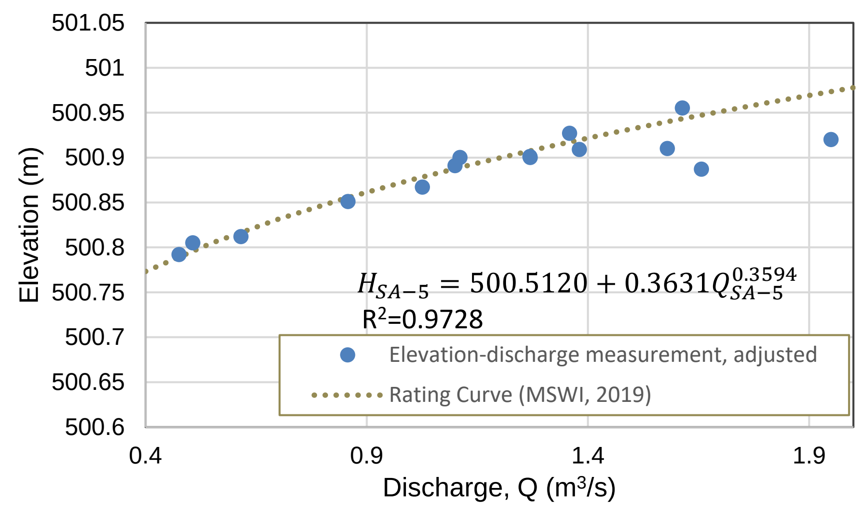
SA-4 facing upstream, June 2018.

SA-4 facing downstream, June 2018.

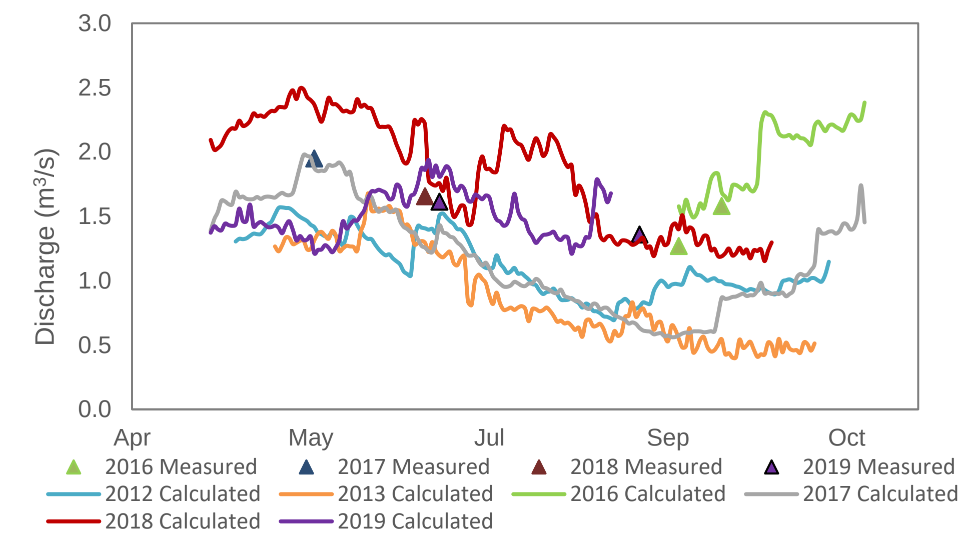
SA-4 facing upstream, March 2018.

Station ID	SA-5	**Periods of continuous recording**	2012-2014, 2016-2019
GPS Coordinates	13 V 477822 6375737	**Instrument deployed**	Solinst levelogger, Serial number 2064994
Access	By road	**Active measurement**	Continuous flow measurement
Periods of monitoring	2011-2014, 2016-2019	**Comments**	The monitoring station was moved upstream from previous location in 2016. The rating curve was adjusted to accommodate this change. SA-5 produces a fair stage-discharge relationship and hence hydrograph.
Measurements	Elevation, instantaneous discharge, continuous discharge		

Map: SA-5 hydrometric monitoring station.



Stage – Discharge Curve



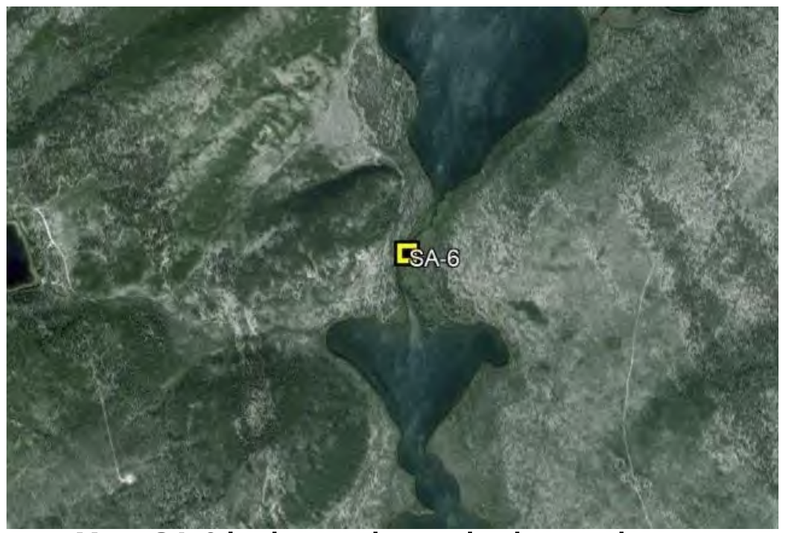
Continuous flow monitoring, 2012-2014 and 2016-2019 open water season

SA-5 facing upstream, May 2017.

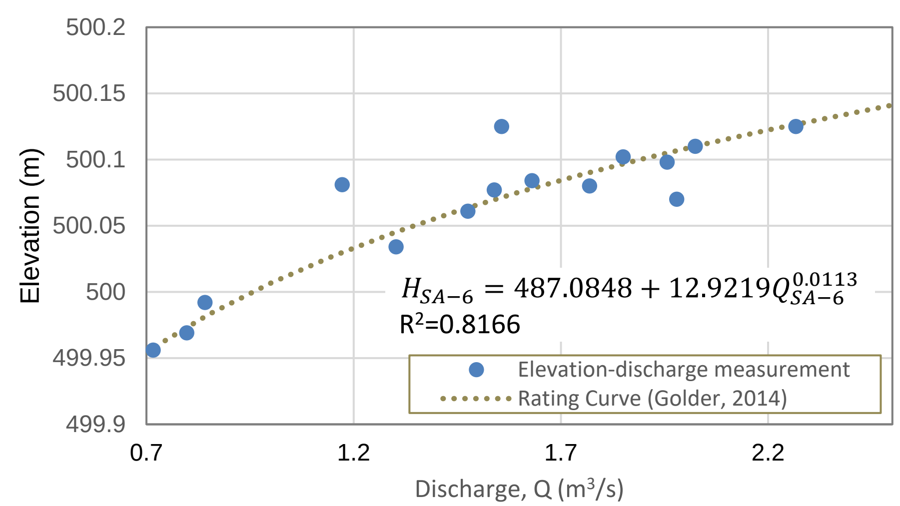
SA-5 facing downstream, May 2017.

SA-5 cross section, July 2019.

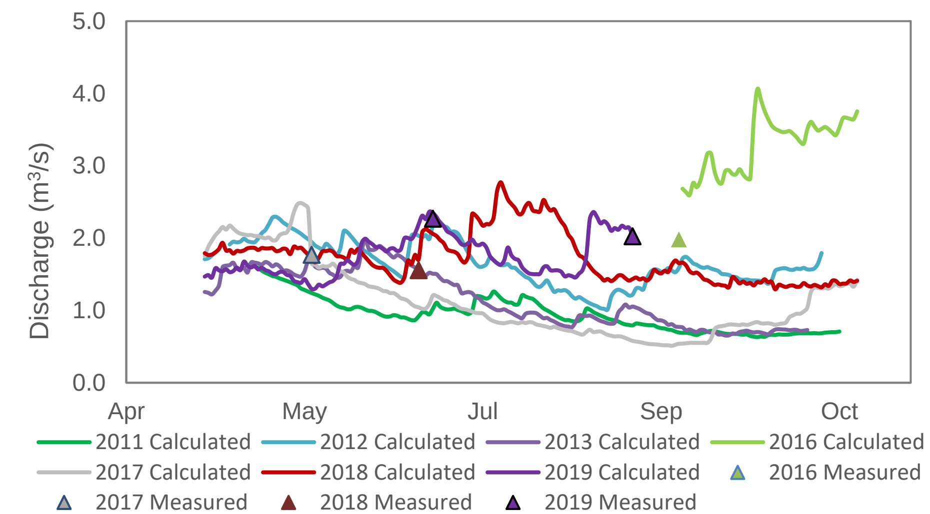
Station ID	SA-6	**Periods of continuous recording**	2011-2014, 2016-2019
GPS Coordinates	13 V 477863 6374742	**Instrument deployed**	Solinst levelogger, Serial number 1061428 (2016-2019). New logger deployed in August 2019 (Serial number 2110527).
Access	By road	**Active measurement**	Continuous flow measurement
Periods of monitoring	2011-2014, 2016-2019	**Comments**	SA-6 produced a fair stage-discharge relationship. SA-6 is recognized by local residence as a narrow connecting LA-5 and LA-6 as one lake (See LA-6 below).
Measurements	Elevation, instantaneous discharge, continuous discharge		



Map: SA-6 hydrometric monitoring station.



Stage – Discharge Curve



Continuous flow monitoring, 2012-2014 and 2016-2019 open water season

SA-6 facing upstream, March 2018.

Station ID	SA-7	Periods of continuous recording	N.A.
GPS Coordinates	13 V 472315 6375473	Instrument deployed	N.A.
Access	By boat	Active measurement	N.A.
Periods of monitoring	2016	Comments	SA-7 was a new station monitored since 2016. It is a narrow marshy stream and not suitable for continuous flow monitoring. This station was replaced by SA-11 in 2017.
Measurements	Elevation, instantaneous discharge.		

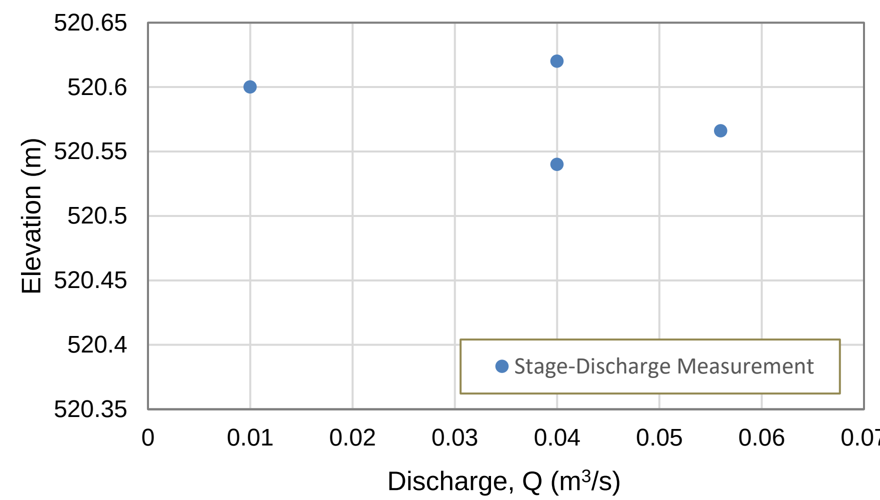
Map: SA-7 hydrometric monitoring station

SA-7 facing upstream, September 2016.

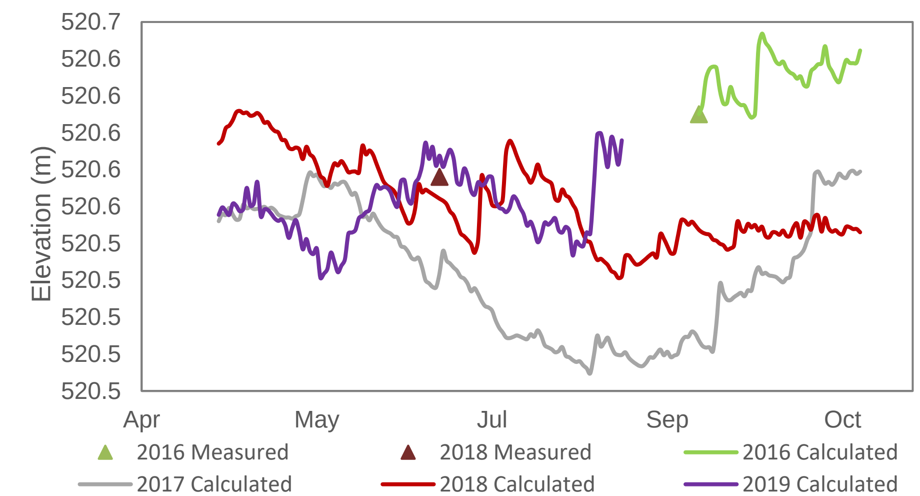
SA-7 facing downstream, September 2016.

Station ID	SA-8	**Periods of continuous recording**	2016-2019
GPS Coordinates	13 V 471579 6378303	**Instrument deployed**	Solinst levelogger, Serial number 2064996
Access	By boat	**Active measurement**	Continuous flow monitoring
Periods of monitoring	2016-2019	**Comments**	SA-8 is a new flow station has been monitored since 2016. It is a narrow stream with deep banks. More extreme flow data is required to establish a reliable rating curve. This station is believed to be impacted by elevation at the Kratchkowsy lake, and the station is moved upstream in 2019.
Measurements	Elevation, instantaneous discharge, continuous flow monitoring.		

Map: SA-8 hydrometric monitoring station



Stage – Discharge Relationship



Levelogger elevation results, 2016-2019 open water season

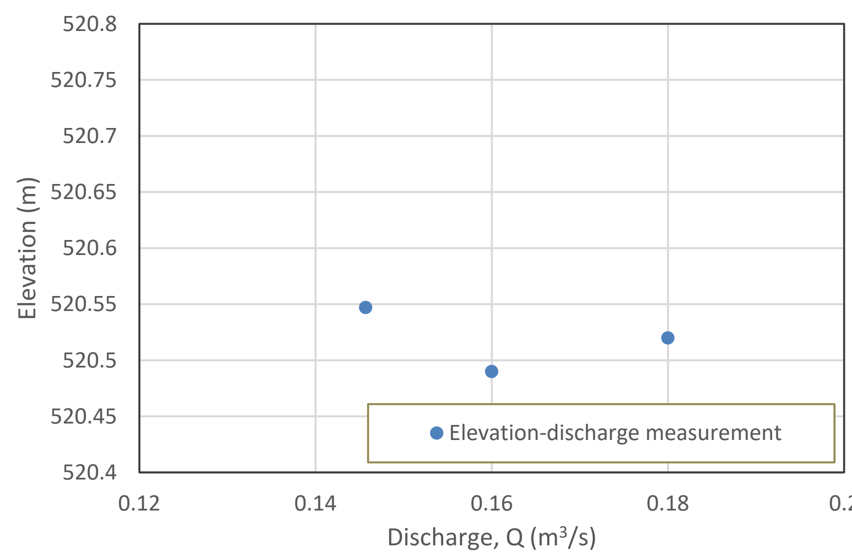
SA-8 facing upstream, September 2016.

SA-8 Hydrometric station, 2016-2019

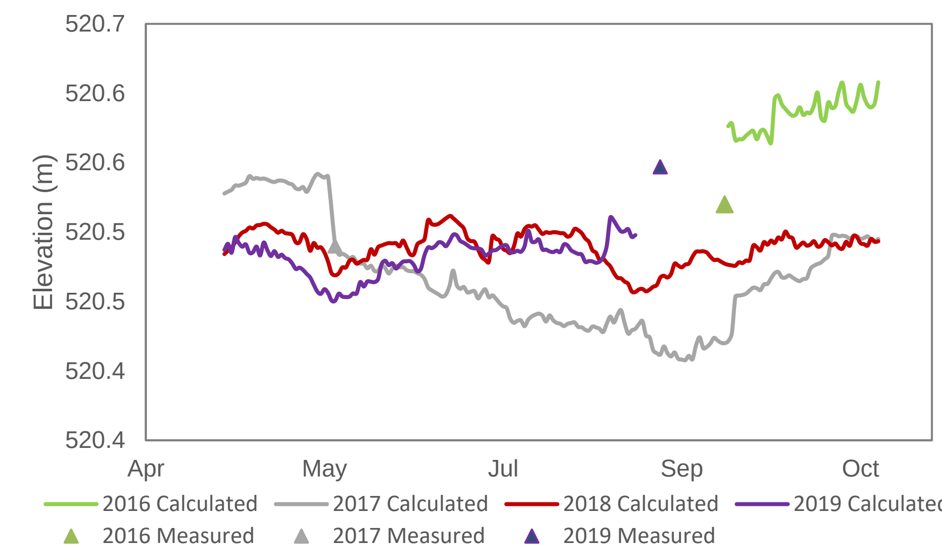
SA-8 new hydrometric station, Aug 2019.

Station ID	SA-9	Periods of continuous recording	2016-2019
GPS Coordinates	13 V 478226 6381589	Instrument deployed	Solinst levelogger, serial number 2065002
Access	By road	Active measurement	Continuous flow monitoring
Periods of monitoring	2016-2019	Comments	SA-9 was initially located at the outlet of a small lake downstream of LA-8. For access purpose, it was relocated to the outlet of LA-8 accessible by an existing ATV road. More stage and discharge data are required to establish a reliable rating curve.
Measurements	Elevation, instantaneous discharge, continuous flow monitoring.		

Map: SA-9 hydrometric monitoring station



Stage – Discharge Relationship



Levelogger elevation results, 2016-2019 open water season

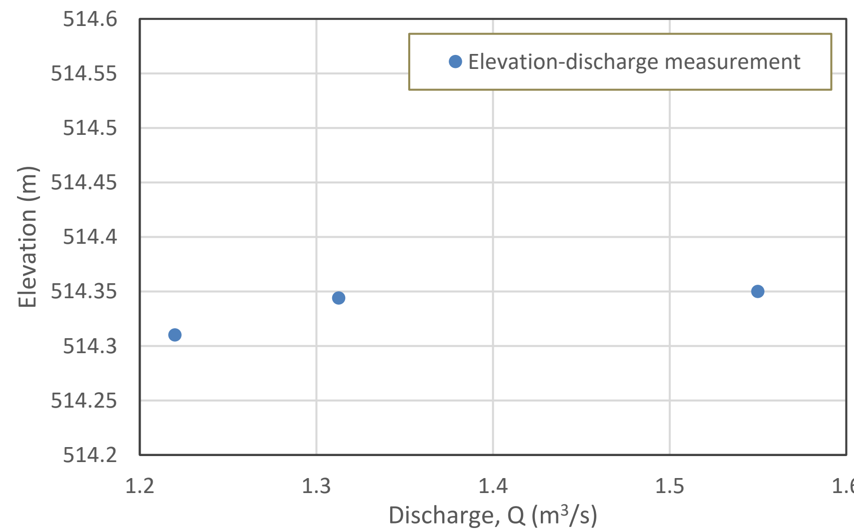

SA-9 facing upstream, Sep 2016.

SA-9 facing downstream, Sep 2016.

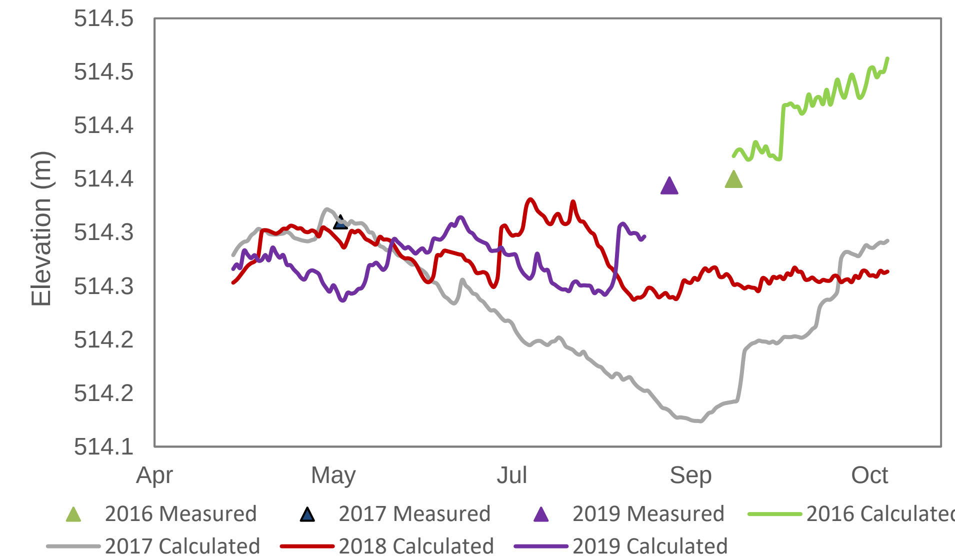

SA-9 cross section, Aug 2019.

Station ID	SA-10	**Periods of continuous recording**	2016-2019
GPS Coordinates	13 V 479003 6380421	**Instrument deployed**	Solinst levelogger, serial number 2065023
Access	By boat	**Active measurement**	Continuous flow monitoring
Periods of monitoring	2016-2019	**Comments**	More stage and discharge data are required to establish a reliable rating curve.
Measurements	Elevation, instantaneous discharge, continuous flow monitoring.		

Map: SA-10 hydrometric monitoring station



Stage – Discharge Relationship



Levelogger elevation results, 2016-2019 open water season

c

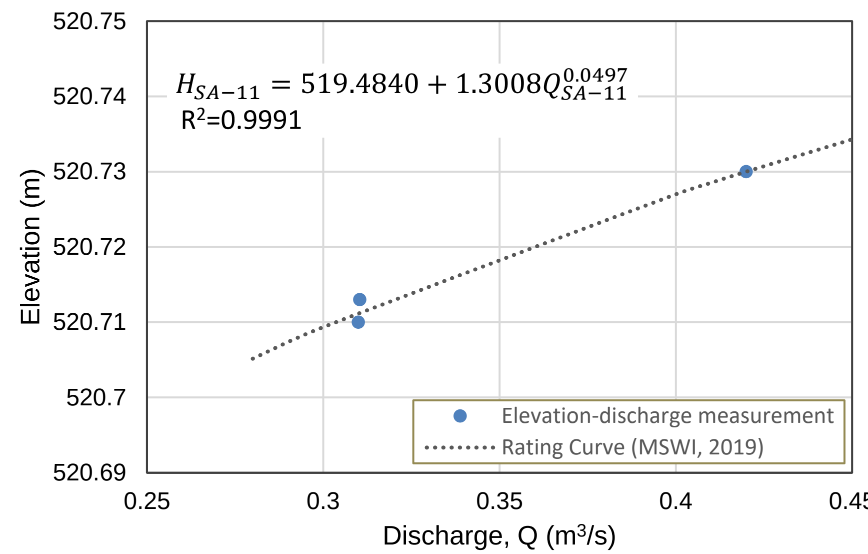
SA-10 facing upstream, September 2016.

SA-10 facing downstream, September 2016.

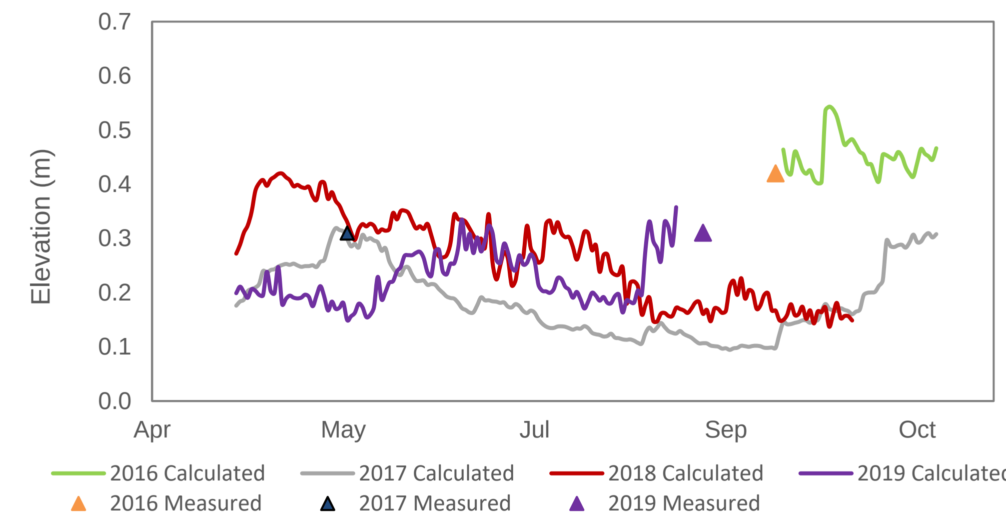
SA-10 cross section, Aug 2019

Station ID	SA-11	**Periods of continuous recording**	2016-2019
GPS Coordinates	13 V 473026 6379260	**Instrument deployed**	Solinst levelogger, serial number 2065010
Access	By boat	**Active measurement**	Continuous flow monitoring
Periods of monitoring	2016-2018 (EcoMetrix and Calder)	**Comments**	SA-11 is added to replace SA-7. A preliminary stage-discharge relationship is developed at SA-11. Validation is recommended to demonstrate accuracy of this relationship.
Measurements	Elevation, instantaneous discharge, continuous flow monitoring.		

Map: SA-11 hydrometric monitoring station



Stage – Discharge Relationship



Levelogger elevation results, 2016-2019 open water season

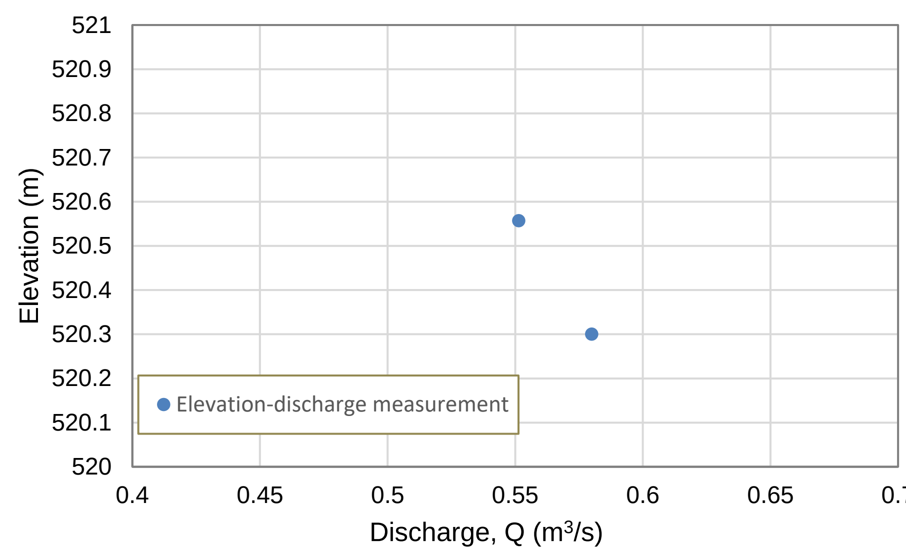
SA-11 facing upstream, September 2016

SA-11 facing downstream, September 2016.

SA-11 cross section, Aug 2019.

Station ID	RC-1 (Kratchkowsky Lake Outlet)	Periods of continuous recording	N.A.
GPS Coordinates	13 V 475468 6375987	Instrument deployed	N.A.
Access	By road	Active measurement	N.A.
Periods of monitoring	2016, 2018 (EcoMetrix and Calder)	Comments	RC-1 is situated immediately downstream of Kratchkowsky Lake. As it is accessible by a road crossing, it was the only location with instantaneous flow measured during the winter, 2018.
Measurements	Elevation, instantaneous discharge.		

Map: RC-1 hydrometric monitoring station



Stage – Discharge Relationship

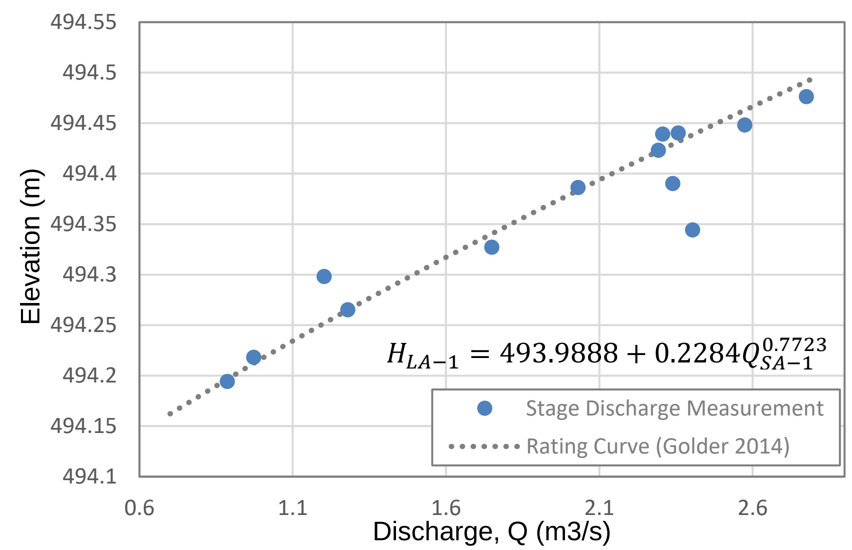
RC-1 facing upstream, September 2016

RC-1 facing downstream, September 2016.

RC-1 cross section, August 2019.

Station ID	McGowan Lake	**Periods of continuous recording**	2011-2014, 2019
GPS Coordinates	13 V 479399 6373215	**Instrument deployed**	Solinst levelogger, serial number 2110528 (installed August 2019).
Access	By road	**Active measurement**	Continuous flow monitoring
Periods of monitoring	2011-2014 (Golder), 2016, 2018 (EcoMetrix and Calder)	**Comments**	Discharge at SA-1 is used as the outlet of LA-1 to evaluate the stage-discharge relationship. A new data logger is installed in LA-1 in August 2019.
Measurements	Elevation, instantaneous discharge (SA-1), continuous flow monitoring (June -Oct, 2018)		

Map: McGowan Lake hydrometric monitoring station

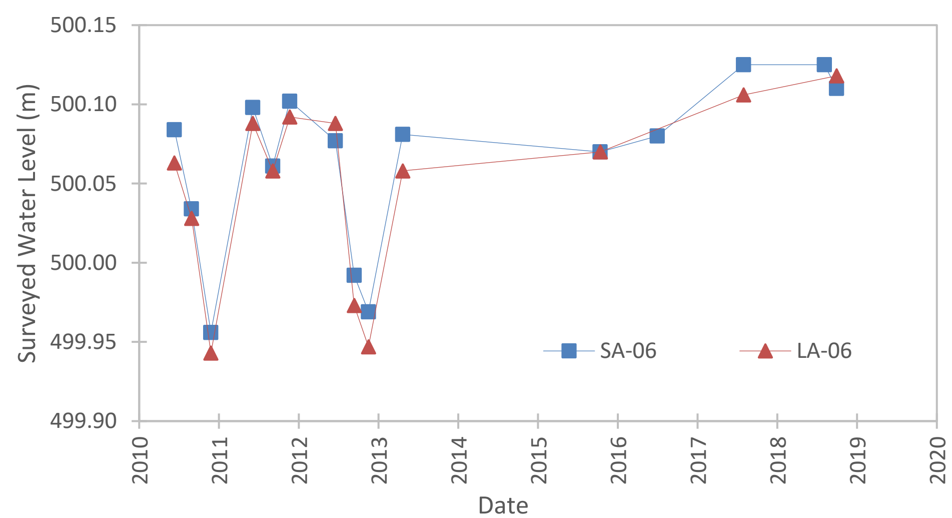


Stage – Discharge Curve

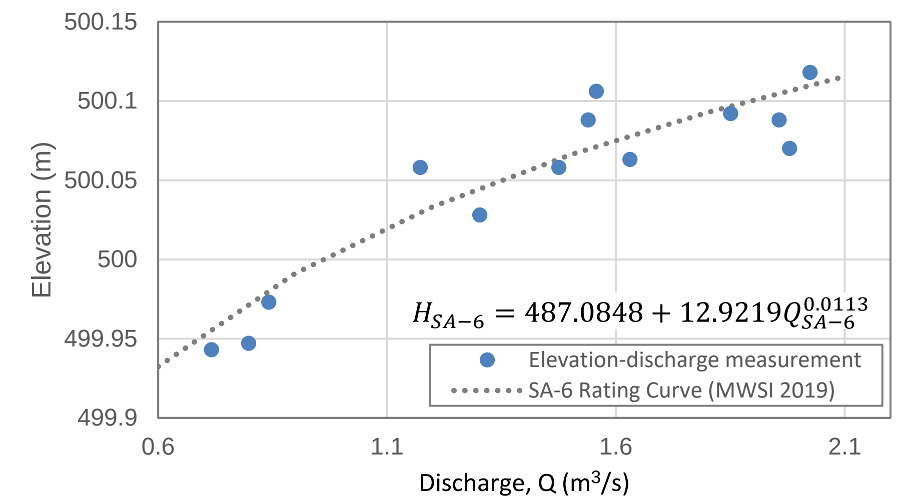
McGowan Lake photo, Sep 2016.

Station ID	LA-6	**Periods of continuous recording**	2011-2014
GPS Coordinates	13 V 477763 6375274	**Instrument deployed**	N.A.
Access	By road	**Active measurement**	N.A.
Periods of monitoring	2011-2014 (Golder), 2016, 2018 (EcoMetrix and Calder)	**Comments**	Both water level and discharge at SA-6 is representative to LA-6, and therefore level logger installed in SA-6 is used to continuously record discharge at this location. In addition, LA-5 and LA-6 is recognized as one lake (Whitefish Lake), and SA-6 is recognized as a narrow in this lake.
Measurements	Elevation, instantaneous discharge (SA-6), continuous flow monitoring (2018)		

Map: LA-6 hydrometric monitoring station



Water Elevation of LA-6 and SA-6



Stage – Discharge Curve

LA-6 photo, Sep 2016.

LA-6 photo, Aug 2019.

Appendix D 2012-2014 Baseline Hydrology Summary Report. Golder Associates

May 2014

DENISON MINES - WHEELER RIVER PROJECT

2012 - 2014 Baseline Hydrology Summary Report

Submitted to:
Mr. Lawson Forand
Exploration Manager
Denison Mines Corp.
Suite 200 - 320 - 22nd Street East
Saskatoon, SK
S7K 0E9

REPORT

Report Number: 12-1362-0050/5000

Distribution:

2 Copies Denison Mines Corporation.

2 Copies Golder Associates Limited.

Golder Associates

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FIGURES

APPENDICES

1.0 INTRODUCTION

1.1 Background Information

In 2011, Golder Associates Ltd. (Golder) was retained by Denison Mines Corp. (Denison) to undertake a hydrological baseline program as part of a pre-feasibility study of the Phoenix deposit at the Wheeler River property (the Project) near Key Lake, Saskatchewan. Golder completed hydrological investigations during the open water season of 2011, 2012, and 2013 as well as one during the ice covered season in 2014. The work was to collect the necessary hydrological baseline data to support various project requirements including environmental assessments, regulatory permitting, and providing design basis information for engineered structures such as fresh water diversions, water management systems, sedimentation ponds, and cross-drainage structures.

This report summarizes the baseline study design, methods and presents the results from the 2011 to 2013 field seasons as well as winter data collected in March 2014. This report builds on a similar interim report produced following the 2013 field season.

1.2 Site Information

The Project is located in north central Saskatchewan, in the south-eastern portion of the Athabasca Basin region, approximately 35 kilometres (km) northeast of Cameco Corporation's (Cameco's) Key Lake Operation and 35 km southwest of Cameco's McArthur River Operation. The site is accessible from the Key Lake – McArthur River haul road. The general Project area is characterized as a morainal plain with southwest trending drumlins and eskers, and glaciofluvial outwash areas, overlying Athabasca sandstones. Numerous interconnected lakes occur in the area, along with low-lying, poorly drained areas of muskeg. The Project is located in the Athabasca Plain Ecoregion which is characterized by jack pine, birch and poplar, and dense spruce forests.

1.3 Climate and Weather

Climate conditions play an important role in the local hydrological cycle by governing the primary inputs and outputs to the surface water environment, including precipitation and evaporation. Environment Canada (EC 2013) has collected data from two weather stations near Key Lake, which can be used to represent general conditions for the Project.

Runoff is a function of several environmental conditions, including rainfall and snow accumulation, evaporation from open water surfaces, evapotranspiration from terrestrial areas, and soil types (infiltration). Although discharge is not exclusively a function of local precipitation, it can provide important context for observed flow characteristic. Figure 1 presents the precipitation record for Key Lake (compiled from two Environment Canada weather stations at Key Lake; EC 2011) for the 2010-2011, 2011-2012, and 2012-2013 hydrological years (October 1 to September 30) and historical averages. The first six months of the 2013-2014 hydrological year are also presented.

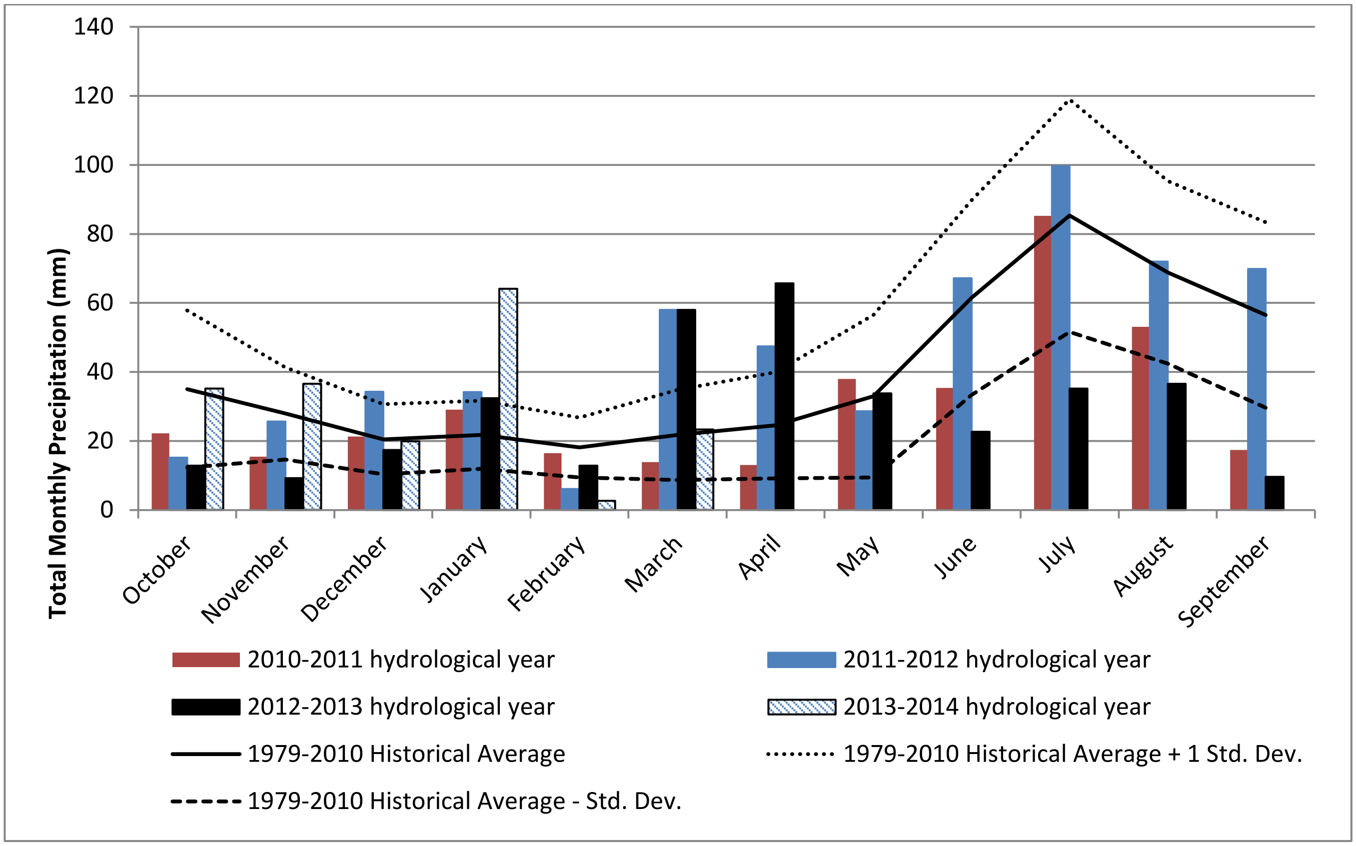


Figure 1: Key Lake Total Precipitation for Hydrological Years between 2010 and 2013 (EC 2013)

Precipitation during the 2010-2011 hydrological year was less than average during all months except January, May and July when precipitation was above average (January) or near average (May and July). The low precipitation throughout most of the winter would contribute to a smaller snowpack and a reduced spring freshet. Low summer and early fall precipitation would contribute to lower than normal flows during these periods.

Precipitation during the 2011-2012 hydrological year was generally near the 1979-2010 historical average. While cumulative precipitation from October to March was within 20% of the historical average, precipitation in March and April was more than twice the historical average. Near normal values were observed throughout the rest of the summer and early fall; the generally high precipitation rates in June through September could result in secondary peak flow events in summer and early fall.

Precipitation during the 2012-2013 hydrological year was below the 1979-2010 historical average. Cumulative precipitation from October to February was 30% below average. However, total precipitation of over twice the historic average during March and April resulted in cumulative precipitation of 20% above normal values by May. The summer of 2013 was dry with precipitation rates well below the historic average.

Precipitation during the first half of the 2013-2014 hydrological year was above the 1979-2010 historical average. Cumulative precipitation from October to March was 25% above average and snowfall during January was three times normal.

1.4 Regional Hydrology

Water Survey of Canada (WSC 2014a, 2014b) operates a hydrometric station on the Wheeler River, downstream of Russell Lake (Station 06DA005). The station is located about 25 km east of the Project site and records flows from a contributing drainage area of 3,030 square kilometres (km^2). The hydrometric station has been in operation from 1973 to the present and real time discharge and water level data are available. While the drainage area is much larger than those near the site (<371 km^2), the drainage areas relevant to the Project are tributaries to the Wheeler River and are thus expected to exhibit similar flow characteristics.

The mean monthly discharge rates at the Wheeler River for the hydrological years (October 1 to September 30) of 2010-2011 and 2011-2012 (WSC 2014a) as well as 2012-2013 and 2013-2014 (WSC 2014b) are presented in Figure 2.

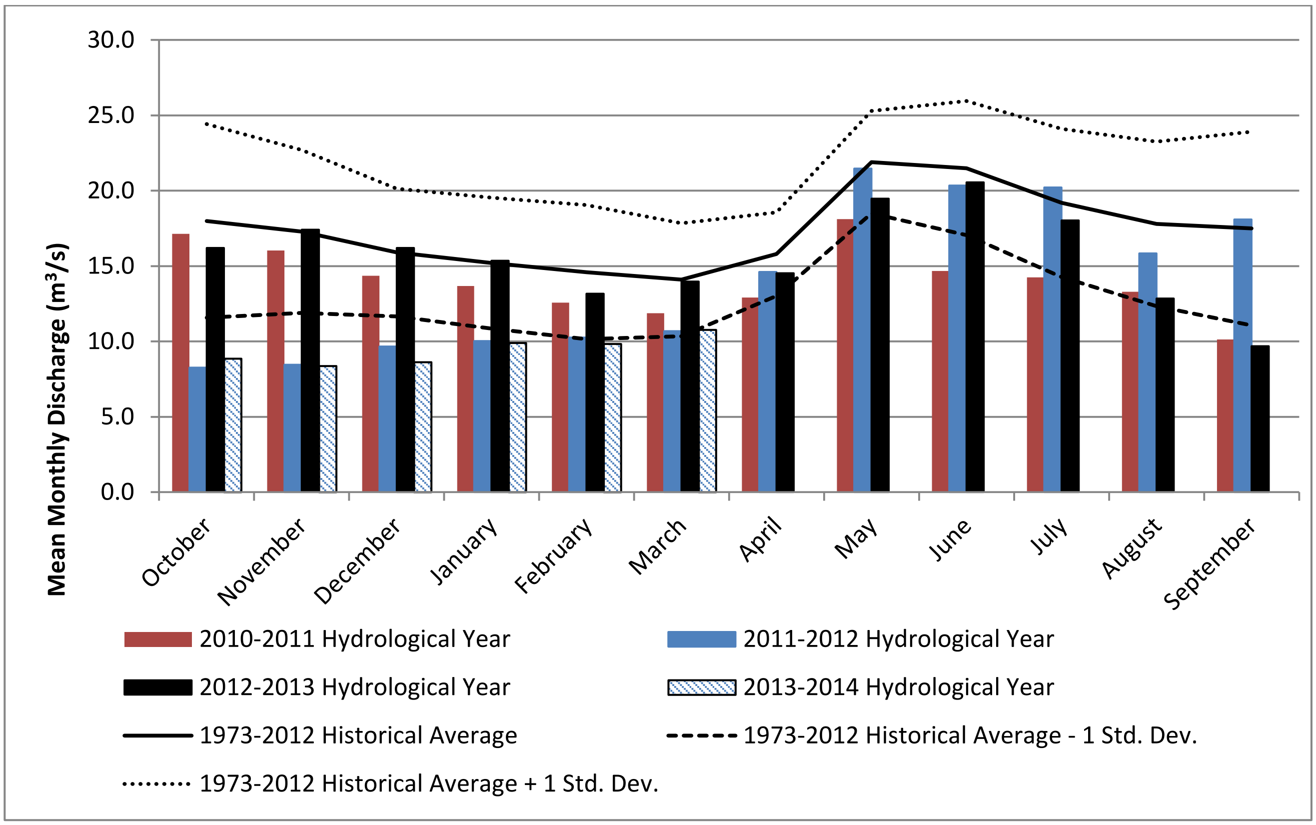


Figure 2: Wheeler River Mean Monthly Discharge for the Hydrological Years Between 2010 and 2013 (WSC 2013, 2014).

Although only provisional data that are subject to revision are available for 2012-2013 and 2013-2014 (Figure 2) these flow rates provide important context to the corresponding flow rates observed near the Project.

During the 2010-2011 hydrological year, discharge at the Wheeler River monitoring station was slightly below the historical average throughout the winter (October–March) and remained well below average during the spring freshet (May and June) and the remainder of the summer and early fall. During this time, flows ranged from 58 percent (%) (September) to 82% (April) of the 1973-2009 normal.

During the 2011-2012 hydrological year, discharge was below the historical average for the winter (January-March). Peak discharge in May approached the historical monthly average of 22 m^3/s, and remained near average during June, July, and September.

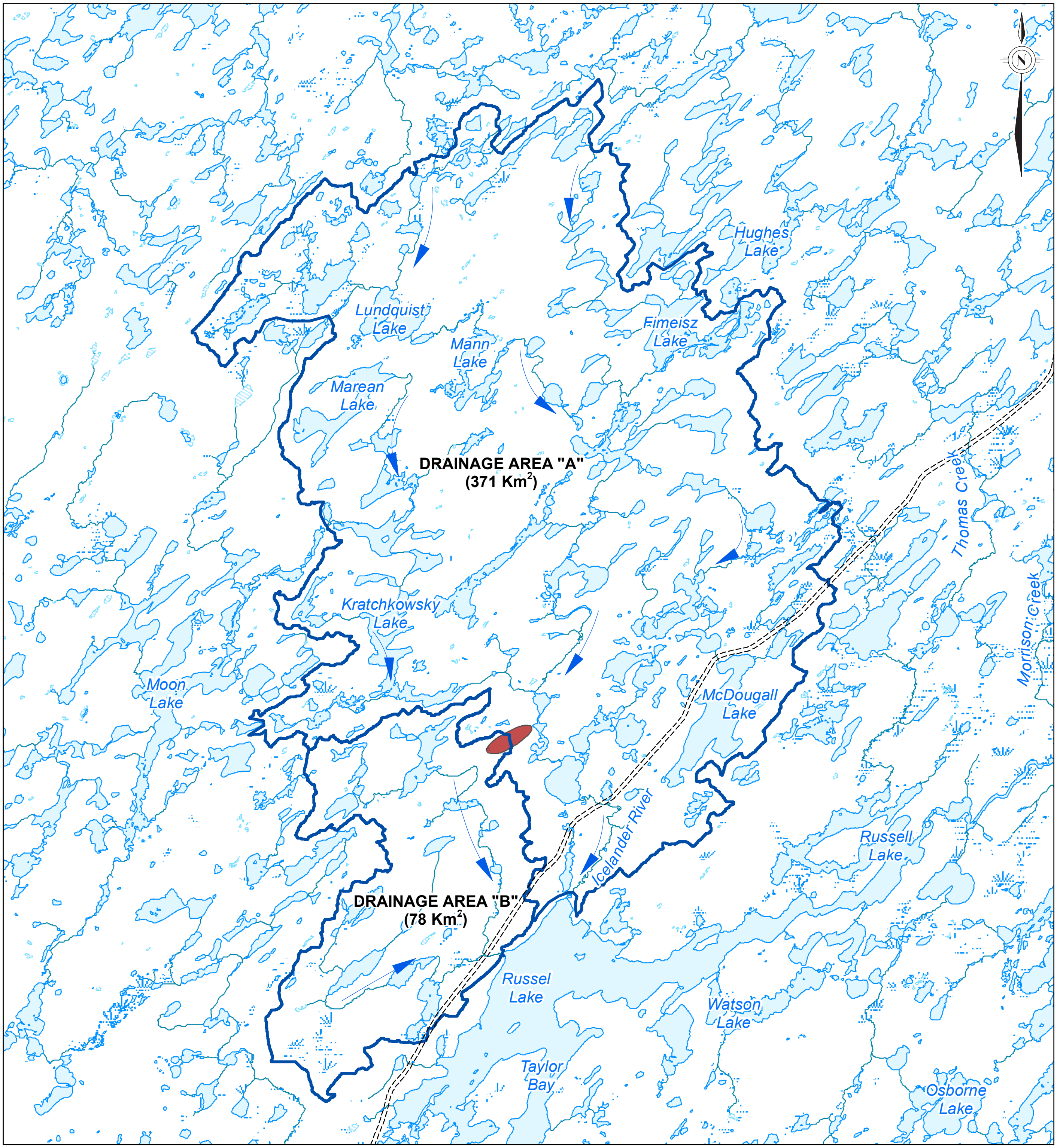
During the winter (October–March) of 2012-2013, discharge at the Wheeler River monitoring station was near or slightly below the historical average. Additional precipitation in April and March (Figure 1) were not matched by a similar streamflow response and discharge remained near but below average until July. In August and September discharge fell well below normal during late summer to 55% of the historical average by September.

During the winter (October–March) of 2013-2014, discharge at the Wheeler River monitoring station was slightly below the normal and rose slightly throughout the winter. The gradual increase in discharge over the winter is likely due to a combination of increased base flow and decreased lake storage. Base flow reaching the stream network is expected to have increased during the fall when evaporative demands ceased and base flow contributions originating in remote terrestrial uplands were free to flow slowly to the stream network. Above average snowfall shown on Figure 1 may also have contributed to higher flow between lakes by depressing the ice surface and decreasing lake storage volume. While flows recovered slightly throughout the winter, they remained one standard deviation below the mean. This increase in flows over winter from the very low levels in the fall of 2013 was also observed in flow data from Project monitoring stations.

2.0 LOCAL HYDROLOGY

2.1 Introduction

The Project is associated with two drainage areas that discharge into Russell Lake (Figure 3). Drainage Area A, with an estimated drainage area of 371 km^2, extends north and east of the Project area while Drainage Area B, with an estimated drainage area of 78 km^2, drains areas south of the Project. The drainage divide between Drainage Area A and Drainage Area B intersects the approximate location of the ore zone (Figure 3). Hydrological monitoring stations were established at six streams and seven lakes in Drainage Area A, and three streams and lakes in Drainage Area B during the 2011 to 2013 field programs; the monitored streams and lakes have been arbitrarily named (Figure 4). The monitored lakes and streams were selected to provide information on all the waterbodies potentially affected by the project and to characterise the general streamflow regime in the area. Table 1 provides the locations and monitoring activities at each waterbody.



LEGEND

==== MCARTHUR RIVER MINE ACCESS ROAD

ORE ZONE

WATERSHED BOUNDARY

4 0 4

SCALE 1:200,000 KILOMETRES

PROJECT

DENISON MINES CORP.
WHEELER RIVER PROPERTY

TITLE

DRAINAGE AREAS ASSOCIATED WITH THE PROJECT

Golder Associates
Saskatoon, Saskatchewan

PROJECT		12-1362-0050	FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
GIS	LMR/ANK	23/01/14	FIGURE: 3	
CHECK	RP	29/05/14		
REVIEW	BT	29/05/14		

REFERENCE

NTS MAPSHEETS 74H02,03,04,05,06,07,10,11,12
NAD83 UTM ZONE 13

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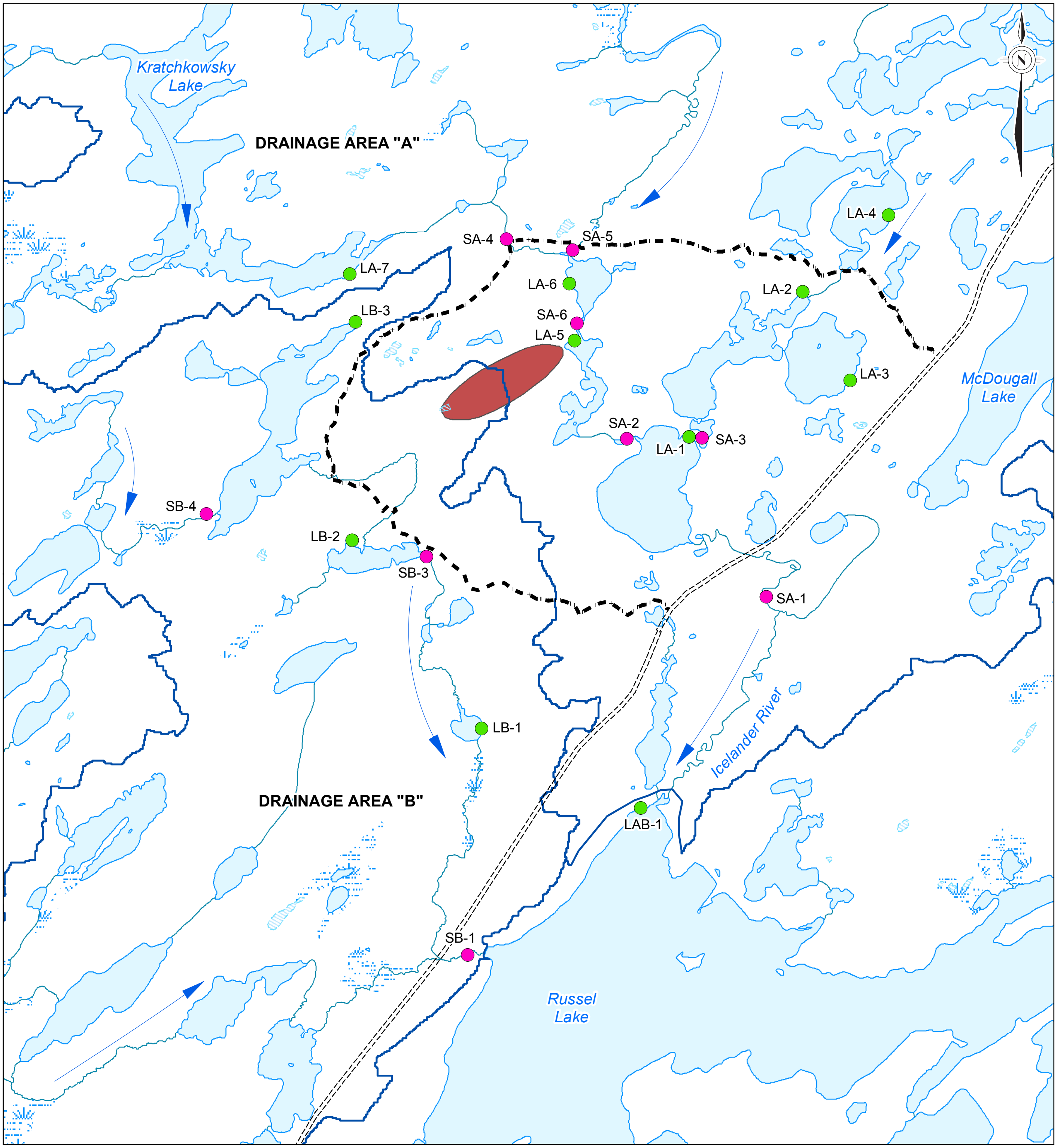

2 0 2

SCALE 1:75,000 KILOMETRES

LEGEND

- MCARTHUR RIVER MINE ACCESS ROAD
- ORE ZONE
- WATERSHED BOUNDARY
- TRAIL
- LAKE MONITORING STATION
- STREAM MONITORING STATION

NOTE

THE GEOGRAPHIC LOCATIONS OF THE MONITORING STATIONS HAVE BEEN ALTERED FOR GRAPHICAL REPRESENTATION.

REFERENCE

NTS MAPSHEETS 74H02,03,04,05,06,07,10,11,12
NAD83 UTM ZONE 13

PROJECT

DENISON MINES CORP.
WHEELER RIVER PROPERTY

TITLE

STREAM AND LAKE MONITORING SITES

Golder Associates
Saskatoon, Saskatchewan

PROJECT		12-1362-0050	FILE No.	
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CHECK	RP	29/05/14		
REVIEW	BT	29/05/14		

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Table 1: Hydrology Monitoring Stations

Station Name	Location (UTM NAD 83)	Instantaneous Discharge Measurements	Continuous Water Level Recording	Staff Gauge	Elevation Survey
Lake Level Monitoring Sites					
LA-1	13 V 479387 6373208	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014
LA-2	13 V 480852 6375164	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014
LA-3	13 V 479387 6373208	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014
LA-4	13 V 481989 6376180	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014
LA-5	13 V 477830 6374521	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014
LA-6	13 V 477763 6375274	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014
LA-7	13 V 474851 6375402	-	2012, 2013	2011, 2012, 2013	2011, 2012, 2013, 2014
LAB-1	13 V 478705 6368323	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014
LB-1	13 V 476598 6369377	-	-	2011, 2012, 2013	2011, 2012, 2013
LB-2	13 V 474882 6371871	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014
LB-3	13 V 474925 6374767	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014
Stream Discharge Monitoring Sites					
SA-1	13 V 480368 6371123	2011, 2012, 2013, 2014	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014
SA-2	13 V 478524 6373216	2011, 2012, 2013, 2014	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014
SA-3	13 V 479415 6373234	2011, 2012, 2013, 2014	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014
SA-4	13 V 476929 6375866	2011, 2012, 2013, 2014	2012, 2013, 2014	-	2011, 2012, 2013, 2014
SA-5	13 V 477804 6375716	2011, 2012, 2013, 2014	2012, 2013, 2014	-	2011, 2012, 2013, 2014
SA-6	13 V 477861 6374749	2011, 2012, 2013, 2014	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014
SB-1	13 V 476041 6366362	2011, 2012, 2013, 2014	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014
SB-3	13 V 475866 6371655	2011, 2012, 2013, 2014	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014
SB-4	13 V 472952 6372222	2011, 2012, 2013, 2014	2012, 2013, 2014	-	2011, 2012, 2013, 2014

Three field programs were completed each open water season in 2011, 2012, and 2013. The field programs were timed to capture the spring peak flows (spring program), summer, and fall, immediately prior to freeze-up. One additional winter field program was completed between March 22 and April 1, 2014. Table 2 indicates the dates of each field program.

Table 2: Field Program Dates

	2011	2012	2013	2014
Spring	May 11 - May16	May 3 – May 9	May 18 – 24	-
Summer	July 27 - July 31	August 5 – August 8	August 12 – 15	-
Fall	October 27 - October 31	October 21 – October 25	October 16 – 19	-
Winter	-	-	-	March 22 – April 1

2.2 Methods

2.2.1 Instantaneous Streamflow Monitoring

At each stream monitoring site, instantaneous streamflow measurements were taken during the spring, summer and fall field campaigns. A suitable cross-section was selected at each stream based on the following characteristics: good bank control, straight channel, most laminar flow, and accessibility. A tag line (a cable marked at regular intervals) was used to divide the channel into vertical segments, with each segment measuring approximately 5% of the channel width or less than 10% of the flow, for streams more than 2 m wide. The depth and velocity at each segment across the channel was measured using a SonTek Flow Tracker current meter attached to a top-set wading rod. The velocity was measured at a depth of 60% (for depths less than 0.75 m) or at 20% and 80% of the depth (for depths greater than 0.75 m). For each section, the product of the mean of the depths and the flow velocity was multiplied by the width of the section to determine the total discharge. This was repeated for each consecutive section across the stream and the total discharge for the stream was then obtained by summing the partial discharges (velocity-area method). The mid-section method was used for discharge calculations (Terzi 1981). Instantaneous winter streamflow measurements were collected for each stream monitoring site observed to have flowing water during the 2014 winter field program. Methods were similar to those used in the summer with the substitution of “effective” flow depth for open water depth to account for the influence of ice cover on flow. Standard methods for the observation of streamflow under ice were followed (Terzi 1981).

2.2.2 Staff Gauge and Elevation Measurements

Water level measurements were collected at each monitoring site. Primarily elevation measurements were collected using an engineer’s rod and level and at some sites secondary elevation measurements were recorded using a staff gauge. At each site, up to three benchmarks were established using the highest point on a large, stable boulder, or a 1.5 m length of rebar driven into the ground. The benchmarks were spray painted, marked as BM1, BM2 or BM3 with flagging tape, and the location was recorded.

An engineer’s rod and level were used to measure water elevations relative to BM1 at each location, which was assigned an arbitrary elevation of 100.000 m. The three benchmarks were used for quality control and to confirm benchmark stability. The water level was measured at the lake surface or at the streamflow monitoring location; if waves affected the accuracy of the reading, the potential error was also recorded. Staff gauges were installed using 2 m lengths of rebar or T-bar and the top (1.000 m) of the staff gauge was measured relative to the local BM1 to monitor potential staff gauge movement between site visits, particularly over winter when ice can disturb the staff gauges.

To convert arbitrary benchmark datums into the geodetic datum, survey results from the 2012 Denison Wheeler River Ground Survey Summary were integrated (Appendix A). This survey used Real Time Kinematic (RTK) GPS to determine the geodetic elevation of the benchmarks. While elevation data were collected for all benchmarks at each site, the vertical error associated with the RTK survey is greater than that associated with the rod and level survey. Therefore, the geodetic elevation of the benchmark with the most accurate reading, i.e., lowest positional dilution of precision (PDOP) value at each site was used to calculate the elevations of the other benchmarks at the site using rod and level survey results.

2.2.3 Continuous Water Level Recording

Water level was continuously measured using a pressure transducer/data logger system. Leveloggers, manufactured by Solinst Canada Ltd, were programmed to record water levels at 30 minute intervals. At each 30 minute interval, the Levelogger records total pressure (atmospheric pressure and water pressure) acting on the sensor, which is internally compensated for temperature. A barologger was also installed near the Denison Mines Wheeler River Exploration Camp. The barologger was only exposed to atmospheric pressure, thereby allowing for barometric compensation of the Levelogger data. The resultant water pressure is related to height of water above the sensor and thus water elevation.

Each Levelogger was secured inside a bracket consisting of a small aluminum pipe that was welded to an aluminum plate or a 0.5 m pin. The plate or pin was fixed in place in the streambed, at or near the discharge measurement cross-section. The elevation of the top of the sensor bracket was measured relative to BM1 during the elevation survey to monitor potential movement between site visits. The sensor's water level measurement and coincident water elevation survey relative to BM1 were used to adjust the continuous water level data to the BM1 datum. An open water stage-discharge rating curve derived from coincident measurements of water depth (stage) and stream discharge was applied to the continuous water level record to derive a continuous discharge record for each site during the open water season.

2.3 Results

2.3.1 Streams

Stage and discharge measurements (Appendix B) were used to create stage-discharge curves for each streamflow monitoring site, as presented in Appendix C. While the three data points typically cover the range of flows and levels observed for the 2011, 2012, and 2013 monitored seasons, the curves are preliminary and discharge records are subject to modification as more measurements are collected and the stage-discharge curves are refined. The hydrograph and instantaneous discharge measurements for streams are provided in Appendix D. Photographs for all streamflow monitoring locations are provided in Appendix E.

In 2011, all hydrographs reflect highest observed flows in the spring during installation. The rising limb of the hydrograph, and spring peak flow rate was not captured at any site. The flow receded throughout May and June, and at all sites a secondary peak was observed during July and early August, which corresponds to relatively high rainfall (Figure 1). Flows receded again until September and remained static for the balance of the monitoring season.

Flows were considerably higher for the 2012 monitoring season than those observed in 2011. In 2012, the spring peak discharge rate, which occurred shortly after the first discharge measurement, was approximately captured at all sites. Discharge peaked in mid-May, and while it generally receded until late August, several other runoff events occurred, and at some sites, reached or exceeded the spring peak flow rate. At most sites, flow rates reached seasonal lows in late August before rising again during September and October to rates approaching those measured in the spring.

Flows were high relative to previous years during spring 2013 but a dry summer meant that by fall, flows were well below those observed in fall 2012 and similar to those observed in fall 2011. Discharge peaked in late June and steadily receded until moderate runoff responses occurred in late August and early September. Flows receded to seasonal lows in late September.

Flows rose above fall 2013 levels through the winter of 2013-2014. The increase in flow through the streams was not matched by increased lake levels. Increased winter flows are expected to result from decreased lake storage due in part to high snow load accumulated on the ice covered lake surfaces.

The following presents a discussion of the physical features and monitoring characteristics observed at each site.

SA-1

SA-1 is the most downstream monitoring station in Drainage Area A with an estimated upstream area of approximately 371 km^2. The monitoring station is located at the transition between an upstream low gradient meandering channel section and a downstream higher gradient riffle channel section. The stream substrate is composed of boulders, cobble and sand and is approximately 15 m wide at the cross-section. Although the banks are well defined and stable with shrubs and moss, the left bank has a notable floodplain vegetated with shrubs and black spruce. SA-1 is a good cross-section and monitoring station, and produces a good stage-discharge relationship and accurate hydrograph.

SA-2

Streamflow monitoring station SA-2 flows into the northwest end of LA-1. The monitoring station at SA-2 is located several meters downstream of the transition between an upstream meandering channel and a downstream riffle section. The monitoring site has a cross-section width of approximately 11 m, is relatively shallow with high velocity flow. The substrate is primarily composed of boulders and cobble, with well-defined and stable vertical banks vegetated with shrubs and trees. SA-2 produces a fair stage-discharge relationship; however the slope is nearly linear, so it may overestimate low and high flows. Further measurements at extreme flows would help verify the accuracy of this rating curve.

SA-3

Streamflow monitoring station SA-3 flows from LA-2 to LA-1. The entire stream length has a sandy and silty substrate with well-defined high vertical banks vegetated with shrubs, willows and jack pine. The monitoring station is located near the middle of the stream length and has a cross-sectional width of approximately 11 m and is shallow. SA-3 produces a good stage-discharge relationship and therefore relatively accurate hydrograph.

SA-4

The stream discharge monitoring station SA-4 drains LA-7, and is to the east of SA-5 and flows into the northwest end of LA-6. The monitoring site is located upstream of the existing temporary bridge and a fast flowing, narrow channel section. The channel has a cross-section width of approximately 6 m. The channel bottom is composed of large angular cobble and boulders. SA-4 produces a poor stage-discharge relationship, likely due to the coarse substrate which increases the stage at low discharge.

SA-5

Station SA-5 is to the west of SA-4 and flows into the northwest end of LA-6. The monitoring station is located downstream of a small temporary bridge in a straight and relatively steep section of the stream. The substrate at the cross-section is primarily boulders and cobble with some sand. The stream has a width of approximately 8 m and has stable vertical organic banks vegetated with shrubs. SA-5 produces a fair stage-discharge relationship and therefore hydrograph.

SA-6

Streamflow monitoring Station SA-6 drains from LA-6 and is upstream of SA-2. The stream section at this monitoring site is characterized by a sandy substrate, slow, deep, and laminar flow, and vertical banks. Although the right bank is well defined, high, and vegetated with trees, sand, and moss, the left bank is low lying with muskeg, shrubs and black spruce. The cross-section has a width of approximately 14 m. SA-6 produces a very good stage-discharge relationship and hydrograph.

SB-1

SB-1 is the most downstream monitored stream in Drainage Area B. The monitoring station is located immediately upstream of the culverts on the Key Lake-McArthur River haul road. The location is characterized by a thick organic substrate, and anthropogenically altered, stable, sand, gravel, and boulder banks with grass, while the channel sections upstream and downstream of the road is generally classified as wetland. The cross-section is approximately 9 m wide and flow is typically deep with gentle laminar flow. SB-1 produces a poor stage-discharge relationship; spring discharge elevations are considerably lower for the corresponding discharge rates than summer and fall measurements. Beaver activity immediately upstream of the culverts affected the stage-discharge relationship during the summer of 2011. Beaver activity approximately 90 m downstream of the culverts resulted in affected water levels from early July and throughout the remainder of the 2013 open water season.

SB-3

Streamflow station SB-3 is located downstream of LB-2. The monitoring station is located in a narrow deep section of the stream with a substrate composed of cobble, boulder, sand and organics. The cross-section has vertical banks with moss and shrubs and a width of approximately 3 m. Although the right bank gains relief within several meters of the stream, the left bank is low lying and reflects flood plain characteristics for tens of meters. SB-3 produces a good stage-discharge relationship and hydrograph.

SB-4

Streamflow Station SB-4 flows into the southwest end of LB-3. The stream flows through low-lying muskeg and is poorly defined. A relatively controlled section was identified as suitable for the streamflow monitoring station;

however both banks are poorly defined, the substrate consists of angular cobbles and boulders, and the stream is surrounded by muskeg. This section of the stream is approximately 5 m wide, has organic banks, and an organic substrate with emergent aquatic vegetation. During the spring site visit, the channel upstream and downstream was blocked with ice. The low velocity and boulder substrate at the cross-section introduce considerable error into discharge measurements. Nevertheless, SB-4 produces a fair stage-discharge relationship and hydrograph. The flow characteristics here differ somewhat from the corresponding flow dynamics in Drainage Area A and SB-3, likely due to the flow characteristics through the muskeg, the buildup of ice during the winter and its gradual melting throughout the summer, and ice blockage during the spring and early summer. A Levelogger was not installed at this location during the 2011 open water season, and in 2012 an animal interfered with the continuous level measurements and disturbed measurements for a portion of July and August.

2.3.2 Relationship to Regional Hydrology

While the drainage area (3,030 km^2) of the Water Survey of Canada (WSC 2012a, 2012b) hydrometric station on the Wheeler River is much larger than those near the site (<371 km^2), the drainage areas relevant to the Project are climatically and physio-graphically similar to the other tributaries of the Wheeler River. As a result, a scaled relationship between flow observed at the larger streamflow stations and the Water Survey of Canada (WSC 2012a, 2012b) hydrometric station on the Wheeler River, downstream of Russell Lake (Station 06DA005) should be valid and could be used to simulate past daily flows in the Project Area based on the 1974-2012 record of flows in the Wheeler River, downstream of Russell Lake (Station 06DA005). A population of 509 samples of observed streamflow from station SA-1 collected over three years were regressed against WSC Station 06DA005 yielded Equation 1 with a correlation coefficient (R) of 0.972. A population of 509 samples of observed streamflow from station SB-3 were regressed against WSC Station 06DA005 yielded Equation 2 with a R= 0.903. A valid relationship between SB-1 and WSC station 06DA005 was not found based on the data collected to date.

$$Q_{SA1} = aQ_{06DA005}{}^{b} \qquad (1)$$

Where:

Q_{SA1} = Daily mean discharge for station SA-1 (m^3/s)
$Q_{06DA005}$= Daily mean discharge for WSC Station 06DA005 (m^3/s)
a = 0.091134488
b = 1.089166899

$$Q_{SB3} = aQ_{06DA005}{}^{b} \qquad (2)$$

Where:

Q_{SB3} = Daily mean discharge for station SB-3 (m^3/s)
$Q_{06DA005}$= Daily mean discharge for WSC Station 06DA005 (m^3/s)
a = 0.004426783
b = 1.272384298

2.3.3 Effect of Seasonal Ice Formation on Streamflow

The development of ice cover in stream channels causes a backwater which is influenced by the quantity and character of ice as well as the quantity of discharge flowing through the stream. Open water rating curves must be adapted to account for the backwater if they are to be applied during ice covered periods (USGS 1982). The backwater effect can be accounted for by comparison of streamflow data to weather records and nearby gaging stations as well as using adjustment factors. An adjustment factor, K, was derived as the ratio of observed ice covered discharge to the open water rated discharge corresponding to the observed stage. The K values observed during March 2014 are presented in Table 3. Late winter discharge could be estimated by multiplying the discharge read from the curves presented in Appendix C by the adjustment factor.

Table 3: Adjustment Factors (K) observed for Ice Covered Discharge

Station	Date	K
SA1	25-Mar-14	0.277
SA2	24-Mar-14	0.364
SA3	24-Mar-14	0.524
SA4	23-Mar-13	0.585
SA5	23-Mar-14	0.409
SA6	23-Mar-14	0.706
SB3	25-Mar-14	0.788

2.3.4 Lakes

Lake stage was measured during each site visit (Table 2), unless snow cover prevented the collection of accurate water level measurements in the spring and winter. In cases where discharge measurements were collected at the outflow channel, lake stage-discharge curves are presented in Appendix C. These data can be used to create continuous lake level records for the measurement periods. Additionally, a continuous water level sensor was installed at LA-7. Table 4 presents a summary of geodetic water levels at each monitored lake during open water conditions between 2011 and 2013. The difference between maximum and minimum water levels measured at the monitored lakes has typically been less than 0.3 m.

Table 4: Lake Water Level Summary

Station	Minimum Measured Water Level (masl)	Maximum Measured Water Level (masl)
LA-1	494.194	494.448
LA-2	494.467	494.654
LA-3	494.439	494.619
LA-4	498.507	498.649
LA-5	499.949	500.074
LA-6	499.943	500.092
LA-7	520.424	520.536
LB-1	503.707	504.079
LB-2	510.392	510.573
LB-3	518.356	518.580
LAB-1	487.994	488.233

masl = metres above sea level

Ice thickness was observed at the deepest point of each monitored lake between March 23, 2014 and April 1, 2014. Ice thickness observed at the end of March can be considered the maximum development of ice thickness for the winter of 2013-2014. Table 5 presents a summary of ice thicknesses. Observed lake ice thickness ranged from 0.70 m to 0.97 m with an average of 0.83 m.

Table 5: Lake Water Level Summary

Station	Ice Surface	Ice Thickness	Water Surface
LA-1	494.258	0.97	494.298
LA-2	494.582	0.76	494.582
LA-3	494.589	0.80	494.649
LA-4	498.634	0.82	498.614
LA-5	500.076	0.70	500.076
LA-6	500.058	0.94	500.058
LA-7	520.472	0.85	520.502
LB-1	n/a	n/a	n/a
LB-2	510.533	0.78	510.533
LB-3	518.463	0.82	518.463
LAB-1	488.332	0.83	488.382

masl = metres above sea level

3.0 CLOSURE

Golder Associates Ltd. appreciates the opportunity to assist Denison with this project. We trust that this report meets your needs at this time. Should you have any questions or comments, please do not hesitate to contact the undersigned.

GOLDER ASSOCIATES LTD.

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RP/BT/pls

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APPENDIX A

Denison Wheeler River Ground Survey Summary

MEMORANDUM

TO Lawson Forand, Denison Mines Corp. **DATE** January 3, 2013

CC Clark Gamelin, Denison Mines Corp.

FROM Ashley Dubnick/Brent Topp **PROJECT No.** 12-1362-0050/1000

DENISON WHEELER RIVER GROUND SURVEY SUMMARY

Introduction

Golder Associates Ltd. (Golder) was retained by Denison Mines Corp. (Denison) to perform a hydrological baseline program as part of a pre-feasibility study of the Phoenix deposit at the Wheeler River property (the Project) near Key Lake, Saskatchewan. As part of the program, Golder has established a number of hydrological monitoring stations to collect the necessary hydrological baseline data to support various project requirements including environmental assessments, regulatory permitting, and providing design basis information for engineered designs, including fresh water diversions, water management systems, sedimentation ponds, and cross-drainage structures. To most accurately complete these hydrological assessments, models that incorporate the hydrological information and the LiDAR surface, collected in June, 2010, may be created. However, to accurately combine these datasets, a topographic survey of the hydrological station benchmarks is necessary. This technical memorandum presents a summary of the geodetic survey results completed at the Denison Wheeler River property.

Methods

The geodetic ground survey was completed on October 21 to 24, 2012 using a GPS Base Station and RTK GPS Rover with the following specifications:

GPS Base Station

- Sokkia GRX1 base station receiver integrated with GPS and GLONASS tracking in conjunction with Satel differential correction external radio.
- Satel radio transmission repeater used to increase signal quality and range.

RTK GPS Rover

- Sokkia GRX1 RTK rover receiver integrated with GPS and GLONASS tracking in conjunction with Satel differential correction internal radio.
- RTK GPS attached to a fixed-height carbon fibre pole.

Because the benchmark or the control points used for the LiDAR survey were not accessible or useable for the purposes of this ground survey, site control was established using planted iron pins at four locations. The base station reference point was established by averaging 2700 autonomous GPS readings and a site-specific geoid model was used for all surveys. Geodetic elevations at all benchmarks established at hydrometric monitoring stations were collected.

Results

Over the course of the survey, no horizontal error exceeded 0.037m to established control and no vertical error exceeded 0.012m to established control. Table 1 presents the greatest errors to established control observed on each day of the survey.

Table 1: Greatest Error to Established Control

	Northing (m)	Easting (m)	Elevation (m)
October 21, 2012	0.017	0.015	0.012
October 22, 2012	0.016	0.013	0.006
October 23, 2012	0.002	0.015	0.010
October 24, 2012	0.021	0.037	0.007

Ground survey results are presented in Table 2 and include the location and elevation of each point as well as indicators of the point quality.

Table 2: Geodetic Survey Results

Benchmark	Type	Location (WGS 84)			Point Quality			
		Northing (m)	Easting (m)	Elevation (m)	HDOP Avg	VDOP Avg	PDOP Avg	Sat Avg
GolderWR CP1	Rebar	6372855.249	474661.887	519.868	-	-	-	-
GolderWR CP2	Rebar	6374770.522	475606.918	540.993	-	-	-	-
GolderWR CP2	Rebar	6370859.443	477535.796	556.213	-	-	-	-
GolderWR CP2	Rebar	6370371.120	477093.253	558.542	-	-	-	-
LA-2 BM1	Rebar	6375172.712	480842.634	497.339	0.8637	1.4567	1.6935	13
LA-2 BM2	Rebar	6375174.795	480846.484	497.064	1.0822	1.6114	1.9415	12
LA-2 BM3	Rebar	6375171.611	480846.491	496.34	0.8806	1.4144	1.6662	14
LA-3 BM1	Rock	6373997.350	481487.807	496.134	0.6176	1.0483	1.2167	16
LA-3 BM2	Rock	6373994.256	481487.899	496.034	0.6212	1.0813	1.2474	16
LA-3 BM3	Rock	6373997.038	481478.058	494.831	0.6510	1.1243	1.2992	15
LA-4 BM1	Rebar	6376186.639	481994.794	500.365	0.8486	1.2003	1.4700	15
LA-4 BM2	Rebar	6376189.113	481991.522	500.252	0.8522	1.2156	1.4846	14
LA-4 BM3	Rebar	6376187.971	481988.774	499.699	0.8540	1.2233	1.4919	15
LA-5 BM1	Rebar	6374540.225	477831.352	501.366	0.7518	1.1807	1.3997	13
LA-5 BM2	Rebar	6374541.110	477824.823	501.014	0.7609	1.1976	1.4189	13
LA-5 BM3	Rebar	6374538.032	477835.822	501.023	0.7499	1.1325	1.3584	13
LA-6 BM1	Rebar	6375257.733	477749.298	502.388	0.9719	1.7615	2.0118	12
LA-6 BM2	Rebar	6375254.317	477756.381	502.08	0.9763	1.8564	2.0981	11
LA-7 BM1	Rock	6375365.152	474859.273	522.374	0.7420	1.0764	1.3074	16
LA-7 BM2	Rock	6375370.136	474856.009	522.067	0.7449	1.0884	1.3188	16
LA-7 BM3	Rock	6375373.196	474852.454	521.8	0.7528	1.1217	1.3509	15
LAB-1 BM1	Rebar	6368332.435	478695.192	489.243	0.6562	1.1309	1.3075	16
LAB-1 BM2	Rebar	6368331.850	478688.921	489.745	0.7115	1.1969	1.3924	16
LAB-1 BM3	Rebar	6368334.674	478697.583	489.597	0.6292	1.0883	1.2571	18
LB-1 BM1	Rebar	6369366.788	476603.997	505.231	0.6245	1.0322	1.2066	17

Benchmark	Type	Location (WGS 84)			Point Quality			
		Northing (m)	Easting (m)	Elevation (m)	HDOP Avg	VDOP Avg	PDOP Avg	Sat Avg
LB-1 BM2	Rebar	6369370.293	476602.209	505.04	0.5854	0.9346	1.1029	19
LB-1 BM3	Rebar	6369363.850	476597.929	505.073	0.6873	1.1251	1.3185	15
LB-2 BM1	Rebar	6371898.916	474903.385	511.767	0.7817	1.3143	1.5293	14
LB-2 BM2	Rebar	6371901.778	474906.357	511.819	0.7503	1.3058	1.5060	15
LB-2 BM3	Rebar	6371904.723	474900.057	511.806	0.7563	1.3243	1.5251	15
LB-3 BM1	Rebar	6374839.646	474884.439	520.159	0.8050	1.3752	1.5935	15
LB-3 BM2	Rebar	6374831.436	474893.291	519.42	0.8075	1.3649	1.5859	14
LB-3 BM3	Rebar	6374834.862	474895.379	520.021	0.8710	1.4123	1.6595	13
SA-1 BM1	Rebar	6371129.601	480327.636	496.123	0.6503	1.1645	1.3338	16
SA-1 BM2	Rock	6371125.303	480328.743	495.576	0.8882	1.4407	1.6926	15
SA-1 BM3	Rebar	6371123.762	480357.257	494.361	0.6567	1.1236	1.3015	15
SA-2 BM1	Rock	6373258.113	478533.160	498.369	0.7284	1.1748	1.3824	14
SA-2 BM2	Rock	6373258.391	478529.590	498.354	0.7223	1.1761	1.3802	14
SA-3/LA-1 BM1	Rebar	6373226.219	479403.750	495.714	0.6648	0.9753	1.1803	15
SA-3/LA-1 BM2	Rebar	6373227.014	479408.484	495.55	0.6932	1.1317	1.3274	14
SA-3/LA-1 BM3	Rebar	6373222.211	479402.381	495.616	0.7095	1.0651	1.2798	15
SA-4 BM1	Rebar	6375855.114	476914.695	507.772	0.7494	1.1259	1.3528	12
SA-4 BM2	Rock	6375853.025	476915.570	508.373	0.6744	1.0823	1.2752	13
SA-5 BM1	Rebar	6375723.540	477791.074	502.58	0.8335	1.5526	1.7626	13
SA-5 BM2	Rock	6375739.656	477807.701	502.045	0.7208	1.3664	1.5449	15
SA-6 BM1	Rebar	6374757.968	477848.597	503.32	0.7968	1.2055	1.4451	13
SA-6 BM2	Rebar	6374752.648	477849.463	503.205	0.6627	1.0256	1.2210	15
SA-6 BM3	Rebar	6374746.296	477855.608	502.021	0.7816	1.2429	1.4682	13
SB-1 BM1	Culvert	6366351.011	476038.945	489.602	0.7076	1.1207	1.3254	16
SB-1 BM2	Culvert	6366355.284	476042.540	489.414	0.7191	1.1384	1.3465	15
SB-1 BM3	Rock	6366375.139	476028.439	489.217	0.7107	1.2371	1.4268	15
SB-3 BM1	Rebar	6371642.428	475847.211	511.473	0.6569	0.9922	1.1900	16
SB-3 BM2	Rock	6371638.405	475838.409	511.897	0.6562	0.9889	1.1868	16
SB-4 BM1	Rock	6372197.891	472953.818	520.307	0.6084	1.1287	1.2822	17
SB-4 BM2	Rock	6372197.460	472955.741	520.205	0.7005	1.3090	1.4847	13
SB-4 BM3	Rock	6372197.402	472957.726	520.305	0.6243	1.1415	1.3011	16

HDOPAvg: Horizontal dilution of precision

VDOPAvg Vertical dilution of precision

PDOPAvg: Positional (3D) dilution of precision

SatAvg: average number of satellites

Closure

Golder Associates Ltd. appreciates the opportunity to assist Denison with this project. We trust that this report meets your needs at this time. Should you have any questions or comments, please do not hesitate to contact us.

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APPENDIX B

Stage and Discharge Measurements

Table B1: Lake Stage Measurements

Location	Date	Elevation (m) (Arbitrary Datum)	Elevation (m) (Geodetic)
LA-1	13-May-11	98.725	494.439
	29-Jul-11	98.613	494.327
	28-Oct-11	98.504	494.218
	4-May-12	98.709	494.423
	5-Aug-12	98.672	494.386
	23-Oct-12	98.734	494.448
	21-May-13	98.726	494.44
	14-Aug-13	98.551	494.265
	16-Oct-13	98.48	494.194
	25-Mar-14	98.584	494.298
LA-2	13-May-11	97.269	494.615
	30-Jul-11	97.256	494.602
	29-Oct-11	97.203	494.549
	4-May-12	97.264	494.61
	6-Aug-12	97.274	494.62
	23-Oct-12	97.308	494.654
	20-May-13	97.278	494.624
	13-Aug-13	97.197	494.543
	16-Oct-13	97.121	494.467
	26-Mar-14	97.236	494.582
LA-3	13-May-11	98.427	494.561
	30-Jul-11	98.433	494.567
	29-Oct-11	98.427	494.561
	4-May-12	98.472	494.606
	6-Aug-12	98.456	494.59
	23-Oct-12	98.485	494.619
	20-May-13	98.459	494.593
	13-Aug-13	98.387	494.521
	16-Oct-13	98.305	494.439
	26-Mar-14	98.515	494.649

Table B1: Lake Stage Measurements (continued)

Location	Date	Elevation (m) (Arbitrary Datum)	Elevation (m) (Geodetic)
LA-4	29-Jul-11	98.284	498.649
	30-Oct-11	98.152	498.517
	4-May-12	98.223	498.588
	5-Aug-12	98.248	498.613
	6-Aug-12	98.257	498.622
	23-Oct-12	98.262	498.627
	20-May-13	98.259	498.624
	13-Aug-13	98.164	498.529
	16-Oct-13	98.142	498.507
	27-Mar-14	98.249	498.614
LA-5	13-May-11	98.706	500.050
	31-Jul-11	98.67	500.014
	27-Oct-11	98.605	499.949
	6-May-12	98.73	500.074
	5-Aug-12	98.693	500.037
	22-Oct-12	98.728	500.072
	21-May-13	98.729	500.073
	13-Aug-13	98.625	499.969
	17-Oct-13	98.606	499.95
	23-Mar-14	98.732	500.076
LA-6	13-May-11	97.675	500.063
	31-Jul-11	97.64	500.028
	27-Oct-11	97.555	499.943
	6-May-12	97.7	500.088
	5-Aug-12	97.67	500.058
	22-Oct-12	97.704	500.092
	19-May-13	97.7	500.088
	13-Aug-13	97.585	499.973
	17-Oct-13	97.559	499.947
	23-Mar-14	97.67	500.058

Table B1: Lake Stage Measurements (continued)

Location	Date	Elevation (m) (Arbitrary Datum)	Elevation (m) (Geodetic)
LA-7	29-Jul-11	98.108	520.482
	31-Oct-11	98.05	520.424
	6-May-12	98.149	520.523
	8-Aug-12	98.108	520.482
	21-Oct-12	98.162	520.536
	24-May-13	98.157	520.531
	13-Aug-13	98.083	520.457
	16-Oct-13	98.066	520.44
	27-Mar-14	98.128	520.502
LAB-1	16-May-11	98.991	488.219
	1-Aug-11	98.891	488.119
	30-Oct-11	98.776	488.004
	9-May-12	99	488.228
	6-Aug-12	98.939	488.167
	23-Oct-12	98.987	488.215
	21-May-13	99.005	488.233
	12-Aug-13	98.879	488.107
	19-Oct-13	98.766	487.994
	25-Mar-14	99.154	488.382
LB-1	14-May-11	98.666	503.902
	1-Aug-11	98.807	504.043
	30-Oct-11	98.648	503.884
	6-May-12	98.636	503.872
	6-Aug-12	98.651	503.887
	21-Oct-12	98.617	503.853
	19-May-13	98.843	504.079
	14-Aug-13	98.509	503.745
	17-Oct-13	98.471	503.707

Table B1: Lake Stage Measurements (continued)

Location	Date	Elevation (m) (Arbitrary Datum)	Elevation (m) (Geodetic)
LB-2	14-May-11	98.767	510.523
	29-Jul-11	98.689	510.445
	30-Oct-11	98.636	510.392
	5-May-12	98.771	510.527
	6-Aug-12	98.745	510.501
	21-Oct-12	98.817	510.573
	21-May-13	98.756	510.512
	14-Aug-13	98.699	510.455
	17-Oct-13	98.651	510.407
	25-Mar-14	98.777	510.533
LB-3	15-May-11	98.365	518.519
	29-Jul-11	98.284	518.438
	29-Oct-11	98.203	518.356
	5-May-12	98.361	518.515
	5-Aug-12	98.37	518.524
	21-Oct-12	98.426	518.58
	19-May-13	98.38	518.534
	13-Aug-13	98.278	518.432
	17-Oct-13	98.233	518.387
	25-Mar-14	98.233	518.463

Table B2: Stream Stage and Discharge Measurements

Location	Date	Elevation (m) (Arbitrary Datum)	Elevation (m) (Geodetic)	Discharge (m^3/s)
SA-1	14-May-11	97.793	492.714	2.307
	29-Jul-11	97.727	492.648	1.750
	28-Oct-11	97.641	492.562	0.973
	5-May-12	97.79	492.711	2.293
	6-Aug-12	97.774	492.695	2.031
	23-Oct-12	97.8	492.721	2.575
	20-May-13	97.784	492.705	2.358
	14-Aug-13	97.666	492.587	1.280
	18-Oct-13	97.633	492.554	0.887
	30-Mar-14	97.948	492.869	1.203
SA-2	12-May-11	98.37	496.727	1.649
	30-Jul-11	98.341	496.698	1.387
	27-Oct-11	98.31	496.667	0.809
	8-May-12	98.391	496.748	2.008
	8-Aug-12	*98.332*	*496.689*	1.305
	24-Oct-12	98.377	496.734	2.030
	21-May-13	98.37	496.727	1.842
	14-Aug-13	98.303	496.66	0.863
	16-Oct-13	98.284	496.641	0.741
	24-Mar-14	98.448	496.805	1.180
SA-3	13-May-11	98.745	494.459	0.476
	29-Jul-11	98.678	494.392	0.370
	28-Oct-11	98.608	494.322	0.239
	4-May-12	98.759	494.473	0.528
	5-Aug-12	98.729	494.443	0.478
	23-Oct-12	98.773	494.487	0.578
	20-May-13	98.768	494.482	0.564
	14-Aug-13	98.63	494.344	0.255
	16-Oct-13	98.529	494.243	0.051
	24-Mar-14	98.534	494.248	0.362

Table B2: Stream Stage and Discharge Measurements (continued)

Location	Date	Elevation (m) (Arbitrary Datum)	Elevation (m) (Geodetic)	Discharge (m^3/s)
SA-4	11-May-11	98.577	506.357	0.483
	30-Jul-11	98.534	506.314	0.335
	31-Oct-11	98.53	506.31	0.199
	4-May-12	98.568	506.348	0.466
	5-Aug-12	98.549	506.329	0.361
	22-Oct-12	98.587	506.367	0.497
	19-May-13	98.589	506.369	0.519
	13-Aug-13	98.497	506.277	0.276
	17-Oct-13	98.469	506.249	0.206
	23-Mar-13	98.601	506.381	0.330
SA-5	12-May-11	98.129	500.708	1.100
	30-Jul-11	98.089	500.668	0.858
	29-Oct-11	98.03	500.609	0.476
	4-May-12	98.138	500.717	1.111
	5-Aug-12	98.105	500.684	1.026
	22-Oct-12	98.139	500.718	1.269
	19-May-13	98.147	500.726	1.381
	13-Aug-13	98.05	500.629	0.616
	17-Oct-13	98.043	500.622	0.507
	23-Mar-14	98.219	500.798	0.886
SA-6	13-May-11	96.753	500.084	1.631
	30-Jul-11	96.703	500.034	1.303
	27-Oct-11	96.625	499.956	0.717
	6-May-12	96.767	500.098	1.957
	5-Aug-12	96.73	500.061	1.476
	22-Oct-12	96.771	500.102	1.851
	19-May-13	96.746	500.077	1.540
	13-Aug-13	96.661	499.992	0.842
	17-Oct-13	96.638	499.969	0.798
	23-Mar-14	96.75	500.081	1.173

Table B2: Stream Stage and Discharge Measurements (continued)

Location	Date	Elevation (m) (Arbitrary Datum)	Elevation (m) (Geodetic)	Discharge (m^3/s)
SB-1	14-May-11	98.884	488.486	0.517
	31-Jul-11	99.425	489.027	0.186
	30-Oct-11	98.816	488.418	0.217
	3-May-12	98.922	488.524	0.644
	6-Aug-12	98.92	488.522	0.358
	23-Oct-12	98.997	488.599	0.578
	18-May-13	98.882	488.484	0.547
	12-Aug-13	98.733	488.335	0.158
	19-Oct-13	99.248	488.85	0.277
	27-Mar-14	99.221	488.823	0.289
SB-3	11-May-11	98.964	510.465	0.187
	31-Jul-11	98.905	510.406	0.109
	30-Oct-11	98.888	510.389	0.082
	5-May-12	99.005	510.506	0.235
	8-Aug-12	98.955	510.456	0.136
	21-Oct-12	99.016	510.517	0.255
	20-May-13	98.976	510.476	0.209
	14-Aug-13	98.921	510.421	0.107
	17-Oct-13	98.914	510.414	0.080
	25-Mar-14	98.923	510.423	0.090
SB-4	15-May-11	98.827	519.134	0.074
	1-Aug-11	98.657	518.964	0.008
	30-Oct-11	98.763	519.07	0.018
	5-May-12	98.912	519.219	0.109
	6-Aug-12	98.837	519.144	0.032
	21-Oct-12	98.938	519.245	0.099
	21-May-13	98.875	519.185	0.114
	15-Aug-13	98.764	519.074	0.007
	17-Oct-13	98.805	519.115	0.036

APPENDIX C

Open Water Stage-Discharge Curves for Lake Level and Streamflow Monitoring Stations

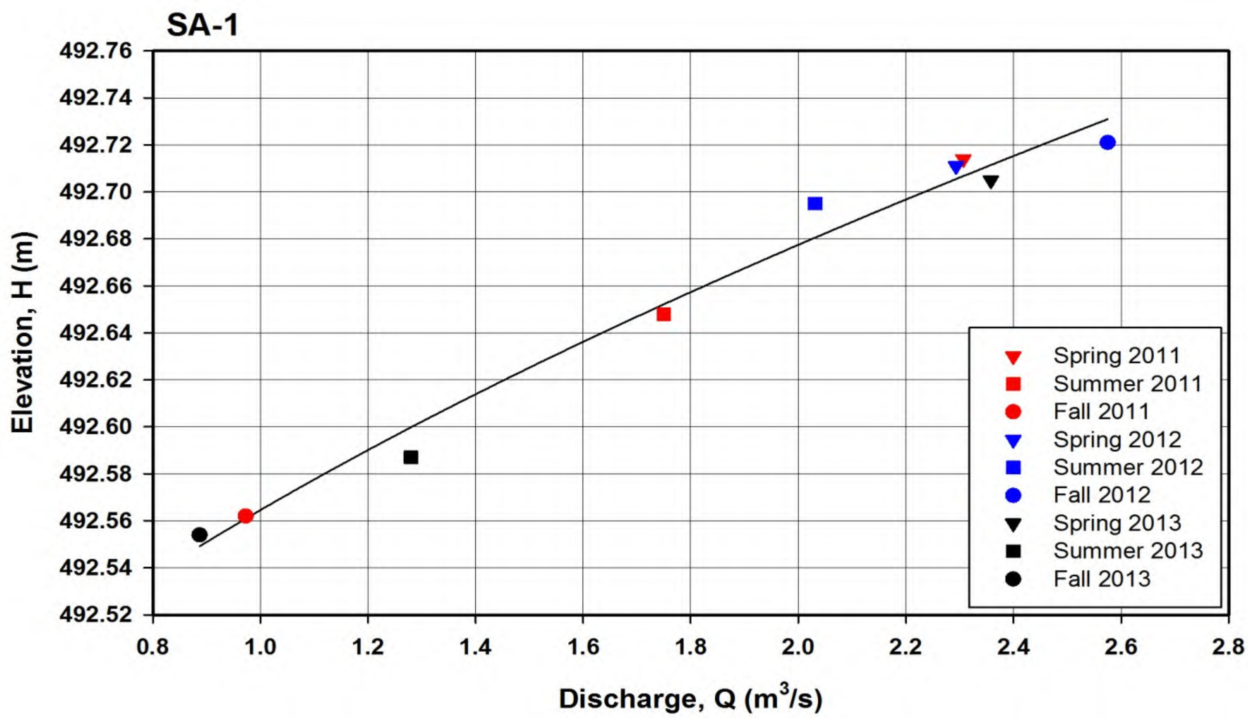

Figure C1: Relationship between Water Surface Elevation, H (m), and Discharge, Q (m^3/s), at Streamflow Station SA-1.

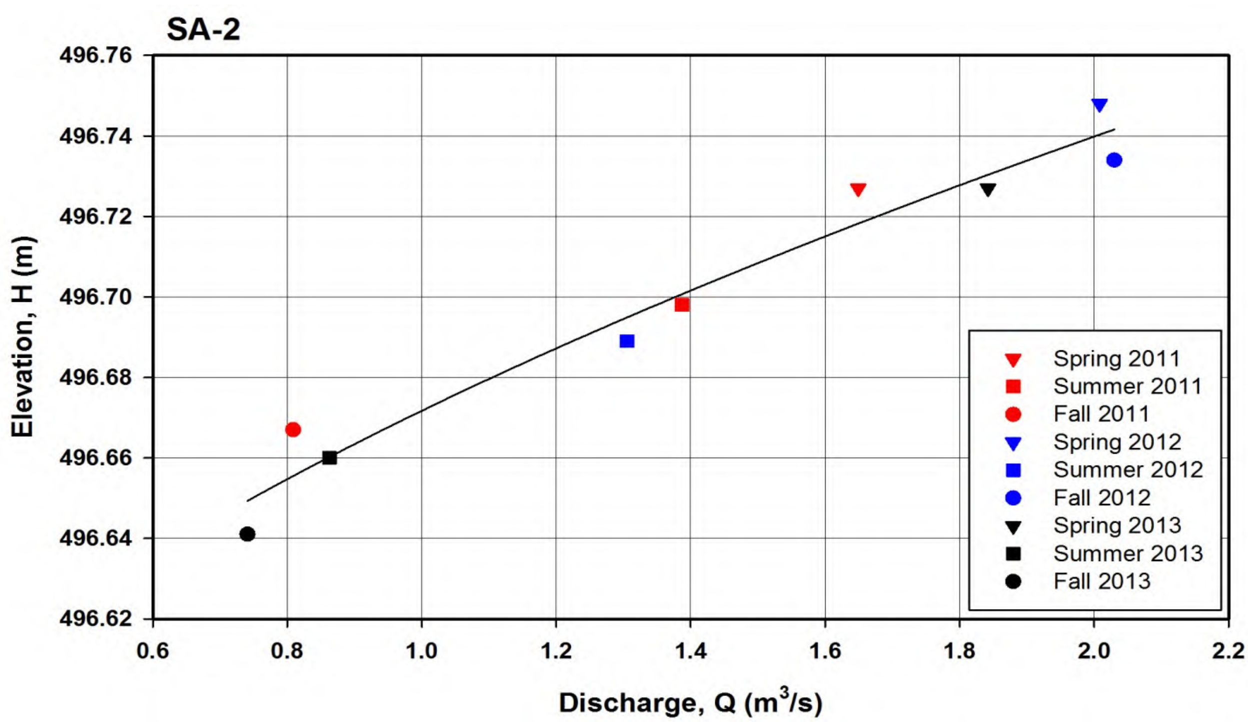

Figure C2: Relationship between Water Surface Elevation, H (m), and Discharge, Q (m^3/s), at Streamflow Station SA-2.

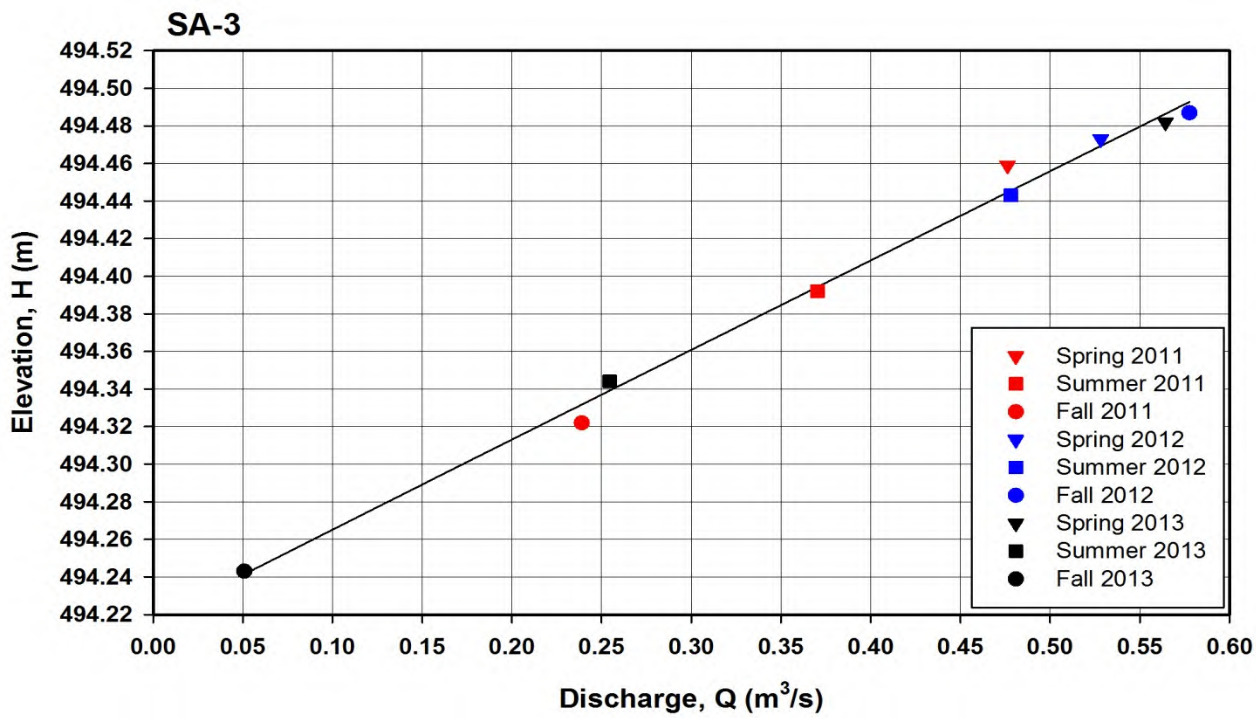

Figure C3: Relationship between Water Surface Elevation, H (m), and Discharge, Q (m^3/s), at Streamflow Station SA-3.

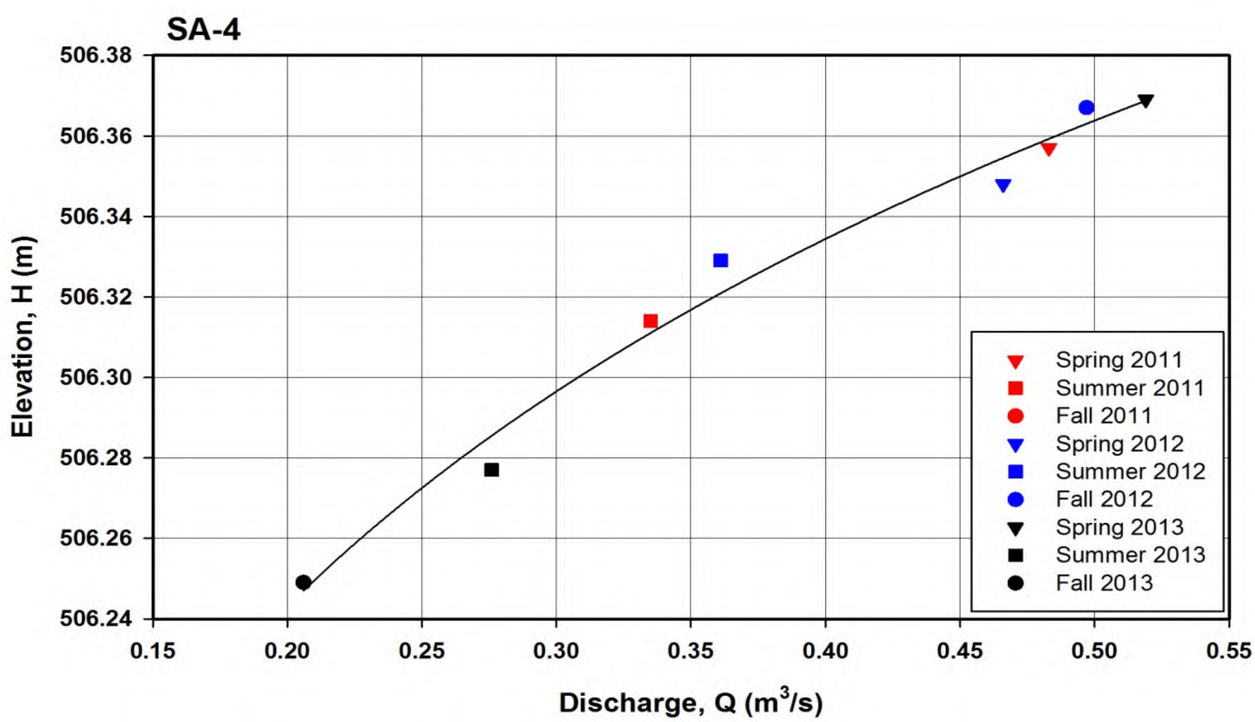

Figure C4: Relationship between Water Surface Elevation, H (m), and Discharge, Q (m^3/s), at Streamflow Station SA-4.

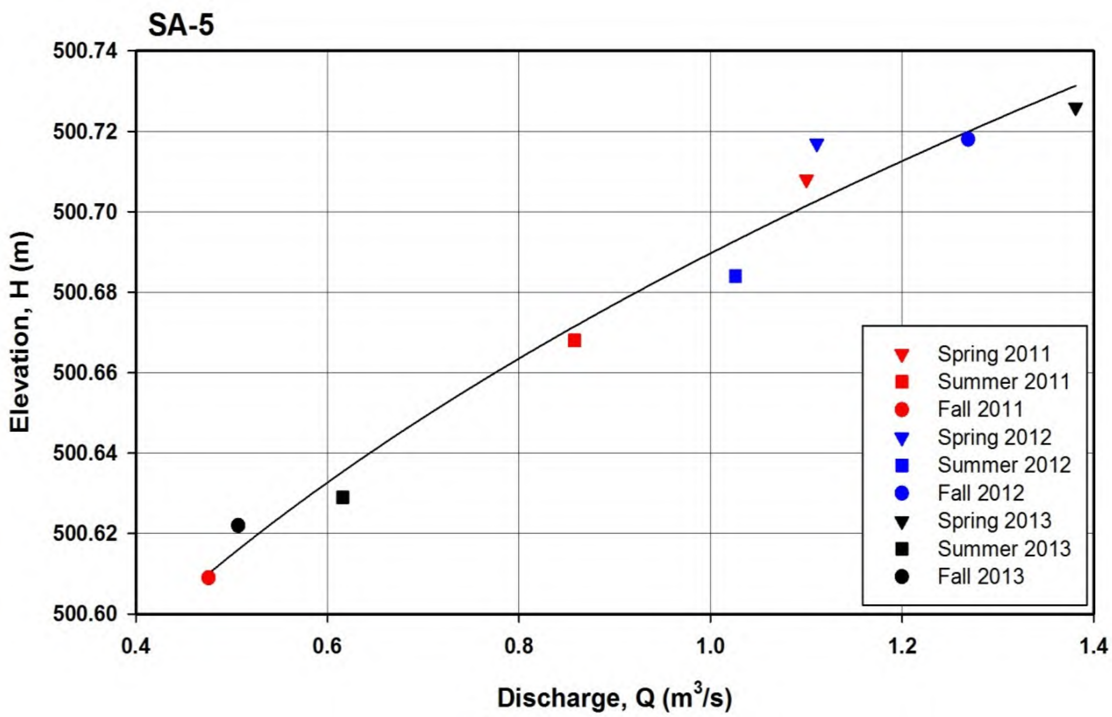

Figure C5: Relationship between Water Surface Elevation, H (m), and Discharge, Q (m^3/s), at Streamflow Station SA-5.

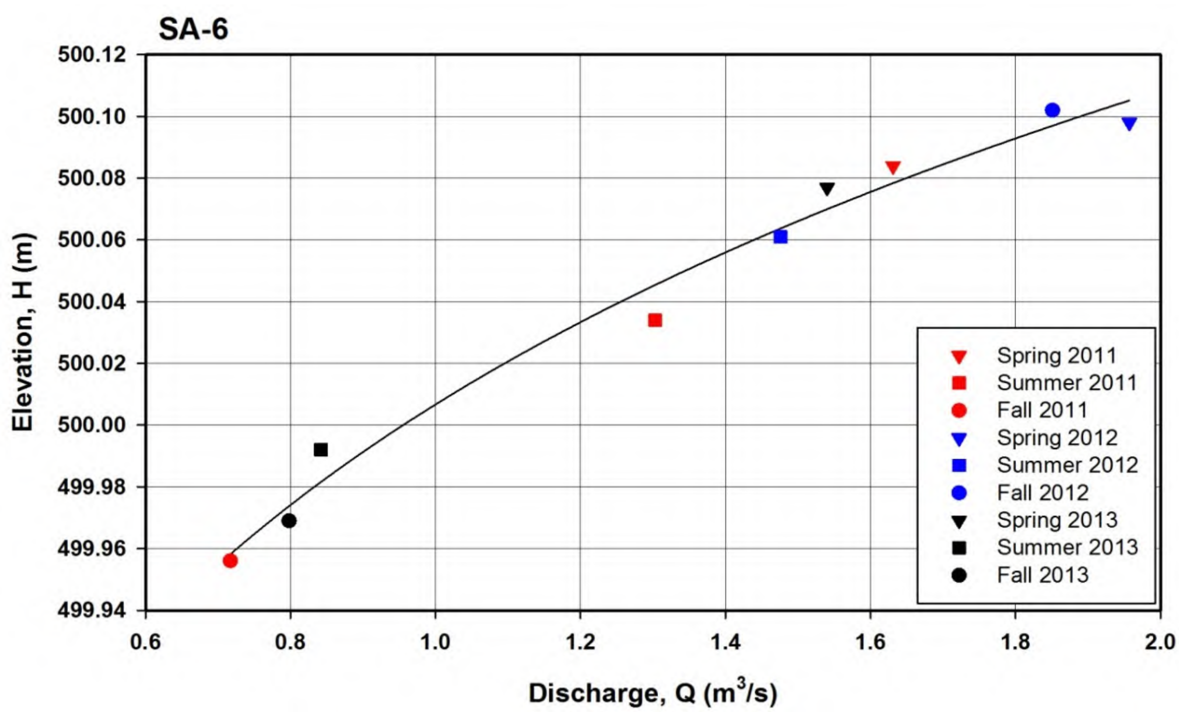

Figure C6: Relationship between Water Surface Elevation, H (m), and Discharge, Q (m^3/s), at Streamflow Station SA-6.

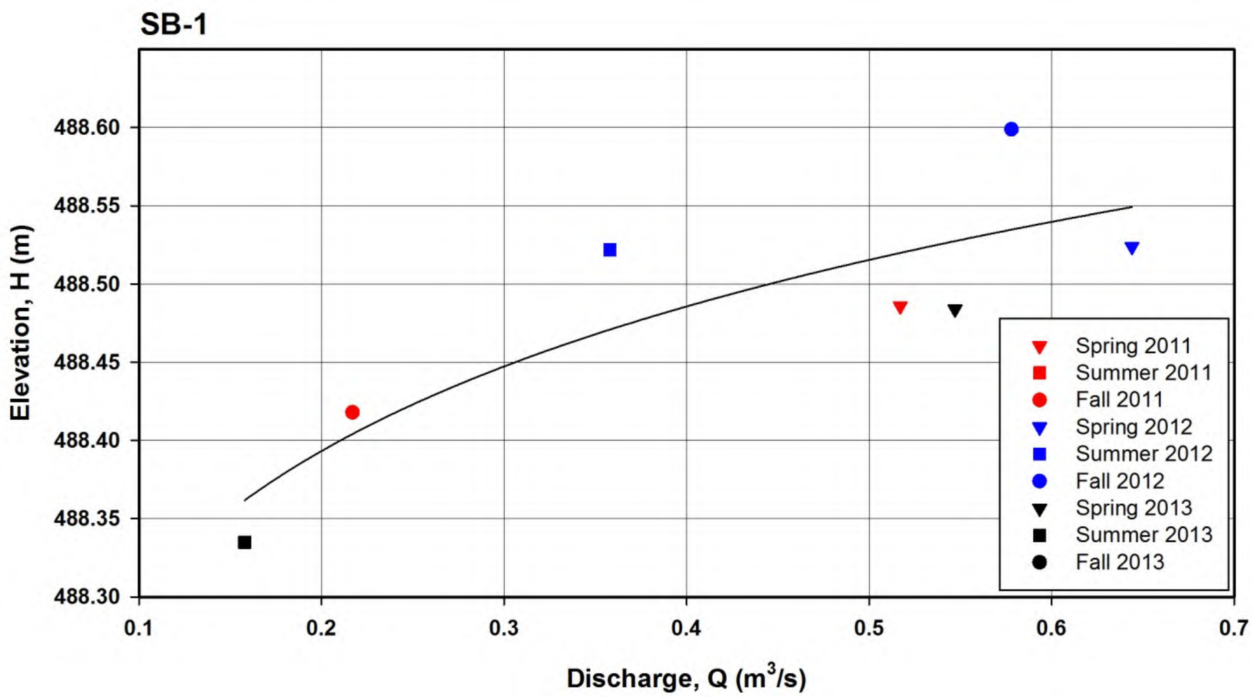

Figure C7: Relationship between Water Surface Elevation, H (m), and Discharge, Q (m^3/s), at Streamflow Station SB-1.

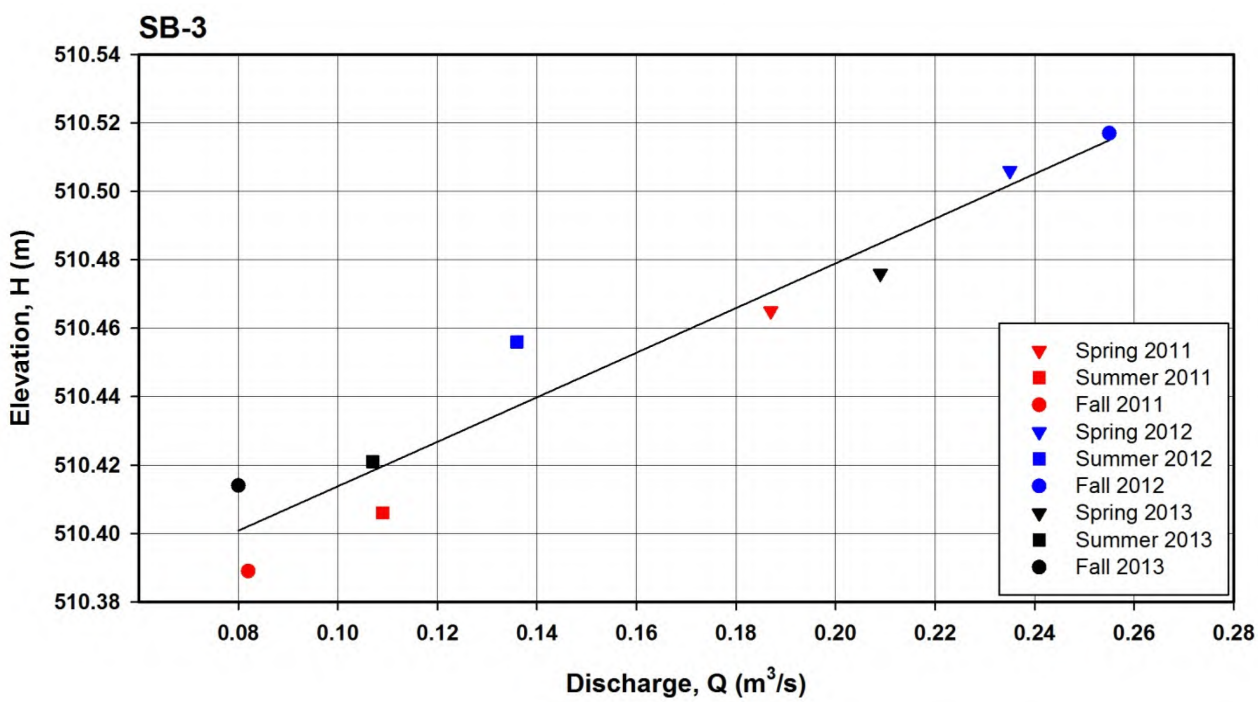

Figure C8: Relationship between Water Surface Elevation, H (m), and Discharge, Q (m^3/s), at Streamflow Station SB-3.

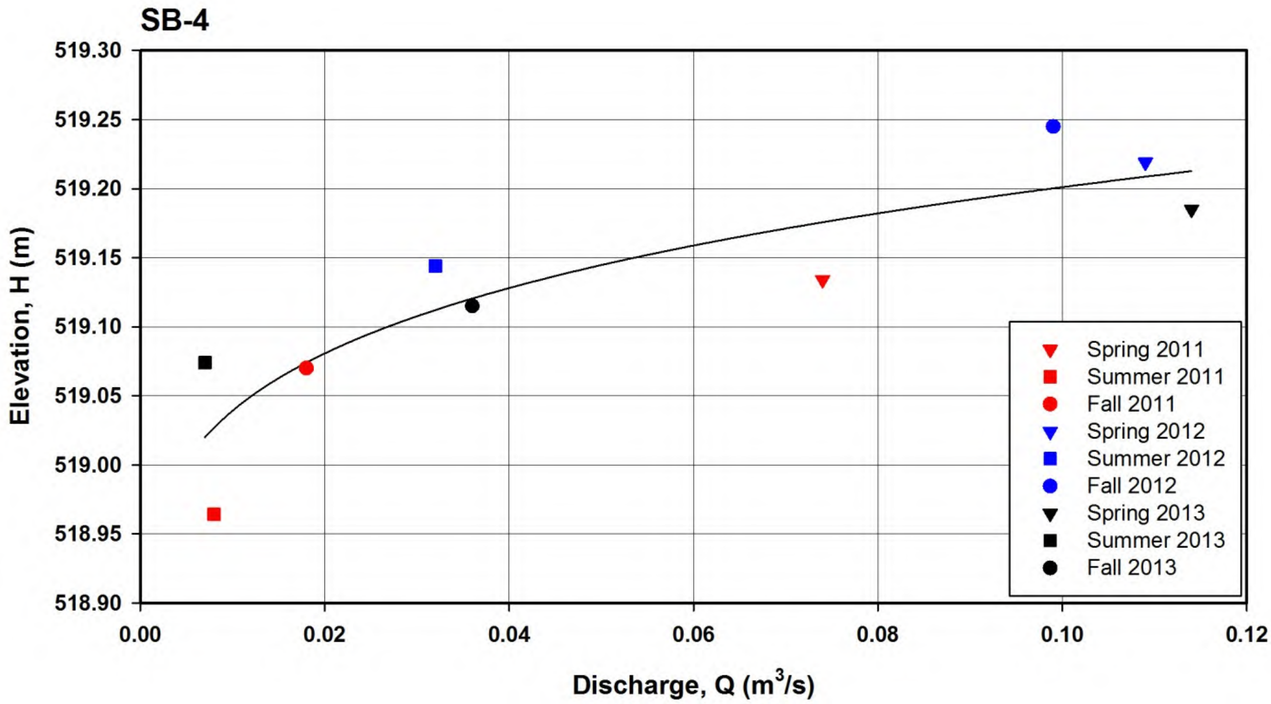

Figure C9: Relationship between Water Surface Elevation, H (m), and Discharge, Q (m^3/s), at Streamflow Station SB-4.

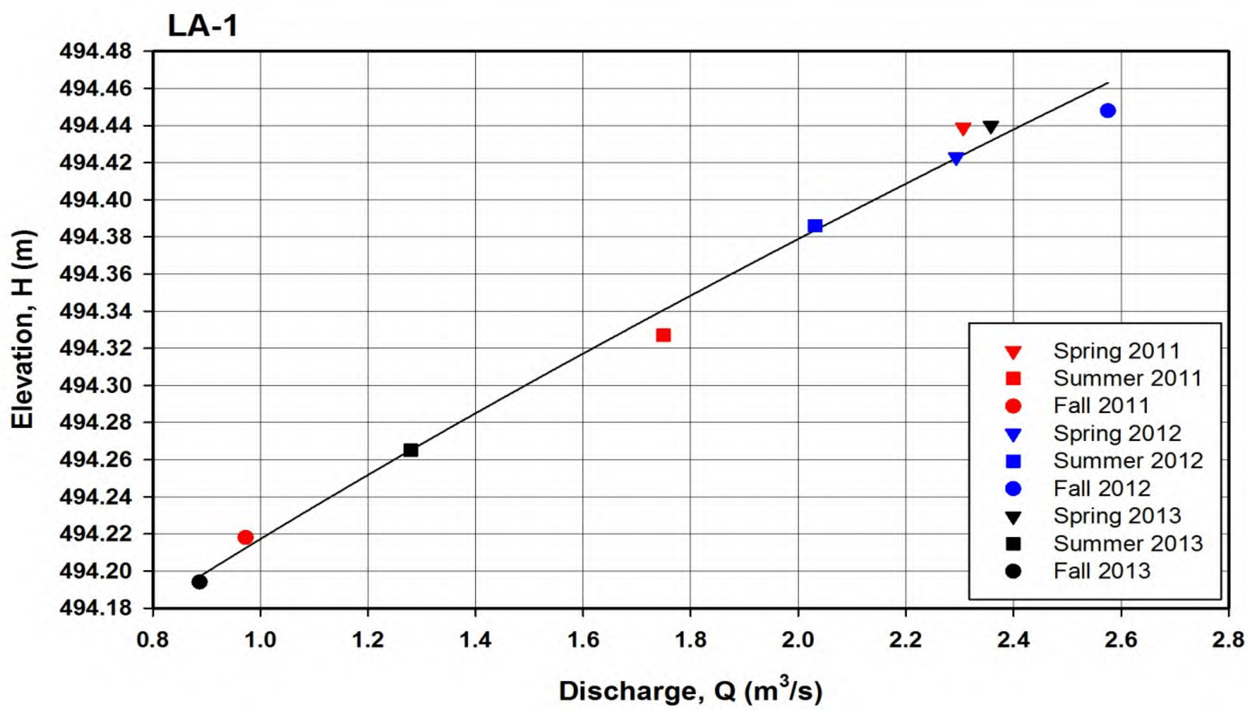

Figure C10: Relationship between Water Surface Elevation, H (m), and Outflow Discharge, Q (m^3/s), at Lake Level Station LA-1.

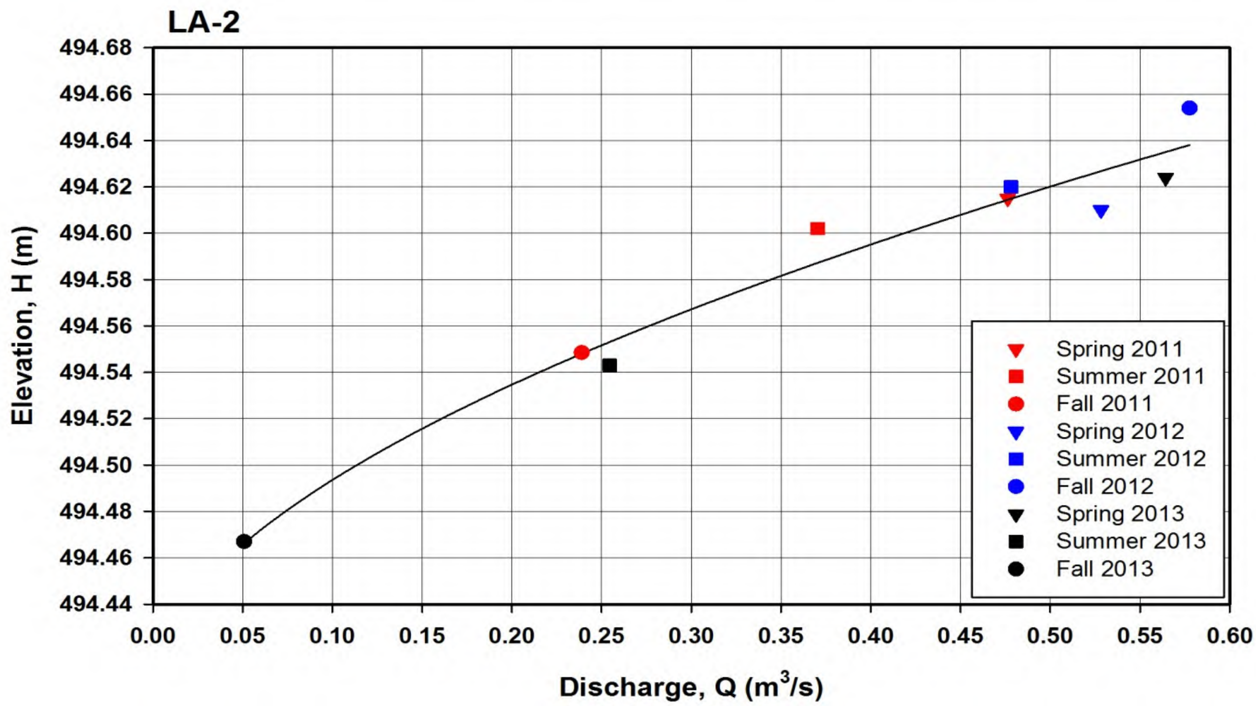

Figure C11: Relationship between Water Surface Elevation, H (m), and Outflow Discharge, Q (m^3/s), at Lake Level Station LA-2.

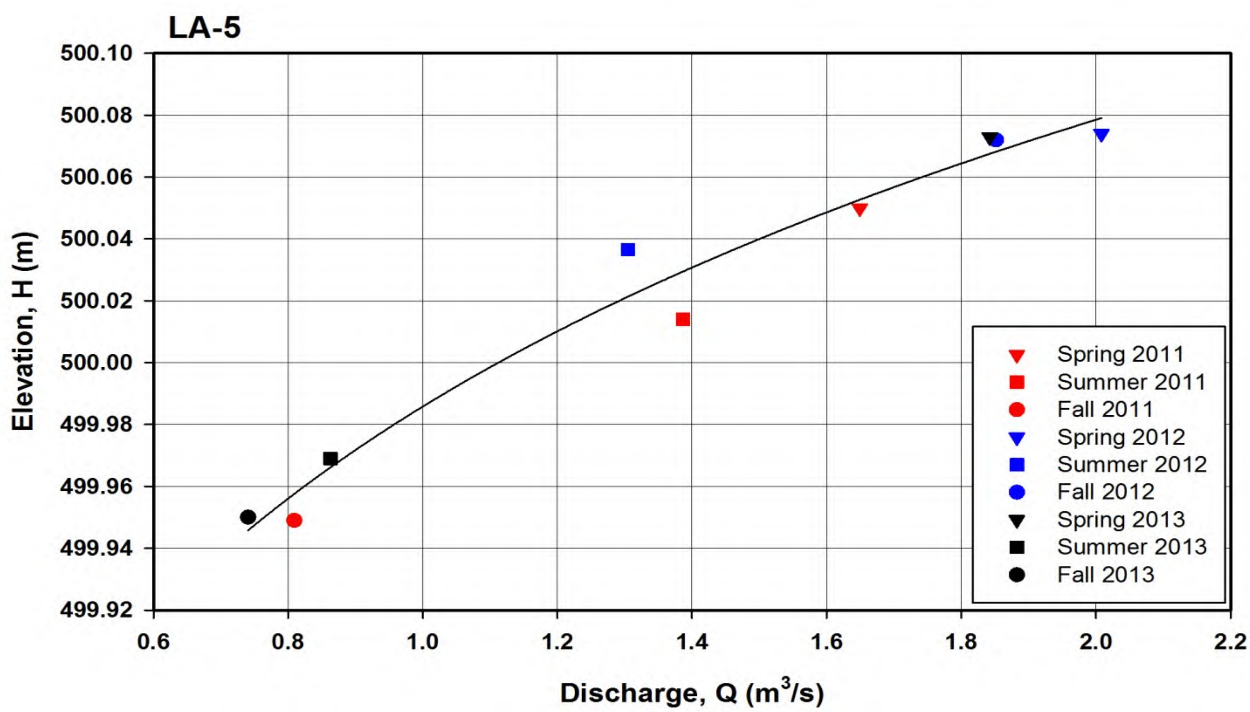

Figure C12: Relationship between Water Surface Elevation, H (m), and Outflow Discharge, Q (m^3/s), at Lake Level Station LA-5.

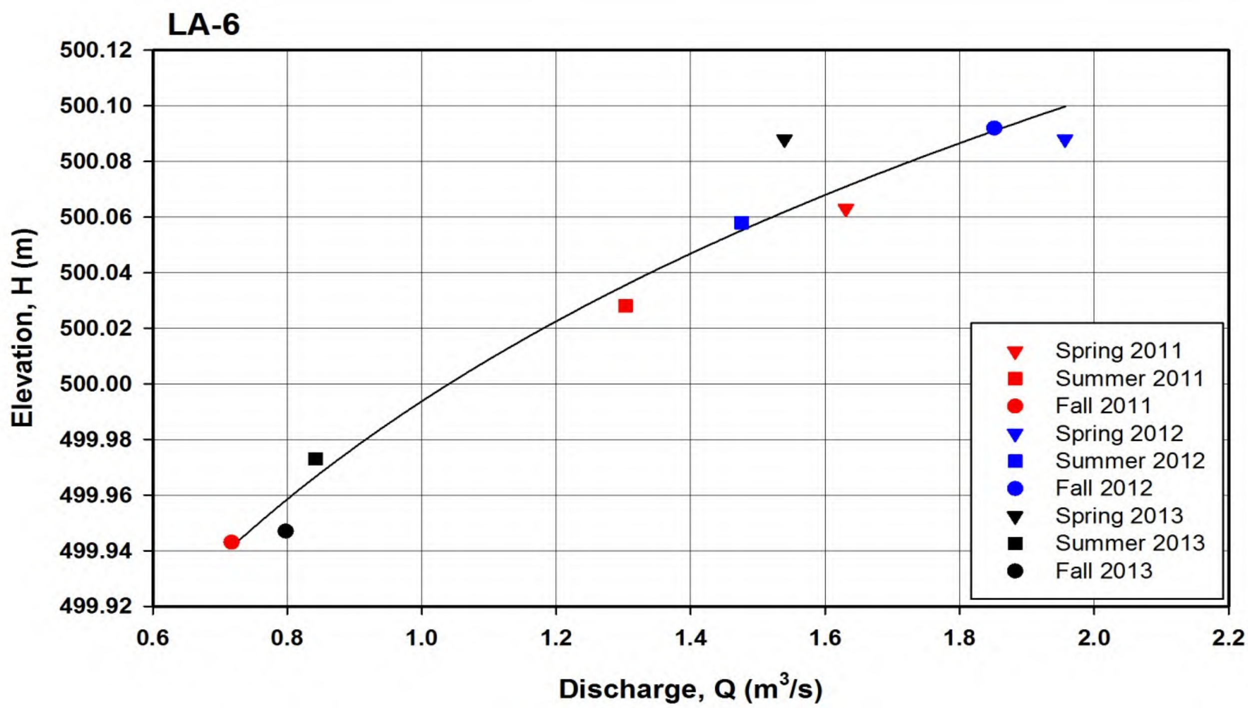

Figure C13: Relationship between Water Surface Elevation, H (m), and Outflow Discharge, Q (m^3/s), at Lake Level Station LA-6.

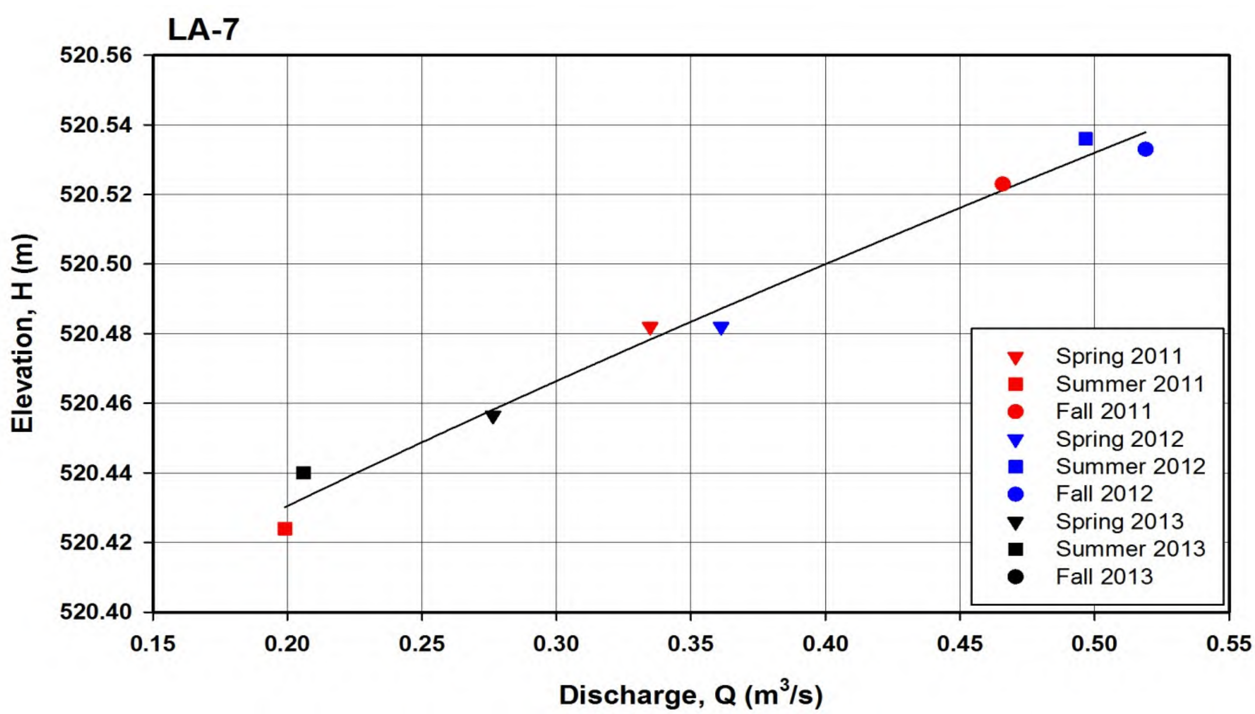

Figure C14: Relationship between Water Surface Elevation, H (m), and Outflow Discharge, Q (m^3/s), at Lake Level Station LA-7.

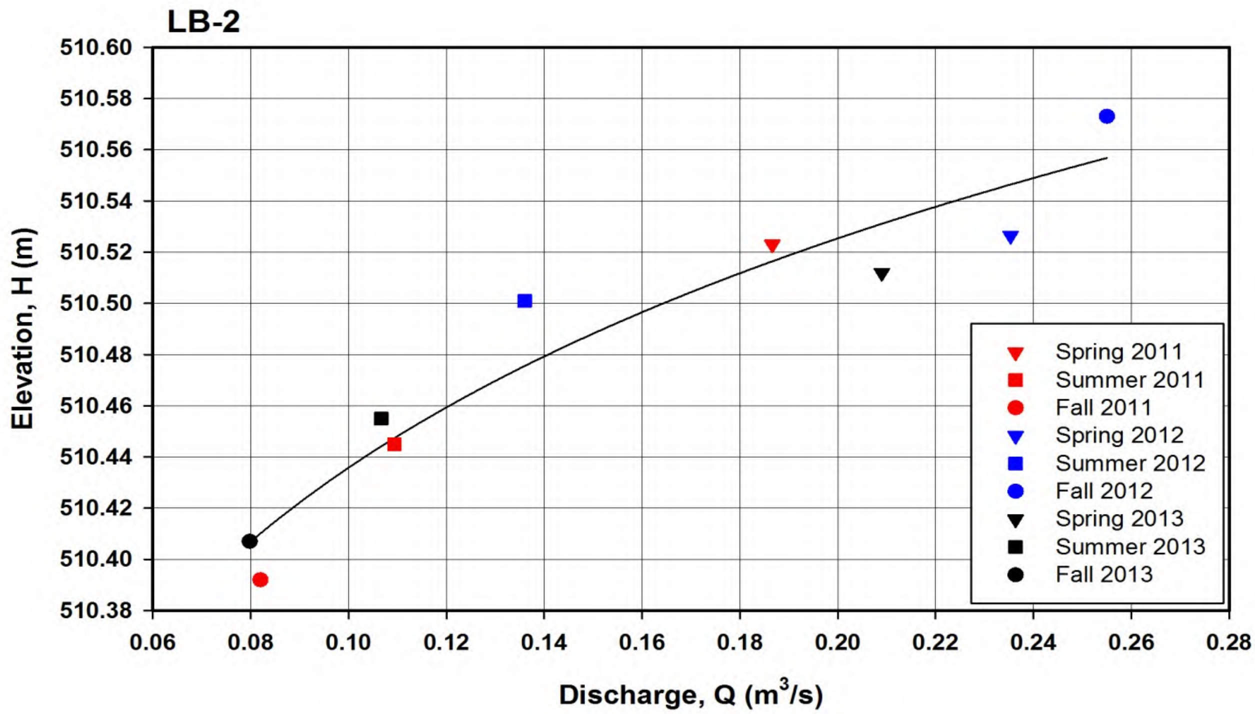

Figure C15: Relationship between Water Surface Elevation, H (m), and Outflow Discharge, Q (m^3/s), at Lake Level Station LB-2.

Table C1: Open Water Stage-Discharge Equations

Site	Equation	R^2	Maximum Q	Minimum Q
SA-1	$H_{SFA1} = 492.3288 + 0.2358\ Q_{SA-1}^{0..5647}$	0.98	2.575	0.887
SA-2	$H_{SFA2} = 496.5236 + 0.1481 Q_{SA-2}^{0.5463}$	0.96	2.030	0.741
SA-3	$H_{SFA3} = 494.2166 + 0.4758\ Q_{SA-3}^{0.9914}$	0.99	0.578	0.051
SA-4	$H_{SFA4} = 463.0674 + 43.3880\ Q_{SA-4}^{0.0030}$	0.98	0.519	0.206
SA-5	$H_{SFA5} = 500.3430 + 0.3466\ Q_{SA-5}^{0.3517}$	0.97	1.381	0.476
SA-6	$H_{SFA6} = 487.0848 + 12.9219\ Q_{SA-6}^{0.0113}$	0.98	1.957	0.717
SB-1	$H_{SFB1} = 200.2805 + 288.3274\ Q_{SB-1}^{0.0005}$	0.74	0.644	0.158
SB-3	$H_{SFB3} = 510.3495 + 0.6573\ Q_{SB-3}^{1.0096}$	0.94	0.255	0.080
SB-4	$H_{SFB4} = 518.7461 + 0.7063\ Q_{SB-4}^{0.1911}$	0.79	0.114	0.007
LA-1	$H_{LLA1} = 493.9888 + 0.2284\ Q_{SA-1}^{0.7723}$	0.99	2.575	0.887
LA-2	$H_{LLA2} = 494.4063 + 0.3146\ Q_{SA-3}^{0.5570}$	0.96	0.578	0.051
LA-5	$H_{LLA5} = 483.1565 + 16.8293\ Q_{SA-2}^{0.0079}$	0.97	2.008	0.741
LA-6	$H_{LLA6} = 239.5643 + 260.4294\ Q_{SA-6}^{0.0006}$	0.98	1.957	0.717
LA-7	$H_{LLA7} = 520.3372 + 0.3401\ Q_{SA-4}^{0.0309}$	0.99	0.519	0.199
LB-2	$H_{LLB2} = 233.8270 + 276.9066\ Q_{SB-3}^{0.0005}$	0.93	0.255	0.080

* Where Q is discharge in m^3/s and H is water level in metres above mean sea level.

APPENDIX D

Hydrographs for Streamflow Monitoring Stations

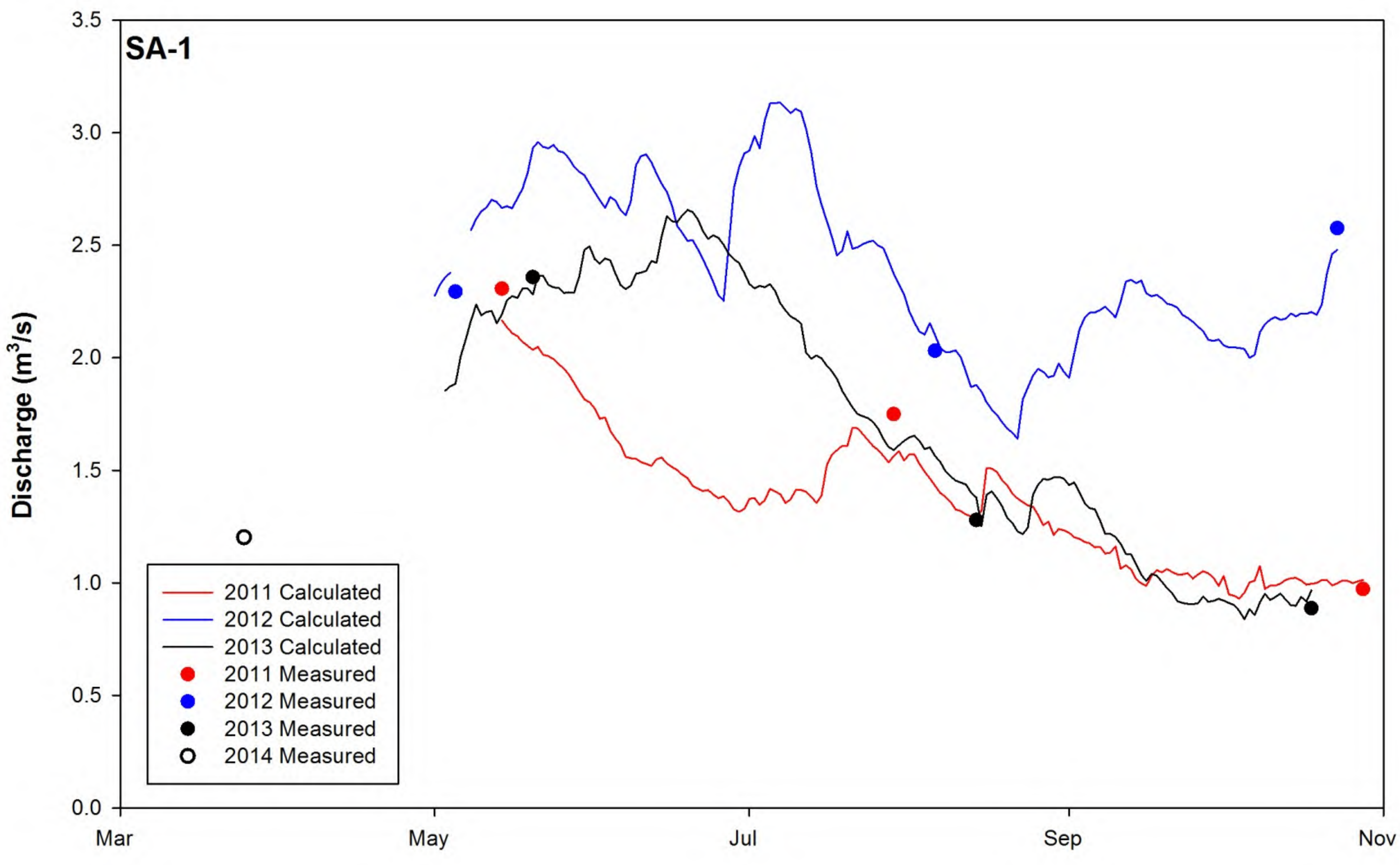

Figure D1: Measured and Calculated Discharge, Q (m^3/s), for Stream Monitoring Station SA-1.

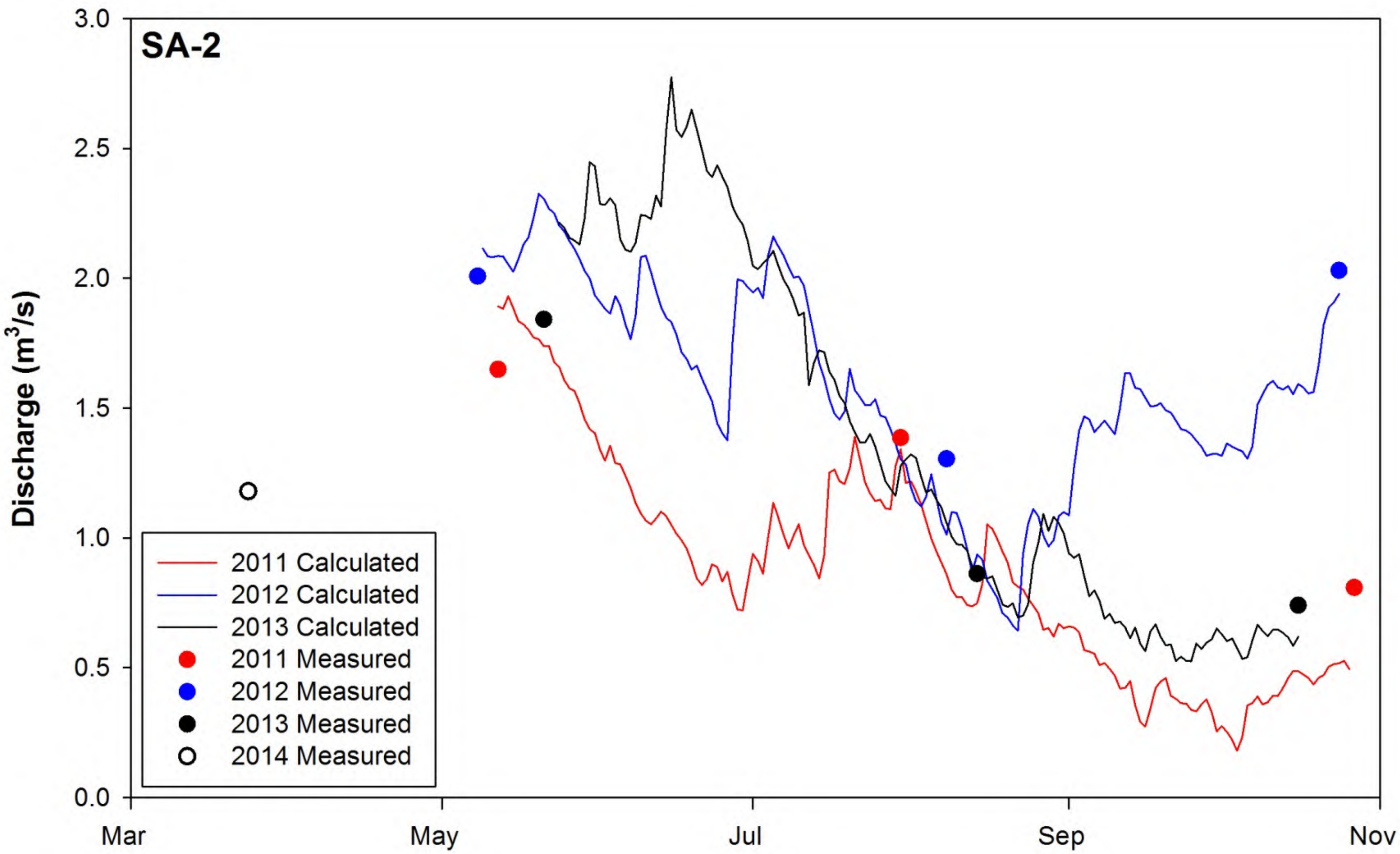

Figure D2: Measured and Calculated Discharge, Q (m^3/s), for Stream Monitoring Station SA-2.

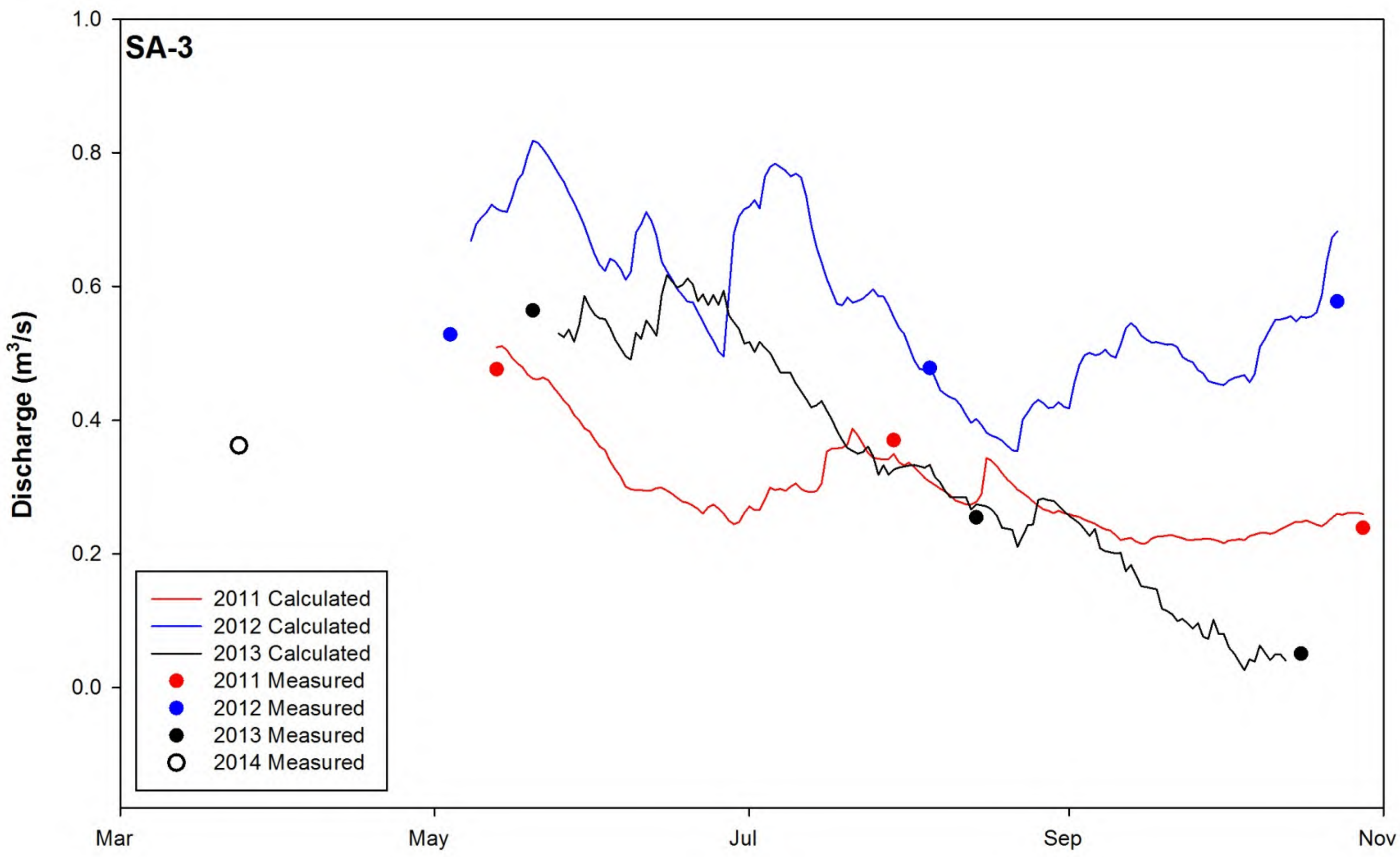

Figure D3: Measured and Calculated Discharge, Q (m^3/s), for Stream Monitoring Station SA-3.

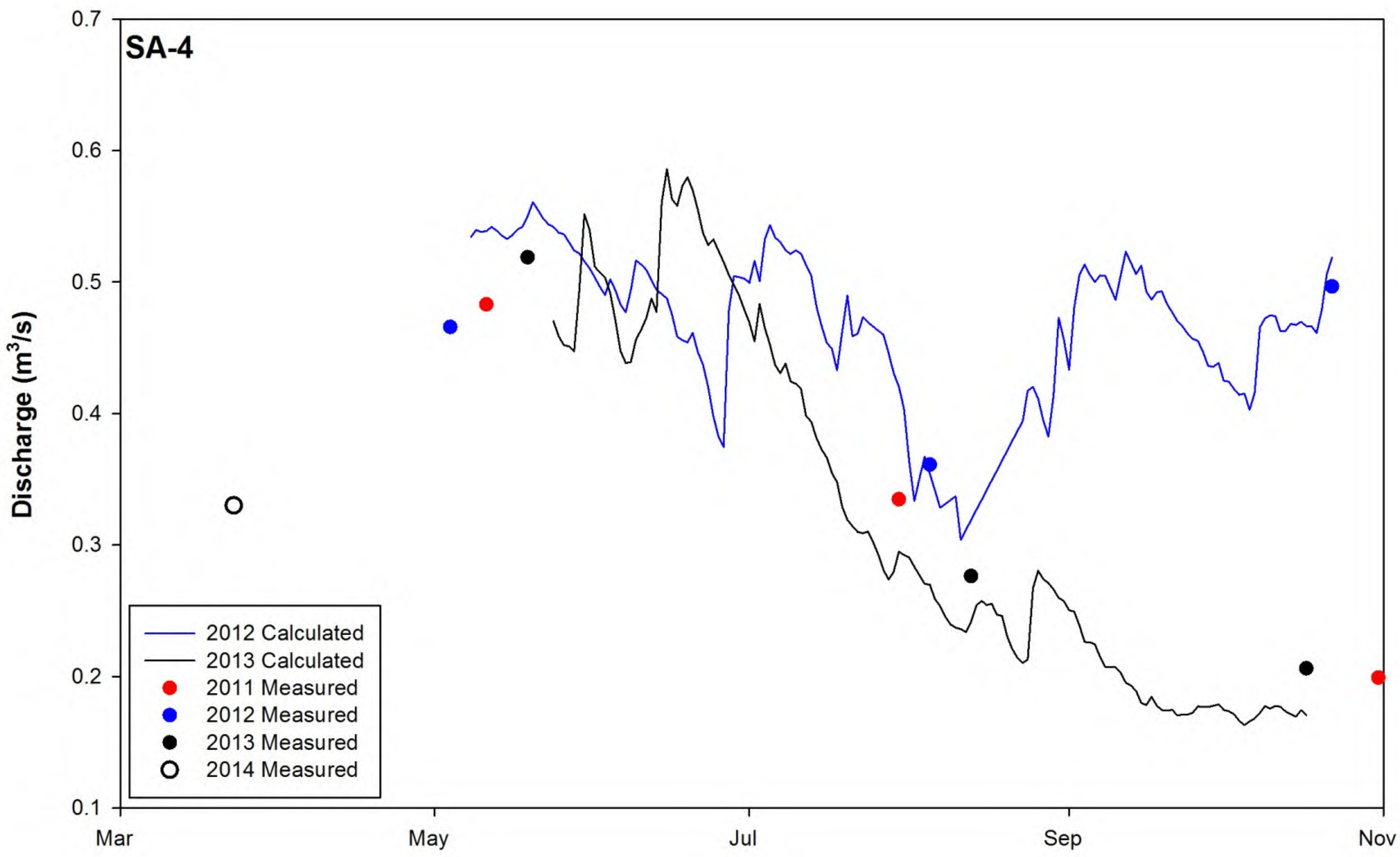

Figure D4: Measured and Calculated Discharge, Q (m^3/s), for Stream Monitoring Station SA-4.

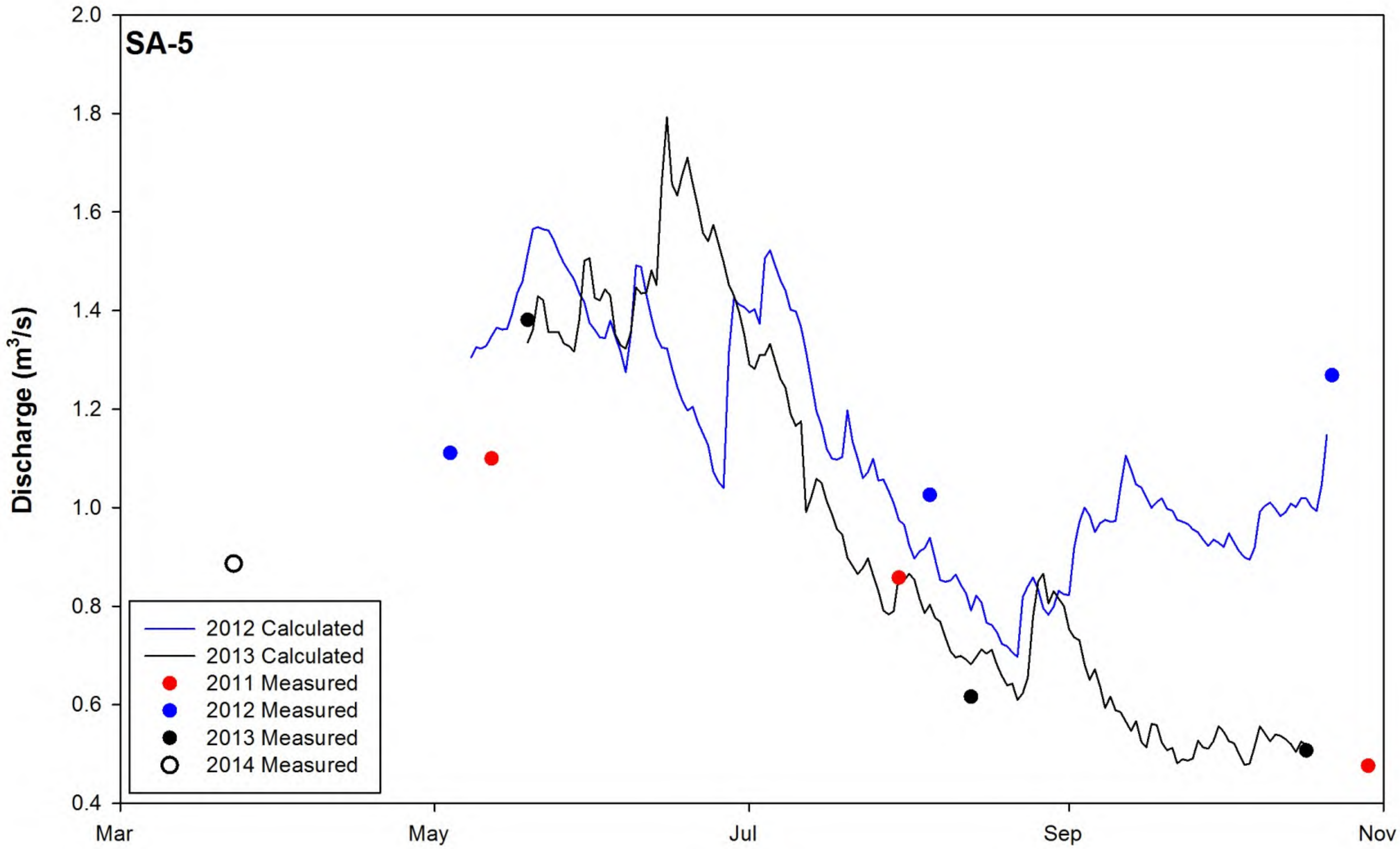

Figure D5: Measured and Calculated Discharge, Q (m^3/s), for Stream Monitoring Station SA-5.

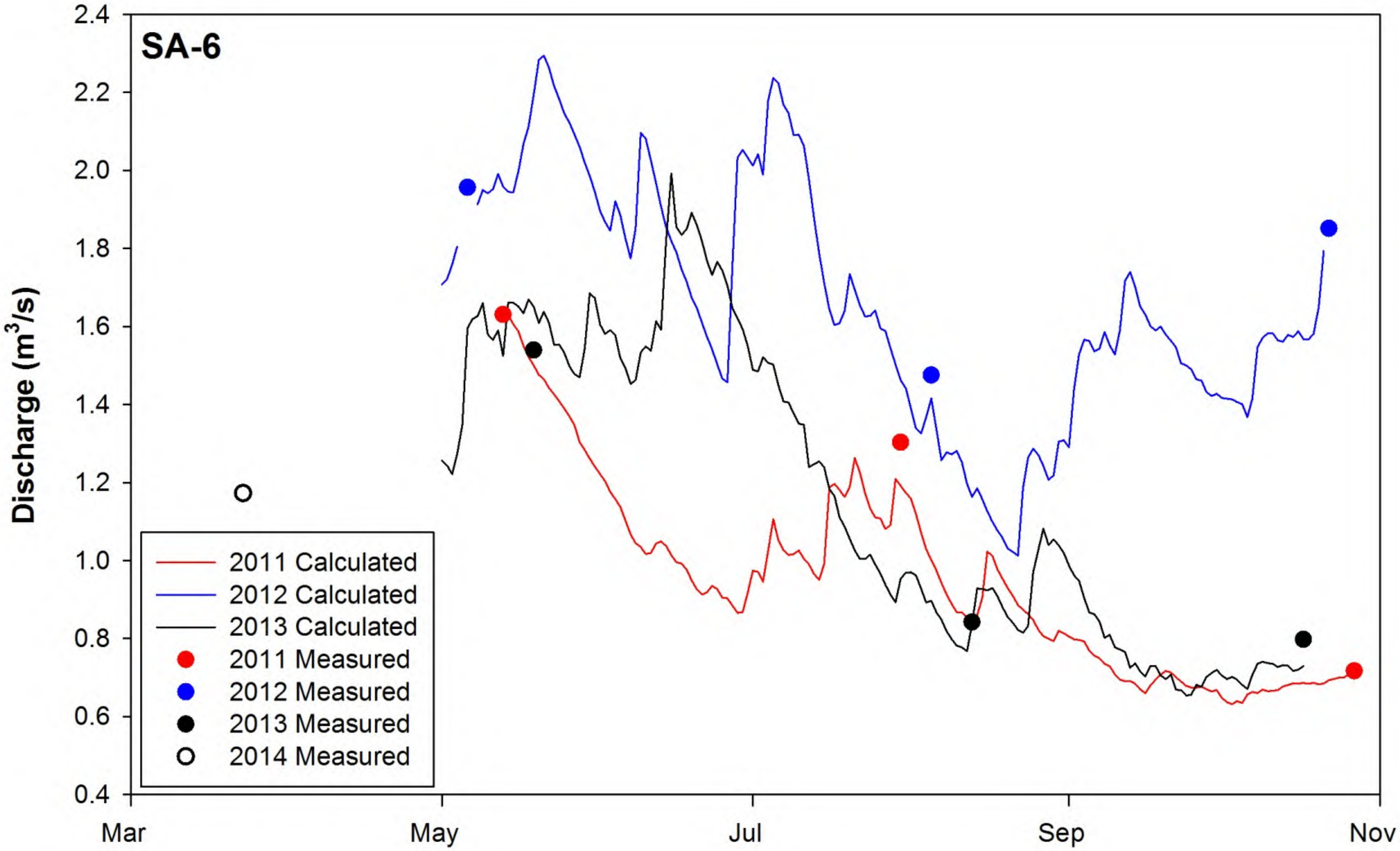

Figure D6: Measured and Calculated Discharge, Q (m^3/s), for Stream Monitoring Station SA-6.

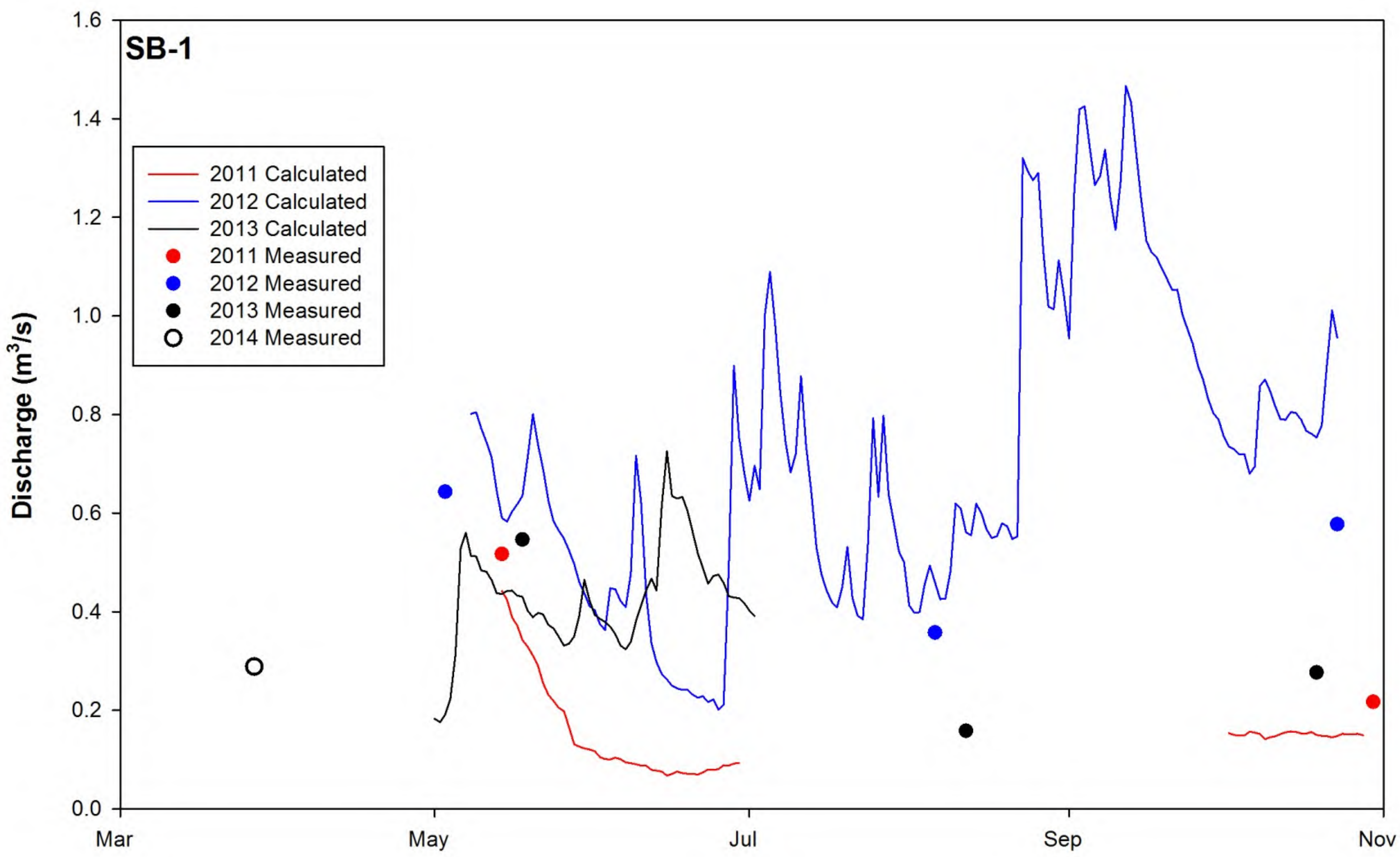

Figure D7: Measured and Calculated Discharge, Q (m^3/s), for Stream Monitoring Station SB-1.

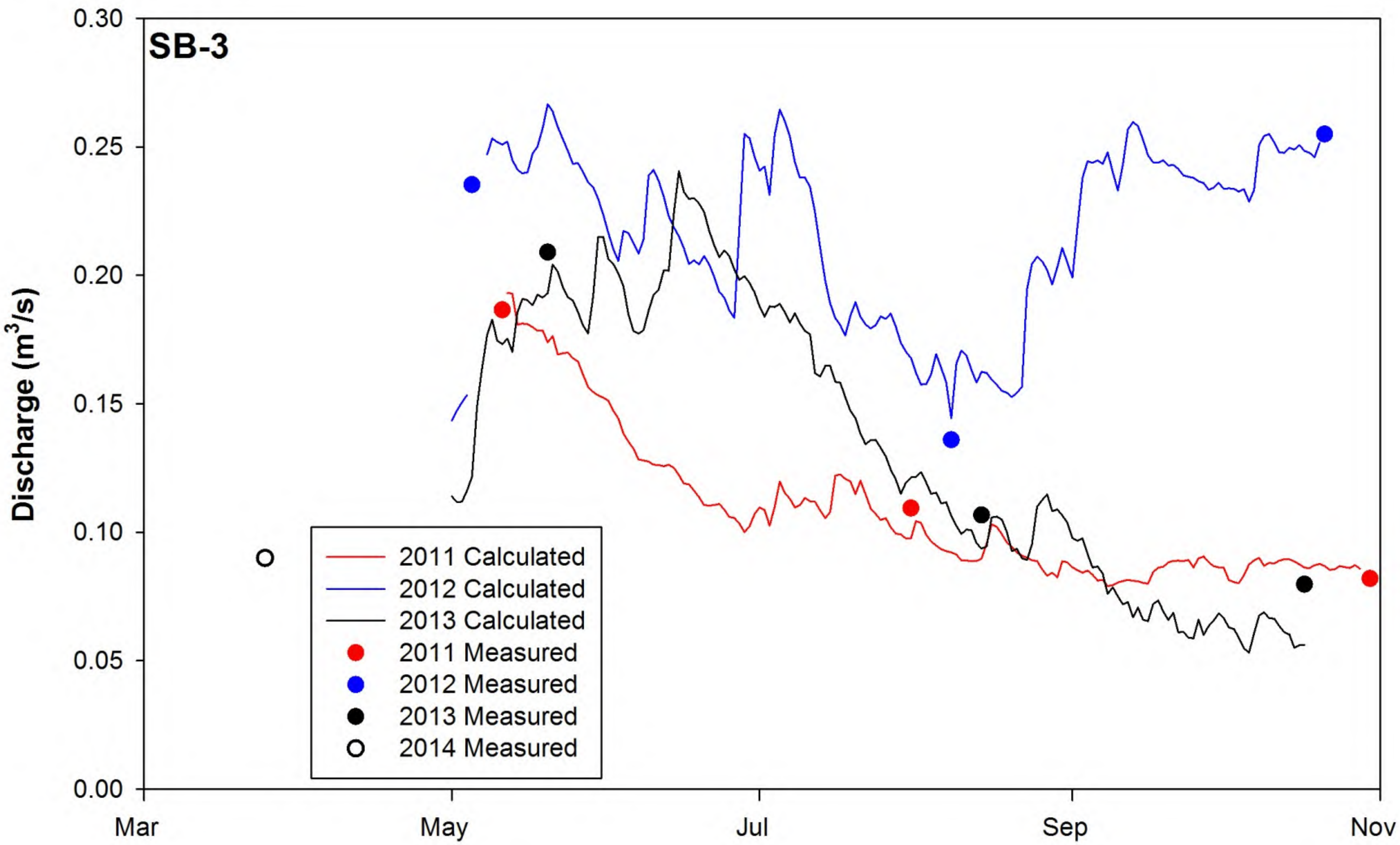

Figure D8: Measured and Calculated Discharge, Q (m^3/s), for Stream Monitoring Station SB-3.

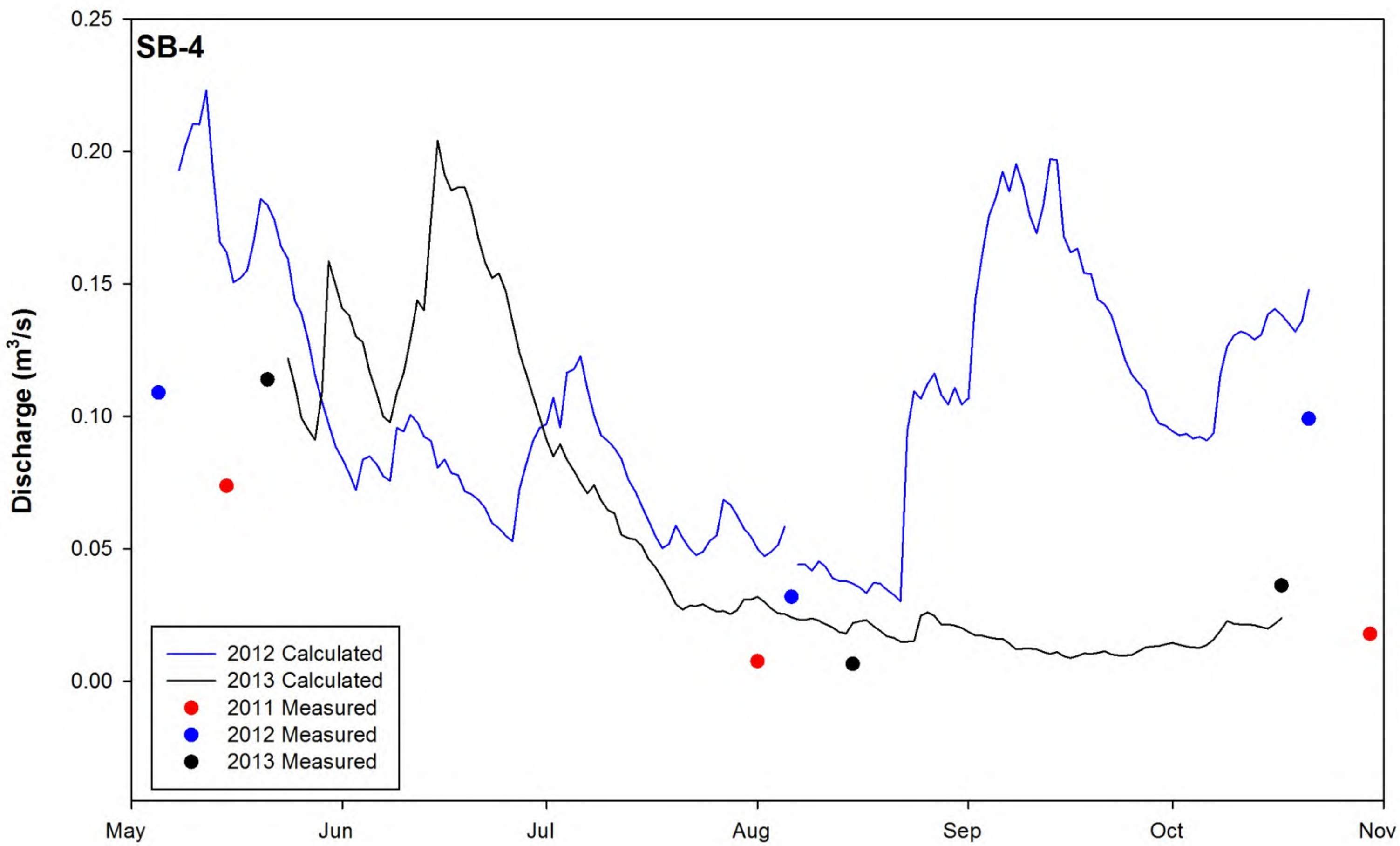

Figure D9: Measured and Calculated Discharge, Q (m^3/s),for Stream Monitoring Station SB-4.

APPENDIX E

Photos

Photo 1: SA-1 looking downstream. Photo taken May 14, 2011.

Photo 2: SA-2 looking downstream. Photo taken July 30, 2011.

Photo 3: SA-3 looking downstream. Photo taken May 13, 2011.

Photo 4: SA-4 looking downstream. Photo taken July 30, 2011.

Photo 5: SA-5 looking downstream. Photo taken July 31, 2011.

Photo 6: SA-6 looking upstream. Photo taken May 13, 2011.

Photo 7: SB-1 looking upstream. Photo taken May 14, 2011.

Photo 8: SB-3 looking upstream. Photo taken July 28, 2011.

Photo 9: SB-4 looking downstream. Photo taken July 31, 2011.

Photo 10: LA-1 looking west. Photo taken July 29, 2011.

Photo 11: LA-2 looking south. Photo taken July 29, 2011.

Photo 12: LA-3 looking northwest. Photo taken May 13, 2011.

Photo 13: LA-4 looking west. Photo taken July 29, 2011.

Photo 14: LA-5 looking south. Photo taken July 20, 2011.

Photo 15: LA-6 looking east. Photo taken July 30, 2011.

Photo 16: LA-7 looking north. Photo taken July 28. 2011.

Photo 17: LB-1 looking west. Photo taken July 31, 2011.

Photo 18: LB-2 looking southwest. Photo taken July 28, 2011.

Photo 19: LAB-1 looking east. Photo taken July 31, 2011.

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Golder Associates

Appendix E Wheeler River Lake Level Survey and 2016/2017 Streamflow Monitoring. Calder Engineering Ltd.

Calder Engineering Ltd.

TECHNICAL MEMORANDUM

Project: **Wheeler River Lake Level Survey and 2016/2017 Streamflow Monitoring**
Wheeler Rive Mining Exploration, Key Lake, Saskatchewan
Calder Engineering Ltd. Project #16-190

To: **Janeen Tang**
EcoMetrix Incorporated

Date: **July 7th, 2017 revised August 2017**

INTRODUCTION

Provided in this Technical Memorandum is a summary of a lake level survey and streamflow monitoring program implemented in 2016/2017 at the Wheeler River Mine Exploration. The mine exploration is located in the Key Lake area of Saskatchewan. Surface water level elevations were surveyed at a number of lakes (13) and ponds (2) at the Wheeler River Mine Exploration Site. In addition, manual streamflow measurements were taken on 16 watercourses, continuous streamflow monitoring equipment was installed at 8 locations, and streamflow monitoring equipment was retrieved from 2 locations.

The respective pond/lake and streamflow locations are shown on **Figure 1(a and b)**.

LAKE AND POND LEVEL SURVEY

Surface water level elevations were surveyed for thirteen lakes and two ponds associated with the Wheeler River Mine Exploration near Key Lake, Saskatchewan. The water level elevation survey was performed by staff of Calder Engineering Ltd. and Ecometrix Incorporated between September 11 and September 22, 2016. Where possible, surface water elevations were referenced to geodetic benchmarks established by Golder Associates. New locations (LA8, LA9, PA2 and PA3) were initially referenced to temporary benchmarks. Geodetic elevations were assigned to the temporary benchmarks in June 2017 in conjunction with establishment of benchmarks by Webb Survey. An iron bar was installed at each of LA8, LA9, PA2 and PA3, and corrected static positions of each bar were determined from NRCAN. A copy of the report from Webb Survey is included as Attachment D.

A description of how the geodetic elevations of the Golder benchmarks were established is available in the 2012 – 2014 Baseline Hydrology Summary Report prepared by Golder Associates.

Summarized in Table 1 are surveyed pond and lake surface water level elevations. The pond and lake locations are shown on **Figure 1(a and b)**.

DRAFT

Calder Engineering Ltd.

TABLE 1
LAKE AND POND SURFACE WATER LEVEL ELEVATIONS

Lake/Pond	Date	Water Level Elevation (m)
LB1	September 11, 2016	503.66
LB2	September 11, 2016	510.54
LB3 (Williams Lake)	September 11, 2016	518.57
LAB1 (Russel Lake)	September 22, 2016	488.26
LA1	September 16, 2016	494.39
LA2	September 13, 2016	494.58
LA3	September 18, 2016	494.57
LA4	September 13, 2016	498.62
LA5	September 12, 2016	500.06
LA6	September 12, 2016	500.07
LA7 (Kratchowsky Lake)	September 12, 2016	520.53
	May 30, 2017	520.53
LA8	September 13, 2016	520.86
	June 1, 2017	520.80
LA9	September 13, 2016	514.25
	May 31, 2017	514.28
PA2	September 15, 2016	510.46
PA3	September 15, 2016	517.36

Note:
1. Units: m – metres.
2. Water level elevations are referenced to benchmarks with geodetic elevations established by Golder Associates, except for LA8, LA9, PA2 and PA3 which are referenced to geodetic elevations established as part of this report.
3. Water level elevations based on survey conducted by Calder Engineering Ltd. and Ecometrix Incorporated

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STREAMFLOW MONITORING

Stream Descriptions

Provided below are descriptions of each stream. Photographs are provided in **Attachment A**.

SA1

SA1 is located close to the outlet of Drainage Area A at Russel Lake. The stream bottom is comprised of boulders, cobble, gravel and sand. It is our understanding that a logger was left at this location; however, this logger was not located during the site visit and is presumed to be lost. The logger retrieved from SB1 was installed in a low gradient section immediately upstream of a high gradient section. SA1 is accessible by road.

SA2

SA2 flows into the northwest end of LA1. The stream at SA2 is generally steep with vertical banks and high velocities. No logger was installed at this location. SA2 is accessible by boat.

SA3

SA3 is shallow wide sandy bottom stream with vertical banks that connects LA2 to LA1. No logger was installed at this location. SA3 is accessible by boat.

SA4

SA4 is located upstream of LA6. The channel bottom is composed primarily of cobbles and boulders. A logger was installed at this location and was located in a pool upstream of a fast high gradient section. The barometric logger was located on the bank at this station. SA4 is accessible by road.

SA5

SA5 is located upstream of LA6. The channel bottom is primarily small boulders and cobbles overlain sand. A logger was installed on a straight run downstream of the removed bridge crossing. SA5 is accessible by road.

SA6

SA6 is a wide sandy bottom stream with vertical banks connecting lakes LA5 and LA6. Flow in the stream is deep and slow. The logger installed by Golder Associates was retrieved and reinstalled at the same location. The stream gauging equipment was located approximately halfway between the two lakes. SA6 is accessible by road.

SA7

SA7 is a narrow marshy stream with vertical banks. SA7 was identified for continuous water level monitoring, however no logger was installed at this location. While the water levels at this stream

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could be monitored, it is unlikely that a reliable rating curve could be developed for this location to convert levels to flows due to the site conditions. Flow in the stream is slow and deep, with significant undercut banks. The gradient from LA7 is shallow, allowing backwater from the lake to influence stream water levels. SA7 is accessible by boat.

SA8

SA8 is a meandering narrow sandy bottom stream with deep banks. Some areas of the bank were undercut. The monitoring station was installed in a relatively straight faster section immediately upstream of the lake. SA8 is accessible by boat.

SA9

SA9 was initially located at the outlet a small lake downstream of LA8. For access purposes, this station was relocated to the outlet of LA8 which is accessible by an existing ATV road. The stream in this section is shallow and relatively narrow. The stream bottom is comprised mainly of sand, gravel, cobbles. The monitoring station was located in a pool upstream of the road crossing. Stream banks are shallow and the surrounding land is relatively flat. The area has recently been impacted by a forest fire, so this station is at greater risk of trees/debris falling into the flow and impacting water levels. SA9 is accessible by road.

SA10

SA10 is a wide sandy bottom stream with vertical banks flowing into the northwest part of LA9. The water is deep and slow moving. The monitoring station was located in a relatively straight section with wadeable depths at the time of installation. The water depths downstream closer to the lake were too deep to wade at the time of installation. SA10 is accessible by boat.

SA11

SA11 is an additional station added to replace SA7. SA11 is located at the northern most inlet of LA7. The stream bottom is comprised primarily of gravel and cobbles. The stream channel is braided. The monitoring station was located in an unbraided section immediately upstream of the lake. SA11 is accessible by boat.

SB1

SB1 is located close to the outlet of Drainage Area B at Russel Lake. The monitoring station was located immediately upstream of the culverts at the McArthur River haul road. The stream in this area is marshy with a thick organic base. The stream base in the immediate vicinity of the monitoring station has been altered as result of the road crossing and consists sand, gravel and boulders. Signs of beaver activity were observed both upstream and downstream of the monitoring location. The logger installed by Golder Associates was retrieved from this location and redeployed at another station. SB1 is accessible by road.

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SB2

SB2 is located in a second channel immediately west of SB1. The characteristics of SB2 are similar to SB1 – marshy with a thick organic base impacted by the road construction with signs of beaver activity. At the time of the field visit, no flow was observed at this location. It is suspected that it either flows laterally towards SB1 or seeps under the road embankment. SB2 is accessible by road.

SB3

SB3 is located downstream of LB2. The stream bottom is comprised of organics, sand, cobbles and boulders. The banks are nearly vertical. No monitoring equipment was installed or retrieved from this location. SB3 is accessible by road.

SB4

SB4 is located at the southwest inlet of LB3. The stream banks are shallow and poorly defined. It is our understanding that monitoring equipment was left at this location; however the logger was not found and is assumed to be lost. The stream bottom is primarily boulders and large cobbles. SB4 is accessible by boat.

SB5

SB5 is located at the outlet of LB3. Gauging was conducted in a relatively straight section downstream of the camp road crossing and upstream of a low gradient pool and braid. The stream bottom was composed of sand, gravel and cobbles. SB5 is accessible by road.

Streamflow Monitoring Stations

Eight temporary streamflow monitoring stations were installed by Calder at the Wheeler River Mine Exploration. The streamflow monitoring stations were established to obtain information on local watercourse flow characteristics. Summarized in Table 2 and shown on Figure 1 are locations of the eight streamflow monitoring stations.

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TABLE 2
SUMMARY OF STREAMFLOW MONITORING STATION LOCATIONS

Station	Installation Date	Easting	Northing
SA1	September 22, 2016	480368	6371123
SA4	September 10, 2016	476926	6375868
SA5	September 9, 2016	477822	6375737
SA6	September 12, 2016	477863	6374742
SA8	September 15, 2016	471579	6378303
SA9	September 18, 2016	478226	6381589
SA10	September 18, 2016	479003	6380421
SA11	September 19, 2016	473026	6379260

Note:
1. Refer to Figure 1 for location of streamflow monitoring stations.
2. Eastings and northings referenced to the UTM Zone 17 grid and NAD83 datum.

The streamflow monitoring installations each comprised a Solinst Model 3001 LT F15/M5 Levelogger programmed to record water level at 15 minute intervals on a continuous basis. The Solinst Leveloggers were installed at the dates listed in Table 2. Leveloggers were programmed in June 2017 to collect data until the memory is full – around June 2018.

The Solinst Levelogger instrumentation measures absolute pressure and therefore compensation is required for atmospheric pressure fluctuations. Barometric pressure compensation is achieved using an additional device (e.g., Barologger) to measure barometric pressure. A barologger was installed and deployed adjacent the SA4 site. The data collected from the barologger will be used to apply barometric pressure compensation to data collected from the Solinst Levelogger instrumentation.

Streamflow Measurements

Streamflow measurements were conducted at 16 watercourses within the study area. For the sites with streamflow monitoring equipment installed, with enough manual flow measurements they can be used to develop site specific rating curves for each station. Results are shown in Table 3, detailed calculations sheets are provided in **Attachment B**.

Streamflow measurements were undertaken by wading using a portable velocity meter (Marsh-McBirney Model 2000 Flow-mate) and 1 metre staff gauge graduated in 2 millimetre increments. Streamflow measurements were conducted in accordance with ASTM Standard D 3868 – Standard Test Method for Open-Channel Flow Measurement of Water by Velocity-Area Method, whereby flow velocity is measured at the 20% and 80% depth increments when water depths are greater than 1.0 meter, and at the 60% depth increment if water depth is less than 1.0 meter.

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With respect to streamflow measurements, typically, a minimum of 10 segments across the stream were used to measure flow depth and flow velocity. Flow velocity was measured at each segment and applicable depth increment four times. Flow was computed by multiplication of measured mean flow velocities by the determined cross-sectional flow area (for each segment) and summing the respective values.

Water elevation was determined by referencing the water surface elevation to benchmarks at each location. Benchmarks for streams SA1, SA2, SA3, SA4, SA5, SA6, SB1, SB3, and SB4 were established by Golder Associates as part of the 2012 – 2014 Baseline Hydrology Summary Report. Elevations at SA8, SA9, SA10, SA11, Kratchowsky Creek were transferred across the lake surface from the lake benchmarks established by Golder Associates. The benchmark elevation at SB5 was established by Webb Survey and Calder Engineering in June 2017. An iron bar was installed at SB5 and the corrected static positions of the bar determined from NRCAN. A copy of the report from Webb Survey is included as Attachment D.

TABLE 3
SUMMARY OF MANUAL STREAMFLOW MEASUREMENTS

Station	Date	Water Elevation (mASL)	Flow (cms)
SA1*	September 17, 2016	492.71	2.34
	May 31, 2017	492.72	2.43
SA2	September 16, 2016	496.46	2.24
SA3	September 16, 2016	494.43	0.44
Kratchowsky Creek Outlet	September 14, 2016	520.30	0.58
SA4*	September 10, 2016	506.35	0.49
	May 30, 2017	506.37	0.58
SA5*	September 9, 2016	500.90	1.27
	September 21, 2016	500.91	1.58
	May 30, 2017	500.92	1.95
SA6*	September 11, 2016	500.07	1.98
	May 31, 2017	500.08	1.77
SA7	September 15, 2016	No BM set	0.04
SA8*	September 15, 2016	520.60	0.01
	September 19, 2016	520.62	0.04
	May 30, 2017	520.54	0.04

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SA9*	September 18, 2016	520.52	0.18
	June 1, 2017	520.49	0.16
SA10*	September 18, 2016	514.35	1.55
	May 31, 2017	514.31	1.22
SA11*	September 19, 2016	520.73	0.42
	May 30, 2017	520.71	0.31
SB1	September 17, 2016	488.55	0.64
SB2	September 17, 2016	No measurement taken	
SB3	September 11, 2016	510.47	0.20
SB4	September 11, 2016	519.21	0.12
SB5	September 14, 2016	518.33	0.14

Note:
1. Units: mASL = metres above sea leavel; cms = cubic metres per second
2. Refer to Figure 1 for location of streamflow monitoring stations.
3. Water level elevations are referenced to benchmarks with geodetic elevations established by Golder Associates, except for SA8, SA9, SA10, SA11, and SB5 which are referenced to geodetic elevations established as part of this report.
4. Water level elevations based on survey conducted by Calder Engineering Ltd. and Ecometrix Incorporated
5. * - indicates that continuous monitoring equipment was installed

RATING CURVES

Golder Associates Ltd. (2013) presented rating curves for SA1, SA4, SA5 and SA6. The manual flow measurements taken as part of the 2016-2017 field program were graphed along with the measurements and rating curves by Golder (2013) to review for suitability for use with the new installations.

Based on the data, the new station for SA5 was installed upstream of the Golder location. The stream bed in this area is of consistent width and slope. The rating curve for SA5 was shifted upstream based on the three manual flow measurements taken in 2016 and 2017.

Manual flow measurements taken at SA1, SA4, and SA6 appear to fit into the existing rating curve and the rating curve can be applied to the level data.

For streams SA8, SA9, SA10 and SA11 the manual flow measurements taken to date are not sufficient to develop a rating curve for conversion from level to flow.

Rating curves are presented in **Attachment B**.

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CONTINUOUS WATER LEVEL DATA

It is our understanding that loggers installed by Golder in 2013 were left in place at the following locations: SB1, SB4, SA1, and SA6. Leveloggers were located and retrieved at SB1 and SA6 in the Fall of 2016; we were unable to locate equipment at SB4 and SA1. The logger at SA6 was redeployed at SA6 and the logger at SB1 was redeployed at SA1. Available on the instruments were level and temperature data from May 18, 2013 to August 30, 2015.

Recorded data from the leveloggers deployed in the Fall of 2016 at streams SA1, SA4, SA5, SA6, SA8, SA9 and SA10 and the site barologger was retrieved in the Spring of 2017.

<u>Barometric Compensation</u>

Barometric compensation for the 2016-2017 field program was completed using the site barologger with any gaps filled using transformed data from the Key Lake Climate Station (Climate ID = 4063757) at 57°15'23.000" N, 105°37'03.000" W. Barometric compensation for the retrieved 2013 to 2015 data at SB-1 and SA-6 was completed using transformed data from the Key Lake Climate Station.

The Key Lake Climate Station has an hourly barometric pressure record at 57°15'23.000" N, 105°37'03.000" W. The data was linearly interpolated to 15 minute and 30 minute intervals for use the levelogger data. A relationship between the barometric pressure at the site barologger and the Key Lake station was developed using the May 2017 data and applied to the Key Lake Climate Station data for use with the project Levelogger data.

<u>Elevation Data</u>

Calculated water elevation data for each of the locations is presented in **Attachment C**.

<u>Calculated Flow</u>

For stations SA1, SA4, SA6 and SB1 the water elevation data was converted to flow using rating curve relationships developed by Golder (May 2014). The modified rating curve was applied for SA5.

For streams SA8, SA9, SA10 and SA11 the manual flow measurements taken to date are not sufficient to develop a rating curve for conversion from level to flow.

Calculated flow data for each of SA1, SA4, SA5, SA6 and SB1 is presented in **Attachment C**.

<u>Recommendations</u>

- Additional manual flow measurements be taken at new monitoring locations: SA8, SA9, SA10, SA11 to establish a rating curve at each location
- Rating curves established by Golder Associates Ltd. for SA1, SA4, SA5 and SA6 be reviewed for suitability for use with the reinstallations, including additional manual flow measurements.

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Yours Sincerely,

CALDER ENGINEERING LTD.

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FIGURE 1a: LAKE AND POND LOCATIONS

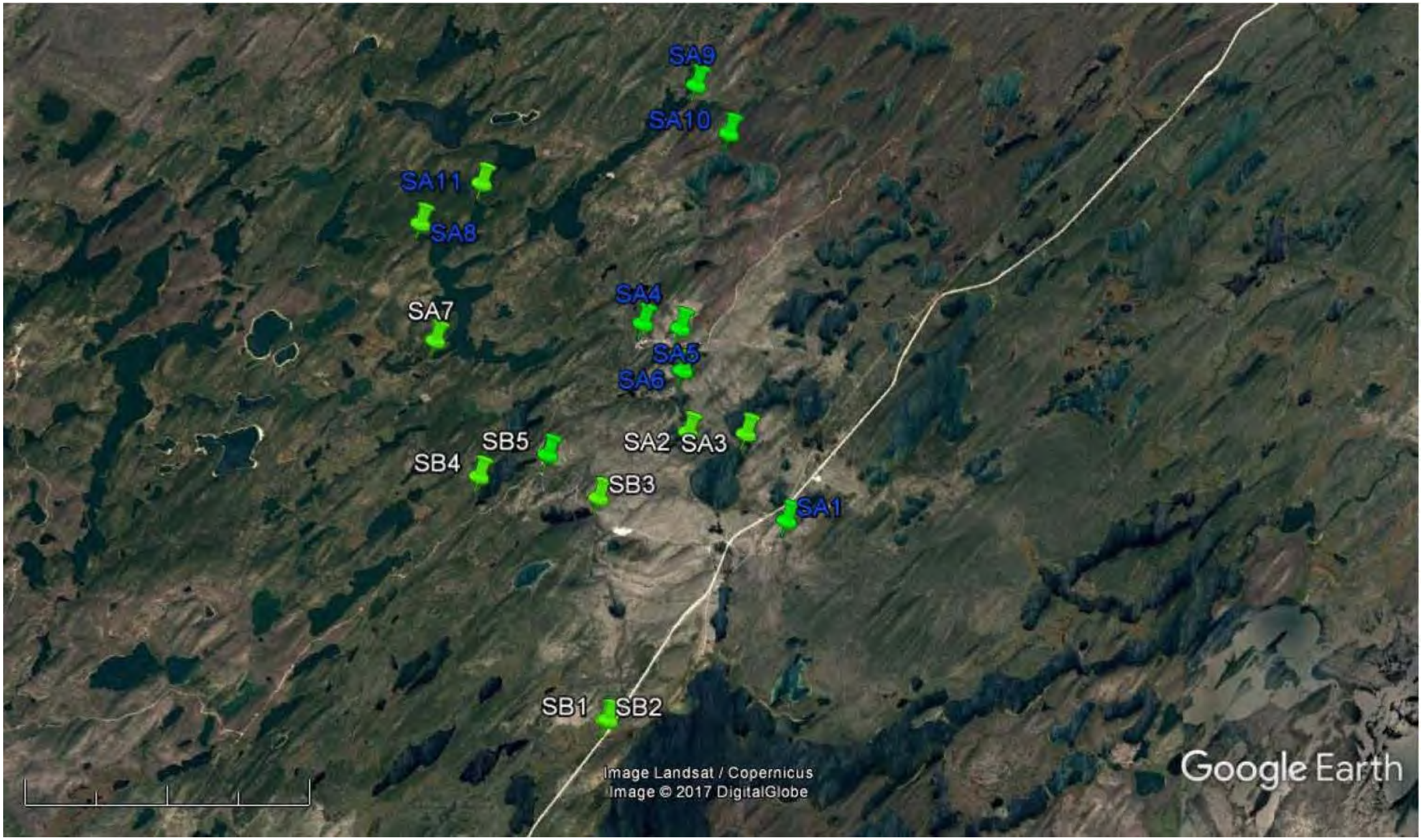


FIGURE 1b: STREAM LOCATIONS

ATTACHMENT A

PHOTOS

SA-1 facing upstream

SA-2 facing upstream

SA-1 facing downstream

SA-2 facing downstream

PHOTOS WHEELER RIVER	Calder Engeering Ltd.	SA1 and SA2	SEPT 2016 SHEET 1/9

SA-3 facing upstream

SA-4 facing upstream

SA-3 facing downstream

SA-4 facing downstream

PHOTOS WHEELER RIVER	Calder Engeering Ltd.	SA3 and SA4	SEPT 2016 SHEET 2/9

SA-5 facing upstream

SA-6 facing upstream

SA-5 facing downstream

SA-6 facing downstream

PHOTOS WHEELER RIVER	Calder Englneering Ltd.	SA5 and SA6	SEPT 2016 SHEET 3/9

SA-7 facing upstream

SA-8 facing upstream

SA-7 facing downstream


SA-8 facing downstream

PHOTOS WHEELER RIVER	Calder Engineering Ltd.	SA7 and SA8	SEPT 2016 SHEET 4/9

SA-9 facing upstream

SA-10 facing upstream

SA-9 facing downstream

SA-10 facing downstream

PHOTOS WHEELER RIVER	Calder Englneering Ltd.	SA9 and SA10	SEPT 2016 SHEET 5/9

SA-11 facing upstream


Kratchkowsky Lake Outlet facing upstream

SA-11 facing downstream

Kratchkowsky Lake Outlet facing downstream

PHOTOS WHEELER RIVER	Calder Englneering Ltd.	SA11 and Kractchowsky Lake Outlet	SEPT 2016 SHEET 6/9

SB-1 facing upstream

SB-2 facing upstream

SB-1 facing downstream

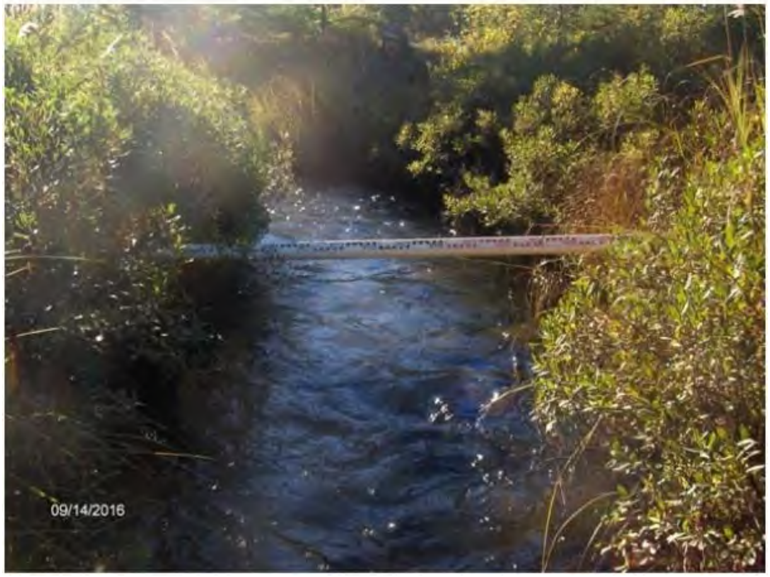
PHOTOS WHEELER RIVER	Calder Englneering Ltd.	SBI end SB2	SEPT 2016 SHEET 7/9

SB-4 facing upstream

SB-3 facing downstream

SB-4 facing downstream

PHOTOS WHEELER RIVER	Calder Engineering Ltd.	SB3 and S84	SEPT 2016 SHEET 8/9



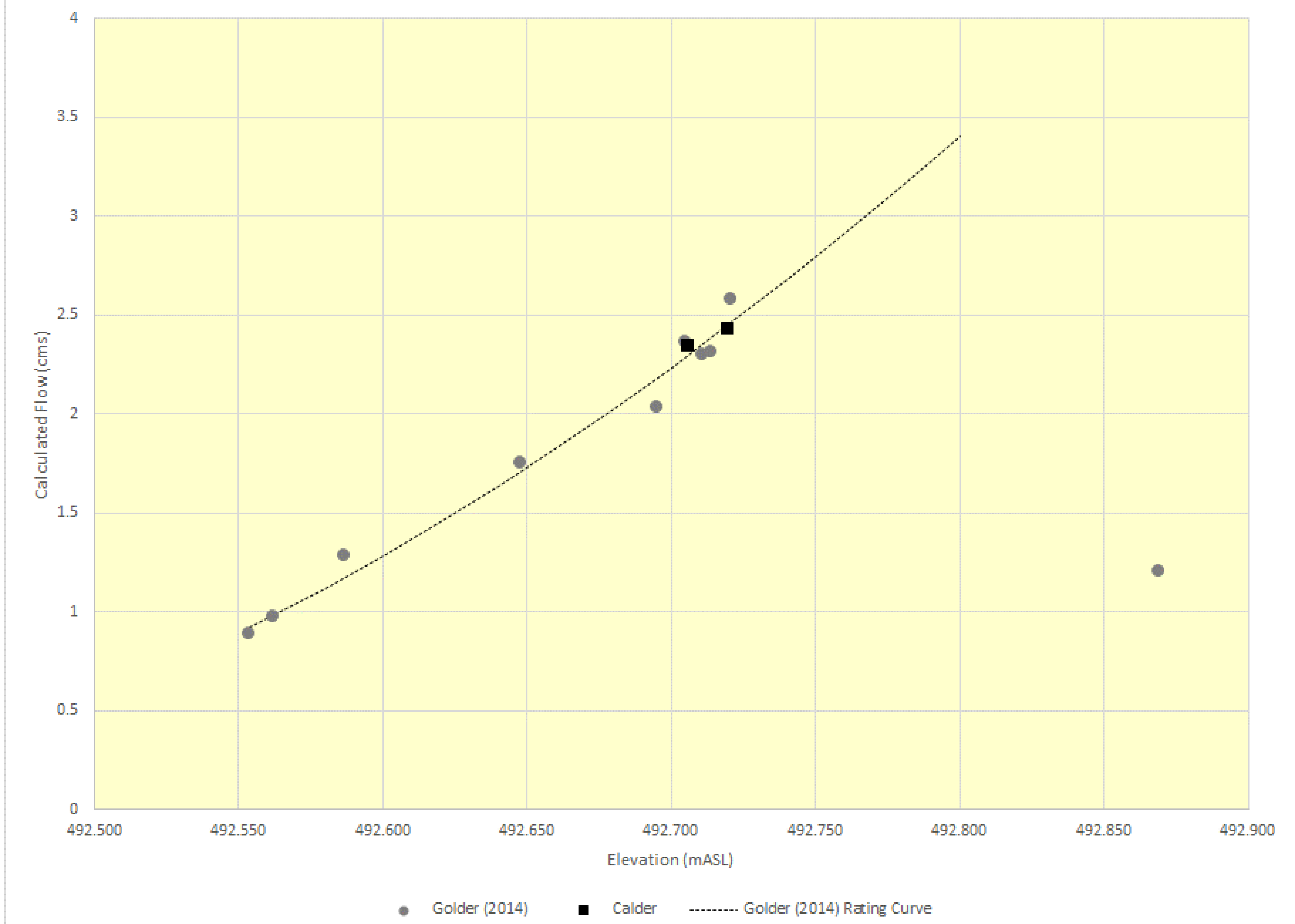
SB-5 facing upstream

SB-5 facing downstream

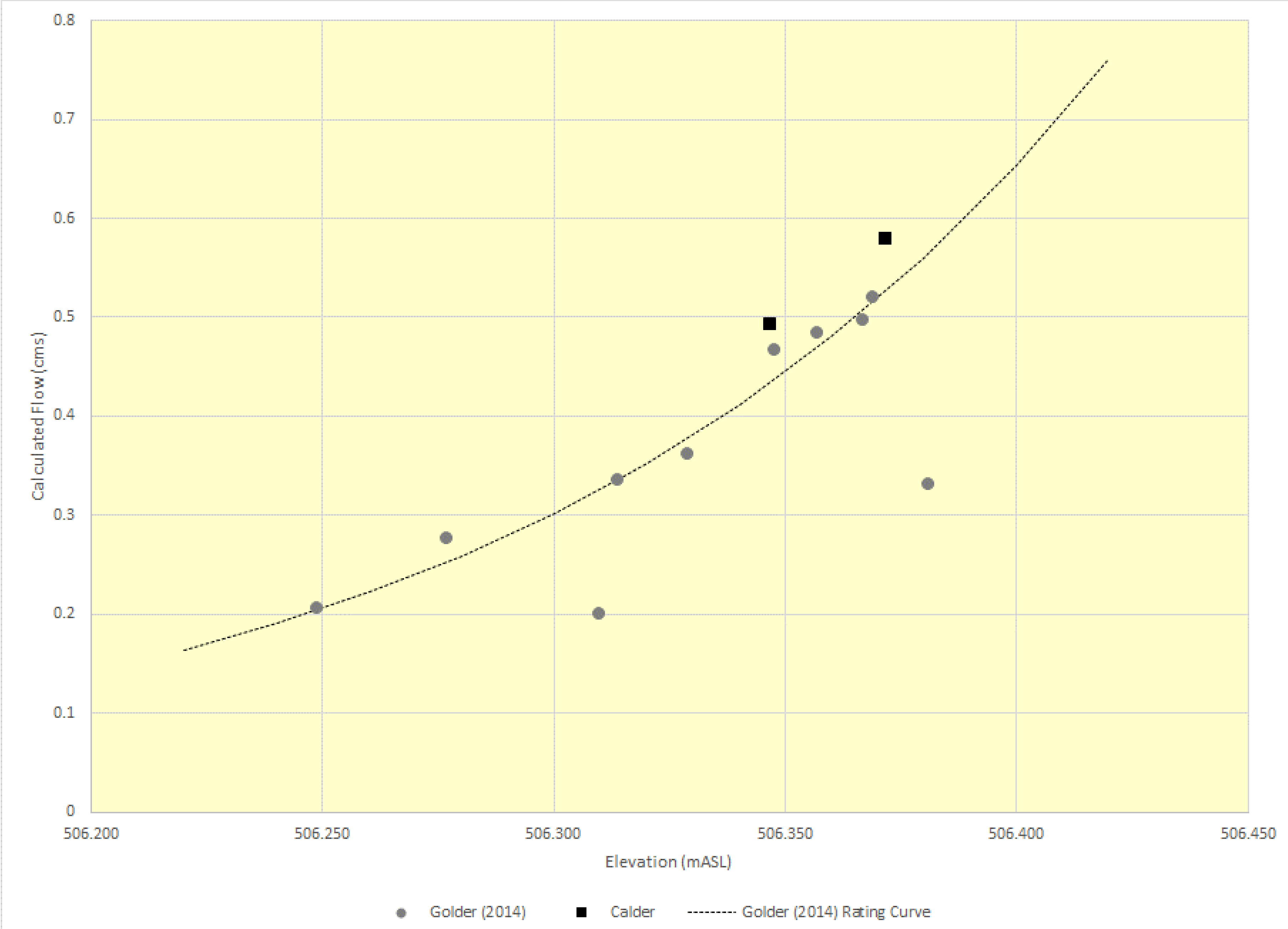
PHOTOS WHEELER RIVER	Calder Englneering Ltd.	SB5	SEPT 2016 SHEET 9/9

ATTACHMENT B

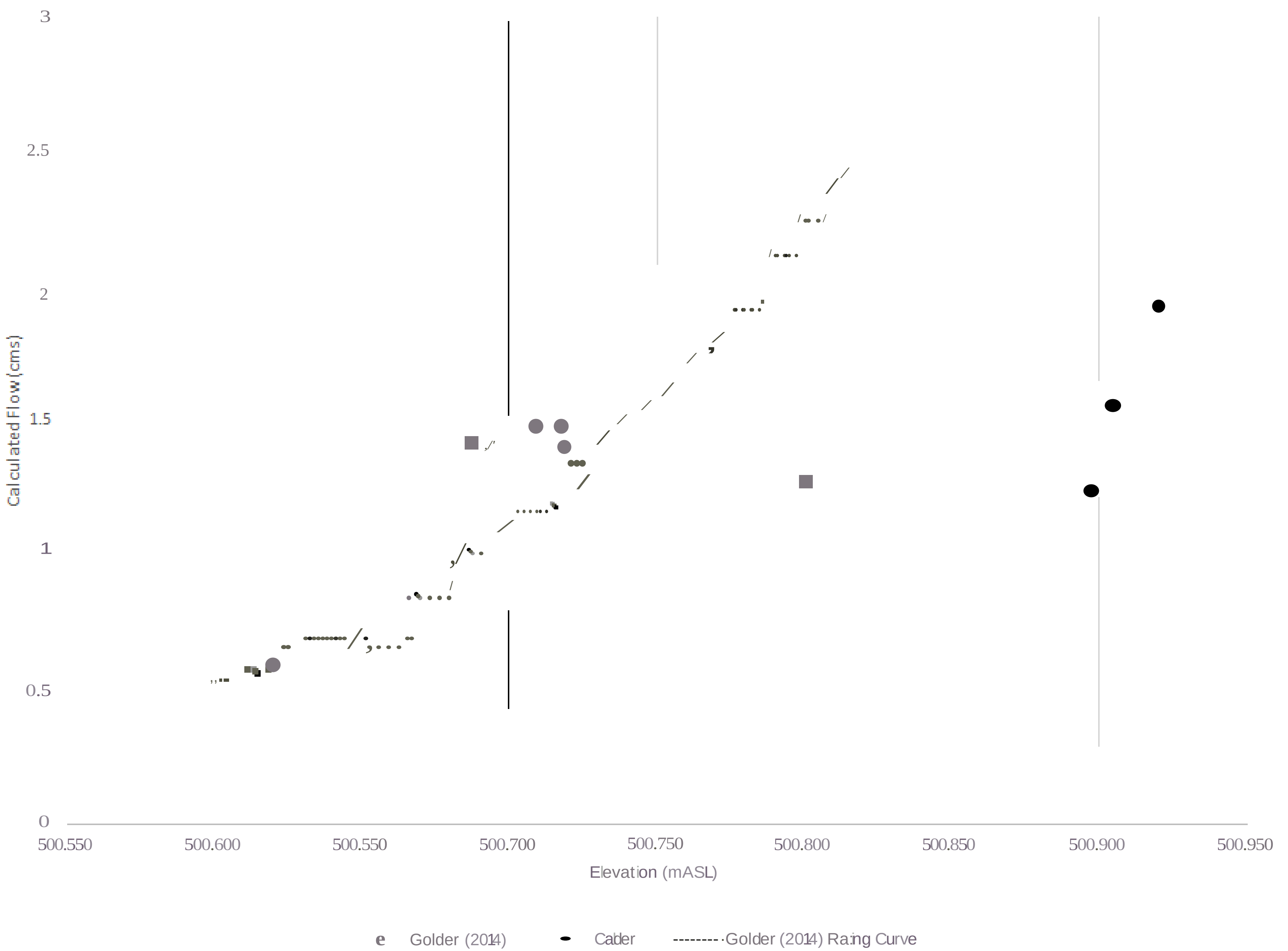
RATING CURVES AND MANUAL FLOW MEASUREMENTS



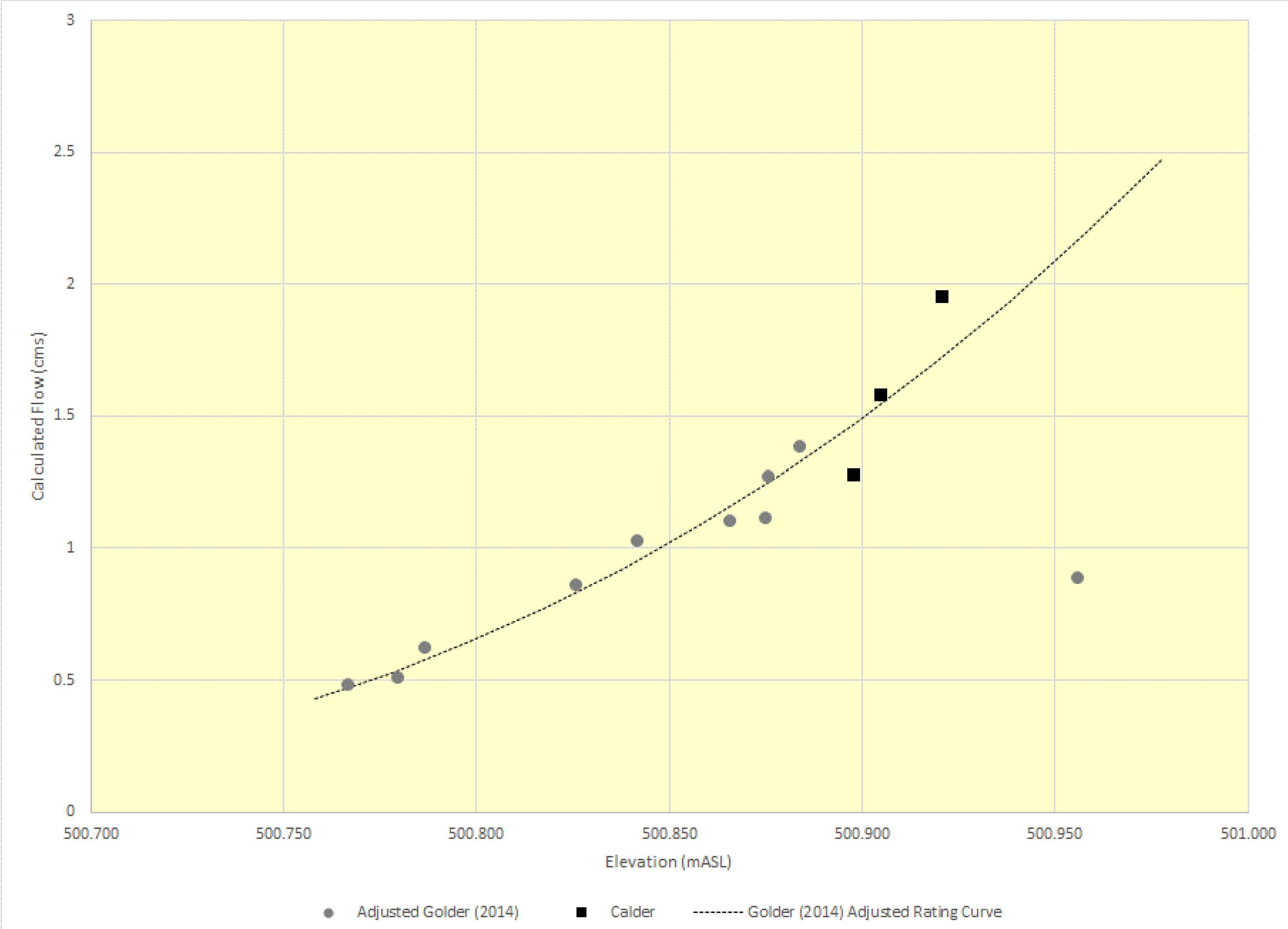
SA1 – MANUAL FLOW MEASUREMENTS AND RATING CURVE



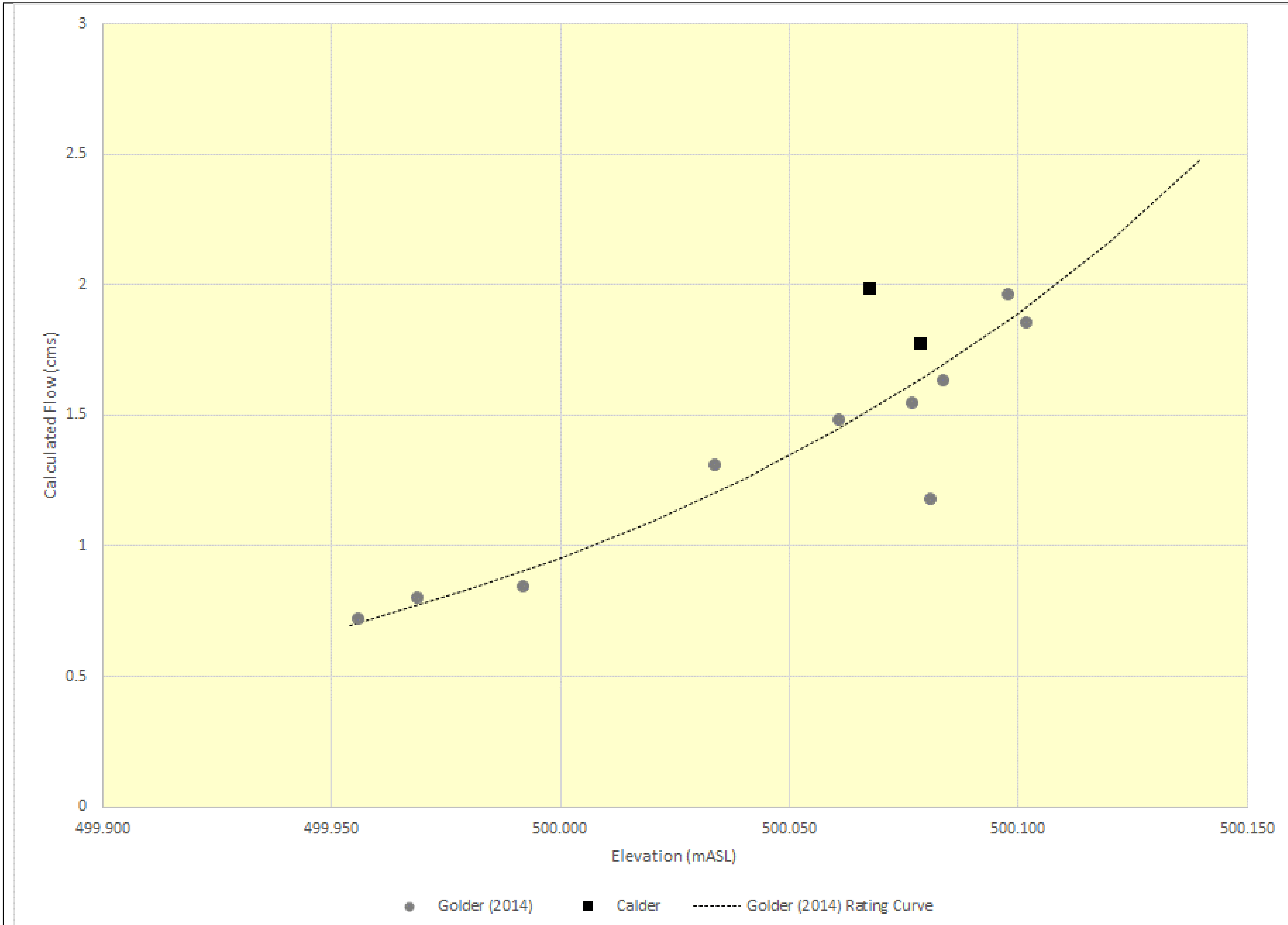
SA4 – MANUAL FLOW MEASUREMENTS AND RATING CURVE



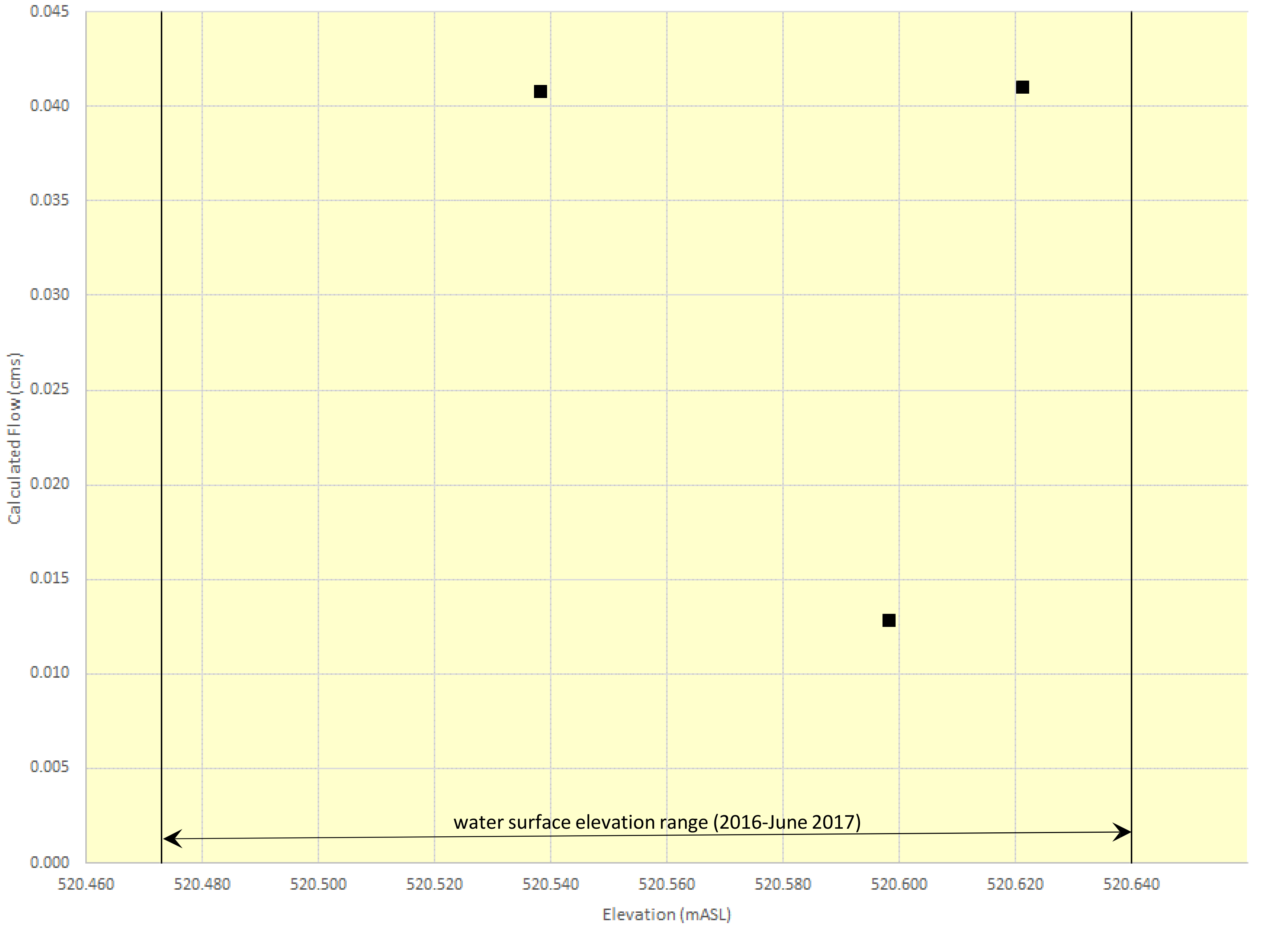
SA5 - MANUAL FLOW MEASUREMENTS AND RATING CURVE



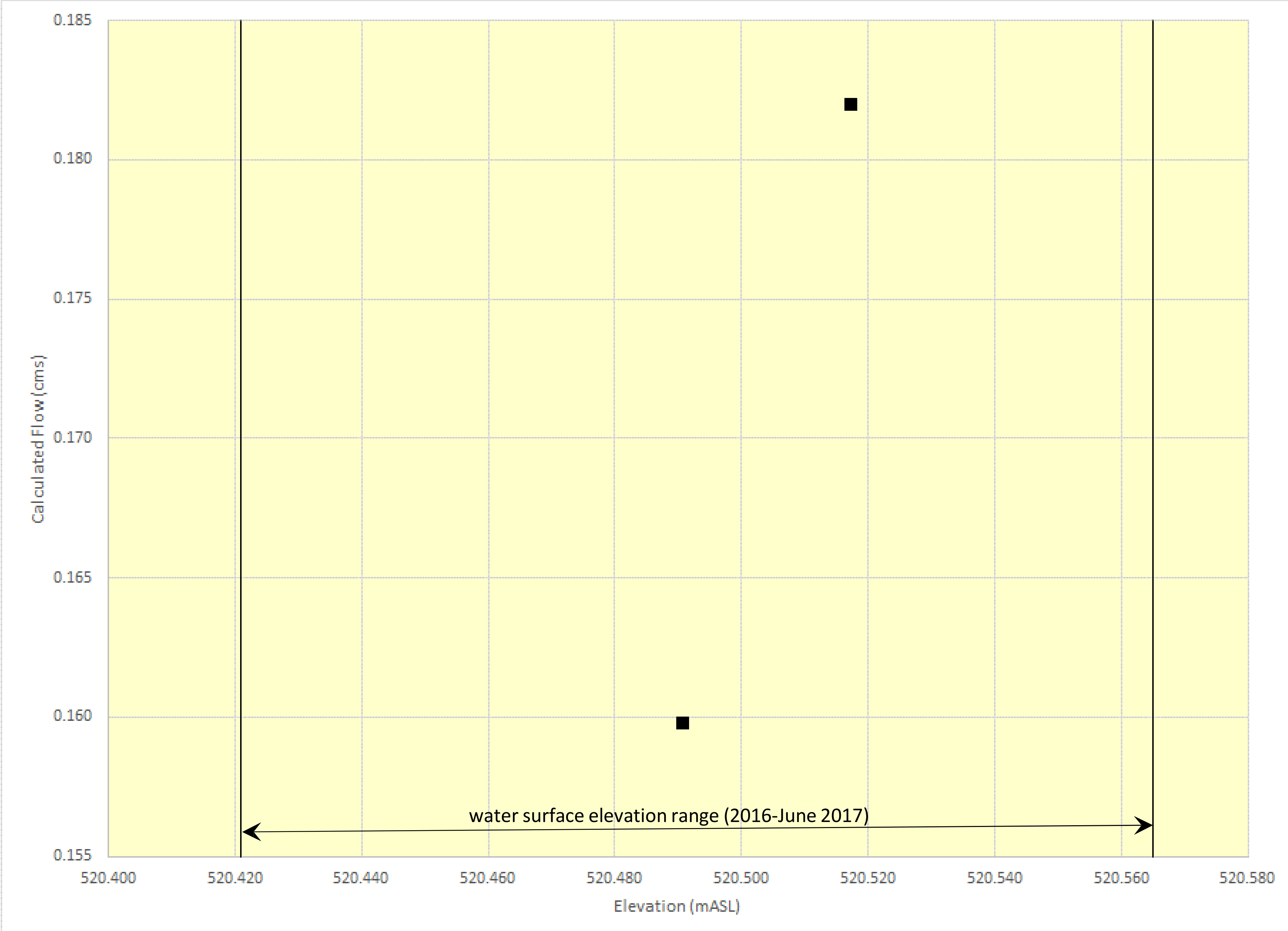
SA5 – ADJUSTED MANUAL FLOW MEASUREMENTS AND ADJUSTED RATING CURVE



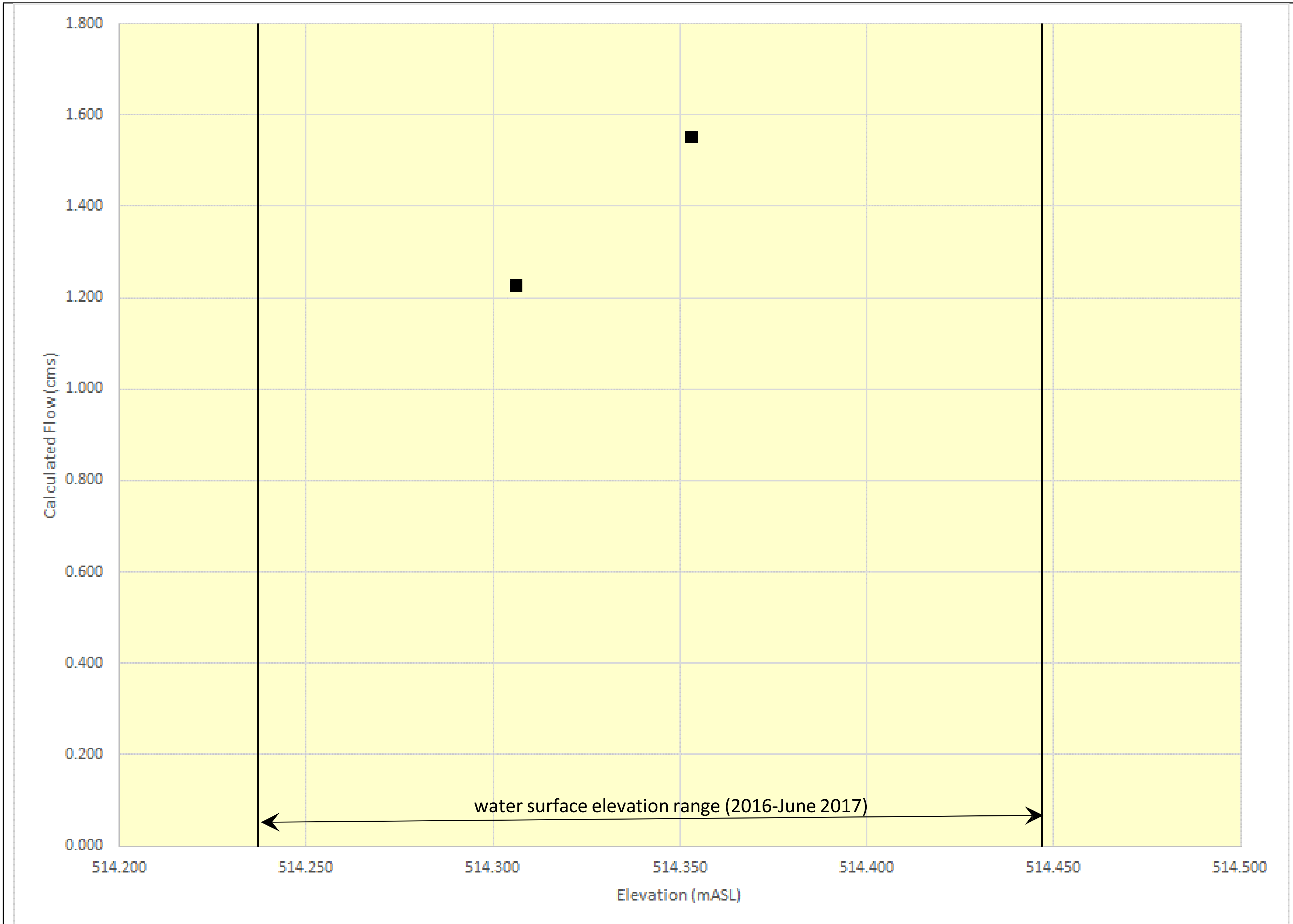
SA6 – MANUAL FLOW MEASUREMENTS AND RATING CURVE



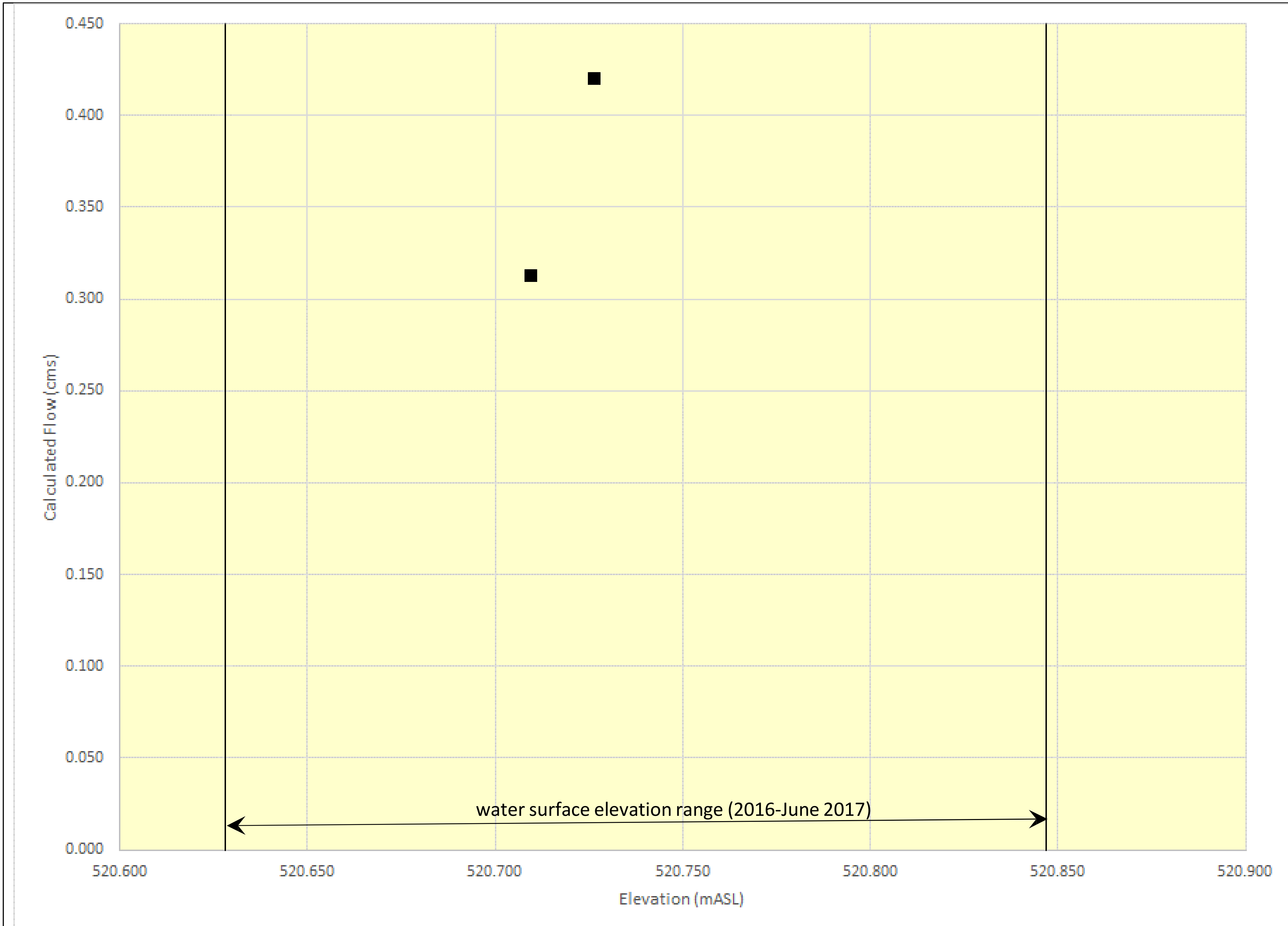
SA8 – MANUAL FLOW MEASUREMENTS



SA9 – MANUAL FLOW MEASUREMENTS



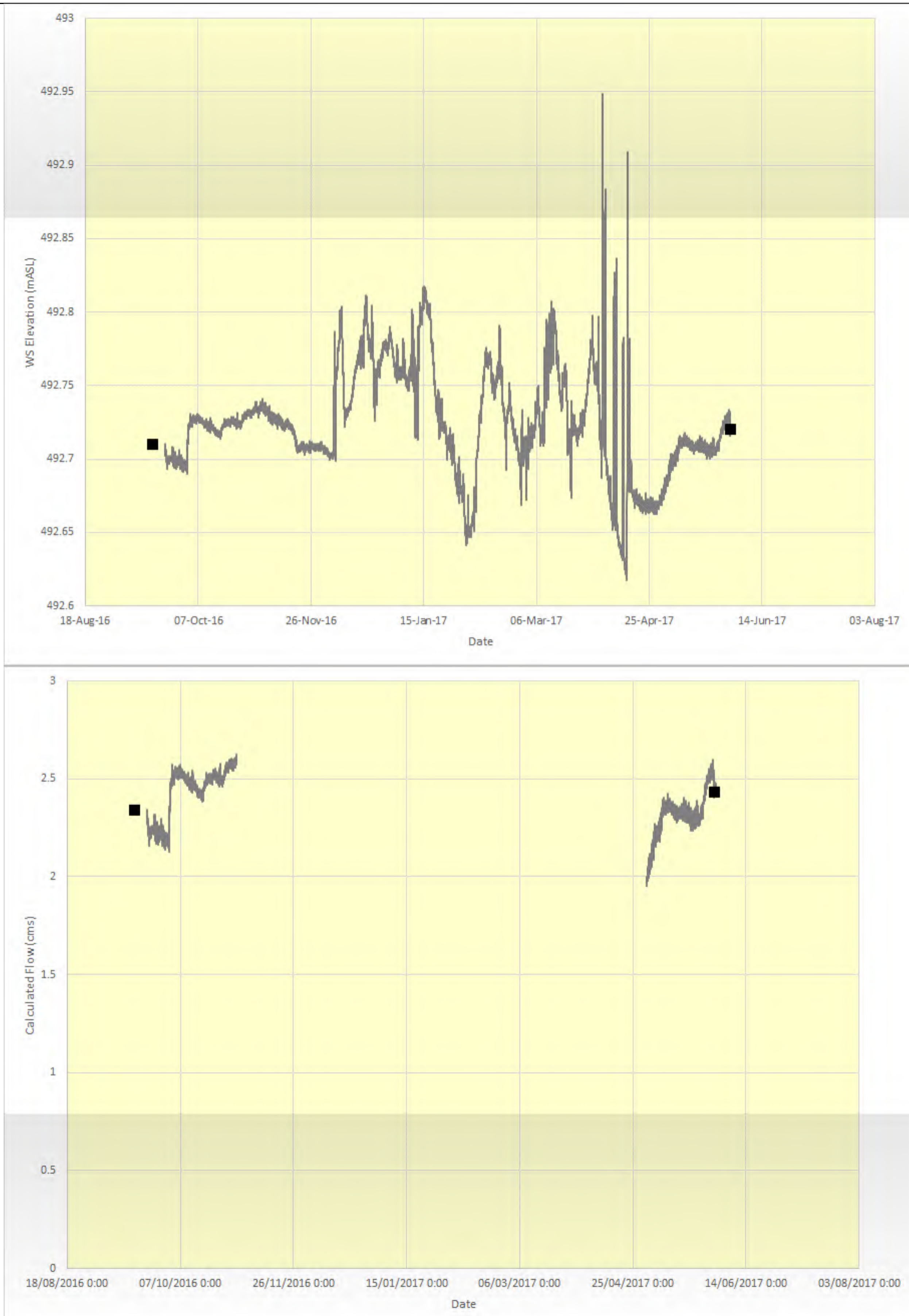
SA10 – MANUAL FLOW MEASUREMENTS



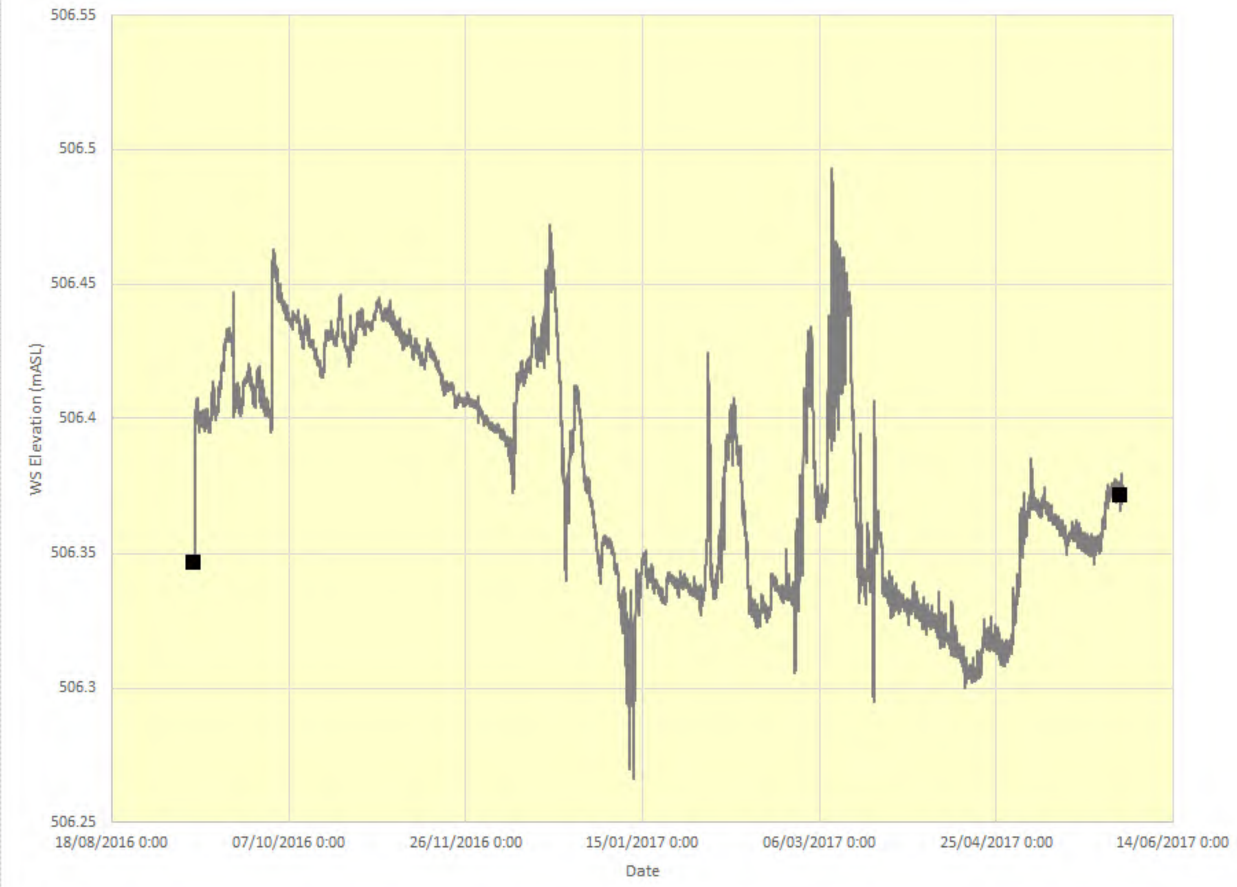
SA11 – MANUAL FLOW MEASUREMENTS

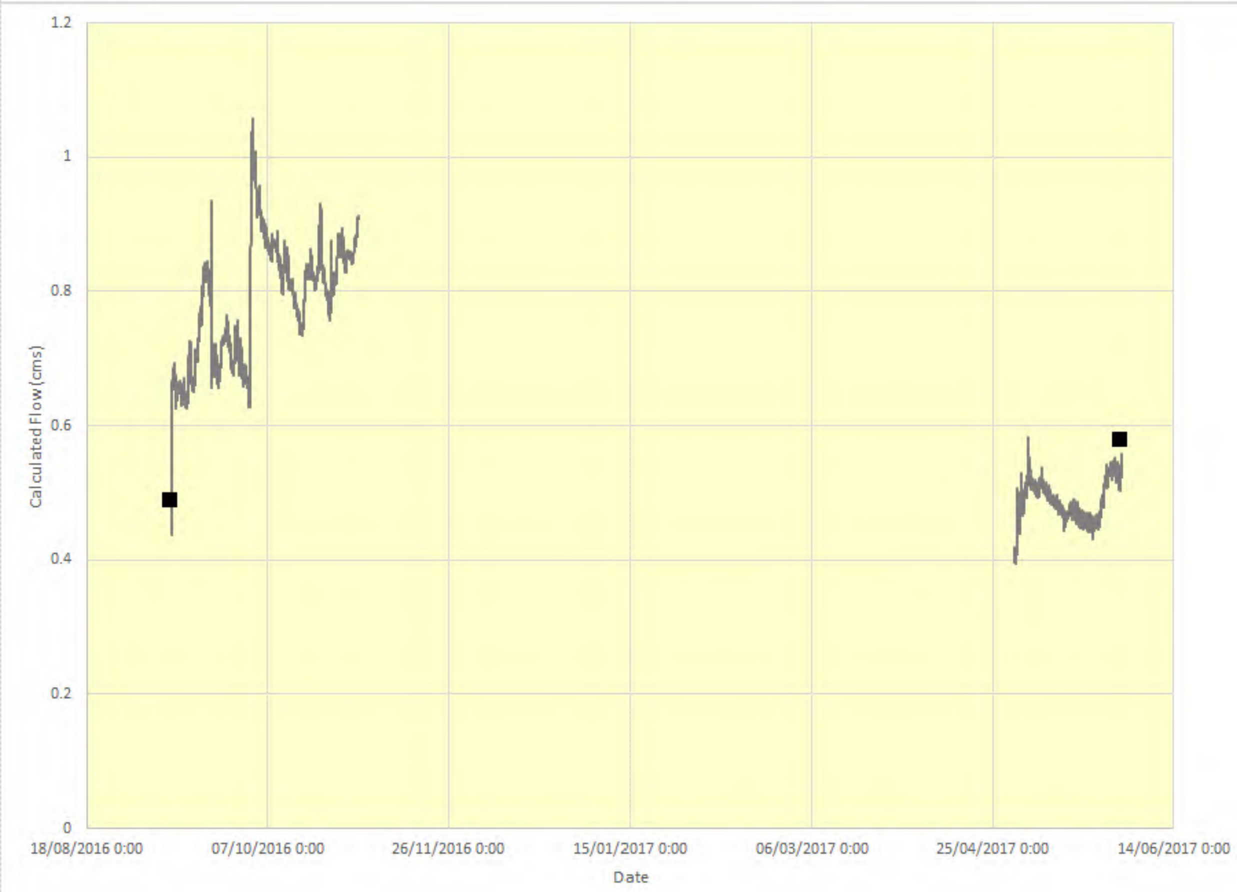
ATTACHMENT C

LEVEL LOGGER DATA

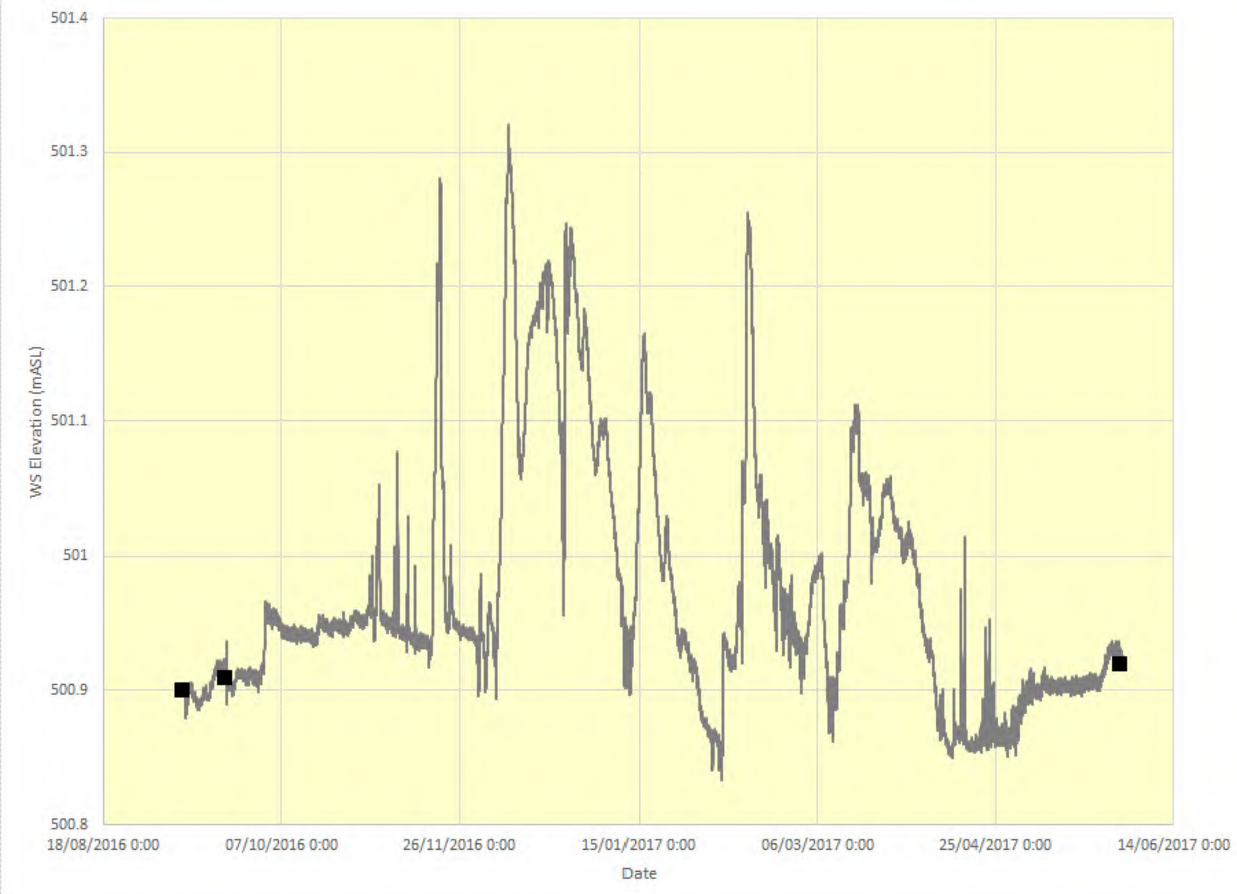


SA1 – Elevation and Discharge (September 2016 to June 2017)



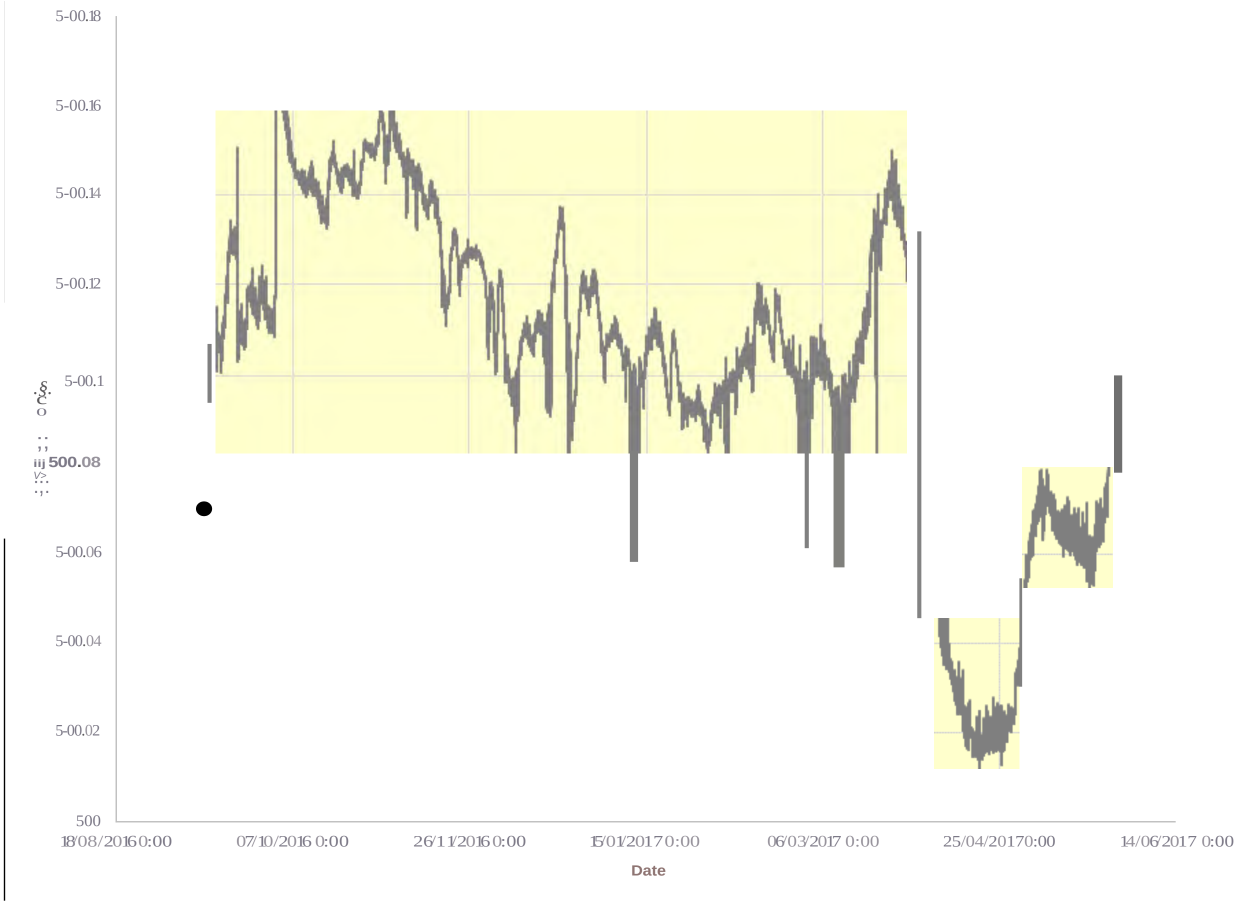


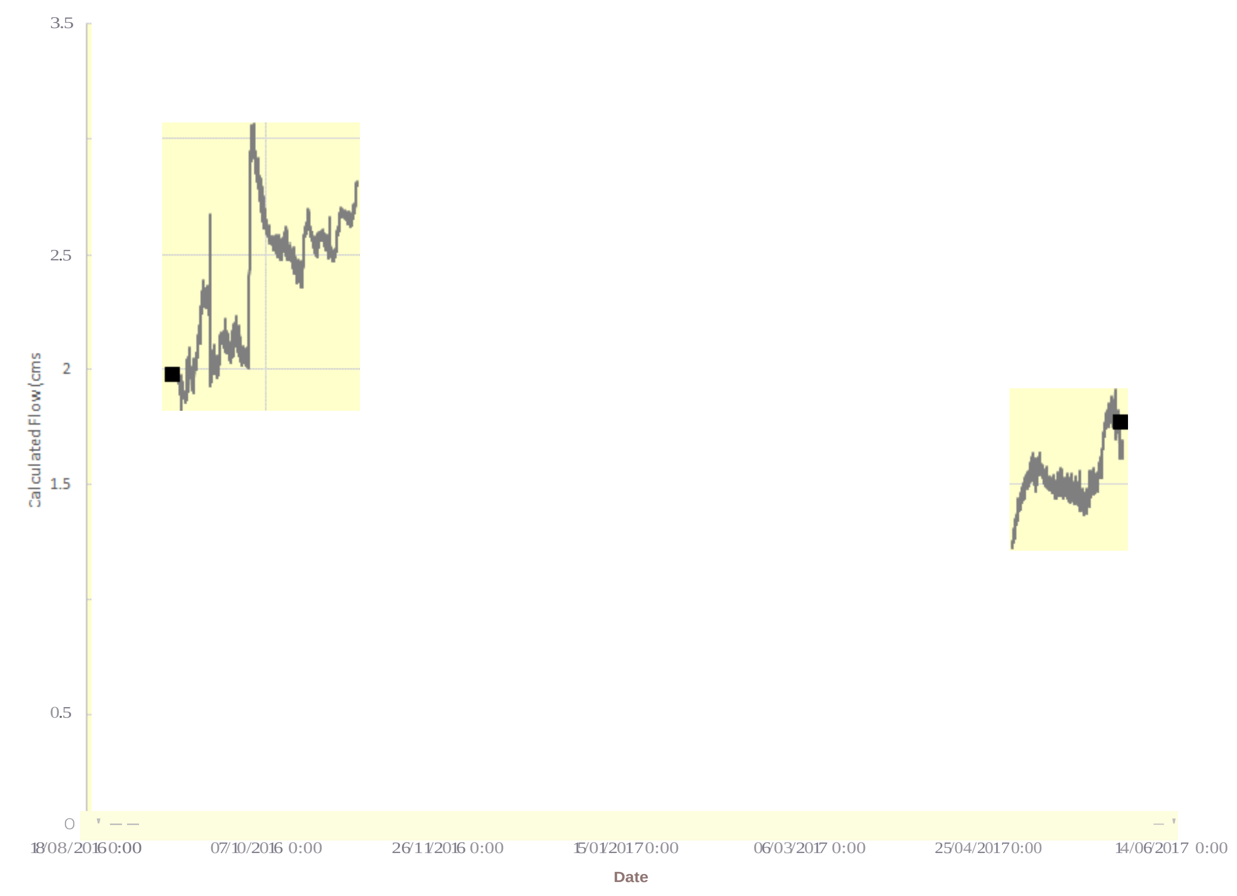
SA4 – Elevation and Discharge (September 2016 to June 2017)



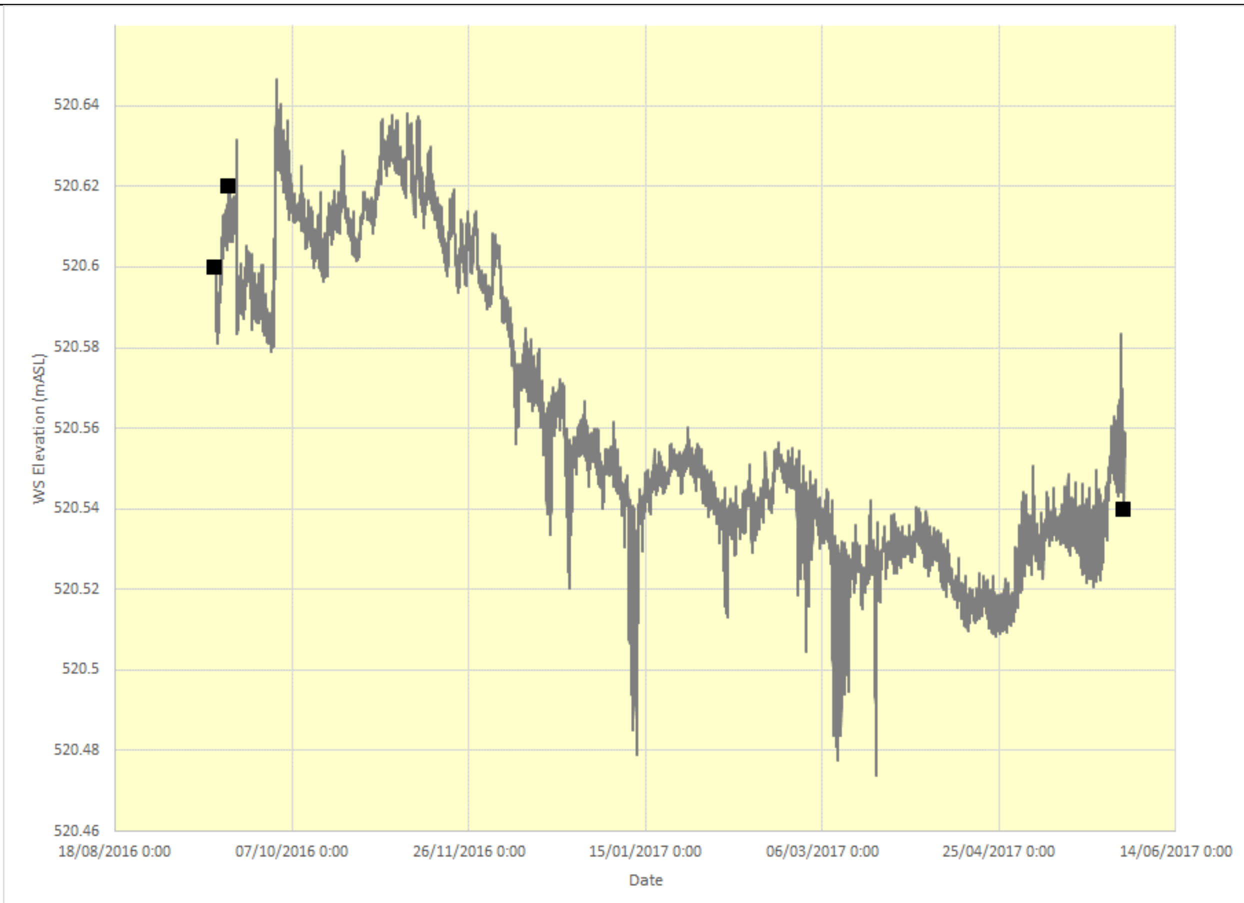
SA5 – Elevation and Discharge (September 2016 to June 2017)

SA6 – Elevation and Discharge (March 2014 to August 2015)

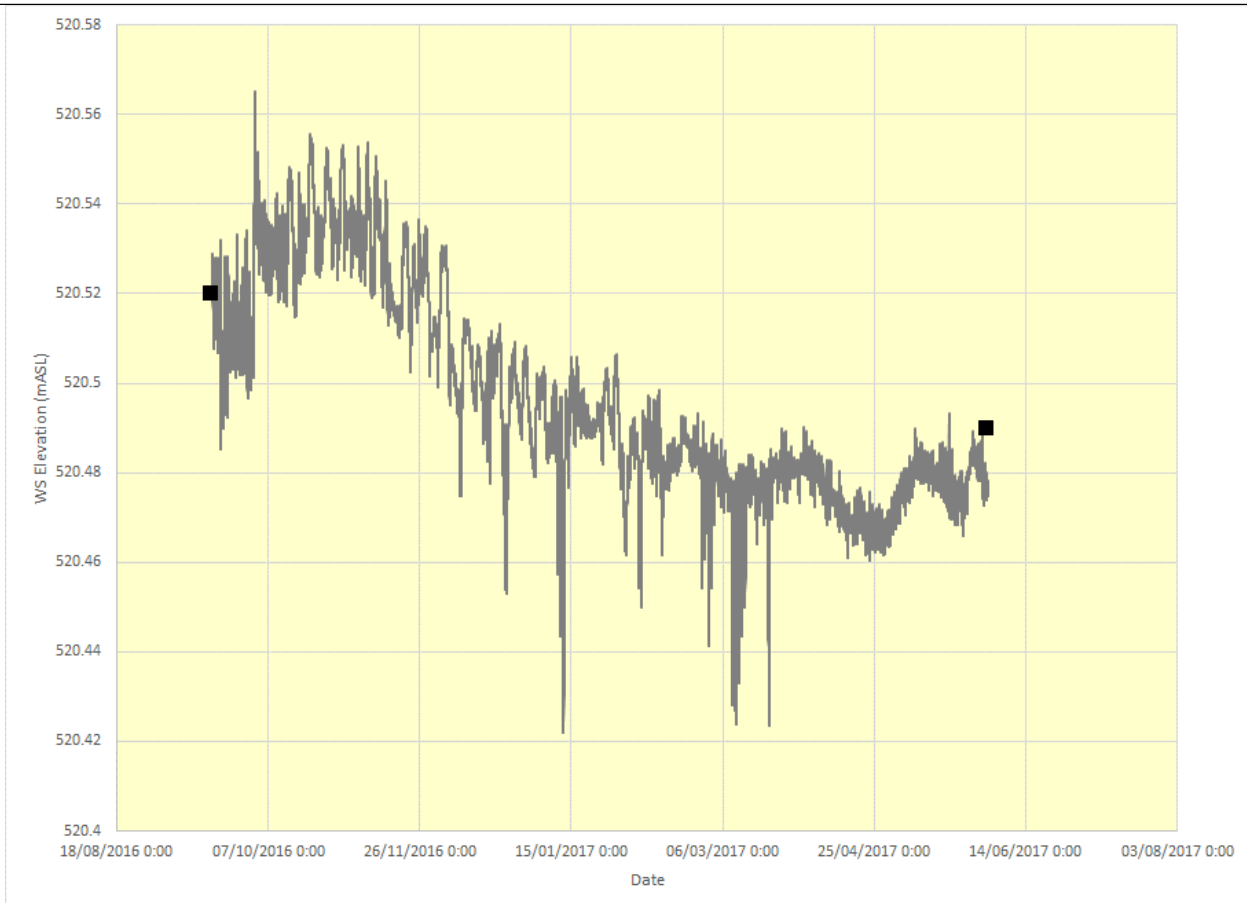




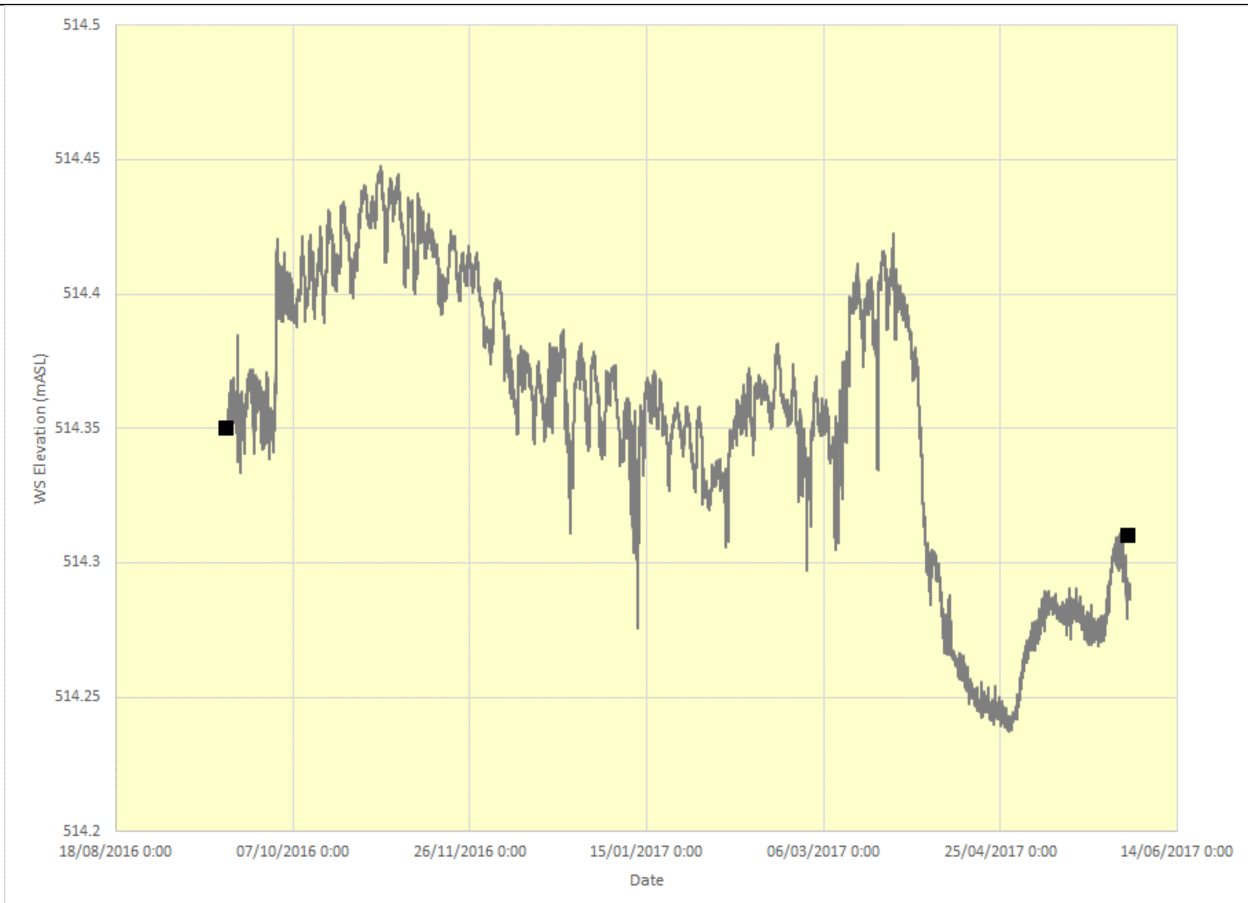
SA6 - Elevation and Discharge (September 2016 to June 2017)



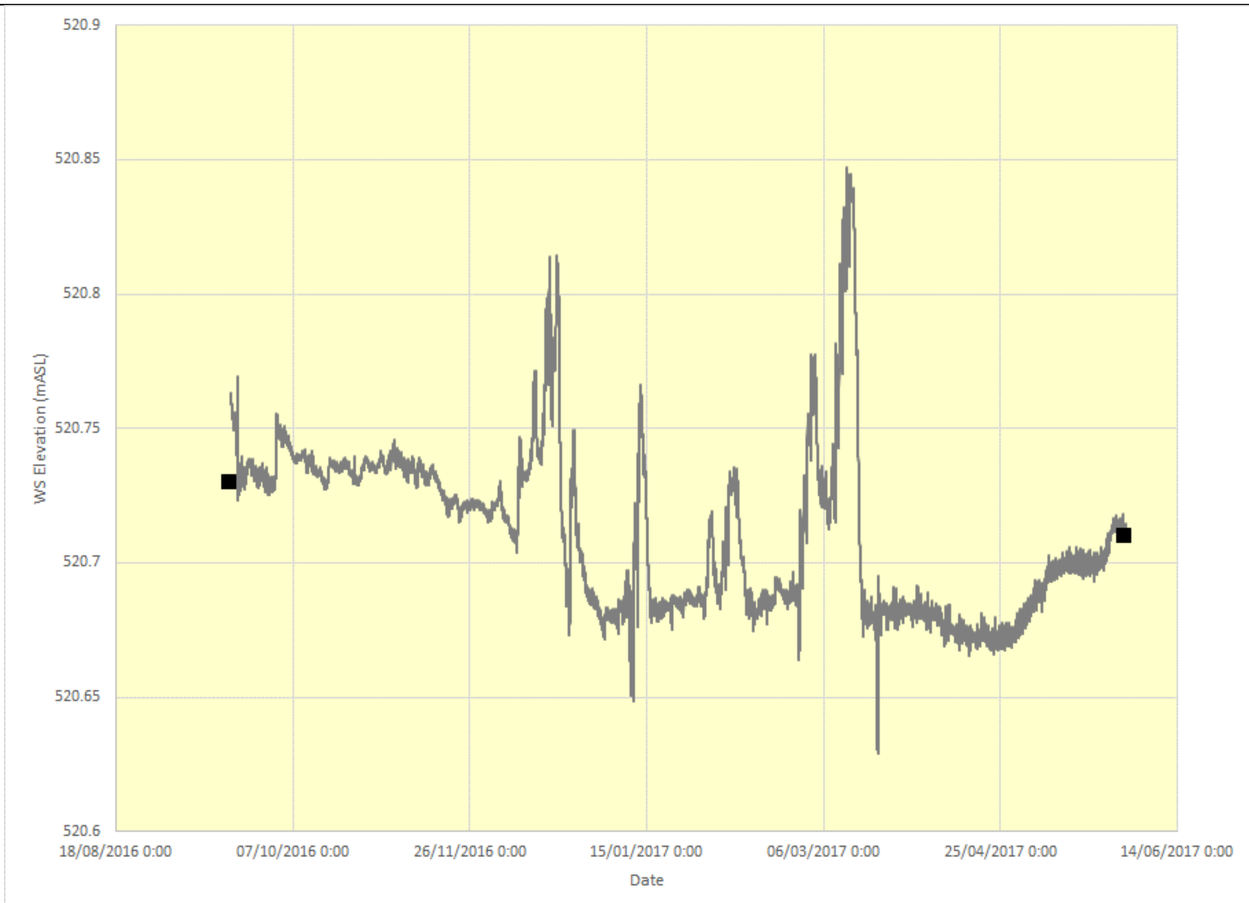
SA8 – Elevation (September 2016 to June 2017)



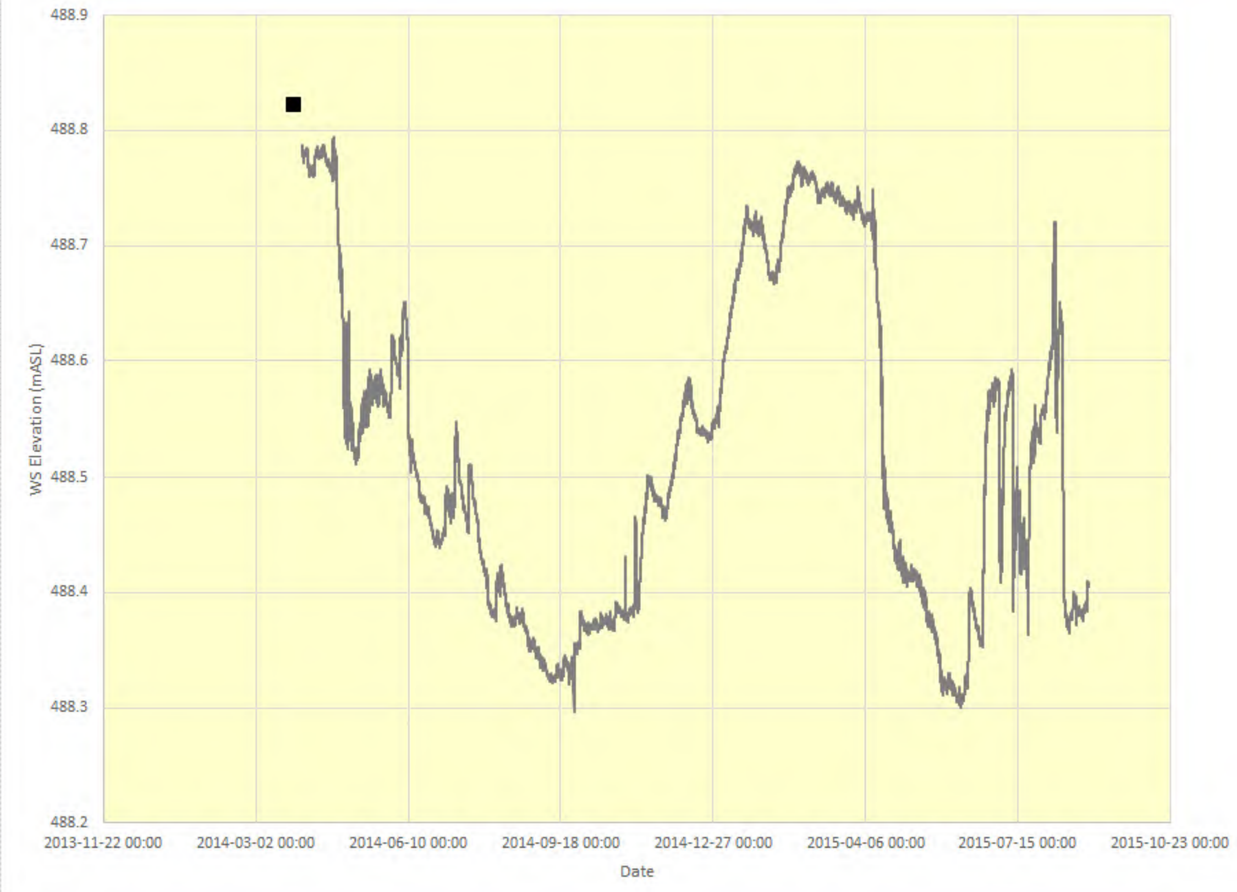
SA9 – Elevation (September 2016 to June 2017)

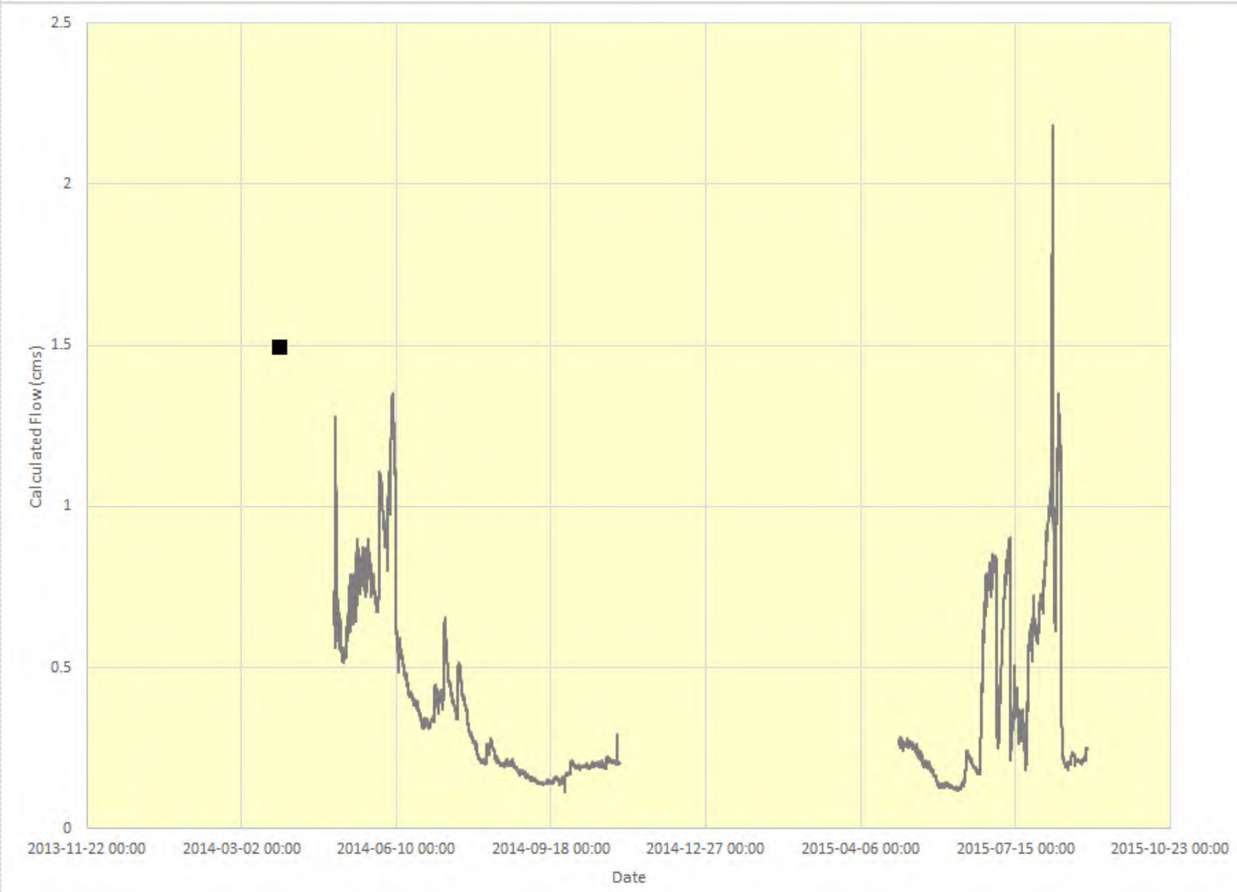


SA10 – Elevation (September 2016 to June 2017)



SA11 – Elevation (September 2016 to June 2017)





SB1 – Elevation and Discharge (March 2014 to August 2015)

ATTACHMENT D

WEBB SURVEY REPORT

Webb Surveys
REGISTERED LAND SURVEYORS
LAND DEVELOPMENT CONSULTANTS

June 6, 2017 WO# 17-246

Calder Engineering Ltd.
6440 King Street
Caledon, ON
L7C 0S1

Attn: Robert Whyte

Robert,

Please find attached the static reports from NRCAN showing the corrected static positions of the points that I surveyed between May 29 and June 1, 2017.

As a brief summary here is a list of the points and elevations:

LA8	523.991
LA9	515.312
PA2	511.303
PA3	517.851
SB5	518.673

Feel free to contact me if you have any questions.

Thank you,

D.L. (Dan) Codling, SLS, P.Surv

222 Jessop Avenue • Saskatoon SK • S7N 1Y4 • Phone: (306) 955-5330 • Fax: (306) 955-0292 • Email: admin@webbsurveys.ca

CSRS-PPP (V 1.05 11216)

LA8

Data Start	Data End	Duration of Observations
2017-06-01 15:47:00.000	2017-06-01 21:11:30.000	5h 24m 30.00s
Apri / Aposteriori Phase Std		**Apri / Aposteriori Code Std**
0.015m / 0.010m		2.0m / 2.092m
Observations	**Frequency**	**Mode**
Phase and Code	L1 and L2	Static
Elevation Cut-Off	**Rejected Epochs**	**Observation & Estimation Steps**
10.000 degrees	0.00 %	15.00 sec / 15.00 sec
Antenna Model	**APC to ARP**	**ARP to Marker**
TPSGR5 NONE	L1= 0.221 m L2= 0.218 m	1.459 m

(APC = antenna phase center; ARP = antenna reference point)

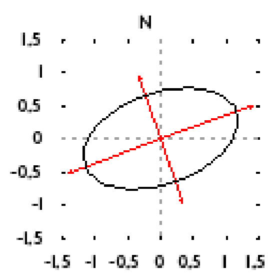
Estimated Position for LA8152p.17O

	Latitude (+n)	Longitude (+e)	Ell. Height
NAD83(CSRS) (1997)	57° 33' 39.2611''	-105° 23' 48.9852''	492.933 m
Sigmas(95%)	0.006 m	0.009 m	0.021 m
Apriori	57° 33' 39.262''	-105° 23' 49.066''	494.022 m
Estimated - Apriori	-0.042 m	1.352 m	-1.089 m

Orthometric Height
CGVD28 (HTv2.0)

523.991 m
(click for height reference information)

95% Error Ellipse (cm)
semi-major: 1.219cm
semi-minor: 0.688cm
semi-major azimuth: 71° 1' 7.79''



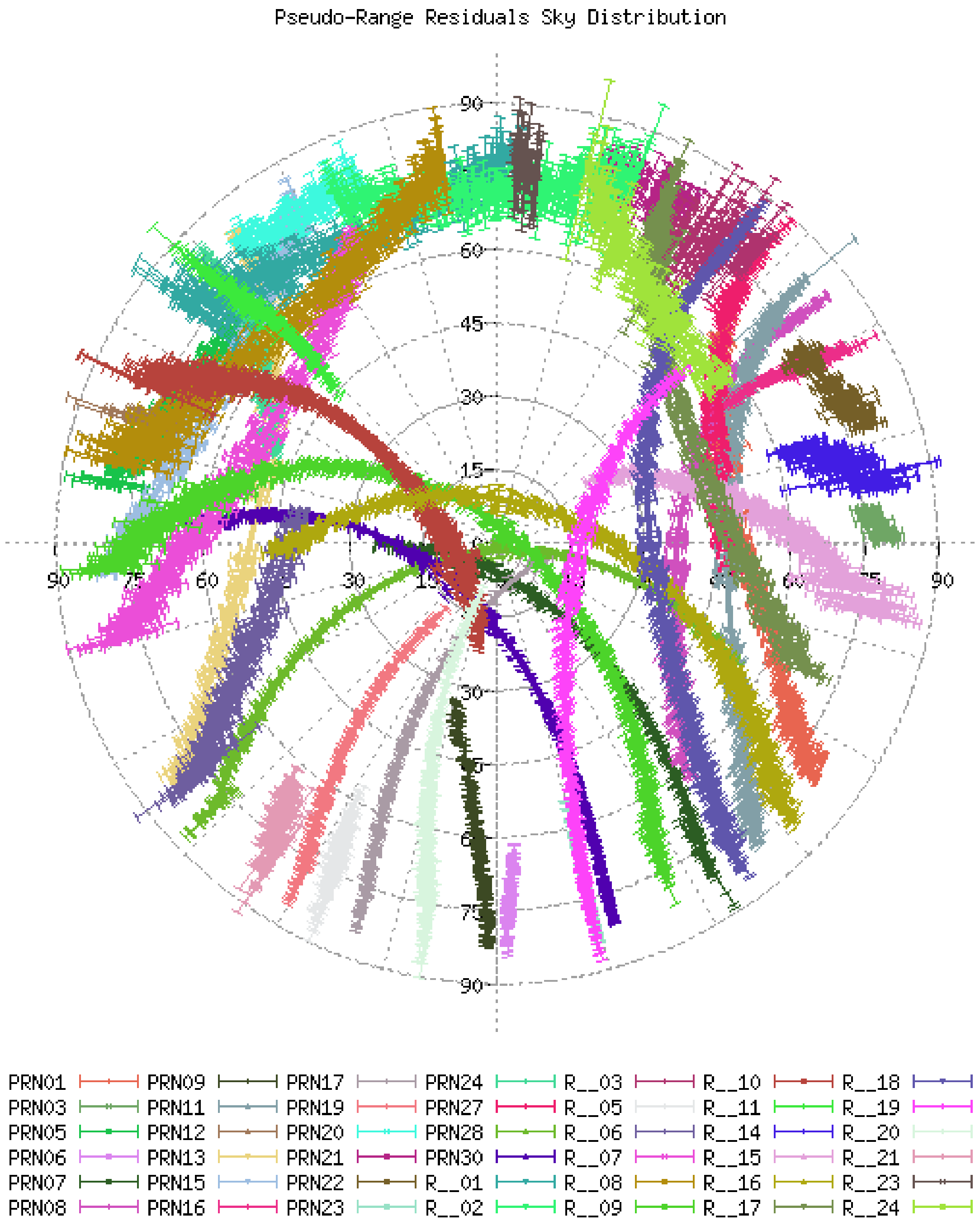
UTM (North) Zone 13

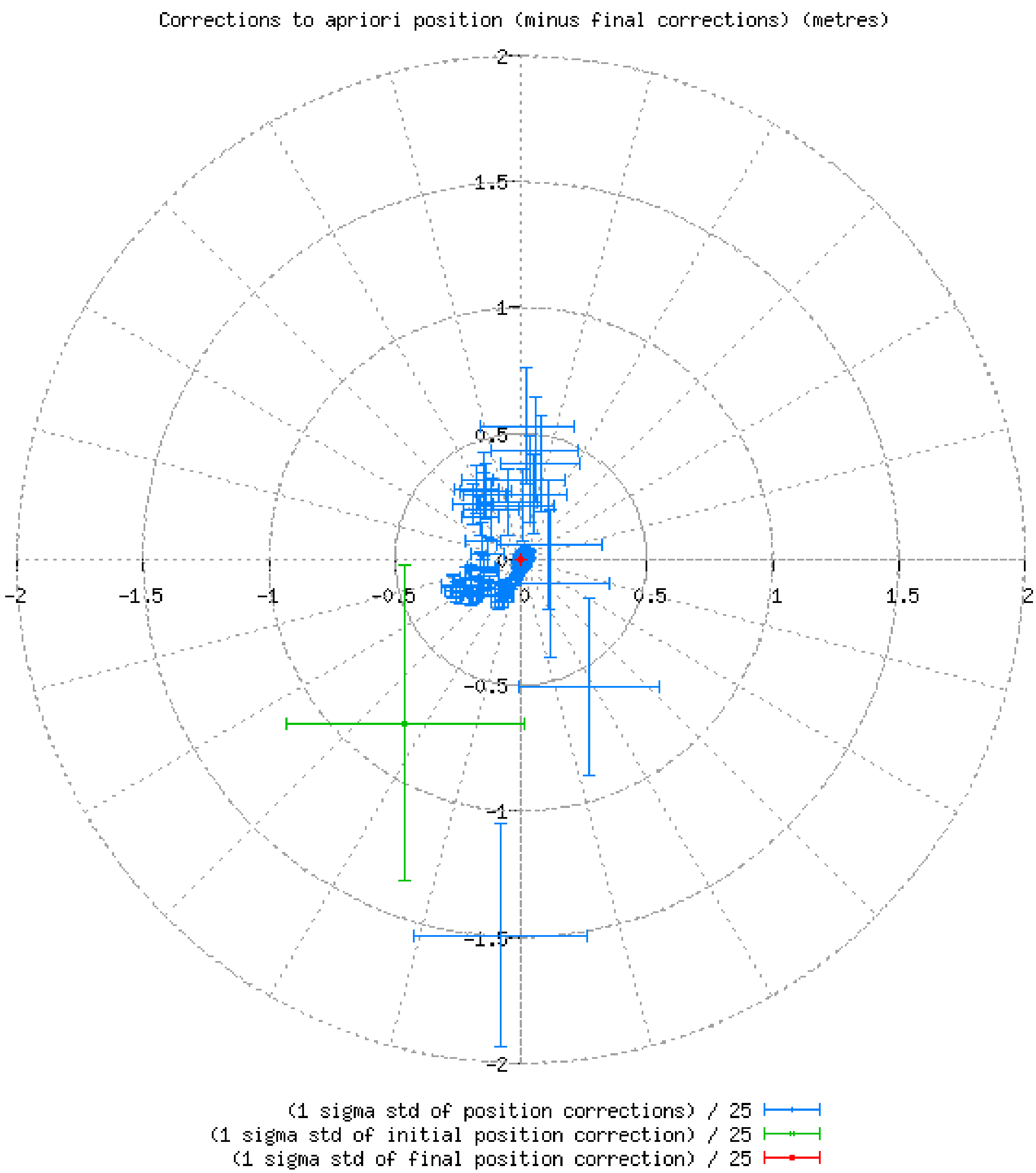
6379895.581m (N) 476250.738m (E)

Scale Factors
0.99960692 (point)
0.99952959 (combined)

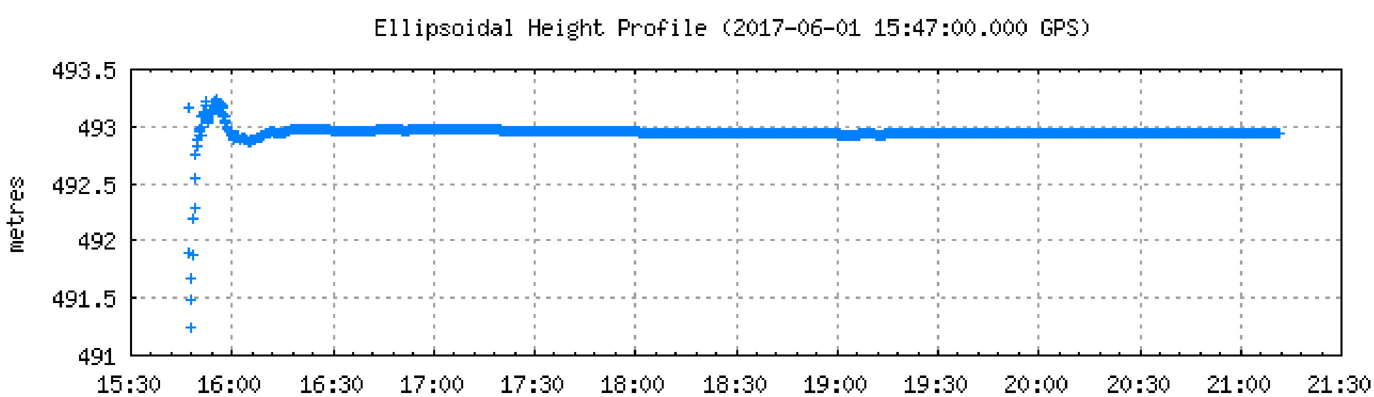
(Coordinates from RINEX file used as apriori position)

Estimated Parameters & Observations Statistics

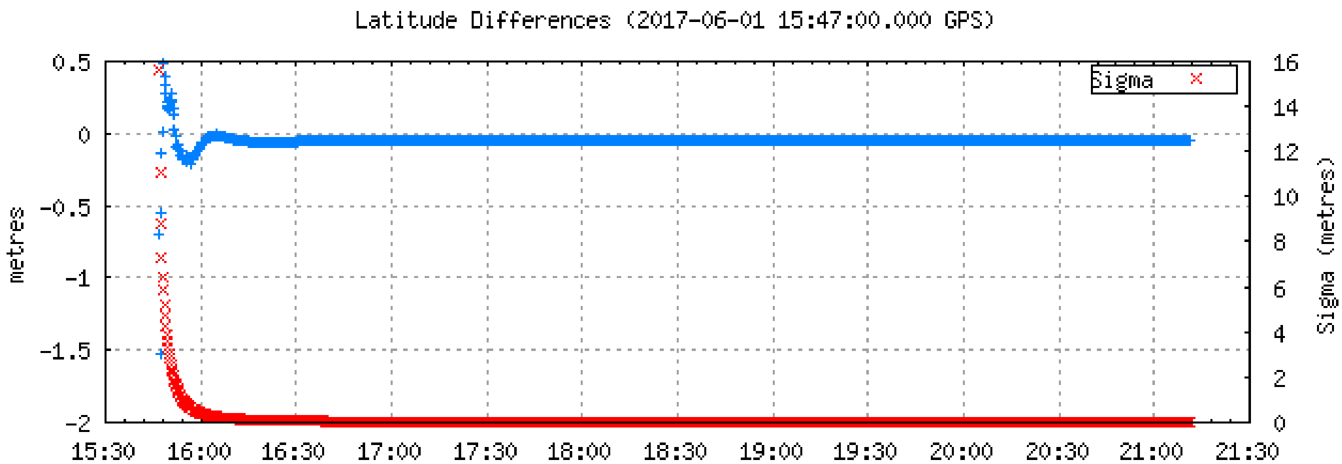


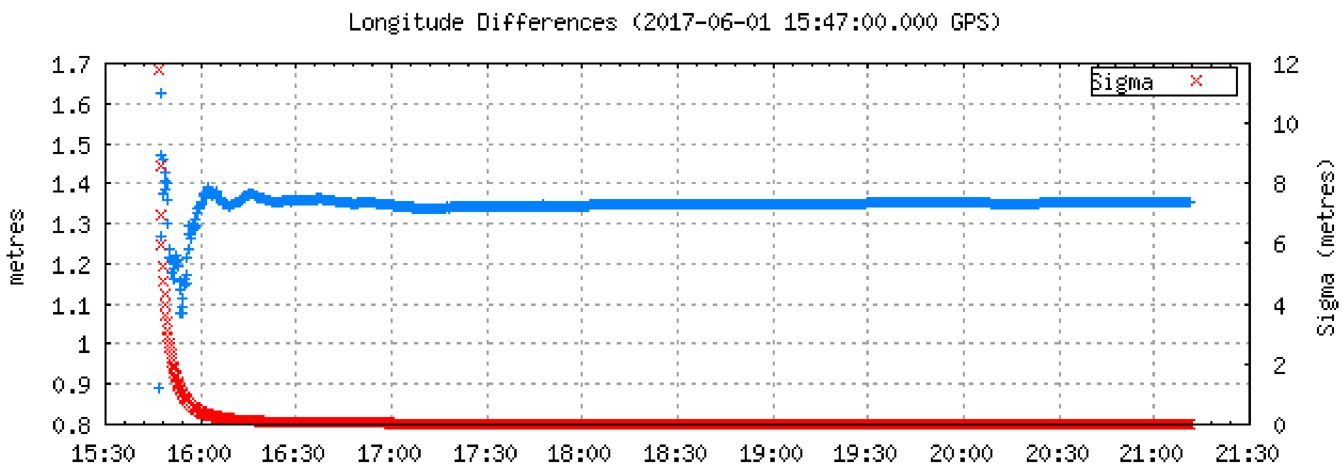


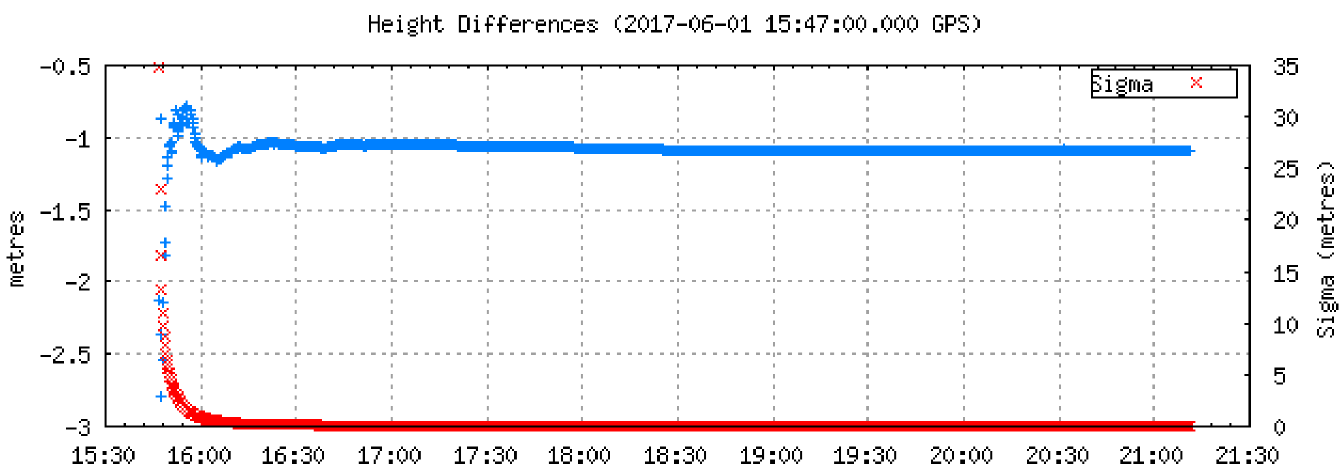
Corrections to apriori position (minus final corrections) (metres)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
(1 sigma std of position corrections) / 25
(1 sigma std of initial position correction) / 25
(1 sigma std of final position correction) / 25

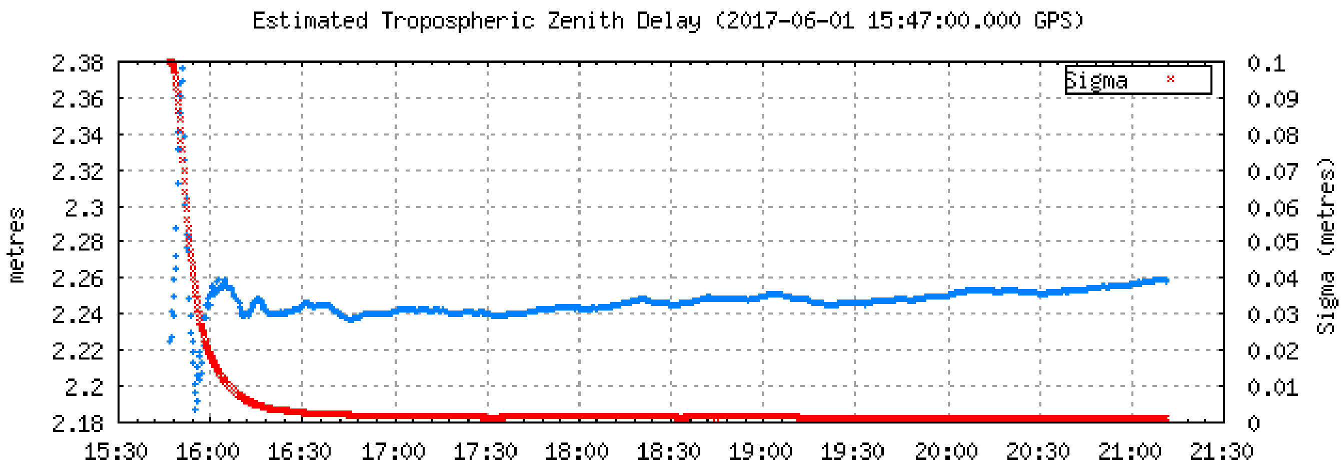


Ellipsoidal Height Profile (2017-06-01 15:47:00.000 GPS)
metres
493.5
493
492.5
492
491.5
491
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30
21:00
21:30

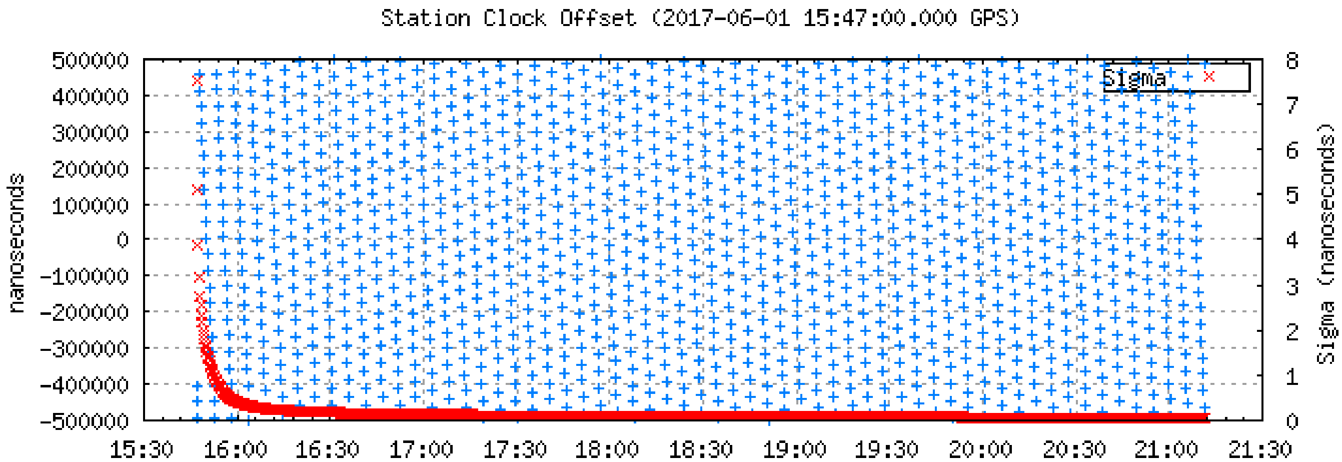

Latitude Differences (2017-06-01 15:47:00.000 GPS)
metres
Sigma (metres)
Sigma
0.5
0
-0.5
-1
-1.5
-2
16
14
12
10
8
6
4
2
0
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30
21:00
21:30


Longitude Differences (2017-06-01 15:47:00.000 GPS)
metres
Sigma (metres)
Sigma
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
12
10
8
6
4
2
0
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30
21:00
21:30

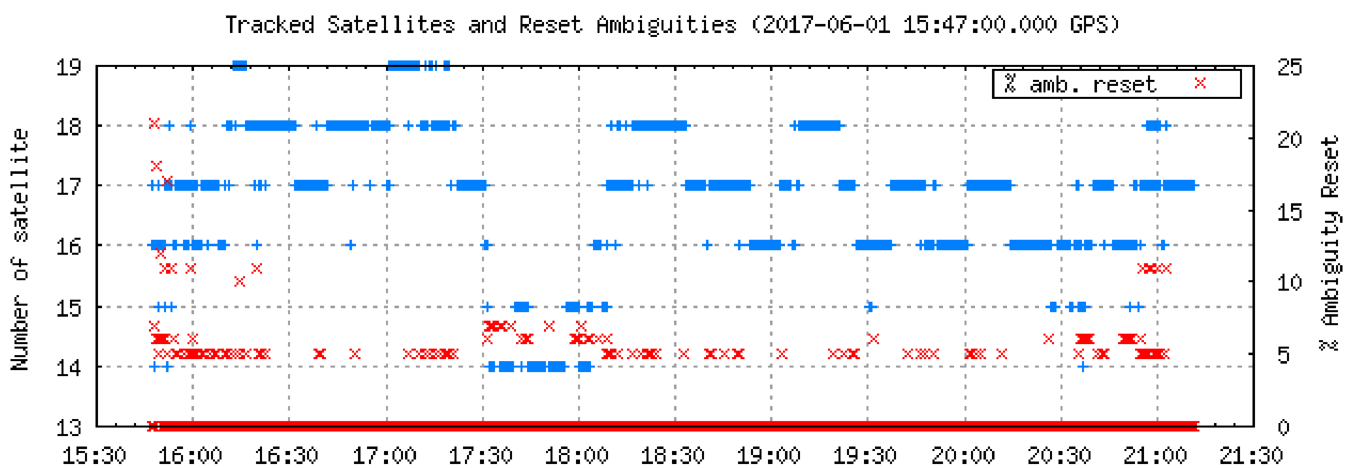

Height Differences (2017-06-01 15:47:00.000 GPS)
metres
Sigma (metres)
Sigma
-0.5
-1
-1.5
-2
-2.5
-3
35
30
25
20
15
10
5
0
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30
21:00
21:30



Estimated Tropospheric Zenith Delay (2017-06-01 15:47:00.000 GPS)
metres
Sigma (metres)
Sigma
2.38
2.36
2.34
2.32
2.3
2.28
2.26
2.24
2.22
2.2
2.18
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30
21:00
21:30

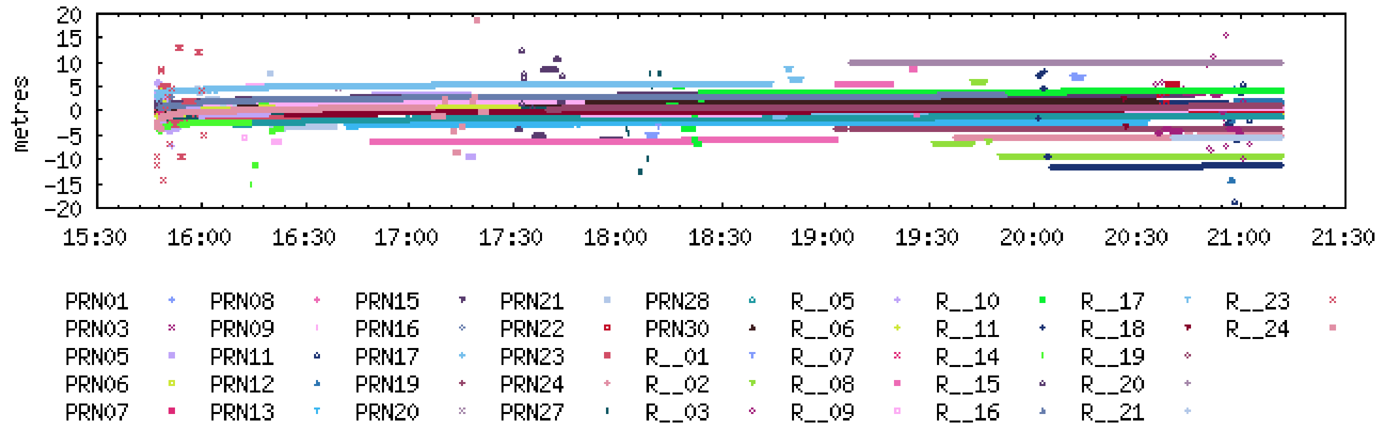


Station Clock Offset (2017-06-01 15:47:00.000 GPS)
nanoseconds
Sigma (nanoseconds)
Sigma
500000
400000
300000
200000
100000
0
-100000
-200000
-300000
-400000
-500000
8
7
6
5
4
3
2
1
0
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30
21:00
21:30

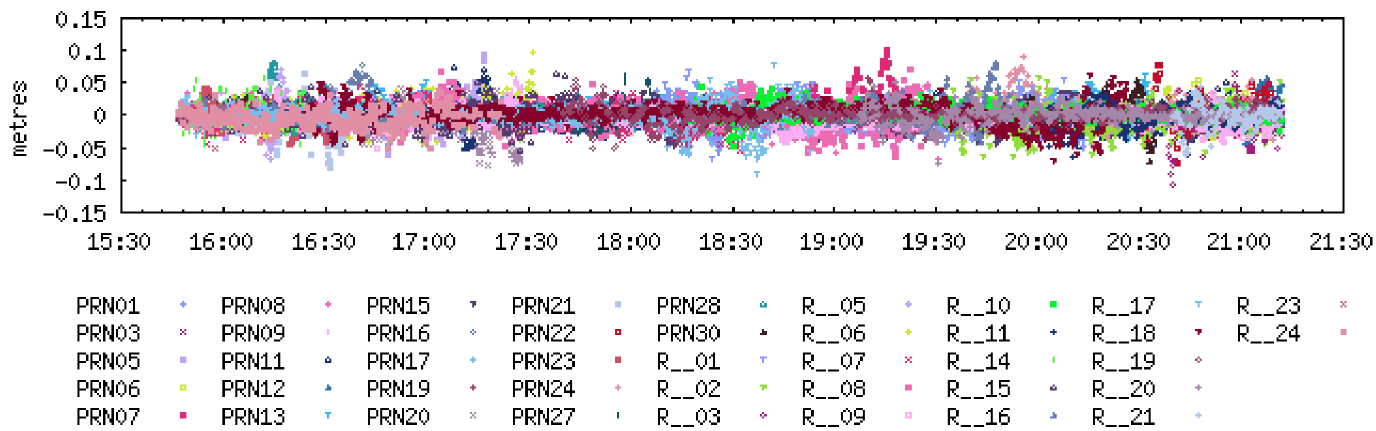


Tracked Satellites and Reset Ambiguities (2017-06-01 15:47:00.000 GPS)
Number of satellite
% Ambiguity Reset
% amb. reset
19
18
17
16
15
14
13
25
20
15
10
5
0
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30
21:00
21:30

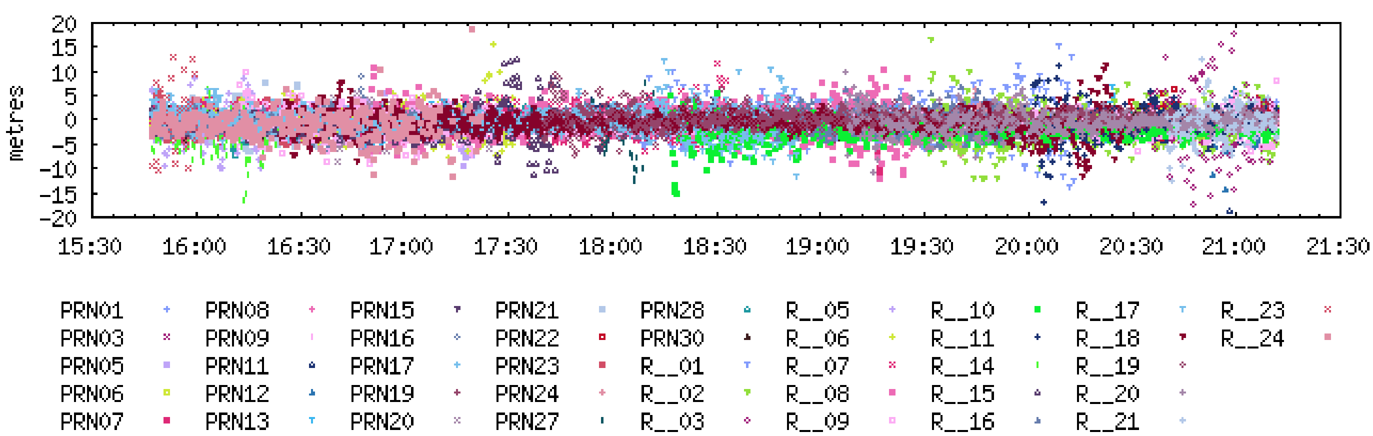
Ambiguities (2017-06-01 15:47:00.000 GPS)



Carrier-Phase Residuals (2017-06-01 15:47:00.000 GPS)



Pseudo-Range Residuals (2017-06-01 15:47:00.000 GPS)



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If you have any questions, please feel free to contact:
EMail: nrcan.geodeticinformationservices.rncan@canada.ca
Phone:343-292-6617

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CSRS-PPP (V 1.05 11216)

LA9

Data Start	Data End	Duration of Observations
2017-05-31 15:37:30.000	2017-05-31 20:08:15.000	4h 30m 45.00s
Apri / Aposteriori Phase Std		**Apri / Aposteriori Code Std**
0.015m / 0.010m		2.0m / 1.435m
Observations	**Frequency**	**Mode**
Phase and Code	L1 and L2	Static
Elevation Cut-Off	**Rejected Epochs**	**Observation & Estimation Steps**
10.000 degrees	0.00 %	15.00 sec / 15.00 sec
Antenna Model	**APC to ARP**	**ARP to Marker**
TPSGR5 NONE	L1= 0.221 m L2= 0.218 m	1.440 m

(APC = antenna phase center; ARP = antenna reference point)

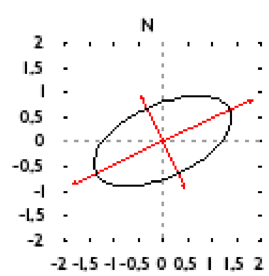
Estimated Position for LA9151p.17O

	Latitude (+n)	Longitude (+e)	Ell. Height
NAD83(CSRS) (1997)	57º 33’ 18.1971’’	-105º 20’ 19.7196’’	484.198 m
Sigmas(95%)	0.007 m	0.011 m	0.022 m
Apriori	57º 33’ 18.204’’	-105º 20’ 19.803’’	484.162 m
Estimated - Apriori	-0.207 m	1.393 m	0.036 m

Orthometric Height
CGVD28 (HTv2.0)

515.312 m
(click for height reference information)

95% Error Ellipse (cm)
semi-major: 1.502cm
semi-minor: 0.730cm
semi-major azimuth: 65º 23’ 47.07’’



UTM (North) Zone 13

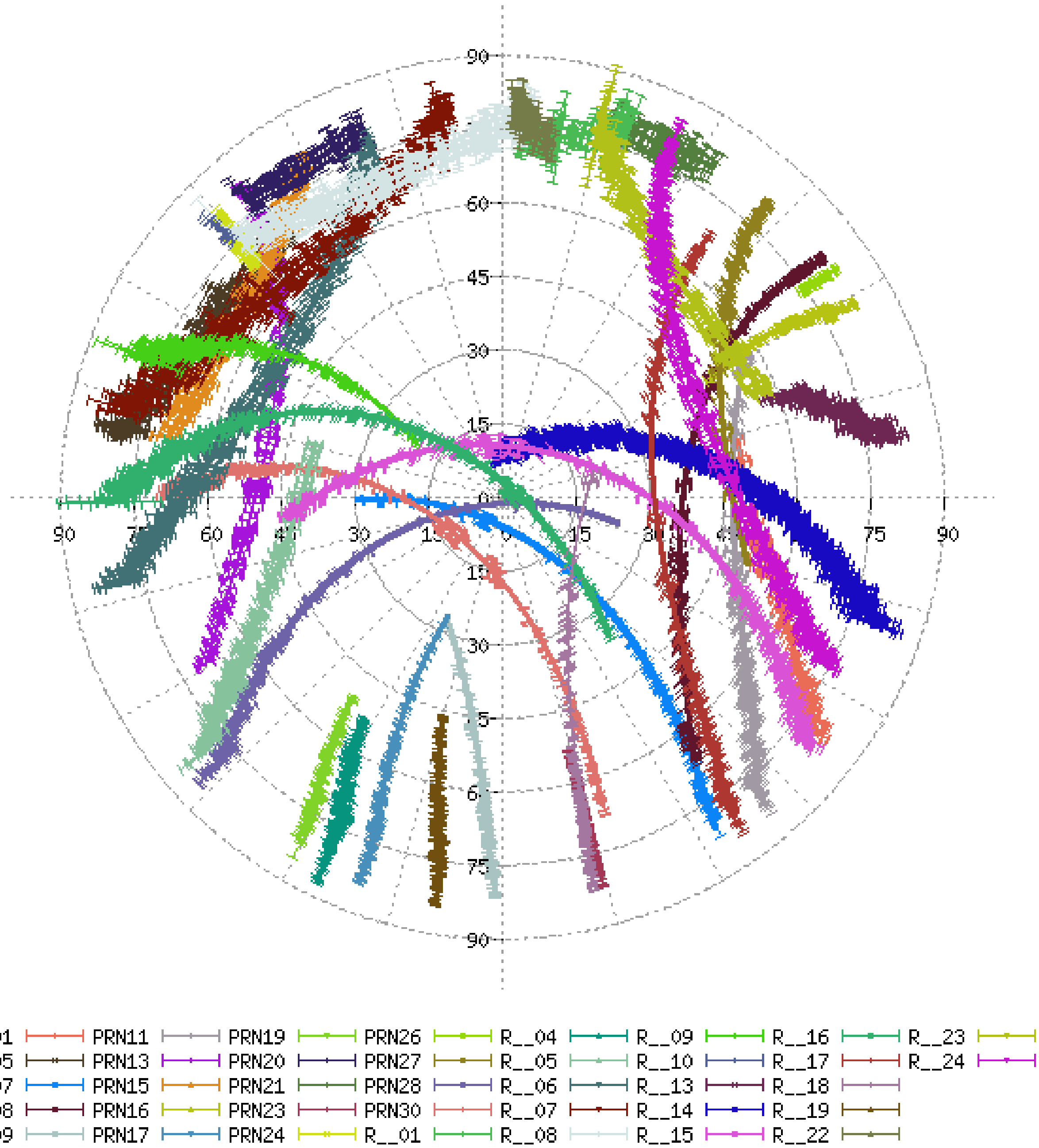
6379225.363m (N) 479725.394m (E)

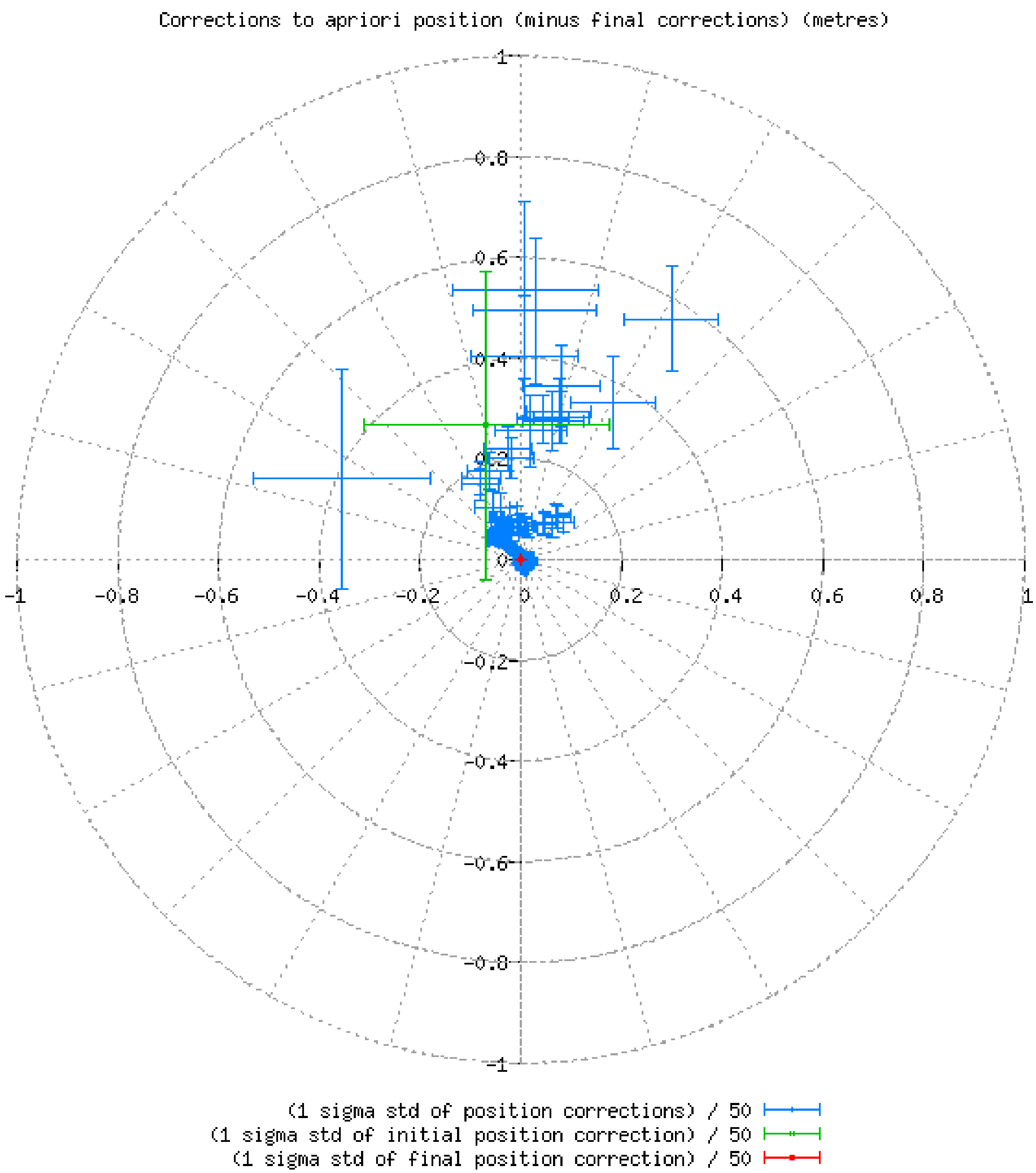
Scale Factors
0.99960504 (point)
0.99952908 (combined)

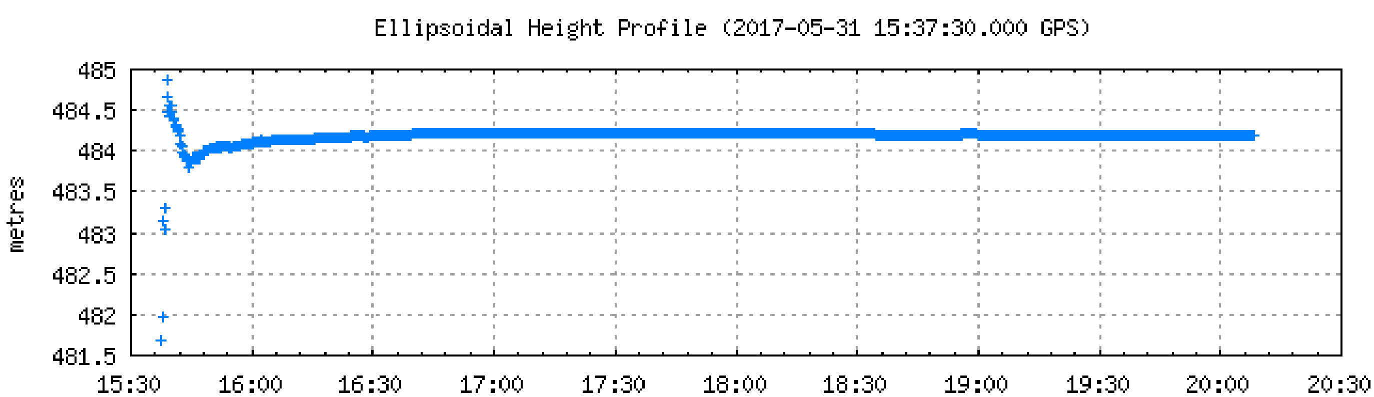
(Coordinates from RINEX file used as apriori position)

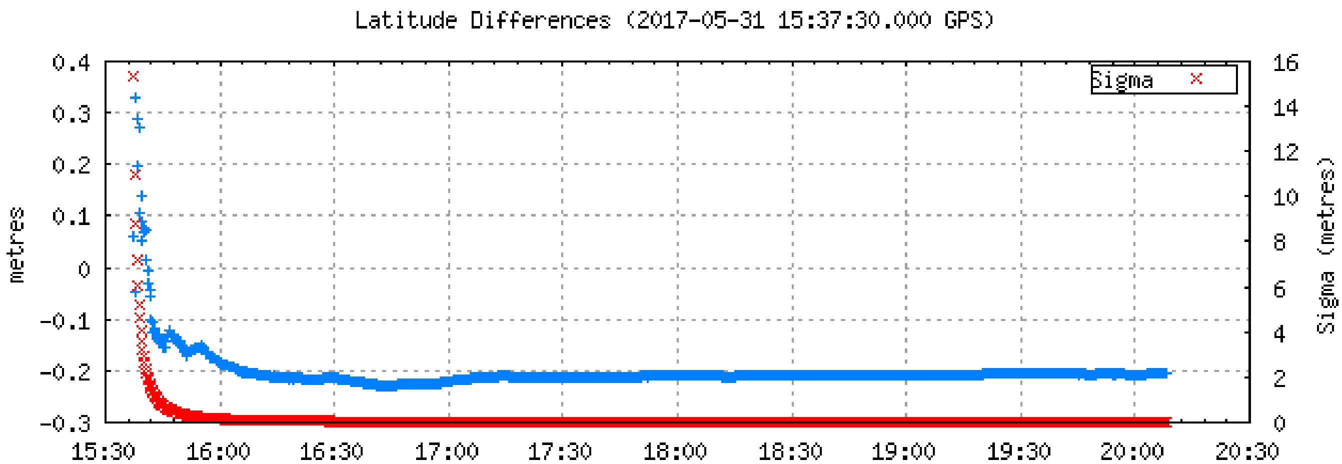
Estimated Parameters & Observations Statistics

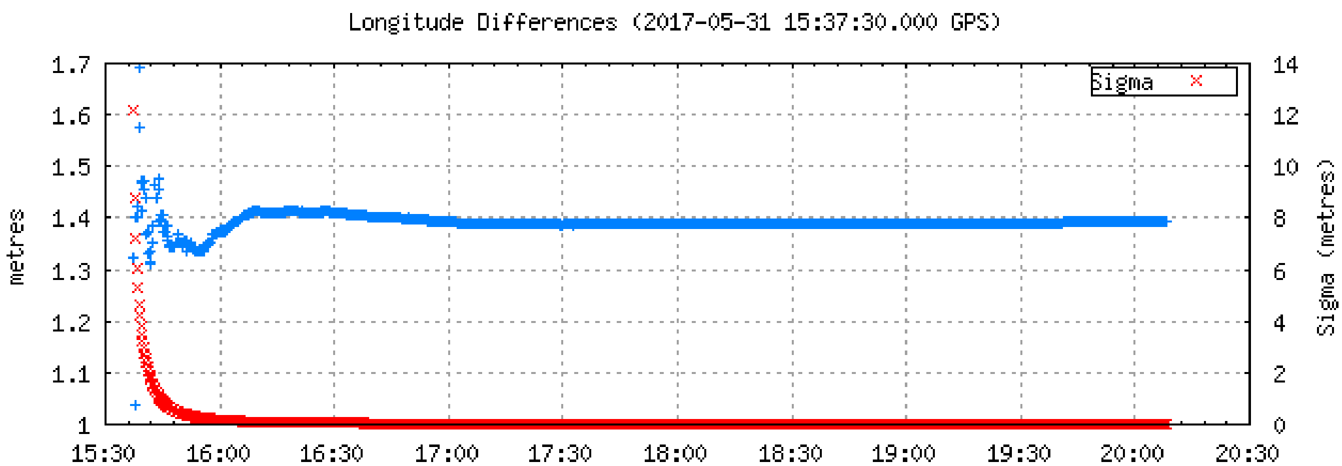
Pseudo-Range Residuals Sky Distribution

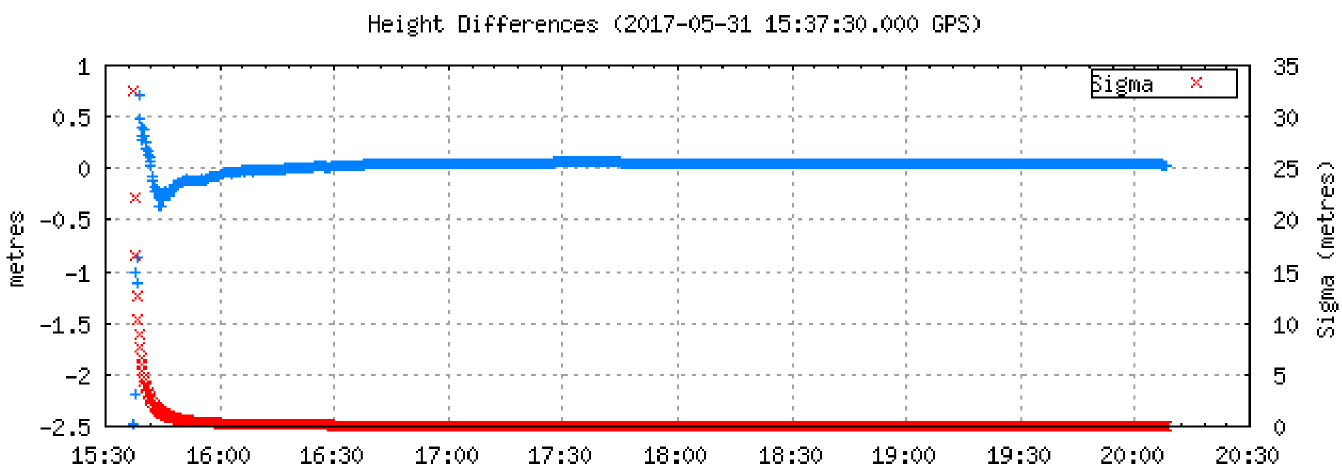


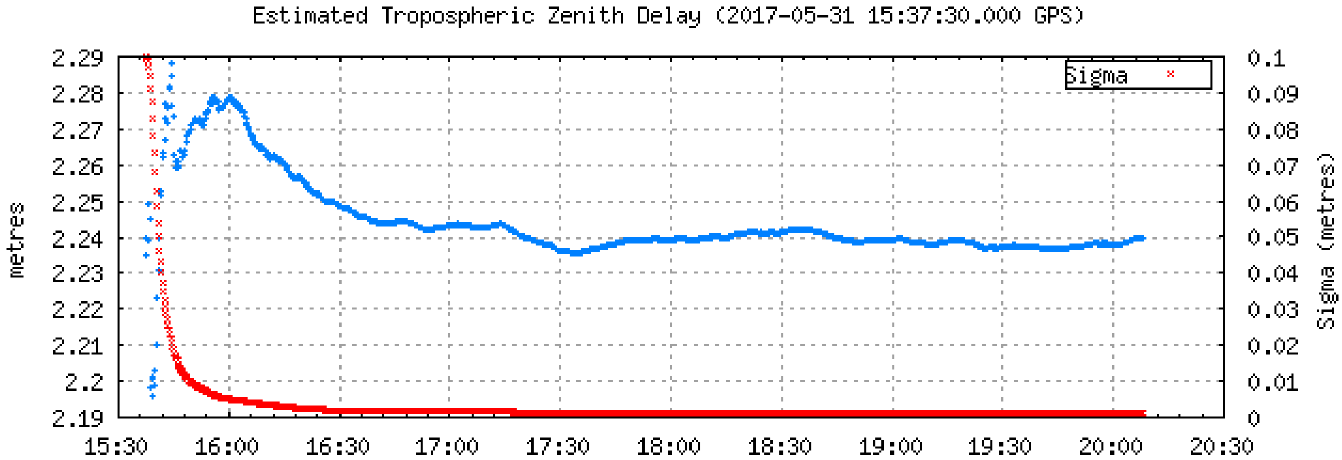

Corrections to apriori position (minus final corrections) (metres)
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
(1 sigma std of position corrections) / 50
(1 sigma std of initial position correction) / 50
(1 sigma std of final position correction) / 50

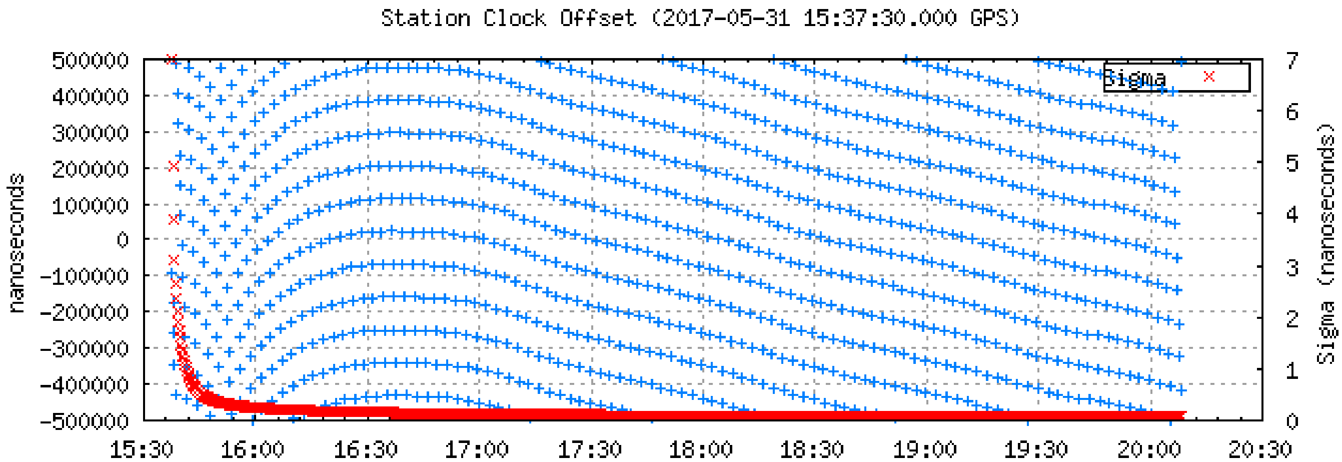

Ellipsoidal Height Profile (2017-05-31 15:37:30.000 GPS)
metres
485
484.5
484
483.5
483
482.5
482
481.5
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30

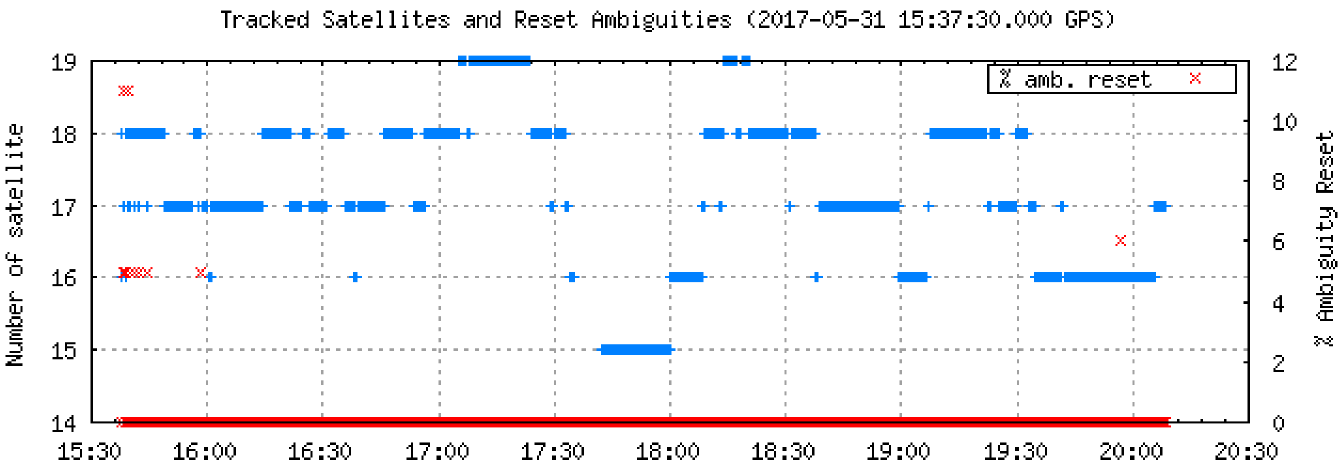

Latitude Differences (2017-05-31 15:37:30.000 GPS)
Sigma
metres
Sigma (metres)
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
16
14
12
10
8
6
4
2
0
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30


Longitude Differences (2017-05-31 15:37:30.000 GPS)
Sigma
metres
Sigma (metres)
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
14
12
10
8
6
4
2
0
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30

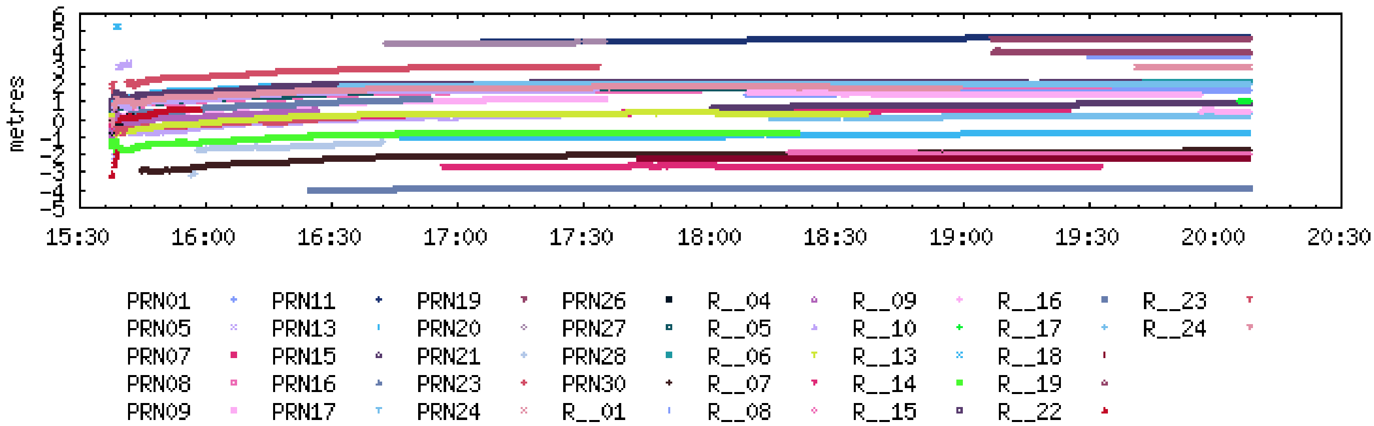

Height Differences (2017-05-31 15:37:30.000 GPS)
Sigma
metres
Sigma (metres)
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
35
30
25
20
15
10
5
0
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30


Estimated Tropospheric Zenith Delay (2017-05-31 15:37:30.000 GPS)
metres
Sigma (metres)
Sigma
2.29
2.28
2.27
2.26
2.25
2.24
2.23
2.22
2.21
2.2
2.19
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
15:30 16:00 16:30 17:00 17:30 18:00 18:30 19:00 19:30 20:00 20:30

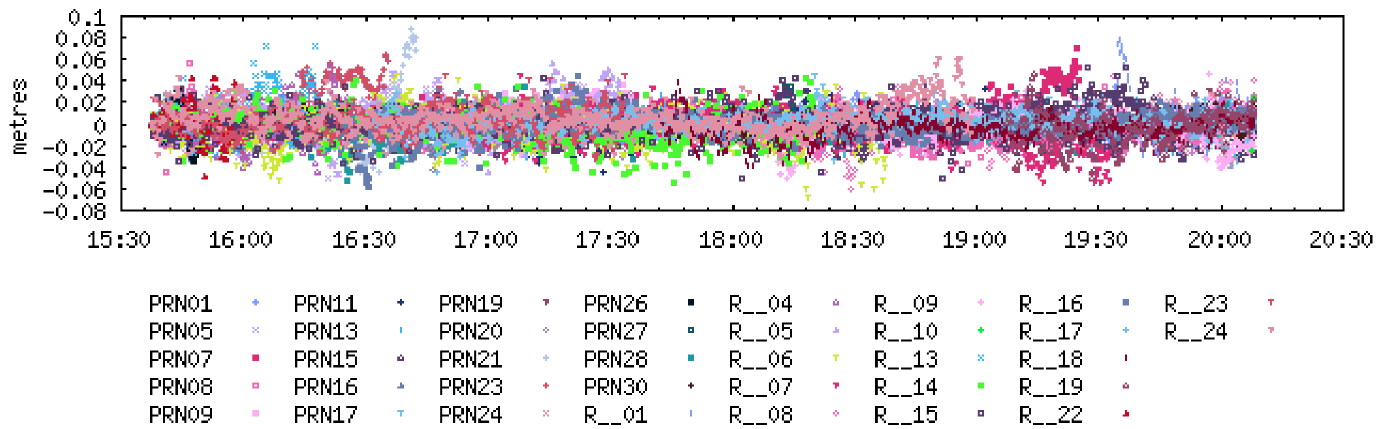

Station Clock Offset (2017-05-31 15:37:30.000 GPS)
nanoseconds
Sigma (nanoseconds)
Sigma
500000
400000
300000
200000
100000
0
-100000
-200000
-300000
-400000
-500000
7
6
5
4
3
2
1
0
15:30 16:00 16:30 17:00 17:30 18:00 18:30 19:00 19:30 20:00 20:30


Tracked Satellites and Reset Ambiguities (2017-05-31 15:37:30.000 GPS)
Number of satellite
% Ambiguity Reset
% amb. reset
19
18
17
16
15
14
12
10
8
6
4
2
0
15:30 16:00 16:30 17:00 17:30 18:00 18:30 19:00 19:30 20:00 20:30

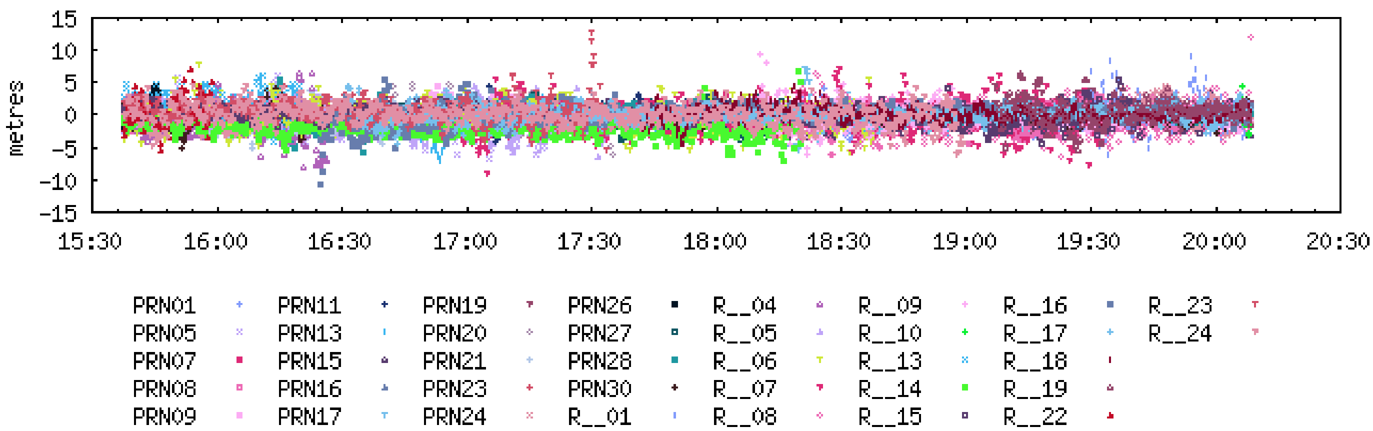
Ambiguities (2017-05-31 15:37:30.000 GPS)



Carrier-Phase Residuals (2017-05-31 15:37:30.000 GPS)



Pseudo-Range Residuals (2017-05-31 15:37:30.000 GPS)



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Phone:343-292-6617

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CSRS-PPP (V 1.05 11216)

PA2

Data Start	**Data End**	**Duration of Observations**
2017-05-30 15:19:45.000	2017-05-30 23:52:00.000	8h 32m 15.00s
Apri / Aposteriori Phase Std		**Apri / Aposteriori Code Std**
0.015m / 0.014m		2.0m / 2.594m
Observations	**Frequency**	**Mode**
Phase and Code	L1 and L2	Static
Elevation Cut-Off	**Rejected Epochs**	**Observation & Estimation Steps**
10.000 degrees	0.00 %	15.00 sec / 15.00 sec
Antenna Model	**APC to ARP**	**ARP to Marker**
TPSGR5 NONE	L1= 0.221 m L2= 0.218 m	1.303 m

(APC = antenna phase center; ARP = antenna reference point)

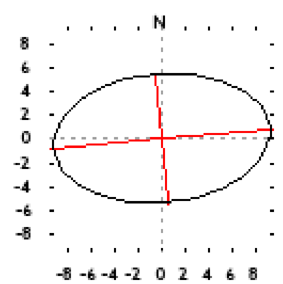
Estimated Position for PA2150p.17O

	Latitude (+n)	**Longitude (+e)**	**Ell. Height**
NAD83(CSRS) (1997)	57º 32’ 12.2526’’	-105º 22’ 56.6452’’	480.270 m
Sigmas(95%)	0.004 m	0.007 m	0.017 m
Apriori	57º 32’ 12.253’’	-105º 22’ 56.731’’	480.126 m
Estimated - Apriori	-0.019 m	1.422 m	0.144 m

Orthometric Height
CGVD28 (HTv2.0)

511.303 m
(click for height reference information)

95% Error Ellipse (mm)
semi-major: 9.266mm
semi-minor: 5.453mm
semi-major azimuth: 84º 48’ 31.47’’



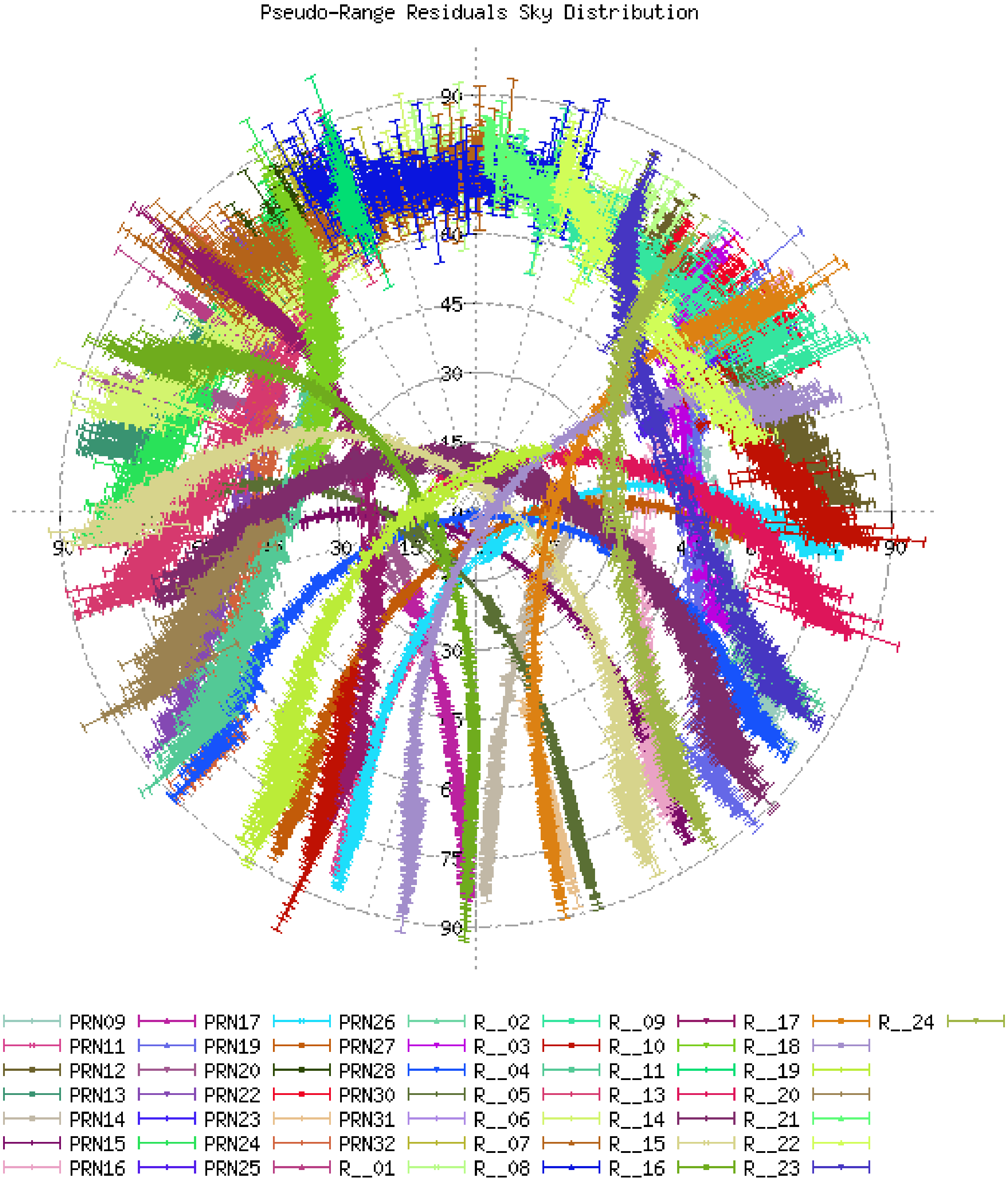
UTM (North) Zone 13

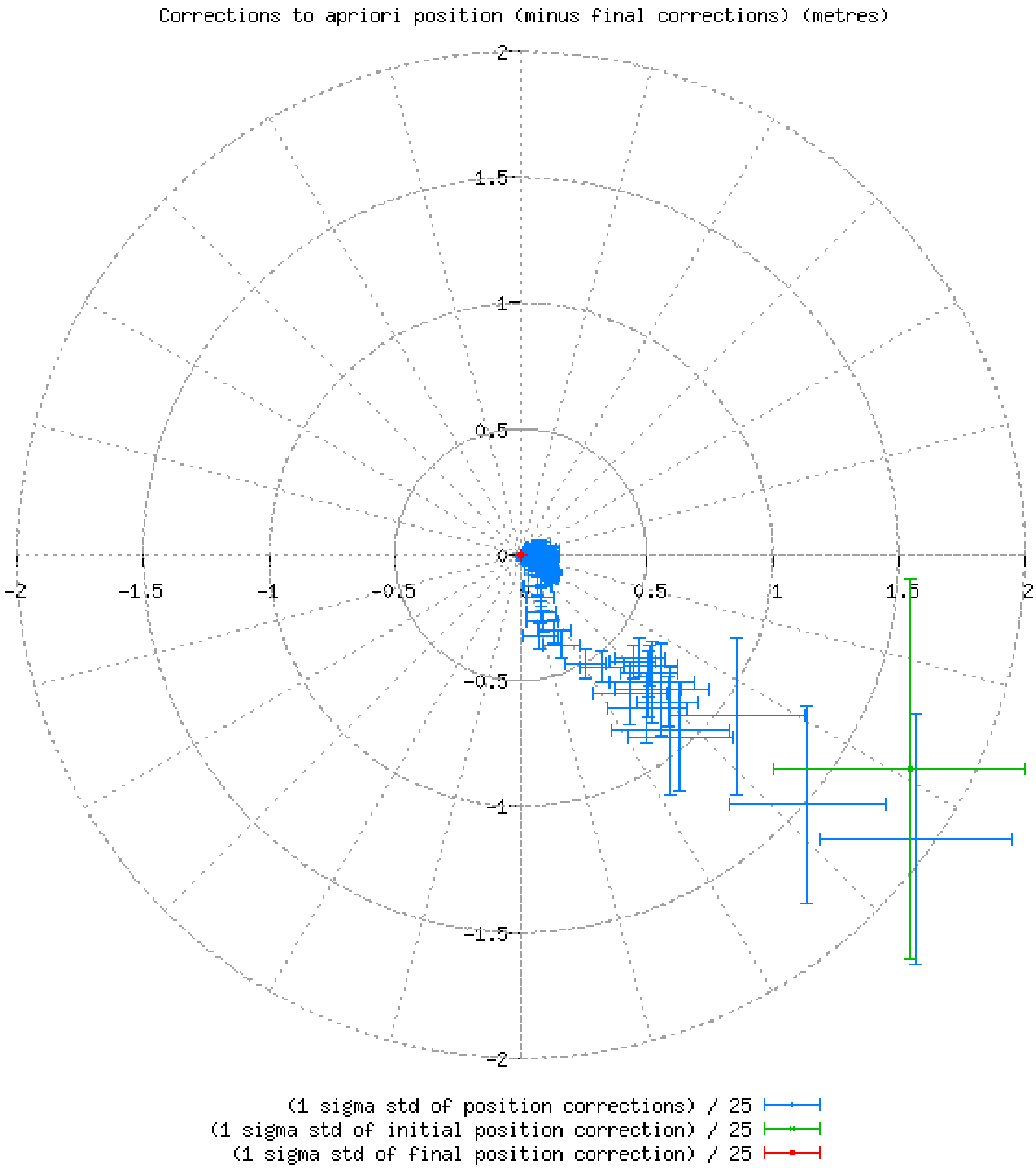
6377199.994m (N) 477105.453m (E)

Scale Factors
0.99960643 (point)
0.99953108 (combined)

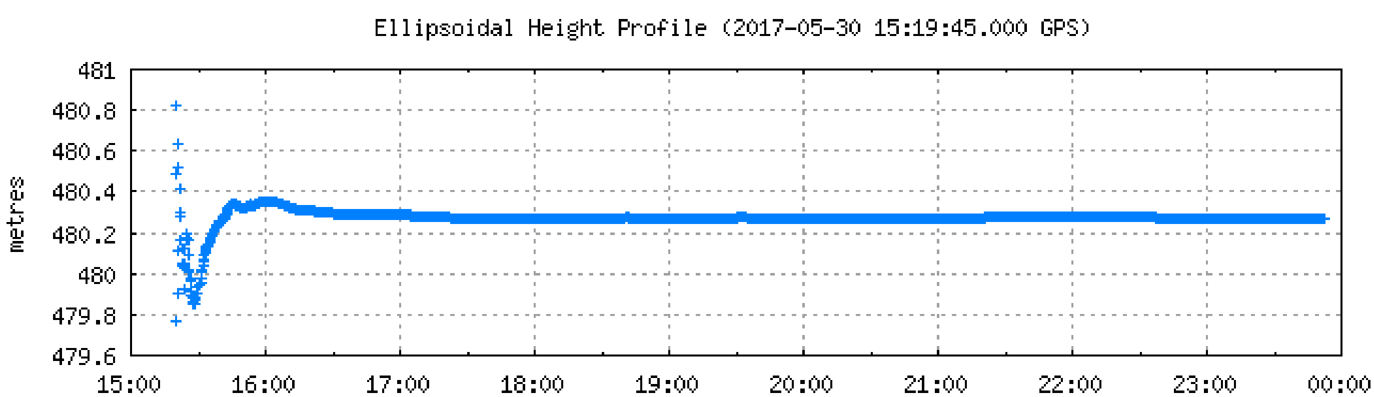
(Coordinates from RINEX file used as apriori position)

Estimated Parameters & Observations Statistics

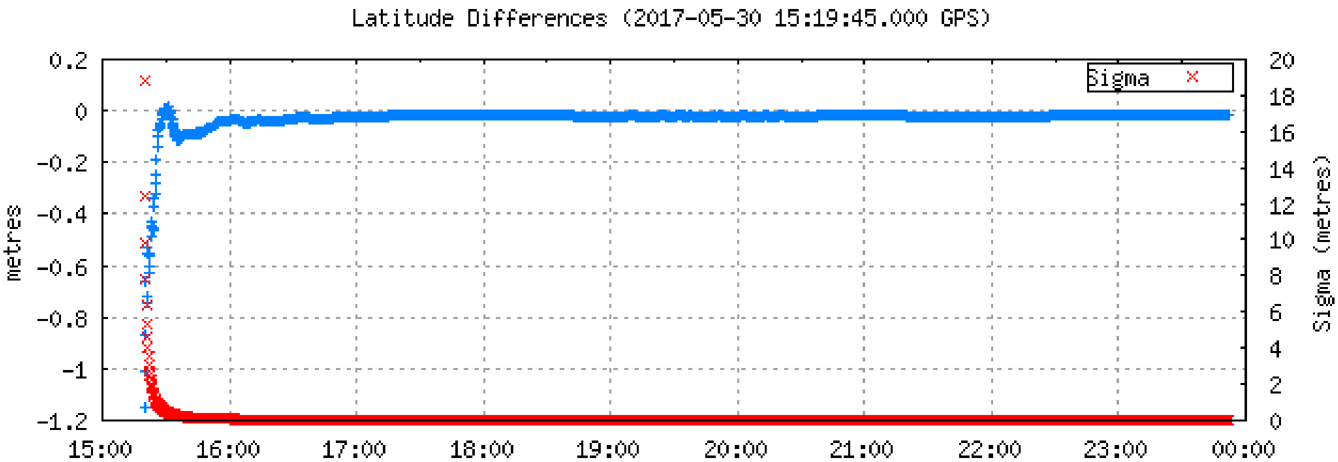


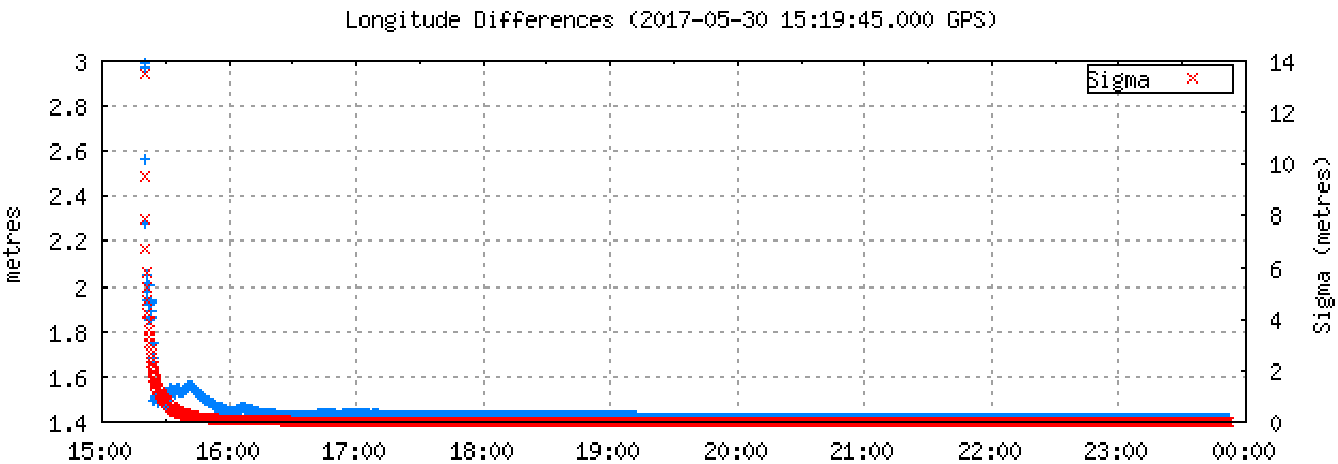


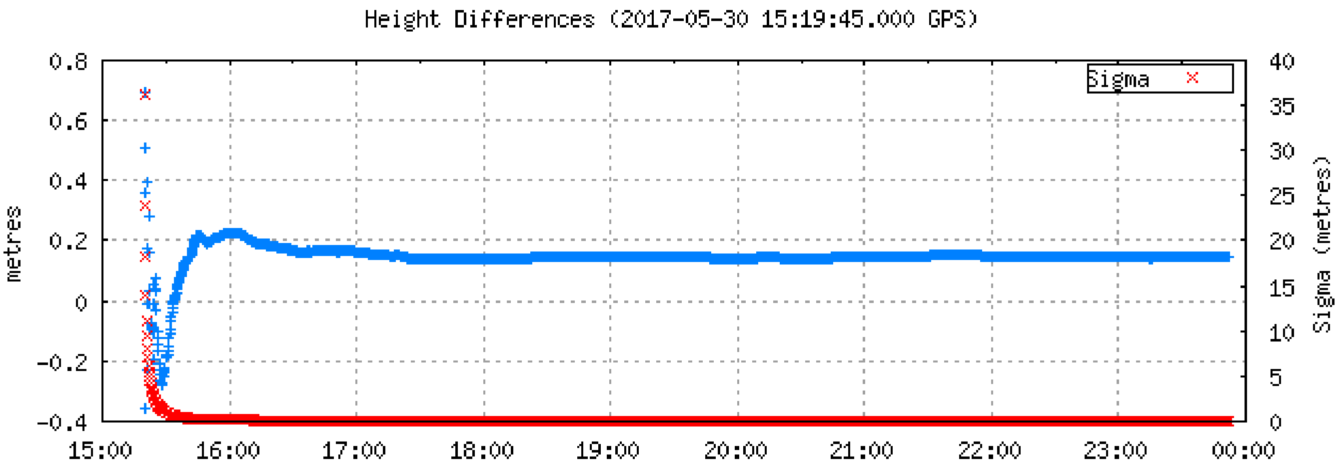
Corrections to apriori position (minus final corrections) (metres)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2
-1.5
-1
-0.5
0.5
1
1.5
2
(1 sigma std of position corrections) / 25
(1 sigma std of initial position correction) / 25
(1 sigma std of final position correction) / 25

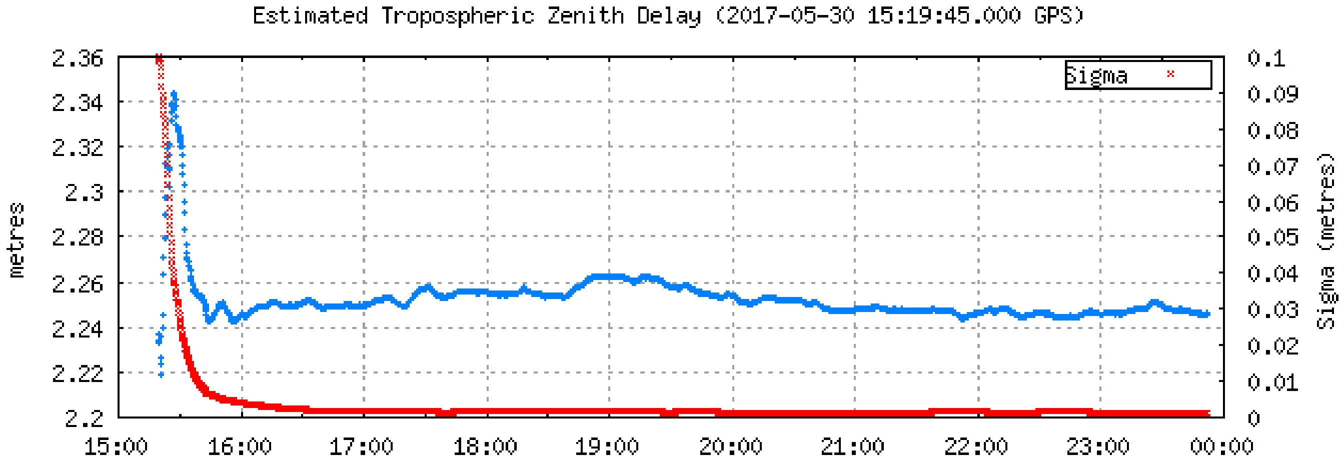


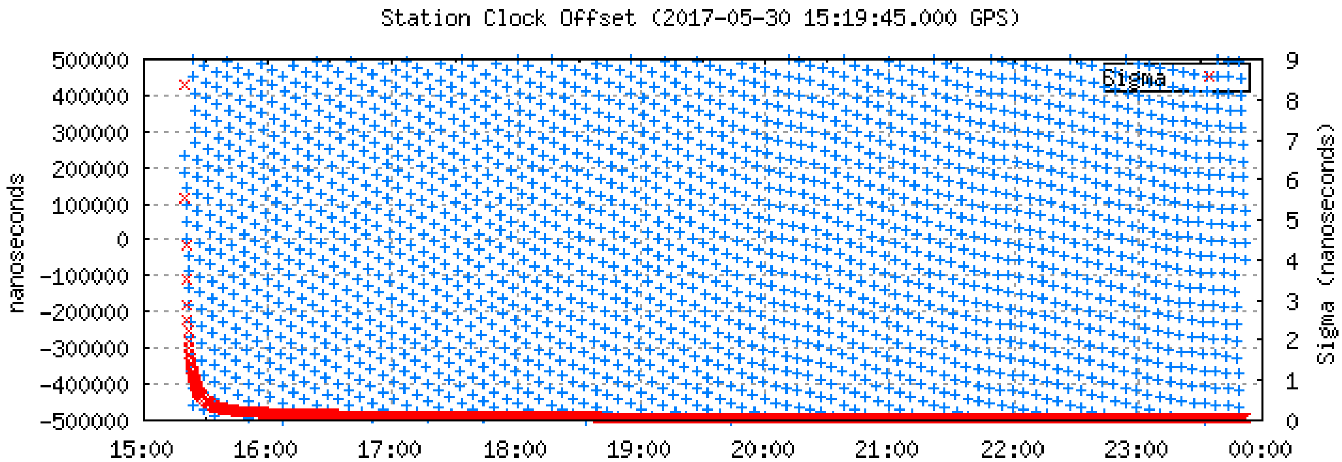
Ellipsoidal Height Profile (2017-05-30 15:19:45.000 GPS)
metres
481
480.8
480.6
480.4
480.2
480
479.8
479.6
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00

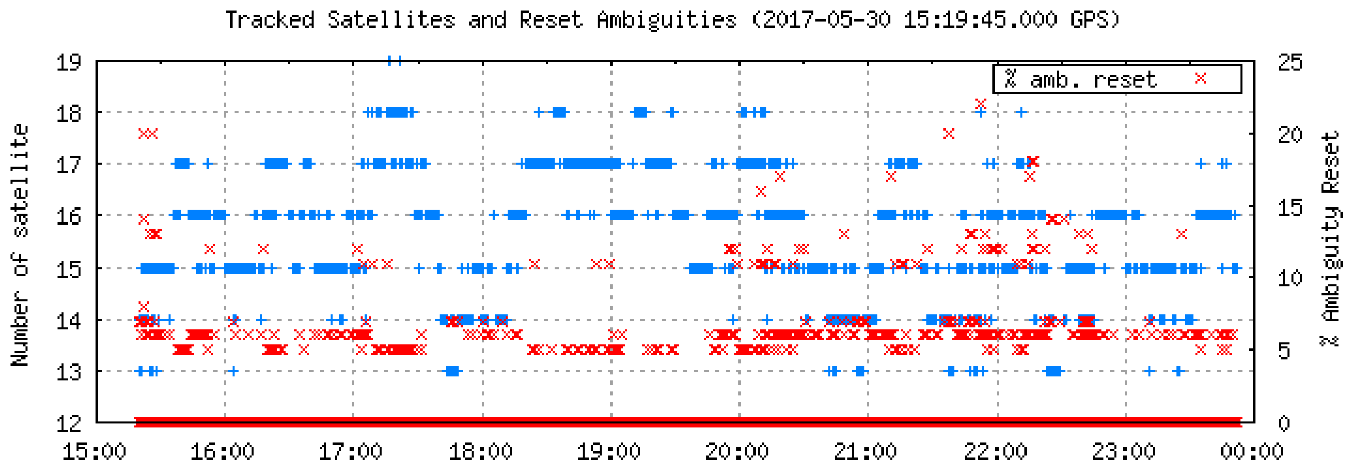

Latitude Differences (2017-05-30 15:19:45.000 GPS)
Sigma
metres
Sigma (metres)
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
20
18
16
14
12
10
8
6
4
2
0
15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00


Longitude Differences (2017-05-30 15:19:45.000 GPS)
Sigma
metres
Sigma (metres)
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
14
12
10
8
6
4
2
0
15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00


Height Differences (2017-05-30 15:19:45.000 GPS)
Sigma
metres
Sigma (metres)
0.8
0.6
0.4
0.2
0
-0.2
-0.4
40
35
30
25
20
15
10
5
0
15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00


Estimated Tropospheric Zenith Delay (2017-05-30 15:19:45.000 GPS)
metres
Sigma (metres)
Sigma
2.36
2.34
2.32
2.3
2.28
2.26
2.24
2.22
2.2
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00


Station Clock Offset (2017-05-30 15:19:45.000 GPS)
nanoseconds
Sigma (nanoseconds)
Sigma
500000
400000
300000
200000
100000
0
-100000
-200000
-300000
-400000
-500000
9
8
7
6
5
4
3
2
1
0
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00


Tracked Satellites and Reset Ambiguities (2017-05-30 15:19:45.000 GPS)
Number of satellite
% Ambiguity Reset
% amb. reset
19
18
17
16
15
14
13
12
25
20
15
10
5
0
15:00
16:00
17:00
18:00
19:00
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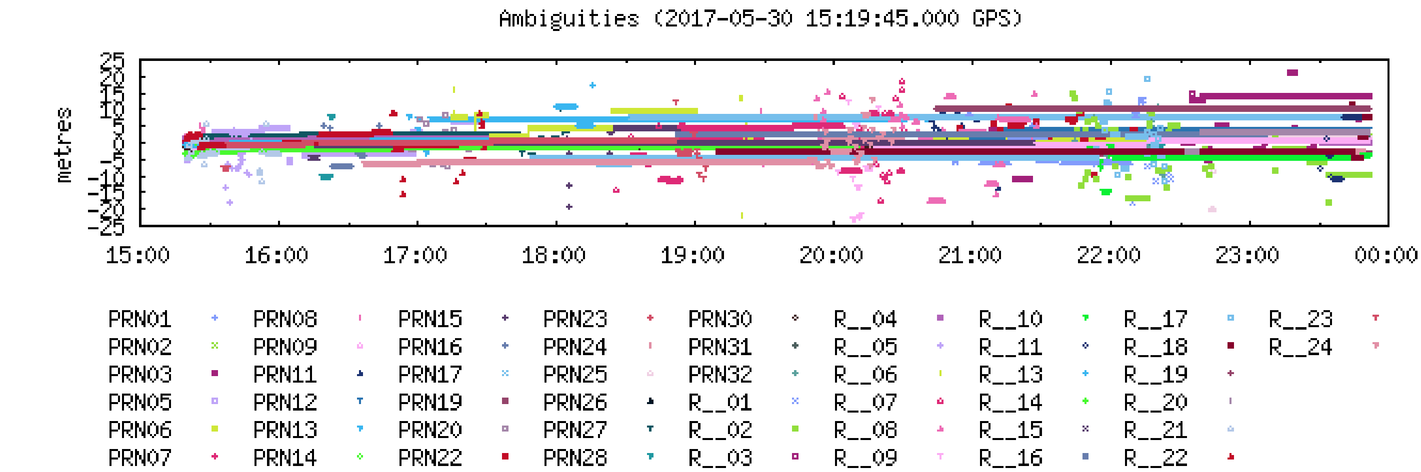
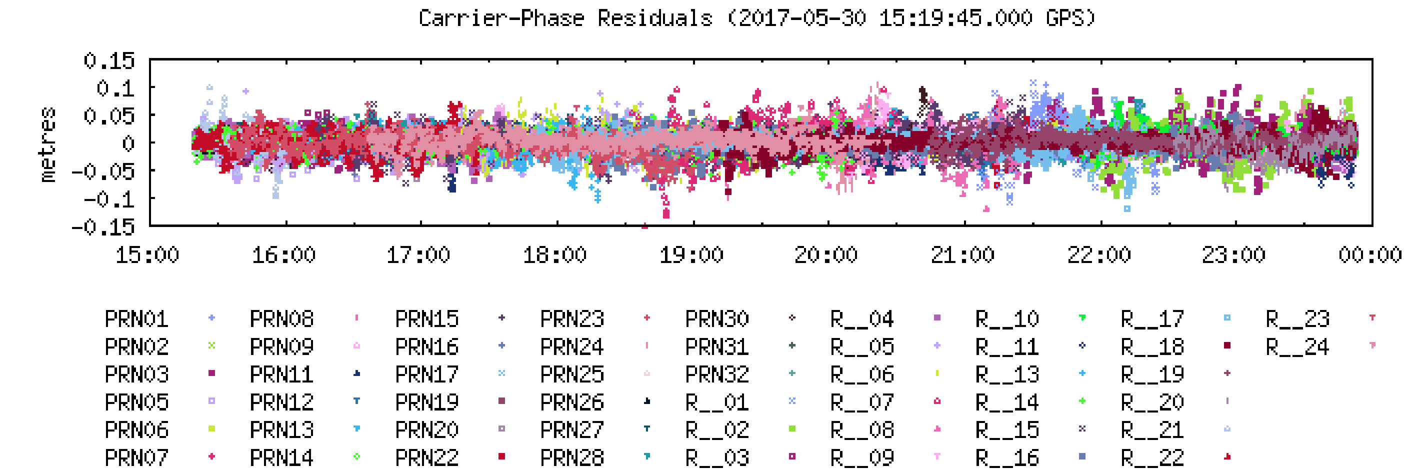
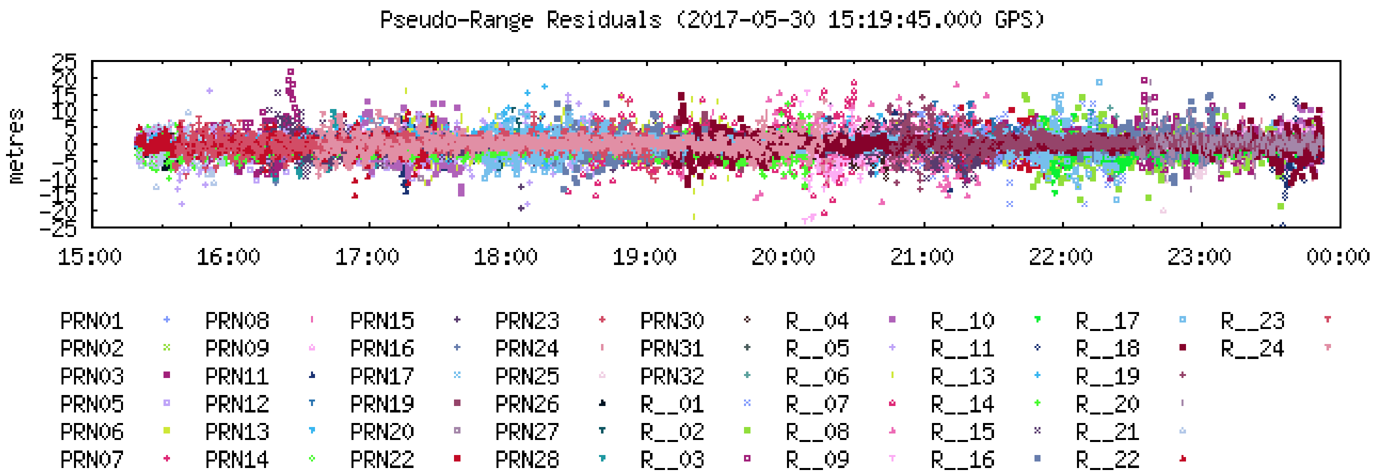
22:00
23:00
00:00


Ambiguities (2017-05-30 15:19:45.000 GPS)
metres
25 20 15 10 5 0 -5 -10 -15 -20 -25
15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00
PRN01 PRN08 PRN15 PRN23 PRN30 R__04 R__10 R__17 R__23
PRN02 PRN09 PRN16 PRN24 PRN31 R__05 R__11 R__18 R__24
PRN03 PRN11 PRN17 PRN25 PRN32 R__06 R__13 R__19
PRN05 PRN12 PRN19 PRN26 R__01 R__07 R__14 R__20
PRN06 PRN13 PRN20 PRN27 R__02 R__08 R__15 R__21
PRN07 PRN14 PRN22 PRN28 R__03 R__09 R__16 R__22


Carrier-Phase Residuals (2017-05-30 15:19:45.000 GPS)
metres
0.15 0.1 0.05 0 -0.05 -0.1 -0.15
15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00
PRN01 PRN08 PRN15 PRN23 PRN30 R__04 R__10 R__17 R__23
PRN02 PRN09 PRN16 PRN24 PRN31 R__05 R__11 R__18 R__24
PRN03 PRN11 PRN17 PRN25 PRN32 R__06 R__13 R__19
PRN05 PRN12 PRN19 PRN26 R__01 R__07 R__14 R__20
PRN06 PRN13 PRN20 PRN27 R__02 R__08 R__15 R__21
PRN07 PRN14 PRN22 PRN28 R__03 R__09 R__16 R__22


Pseudo-Range Residuals (2017-05-30 15:19:45.000 GPS)
metres
25 20 15 10 5 0 -5 -10 -15 -20 -25
15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00
PRN01 PRN08 PRN15 PRN23 PRN30 R__04 R__10 R__17 R__23
PRN02 PRN09 PRN16 PRN24 PRN31 R__05 R__11 R__18 R__24
PRN03 PRN11 PRN17 PRN25 PRN32 R__06 R__13 R__19
PRN05 PRN12 PRN19 PRN26 R__01 R__07 R__14 R__20
PRN06 PRN13 PRN20 PRN27 R__02 R__08 R__15 R__21
PRN07 PRN14 PRN22 PRN28 R__03 R__09 R__16 R__22

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Phone:343-292-6617

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CSRS-PPP (V 1.05 11216)

PA3

Data Start	Data End	Duration of Observations
2017-05-30 15:57:00.000	2017-05-30 23:34:00.000	7h 36m 60.00s
Apri / Aposteriori Phase Std		**Apri / Aposteriori Code Std**
0.015m / 0.012m		2.0m / 2.020m
Observations	**Frequency**	**Mode**
Phase and Code	L1 and L2	Static
Elevation Cut-Off	**Rejected Epochs**	**Observation & Estimation Steps**
10.000 degrees	0.00 %	15.00 sec / 15.00 sec
Antenna Model	**APC to ARP**	**ARP to Marker**
TPSGR5 NONE	L1= 0.221 m L2= 0.218 m	1.327 m

(APC = antenna phase center; ARP = antenna reference point)

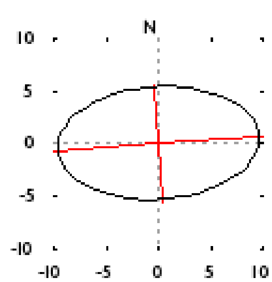
Estimated Position for PA3150p.17O

	Latitude (+n)	Longitude (+e)	Ell. Height
NAD83(CSRS) (1997)	57° 32’ 26.9749’’	-105° 23’ 36.1688’’	486.823 m
Sigmas(95%)	0.004 m	0.008 m	0.016 m
Apriori	57° 32’ 26.976’’	-105° 23’ 36.263’’	486.523 m
Estimated - Apriori	-0.039 m	1.567 m	0.299 m

Orthometric Height
CGVD28 (HTv2.0)

517.851 m
(click for height reference information)

95% Error Ellipse (mm)
semi-major: 9.630mm
semi-minor: 5.345mm
semi-major azimuth: 86° 16’ 41.17’’



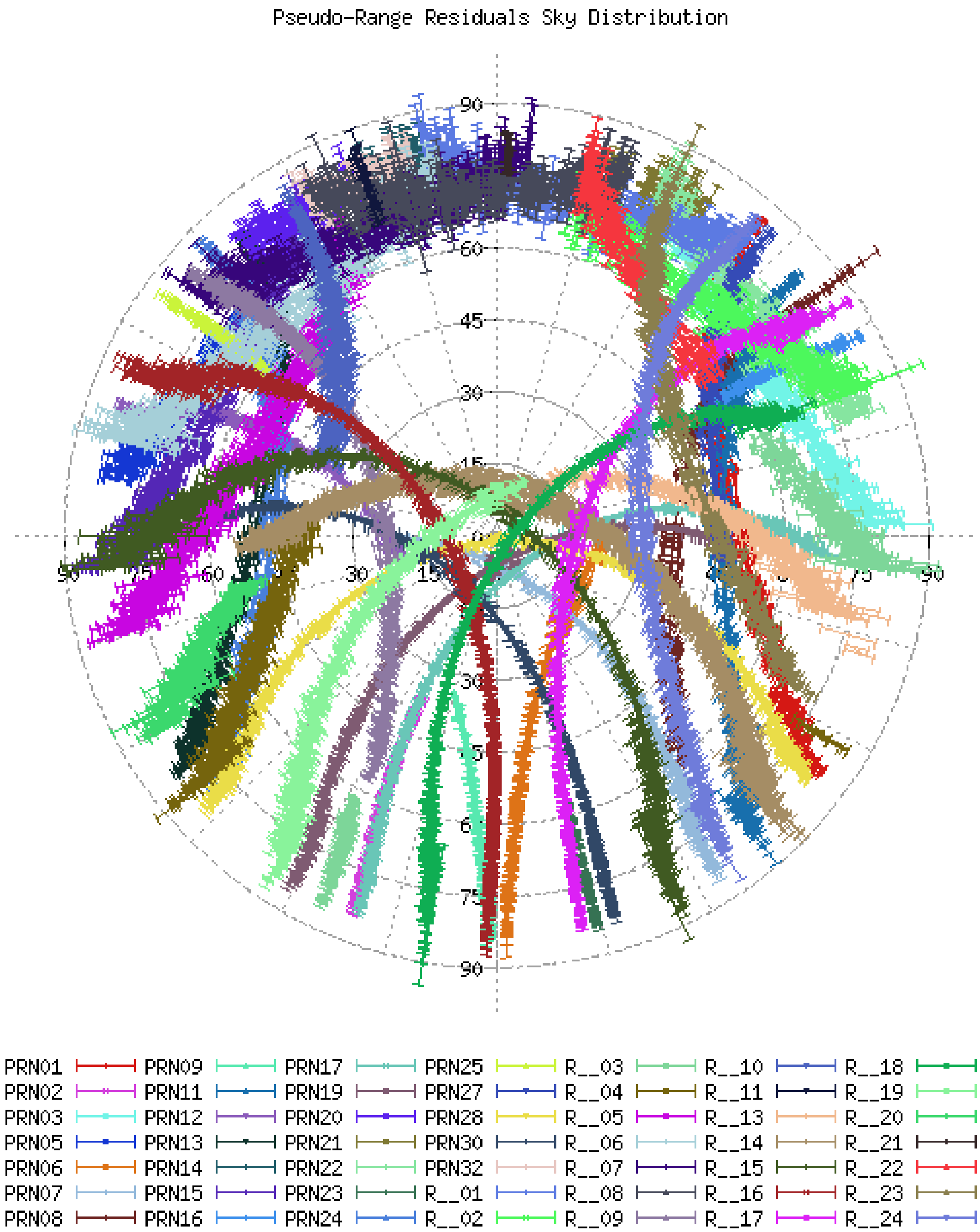
UTM (North) Zone 13

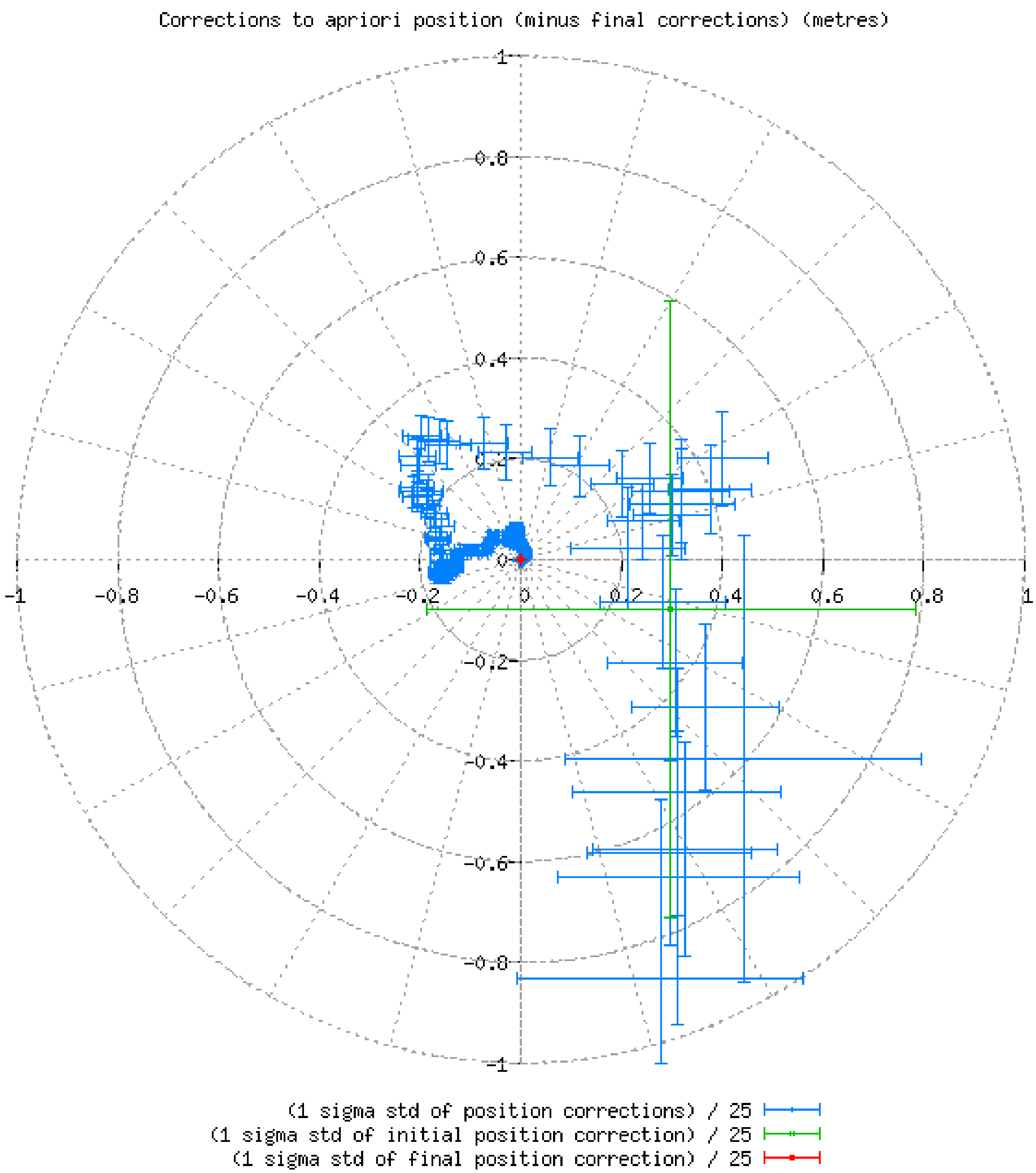
6377659.010m (N) 476450.790m (E)

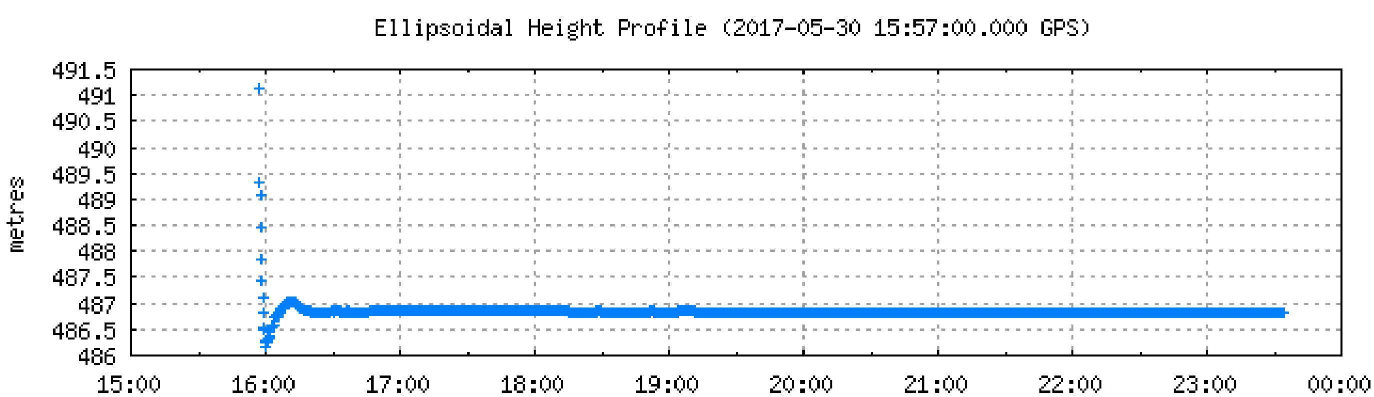
Scale Factors
0.99960680 (point)
0.99953042 (combined)

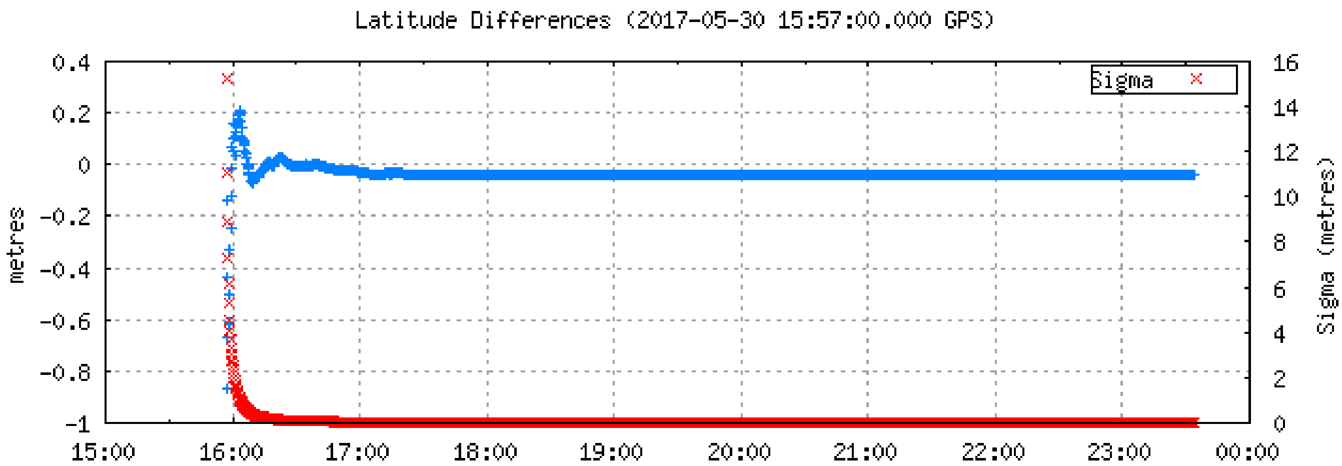
(Coordinates from RINEX file used as apriori position)

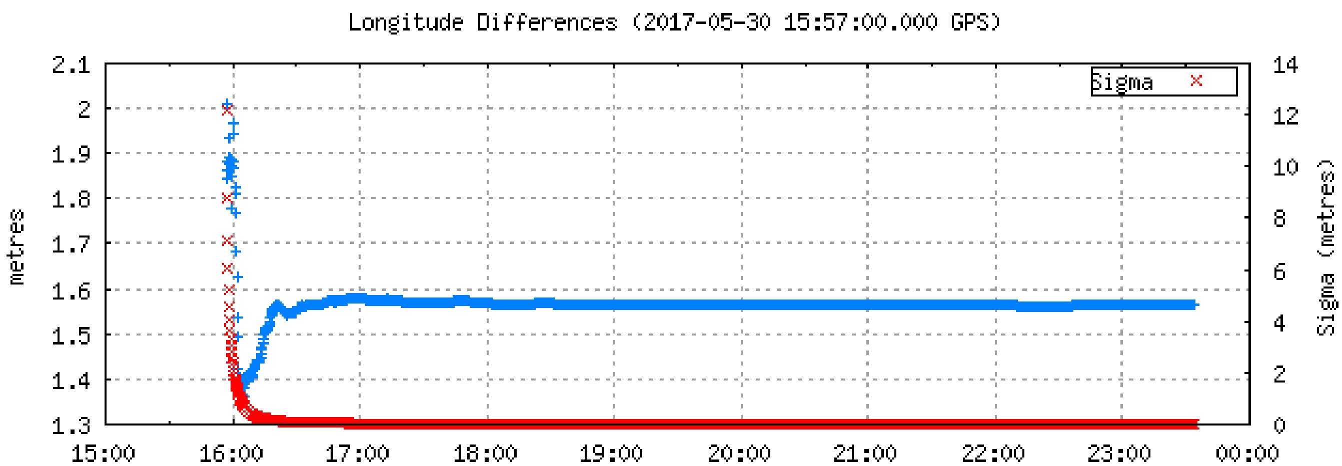
Estimated Parameters & Observations Statistics

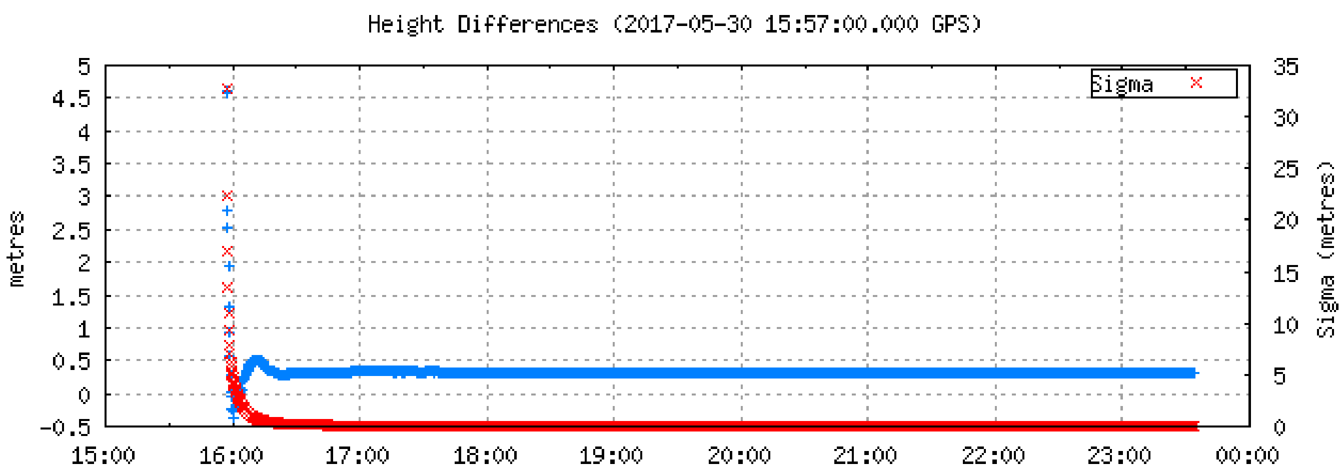


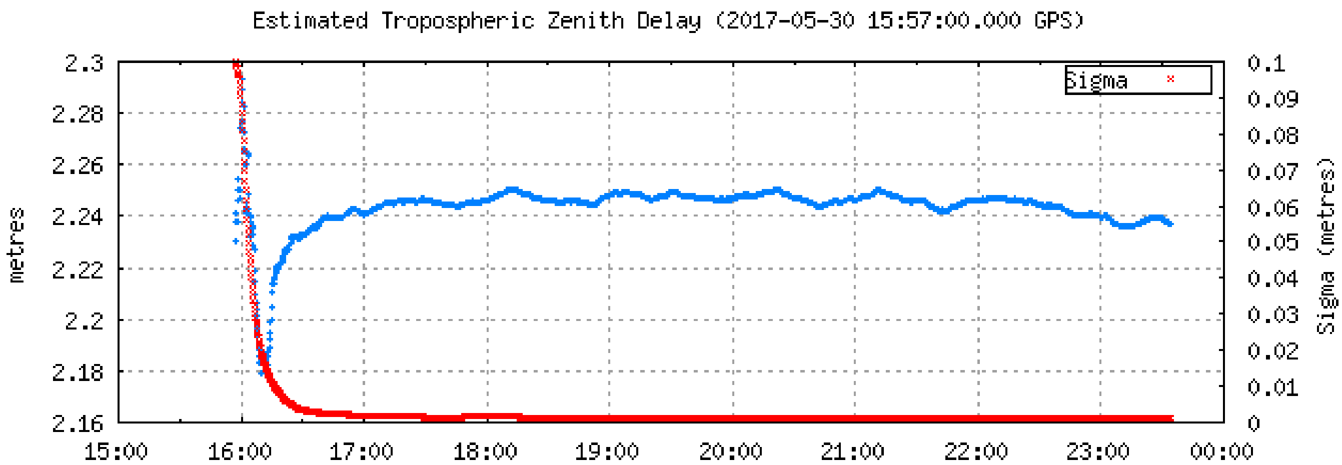

Corrections to apriori position (minus final corrections) (metres)
(1 sigma std of position corrections) / 25
(1 sigma std of initial position correction) / 25
(1 sigma std of final position correction) / 25

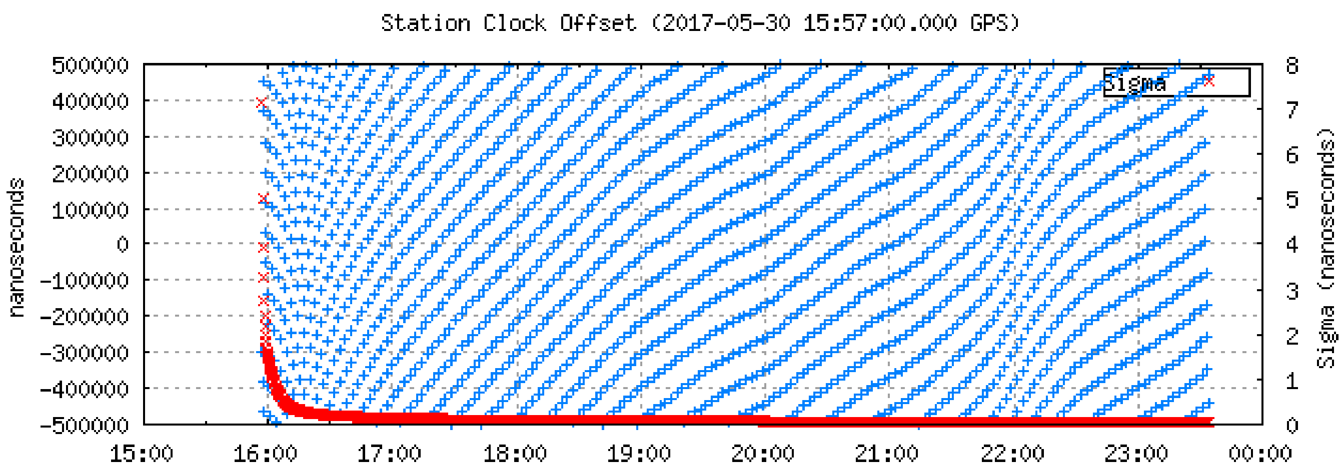

Ellipsoidal Height Profile (2017-05-30 15:57:00.000 GPS)
metres

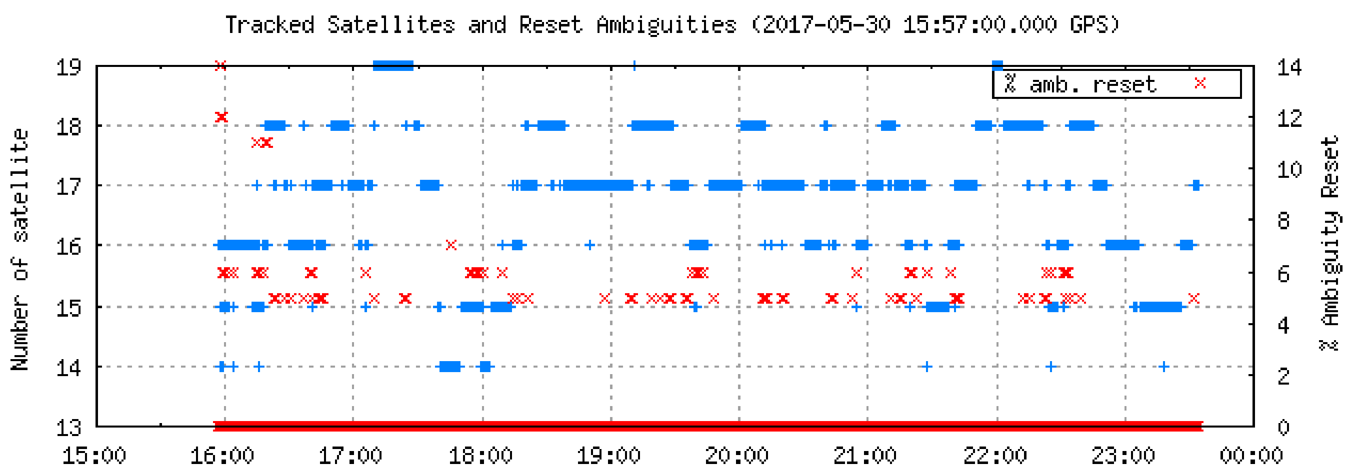

Latitude Differences (2017-05-30 15:57:00.000 GPS)
metres
Sigma (metres)
Sigma
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
16
14
12
10
8
6
4
2
0
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00

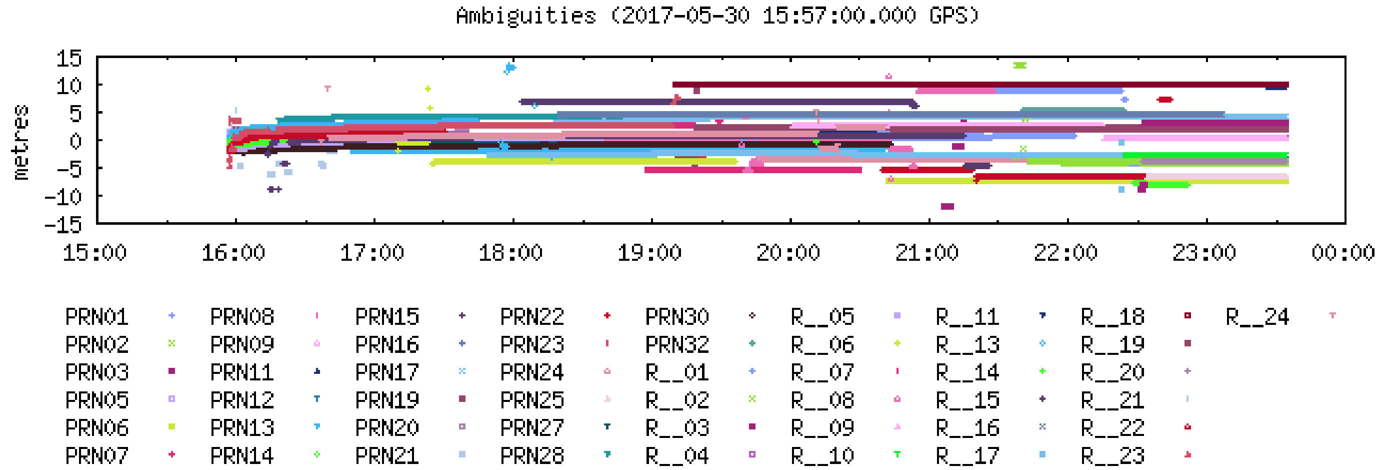

Longitude Differences (2017-05-30 15:57:00.000 GPS)
metres
Sigma (metres)
Sigma
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
14
12
10
8
6
4
2
0
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00


Height Differences (2017-05-30 15:57:00.000 GPS)
metres
Sigma (metres)
Sigma
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
35
30
25
20
15
10
5
0
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00


Estimated Tropospheric Zenith Delay (2017-05-30 15:57:00.000 GPS)
metres
Sigma (metres)
Sigma
2.3
2.28
2.26
2.24
2.22
2.2
2.18
2.16
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00


Station Clock Offset (2017-05-30 15:57:00.000 GPS)
nanoseconds
Sigma (nanoseconds)
Sigma
500000
400000
300000
200000
100000
0
-100000
-200000
-300000
-400000
-500000
8
7
6
5
4
3
2
1
0
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00


Tracked Satellites and Reset Ambiguities (2017-05-30 15:57:00.000 GPS)
Number of satellite
% Ambiguity Reset
% amb. reset
19
18
17
16
15
14
13
14
12
10
8
6
4
2
0
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00


Ambiguities (2017-05-30 15:57:00.000 GPS)
metres
15
10
5
0
-5
-10
-15
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00
PRN01
PRN02
PRN03
PRN05
PRN06
PRN07
PRN08
PRN09
PRN11
PRN12
PRN13
PRN14
PRN15
PRN16
PRN17
PRN19
PRN20
PRN21
PRN22
PRN23
PRN24
PRN25
PRN27
PRN28
PRN30
PRN32
R__01
R__02
R__03
R__04
R__05
R__06
R__07
R__08
R__09
R__10
R__11
R__13
R__14
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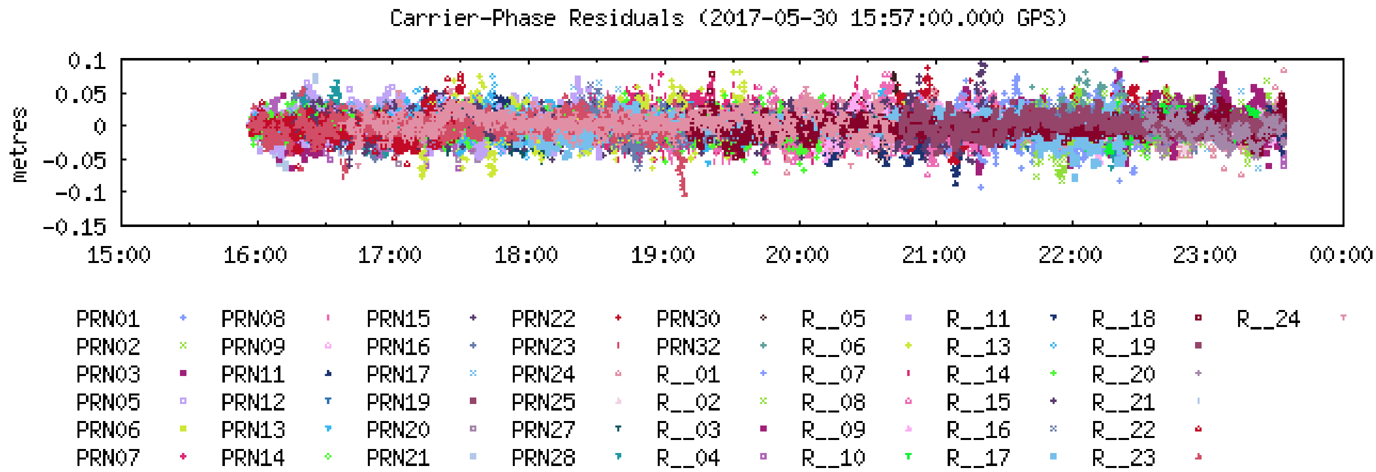
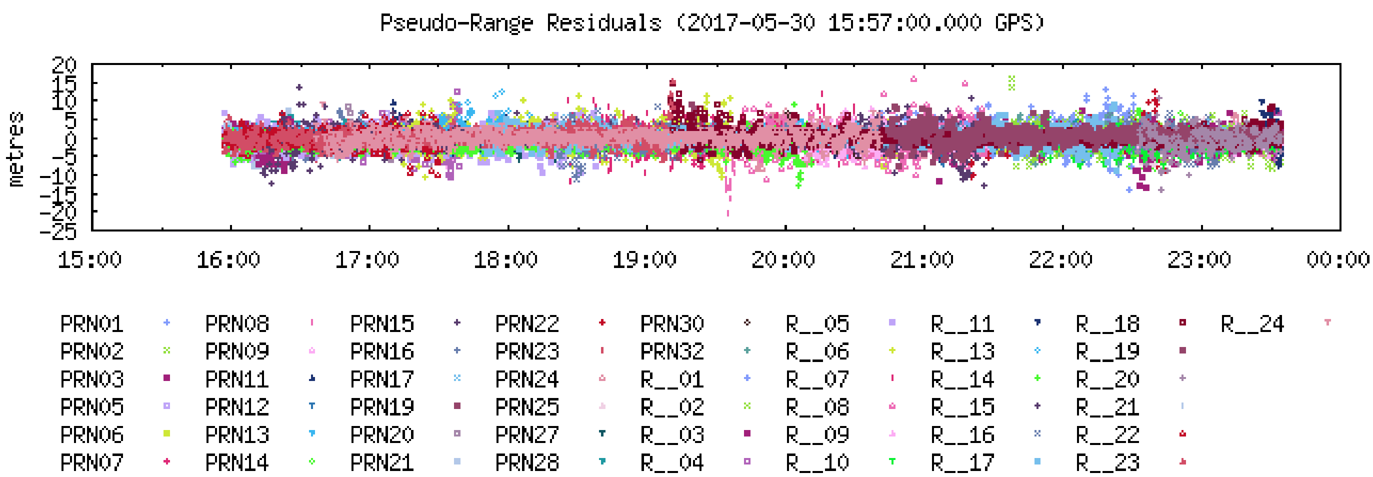
R__16
R__17
R__18
R__19
R__20
R__21
R__22
R__23
R__24


Carrier-Phase Residuals (2017-05-30 15:57:00.000 GPS)
metres
0.1
0.05
0
-0.05
-0.1
-0.15
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00
PRN01
PRN02
PRN03
PRN05
PRN06
PRN07
PRN08
PRN09
PRN11
PRN12
PRN13
PRN14
PRN15
PRN16
PRN17
PRN19
PRN20
PRN21
PRN22
PRN23
PRN24
PRN25
PRN27
PRN28
PRN30
PRN32
R__01
R__02
R__03
R__04
R__05
R__06
R__07
R__08
R__09
R__10
R__11
R__13
R__14
R__15
R__16
R__17
R__18
R__19
R__20
R__21
R__22
R__23
R__24


Pseudo-Range Residuals (2017-05-30 15:57:00.000 GPS)
metres
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00
PRN01
PRN02
PRN03
PRN05
PRN06
PRN07
PRN08
PRN09
PRN11
PRN12
PRN13
PRN14
PRN15
PRN16
PRN17
PRN19
PRN20
PRN21
PRN22
PRN23
PRN24
PRN25
PRN27
PRN28
PRN30
PRN32
R__01
R__02
R__03
R__04
R__05
R__06
R__07
R__08
R__09
R__10
R__11
R__13
R__14
R__15
R__16
R__17
R__18
R__19
R__20
R__21
R__22
R__23
R__24

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CSRS-PPP (V 1.05 11216)

SB5

Data Start	**Data End**	**Duration of Observations**
2017-05-29 23:07:00.000	2017-05-30 01:49:00.000	2h 42m 0.00s
Apri / Aposteriori Phase Std		**Apri / Aposteriori Code Std**
0.015m / 0.010m		2.0m / 1.887m
Observations	**Frequency**	**Mode**
Phase and Code	L1 and L2	Static
Elevation Cut-Off	**Rejected Epochs**	**Observation & Estimation Steps**
10.000 degrees	0.00 %	10.00 sec / 10.00 sec
Antenna Model	**APC to ARP**	**ARP to Marker**
TPSGR5 NONE	L1= 0.221 m L2= 0.218 m	1.242 m

(APC = antenna phase center; ARP = antenna reference point)

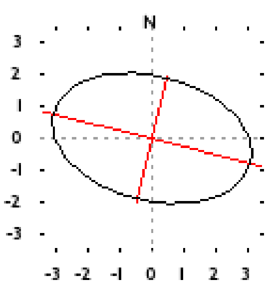
Estimated Position for SB5149x.17O

	Latitude (+n)	**Longitude (+e)**	**Ell. Height**
NAD83(CSRS) (1997)	57º 29’ 47.4940’’	-105º 25’ 23.7269’’	487.757 m
Sigmas(95%)	0.016 m	0.025 m	0.044 m
Apriori	57º 29’ 47.490’’	-105º 25’ 23.821’’	487.571 m
Estimated - Apriori	0.126 m	1.575 m	0.186 m

Orthometric Height
CGVD28 (HTv2.0)

518.673 m
(click for height reference information)

95% Error Ellipse (cm)
semi-major: 3.203cm
semi-minor: 1.946cm
semi-major azimuth: 103º 35’ 31.03’’



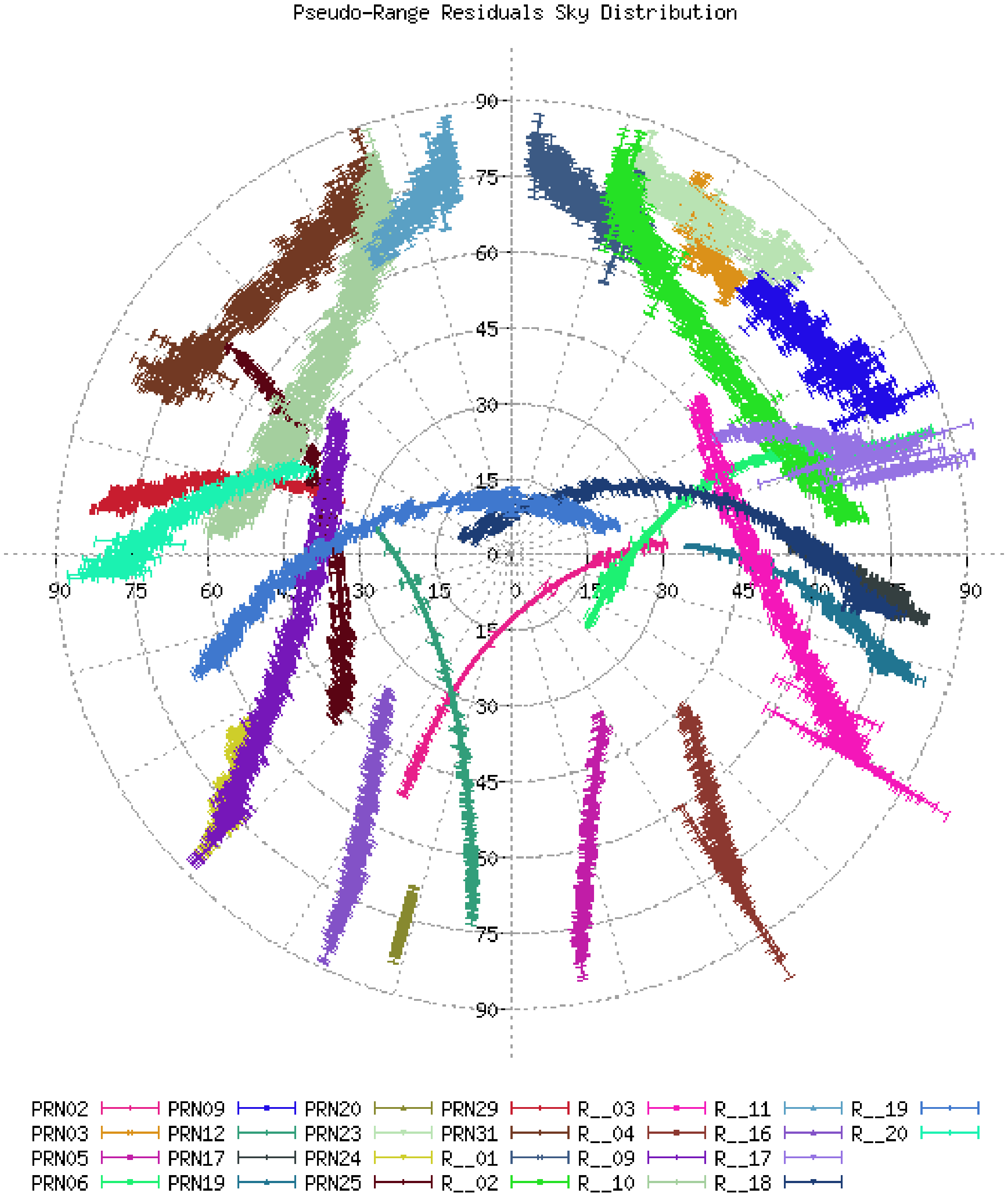
UTM (North) Zone 13

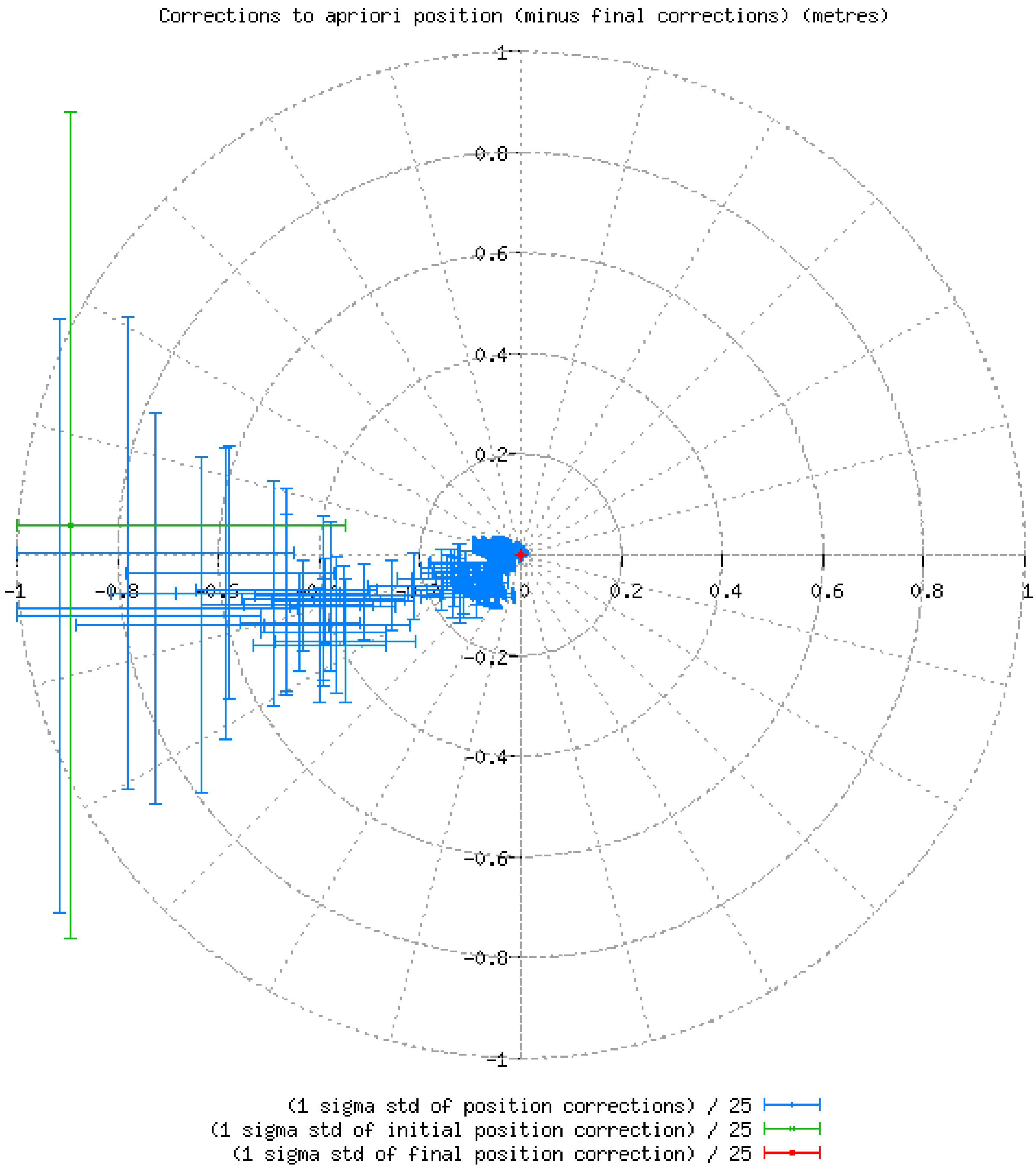
6372738.116m (N) 474631.507m (E)

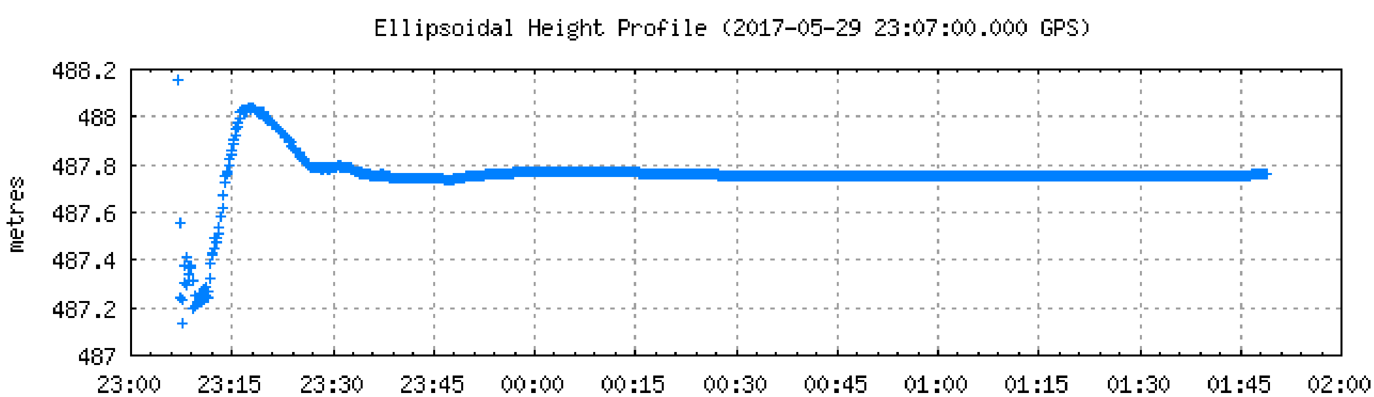
Scale Factors
0.99960789 (point)
0.99953137 (combined)

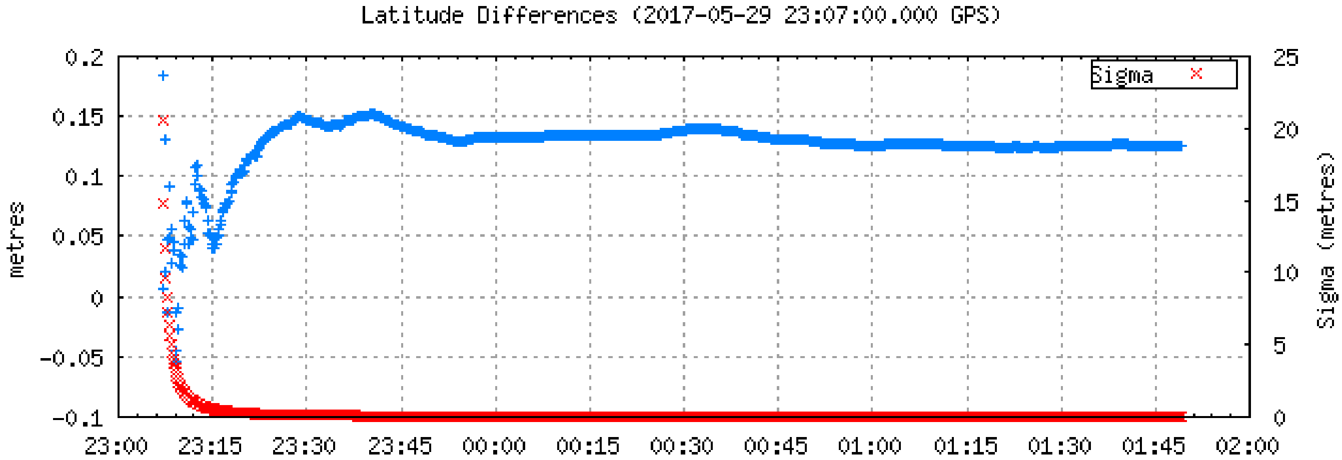
(Coordinates from RINEX file used as apriori position)

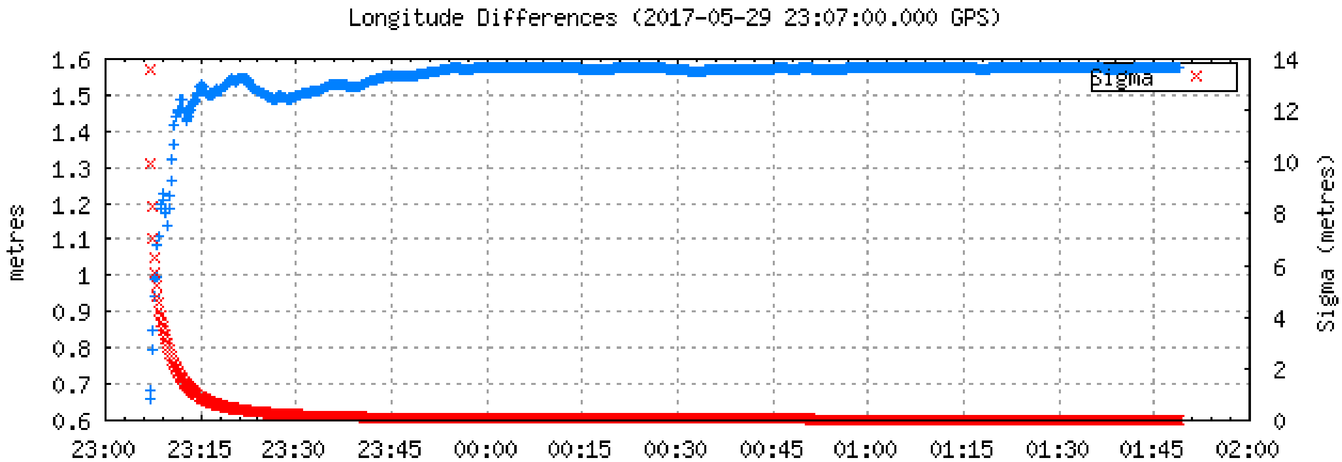
Estimated Parameters & Observations Statistics

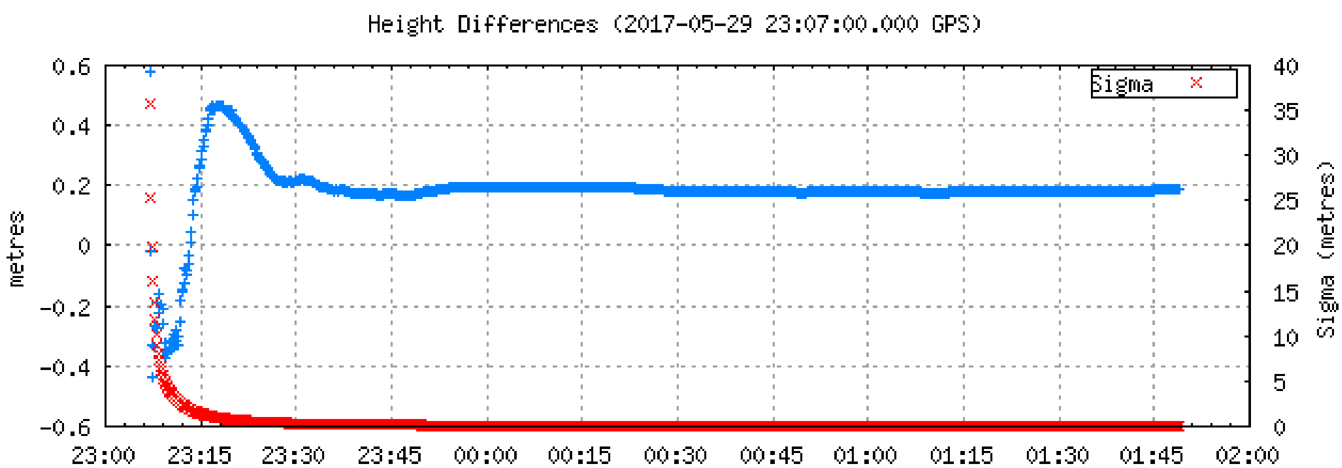



Corrections to apriori position (minus final corrections) (metres)
(1 sigma std of position corrections) / 25
(1 sigma std of initial position correction) / 25
(1 sigma std of final position correction) / 25

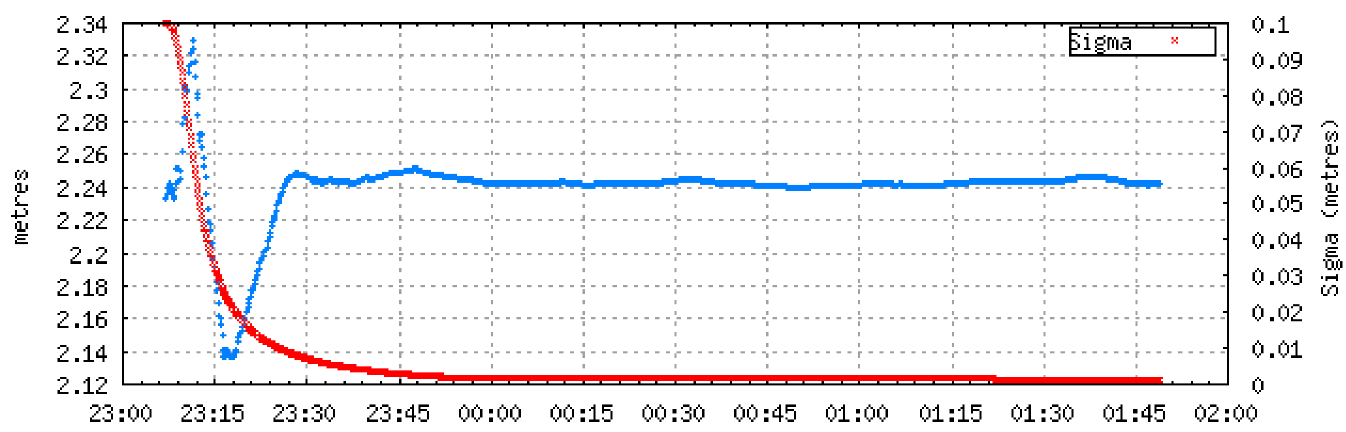

Ellipsoidal Height Profile (2017-05-29 23:07:00.000 GPS)
metres
488.2
488
487.8
487.6
487.4
487.2
487
23:00
23:15
23:30
23:45
00:00
00:15
00:30
00:45
01:00
01:15
01:30
01:45
02:00


Latitude Differences (2017-05-29 23:07:00.000 GPS)
metres
Sigma (metres)
Sigma
0.2
0.15
0.1
0.05
0
-0.05
-0.1
25
20
15
10
5
0
23:00
23:15
23:30
23:45
00:00
00:15
00:30
00:45
01:00
01:15
01:30
01:45
02:00

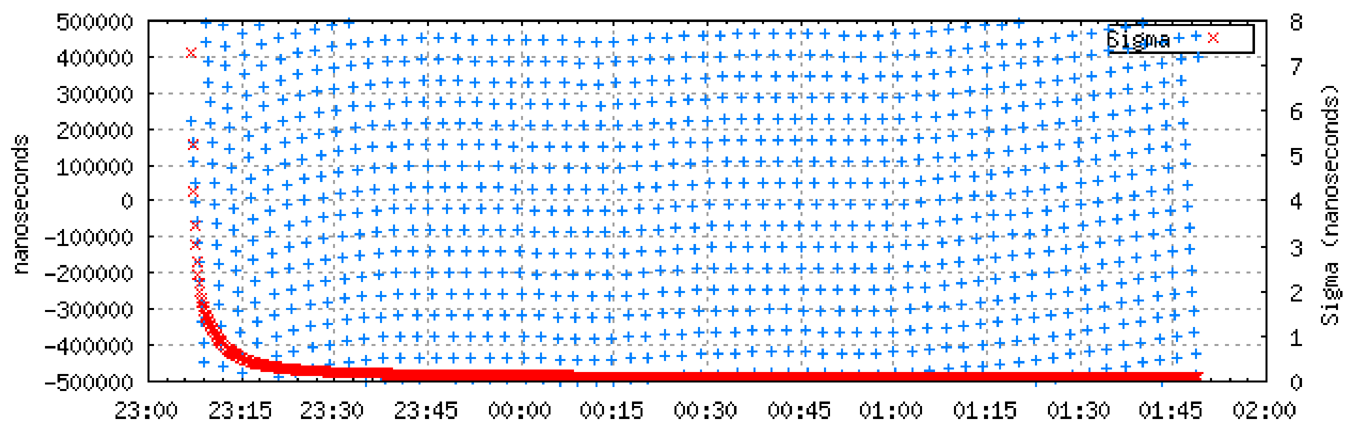

Longitude Differences (2017-05-29 23:07:00.000 GPS)
metres
Sigma (metres)
Sigma
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
14
12
10
8
6
4
2
0
23:00
23:15
23:30
23:45
00:00
00:15
00:30
00:45
01:00
01:15
01:30
01:45
02:00


Height Differences (2017-05-29 23:07:00.000 GPS)
metres
Sigma (metres)
Sigma
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
40
35
30
25
20
15
10
5
0
23:00
23:15
23:30
23:45
00:00
00:15
00:30
00:45
01:00
01:15
01:30
01:45
02:00

Estimated Tropospheric Zenith Delay (2017-05-29 23:07:00.000 GPS)



Station Clock Offset (2017-05-29 23:07:00.000 GPS)



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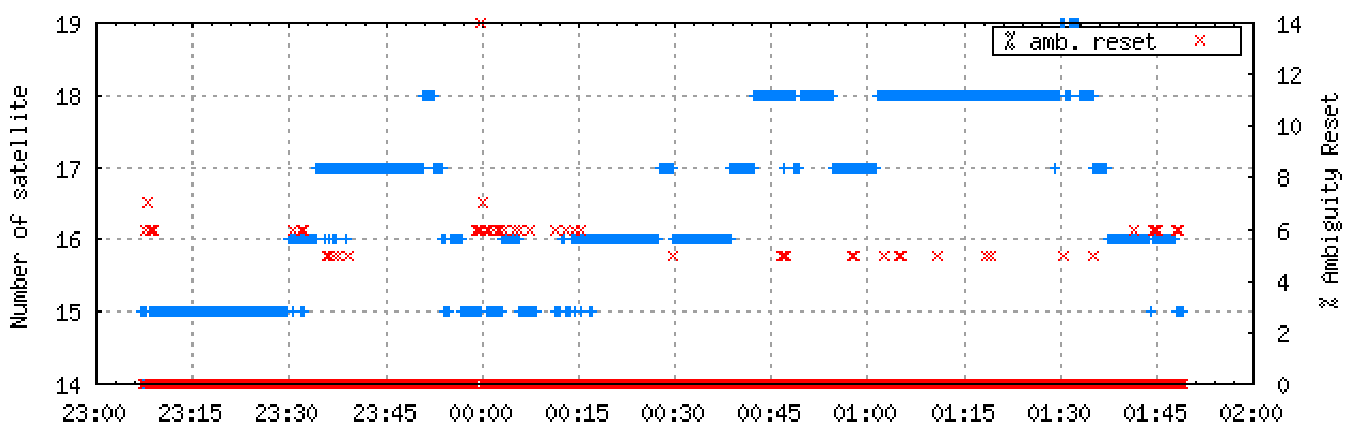

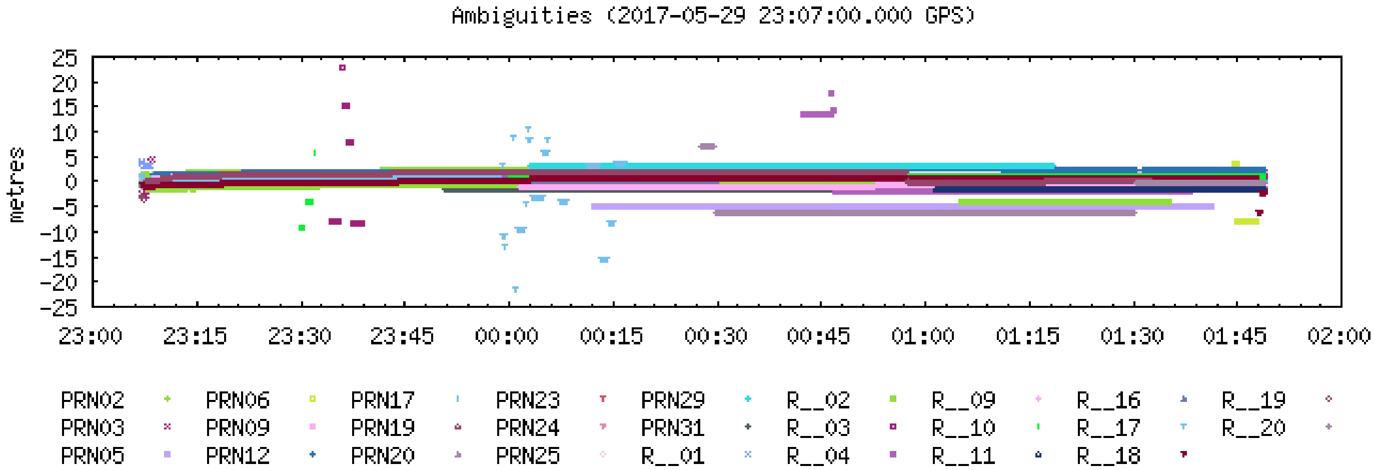
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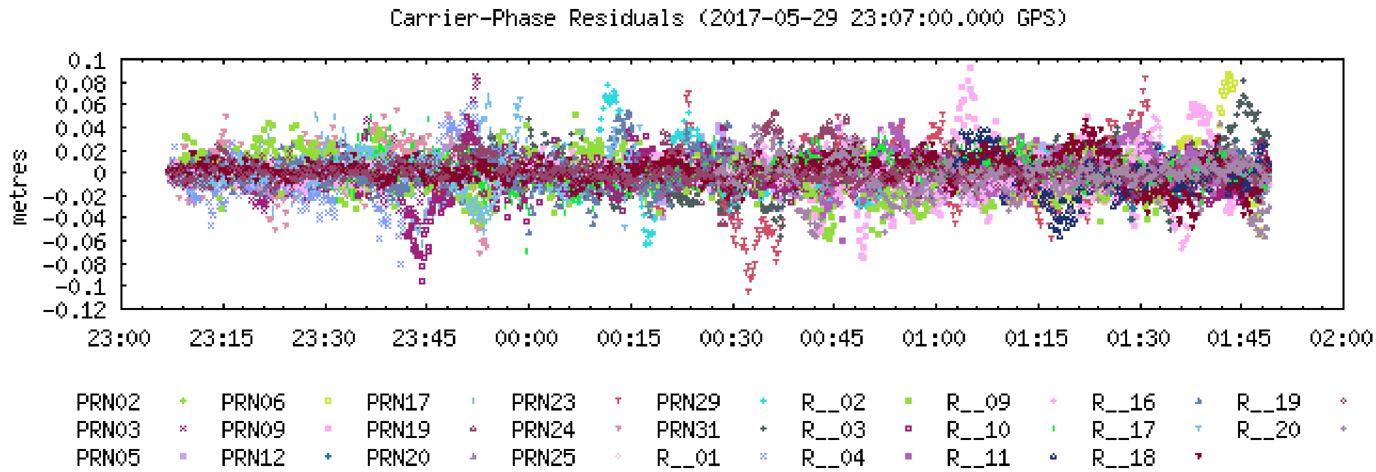
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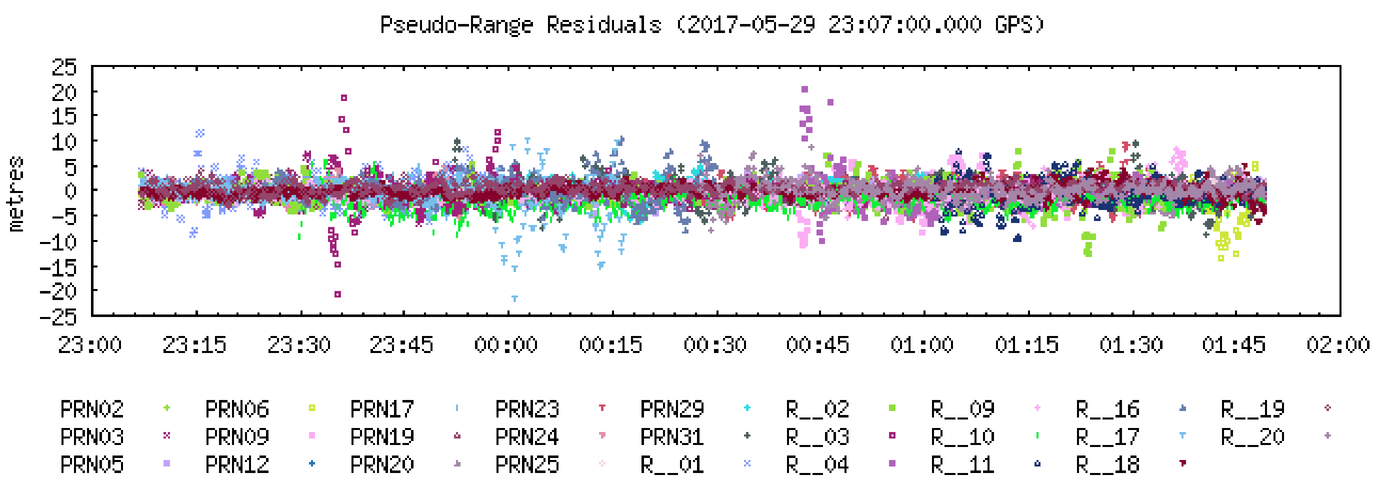
Pseudo-Range Residuals (2017-05-29 23:07:00.000 GPS)
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If you have any questions, please feel free to contact:
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Phone:343-292-6617

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Appendix F Wheeler River Hydrometric Monitoring Activity Summary 2019. Missinipi Water Solutions.

November 6, 2019 File Number: MWS-19-013

Dr. Fei Luo
Environmental Engineer
EcoMetrix Incorporated
6800 Campobello Road
Mississauga, ON L5N 2L8

RE: 2019 Wheeler River Hydrometric Monitoring Activity Summary

Dear Dr. Luo,

This letter is provided to you as a summary of field hydrometric monitoring activities during 2019 at Denison Mine's (Denison) Wheeler River Project (the Project). EcoMetrix Incorporated (EcoMetrix) is completing baseline monitoring for the Project on behalf of Denison and has retained Missinipi Water Solutions Inc. (MWSI) to provide hydrometric monitoring and water sampling at the Project.

Introduction

The Project is located approximately 750 km north of Saskatoon within Saskatchewan's Athabasca Basin. The Project is considered to be Denison's flagship project and Denison is currently proceeding with development of an Environmental Impact Statement (EIS) for the property. Data recorded during baseline monitoring are important to the development of an EIS in context of existing conditions and predicted impacts.

In coordination with EcoMetrix, MWSI completed two field programs at the project in 2019 from July 3 to 7 and August 28 to September 1. The purpose of each field program was as follows:

July Field Program

- Project introduction with EcoMetrix including guided access to all stations and identification of survey benchmarks;
- Discharge measurement and water level survey at SA-1, SA-2, SA-3, SA-4, SA-5, SA-6 and RC-1;
- Water level survey at LA-1; and,
- Water sampling at SA-1, SA-2, SA-3, SA-4, SA-5, SA-6 and RC-1.

August Field Program

- Discharge measurement and water level survey at SA-1, SA-2, SA-3, SA-4, SA-5, SA-6, SA-8, SA-9, SA-10, SA-11 and RC-1;
- Water level survey at LA-1 and LA-6; and,
- Water sampling at SA-1, SA-2, SA-3, SA-4, SA-5, SA-6 and RC-1.

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Saskatoon SK S7S 1N8
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Email: info@missinipisolutions.ca

Some stations are equipped with water level dataloggers which were downloaded in 2019. Each station is discussed in detail below and notes any observations or changes to instrumentation. Discharge and water level data developed from installed dataloggers are being provided electronically to EcoMetrix as a part of, but not attached/appended to, this letter.

Methodology and Equipment

This monitoring program is a continuation of work completed by others and all relevant background data and previous measurements for each station are discussed by EcoMetrix (2019) in *Baseline Hydrology Summary Report – Wheeler River Project, Denison Mines*. Work completed by MWSI in 2019 included extension of the stage-discharge rating curves (rating curve) at each station and development of hydrographs.

A rating curve requires several measurements of water level (stage) and discharge measurement over a wide range of flow conditions. During 2019, discharge was measured at each station by in-stream velocity measurements via the Mid-Section Method (Terzi, 1981). A Sontek FlowTracker was used to record velocity measurements at all stations for the Project in 2019. Water levels were recorded by elevation surveys to previously installed benchmarks using an engineer's rod and level. At some locations (SA-1, SA-4, SA-5, SA-6, SA-8, SA-9, SA-10, SA-11 and LA-6) Solinst Leveloggers are installed to record water level.

The quality of the data collected and reported is directly related to the accuracy of the measurements collected in the field. MWSI regularly inspects and calibrates field equipment to provide quality data for analysis. As of the spring of 2019 there are no facilities in Canada to perform calibration of Sontek FlowTrackers; however, MWSI regularly calibrates the older mechanical flow meters and annual verification is completed to confirm that all flow meters have agreement under a range of velocities in a lab controlled hydraulic flume. Two Peg Test surveys are performed to verify the accuracy of survey equipment. During station monitoring additional survey collection and measurements are often completed to confirm and validate measurements prior to leaving the station.

Solinst Leveloggers installed in-stream record total pressure which is a combination of water level and barometric pressures. A Solinst Barologger is used to measure local barometric pressure and this data record can be confirmed and extended, if needed, using local climate station data. The barometric pressure record is subtracted from the total pressure record for all in-stream Leveloggers. This record is used to generate the hydrograph by correcting the record to the surveyed water level, referenced to local benchmarks, and applying the trendline equation from the rating curve at a given station. Any users of hydrograph data should exercise caution if a given hydrograph has data that are developed by extrapolation beyond the measured range of a rating curve.

Winter water level data records are often impacted by ice cover and encroachment of the channel by snow. All stations with dataloggers installed at the Project are similarly impacted. Winter flow data can be estimated from other regional stations, but this effort is not included as a part of this report.

During the 2019 field programs the dataloggers were observed to have a two hour time shift from Central Standard Time (CST). All dataloggers were reset to CST to ease future processing of logger data at a sampling frequency of 30 minutes.

Stream Discharge and Lake Level Monitoring

This section provides a summary of activities for each station as well as updated tables of measured stage and discharge. When possible the current stage-discharge rating curve is plotted including the equation for the fitted trendline and the coefficient of determination (R^2). In some cases, a measurement may be rejected from the trendline equation and R^2 assessment based upon the type of measurement (i.e. winter vs. open water) or professional judgment based on the perceived fit of the data point. Rejection of data points is based upon close scrutiny of the data set, consideration for the data and conditions associated with that measurement and the potential perceived influence of site conditions such as measurement location.

As previously discussed, this monitoring is a continuation of work completed by others. The measurements discussed below are a compilation of all work at each station where MWSI completed measurements made in 2019 and all other work is discussed by EcoMetrix (2019).

SA-1 (Icelander River)

Measurements were completed at SA-1 twice in 2019 (Table 1). A data logger is installed at this location and a new sensor housing was added during the August field program. The current data logger is an older model of the Solinst Levelogger product and will need replacement soon but was not believed to be required for 2019.

Some discrepancy was noted at this station regarding previously reported benchmark labels and elevations. For the 2019 data to fit with previously reported data in the rating curve (Figure 1) the benchmark elevation from BM3 (as previously reported by others) needed to be assigned to BM1. This is a somewhat arbitrary correction; however, it creates a proper fit to the rating curve based on the measured flow and stage data. Should other information regarding the benchmarks at SA-1 become available it could be used to provide any other correction which may be required.

Photo 1 and Photo 2 are photos of the cross-section at SA-1 taken in July and August, respectively.

Table 1: SA-1 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2011-05-14	492.714	2.3070
2011-07-29	492.648	1.7500
2011-10-28	492.562	0.9730
2012-05-05	492.711	2.2930
2012-08-06	492.695	2.0310
2012-10-23	492.721	2.5750
2013-05-20	492.705	2.3580
2013-08-14	492.587	1.2800
2013-10-18	492.554	0.8870
2014-03-30	492.869	1.2030
2016-09-17	492.710	2.3400
2017-05-31	492.720	2.4300
2018-07-02	494.043	2.4100
2019-07-05 9:00	492.744	3.0553
2019-08-30 9:30	492.733	2.7760

Figure 1: SA-1 Rating Curve

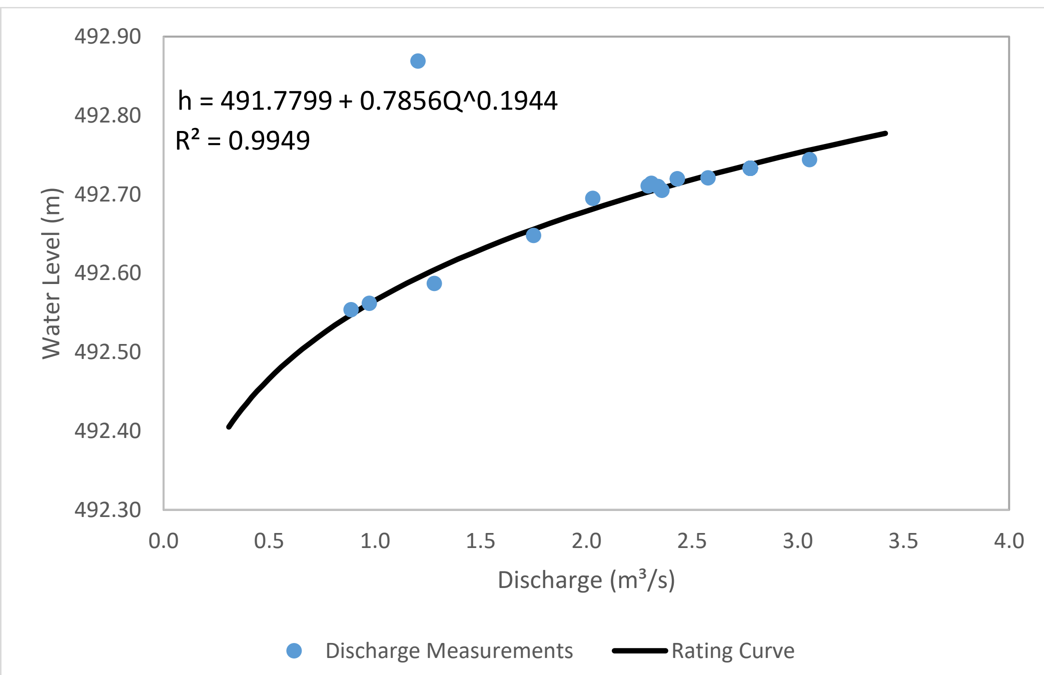

Photo 1: SA-1 - July Field Program

Photo 2: SA-1 - August Field Program

SA-2 (Northwest Flow into McGowan Lake)

Station SA-2 is located to the northwest of McGowan Lake. A datalogger is not installed at this location. During the 2019 monitoring program it was learned that the cross-section had been moved in 2016 creating a discrepancy in water levels. The old cross-section was identified during the August field program and sufficient data are available to correct the July 2019 measurement (Table 2 and Figure 2). The original cross-section will be used for measurements in future field monitoring programs. Photo 3 is taken of the cross-section used during the July field program while Photo 4 is the original cross-section used in August.

Table 2: SA-2 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2011-05-12	496.727	1.6490
2011-07-30	496.698	1.3870
2011-10-27	496.667	0.8090
2012-05-08	496.748	2.0080
2012-08-08	496.689	1.3050
2012-10-24	496.734	2.0300
2013-05-21	496.727	1.8420
2013-08-14	496.660	0.8630
2013-10-16	496.641	0.7410
2014-03-24	496.805	1.1800
2016-09-16	496.460	2.2400
2019-07-05 12:30	496.773	2.2095
2019-08-30 13:30	496.748	1.9537

Figure 2: SA-2 Rating Curve

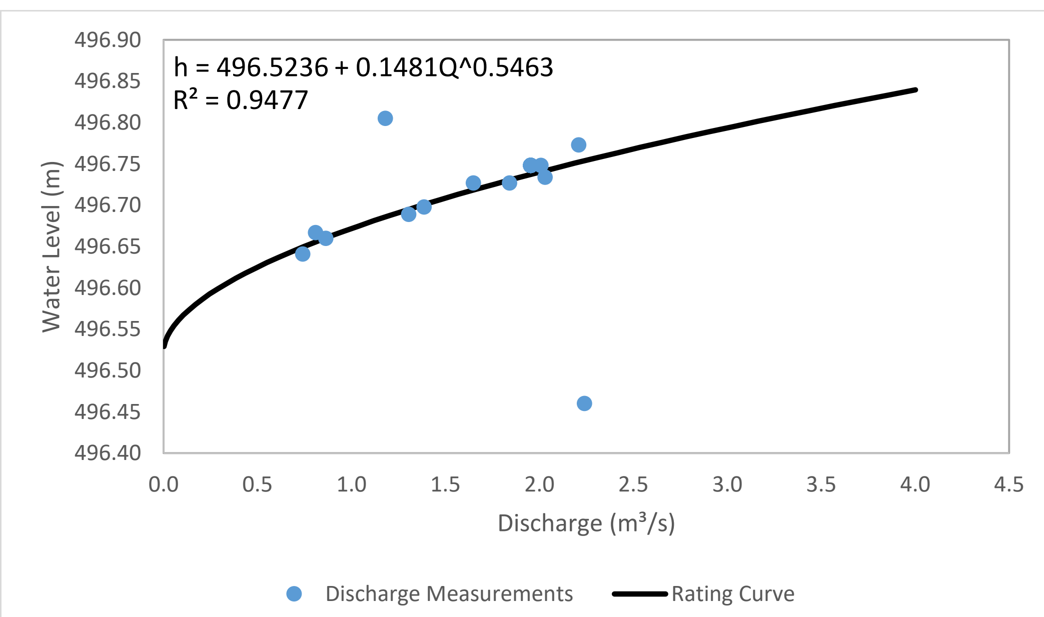

Photo 3: SA-2 - July Field Program

Photo 4: SA-2 - August Field Program

SA-3 (LA-2 to McGowan Lake)

SA-3 is located on an inflow stream to McGowan Lake from the northeast. The station does not have a datalogger. Stage and discharge measurement data are provided in Table 3 and plotted in Figure 3. Photo 5 and Photo 6 are taken during the July and August field programs, respectively. The stream at this location has a low gradient and, due to the proximity to the lake, is believed to have been slightly backwatered by McGowan Lake during 2019.

Table 3: SA-3 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2011-05-13	494.459	0.4760
2011-07-29	494.392	0.3700
2011-10-28	494.322	0.2390
2012-05-04	494.473	0.5280
2012-08-05	494.443	0.4780
2012-10-23	494.487	0.5780
2013-05-20	494.482	0.5640
2013-08-14	494.344	0.2550
2013-10-16	494.243	0.0510
2014-03-24	494.248	0.3620
2016-09-16	494.430	0.4400
2019-07-05 14:00	494.541	0.6219
2019-08-30 15:30	494.506	0.5474

Figure 3: SA-3 Rating Curve

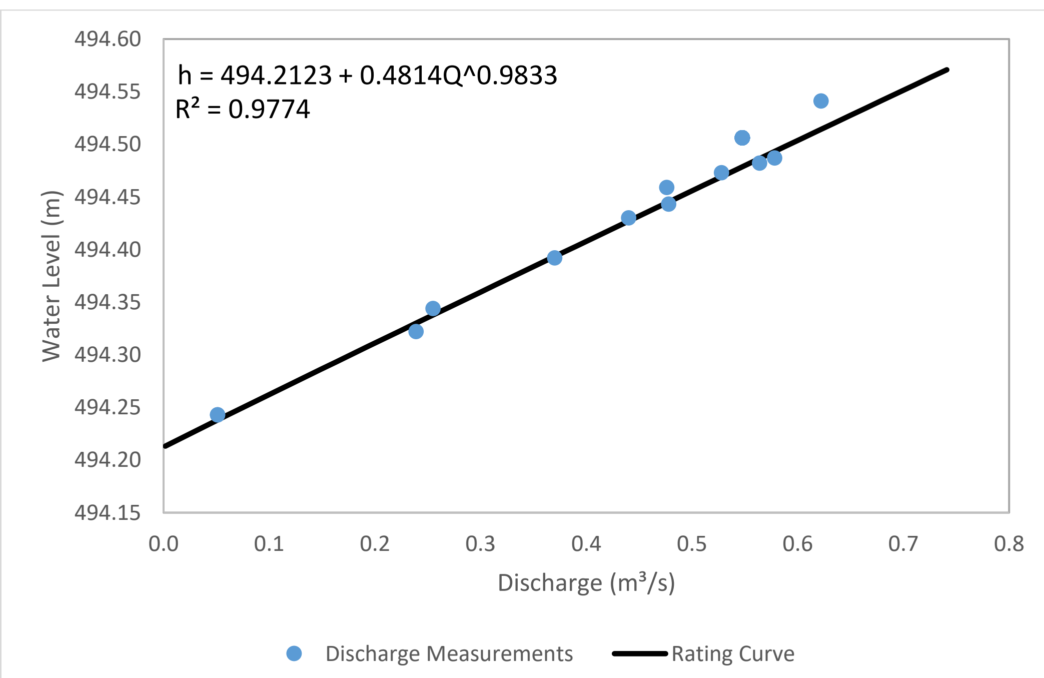

Photo 5: SA-3 - July Field Program

Photo 6: SA-3 - August Field Program

SA-4 (Downstream of Outflow from Kratchkowsky Lake)

SA-4 is located downstream of Kratchkowsky Lake and flows into LA-6 from the northwest. This station has a datalogger. The measured stage and discharge data are presented in Table 4 and Figure 4. Photo 7 was taken during the July field program while Photo 8 is from August.

Table 4: SA-4 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2011-05-11	506.357	0.4830
2011-07-30	506.314	0.3350
2011-10-31	506.310	0.1990
2012-05-04	506.348	0.4660
2012-08-05	506.329	0.3610
2012-10-22	506.367	0.4970
2013-05-19	506.369	0.5190
2013-08-13	506.277	0.2760
2013-10-17	506.249	0.2060
2014-03-23	506.381	0.3300
2016-09-10	506.350	0.4900
2017-05-30	506.370	0.5800
2018-06-29	506.357	0.4845
2019-07-04 12:00	506.387	0.6336
2019-08-29 13:00	506.374	0.5900

Figure 4: SA-4 Rating Curve

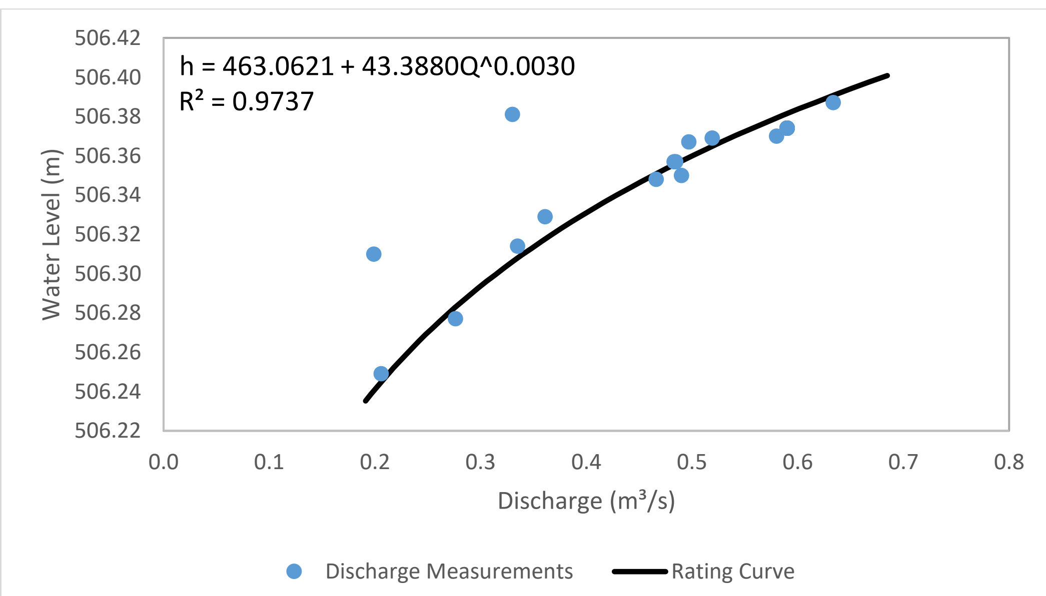

Photo 7: SA-4 - July Field Program

Photo 8: SA-4 - August Field Program

SA-5 (Northwest Inflow to LA-6)

A second northwest inflow to LA-6 is monitored at SA-5. This station is equipped with a datalogger and a new logger housing was installed during the August field program. Stage and discharge measurements are presented in Table 5 and the rating curve is shown in Figure 5. Photo 9 and Photo 10 show the cross-section during the July and August field programs, respectively.

This station has been measured at two cross-sections approximately 30 m apart. The reason for the change in cross-section is unknown at this time; however, efforts have been undertaken both in previous reporting and this document to shift all measurements to a common datum. This may not be justifiable in consideration of hydraulic characteristics but it will be possible in future measurements to confirm the shape of the rating curve and provide any additional shifts that may be required.

Table 5: SA-5 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2011-05-12	500.891	1.1000
2011-07-30	500.851	0.8580
2011-10-29	500.792	0.4760
2012-05-04	500.900	1.1110
2012-08-05	500.867	1.0260
2012-10-22	500.901	1.2690
2013-05-19	500.909	1.3810
2013-08-13	500.812	0.6160
2013-10-17	500.805	0.5070
2014-03-23	500.981	0.8860
2016-09-09	500.900	1.2700
2016-09-21	500.910	1.5800
2017-05-30	500.920	1.9500
2018-06-30	500.890	1.6567
2019-07-04 10:30	500.955	1.6137
2019-08-29 10:30	500.927	1.3589

Figure 5: SA-5 Rating Curve

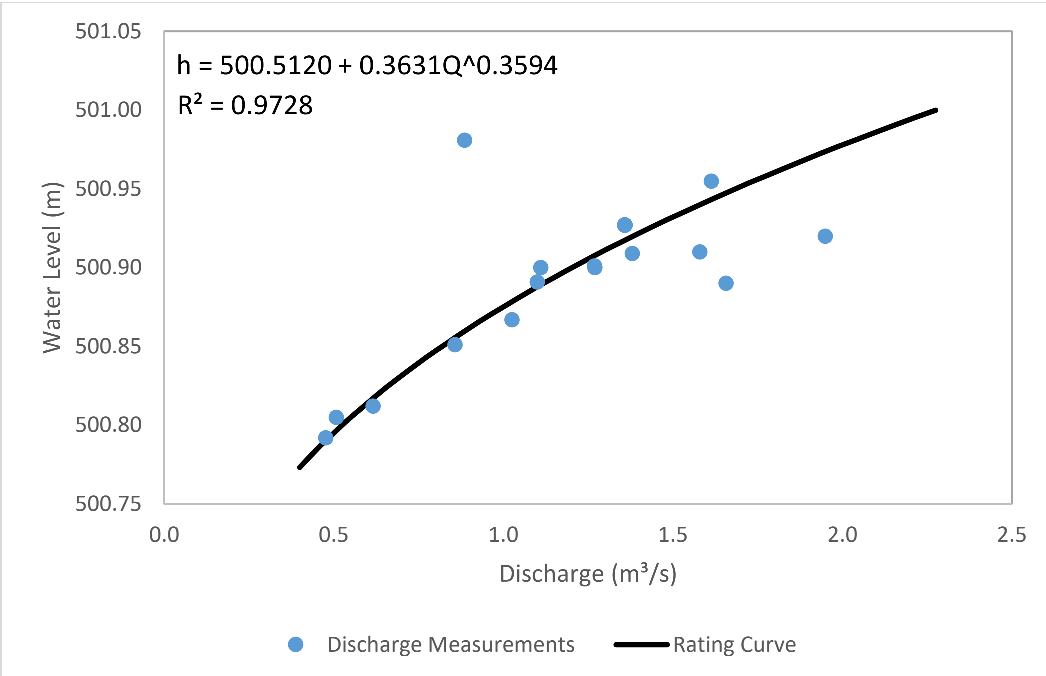

Photo 9: SA-5 - July Field Program

Photo 10: SA-5 - August Field Program

SA-6 (Outflow from LA-6)

SA-6 is the outflow from LA-6 and is equipped with a stage recording datalogger. The sensor and sensor housing at this location were replaced in August. Stage and discharge data for SA-6 are presented in Table 6 and the rating curve is shown as Figure 6. The cross-section is shown in Photo 11 for the July field program and Photo 12 is from the August field program.

Table 6: SA-6 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m³/s)
2011-05-13	500.084	1.6310
2011-07-30	500.034	1.3030
2011-10-27	499.956	0.7170
2012-05-06	500.098	1.9570
2012-08-05	500.061	1.4760
2012-10-22	500.102	1.8510
2013-05-19	500.077	1.5400
2013-08-13	499.992	0.8420
2013-10-17	499.969	0.7980
2014-03-23	500.081	1.1730
2016-09-11	500.070	1.9800
2017-05-31	500.080	1.7700
2018-06-30	500.125	1.5576
2019-07-04 14:30	500.125	2.2674
2019-08-29 16:00	500.110	2.0247

Figure 6: SA-6 Rating Curve

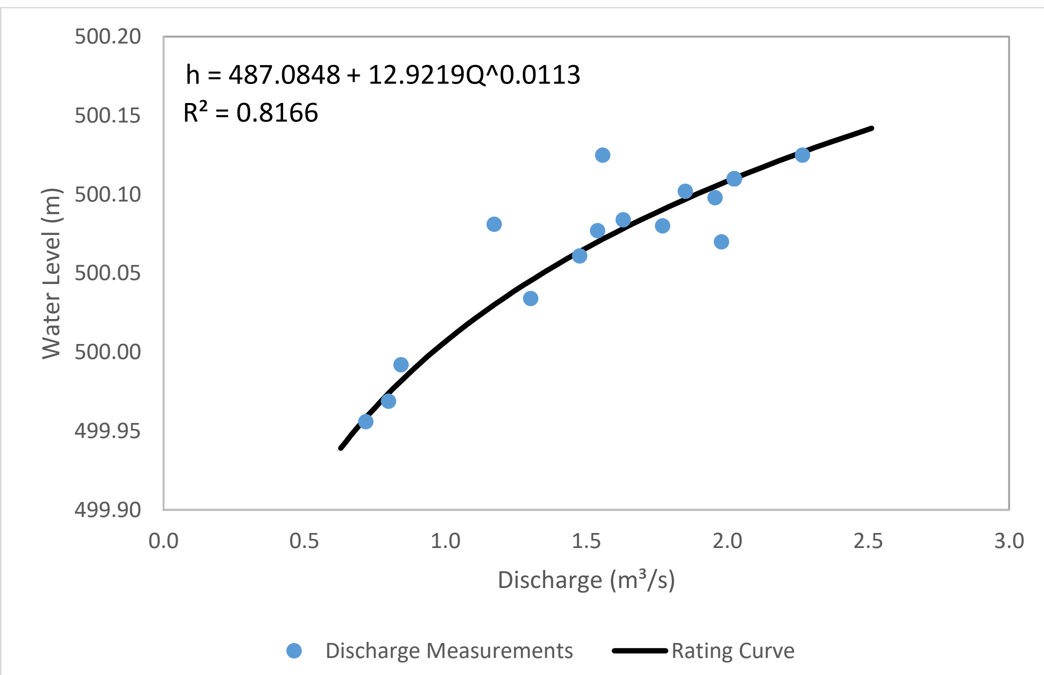

Photo 11: SA-6 - July Field Program

Photo 12: SA-6 - August Field Program

SA-8 (Inflow to Kratchkowsky Lake)

SA-8 is an inflow to Kratchkowsky Lake and was located immediately upstream of the shoreline. It is believed that stage measurements at that location were influenced by the lake level in Kratchkowsky Lake and not representative of the hydraulics of the inflow channel. The station was moved upstream and re-installed with a new sensor housing. The station was surveyed to new local benchmarks and not referenced to the old cross-section (Table 7). Photo 13 shows the old monitoring location during the July field program while Photo 14 was taken at the new upstream location in August.

Table 7: SA-8 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2016-09-15	520.600	0.0100
2016-09-19	520.620	0.0400
2017-05-30	520.540	0.0400
2018-07-03	520.570	0.0560
2019-08-31 10:00	99.455*	0.0443

* Referenced to local benchmark after moving measurement location.

Photo 13: SA-8 - July Field Program

Photo 14: SA-8 - August Field Program

SA-9 (Outflow from LA-8)

SA-9 is located downstream of LA-8 and is equipped with a datalogger. Insufficient stage and discharge measurement data (Table 8) are available to generate a rating curve at this time. Photo 15 was taken during the August field program.

Table 8: SA-9 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2016-09-18	520.520	0.1800
2017-06-01	520.490	0.1600
2019-08-31 14:10	520.547	0.1457

Photo 15: SA-9 - August Field Program

SA-10 (Northwest Inflow to LA-9)

SA-10 is an inflow to LA-9 and is equipped with a datalogger. Stage and discharge measurement data are presented in Table 9 but are insufficient to generate a rating curve. Photo 16 was taken during the August field program.

Table 9: SA-10 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2016-09-18	514.350	1.5500
2017-05-31	514.310	1.2200
2019-08-31 17:30	514.344	1.3127

Photo 16: SA-10 - August Field Program

SA-11 (North Inflow to Kratchkowsky Lake)

The north inflow to Kratchkowsky Lake is monitored at SA-11. This station is equipped with a datalogger. Stage and discharge measurement data are provided in Table 10 and the rating curve is shown in Figure 7. Due to the brevity of data, caution is advised when using this rating curve especially for extrapolation above the highest measured discharge. Photo 17 was taken of the cross-section during the August field program.

Table 10: SA-11 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2016-09-19	520.730	0.4200
2017-05-30	520.710	0.3100
2018-07-02	520.561	Not Measured
2019-08-31 11:00	520.713	0.3104

Figure 7: SA-11 Rating Curve

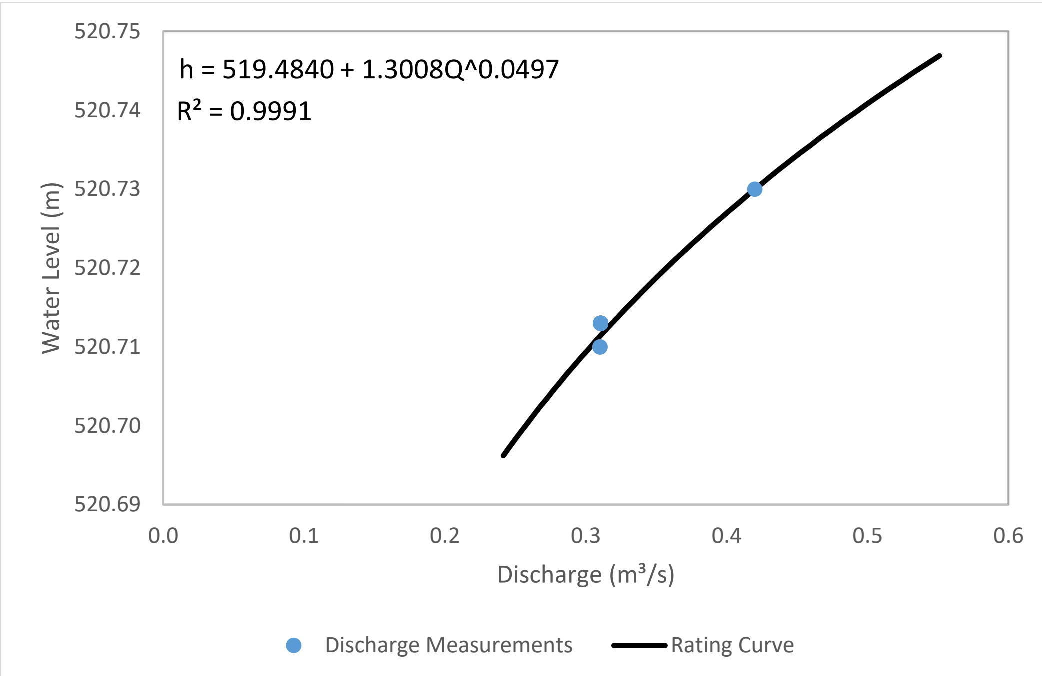

Photo 17: SA-11 - August Field Program

RC-1 (Outflow from Kratchkowsky Lake Upstream of SA-4)

RC-1 is measured near the outflow from Kratchkowsky Lake and upstream of SA-4. A datalogger is not installed at this location. Water level measurements in Table 11 are referenced to the lake water level measured at a different location on Kratchkowsky Lake. There are not enough data to generate a rating curve. Photo 18 and Photo 19 show the cross-section during the July and August field programs, respectively.

Table 11: RC-1 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2016-09-14	520.300	0.5800
2018-03-15	No WL Measured	0.2303
2019-07-06 9:00	No WL Measured	0.6041
2019-09-01 8:30	520.559	0.5514

Photo 18: RC-1 - July Field Program

Photo 19: RC-1 - August Field Program

LA-1 Water Level

Measurements of water level for LA-1 occur coincident with monitoring at SA-3. The stream and lake are separated by a long natural levy and survey benchmarks are located between the two stations and used for both water level surveys. Table 12 presents the survey data for LA-1. A new datalogger was installed at this location during the August field program.

Table 12: LA-1 - Water Level Measurements

Measurement Date & Time	Water Level (m)
2011-05-13	494.439
2011-07-29	494.327
2011-10-28	494.218
2012-05-04	494.423
2012-08-05	494.386
2012-10-23	494.448
2013-05-21	494.440
2013-08-14	494.265
2013-10-16	494.194
2014-03-24	494.298
2016-09-16	494.390
2018-07-02	494.344
2019-07-05 14:00	494.515
2019-08-30 15:30	494.476

LA-6 Water Level

LA-6 is upstream of SA-6. Water level survey (Table 13) was completed once during the August field program. A datalogger for LA-6 could not be found during the August field program; however, comparison of historical measurement between LA-6 and SA-6 (Figure 8) indicate that the water levels are similar enough to use water level data from the SA-6 datalogger to represent the water level of LA-6.

Table 13: LA-6 - Water Level Measurements

Measurement Date & Time	Water Level (m)
2011-05-13	500.063
2011-07-31	500.028
2011-10-27	499.943
2012-05-06	500.088
2012-08-05	500.058
2012-10-22	500.092
2013-05-19	500.088
2013-08-13	499.973
2013-10-17	499.947
2014-03-23	500.058
2016-09-12	500.070
2018-06-30	500.106
2019-08-29 14:25	500.118

Figure 8: Comparison of LA-6 and SA-6 Water Levels

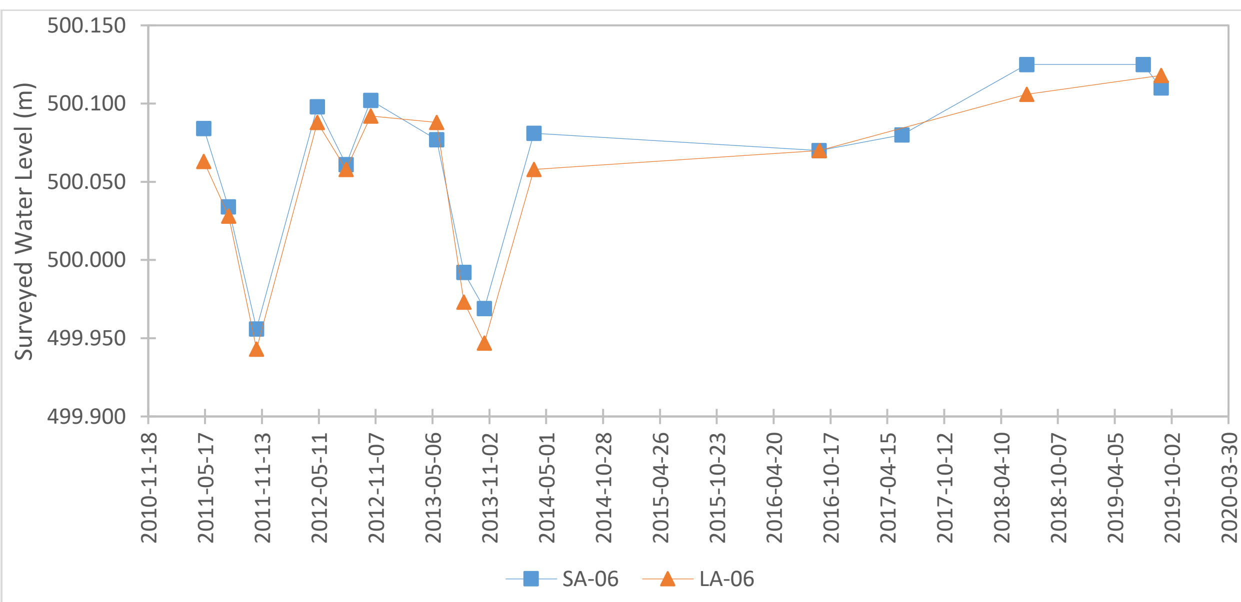

Photo 20: LA-6 - August Field Program

Water Quality Parameter Measurements

Water samples were collected during both 2019 field programs. Water quality parameters recorded during the August field program are presented in Table 14.

Table 14: August Water Quality Field Measurements

Station ID	SA-01	SA-02	SA-03	SA-04	SA-05	SA-06	RC-01
Water Depth (m):	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Water Temp (°C)	12.8	14	15.2	14.1	12.4	13.8	12.8
Conductivity (uS/cm):	14	13.7	16.7	15.8	12.3	13.7	15.4
Spec. Conductivity (uS/cm):	18.3	17.4	20.6	19.9	16.2	17.5	20.1
pH:	6.82	6.98	6.76	6.93	6.75	6.86	7.04
Dissolved Oxygen (mg/L):	8.91	9.11	9.21	7.15	7.81	7.33	9.09
DO Sat. (%):	84.1	88.2	92.3	70.2	73.2	71.1	86.1

Summary and Closure

On behalf of Denison, EcoMetrix has retained MWSI for monitoring and reporting of discharges in the vicinity of the Project. This reporting consists of the monitoring data and other pertinent observations recorded during two field programs in 2019.

This report has been prepared for the exclusive use of Denison and EcoMetrix. MWSI is not responsible for any unauthorized use or modification of this document. All third parties relying on information presented herein do so at their own risk.

MWSI appreciates the opportunity to work with Denison and EcoMetrix on this project. Should there be any questions regarding this document please contact the undersigned.

Respectfully submitted,

Missinipi Water Solutions Inc.

Tyrel J. Lloyd, M.Eng., P.Eng.

Senior Water Resources Engineer

References

EcoMetrix Incorporated. 2019. Baseline Hydrology Summary Report – Wheeler River Project, Denison Mines. Ref. 16-2285. Mississauga, ON.

Terzi, R.A. 1981. Hydrometric Field Manual – Measurement of Streamflow. Inland Waters Directorate, Water Resources Branch, Environment Canada.

Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

Powering
PEOPLE, PARTNERSHIPS
AND PASSION.

EcoMetrix Incorporated

Hydrological Effects Assessment Report

Denison Mines Wheeler River Project

Northern Saskatchewan

Prepared By:

NewFields Canada Mining & Environment
1002 Hurley Way
Saskatoon, Saskatchewan
Canada
S7N 4J7

December 2021
680.0018.000

680.0018.000

EcoMetrix Incorporated
6800 Campobello Road
Mississauga, ON L5N 2L8

Date: August 26, 2022

ATTN: Jason Dietrich

RE: Denison Wheeler River Hydrological Information

Dear Mr. Dietrich,

This report presents the results of the development of hydrological data and impacts related to Denison Mines Corp. proposed Wheeler River Project (the Project). EcoMetrix Incorporated has retained NewFields Canada Mining & Environment ULC (NewFields) for preparation of this document for inclusion with the Environmental Impact Statement in support of the Project.

If you have any questions or require additional information, please contact the undersigned.

Best Regards,

NewFields Canada

Prepared By:

Tyrel J. Lloyd, M.Eng., P.Eng.
Senior Water Resources Engineer

TJL/tjl

EXECUTIVE SUMMARY

Denison Mines Corp. (Denison) has initiated the development of an Environmental Impact Assessment (EIA) to develop their Wheeler River Project (the Project). EcoMetrix Incorporated (EcoMetrix) is engaged by Denison and has retained NewFields Canada Mining & Environment ULC (NewFields) to provide hydrological assessment in support of the EIA.

Denison has proposed that the Project will consist of a 170 hectare (ha) footprint (75 ha infrastructure plus a 95 ha buffer) associated with an in-situ recovery (ISR) process. ISR allows for the mining of ore without a conventional pit, mine shaft, waste rock piles or tailings impoundment. Denison does not intend to have constant freshwater withdrawal or effluent discharge throughout operations; however, the Project is assessed in this document using a freshwater withdrawal rate of 40.5 cubic meters per hour (m^3/hour) and effluent discharge of 81.0 m^3/hour. The withdrawal and discharge rates are assessed independently to exaggerate the projected impacts and are assessed cumulatively with the site footprint and estimated changes to groundwater contributions through different temporal phases of the Project.

Denison initiated hydrometric baseline monitoring in 2011 which has continued to present at various locations around the Project. Assessment nodes for the EIA were typically selected coincident to existing stream stations, though others were added for other points of interest to the Project. Streamflow records at existing stations provide an understanding of the range of flows during open water conditions including snowmelt runoff, rainfall response to storm events and late summer low flow periods. Winter data are not available at most stations due to a lack of winter field monitoring programs. Long-term flow records with winter discharge are available from a Water Survey Canada hydrometric monitoring station located downstream of Russell Lake on the Wheeler River (Station ID 06DA005). Flow records from 06DA005 have been extended to the assessment nodes at the Project either through correlation or unit area runoff analysis.

LA-5 (Whitefish Lake) is an assessment node immediately downstream at the outlet of the lake adjacent to the main Project facilities. The extended flow record estimated for this node presents mean annual flows ranging from 0.867 to 2.990 cubic meters per second (m^3/s) with an average of 1.409 m^3/s. The projected withdrawal and discharge rates proposed for the Project are the largest influence on the hydrological impact of the Project; however, the largest predicted change in streamflow rate is -3.1% occurring at the LA-5 and SA-2 nodes (immediately downstream of the Project) during Operations and Decommissioning as projected against the 5th percentile low flow dataset in the month of March. Lake levels will deviate less than ±0.01 m due to all Project influences. All Project influences on the environment are expected to return to baseline conditions during the Post-Decommissioning phase of the Project.

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1. INTRODUCTION

The Wheeler River Project (Wheeler or the Project or Site) is a proposed uranium mine and processing plant in northern Saskatchewan, Canada. It is located in a relatively undisturbed area of the boreal forest about 4 kilometers (km) off of Highway 914 and approximately 35 km north-northeast of the Key Lake uranium operation.

Denison Mines Corp. (Denison) has an effective 95.0% ownership in the Project through a 90.0% direct interest and an additional 5.0% interest through its investment in JCU Exploration Company. The remaining 5.0% is owned by UEX Corporation. The Project will apply an innovative approach to uranium mining in Canada called in-situ recovery (ISR). The use of ISR mining at Wheeler means that there will be no need for a large open pit mining operation or multiple shafts to access underground mine workings; no workers will be underground as the ISR process is conducted from surface facilities. While this mining method has been used extensively on an international basis and currently accounts for more than 50% of global uranium production, it has not previously been used in Canada for uranium mining. Denison has completed research on international uranium ISR operations to understand best practices and incorporate lessons learned into the design of Wheeler. In order to implement ISR at Wheeler, Denison will apply existing technologies to eliminate the typical challenges experienced at some international uranium ISR operations.

ISR mining at Wheeler will involve injecting a mining solution into the uranium deposit through a series of cased drill holes (about 4 to 8 inches in diameter) called injection wells (more detail is provided in Denison, 2020). The mining solution proposed for Wheeler is a low pH or acidic solution. As the mining solution passes from the injection wells through the uranium deposit, it dissolves the uranium and leaves virtually all other minerals in the host rock in place. Once dissolved, the uranium-rich mining solution is recovered and pumped back up to the surface through another set of cased drill holes called recovery wells. The combination of injection and recovery wells is called a wellfield. Denison anticipates the wellfield will have the general arrangement of one recovery well in the centre surrounded by 6-8 injection wells with about 10-meter (m) spacing between wells. With these configuration options, the final wellfield may include approximately 310 wells over a 90 m x 900 m area (Denison, 2020).

To contain the solution within the uranium deposit and maximize recovery, as well as prevent interaction of the mining solution with surrounding groundwater, Denison will create an impermeable wall using conventional ground freezing technology. The freeze wall will encompass the deposit located at 400 m depth and the overlying sandstone from the basement rock to surface with the existing impermeable basement rock acting as a bottom barrier beneath the uranium deposit. The approximate area of the freeze containment is 90 m wide x 900 m long (Denison, 2020).

Newfields Canada Mining & Environment ULC (NewFields) has been retained by Denison through EcoMetrix Incorporated (EcoMetrix) to conduct an assessment of potential effects on surface water hydrology as a result of the Project. This report provides the effects assessment using the most up to date information available with respect to surface water hydrology for the defined study area, as well as the Project layout and water balance.

The surface water hydrology assessment has been completed to inform the Environmental Assessment (EA) which will be prepared to meet requirements of the coordinated provincial-federal EA as per the spirit of the Canada-Saskatchewan Agreement on Environmental Assessment Cooperation (2005). The cooperation agreement allows for the production of a single EA that meets the requirements of both levels of government, so that each level of government can make an independent decision.

1.1. Assessment Purpose and Objectives

The purpose of this assessment is to assess potential change to hydrological conditions (as represented by the "surface water quantity" Valued Component [VC]) in consideration of all life of mine (LOM) phases at the Site. Hydrological parameters of interest include flow regime in local streams and water levels in selected waterbodies. This assessment predicts changes to hydrological parameters through all temporal phases of the Project within the defined Local and Regional Study Areas.

This report is presented as a summary of existing conditions at Site and includes assessment of predicted changes to the aforementioned hydrological parameters. This report includes the following sections:

- Project overview and purpose of this assessment including identification of spatial and temporal study areas (Section 1.0);
- Discussion of regulatory framework used in this assessment (Section 2.0);
- Summary of existing conditions (Section 3.0);
- Methodology used in the impact assessment (Section 4.0); and,
- Presentation and discussion of the results of assessment (Section 5.0).

1.2. Assessment Boundaries

For this assessment, spatial and temporal boundaries have been defined in consideration of the proposed LOM plan and all associated activities. These boundaries are discussed in the following sections.

1.2.1. Spatial Boundaries

1.2.1.1. Project Study Area (PSA)

The Project Study Area (PSA) is the direct footprint of the Project. The PSA represents the area in which Project activities and components may occur and, as such, represents the area within which direct physical disturbance may occur as a result of the Project, either temporary or permanent. (i.e., the Project footprint; the area of maximum physical disturbance plus the buffer). This area is not VC-specific, but consistent throughout the EIA.

1.2.1.2. Local Study Area (LSA) and Regional Study Area (RSA)

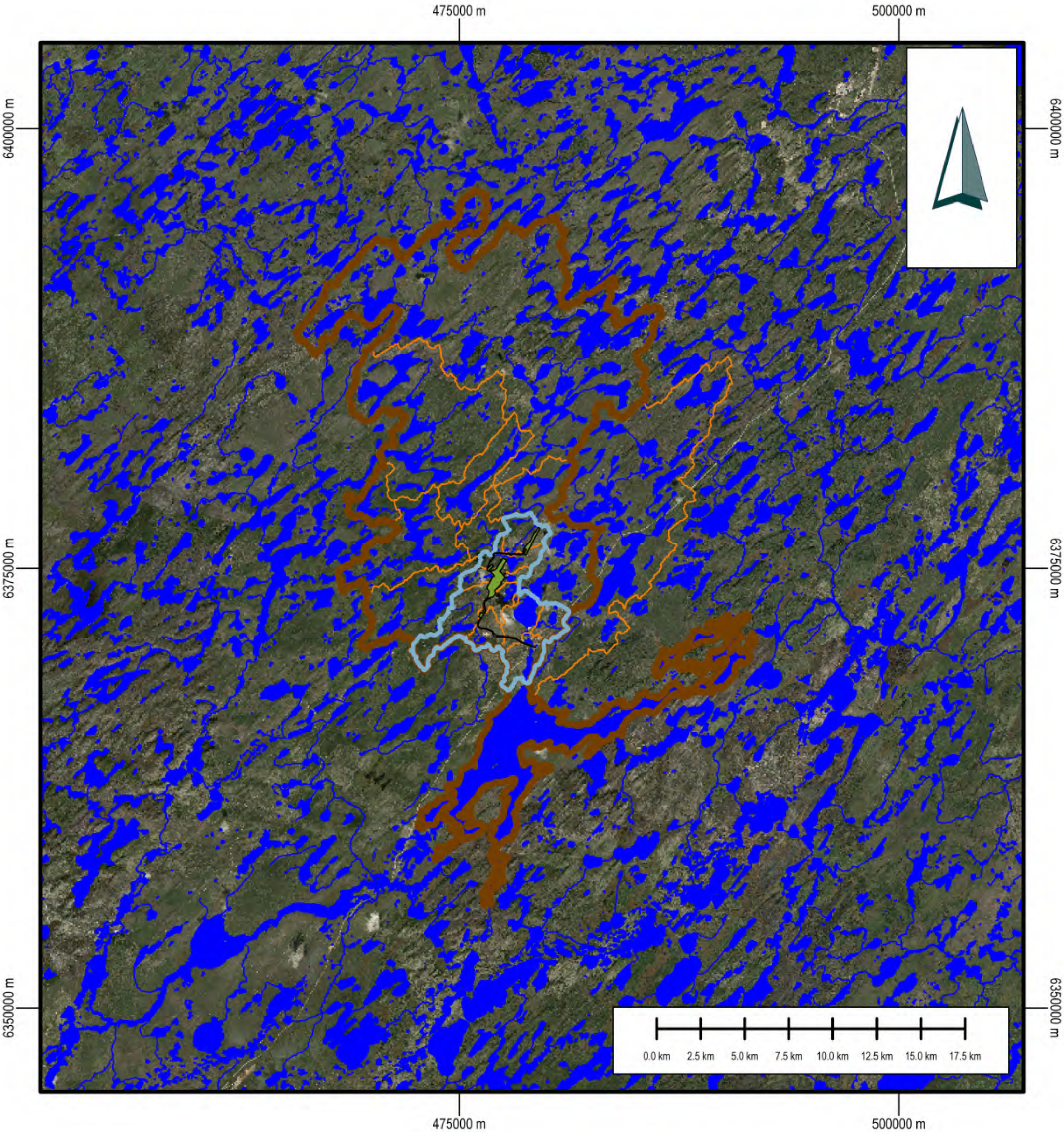
The Local Study Area (LSA) is the area that surrounds the Project Area where both direct and indirect effects resulting from Project activities can be reasonably measured. The LSA is established to assess the potential, largely direct effects of the Project and represents the extent to which there is a reasonable potential for the Project or Project-related activities to interact with and potentially adversely affect the VC. The LSA is derived from watershed boundaries local to the Project Area.

The Regional Study Area (RSA) is the area that surrounds and includes the LSA, established to assess the potential, largely indirect effects of the Project in a regional context. The RSA is large enough to capture the extent of potential effects (i.e., zone of influence) on a VC and defines the area within which cumulative effects may occur (i.e., cumulative effects assessment boundary). The RSA is bounded by the regional watershed area in which the Project Area is located.

The LSA for the assessment of the surface water quantity VC is based upon portions of watersheds containing direct footprint of the Site, as well as areas directly downstream which are influenced by the Site footprint or effluent discharge/water withdrawal effects (Figure 1-1). This area is selected based upon important waterbodies downstream (notably Whitefish and McGowan Lakes) of the Project which may be impacted through all temporal phases. The LSA extends from those waterbodies down to their inflow to Russell Lake.

The RSA for this assessment is based upon the whole watershed within which the Project is located and extends downstream to include the whole of Russell Lake (Figure 1-1). This is the area in which cumulative effects are assessed.

The watersheds within the area of the LSA are presented in Figure 1-2.



Legend:
- Site Study Area
- Waterbody
- Local Study Area
- Regional Study Area
- Stream Alignment
- Watershed Boundary

NewFields

Date: February 8, 2022

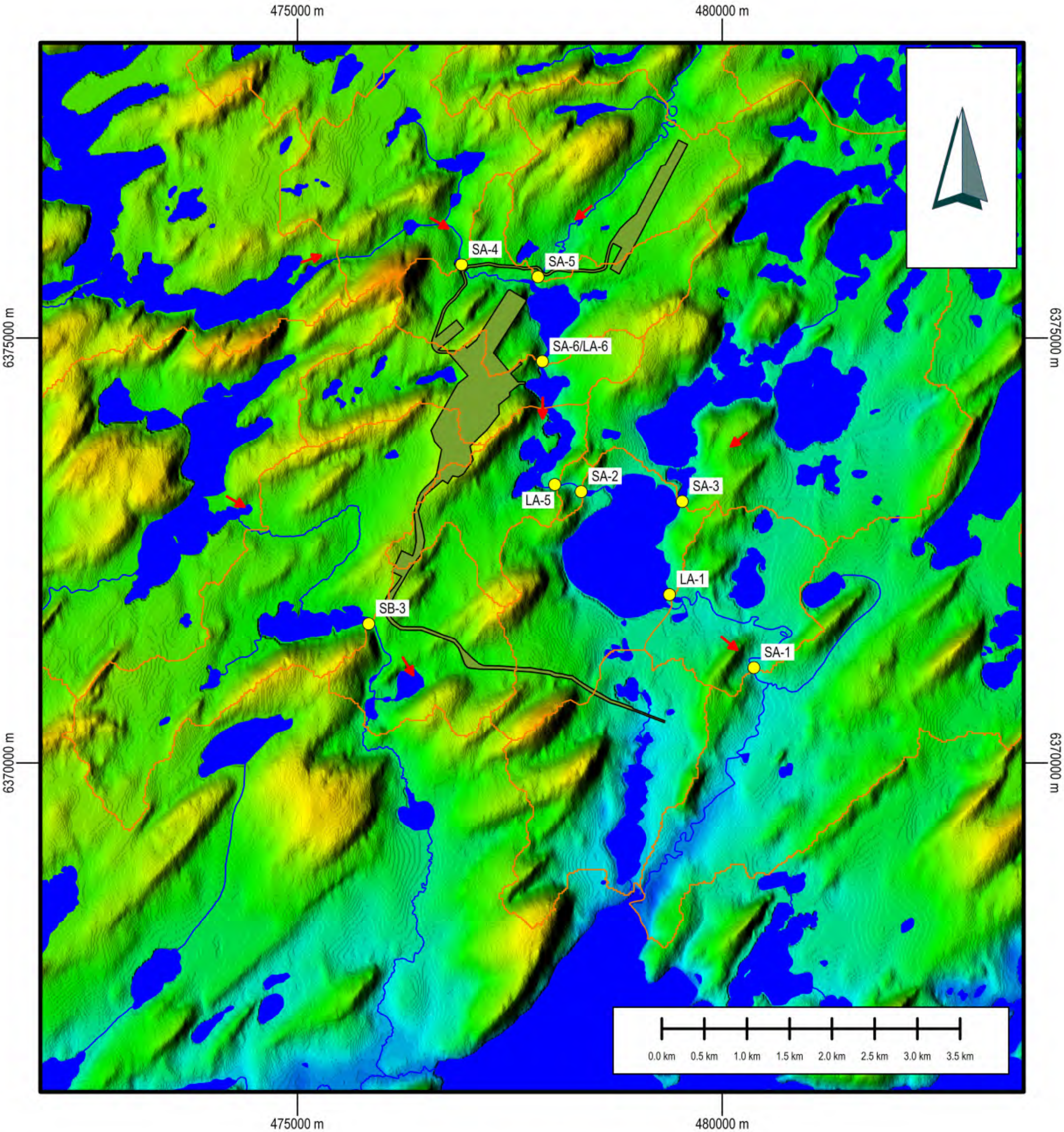
Project Number: 680.0018.000

Figure Title: Study Areas

Projection: UTM NAD83 Zone 13
References: World Imagery provided by Global Mapper

Figure: 1

Revision: 2



Legend:
- Site Study Area
- Waterbody
- Stream Alignment
- Watershed Boundary
- Assessment Node
- Flow Direction

NewFields

Date: February 8, 2022

Project Number: 680.0018.000

Figure Title: Watersheds in Local Study Area

Projection: UTM NAD83 Zone 13
References: Elevation model from CDEM NTS Mapsheets

Figure: 2

Revision: 4

1.2.2. Temporal Boundaries Phases

The temporal boundaries of the Project are defined by the four mine life phases as outlined in Table 1-1.

TABLE 1-1: TEMPORAL BOUNDARIES FOR THE ENVIRONMENTAL ASSESSMENT

Phase	Year	Description of Activities
Site Construction	1 to 3	Development of access roads and air strip; clearing, level and grading of the project site, laydown area; wellfield and freeze hole drilling; ground freezing; batch plant operation (concrete); development of surface infrastructure (camp, administration buildings, plants, ponds, pads and support infrastructure); waste management (incineration and landfill operation); water management (including treatment); power generation – generators; groundwater supply and release; surface water supply and release; fuel management (e.g., propane for comfort heating; vehicle and aircraft fuel); on-site and off-site operation of vehicles and transportation of materials; air transportation for workers.
Operation	3 to 18	Operation of the ISR wellfield; wellfield and freeze wall drilling; operation of freeze wall; expansion of pond and pads; operation of the ISR processing plant and production of uranium concentrate; water withdrawal from groundwater or surface water body; management of surface water (including seepage and site run-off); water treatment of human waste (black, grey and kitchen water treated and discharged to an effluent pond) and process water; water release to groundwater and/or surface water body; waste management (incineration and landfill operation); hazardous waste management (temporary storage, handling, and off-site transportation); contaminated waste management (temporary storage, handling, and off-site transportation); storage and disposal of process waste rock and radioactive plant precipitates; on-site and off-site operation of vehicles and transportation of materials; power supply – generators and back-up generators; package and transport of nuclear substances; fuel management (e.g., propane for comfort heating; vehicle and aircraft fuel); air transportation for workers.
Decommissioning	18 to 23	Mining horizon remediation and thawing of freeze wall; process water treatment and release; closure of ISR and freeze wells and infrastructure; salvageable asset removal (including site power transmission lines and electrical infrastructure); demolition and disposal of non-salvageable surface infrastructure and materials; remediation of contaminated areas (wellfield, waste pads, ponds, water treatment location, and process plant area); reclamation disturbed areas (site, roads, camp, and airstrip); site water management, treatment and release; power generation – gensets; waste management (incineration and landfill operation); management of hazardous waste; on-site and off-site operation of vehicles and transportation of materials.
Post-decommissioning	23 to 33	Active: monitoring of vegetation growth; monitoring of surface and groundwater quality; monitoring of wildlife site Passive: conduct environmental monitoring as required Regulatory site inspections Engagement - Site visit from interested parties

2. REGULATORY FRAMEWORK

The Wheeler River Project Description has been reviewed by the Canadian Nuclear Safety Commission who have concluded that the project meets the definition of a "designated project". As such, an Environmental Assessment is required under the *Canadian Environmental Assessment Act, 2012*. The project is also subject to Environmental Assessment requirements of the Government of Saskatchewan under *The Environmental Assessment Act* of Saskatchewan. In the context of local hydrology, the proponent is required to assess impacts of the Project within the context of the federal *Canadian Environmental Protection Act, 1999* and *the Fisheries Act*, as well as Surface Water Quality Objectives – Interim Edition from the Government of Saskatchewan.

3. EXISTING CONDITIONS

Denison initiated baseline hydrological monitoring in 2011 which has continued to present. Data are reported by EcoMetrix (2019) for the period 2011 to 2019. Though some periods in the reported baseline flow records are missing, notably winter data, the duration of monitoring at Site is sufficient for use to establish the long-term streamflow trends at the Site through relationships to long-term operating hydrometric gauging stations in the same watershed. As such, these records can be used to estimate long-term potential effects for the temporal phases and spatial study areas at the Site.

Baseline monitoring at the Project included streamflow monitoring, lake level monitoring and installation of stage dataloggers at various locations throughout two main watersheds reporting to Russell Lake identified as Watersheds A and B (EcoMetrix, 2019). Hydrometric monitoring at the Site has been carried out by several organizations since 2011 and recently the focus of each program has shifted to Watershed A stations predominantly in the vicinity of the Site. Hydrometric monitoring at streamflow stations by each organization has included measurement of stream discharge, water level survey and maintenance of in-stream dataloggers. The discussion of methodology used by each organization is provided by EcoMetrix (2019).

Critical locations of interest for this assessment include the following nodes (also in Table 3-1) which are coincident with baseline monitoring stations and/or watersheds of interest to the assessment (locations shown in Figure 1-2). The assessment nodes represent the collective watershed upstream.

- SA-1 – streamflow monitoring station on the stream colloquially known as the Icelander River located downstream of LA-1 (McGowan Lake);
- SA-2 – streamflow monitoring station situated downstream of outflow from LA-5 (Whitefish Lake) and upstream of inflow to LA-1 (McGowan Lake);
- SA-3 – streamflow monitoring station upstream of inflow to LA-1 (McGowan Lake);
- SA-4 – streamflow monitoring station upstream of inflow to LA-6 (Unnamed Lake);
- SA-5 – streamflow monitoring station upstream of inflow to LA-6 (Unnamed Lake);
- SA-6/LA-6 – streamflow and lake level monitoring station from LA-6 (Unnamed Lake) to inflow of LA-5 (Whitefish Lake);
- SB-3 – south Project drainage basin flowing to Russell Lake;

- LA-1 – McGowan Lake; and,
- LA-5 – Whitefish Lake.

Gross drainage areas for the above-mentioned locations are presented in Table 3-1.

TABLE 3-1: DRAINAGE AREAS FOR ASSESSMENT NODES

Location	Description	Gross Drainage Area (km²)
SA-1*	Icelander River flowing from McGowan Lake	280.6
SA-2*	Inflow to McGowan Lake from Whitefish Lake	257.4
SA-3*	Inflow to McGowan Lake	15.5
SA-4*	Inflow to LA-6 (Unnamed Lake) from Kratchkowski Lake	80.5
SA-5*	Inflow to LA-6	167.3
SA-6/LA-6*	Flow from LA-6 to Whitefish Lake	251.7
SB-3	Southern project drainage basin flowing to Russell Lake	24.9
LA-1	McGowan Lake	277.5
LA-5	Whitefish Lake	257.2
*Based on monitoring station		

Note:
Gross drainage is the total area (km^2 = square kilometers) of watershed that would generate runoff to a contributing point.

3.1. Baseline Streamflow Record Extension

The available baseline streamflow data for the Project covered a sufficient time period to support the assessment yet was not robust with respect to winter flow data. To ensure that seasonable variability in hydrology was adequately captured as part of the dataset used to assess potential effects, an additional step in data preparation was undertaken to fill in such seasonal gaps in the long-term record. This was accomplished by additional modelling (pro-rating) using a known continuous data source. Environment and Climate Change Canada (ECCC) operates hydrometric gauging stations across the country including one station located approximately 32 km downstream of the Project (i.e., the Project footprint and RSA lie within the watershed at that gauge). ECCC monitors flow rates on the Wheeler River below Russell Lake (Station 06DA005) and has reported historical data from 1973 to 2019 (ECCC 2021). Data prior to 1977 have frequent missing records and were not used for this assessment. Daily average discharge data from 06DA005 were used extending from 1977 to 2019 for modelling purposes. Monthly average discharge data for 06DA005 for the period of interest are provided in Appendix I.

To extend the discharge records from 06DA005 to other assessment nodes required correlation either through Unit Area Runoff relationships or same day discharge best fit correlation. The methodology used is discussed in Appendix II. The extended discharge records for each station were then processed to obtain monthly average discharge for each assessment node for purposes of the effect assessment for the Project. These data are presented in Appendix I with summary statistics presented in Table 3-2.

TABLE 3-2: SUMMARY STATISTICS FOR PROJECT RELEVANT NODES

Station	Gross Drainage Area (km²)	Statistic	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Monthly Average	Monthly Average Yield (m³/s/km²)
SA-1 - Correlated from WSC Wheeler River Station	280.55	Max (m³/s)	3.076	3.182	2.782	2.659	3.507	4.075	4.037	3.436	3.393	4.114	3.497	2.753	3.376	0.0120
		Average (m³/s)	1.589	1.518	1.474	1.692	2.398	2.382	2.100	1.888	1.820	1.884	1.823	1.659	1.852	0.0066
		25th Percentile (m³/s)	1.200	1.167	1.152	1.445	2.103	2.110	1.719	1.499	1.288	1.394	1.429	1.275	1.482	0.0053
		5th Percentile (m³/s)	1.067	0.982	0.900	1.211	1.786	1.469	1.273	1.093	0.984	0.986	1.075	1.065	1.158	0.0041
		Min (m³/s)	1.007	0.901	0.875	1.106	1.679	1.414	1.133	1.054	0.945	0.870	0.893	1.028	1.075	0.0038
SA-2 – Adjusted Unit Area Runoff from SA-6	257.36	Max (m³/s)	2.840	2.999	2.446	2.312	3.532	4.554	4.485	3.410	3.346	4.632	3.522	2.379	3.372	0.0131
		Average (m³/s)	1.147	1.089	1.040	1.221	1.972	1.972	1.658	1.442	1.394	1.463	1.376	1.199	1.414	0.0055
		25th Percentile (m³/s)	0.799	0.778	0.770	0.991	1.592	1.613	1.220	1.023	0.862	0.942	0.969	0.852	1.034	0.0040
		5th Percentile (m³/s)	0.712	0.660	0.613	0.810	1.278	1.008	0.852	0.734	0.663	0.663	0.716	0.710	0.785	0.0030
		Min (m³/s)	0.675	0.613	0.598	0.755	1.177	0.956	0.759	0.705	0.638	0.596	0.609	0.688	0.731	0.0028
SA-3 - Adjusted Unit Area Runoff from SA-1	15.537	Max (m³/s)	0.721	0.746	0.652	0.624	0.822	0.956	0.947	0.806	0.796	0.965	0.820	0.646	0.792	0.0510
		Average (m³/s)	0.373	0.356	0.346	0.397	0.562	0.559	0.493	0.443	0.427	0.442	0.428	0.389	0.434	0.0280
		25th Percentile (m³/s)	0.282	0.274	0.270	0.339	0.493	0.495	0.403	0.352	0.302	0.327	0.335	0.299	0.348	0.0224
		5th Percentile (m³/s)	0.250	0.230	0.211	0.284	0.419	0.345	0.299	0.256	0.231	0.231	0.252	0.250	0.271	0.0175
		Min (m³/s)	0.236	0.211	0.205	0.259	0.394	0.332	0.266	0.247	0.222	0.204	0.209	0.241	0.252	0.0162
SA-4 - Correlated from SA-6	80.498	Max (m³/s)	0.662	0.695	0.579	0.550	0.803	1.008	0.994	0.779	0.765	1.023	0.801	0.566	0.769	0.0096
		Average (m³/s)	0.298	0.285	0.274	0.315	0.478	0.478	0.410	0.363	0.352	0.367	0.348	0.310	0.357	0.0044
		25th Percentile (m³/s)	0.221	0.216	0.214	0.264	0.398	0.402	0.316	0.272	0.235	0.254	0.260	0.233	0.274	0.0034
		5th Percentile (m³/s)	0.200	0.188	0.177	0.223	0.329	0.268	0.233	0.205	0.189	0.189	0.201	0.200	0.217	0.0027
		Min (m³/s)	0.192	0.177	0.174	0.210	0.307	0.257	0.211	0.199	0.183	0.173	0.176	0.195	0.204	0.0025
SA-5 - Unit Area Runoff from SA-6	167.32	Max (m³/s)	1.802	1.901	1.557	1.474	2.232	2.866	2.823	2.156	2.116	2.915	2.226	1.516	2.132	0.0127
		Average (m³/s)	0.751	0.715	0.684	0.797	1.263	1.263	1.068	0.934	0.904	0.947	0.893	0.783	0.917	0.0055
		25th Percentile (m³/s)	0.535	0.522	0.517	0.654	1.027	1.040	0.796	0.674	0.574	0.624	0.640	0.568	0.681	0.0041
		5th Percentile (m³/s)	0.481	0.448	0.419	0.541	0.832	0.664	0.568	0.495	0.451	0.450	0.484	0.480	0.526	0.0031
		Min (m³/s)	0.458	0.419	0.410	0.508	0.769	0.632	0.510	0.476	0.435	0.409	0.417	0.466	0.492	0.0029
SA-6/LA-6 - Correlated from SA-1	251.69	Max (m³/s)	2.711	2.859	2.343	2.218	3.357	4.312	4.247	3.243	3.183	4.384	3.348	2.280	3.207	0.0127
		Average (m³/s)	1.129	1.075	1.029	1.199	1.900	1.900	1.607	1.405	1.360	1.425	1.343	1.178	1.379	0.0055
		25th Percentile (m³/s)	0.805	0.785	0.778	0.984	1.545	1.565	1.198	1.014	0.864	0.939	0.963	0.854	1.024	0.0041
		5th Percentile (m³/s)	0.724	0.675	0.631	0.814	1.252	0.999	0.854	0.744	0.678	0.677	0.728	0.722	0.791	0.0031
		Min (m³/s)	0.689	0.631	0.617	0.764	1.157	0.951	0.767	0.717	0.655	0.615	0.627	0.701	0.741	0.0029
SB3 - UAR from SA-1	24.87	Max (L/s)	0.273	0.282	0.247	0.236	0.311	0.361	0.358	0.305	0.301	0.365	0.310	0.244	0.299	0.0120
		Average (L/s)	0.141	0.135	0.131	0.150	0.213	0.211	0.186	0.167	0.161	0.167	0.162	0.147	0.164	0.0066
		25th Percentile (L/s)	0.106	0.103	0.102	0.128	0.186	0.187	0.152	0.133	0.114	0.124	0.127	0.113	0.131	0.0053

Station	Gross Drainage Area (km²)	Statistic	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Monthly Average	Monthly Average Yield (m³/s/km²)
		5th Percentile (L/s)	0.095	0.087	0.080	0.107	0.158	0.130	0.113	0.097	0.087	0.087	0.095	0.094	0.103	0.0041
		Min (L/s)	0.089	0.080	0.078	0.098	0.149	0.125	0.100	0.093	0.084	0.077	0.079	0.091	0.095	0.0038
LA-1 - UAR from SA-1	277.52	Max (m³/s)	3.043	3.148	2.752	2.630	3.469	4.031	3.993	3.399	3.356	4.069	3.459	2.724	3.339	0.0120
		Average (m³/s)	1.572	1.502	1.458	1.674	2.372	2.356	2.078	1.868	1.800	1.863	1.803	1.641	1.832	0.0066
		25th Percentile (m³/s)	1.187	1.155	1.140	1.429	2.080	2.087	1.700	1.483	1.275	1.379	1.414	1.262	1.466	0.0053
		5th Percentile (m³/s)	1.055	0.971	0.890	1.198	1.767	1.453	1.260	1.082	0.974	0.975	1.063	1.053	1.145	0.0041
		Min (m³/s)	0.996	0.891	0.865	1.094	1.661	1.399	1.121	1.043	0.935	0.861	0.883	1.017	1.064	0.0038
LA-5 - UAR from SA-1	257.18	Max (m³/s)	2.820	2.917	2.550	2.437	3.215	3.735	3.701	3.150	3.110	3.771	3.205	2.524	3.095	0.0120
		Average (m³/s)	1.456	1.391	1.351	1.551	2.198	2.184	1.925	1.731	1.668	1.727	1.671	1.521	1.698	0.0066
		25th Percentile (m³/s)	1.100	1.070	1.056	1.324	1.928	1.934	1.576	1.374	1.181	1.278	1.310	1.169	1.358	0.0053
		5th Percentile (m³/s)	0.978	0.900	0.825	1.110	1.638	1.347	1.167	1.002	0.902	0.904	0.985	0.976	1.061	0.0041
		Min (m³/s)	0.923	0.826	0.802	1.014	1.539	1.296	1.039	0.966	0.866	0.798	0.819	0.943	0.986	0.0038

3.2. Low Flow Statistics

Low flow assessment statistics are required for water quality modelling when a proposed discharge is anticipated for a Project. The statistic required for the assessment, as required by the Saskatchewan Water Security Agency, is the seven-day average 1:10-year low flow return period (7Q10). This assessment requires tabulation of flow data series into one-week intervals with summary statistics of the low flow return periods generated from the Log-Pearson III analysis. The 7Q10 estimates are presented in Table 3-3 for assessment nodes LA-1 and LA-5 as these two waterbodies are anticipated to receive effluent discharge during operation phase of the project. The effects assessment associated with potential changes to water quality will be conducted under separate cover in support of the EA.

TABLE 3-3: 7Q10 ESTIMATED DISCHARGE

Assessment Node	7Q10 Flow Rate (m^3/s)
LA-1	0.874
LA-5	0.616

Note: m^3/s = cubic meters per second

3.3. Climate Change

3.3.1. Water Balance Influencing Climate Change Parameters

Climate change is recognized as a growing issue facing future developments. The Canadian Centre for Climate Services (CCCS, 2021) provides an online tool identifying potential changes to Mean Annual Temperature, Surface Wind Speed, Total Precipitation, and Snow Depth among other parameters based on location and timeframes within Canada. The four aforementioned parameters influence the water balance at the Project where the former affects evaporation and the latter impacts local runoff. The change to parameters presented in Table 3-4 are based on the projected time interval, emission scenario referred to as Representative Concentration Pathways (RCPs), as well as the predicted change referenced to the average of the period 1986 to 2005. The RCP scenarios represent projected plausible emissions based on potential future anthropogenic activity.

TABLE 3-4: CLIMATE CHANGE PARAMETER ESTIMATES

Parameter	Units	Time Period	Emission Scenario (Representative Concentration Pathway (RCP))		
			Low (RCP 2.6)	Moderate (RCP 4.5)	High (RCP 8.5)
Mean Temperature	°C	2021-2040	+1.3	+1.4	+1.6
		2041-2060	+1.7	+2.3	+3.2
		2061-2080	+1.7	+2.8	+4.8
		2081-2100	+1.7	+3.1	+6.2
Surface Wind Speed	% Change	2021-2040	-1.4	-1.3	-1.2
		2041-2060	-0.9	-1.3	-2.6
		2061-2080	-1.3	-0.9	-2.8
		2081-2100	-1.4	-1.6	-2.6
Total Precipitation	% Change	2021-2040	+3.6	+2.7	+5.0
		2041-2060	+5.7	+7.3	+8.1
		2061-2080	+5.3	+8.0	+9.4
		2081-2100	+5.7	+7.9	+10.7
Snow Depth	% Change	2021-2040	-9.0	-7.1	-9.7
		2041-2060	-7.6	-11.8	-16.0
		2061-2080	-7.5	-14.3	-30.5
		2081-2100	-12.0	-19.5	-38.6

Table 3-4 indicates that through all temporal phases of the Project, the mean annual temperature is expected to increase in a range of +1.3°C to +6.2°C above the normal for the period from 1986 to 2005 based on all RCPs. Wind speed is anticipated to decrease by -0.9% to -2.8% relative to the 1986 to 2005 average through all temporal phases and RCPs. Evaporation processes are a function of both temperature and wind speed as well as relative humidity and, through some models, solar and net radiation. An increase in temperature in the area will increase saturation vapour pressure of the air, thus creating a potential increase in evaporation. Decreasing wind speed, however, will reduce the ability for saturated air to be moved away from water surfaces thus decreasing potential evaporation. The two influences would not likely cancel out and will be dependent on data sets based on observation of climate change phenomena.

Table 3-4 indicates that total precipitation will increase in a range of 2.7% to 10.7% referenced to the 1986 to 2005 averages and that snow depth will decrease by -7.1% to -38.6%. Increased precipitation will increase the amount of flow from each assessment node watershed. Decreased snow depth may indicate a shorter snow accumulation period in the winter or potentially decreased snow fall during winter months. The decrease in snow depth may also mean that snow melt runoff events would be of lower magnitude and duration under future climate change scenarios.

Predictive modelling of future climate conditions is a challenging endeavour and unlikely to yield definitive assessment of the long-term impact of the Project; however, qualitative assessment of the Project effects can be based upon four chosen scenarios in the discussion of climate change:

- Mean precipitation static and increased evaporation;
- Increased precipitation and increased evaporation;
- Mean precipitation static and decreased evaporation; and,
- Increased precipitation and decreased evaporation.

These four scenarios allow for qualitative assessment of the Project based on varying probable climate conditions as discussed later in this report.

3.3.2. Climate Change Influenced Extreme Event Data

3.3.2.1. Intensity-Duration-Frequency Data

Intensity-Duration-Frequency (IDF) curves are used to estimate the sizing of water management structures around a Site. Often, the 1:100-year, 24-hour precipitation event is the design event used in analyses for water management. IDF curves are often specific to climate monitoring stations; however, the online tool IDF_CC Tool 5.0 developed by the Institute for Catastrophic Loss Reduction, FIDS – Facility for Intelligent Decision Support and Western University (2021) is available for presentation of IDF curves at ungauged locations and includes the ability to estimate future IDF curve values under influences from climate change IDF.

IDF data extracted from the online tool were selected for geographic location 57.51103°N, 105.37622°W. The baseline IDF curve data (Table 3-5) are based on a gridded data set extracted from the online tool. The climate change influenced IDF curve data (Table 3-6) are based on the time window of 2020 to 2050 under a climate condition scenario yielding the largest magnitude storm fall. The 1:100-year, 24-hour return period rainfall events for the baseline and climate change influence IDF curves are 79.9 and 88.6 millimeters (mm), respectively.

TABLE 3-5: BASELINE IDF CURVE DATA

Duration	Return Period (years) Rainfall (mm)						
	2	5	10	20	25	50	100
5 minutes	4.3	6.7	8.8	11.5	12.4	16.0	20.7
10 minutes	6.4	9.8	12.8	16.7	17.9	23.0	29.3
15 minutes	7.7	11.9	15.8	21.0	22.7	29.8	39.1
30 minutes	9.8	14.8	19.1	24.6	26.4	33.6	42.8
1 hour	12.3	17.9	22.8	29.0	31.0	39.1	49.7
2 hours	15.7	21.7	26.8	33.4	35.5	44.4	56.4
6 hours	24.1	31.7	37.5	43.8	45.8	52.9	60.7
12 hours	31.7	42.4	49.9	57.5	59.7	67.3	75.1
24 hours	38.3	50.7	58.4	65.6	67.5	73.9	79.9

TABLE 3-6: CLIMATE CHANGE INFLUENCED IDF CURVE DATA

Duration	Return Period (years) Rainfall (mm)						
	2	5	10	20	25	50	100
5 minutes	4.7	7.1	9.5	12.4	13.4	17.6	22.9
10 minutes	6.9	10.5	13.8	17.9	19.3	25.1	32.5
15 minutes	8.3	12.7	17.0	22.6	24.5	32.7	43.3
30 minutes	10.5	15.8	20.6	26.5	28.4	36.8	47.5
1 hour	13.3	19.2	24.6	31.3	33.4	42.9	55.1
2 hours	16.9	23.2	28.9	36.0	38.2	48.6	62.5
6 hours	26.0	33.9	40.4	47.2	49.4	57.9	67.3
12 hours	34.2	45.4	53.8	61.9	64.4	73.8	83.3
24 hours	41.3	54.3	63.0	70.7	72.8	81.0	88.6

3.3.2.2. Probable Maximum Precipitation Events

The Probable Maximum Precipitation (PMP) event is a design standard value for an extreme rainfall event. The PMP event does not have an estimated return period but instead is based upon the theoretical maximum amount of water that a storm could produce based on the maximum persisting dew point (Atmospheric & Hydrologic Sciences Division – Atmospheric Environment Branch [AES], 1999). Assessment completed AES (1999) indicate that a trend in the maximum persisting dew point is not shifting appreciably but no formal analysis of projected climate change impacts has been completed. Based on data presented by AES (1999), the estimated PMP event for the Project is 489.3 mm.

4. EFFECTS ASSESSMENT METHODOLOGY

There are four primary anticipated interactions with the Project on the surface water hydrology in the PSA and LSA. These include:

- Direct impacts:
  - Footprint – Direct overprinting (loss) or change to drainage area (watershed) due to Site footprint development.
  - Water Withdrawal – Fresh water withdrawal from LA-5 (Whitefish Lake) for purposes of mine process water and Site water balance.
  - Water Discharge – Mine water discharge to LA-5 for maintenance of Site water balance.
- Indirect impacts:
  - Groundwater – Changes to hydrogeological influences to local waterbodies.

The four temporal phases for the Project include Construction (Year 1 to 3), Operations (Year 3 to 18), Decommissioning (Year 18 to 23), and Post-Decommissioning (Year 23 to 33). Influence of each impact through the project is described in Table 4-1 where it is assumed that the worst case scenario of each impact is incurred.

TABLE 4-1: PROJECT IMPACTS THROUGH TEMPORAL PHASES

Temporal Phase	Projected Impact
Construction	▪ Footprint – Fully developed footprint by end of construction
Operations	▪ Footprint – Fully developed footprint ▪ Water Withdrawal – Potential freshwater withdrawal from LA-5 ▪ Water Discharge – Potential treated discharge to LA-5 ▪ Groundwater – Maximum projected change in groundwater contribution to LA-5
Decommissioning	▪ Footprint – Fully developed footprint ▪ Water Withdrawal – Potential freshwater withdrawal from LA-5 ▪ Water Discharge – Potential treated discharge to LA-5 ▪ Groundwater – Maximum projected change in groundwater contribution to LA-5
Post-decommissioning	▪ Returned to Pre-Development conditions

Flows and water levels under pre-development conditions were used as the baseline against which Project-related changes during the construction, operation, decommissioning and post-decommissioning stages were assessed. Pre-disturbance (baseline) watershed areas are presented in Figure 1-2 and expected changes to these watersheds were estimated for subsequent phases of the mine life. Changes in watershed areas are primarily a result of the construction of mine infrastructure and the implementation of the Water Management Plan (WMP). There are two scenarios considered separately for water withdrawal and treated effluent discharge to LA-5 relevant to both the operations and decommissioning stages. Groundwater is received in LA-5 under natural conditions and estimates of the changes to this contribution are evaluated for Operations and Decommissioning. The following sections discuss each projected impact.

4.1. Site Footprint

The site footprint consists of an access road from Highway 914 northwest through to the main Project facilities and extending northeast to the proposed airstrip. The road and airstrip are not considered to be impacts to hydrology. Both will potentially redirect some flow and have a small influence on times of concentration of runoff as well as infiltration rates but in general will have a very small influence and are not expected to change runoff volumes at assessment nodes. Project facilities will have influence on runoff to assessment nodes as Denison intends to collect all runoff water to Project facilities where it can be used in the ISR process and treated in the wastewater treatment plant prior to release to the environment. The assessment nodes impacted by project footprint are presented in Table 4-2.

TABLE 4-2: SITE FOOTPRINT IMPACTS

Impacted Assessment Node	Decrease in Drainage Area (km²)
SA-5	0.273
SA-6	0.566
SB-3	0.214

Note: km^2 = square kilometers.

4.2. Water Withdrawal and Effluent Discharge

The Project is assessed via two differing scenarios which reflect either water withdrawal from or effluent discharge to LA-5. For purposes of this assessment, Denison anticipates a maximum freshwater withdrawal of 40.5 m^3/hr (0.0113 m^3/s) and a maximum discharge rate of 81.0 m^3/hr (0.0225 m^3/s) for the Project. These withdrawal and discharge rates are assessed independently of each other and assumed to occur as a constant rate throughout all phases of the project.

4.3. Groundwater Discharge to LA-5

Hydrogeological impacts are anticipated from the Project and reported by others. Whitefish Lake (LA-5) is estimated under baseline conditions to receive 40 liters per second (L/s) from hydrogeological sources. Modelling for the project estimates a decrease in this input to 36 L/s during Operations and Decommissioning. This input is anticipated to return to pre-disturbance conditions for Post-Decommissioning.

4.4. Effects Assessment

Effects are assessed for each temporal stage of the project and for those assessment nodes projected to be impacted within their respective watersheds. The nodes relevant to this assessment include SA-1, SA-2 SA-6/LA-6, SB-3, LA-1 and LA-5. As discussed and presented in Table 4-1, projected impacts relate to footprint, water withdrawal/effluent discharge, and changes to groundwater contributions. For temporal stages influenced by water withdrawal/effluent discharge, two scenarios are presented for only water withdrawal or only effluent discharge to understand the magnitude of each without offsetting. This assumes that the withdrawal and discharge to/from LA-5 would not be happening simultaneously. Operations and De-commissioning are considered to be similar in project influence and are assessed together. From a hydrological perspective, post-decommissioning is anticipated to be a full return to pre-disturbance conditions resulting in a null effect.

Project impacts are assessed based on scenarios as presented in Table 4-3.

TABLE 4-3: PROJECT IMPACT SCENARIOS

Temporal Stage(s)	Scenario Number	Project Influence
Construction	1	▪ Fully Developed Site Footprint
Operations and Decommissioning with Water Withdrawal	2	▪ Fully Developed Site Footprint ▪ Freshwater Withdrawal from LA-5 ▪ Change in Groundwater Contribution to LA-5
Operations and Decommissioning with Effluent Discharge	3	▪ Fully Developed Site Footprint ▪ Effluent Discharge to LA-5 ▪ Change in Groundwater Contribution to LA-5

Based on the results of scenarios identified in Table 4-3, projected changes to water levels in target waterbodies can be assessed. Waterbodies LA-1, LA-5 and LA-6 are within impacted assessment nodes for the Project. The change to the water level of each waterbody can be estimated based on baseline water level survey data at the waterbody and coincident discharge measurement at downstream hydrometric gauging stations. The compilation of these two data sets creates a stage-outflow rating curve. The stage-outflow rating curve for LA-1 is developed from flow records at SA-1 (Figure 4-1) and LA-5 is developed from SA-2 (Figure 4-2). The stage-outflow curve for LA-6 (Figure 4-3) is the same rating curve as for SA-6 given the proximity between the station and the lake. These outflow rating curves can be used to assess the difference between water levels of the baseline and impacted discharges for each of the waterbodies.

FIGURE 4-1: LA-1 STAGE-OUTFLOW RATING CURVE

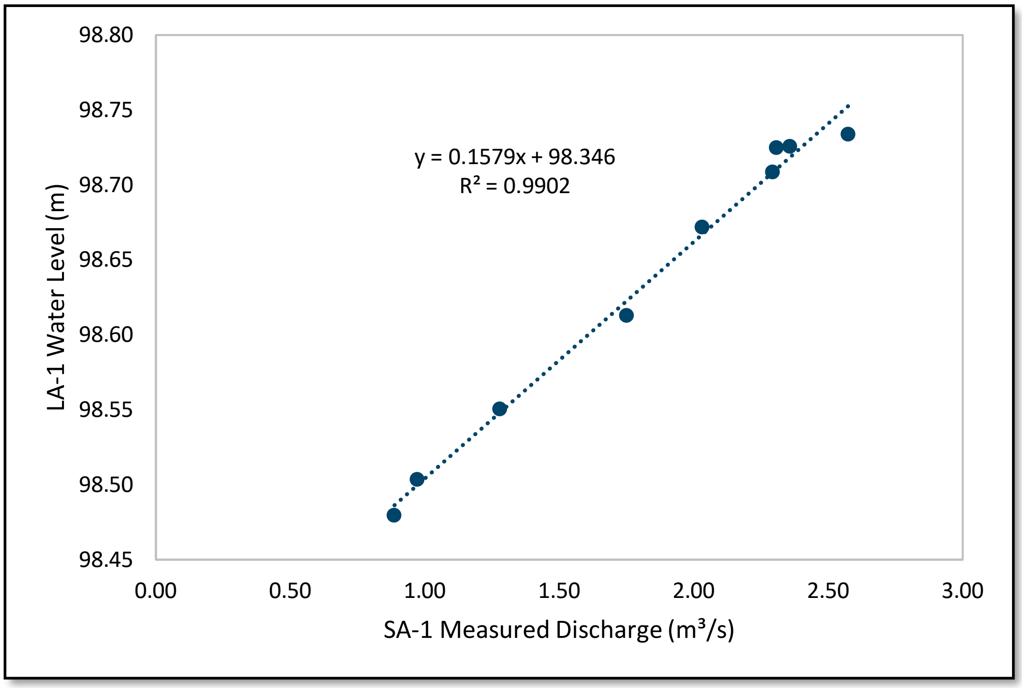


FIGURE 4-2: LA-5 STAGE-OUTFLOW RATING CURVE

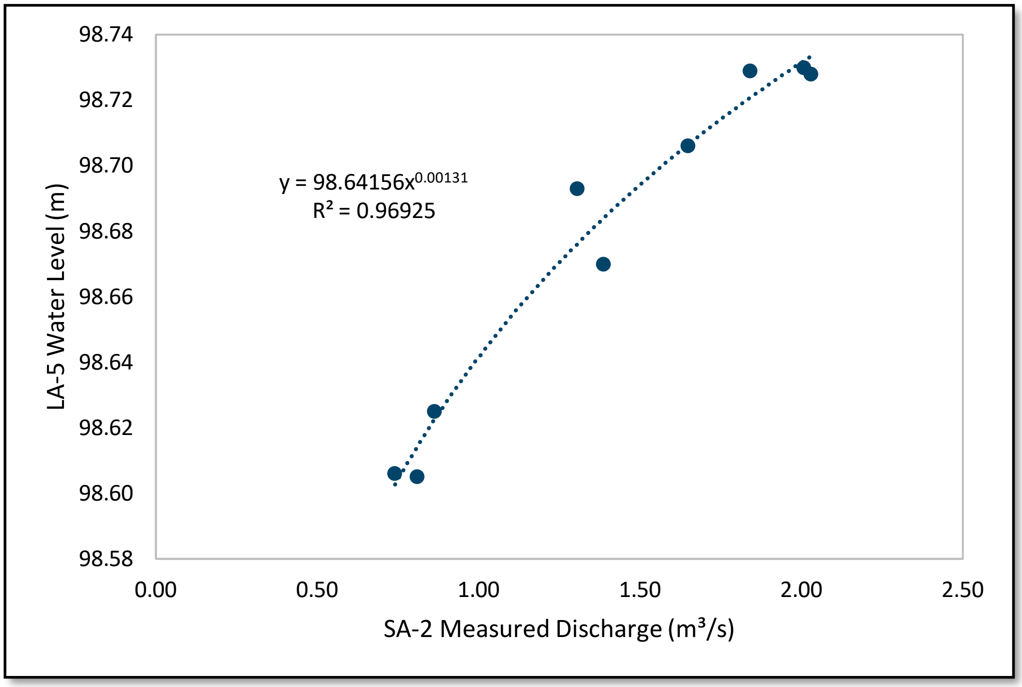
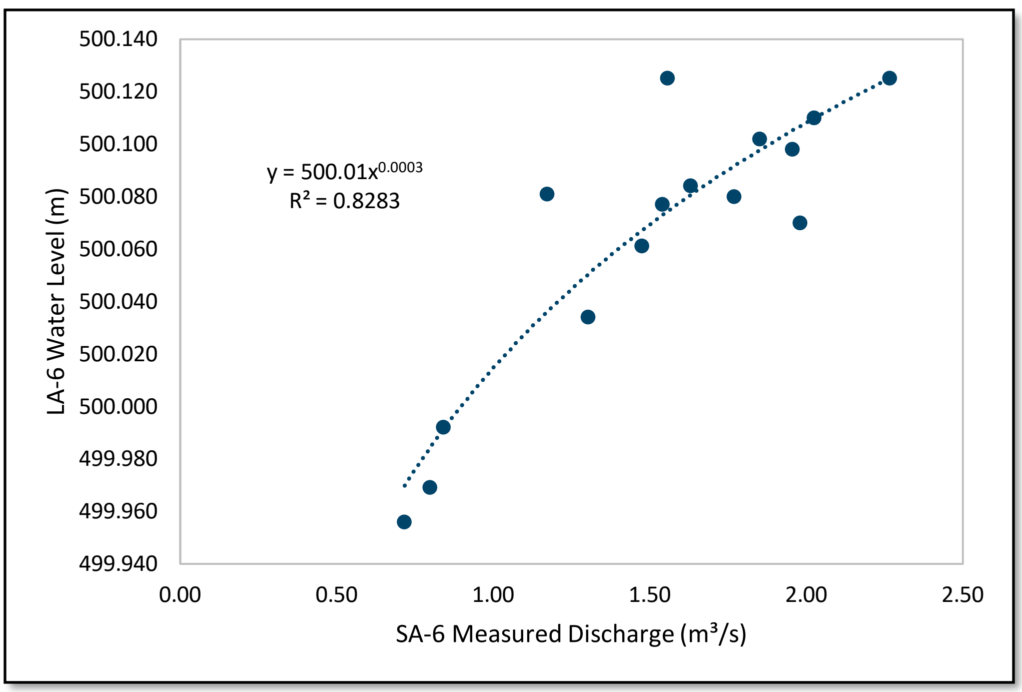


FIGURE 4-3: LA-6 STAGE-OUTFLOW RATING CURVE



5. RESULTS AND DISCUSSIONS

5.1. Assessment Results for Impact Scenarios

The three scenarios identified in Table 4-3 were assessed for their respective impact(s). The change to monthly and annual streamflow rates are projected based on those impacts for assessment nodes SA-1, SA-2, SA-6/LA-6, LA-1, LA-5 and SB-3. The change in flow rates were assessed for the mean and 5th percentile low flow statistics; these statistics are selected as being most representative of potential effects given the relatively small withdrawal/discharge rates with respect to baseline flow rates in the area. Further, the project is expected to have the greatest impact on baseline flow rates during very low flow conditions of which have not been observed in the measured record. The results of Scenarios 1, 2 and 3 are presented in Table 5-1, Table 5-2 and Table 5-3, respectively.

The largest estimated percentage change in flow through all scenarios is -3.10%. This magnitude of change occurs in Scenario 2 (water withdrawal during Operations and Decommissioning) for the month of March under the 5th percentile low flow data at assessment node LA-5 and SA-2 (immediately downstream of the Project). Under Scenario 3 (effluent discharge during Operations and Decommissioning), the largest estimated percentage change is 2.54% also occurring at LA-5/SA-2 during March of the 5th percentile low flow data set. The maximum observed change for any assessment node during Construction (Scenario 1) is less than 1%.

TABLE 5-1: SCENARIO 1 – CONSTRUCTION PHASE – EFFECTS RESULTS

Station	Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Monthly Average
SA-1	Baseline Scenario Average (m^3/s)	1.589	1.518	1.474	1.692	2.398	2.382	2.100	1.888	1.820	1.884	1.823	1.659	1.852
	Impacted Scenario Average (m^3/s)	1.585	1.514	1.470	1.688	2.392	2.376	2.095	1.884	1.815	1.879	1.819	1.655	1.848
	Percentage Change to Average Condition Flow (%)	**-0.24**	**-0.24**	**-0.23**	**-0.24**	**-0.26**	**-0.27**	**-0.26**	**-0.25**	**-0.25**	**-0.25**	**-0.25**	**-0.24**	**-0.25**
	Baseline Scenario 5th Percentile (m^3/s)	1.067	0.982	0.900	1.211	1.786	1.469	1.273	1.093	0.984	0.986	1.075	1.065	1.158
	Impacted Scenario 5th Percentile (m^3/s)	1.064	0.980	0.898	1.208	1.782	1.466	1.270	1.091	0.982	0.984	1.072	1.062	1.155
	Percentage Change to 5th Percentile Condition Flow (%)	**-0.23**	**-0.23**	**-0.23**	**-0.22**	**-0.23**	**-0.23**	**-0.22**	**-0.23**	**-0.23**	**-0.23**	**-0.23**	**-0.23**	**-0.23**
SA-2	Baseline Scenario Average (m^3/s)	1.147	1.089	1.040	1.221	1.972	1.972	1.658	1.442	1.394	1.463	1.376	1.199	1.414
	Impacted Scenario Average (m^3/s)	1.143	1.085	1.036	1.217	1.966	1.966	1.653	1.437	1.389	1.459	1.371	1.195	1.410
	Percentage Change to Average Condition Flow (%)	**-0.33**	**-0.33**	**-0.33**	**-0.33**	**-0.32**	**-0.32**	**-0.32**	**-0.32**	**-0.33**	**-0.32**	**-0.33**	**-0.33**	**-0.33**
	Baseline Scenario 5th Percentile (m^3/s)	0.712	0.660	0.613	0.810	1.278	1.008	0.852	0.734	0.663	0.663	0.716	0.710	0.785
	Impacted Scenario 5th Percentile (m^3/s)	0.710	0.657	0.611	0.807	1.274	1.004	0.849	0.732	0.661	0.661	0.714	0.708	0.782
	Percentage Change to 5th Percentile Condition Flow (%)	**-0.34**	**-0.34**	**-0.34**	**-0.34**	**-0.33**	**-0.33**	**-0.33**	**-0.34**	**-0.34**	**-0.34**	**-0.34**	**-0.34**	**-0.34**
SA-6/LA-6	Baseline Scenario Average (m^3/s)	1.129	1.075	1.029	1.199	1.900	1.900	1.607	1.405	1.360	1.425	1.343	1.178	1.379
	Impacted Scenario Average (m^3/s)	1.128	1.074	1.028	1.197	1.898	1.898	1.605	1.403	1.359	1.424	1.342	1.177	1.378
	Percentage Change to Average Condition Flow (%)	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**
	Baseline Scenario 5th Percentile (m^3/s)	0.724	0.675	0.631	0.814	1.252	0.999	0.854	0.744	0.678	0.677	0.728	0.722	0.791
	Impacted Scenario 5th Percentile (m^3/s)	0.723	0.674	0.630	0.814	1.251	0.998	0.853	0.743	0.677	0.677	0.727	0.721	0.791
	Percentage Change to 5th Percentile Condition Flow (%)	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**
LA-1	Baseline Scenario Average (m^3/s)	1.572	1.502	1.458	1.674	2.372	2.356	2.078	1.868	1.800	1.863	1.803	1.641	1.832
	Impacted Scenario Average (m^3/s)	1.568	1.498	1.455	1.670	2.366	2.350	2.072	1.863	1.795	1.859	1.799	1.637	1.828
	Percentage Change to Average Condition Flow (%)	**-0.24**	**-0.24**	**-0.24**	**-0.24**	**-0.27**	**-0.27**	**-0.26**	**-0.25**	**-0.25**	**-0.25**	**-0.25**	**-0.24**	**-0.25**
	Baseline Scenario 5th Percentile (m^3/s)	1.055	0.971	0.890	1.198	1.767	1.453	1.260	1.082	0.974	0.975	1.063	1.053	1.145
	Impacted Scenario 5th Percentile (m^3/s)	1.053	0.969	0.888	1.195	1.763	1.450	1.257	1.079	0.972	0.973	1.061	1.051	1.142
	Percentage Change to 5th Percentile Condition Flow (%)	**-0.23**	**-0.23**	**-0.24**	**-0.23**	**-0.24**	**-0.23**	**-0.23**	**-0.23**	**-0.23**	**-0.23**	**-0.23**	**-0.23**	**-0.23**
LA-5	Baseline Scenario Average (m^3/s)	1.146	1.088	1.039	1.220	1.971	1.971	1.657	1.441	1.393	1.462	1.375	1.198	1.413

Station	Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Monthly Average
	Impacted Scenario Average (m³/s)	1.142	1.085	1.036	1.216	1.964	1.964	1.652	1.436	1.388	1.458	1.370	1.194	1.409
	Percentage Change to Average Condition Flow (%)	**-0.33**	**-0.33**	**-0.33**	**-0.33**	**-0.32**	**-0.32**	**-0.32**	**-0.33**	**-0.33**	**-0.32**	**-0.33**	**-0.33**	**-0.33**
	Baseline Scenario 5th Percentile (m³/s)	0.712	0.659	0.612	0.809	1.277	1.007	0.851	0.734	0.663	0.662	0.716	0.710	0.784
	Impacted Scenario 5th Percentile (m³/s)	0.709	0.657	0.610	0.806	1.273	1.004	0.849	0.731	0.660	0.660	0.714	0.707	0.782
	Percentage Change to 5th Percentile Condition Flow (%)	**-0.34**	**-0.34**	**-0.34**	**-0.34**	**-0.33**	**-0.33**	**-0.33**	**-0.34**	**-0.34**	**-0.34**	**-0.34**	**-0.34**	**-0.34**
SB-3	Baseline Scenario Average (m³/s)	0.141	0.135	0.131	0.150	0.213	0.211	0.186	0.167	0.161	0.167	0.162	0.147	0.164
	Impacted Scenario Average (m³/s)	0.140	0.133	0.130	0.149	0.211	0.209	0.185	0.166	0.160	0.166	0.160	0.146	0.163
	Percentage Change to Average Condition Flow (%)	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**
	Baseline Scenario 5th Percentile (m³/s)	0.095	0.087	0.080	0.107	0.158	0.130	0.113	0.097	0.087	0.087	0.095	0.094	0.103
	Impacted Scenario 5th Percentile (m³/s)	0.094	0.086	0.079	0.106	0.157	0.129	0.112	0.096	0.087	0.087	0.094	0.094	0.102
	Percentage Change to 5th Percentile Condition Flow (%)	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**

TABLE 5-2: SCENARIO 2 - OPERATIONS AND DECOMMISSIONING PHASE - WATER WITHDRAWAL - EFFECTS RESULTS

Station	Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Monthly Average
SA-1	Baseline Scenario Average (m³/s)	1.589	1.518	1.474	1.692	2.398	2.382	2.100	1.888	1.820	1.884	1.823	1.659	1.852
	Impacted Scenario Average (m³/s)	1.568	1.497	1.454	1.671	2.375	2.359	2.078	1.867	1.798	1.862	1.802	1.638	1.831
	Percentage Change to Average Condition Flow (%)	**-1.30**	**-1.35**	**-1.38**	**-1.23**	**-0.97**	**-0.97**	**-1.06**	**-1.14**	**-1.18**	**-1.15**	**-1.17**	**-1.25**	**-1.16**
	Baseline Scenario 5th Percentile (m³/s)	1.067	0.982	0.900	1.211	1.786	1.469	1.273	1.093	0.984	0.986	1.075	1.065	1.158
	Impacted Scenario 5th Percentile (m³/s)	1.047	0.963	0.881	1.191	1.765	1.449	1.254	1.074	0.965	0.967	1.055	1.046	1.138
	Percentage Change to 5th Percentile Condition Flow (%)	**-1.81**	**-1.95**	**-2.11**	**-1.62**	**-1.18**	**-1.38**	**-1.55**	**-1.77**	**-1.94**	**-1.94**	**-1.80**	**-1.81**	**-1.69**
SA-2	Baseline Scenario Average (m³/s)	1.147	1.089	1.040	1.221	1.972	1.972	1.658	1.442	1.394	1.463	1.376	1.199	1.414
	Impacted Scenario Average (m³/s)	1.126	1.068	1.019	1.200	1.949	1.949	1.636	1.420	1.372	1.442	1.355	1.178	1.393
	Percentage Change to Average Condition Flow (%)	**-1.80**	**-1.88**	**-1.95**	**-1.71**	**-1.18**	**-1.18**	**-1.34**	**-1.50**	**-1.54**	**-1.48**	**-1.55**	**-1.74**	**-1.52**
	Baseline Scenario 5th Percentile (m³/s)	0.712	0.660	0.613	0.810	1.278	1.008	0.852	0.734	0.663	0.663	0.716	0.710	0.785
	Impacted Scenario 5th Percentile (m³/s)	0.693	0.641	0.594	0.790	1.257	0.987	0.832	0.715	0.644	0.644	0.697	0.691	0.765

Station	Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Monthly Average
	Percentage Change to 5th Percentile Condition Flow (%)	**-2.71**	**-2.90**	**-3.10**	**-2.42**	**-1.65**	**-2.01**	**-2.32**	**-2.64**	**-2.89**	**-2.89**	**-2.69**	**-2.72**	**-2.49**
SA-6/LA-6	Baseline Scenario Average (m^3/s)	1.129	1.075	1.029	1.199	1.900	1.900	1.607	1.405	1.360	1.425	1.343	1.178	1.379
	Impacted Scenario Average (m^3/s)	1.128	1.074	1.028	1.197	1.898	1.898	1.605	1.403	1.359	1.424	1.342	1.177	1.378
	Percentage Change to Average Condition Flow (%)	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**
	Baseline Scenario 5th Percentile (m^3/s)	0.724	0.675	0.631	0.814	1.252	0.999	0.854	0.744	0.678	0.677	0.728	0.722	0.791
	Impacted Scenario 5th Percentile (m^3/s)	0.723	0.674	0.630	0.814	1.251	0.998	0.853	0.743	0.677	0.677	0.727	0.721	0.791
	Percentage Change to 5th Percentile Condition Flow (%)	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**
LA-1	Baseline Scenario Average (m^3/s)	1.572	1.502	1.458	1.674	2.372	2.356	2.078	1.868	1.800	1.863	1.803	1.641	1.832
	Impacted Scenario Average (m^3/s)	1.551	1.481	1.438	1.653	2.349	2.333	2.055	1.846	1.779	1.842	1.782	1.620	1.811
	Percentage Change to Average Condition Flow (%)	**-1.31**	**-1.36**	**-1.39**	**-1.25**	**-0.98**	**-0.99**	**-1.07**	**-1.15**	**-1.19**	**-1.16**	**-1.18**	**-1.27**	**-1.17**
	Baseline Scenario 5th Percentile (m^3/s)	1.055	0.971	0.890	1.198	1.767	1.453	1.260	1.082	0.974	0.975	1.063	1.053	1.145
	Impacted Scenario 5th Percentile (m^3/s)	1.036	0.952	0.871	1.178	1.746	1.433	1.240	1.062	0.955	0.956	1.044	1.034	1.126
	Percentage Change to 5th Percentile Condition Flow (%)	**-1.83**	**-1.97**	**-2.13**	**-1.64**	**-1.19**	**-1.39**	**-1.57**	**-1.79**	**-1.97**	**-1.96**	**-1.82**	**-1.83**	**-1.70**
LA-5	Baseline Scenario Average (m^3/s)	1.456	1.391	1.351	1.551	2.198	2.184	1.925	1.731	1.668	1.727	1.671	1.521	1.698
	Impacted Scenario Average (m^3/s)	1.436	1.371	1.331	1.530	2.175	2.160	1.903	1.710	1.647	1.705	1.650	1.500	1.676
	Percentage Change to Average Condition Flow (%)	**-1.42**	**-1.47**	**-1.50**	**-1.35**	**-1.06**	**-1.06**	**-1.15**	**-1.25**	**-1.28**	**-1.25**	**-1.28**	**-1.37**	**-1.26**
	Baseline Scenario 5th Percentile (m^3/s)	0.978	0.900	0.825	1.110	1.638	1.347	1.167	1.002	0.902	0.904	0.985	0.976	1.061
	Impacted Scenario 5th Percentile (m^3/s)	0.958	0.881	0.806	1.090	1.617	1.326	1.147	0.983	0.883	0.885	0.966	0.957	1.042
	Percentage Change to 5th Percentile Condition Flow (%)	**-1.97**	**-2.12**	**-2.30**	**-1.77**	**-1.29**	**-1.50**	**-1.69**	**-1.93**	**-2.12**	**-2.12**	**-1.96**	**-1.98**	**-1.84**
SB-3	Baseline Scenario Average (m^3/s)	0.141	0.135	0.131	0.150	0.213	0.211	0.186	0.167	0.161	0.167	0.162	0.147	0.164
	Impacted Scenario Average (m^3/s)	0.140	0.133	0.130	0.149	0.211	0.209	0.185	0.166	0.160	0.166	0.160	0.146	0.163
	Percentage Change to Average Condition Flow (%)	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**
	Baseline Scenario 5th Percentile (m^3/s)	0.095	0.087	0.080	0.107	0.158	0.130	0.113	0.097	0.087	0.087	0.095	0.094	0.103
	Impacted Scenario 5th Percentile (m^3/s)	0.094	0.086	0.079	0.106	0.157	0.129	0.112	0.096	0.087	0.087	0.094	0.094	0.102
	Percentage Change to 5th Percentile Condition Flow (%)	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**

TABLE 5-3: SCENARIO 3 - OPERATIONS AND DECOMMISSIONING PHASE – EFFLUENT DISCHARGE - EFFECTS RESULTS

Station	Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Monthly Average
SA-1	Baseline Scenario Average (m^3/s)	1.589	1.518	1.474	1.692	2.398	2.382	2.100	1.888	1.820	1.884	1.823	1.659	1.852
	Impacted Scenario Average (m^3/s)	1.603	1.532	1.488	1.706	2.409	2.393	2.113	1.901	1.833	1.897	1.836	1.673	1.865
	Percentage Change to Average Condition Flow (%)	**0.88**	**0.93**	**0.97**	**0.81**	**0.47**	**0.48**	**0.59**	**0.69**	**0.72**	**0.69**	**0.72**	**0.83**	**0.71**
	Baseline Scenario 5th Percentile (m^3/s)	1.067	0.982	0.900	1.211	1.786	1.469	1.273	1.093	0.984	0.986	1.075	1.065	1.158
	Impacted Scenario 5th Percentile (m^3/s)	1.082	0.997	0.915	1.226	1.800	1.483	1.288	1.109	1.000	1.001	1.090	1.080	1.173
	Percentage Change to 5th Percentile Condition Flow (%)	**1.43**	**1.57**	**1.73**	**1.24**	**0.76**	**0.98**	**1.16**	**1.39**	**1.57**	**1.56**	**1.42**	**1.43**	**1.30**
SA-2	Baseline Scenario Average (m^3/s)	1.147	1.089	1.040	1.221	1.972	1.972	1.658	1.442	1.394	1.463	1.376	1.199	1.414
	Impacted Scenario Average (m^3/s)	1.160	1.103	1.054	1.235	1.983	1.983	1.670	1.455	1.407	1.476	1.389	1.213	1.427
	Percentage Change to Average Condition Flow (%)	**1.21**	**1.29**	**1.37**	**1.12**	**0.57**	**0.57**	**0.74**	**0.90**	**0.94**	**0.88**	**0.96**	**1.15**	**0.92**
	Baseline Scenario 5th Percentile (m^3/s)	0.712	0.660	0.613	0.810	1.278	1.008	0.852	0.734	0.663	0.663	0.716	0.710	0.785
	Impacted Scenario 5th Percentile (m^3/s)	0.727	0.675	0.628	0.824	1.292	1.022	0.867	0.749	0.679	0.678	0.732	0.725	0.800
	Percentage Change to 5th Percentile Condition Flow (%)	**2.14**	**2.34**	**2.54**	**1.85**	**1.06**	**1.42**	**1.74**	**2.07**	**2.32**	**2.33**	**2.13**	**2.15**	**1.92**
SA-6/LA-6	Baseline Scenario Average (m^3/s)	1.129	1.075	1.029	1.199	1.900	1.900	1.607	1.405	1.360	1.425	1.343	1.178	1.379
	Impacted Scenario Average (m^3/s)	1.128	1.074	1.028	1.197	1.898	1.898	1.605	1.403	1.359	1.424	1.342	1.177	1.378
	Percentage Change to Average Condition Flow (%)	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**
	Baseline Scenario 5th Percentile (m^3/s)	0.724	0.675	0.631	0.814	1.252	0.999	0.854	0.744	0.678	0.677	0.728	0.722	0.791
	Impacted Scenario 5th Percentile (m^3/s)	0.723	0.674	0.630	0.814	1.251	0.998	0.853	0.743	0.677	0.677	0.727	0.721	0.791
	Percentage Change to 5th Percentile Condition Flow (%)	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**	**-0.11**
LA-1	Baseline Scenario Average (m^3/s)	1.572	1.502	1.458	1.674	2.372	2.356	2.078	1.868	1.800	1.863	1.803	1.641	1.832
	Impacted Scenario Average (m^3/s)	1.586	1.516	1.472	1.687	2.383	2.368	2.090	1.881	1.813	1.876	1.817	1.655	1.845
	Percentage Change to Average Condition Flow (%)	**0.88**	**0.94**	**0.98**	**0.82**	**0.48**	**0.48**	**0.59**	**0.70**	**0.73**	**0.69**	**0.73**	**0.84**	**0.71**
	Baseline Scenario 5th Percentile (m^3/s)	1.055	0.971	0.890	1.198	1.767	1.453	1.260	1.082	0.974	0.975	1.063	1.053	1.145
	Impacted Scenario 5th Percentile (m^3/s)	1.070	0.987	0.906	1.213	1.781	1.467	1.274	1.097	0.989	0.991	1.078	1.069	1.160
	Percentage Change to 5th Percentile Condition Flow (%)	**1.45**	**1.59**	**1.75**	**1.25**	**0.76**	**0.99**	**1.18**	**1.40**	**1.58**	**1.58**	**1.43**	**1.45**	**1.31**
LA-5	Baseline Scenario Average (m^3/s)	1.456	1.391	1.351	1.551	2.198	2.184	1.925	1.731	1.668	1.727	1.671	1.521	1.698

Station	Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Monthly Average
	Impacted Scenario Average (m³/s)	1.470	1.406	1.365	1.565	2.209	2.195	1.938	1.744	1.681	1.740	1.684	1.535	1.711
	Percentage Change to Average Condition Flow (%)	**0.95**	**1.01**	**1.05**	**0.88**	**0.52**	**0.52**	**0.64**	**0.75**	**0.79**	**0.75**	**0.79**	**0.90**	**0.77**
	Baseline Scenario 5th Percentile (m³/s)	0.978	0.900	0.825	1.110	1.638	1.347	1.167	1.002	0.902	0.904	0.985	0.976	1.061
	Impacted Scenario 5th Percentile (m³/s)	0.993	0.916	0.840	1.125	1.651	1.361	1.182	1.018	0.918	0.919	1.000	0.991	1.076
	Percentage Change to 5th Percentile Condition Flow (%)	**1.56**	**1.71**	**1.89**	**1.35**	**0.82**	**1.06**	**1.27**	**1.52**	**1.71**	**1.71**	**1.55**	**1.56**	**1.42**
SB-3	Baseline Scenario Average (m³/s)	0.141	0.135	0.131	0.150	0.213	0.211	0.186	0.167	0.161	0.167	0.162	0.147	0.164
SB-3	Impacted Scenario Average (m³/s)	0.140	0.133	0.130	0.149	0.211	0.209	0.185	0.166	0.160	0.166	0.160	0.146	0.163
SB-3	Percentage Change to Average Condition Flow (%)	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**
SB-3	Baseline Scenario 5th Percentile (m³/s)	0.095	0.087	0.080	0.107	0.158	0.130	0.113	0.097	0.087	0.087	0.095	0.094	0.103
SB-3	Impacted Scenario 5th Percentile (m³/s)	0.094	0.086	0.079	0.106	0.157	0.129	0.112	0.096	0.087	0.087	0.094	0.094	0.102
SB-3	Percentage Change to 5th Percentile Condition Flow (%)	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**

5.2. Estimated Changes to Water Levels in LA-1, LA-5 and LA-6

Using the stage-outflow curves presented in Section 4.3, the potential change in water level in each of LA-1 (McGowan Lake), LA-5 (Whitefish Lake), and LA-6 (Unnamed Lake) can be estimated from the difference in flow rates between the baseline and impacted scenarios identified in Table 5-1, Table 5-2 and Table 5-3.

For LA-1, the largest predicted change in water level is -0.0037 m under average conditions for the months of May and June during withdrawal. For the discharge scenario, the maximum predicted change is 0.0025 m occurring in March using the 5th percentile dataset.

At LA-5, the largest predicted change in water level in a withdrawal scenario is -0.0041 m during March of the 5th percentile dataset. During a discharge scenario, the maximum predicted change is 0.0032 m in March of the 5th percentile dataset.

All expected water level effects to other lakes, including LA-6, within the vicinity of the Project are expected to have negligible effects with magnitudes also in the sub-centimeter range.

5.3. Effects Due to Climate Change

5.3.1. Climate Change Effects on Water Balance

As discussed in Section 3.3.1, climate change is projected to increase precipitation in the vicinity of the Project. Though this will result in an increase to runoff in the LSA, the potential implications to evaporative effects are unknown. Evaporation, being a function of air temperature, wind speed, relative humidity and radiation, may have a small increase given that air temperature may increase by as much as 6.2% (Table 3-4), though wind speed may similarly decrease by 2.6% in the same RCP scenario. Relative humidity is a representation of the ratio of actual to saturation vapour pressure and both are a function of temperature as well as vapour phase water in the air. Without a complete projected dataset for all parameters, as well as an accepted model, it is difficult to estimate the response of evaporation to these climatic influences.

NewFields has observed that augmenting the data in an existing dataset did not yield a consistent shift in evaporation which indicates the relationship to be dynamic. Any noted change between the datasets resulted in a change to evaporation rates of less than 5%. As such, given the small influence of evaporation and the variable range of predicted changes in precipitation and snow depth, the effects of climate change on the water balance are discussed qualitatively based on the four scenarios described in Section 3.3.1. The four projections for climate change scenarios are:

1. Mean precipitation static and increased evaporation – this projection would see an expectedly marginal decrease in flow rates from the area.
2. Increased precipitation and increased evaporation – this projection would at least partially cancel out with either increased or decreased flows in the area.
3. Mean precipitation static and decreased evaporation – this projection would result in increased flow rates from the Project.
4. Increased precipitation and decreased evaporation – this projection would also see increased flow rates from the Project.

Of the four potential climate change scenarios, only Projections 1 and 2 have the potential to result in a condition where flow rates decrease as a result of climate change. Any decrease in flow rates due to climate change would likely be marginal and not statistically detectable as a result of Projections 1 and 2. This is typically due to the already highly variable climate in Saskatchewan. Appreciable changes to the timing and magnitude of snow depth would have the potential to alter current flow rates, but are still unlikely to have substantial influence from the Project.

5.3.2. Climate Change Effects on Extreme Events

Extreme events are expected to change due to climate change. Qualitatively, climate change is expected to increase the frequency and magnitude of such events. Though the potential maximum PMP is not expected to increase as it is limited by the persistent dew point, the magnitude of the 1:100-year, 24-hour storm is expected to increase from 77.9 mm to 88.6 mm (approximately 10%). This may require consideration for greater storage and conveyance capacity for Project water management infrastructure.

5.4. Discussion

The low potential water withdrawal and discharge magnitudes proposed by Denison for the Project result in negligible impacts to the receiving environment within the LSA. The RSA is not assessed due to the much larger drainage area at the outlet of Russell Lake and greater attenuation of the signal of expected effects. All projected influences on streamflow from the Project are within +/- 5% of baseline conditions on a monthly average basis with the largest influence occurring during withdrawal at a magnitude of -3.1%. Lake levels are anticipated to have a similarly negligible impact with expected changes to water levels of LA-1 and LA-5 being less than 0.01 m.

Confidence in the assessment of projected effects to hydrology is quite high due to available hydrological data for the LSA. Uncertainty is minimal with the assumptions that water withdrawal and discharge scenarios presented herein represent the bounding case and hydrogeological modelling projections are not changed.

6. LIMITATIONS

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NewFields would like to thank EcoMetrix for the support its personnel provided during this review. We trust that this information meets your needs at this time. Should any portion of this report require further information or clarification, please do not hesitate to contact the undersigned.

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APPENDIX I

MONTHLY AVERAGE FLOW RECORDS

Table I-1: Wheeler River (06DA005) Monthly Average Discharge (m³/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean Annual
1977	26.85	25.68	20.95	23.67	30.77	35.45	35.14	30.18	29.38	26.91	23.90	22.52	27.62
1978	24.54	23.85	21.91	19.66	27.28	29.65	24.87	25.65	29.82	30.76	27.21	24.49	25.81
1979	27.19	28.08	24.72	21.03	25.32	27.72	25.21	24.50	23.13	23.87	24.56	21.64	24.75
1980	17.99	14.74	13.79	14.05	19.29	17.16	14.35	14.83	15.40	18.95	18.31	16.61	16.29
1981	16.66	17.39	17.14	17.79	24.88	21.32	15.77	11.36	8.93	9.44	11.09	11.46	15.27
1982	10.00	8.53	8.30	10.34	22.24	25.48	21.32	22.96	21.83	18.65	17.02	17.40	17.01
1983	16.88	15.88	15.54	17.10	20.79	25.52	20.31	16.90	18.04	19.35	19.79	18.42	18.71
1984	16.07	15.88	16.75	20.28	22.67	21.44	16.77	13.80	11.96	13.30	15.17	14.95	16.59
1985	15.06	14.79	15.43	16.55	28.95	25.36	22.95	18.78	17.68	16.74	17.16	16.02	18.79
1986	16.07	16.33	16.22	16.54	25.29	24.06	23.44	21.59	17.29	16.79	16.06	15.06	18.73
1987	14.73	14.79	15.08	19.02	22.84	18.04	12.43	9.90	10.14	9.57	10.48	10.15	13.93
1988	10.99	11.24	12.28	13.42	19.26	22.43	20.39	16.36	15.74	15.21	15.14	14.77	15.60
1989	15.16	15.97	15.16	14.59	23.81	24.89	22.93	17.99	16.15	15.29	14.52	14.46	17.58
1990	14.37	14.29	14.26	14.55	19.10	19.42	19.41	14.43	12.28	12.89	13.96	13.84	15.23
1991	12.95	12.84	13.02	15.17	21.78	23.45	20.47	16.26	15.78	15.50	14.55	14.36	16.34
1992	13.48	13.28	13.40	14.76	22.97	20.37	16.79	14.49	15.63	20.74	16.47	14.31	16.39
1993	13.23	12.73	12.25	15.11	16.98	13.24	12.57	18.13	17.25	15.58	15.39	13.89	14.70
1994	13.04	12.29	13.29	16.07	25.82	27.21	22.48	15.32	10.96	10.81	10.43	10.29	15.67
1995	10.29	10.03	10.73	14.25	18.46	21.25	15.95	19.67	20.76	18.33	17.68	14.25	15.97
1996	11.59	10.90	10.81	13.20	18.56	20.68	20.15	18.06	16.31	16.03	15.84	14.56	15.56
1997	13.91	13.43	13.09	14.22	20.21	21.55	18.95	20.27	25.82	35.77	30.68	23.46	20.95
1998	19.92	19.19	18.56	19.73	20.05	15.46	14.59	12.80	10.23	11.88	12.15	11.71	15.52
1999	11.15	9.72	8.37	13.32	18.99	16.37	14.13	14.03	11.53	10.80	11.57	10.76	12.56
2000	10.07	9.61	9.65	11.61	19.85	20.64	16.37	13.85	12.61	15.51	14.43	11.90	13.84
2001	11.14	10.16	10.47	12.79	18.30	16.54	14.94	12.41	14.10	15.75	14.35	13.61	13.71
2002	12.57	12.03	11.59	11.89	16.12	14.98	16.31	23.07	22.80	20.64	19.17	17.73	16.57
2003	15.41	12.52	10.76	14.62	23.22	21.17	20.30	16.85	16.36	19.20	20.18	17.91	17.38
2004	16.36	15.88	16.00	15.52	16.92	22.45	18.68	14.07	14.00	14.07	14.15	13.48	15.97
2005	12.97	12.63	12.28	17.62	24.35	21.17	18.53	24.70	24.18	24.26	23.18	21.14	19.75
2006	19.55	18.63	18.19	18.63	21.59	22.88	17.89	16.97	13.45	12.49	12.51	12.33	17.09
2007	11.84	11.40	11.21	16.12	25.72	19.05	13.78	12.42	14.17	19.52	20.11	17.14	16.04
2008	14.37	13.74	13.49	15.01	21.67	21.30	20.56	16.42	15.38	15.96	13.42	11.49	16.07
2009	10.49	9.98	9.84	15.28	23.46	25.05	28.16	25.00	23.69	21.68	19.51	17.06	19.10
2010	14.89	13.75	13.19	17.79	19.62	17.13	10.60	10.01	15.57	17.14	16.04	14.36	15.01
2011	13.67	12.57	11.87	12.91	18.11	14.68	14.25	13.29	10.13	8.26	8.46	9.67	12.32
2012	10.02	10.26	10.70	14.61	21.47	20.34	20.22	15.85	18.09	18.40	19.27	15.39	16.22
2013	13.71	11.80	11.06	12.41	19.34	20.43	17.82	12.82	10.33	9.26	10.02	9.97	13.25
2014	9.48	9.17	9.12	11.20	20.24	27.43	21.66	14.91	10.29	11.05	11.77	11.07	13.95
2015	11.19	11.18	10.52	13.45	15.35	13.06	11.68	11.15	11.11	11.70	12.36	10.89	11.97
2016	10.17	9.75	9.81	12.20	17.77	19.48	21.09	19.44	19.33	22.90	23.93	18.98	17.07
2017	16.22	15.71	15.11	16.99	20.89	20.12	15.70	11.21	9.06	12.97	16.54	17.45	15.66
2018	13.36	10.90	11.52	13.26	24.67	22.54	21.87	20.53	18.64	18.13	16.96	15.73	17.34
2019	15.88	15.49	15.37	15.94	18.43	19.30	22.42	22.86	24.85	21.73			19.23

Table I-2: SA-1 Monthly Average Discharge (m³/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean Annual
1977	3.035	2.895	2.334	2.659	3.507	4.075	4.037	3.436	3.340	3.042	2.683	2.519	3.130
1978	2.759	2.678	2.446	2.182	3.088	3.372	2.799	2.892	3.393	3.505	3.078	2.753	2.912
1979	3.076	3.182	2.782	2.342	2.855	3.140	2.839	2.755	2.592	2.680	2.761	2.414	2.785
1980	1.986	1.607	1.498	1.529	2.138	1.888	1.562	1.618	1.685	2.098	2.023	1.824	1.788
1981	1.830	1.916	1.886	1.962	2.801	2.377	1.728	1.220	0.945	1.002	1.189	1.231	1.674
1982	1.066	0.901	0.875	1.106	2.486	2.872	2.377	2.572	2.438	2.063	1.872	1.917	1.879
1983	1.856	1.739	1.700	1.882	2.314	2.877	2.258	1.859	1.992	2.144	2.197	2.035	2.071
1984	1.762	1.739	1.841	2.256	2.537	2.391	1.843	1.499	1.288	1.442	1.657	1.632	1.824
1985	1.645	1.613	1.687	1.818	3.288	2.858	2.571	2.079	1.949	1.839	1.888	1.756	2.083
1986	1.762	1.792	1.779	1.816	2.850	2.702	2.629	2.409	1.903	1.845	1.761	1.645	2.075
1987	1.606	1.613	1.647	2.110	2.558	1.992	1.343	1.054	1.081	1.017	1.119	1.082	1.518
1988	1.177	1.206	1.325	1.455	2.135	2.509	2.267	1.796	1.724	1.662	1.654	1.611	1.710
1989	1.657	1.750	1.657	1.590	2.675	2.801	2.568	1.987	1.771	1.671	1.582	1.576	1.940
1990	1.565	1.556	1.552	1.586	2.116	2.153	2.152	1.572	1.325	1.394	1.517	1.504	1.666
1991	1.401	1.389	1.409	1.657	2.433	2.630	2.277	1.785	1.728	1.696	1.586	1.564	1.796
1992	1.462	1.439	1.453	1.610	2.573	2.266	1.846	1.579	1.712	2.309	1.808	1.557	1.801
1993	1.433	1.376	1.322	1.651	1.868	1.436	1.359	2.003	1.899	1.705	1.683	1.509	1.604
1994	1.412	1.325	1.440	1.762	2.915	3.078	2.514	1.676	1.174	1.157	1.114	1.098	1.722
1995	1.098	1.069	1.149	1.551	2.041	2.369	1.748	2.184	2.311	2.025	1.949	1.551	1.754
1996	1.246	1.167	1.158	1.430	2.053	2.302	2.239	1.994	1.790	1.757	1.735	1.587	1.705
1997	1.512	1.456	1.417	1.547	2.246	2.404	2.099	2.253	2.914	4.114	3.497	2.631	2.341
1998	2.212	2.126	2.052	2.189	2.227	1.692	1.591	1.384	1.092	1.279	1.309	1.259	1.701
1999	1.195	1.034	0.883	1.445	2.103	1.797	1.537	1.526	1.239	1.157	1.244	1.152	1.359
2000	1.074	1.021	1.026	1.249	2.204	2.297	1.796	1.505	1.363	1.697	1.572	1.281	1.507
2001	1.195	1.083	1.118	1.384	2.023	1.816	1.631	1.340	1.534	1.725	1.563	1.477	1.491
2002	1.358	1.296	1.246	1.280	1.768	1.636	1.791	2.584	2.552	2.296	2.124	1.955	1.824
2003	1.685	1.352	1.152	1.597	2.603	2.359	2.257	1.853	1.796	2.128	2.243	1.976	1.917
2004	1.795	1.740	1.753	1.697	1.861	2.511	2.067	1.531	1.523	1.531	1.539	1.462	1.751
2005	1.404	1.365	1.325	1.945	2.737	2.360	2.050	2.778	2.716	2.726	2.597	2.356	2.197
2006	2.169	2.060	2.009	2.060	2.409	2.562	1.974	1.867	1.459	1.349	1.351	1.331	1.883
2007	1.274	1.225	1.203	1.770	2.900	2.110	1.497	1.341	1.543	2.165	2.234	1.886	1.762
2008	1.565	1.492	1.463	1.640	2.419	2.375	2.287	1.803	1.682	1.749	1.455	1.235	1.764
2009	1.121	1.064	1.047	1.671	2.632	2.820	3.192	2.814	2.658	2.419	2.164	1.877	2.123
2010	1.625	1.493	1.429	1.963	2.177	1.887	1.133	1.068	1.704	1.886	1.758	1.564	1.641
2011	1.484	1.358	1.278	1.397	2.000	1.602	1.551	1.441	1.080	0.870	0.893	1.028	1.332
2012	1.068	1.095	1.144	1.593	2.395	2.262	2.248	1.736	1.997	2.033	2.136	1.683	1.783
2013	1.488	1.270	1.186	1.340	2.145	2.272	1.967	1.386	1.104	0.982	1.068	1.062	1.439
2014	1.007	0.972	0.966	1.201	2.252	3.105	2.417	1.628	1.098	1.185	1.266	1.186	1.524
2015	1.200	1.199	1.125	1.459	1.679	1.414	1.256	1.196	1.191	1.258	1.333	1.167	1.290
2016	1.085	1.037	1.045	1.316	1.960	2.160	2.350	2.155	2.142	2.565	2.686	2.102	1.884
2017	1.779	1.720	1.650	1.869	2.327	2.236	1.719	1.203	0.960	1.405	1.816	1.923	1.717
2018	1.449	1.167	1.238	1.438	2.775	2.522	2.442	2.284	2.062	2.001	1.866	1.722	1.914
2019	1.740	1.695	1.681	1.746	2.037	2.140	2.507	2.560	2.797	2.425			

Table I-3: SA-2 Monthly Average Discharge (m³/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean Annual
1977	2.777	2.576	1.855	2.312	3.532	4.554	4.485	3.410	3.247	2.792	2.285	2.073	2.992
1978	2.388	2.284	1.985	1.676	2.865	3.305	2.454	2.585	3.346	3.523	2.850	2.379	2.637
1979	2.840	2.999	2.446	1.860	2.572	2.937	2.497	2.384	2.167	2.282	2.392	1.947	2.444
1980	1.476	1.115	1.022	1.054	1.629	1.374	1.075	1.124	1.183	1.585	1.508	1.309	1.288
1981	1.314	1.398	1.368	1.444	2.456	1.911	1.230	0.815	0.638	0.673	0.792	0.821	1.238
1982	0.712	0.613	0.598	0.755	2.046	2.546	1.901	2.147	1.977	1.550	1.355	1.398	1.466
1983	1.340	1.230	1.195	1.369	1.826	2.561	1.768	1.346	1.482	1.635	1.693	1.521	1.580
1984	1.252	1.230	1.325	1.786	2.097	1.921	1.332	1.023	0.862	0.982	1.156	1.134	1.342
1985	1.145	1.118	1.182	1.309	3.201	2.525	2.151	1.569	1.431	1.323	1.371	1.245	1.631
1986	1.250	1.278	1.266	1.304	2.540	2.328	2.225	1.948	1.388	1.329	1.250	1.145	1.604
1987	1.111	1.117	1.147	1.660	2.137	1.485	0.905	0.705	0.721	0.681	0.745	0.721	1.095
1988	0.783	0.803	0.888	0.988	1.628	2.065	1.775	1.285	1.216	1.161	1.153	1.116	1.239
1989	1.156	1.239	1.156	1.098	2.337	2.451	2.141	1.478	1.260	1.170	1.091	1.086	1.472
1990	1.077	1.069	1.066	1.096	1.609	1.647	1.646	1.090	0.888	0.942	1.038	1.026	1.183
1991	0.945	0.935	0.951	1.163	1.980	2.216	1.788	1.284	1.220	1.191	1.095	1.076	1.320
1992	0.993	0.975	0.986	1.123	2.149	1.778	1.333	1.091	1.226	1.823	1.297	1.071	1.320
1993	0.970	0.926	0.885	1.154	1.352	0.981	0.917	1.495	1.386	1.199	1.179	1.031	1.123
1994	0.954	0.888	0.977	1.254	2.656	2.853	2.073	1.185	0.782	0.772	0.742	0.731	1.322
1995	0.731	0.713	0.771	1.065	1.534	1.893	1.239	1.711	1.824	1.509	1.431	1.069	1.291
1996	0.832	0.777	0.770	0.976	1.543	1.812	1.742	1.478	1.277	1.247	1.226	1.096	1.231
1997	1.033	0.988	0.958	1.067	1.752	1.932	1.588	1.758	2.652	4.632	3.522	2.229	2.009
1998	1.710	1.614	1.536	1.688	1.734	1.190	1.103	0.938	0.728	0.857	0.876	0.840	1.235
1999	0.796	0.692	0.603	0.991	1.592	1.289	1.055	1.048	0.826	0.771	0.830	0.767	0.938
2000	0.716	0.683	0.686	0.844	1.710	1.809	1.285	1.028	0.917	1.192	1.085	0.856	1.068
2001	0.795	0.722	0.745	0.938	1.513	1.307	1.135	0.902	1.058	1.218	1.075	1.004	1.034
2002	0.913	0.866	0.831	0.859	1.260	1.144	1.289	2.157	2.116	1.806	1.613	1.437	1.358
2003	1.182	0.909	0.766	1.144	2.182	1.881	1.762	1.338	1.286	1.619	1.745	1.459	1.440
2004	1.282	1.230	1.242	1.192	1.348	2.070	1.558	1.053	1.048	1.049	1.055	0.993	1.260
2005	0.947	0.917	0.888	1.462	2.357	1.890	1.552	2.414	2.331	2.342	2.174	1.877	1.763
2006	1.661	1.544	1.492	1.547	1.942	2.136	1.458	1.351	0.999	0.907	0.907	0.892	1.403
2007	0.851	0.816	0.801	1.298	2.586	1.613	1.025	0.900	1.072	1.659	1.734	1.375	1.311
2008	1.076	1.017	0.994	1.155	1.963	1.901	1.802	1.293	1.180	1.239	0.989	0.823	1.286
2009	0.746	0.709	0.699	1.192	2.238	2.471	3.017	2.465	2.254	1.951	1.658	1.361	1.730
2010	1.128	1.018	0.967	1.462	1.673	1.386	0.759	0.719	1.202	1.370	1.248	1.076	1.167
2011	1.011	0.912	0.854	0.946	1.486	1.115	1.068	0.978	0.723	0.596	0.609	0.688	0.915
2012	0.712	0.729	0.762	1.104	1.927	1.768	1.756	1.230	1.482	1.520	1.629	1.181	1.317
2013	1.015	0.848	0.790	0.902	1.649	1.779	1.463	0.934	0.739	0.660	0.712	0.708	1.017
2014	0.675	0.654	0.650	0.801	1.789	2.890	1.956	1.139	0.734	0.789	0.845	0.790	1.143
2015	0.799	0.798	0.748	0.996	1.177	0.956	0.839	0.797	0.794	0.840	0.894	0.777	0.868
2016	0.723	0.694	0.701	0.887	1.445	1.664	1.874	1.651	1.636	2.135	2.290	1.601	1.442
2017	1.267	1.212	1.152	1.352	1.846	1.746	1.220	0.803	0.649	0.959	1.302	1.407	1.243
2018	0.988	0.778	0.827	0.992	2.413	2.081	1.990	1.812	1.547	1.484	1.349	1.214	1.456
2019	1.230	1.189	1.177	1.239	1.521	1.636	2.065	2.139	2.439	1.960			

Table I-4: SA-3 Monthly Average Discharge (m³/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean Annual
1977	0.712	0.679	0.547	0.624	0.822	0.956	0.947	0.806	0.783	0.713	0.629	0.591	0.734
1978	0.647	0.628	0.574	0.512	0.724	0.791	0.656	0.678	0.796	0.822	0.722	0.646	0.683
1979	0.721	0.746	0.652	0.549	0.670	0.736	0.666	0.646	0.608	0.628	0.648	0.566	0.653
1980	0.466	0.377	0.351	0.358	0.501	0.443	0.366	0.380	0.395	0.492	0.474	0.428	0.419
1981	0.429	0.449	0.442	0.460	0.657	0.558	0.405	0.286	0.222	0.235	0.279	0.289	0.393
1982	0.250	0.211	0.205	0.259	0.583	0.673	0.558	0.603	0.572	0.484	0.439	0.449	0.441
1983	0.435	0.408	0.399	0.441	0.543	0.675	0.530	0.436	0.467	0.503	0.515	0.477	0.486
1984	0.413	0.408	0.432	0.529	0.595	0.561	0.432	0.352	0.302	0.338	0.389	0.383	0.428
1985	0.386	0.378	0.396	0.426	0.771	0.670	0.603	0.488	0.457	0.431	0.443	0.412	0.488
1986	0.413	0.420	0.417	0.426	0.668	0.634	0.617	0.565	0.446	0.433	0.413	0.386	0.487
1987	0.377	0.378	0.386	0.495	0.600	0.467	0.315	0.247	0.254	0.238	0.263	0.254	0.356
1988	0.276	0.283	0.311	0.341	0.501	0.588	0.532	0.421	0.404	0.390	0.388	0.378	0.401
1989	0.389	0.410	0.389	0.373	0.627	0.657	0.602	0.466	0.415	0.392	0.371	0.370	0.455
1990	0.367	0.365	0.364	0.372	0.496	0.505	0.505	0.369	0.311	0.327	0.356	0.353	0.391
1991	0.329	0.326	0.330	0.389	0.571	0.617	0.534	0.419	0.405	0.398	0.372	0.367	0.421
1992	0.343	0.337	0.341	0.378	0.604	0.531	0.433	0.370	0.401	0.541	0.424	0.365	0.422
1993	0.336	0.323	0.310	0.387	0.438	0.337	0.319	0.470	0.445	0.400	0.395	0.354	0.376
1994	0.331	0.311	0.338	0.413	0.684	0.722	0.590	0.393	0.275	0.271	0.261	0.258	0.404
1995	0.257	0.251	0.269	0.364	0.479	0.555	0.410	0.512	0.542	0.475	0.457	0.364	0.411
1996	0.292	0.274	0.271	0.335	0.481	0.540	0.525	0.468	0.420	0.412	0.407	0.372	0.400
1997	0.355	0.342	0.332	0.363	0.527	0.564	0.492	0.528	0.683	0.965	0.820	0.617	0.549
1998	0.519	0.499	0.481	0.513	0.522	0.397	0.373	0.325	0.256	0.300	0.307	0.295	0.399
1999	0.280	0.243	0.207	0.339	0.493	0.421	0.361	0.358	0.291	0.271	0.292	0.270	0.319
2000	0.252	0.239	0.241	0.293	0.517	0.539	0.421	0.353	0.320	0.398	0.369	0.300	0.353
2001	0.280	0.254	0.262	0.325	0.474	0.426	0.382	0.314	0.360	0.405	0.367	0.346	0.350
2002	0.318	0.304	0.292	0.300	0.415	0.384	0.420	0.606	0.599	0.539	0.498	0.459	0.428
2003	0.395	0.317	0.270	0.374	0.610	0.553	0.529	0.435	0.421	0.499	0.526	0.463	0.449
2004	0.421	0.408	0.411	0.398	0.436	0.589	0.485	0.359	0.357	0.359	0.361	0.343	0.411
2005	0.329	0.320	0.311	0.456	0.642	0.554	0.481	0.652	0.637	0.639	0.609	0.553	0.515
2006	0.509	0.483	0.471	0.483	0.565	0.601	0.463	0.438	0.342	0.316	0.317	0.312	0.442
2007	0.299	0.287	0.282	0.415	0.680	0.495	0.351	0.315	0.362	0.508	0.524	0.442	0.413
2008	0.367	0.350	0.343	0.385	0.567	0.557	0.536	0.423	0.394	0.410	0.341	0.290	0.414
2009	0.263	0.249	0.246	0.392	0.617	0.661	0.749	0.660	0.623	0.567	0.508	0.440	0.498
2010	0.381	0.350	0.335	0.460	0.510	0.442	0.266	0.250	0.400	0.442	0.412	0.367	0.385
2011	0.348	0.318	0.300	0.328	0.469	0.376	0.364	0.338	0.253	0.204	0.209	0.241	0.312
2012	0.251	0.257	0.268	0.374	0.562	0.530	0.527	0.407	0.468	0.477	0.501	0.395	0.418
2013	0.349	0.298	0.278	0.314	0.503	0.533	0.461	0.325	0.259	0.230	0.250	0.249	0.338
2014	0.236	0.228	0.227	0.282	0.528	0.728	0.567	0.382	0.258	0.278	0.297	0.278	0.357
2015	0.282	0.281	0.264	0.342	0.394	0.332	0.295	0.281	0.279	0.295	0.313	0.274	0.303
2016	0.254	0.243	0.245	0.309	0.460	0.507	0.551	0.505	0.502	0.602	0.630	0.493	0.442
2017	0.417	0.403	0.387	0.438	0.546	0.524	0.403	0.282	0.225	0.329	0.426	0.451	0.403
2018	0.340	0.274	0.290	0.337	0.651	0.591	0.573	0.536	0.484	0.469	0.438	0.404	0.449
2019	0.408	0.397	0.394	0.410	0.478	0.502	0.588	0.600	0.656	0.569			

Table I-5: SA-4 Monthly Average Discharge (m³/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean Annual
1977	0.649	0.607	0.455	0.550	0.803	1.008	0.994	0.779	0.746	0.652	0.546	0.502	0.691
1978	0.568	0.546	0.483	0.416	0.667	0.757	0.581	0.609	0.765	0.802	0.664	0.566	0.619
1979	0.662	0.695	0.579	0.456	0.605	0.682	0.591	0.567	0.522	0.546	0.569	0.475	0.579
1980	0.373	0.293	0.272	0.279	0.406	0.350	0.284	0.295	0.308	0.397	0.380	0.336	0.331
1981	0.337	0.356	0.349	0.366	0.582	0.467	0.318	0.224	0.183	0.191	0.219	0.226	0.318
1982	0.200	0.177	0.174	0.210	0.495	0.601	0.465	0.517	0.481	0.389	0.346	0.356	0.368
1983	0.343	0.318	0.311	0.349	0.449	0.604	0.436	0.344	0.374	0.408	0.420	0.383	0.395
1984	0.323	0.318	0.340	0.439	0.507	0.469	0.341	0.272	0.235	0.262	0.302	0.297	0.342
1985	0.299	0.293	0.308	0.336	0.735	0.597	0.518	0.393	0.363	0.339	0.350	0.322	0.404
1986	0.323	0.329	0.327	0.335	0.599	0.555	0.533	0.475	0.353	0.340	0.323	0.300	0.399
1987	0.292	0.293	0.300	0.411	0.515	0.374	0.245	0.199	0.202	0.193	0.208	0.202	0.286
1988	0.217	0.222	0.241	0.264	0.406	0.500	0.438	0.331	0.315	0.303	0.301	0.293	0.319
1989	0.302	0.320	0.302	0.289	0.555	0.581	0.516	0.373	0.325	0.305	0.287	0.286	0.370
1990	0.284	0.282	0.282	0.288	0.402	0.410	0.410	0.287	0.241	0.254	0.275	0.273	0.307
1991	0.254	0.252	0.256	0.303	0.481	0.532	0.440	0.330	0.316	0.310	0.288	0.284	0.337
1992	0.265	0.261	0.263	0.294	0.517	0.438	0.341	0.287	0.317	0.448	0.333	0.283	0.337
1993	0.260	0.250	0.241	0.301	0.345	0.262	0.248	0.377	0.353	0.311	0.307	0.274	0.294
1994	0.256	0.241	0.262	0.324	0.622	0.664	0.501	0.308	0.217	0.214	0.207	0.205	0.335
1995	0.205	0.200	0.214	0.281	0.385	0.463	0.320	0.423	0.448	0.380	0.363	0.282	0.330
1996	0.228	0.215	0.214	0.261	0.387	0.446	0.431	0.373	0.329	0.322	0.318	0.288	0.318
1997	0.274	0.264	0.257	0.282	0.433	0.472	0.397	0.434	0.621	1.023	0.801	0.534	0.483
1998	0.424	0.403	0.386	0.419	0.429	0.309	0.290	0.252	0.204	0.234	0.238	0.230	0.318
1999	0.220	0.196	0.175	0.264	0.398	0.331	0.279	0.277	0.227	0.214	0.228	0.213	0.252
2000	0.201	0.194	0.194	0.231	0.423	0.445	0.331	0.273	0.248	0.310	0.286	0.234	0.281
2001	0.220	0.203	0.208	0.252	0.381	0.335	0.297	0.244	0.280	0.316	0.284	0.268	0.274
2002	0.247	0.236	0.228	0.234	0.325	0.299	0.331	0.519	0.511	0.444	0.403	0.364	0.345
2003	0.308	0.246	0.213	0.298	0.525	0.460	0.435	0.342	0.331	0.404	0.431	0.369	0.364
2004	0.330	0.319	0.321	0.310	0.345	0.501	0.391	0.278	0.277	0.278	0.279	0.265	0.324
2005	0.255	0.248	0.241	0.369	0.562	0.462	0.389	0.573	0.556	0.558	0.523	0.460	0.433
2006	0.413	0.388	0.376	0.388	0.473	0.515	0.369	0.345	0.266	0.245	0.246	0.242	0.356
2007	0.233	0.224	0.221	0.332	0.609	0.402	0.272	0.244	0.282	0.413	0.429	0.350	0.334
2008	0.284	0.271	0.265	0.301	0.478	0.465	0.443	0.332	0.307	0.320	0.264	0.226	0.330
2009	0.208	0.200	0.197	0.309	0.536	0.585	0.698	0.584	0.540	0.476	0.413	0.347	0.424
2010	0.296	0.271	0.259	0.369	0.416	0.352	0.211	0.202	0.312	0.349	0.322	0.284	0.304
2011	0.269	0.247	0.233	0.254	0.375	0.292	0.282	0.262	0.203	0.173	0.176	0.195	0.247
2012	0.200	0.204	0.212	0.290	0.470	0.436	0.434	0.318	0.374	0.382	0.406	0.307	0.336
2013	0.270	0.232	0.218	0.244	0.410	0.439	0.370	0.252	0.207	0.188	0.200	0.199	0.269
2014	0.192	0.187	0.186	0.221	0.440	0.672	0.476	0.298	0.205	0.218	0.231	0.218	0.295
2015	0.221	0.220	0.209	0.266	0.307	0.257	0.230	0.220	0.219	0.230	0.242	0.216	0.236
2016	0.203	0.196	0.198	0.241	0.366	0.413	0.459	0.411	0.408	0.515	0.547	0.400	0.363
2017	0.327	0.314	0.301	0.345	0.453	0.431	0.316	0.221	0.185	0.257	0.334	0.358	0.320
2018	0.264	0.216	0.227	0.264	0.573	0.503	0.484	0.445	0.388	0.375	0.345	0.315	0.366
2019	0.318	0.309	0.307	0.320	0.383	0.408	0.500	0.515	0.579	0.477			

Table I-6: SA-5 Monthly Average Discharge (m³/s)

Year	1	2	3	4	5	6	7	8	9	10	11	12	Mean Annual
1977	1.763	1.638	1.191	1.474	2.232	2.866	2.823	2.156	2.055	1.772	1.457	1.326	1.896
1978	1.521	1.457	1.271	1.080	1.818	2.091	1.562	1.644	2.116	2.226	1.808	1.516	1.676
1979	1.802	1.901	1.557	1.193	1.636	1.862	1.589	1.519	1.384	1.456	1.524	1.247	1.556
1980	0.955	0.731	0.673	0.693	1.050	0.892	0.706	0.736	0.773	1.023	0.975	0.851	0.838
1981	0.855	0.907	0.888	0.935	1.564	1.225	0.802	0.545	0.435	0.457	0.531	0.549	0.808
1982	0.481	0.419	0.410	0.508	1.309	1.619	1.219	1.372	1.266	1.001	0.880	0.907	0.949
1983	0.871	0.802	0.781	0.889	1.173	1.629	1.136	0.874	0.959	1.054	1.090	0.983	1.020
1984	0.816	0.802	0.862	1.148	1.341	1.232	0.866	0.674	0.574	0.648	0.757	0.743	0.872
1985	0.750	0.733	0.773	0.851	2.026	1.607	1.375	1.013	0.927	0.860	0.890	0.812	1.051
1986	0.815	0.832	0.825	0.849	1.616	1.484	1.420	1.248	0.901	0.864	0.815	0.750	1.035
1987	0.729	0.733	0.751	1.069	1.365	0.961	0.601	0.476	0.487	0.462	0.502	0.487	0.718
1988	0.525	0.537	0.590	0.652	1.050	1.321	1.141	0.837	0.794	0.760	0.755	0.732	0.808
1989	0.757	0.808	0.756	0.721	1.490	1.561	1.368	0.957	0.821	0.765	0.716	0.713	0.953
1990	0.707	0.703	0.701	0.719	1.038	1.061	1.061	0.715	0.590	0.624	0.683	0.676	0.773
1991	0.626	0.620	0.629	0.761	1.268	1.414	1.149	0.836	0.796	0.778	0.718	0.707	0.858
1992	0.655	0.644	0.651	0.736	1.373	1.143	0.867	0.716	0.800	1.171	0.844	0.704	0.859
1993	0.641	0.614	0.589	0.755	0.878	0.648	0.608	0.967	0.899	0.783	0.771	0.679	0.736
1994	0.631	0.590	0.646	0.818	1.688	1.810	1.326	0.774	0.524	0.518	0.499	0.493	0.860
1995	0.493	0.481	0.517	0.700	0.991	1.214	0.808	1.101	1.171	0.976	0.927	0.703	0.840
1996	0.555	0.521	0.517	0.645	0.997	1.164	1.120	0.956	0.832	0.813	0.800	0.719	0.803
1997	0.680	0.652	0.633	0.701	1.127	1.239	1.025	1.131	1.685	2.915	2.226	1.423	1.286
1998	1.100	1.041	0.993	1.087	1.115	0.778	0.724	0.621	0.491	0.571	0.583	0.560	0.805
1999	0.533	0.468	0.413	0.654	1.027	0.839	0.694	0.690	0.552	0.517	0.554	0.515	0.621
2000	0.483	0.463	0.465	0.563	1.101	1.162	0.837	0.677	0.608	0.779	0.712	0.570	0.702
2001	0.532	0.487	0.501	0.621	0.978	0.850	0.744	0.599	0.696	0.795	0.706	0.662	0.681
2002	0.606	0.577	0.555	0.572	0.821	0.749	0.839	1.378	1.353	1.160	1.040	0.931	0.882
2003	0.773	0.603	0.515	0.749	1.394	1.206	1.133	0.870	0.837	1.044	1.122	0.945	0.933
2004	0.834	0.803	0.810	0.779	0.876	1.324	1.006	0.692	0.690	0.690	0.694	0.655	0.821
2005	0.627	0.608	0.590	0.947	1.502	1.212	1.002	1.538	1.486	1.493	1.388	1.204	1.133
2006	1.070	0.998	0.965	1.000	1.244	1.365	0.944	0.877	0.659	0.602	0.602	0.593	0.910
2007	0.567	0.545	0.536	0.844	1.645	1.040	0.675	0.598	0.704	1.069	1.115	0.892	0.853
2008	0.707	0.670	0.656	0.756	1.258	1.219	1.158	0.842	0.771	0.808	0.653	0.550	0.837
2009	0.502	0.479	0.473	0.779	1.429	1.573	1.912	1.569	1.438	1.250	1.068	0.884	1.113
2010	0.739	0.671	0.639	0.946	1.077	0.899	0.510	0.485	0.785	0.889	0.814	0.707	0.763
2011	0.666	0.605	0.569	0.626	0.961	0.731	0.702	0.646	0.488	0.409	0.417	0.466	0.607
2012	0.481	0.492	0.512	0.724	1.235	1.136	1.129	0.802	0.959	0.982	1.050	0.772	0.856
2013	0.669	0.566	0.529	0.599	1.063	1.143	0.947	0.619	0.498	0.449	0.481	0.479	0.670
2014	0.458	0.445	0.443	0.536	1.150	1.833	1.253	0.746	0.494	0.529	0.564	0.529	0.748
2015	0.535	0.535	0.504	0.657	0.769	0.632	0.560	0.534	0.532	0.560	0.594	0.521	0.578
2016	0.488	0.469	0.474	0.589	0.936	1.072	1.202	1.064	1.055	1.364	1.461	1.033	0.934
2017	0.825	0.791	0.754	0.878	1.185	1.123	0.796	0.537	0.442	0.635	0.847	0.912	0.810
2018	0.652	0.522	0.552	0.654	1.537	1.331	1.274	1.164	0.999	0.960	0.877	0.792	0.943
2019	0.803	0.777	0.769	0.808	0.983	1.055	1.321	1.367	1.553	1.256			

Table I-7: SA-6/LA-6 Monthly Average Discharge (m³/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean Annual
1977	2.652	2.464	1.791	2.218	3.357	4.312	4.247	3.243	3.091	2.666	2.192	1.995	2.852
1978	2.288	2.191	1.912	1.624	2.735	3.145	2.350	2.473	3.183	3.349	2.720	2.280	2.521
1979	2.711	2.859	2.343	1.795	2.460	2.801	2.391	2.285	2.082	2.190	2.292	1.876	2.340
1980	1.437	1.100	1.012	1.043	1.580	1.341	1.063	1.108	1.163	1.539	1.467	1.281	1.261
1981	1.286	1.364	1.336	1.407	2.352	1.843	1.207	0.820	0.655	0.687	0.798	0.826	1.215
1982	0.724	0.631	0.617	0.764	1.969	2.436	1.834	2.063	1.905	1.506	1.324	1.364	1.428
1983	1.310	1.207	1.174	1.337	1.764	2.451	1.709	1.315	1.443	1.586	1.639	1.478	1.534
1984	1.228	1.207	1.296	1.726	2.017	1.853	1.302	1.014	0.864	0.975	1.138	1.117	1.311
1985	1.128	1.102	1.163	1.281	3.048	2.417	2.068	1.524	1.395	1.294	1.339	1.221	1.582
1986	1.226	1.252	1.241	1.276	2.431	2.233	2.136	1.878	1.355	1.300	1.226	1.128	1.557
1987	1.096	1.102	1.130	1.609	2.054	1.445	0.904	0.717	0.732	0.695	0.754	0.732	1.081
1988	0.790	0.808	0.888	0.981	1.579	1.987	1.717	1.259	1.194	1.143	1.136	1.101	1.215
1989	1.138	1.216	1.138	1.084	2.241	2.347	2.058	1.439	1.235	1.151	1.077	1.073	1.433
1990	1.064	1.057	1.054	1.082	1.561	1.597	1.596	1.076	0.888	0.939	1.027	1.017	1.163
1991	0.941	0.932	0.947	1.144	1.907	2.128	1.728	1.258	1.197	1.171	1.081	1.063	1.291
1992	0.986	0.969	0.979	1.107	2.065	1.719	1.304	1.078	1.203	1.761	1.270	1.059	1.292
1993	0.964	0.923	0.885	1.136	1.321	0.974	0.915	1.454	1.353	1.178	1.160	1.021	1.107
1994	0.949	0.888	0.971	1.230	2.539	2.723	1.994	1.165	0.789	0.779	0.751	0.741	1.293
1995	0.741	0.724	0.778	1.053	1.491	1.826	1.215	1.656	1.762	1.468	1.395	1.057	1.264
1996	0.836	0.784	0.778	0.970	1.499	1.751	1.685	1.438	1.251	1.223	1.204	1.082	1.208
1997	1.023	0.981	0.953	1.055	1.695	1.863	1.541	1.701	2.535	4.384	3.348	2.140	1.935
1998	1.655	1.566	1.493	1.635	1.678	1.170	1.089	0.935	0.738	0.859	0.877	0.843	1.211
1999	0.802	0.704	0.622	0.984	1.545	1.262	1.043	1.037	0.830	0.778	0.833	0.775	0.935
2000	0.727	0.697	0.699	0.847	1.655	1.748	1.258	1.019	0.915	1.172	1.072	0.858	1.056
2001	0.801	0.733	0.754	0.935	1.471	1.279	1.119	0.901	1.046	1.196	1.063	0.997	1.024
2002	0.911	0.867	0.834	0.860	1.236	1.127	1.262	2.073	2.035	1.745	1.565	1.401	1.326
2003	1.162	0.908	0.774	1.127	2.096	1.815	1.704	1.308	1.260	1.571	1.688	1.421	1.403
2004	1.255	1.207	1.219	1.172	1.318	1.992	1.514	1.041	1.037	1.038	1.044	0.985	1.235
2005	0.943	0.915	0.887	1.424	2.260	1.823	1.508	2.313	2.235	2.246	2.088	1.811	1.705
2006	1.610	1.501	1.451	1.504	1.872	2.053	1.420	1.320	0.991	0.905	0.906	0.891	1.369
2007	0.853	0.820	0.806	1.270	2.474	1.565	1.016	0.899	1.059	1.608	1.678	1.342	1.283
2008	1.064	1.008	0.986	1.137	1.892	1.834	1.741	1.266	1.160	1.216	0.982	0.827	1.259
2009	0.755	0.721	0.711	1.171	2.149	2.366	2.876	2.361	2.163	1.881	1.607	1.329	1.674
2010	1.112	1.009	0.961	1.424	1.621	1.353	0.767	0.730	1.181	1.338	1.224	1.063	1.148
2011	1.002	0.910	0.856	0.942	1.446	1.100	1.056	0.972	0.734	0.615	0.627	0.701	0.913
2012	0.724	0.740	0.770	1.089	1.858	1.709	1.699	1.207	1.443	1.478	1.580	1.162	1.288
2013	1.006	0.851	0.796	0.901	1.599	1.720	1.425	0.931	0.749	0.675	0.723	0.720	1.008
2014	0.689	0.669	0.666	0.806	1.729	2.757	1.885	1.122	0.744	0.796	0.848	0.796	1.126
2015	0.805	0.804	0.757	0.989	1.157	0.951	0.842	0.803	0.800	0.843	0.893	0.784	0.869
2016	0.733	0.706	0.713	0.887	1.408	1.612	1.808	1.601	1.586	2.053	2.197	1.554	1.405
2017	1.241	1.190	1.134	1.321	1.783	1.689	1.198	0.808	0.664	0.955	1.274	1.372	1.219
2018	0.981	0.785	0.830	0.984	2.312	2.002	1.917	1.751	1.503	1.444	1.319	1.192	1.418
2019	1.207	1.169	1.157	1.216	1.479	1.587	1.987	2.056	2.336	1.889			

Table I-8: SB-3 Monthly Average Discharge (m³/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean Annual
1977	0.269	0.257	0.207	0.236	0.311	0.361	0.358	0.305	0.296	0.270	0.238	0.223	0.277
1978	0.245	0.237	0.217	0.193	0.274	0.299	0.248	0.256	0.301	0.311	0.273	0.244	0.258
1979	0.273	0.282	0.247	0.208	0.253	0.278	0.252	0.244	0.230	0.238	0.245	0.214	0.247
1980	0.176	0.142	0.133	0.135	0.190	0.167	0.138	0.143	0.149	0.186	0.179	0.162	0.158
1981	0.162	0.170	0.167	0.174	0.248	0.211	0.153	0.108	0.084	0.089	0.105	0.109	0.148
1982	0.095	0.080	0.078	0.098	0.220	0.255	0.211	0.228	0.216	0.183	0.166	0.170	0.167
1983	0.165	0.154	0.151	0.167	0.205	0.255	0.200	0.165	0.177	0.190	0.195	0.180	0.184
1984	0.156	0.154	0.163	0.200	0.225	0.212	0.163	0.133	0.114	0.128	0.147	0.145	0.162
1985	0.146	0.143	0.150	0.161	0.291	0.253	0.228	0.184	0.173	0.163	0.167	0.156	0.185
1986	0.156	0.159	0.158	0.161	0.253	0.240	0.233	0.214	0.169	0.164	0.156	0.146	0.184
1987	0.142	0.143	0.146	0.187	0.227	0.177	0.119	0.093	0.096	0.090	0.099	0.096	0.135
1988	0.104	0.107	0.117	0.129	0.189	0.222	0.201	0.159	0.153	0.147	0.147	0.143	0.152
1989	0.147	0.155	0.147	0.141	0.237	0.248	0.228	0.176	0.157	0.148	0.140	0.140	0.172
1990	0.139	0.138	0.138	0.141	0.188	0.191	0.191	0.139	0.117	0.124	0.135	0.133	0.148
1991	0.124	0.123	0.125	0.147	0.216	0.233	0.202	0.158	0.153	0.150	0.141	0.139	0.159
1992	0.130	0.128	0.129	0.143	0.228	0.201	0.164	0.140	0.152	0.205	0.160	0.138	0.160
1993	0.127	0.122	0.117	0.146	0.166	0.127	0.120	0.178	0.168	0.151	0.149	0.134	0.142
1994	0.125	0.117	0.128	0.156	0.258	0.273	0.223	0.149	0.104	0.103	0.099	0.097	0.153
1995	0.097	0.095	0.102	0.137	0.181	0.210	0.155	0.194	0.205	0.180	0.173	0.137	0.155
1996	0.110	0.103	0.103	0.127	0.182	0.204	0.198	0.177	0.159	0.156	0.154	0.141	0.151
1997	0.134	0.129	0.126	0.137	0.199	0.213	0.186	0.200	0.258	0.365	0.310	0.233	0.208
1998	0.196	0.188	0.182	0.194	0.197	0.150	0.141	0.123	0.097	0.113	0.116	0.112	0.151
1999	0.106	0.092	0.078	0.128	0.186	0.159	0.136	0.135	0.110	0.103	0.110	0.102	0.120
2000	0.095	0.091	0.091	0.111	0.195	0.204	0.159	0.133	0.121	0.150	0.139	0.114	0.134
2001	0.106	0.096	0.099	0.123	0.179	0.161	0.145	0.119	0.136	0.153	0.139	0.131	0.132
2002	0.120	0.115	0.110	0.113	0.157	0.145	0.159	0.229	0.226	0.204	0.188	0.173	0.162
2003	0.149	0.120	0.102	0.142	0.231	0.209	0.200	0.164	0.159	0.189	0.199	0.175	0.170
2004	0.159	0.154	0.155	0.150	0.165	0.223	0.183	0.136	0.135	0.136	0.136	0.130	0.155
2005	0.124	0.121	0.117	0.172	0.243	0.209	0.182	0.246	0.241	0.242	0.230	0.209	0.195
2006	0.192	0.183	0.178	0.183	0.214	0.227	0.175	0.165	0.129	0.120	0.120	0.118	0.167
2007	0.113	0.109	0.107	0.157	0.257	0.187	0.133	0.119	0.137	0.192	0.198	0.167	0.156
2008	0.139	0.132	0.130	0.145	0.214	0.211	0.203	0.160	0.149	0.155	0.129	0.109	0.156
2009	0.099	0.094	0.093	0.148	0.233	0.250	0.283	0.249	0.236	0.214	0.192	0.166	0.188
2010	0.144	0.132	0.127	0.174	0.193	0.167	0.100	0.095	0.151	0.167	0.156	0.139	0.145
2011	0.132	0.120	0.113	0.124	0.177	0.142	0.137	0.128	0.096	0.077	0.079	0.091	0.118
2012	0.095	0.097	0.101	0.141	0.212	0.201	0.199	0.154	0.177	0.180	0.189	0.149	0.158
2013	0.132	0.113	0.105	0.119	0.190	0.201	0.174	0.123	0.098	0.087	0.095	0.094	0.128
2014	0.089	0.086	0.086	0.106	0.200	0.275	0.214	0.144	0.097	0.105	0.112	0.105	0.135
2015	0.106	0.106	0.100	0.129	0.149	0.125	0.111	0.106	0.106	0.112	0.118	0.103	0.114
2016	0.096	0.092	0.093	0.117	0.174	0.192	0.208	0.191	0.190	0.227	0.238	0.186	0.167
2017	0.158	0.152	0.146	0.166	0.206	0.198	0.152	0.107	0.085	0.125	0.161	0.170	0.152
2018	0.128	0.103	0.110	0.128	0.246	0.224	0.217	0.203	0.183	0.177	0.165	0.153	0.170
2019	0.154	0.150	0.149	0.155	0.181	0.190	0.222	0.227	0.248	0.215			

Table I-9: LA-1 Monthly Average Discharge (m³/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean Annual
1977	3.003	2.864	2.309	2.630	3.469	4.031	3.993	3.399	3.303	3.009	2.654	2.491	3.096
1978	2.729	2.649	2.420	2.158	3.054	3.336	2.769	2.861	3.356	3.468	3.045	2.724	2.881
1979	3.043	3.148	2.752	2.317	2.824	3.106	2.808	2.725	2.564	2.651	2.731	2.388	2.755
1980	1.965	1.590	1.482	1.512	2.115	1.868	1.545	1.601	1.666	2.075	2.001	1.805	1.769
1981	1.810	1.895	1.865	1.941	2.771	2.352	1.709	1.206	0.935	0.991	1.177	1.218	1.656
1982	1.055	0.891	0.865	1.094	2.460	2.841	2.352	2.544	2.411	2.041	1.852	1.896	1.858
1983	1.836	1.721	1.681	1.862	2.289	2.846	2.234	1.839	1.971	2.121	2.173	2.013	2.049
1984	1.743	1.721	1.821	2.232	2.510	2.366	1.823	1.483	1.275	1.426	1.639	1.614	1.804
1985	1.627	1.596	1.669	1.799	3.253	2.827	2.543	2.056	1.928	1.819	1.868	1.737	2.060
1986	1.743	1.772	1.760	1.797	2.820	2.673	2.601	2.383	1.883	1.826	1.741	1.627	2.052
1987	1.589	1.595	1.629	2.087	2.530	1.971	1.328	1.043	1.070	1.006	1.107	1.070	1.502
1988	1.165	1.193	1.310	1.440	2.112	2.482	2.243	1.776	1.705	1.644	1.636	1.594	1.692
1989	1.639	1.731	1.639	1.573	2.647	2.771	2.541	1.965	1.752	1.653	1.565	1.559	1.919
1990	1.548	1.539	1.535	1.569	2.093	2.130	2.128	1.555	1.310	1.379	1.501	1.488	1.648
1991	1.386	1.374	1.394	1.639	2.406	2.601	2.252	1.766	1.709	1.677	1.569	1.547	1.777
1992	1.447	1.423	1.438	1.593	2.546	2.241	1.826	1.561	1.693	2.284	1.788	1.541	1.782
1993	1.418	1.361	1.308	1.633	1.848	1.420	1.344	1.981	1.879	1.687	1.665	1.493	1.586
1994	1.397	1.311	1.425	1.743	2.883	3.045	2.487	1.658	1.161	1.144	1.102	1.086	1.704
1995	1.086	1.057	1.137	1.534	2.019	2.343	1.729	2.161	2.286	2.003	1.928	1.534	1.735
1996	1.233	1.155	1.145	1.415	2.031	2.277	2.215	1.972	1.770	1.738	1.717	1.569	1.686
1997	1.496	1.441	1.402	1.531	2.222	2.378	2.076	2.229	2.882	4.069	3.459	2.603	2.316
1998	2.188	2.103	2.030	2.166	2.203	1.673	1.574	1.369	1.080	1.266	1.295	1.246	1.683
1999	1.182	1.023	0.873	1.429	2.080	1.778	1.521	1.510	1.225	1.144	1.231	1.140	1.345
2000	1.062	1.010	1.015	1.236	2.181	2.273	1.777	1.488	1.348	1.679	1.555	1.267	1.491
2001	1.182	1.071	1.106	1.369	2.001	1.797	1.613	1.325	1.518	1.707	1.546	1.461	1.475
2002	1.343	1.282	1.233	1.266	1.749	1.618	1.771	2.557	2.524	2.271	2.101	1.934	1.804
2003	1.667	1.337	1.140	1.580	2.574	2.334	2.232	1.833	1.776	2.105	2.218	1.955	1.896
2004	1.776	1.721	1.734	1.679	1.841	2.484	2.044	1.514	1.507	1.514	1.523	1.446	1.732
2005	1.389	1.350	1.311	1.924	2.708	2.335	2.028	2.748	2.687	2.697	2.569	2.331	2.173
2006	2.145	2.038	1.987	2.038	2.383	2.534	1.953	1.846	1.444	1.334	1.336	1.316	1.863
2007	1.260	1.211	1.190	1.751	2.868	2.087	1.481	1.327	1.527	2.141	2.210	1.866	1.743
2008	1.548	1.476	1.448	1.622	2.393	2.350	2.263	1.783	1.664	1.730	1.440	1.221	1.745
2009	1.109	1.052	1.036	1.653	2.603	2.789	3.158	2.783	2.630	2.393	2.141	1.857	2.100
2010	1.607	1.477	1.414	1.942	2.153	1.866	1.121	1.056	1.685	1.866	1.739	1.547	1.623
2011	1.468	1.343	1.265	1.382	1.978	1.584	1.534	1.425	1.069	0.861	0.883	1.017	1.317
2012	1.057	1.083	1.132	1.576	2.369	2.237	2.223	1.717	1.976	2.011	2.113	1.664	1.763
2013	1.472	1.256	1.173	1.326	2.122	2.248	1.946	1.371	1.092	0.971	1.056	1.050	1.424
2014	0.996	0.962	0.956	1.188	2.227	3.072	2.391	1.611	1.087	1.172	1.252	1.174	1.507
2015	1.187	1.187	1.113	1.443	1.661	1.399	1.242	1.183	1.179	1.245	1.319	1.154	1.276
2016	1.073	1.026	1.034	1.302	1.939	2.137	2.324	2.132	2.119	2.537	2.657	2.080	1.863
2017	1.760	1.701	1.633	1.849	2.301	2.212	1.700	1.190	0.950	1.389	1.797	1.902	1.699
2018	1.434	1.155	1.224	1.423	2.745	2.495	2.416	2.260	2.040	1.980	1.845	1.703	1.893
2019	1.721	1.677	1.662	1.727	2.015	2.116	2.480	2.533	2.766	2.399			

Table I-10: LA-5 Monthly Average Flow (m³/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean Annual
1977	2.775	2.574	1.854	2.310	3.529	4.551	4.482	3.408	3.245	2.790	2.283	2.072	2.990
1978	2.386	2.282	1.984	1.675	2.863	3.303	2.452	2.584	3.344	3.521	2.848	2.377	2.635
1979	2.838	2.997	2.444	1.858	2.570	2.935	2.496	2.382	2.166	2.281	2.390	1.945	2.442
1980	1.475	1.114	1.021	1.054	1.628	1.373	1.074	1.123	1.182	1.584	1.507	1.308	1.287
1981	1.313	1.397	1.367	1.443	2.455	1.910	1.229	0.814	0.638	0.672	0.791	0.821	1.237
1982	0.712	0.612	0.598	0.754	2.044	2.544	1.900	2.145	1.975	1.549	1.354	1.397	1.465
1983	1.339	1.229	1.194	1.368	1.825	2.560	1.766	1.345	1.481	1.634	1.691	1.519	1.579
1984	1.251	1.229	1.324	1.785	2.095	1.920	1.331	1.022	0.862	0.981	1.155	1.133	1.341
1985	1.144	1.117	1.182	1.308	3.199	2.523	2.150	1.568	1.430	1.322	1.370	1.244	1.630
1986	1.250	1.277	1.266	1.303	2.538	2.327	2.223	1.947	1.387	1.328	1.249	1.145	1.603
1987	1.111	1.117	1.146	1.659	2.135	1.484	0.904	0.704	0.721	0.681	0.745	0.721	1.094
1988	0.783	0.803	0.887	0.987	1.627	2.063	1.774	1.284	1.215	1.160	1.153	1.115	1.238
1989	1.155	1.238	1.155	1.098	2.336	2.449	2.140	1.477	1.259	1.169	1.090	1.085	1.471
1990	1.076	1.068	1.066	1.095	1.607	1.646	1.645	1.089	0.888	0.942	1.037	1.026	1.182
1991	0.944	0.935	0.950	1.162	1.978	2.214	1.786	1.284	1.219	1.190	1.094	1.075	1.319
1992	0.992	0.974	0.985	1.122	2.147	1.777	1.332	1.090	1.225	1.821	1.296	1.070	1.319
1993	0.969	0.925	0.885	1.153	1.351	0.980	0.916	1.494	1.385	1.198	1.178	1.030	1.122
1994	0.953	0.887	0.977	1.253	2.654	2.851	2.072	1.184	0.781	0.771	0.741	0.731	1.321
1995	0.731	0.712	0.770	1.064	1.533	1.892	1.238	1.710	1.823	1.508	1.430	1.068	1.290
1996	0.832	0.776	0.770	0.975	1.542	1.811	1.741	1.477	1.276	1.246	1.225	1.095	1.230
1997	1.032	0.987	0.957	1.066	1.751	1.931	1.587	1.757	2.650	4.629	3.520	2.228	2.008
1998	1.708	1.613	1.535	1.687	1.733	1.189	1.102	0.938	0.728	0.857	0.876	0.839	1.234
1999	0.795	0.691	0.603	0.990	1.590	1.288	1.054	1.047	0.826	0.770	0.829	0.766	0.938
2000	0.715	0.683	0.686	0.844	1.709	1.808	1.284	1.028	0.916	1.191	1.084	0.855	1.067
2001	0.794	0.721	0.744	0.937	1.512	1.306	1.134	0.902	1.057	1.217	1.075	1.004	1.034
2002	0.913	0.866	0.830	0.858	1.260	1.143	1.288	2.156	2.115	1.804	1.612	1.436	1.357
2003	1.181	0.909	0.766	1.144	2.181	1.879	1.761	1.337	1.285	1.618	1.744	1.458	1.439
2004	1.281	1.229	1.241	1.191	1.348	2.069	1.557	1.052	1.048	1.048	1.055	0.992	1.259
2005	0.947	0.916	0.887	1.461	2.356	1.888	1.551	2.412	2.329	2.341	2.172	1.876	1.761
2006	1.660	1.543	1.491	1.546	1.940	2.134	1.457	1.350	0.998	0.906	0.907	0.891	1.402
2007	0.850	0.815	0.800	1.297	2.585	1.612	1.025	0.899	1.071	1.658	1.733	1.374	1.310
2008	1.076	1.016	0.993	1.154	1.962	1.900	1.801	1.292	1.179	1.238	0.988	0.822	1.285
2009	0.746	0.709	0.699	1.191	2.237	2.469	3.015	2.464	2.252	1.950	1.657	1.360	1.729
2010	1.127	1.017	0.966	1.461	1.672	1.385	0.759	0.718	1.201	1.369	1.247	1.075	1.166
2011	1.010	0.911	0.853	0.946	1.485	1.114	1.067	0.977	0.723	0.596	0.608	0.687	0.915
2012	0.712	0.729	0.761	1.103	1.925	1.766	1.755	1.229	1.481	1.519	1.628	1.181	1.316
2013	1.014	0.848	0.789	0.901	1.648	1.778	1.462	0.934	0.739	0.660	0.711	0.708	1.016
2014	0.674	0.653	0.650	0.800	1.788	2.888	1.955	1.138	0.733	0.789	0.845	0.789	1.142
2015	0.798	0.798	0.748	0.995	1.176	0.955	0.838	0.796	0.793	0.839	0.893	0.777	0.867
2016	0.722	0.693	0.701	0.886	1.444	1.663	1.872	1.650	1.635	2.134	2.288	1.600	1.441
2017	1.266	1.211	1.151	1.351	1.845	1.745	1.219	0.802	0.648	0.959	1.301	1.406	1.242
2018	0.987	0.777	0.826	0.991	2.411	2.079	1.989	1.811	1.546	1.483	1.348	1.213	1.455
2019	1.229	1.188	1.176	1.238	1.520	1.635	2.064	2.138	2.437	1.959			

APPENDIX II

CORRELATION METHODOLOGY

NewFields
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TECHNICAL MEMORANDUM

Privileged and Confidential 680.0018.000

FROM: Tyrel Lloyd, M.Eng., P.Eng., Senior Water Resources Engineer

PROJECT: Denison Wheeler River EIS

SUBJECT: Correlation Methodology

DATE: December 15, 2021

This document is prepared as a discussion of methodology used to extend stream flow records from Water Survey Canada's Wheeler River hydrometric monitoring station (06DA005) to assessment nodes associated with the Denison Mines Corp. (Denison) Wheeler River Project (the Project). EcoMetrix Inc. (EcoMetrix) has retained NewFields Canada Mining and Environment ULC (NewFields) to provide hydrological assessment in support of their components of work related to the Project's Environmental Impact Statement (EIS).

Denison initiated hydrometric monitoring at the Project in 2011. Several monitoring stations for streamflow and lake water level were incorporated at inception and throughout the duration since monitoring began and several organizations have been involved with data collection of these stations. Most stage-discharge rating curves at the Project are well developed and flow records during open water periods are reliable. Winter hydrometric monitoring was carried out in March 2014 but is the only winter monitoring program undertaken thus leaving gaps during ice covered periods.

The existing flow record for the Project provides information regarding snowmelt runoff, stream response to storm events and summer low flow data. Brevity of winter flow data is a knowledge gap which is infilled through extension of the flow records at relevant assessment nodes. The extension is completed through correlation of data from Environment and Climate Change Canada's Station 06DA005[1] to assessment nodes at the Project. The remainder of this document provides discussion of the methodology.

Station 06DA005 is located on the Wheeler River below Russell Lake. The gauge has operated from 1973 to 2019 and has a gross drainage area of 3030 km². The primary advantage to this station is that the Project and associated watersheds are within the watershed of 06DA005. Visual inspection of the flow records between 06DA005 and hydrographs at the Project yields similar trends in the data suggesting similar influences from regional hydrological processes. As such, 06DA005 was selected as the candidate for source data to represent flow volumes at the Project.

For the EIS there are nine assessment nodes used to assess impacts related to the Project (Figure 1 attached). The assessment nodes represent important locations within the Local Study Area relevant to the footprint or projected influence of the Project. Many assessment nodes are concurrent with past or current discharge monitoring stations with the exception of LA-1 and LA-5. At some locations the hydrograph data are readily available while at others the hydrographs are of short duration or not reported (Table 1). The amount of available hydrograph data influences the methodology used to extend the record. Table 1 also indicates the methodology used at each node.

Correlation for extension of data record is completed through analysis of same-day discharge values. For any data record available at an assessment node the same day discharge value from the source station is used for comparison (i.e., absolute value of the difference between the values). The subsequent deviations are then summed, and an equation is developed based on iterative processing to optimize the equation thus reducing the summation of the deviations. This methodology is preferred but can only be applied

[1] Environment and Climate Change Canada. 2021. Water Level and Flow Data. https://wateroffice.ec.gc.ca/index_e.html

where sufficient hydrograph length is available and considered to be of acceptable quality. Furthermore, the methodology incorporates hydrograph data at the Project thus representing actual conditions for each assessment node.

Table 1: Assessment Nodes Record Extension Method and Source Data

Assessment Node	Description	Drainage Area (km²)	Extension Method	Source Station
SA-1	Icelander River flowing from McGowan Lake	280.6	Correlation	06DA005
SA-2	Inflow to McGowan Lake from Whitefish Lake	257.4	Unit Area Runoff with Scaling and Offset	SA-6
SA-3	Inflow to McGowan Lake	15.5	Unit Area Runoff with Scaling	SA-1
SA-4	Inflow to LA-6 from Kratchkowski Lake	80.5	Correlation	SA-6
SA-5	Inflow to LA-6	167.3	Unit Area Runoff	SA-6
SA-6/LA-6	Flow from LA-6 to Whitefish Lake	251.7	Correlation	SA-1
SB-3	Southern project drainage basin flowing to Russell Lake	24.9	Unit Area Runoff	SA-1
LA-1	McGowan Lake	277.5	Unit Area Runoff	SA-1
LA-5	Whitefish Lake	257.2	Unit Area Runoff	SA-2

Unit area runoff (UAR) and UAR with offset is used where no hydrograph is available/acceptable at an assessment node. This methodology considers the ratio of mean monthly flow to drainage area (i.e., unit flow rate) and transfers that estimate to the assessment node by product of the assessment node's drainage area. Fit of the data is typically assessed visually to determine if the historically collected instantaneous discharge measurements "match" the estimated hydrograph; when the measurement data appear to be biased, likely due to groundwater input, geographical features in the watershed or similar influence, the hydrograph data are shifted to match the measured discharges.

Through these analyses monthly mean flow records were extended for each assessment nodes and reported within the EIS. These records represent the historical hydrograph for each assessment node for the Project. Should additional information regarding these analyses be required please contact the undersigned.

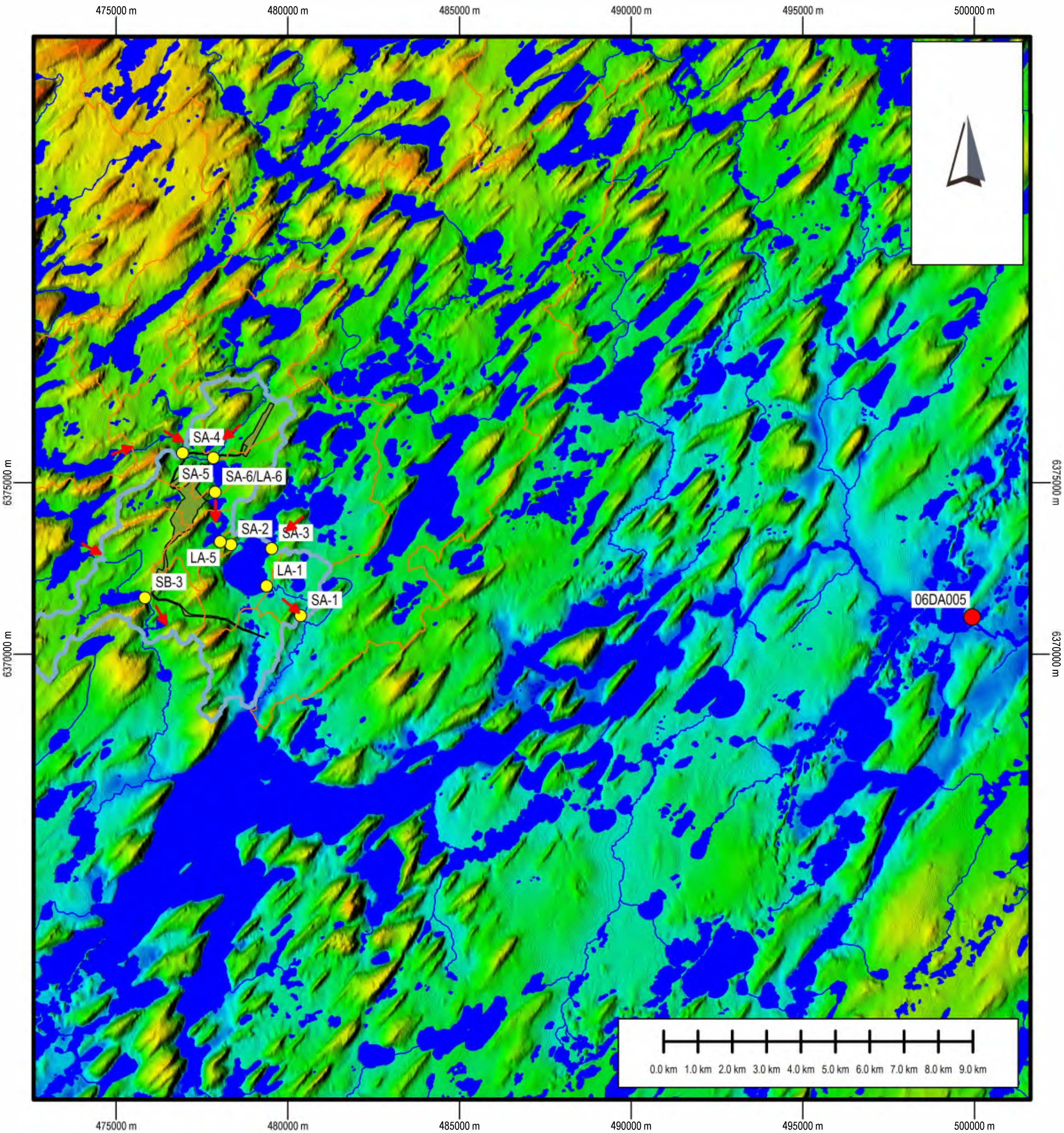
NewFields Canada Mining and Environment ULC

Tyrel J. Lloyd, M.Eng., P.Eng.
Senior Water Resources Engineer

TJL/tjl

Attachment: Figure 1 – Assessment Nodes and Water Survey Canada Station

https://newfields365-my.sharepoint.com/personal/lbotham_newfields_com/Documents/Projects/680.0018.000 - EcoMetrix - Denison Wheeler River EIS/Report/680.0018.000 - Tech Memo - 21 09 02 - Correlation Methodology.docx



Legend:

Site Study Area	Watershed Boundary
Waterbody	Assessment Node
Local Study Area	Flow Direction
Stream Alignment	Hydrometric Monitoring Station

NewFields

Date: August 30, 2021

Project Number: 680.0018.000

Figure Title: Assessment Nodes and Water Survey Canada Station

Projection: UTM NAD83 Zone 13
References: Elevation model from CDEM NTS Mapsheets

Figure: 1

Revision: 0

APPENDIX III

FIRT IR-102

Attachment IR-102

Number	IR-102
Comment From	ECCC
Category	Fish and Fish Habitat
Page # in EIS	
Section # in EIS	8.1.3.1 Appendix 8-C, including Appendix II, Table 1 (p. 2)
Comment	In response to IR-102 issued in first round of IRs: This response has not been accepted for the following reasons: 1. Given the limitation of data availability extension of flow records based on the nearest active WSC hydrometric station (Wheeler River (06DA005)) is acceptable although other methods are not shown to be explored by the proponent including rainfall-runoff modelling techniques (such model can be calibrated at 06DA005 thus computed flow at subbasins or sub watershed can be estimated with good degree of confidence), drainage area ratio method, etc. CNSC staff recommends proponent to consider aforementioned methods or similar or provide justification why other methods were not considered. 2. In Attachment IR-102 Figure 1 to 7 show the plots of measured versus the estimated daily flows using the relationship developed for extension of daily flows at SA-1, SA-2, SA-3, SA- 4, SA-5, SA-6, SB-3, LA-1 and LA-5. CNSC staff however finds it difficult to determine the predictive accuracy of the relationships based on visual comparisons. Therefore, CNSC staff requests that the proponent provide quantitative measures of prediction accuracy, for example in the form of Root Mean Square Error, correlation coefficient, etc., for the Equations presented in Table 1 of Attachment IR-102. In addition, CNSC staff requests that the proponent provide clarification on whether the current relationships are only limited to baseline characterization or will also be considered for estimation of design flows at SA-4 and SA-5 for culvert/crossing design for the access road. 3. Response to third part of the IR to be re-assessed when proponent addresses the above two comments ([1] and [2]).

Response:

1. Though other methods exist for extension of flow rates from 06DA005 to the RSA, the Proponent believes it sufficient to rely on the transfer method used in the water quantity (hydrology) component of the EIS. The transfer method is an advanced form of unit area transfer which incorporates additional algorithms to adjust to streamflow response. In some cases, unit area runoff without additional algorithms was used to transfer the record specifically for SA-5, SB-3, LA-1 and LA-5.

   The transfer method employed in the technical assessment (Appendix 8-C) and summarized in the EIS relies on measured data from the LSA and is compared to other measured data within the same watershed. A rainfall-runoff model would rely upon transfer of climate data to site from the closest meteorological station (Key Lake Mine) or interpolated grid data neither of which can be confirmed to accurately reflect site conditions.

2. To further confirm the viability of the chosen extension method, the Root Mean Square Error (RMSE) between the transfer method and the unit area runoff method was estimated for comparison. Baseline data reported by Ecometrix Incorporated (2019) present hydrometric monitoring data at several of the stations at the Project. These data represent the observed data set against which the synthesized data are checked. The baseline data in some cases are hydrographs from installed sensors and in other cases are point measurements of discharge. The observed and synthesized hydrographs were checked between coincident dates of available data. Two synthesized hydrographs are compared for RMSE, the first hydrographs are those developed using the transfer discussed in the EIS, technical support memo (Appendix 8-C) and previous response to this IR. The second hydrograph is developed using unit area runoff relationships.

   As mentioned above, four stations were developed using the unit area runoff method, therefore nullifying the utility of a method comparison for these locations. The remaining five stations include SA-1, SA-2, SA-3, SA-4 and SA-6. RMSE is a comparison of the differences between observed and synthesized data. The squared error is estimated between coincident data points and the RMSE for a dataset is the sum of that error. A perfectly matching data set would have an RMSE of 0 and a negative RMSE is not possible. The following table presents the estimated RMSE values for the two synthesized hydrographs at the relevant stations. For all stations, the reported transfer equation yields a better RMSE than unit area runoff.

Table 1: Hydrology Station Correlation Coefficients for RMSE Methods as Compared to Historical Data

Station	Reported Transfer Equation RMSE	Unit Area Runoff RMSE
SA-1	0.252	0.426
SA-2	0.317	0.381
SA-3	0.080	0.345
SA-4	0.090	0.118
SA-6	0.362	0.453

As a result, it is confirmed that the use of the reported transfer equation method is fit for use as part of the hydrology assessment and for the purposes of:

a) Baseline water quantity characterization
b) Estimates of change in water quantity as a result of the Operation; and,
c) Assessment of potential impacts to the environment as part of the EIS including for water quantity and all other components of Section 8 that may be influenced by changes in water quantity.

Therefore, no additional changes to the EIS with regard to this IR are required.

Date (for drafting version control): January 30, 2024

Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

Powering PEOPLE, PARTNERSHIPS AND PASSION.

WHEELER RIVER PROJECT: BASELINE AQUATIC ENVIRONMENT STUDY

Report prepared for:

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Ref. 19-2589
March 2020

WHEELER RIVER PROJECT: BASELINE AQUATIC ENVIRONMENT STUDY

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ACKNOWLEDGEMENTS

Several people beyond the authors identified above contributed to the development and execution of this aquatic baseline study including: Janeen Tang (Project Manager), Goran Ivanis (Field Investigator), Carolyn Brown (Field Investigator), Karen Petersen (Field Crew Lead), Kristine Campbell (Hydrology Field Investigator), Nichole Wiemann (Field Investigator, Data Management), Amelia Porter (Data Management), Joseph Tetreault (Benthic Invertebrates), and Michael White (Statistics). The project team would like to acknowledge Jobie Daigneault and Jayme George-Eaglechild, residents of English River First Nation (ERFN) at Patuanak, SK, whose assistance with the field work program was invaluable. Bobby John of ERFN graciously shared his local land user knowledge of the study area, confirming findings and providing addition valuable information pertaining to aquatic resources, including fish spawning areas. The project team would also like to acknowledge the staff of Denison Mines Corporation both at the Project site and in Saskatoon for their support, including Pam Bennett, Clark Gamelin, Yongxing Liu, Lea Willemse and Dave Hamilton.

EXECUTIVE SUMMARY

The Denison Mining Corp. (Denison) Wheeler River Project (Project) is located in north central Saskatchewan, in the eastern portion of the Athabasca Basin. It is situated approximately 35 kilometres northeast of Cameco Corporation's Key Lake Operation and 35 kilometres southwest of Cameco Corporation's McArthur River Operation. Baseline studies in the Project area are required to support pre-feasibility engineering studies, technical assessments and environmental approvals processes. EcoMetrix Incorporated (EcoMetrix) was retained by Denison to implement aquatic environment baseline studies over the period 2016 through 2019 and to synthesize these more recent data with existing aquatic environment information for the study area that dates back to 2011. The current understanding of aquatic environment in the study area based on the full complement of available data is provided herein.

Aquatic environment baseline field surveys were conducted in the fall of 2016, the spring of 2017, the winter and summer of 2018 that included hydrology, water quality, sediment quality, aquatic habitat and bathymetry, plankton community, benthic invertebrate community and tissue chemistry, and fish community, spawning and tissue chemistry. Additional hydrological and water quality data were collected during the summer and fall of 2019.

The 2016 to 2019 surveys build on previous hydrological and aquatic baseline work completed from 2011 to 2014. Data from the 2011 to 2014 baseline surveys are included in this report; however, the report focuses on the more recent 2016 to 2019 results.

Hydrology

Water level elevations were surveyed at a number of lakes, streams and ponds within the study area. In September 2016-2019, lake and pond surface water elevations of the Icelander River Drainage ranged from 520.86 masl at the headwater lake to 487.94 masl at Russell Lake. Water level elevations at the stream locations ranged from 520.84 masl at the most upstream station, to 492.71 masl at the most downstream station. In the Williams Lake Drainage, water levels at stream locations ranged from 518.33 masl at the most upstream station, to 488.55 masl at the most downstream station during September 2016.

Manual stream flow measurements were recorded in September 2016, May 2017, June-July 2018, July 2019 and August-September 2019 in the Icelander River Drainage and in September 2016 in the Williams Lake Drainage at lotic watercourses. Measured flows at the most downstream station (SA-1) have ranged from 2.34 to 3.05 m^3/s between September 2016 and August 2019.

Where possible, water level elevations were calculated for each location using the continuous water level data. For streams SA-1, SA-4, SA-5, SA-6 and SA-11, the water elevation data could be converted to flow using rating curve relationships. For other streams including SA-8, SA-9 and SA-10 however, the manual flow measurements obtained to date were not sufficient to develop a rating curve for conversion from level to flow. Additional data collection is recommended to capture stage-discharge relationship at different discharge level to develop and validate rating curves for these lotic systems.

Water Quality and Limnology

Surface waters within the project study area are soft and have typically low levels of alkalinity, nutrients (nitrate and phosphorus), total dissolved solids and total suspended solids. The pH of surface waters within the study area is slightly acidic to neutral.

In general, the concentrations of metals and metalloids were similar throughout the study area. Radionuclide concentrations were low, with the majority of measurements lower than their respective laboratory detection limits. For parameters with water quality guidelines, most were below their respective guideline limits. Aluminum, cadmium and lead concentrations exceeded guideline values at some locations and appear to be naturally elevated in surface water in the study area. Elevated concentrations of iron and mercury were measured near the Kratchkowsky Lake bottom in lakes that exhibited thermal stratification when they were sampled.

A depth profile was recorded at the deepest location in each lake, measuring conductivity, pH, temperature and dissolved oxygen. Thermal stratification of the water column was not observed in most lakes during the fall 2016 survey. In winter and summer 2018, however, thermal stratification was observed in McGowan Lake and Kratchkowsky Lake. It was also observed in north basin of Whitefish Lake (LA-6) in winter 2018, but not during the summer survey in the same year. Surface water chemistry was also measured in-situ at all stream stations.

Sediment Quality

Surficial sediments were collected from depositional lake areas in 2016, and were largely comprised of silty-clays or sandy-silts. The proportion of total organic carbon in the sediments varied widely among sampling areas and ranged from 0.44% to 26%.

For parameters with sediment quality guidelines, all constituent concentrations were at or below the lowest applicable guideline value, suggesting that the benthic community would not be negatively influenced by the chemical characteristics of sediments within the study area.

Aquatic Habitat and Bathymetry

Aquatic habitat surveys were undertaken in September 2016, coincident with biological collections. In June 2018, aquatic habitat and bathymetry for McGowan Lake (LA-1) and the north basin of Whitefish Lake (LA-6) were assessed using high resolution bathymetric models and bottom habitat imaging to provide high-resolution bathymetry and support water intake and discharge site selection. The typical shoreline vegetation for all lakes consisted of shrubs and black spruce with upland jack pine forests. Shorelines were generally characterized by rock and overhanging shrubs, transitioning from small boulder and cobble to a sand or silty bottom with patches of sandy beach and sparse emergent or submergent aquatic vegetation.

The stream habitats surveyed as part of the baseline study included 2nd and 3rd order streams in the Icelander River basin and Williams Lake drainage area.

Kratchkowsky Lake was the largest lake (323 ha) and the north basin of Whitefish Lake (LA-6) was the smallest lake (26 ha) in terms of surface area, of the lakes surveyed as part of the baseline study. Kratchkowsky Lake was also the largest lake (12,700,000 m^3), and the south basin of Whitefish Lake (LA-5) was the smallest lake (333,000 m^3), in terms of volume, of the lakes surveyed as part of the baseline study.

Plankton Community

Phytoplankton and zooplankton samples were collected in 2016 at six locations within the study area. At all locations, chlorophyll-a concentrations were below the laboratory method detection confirming that the lakes within the Wheeler River Project are oligotrophic.

The phytoplankton community within the study area consisted of 55 taxa from 7 classes. At least 6 classes were identified at each location. Diatoms (*Bacilliarophyceae*) were numerically dominant, based on measured biovolume, at most locations. The cryptophytes (*Cryptophyceae*), cyanophytes (*Cyanophyceae*), and dinoflagellates (*Dinophyceae*) were also numerically important, comprising > 10% of total phytoplankton biovolume, at some locations.

The zooplankton community within the study area consisted of 32 taxa from 10 classes. At least 7 classes were identified at each location. Branchiopods (*Branchiopoda*) were numerically dominant, based on measured biovolume, at all locations. The copepods (*Copepoda*) and rotifers (*Monogononta*) were also numerically important at some locations.

Benthic Invertebrate Community and Tissue Chemistry

Benthic invertebrate samples were collected in 2016 at ten lake locations and a total of 78 benthic invertebrate taxa from 38 major taxonomic groups (Families) were identified within the study area. Chironomids were prevalent across the study area and were the most numerically dominant taxon at most locations. Other taxonomic groups that represented more than 10% of the total benthic invertebrate density at a sampling location were detritus worms (*Naididae*), pill clams (*Pisidiidae*), water fleas from the families *Holopedidae* and *Macrothricidae*, and phantom midges (*Chaoboridae*). From a feeding group perspective, predatory taxa and those that feed on fine particulate organic matter (collector-gatherers) were generally the most abundant groups in lakes within the study area.

Total invertebrate density ranged on average from less than 1,000 to greater than 10,000 animals/m^2 bottom surface area. On average invertebrate richness ranged from approximately 7 to 24 taxa within sampling areas. Simpson's Diversity Index (*D*) values suggested that the benthic communities were relatively diverse at all locations. Simpson's Evenness (*E*) values suggested that few taxa comprised a large proportion of total invertebrate density at any given sampling location.

Benthic invertebrate tissues (whole animals) from nine locations within the study area were analyzed for metals and radionuclide contents. Metal concentrations were generally similar at all locations, with concentrations within an order of magnitude of each other. Cobalt and nickel presented the greatest variability among stations. Benthic invertebrates from Russell Lake had the highest concentrations of some metals including aluminum, cobalt and uranium. Radionuclide levels were generally below the laboratory method detection limits.

Fish Community, Spawning and Fish Tissue Chemistry

A total of 13 species of fish were collected within the study area during baseline surveys. All waterbodies sampled, except one headwater pond, supported fish.

The list of fish species observed during baseline studies in the Project area was discussed with local land user and Indigenous commercial fisherman Bobby John. Bobby reviewed the list and concluded all fish species have been identified in the area, even 'those little ones with the spiny backs.'

Eleven fish species were collected within study area lakes including representative forage and sport fish species. The species captured included Lake Chub, Spottail Shiner, Longnose Sucker, White Sucker, Lake Whitefish, Lake Trout, Northern Pike, Burbot, Ninespine Stickleback, Yellow Perch and Walleye.

Eleven fish species were also collected at stream stations across the study area. These include Lake Chub, Spottail Shiner, Longnose Sucker, White Sucker, Arctic Grayling, Northern Pike, Burbot, Ninespine Stickleback, Slimy Sculpin, Yellow Perch and Walleye.

Large-bodied fish spawning surveys were undertaken during the fall of 2016 and spring of 2017 at selected lake and stream locations to determine the utilization of these areas for spawning.

Fall spawning species present within the study area include Lake Whitefish and Lake Trout. Lake Trout spawning habitat was identified in Russell Lake. Spawning habitat for Lake Whitefish is present within riverine habitats proximate to the lakes.

Spring spawning species present within the study area include Walleye, Northern Pike, Arctic Grayling, White Sucker, Longnose Sucker and Yellow Perch. Spawning habitats for Walleye and suckers were observed at most stream stations within the Icelander River basin. Northern Pike spawning habitats were present in nearly all study area lakes, as well as most stream stations. Tissue samples (muscle and bone) from Northern Pike and White Sucker collected in 2016 and 2017 were retained for chemical and radiological analyses. Guideline values for constituents in fish tissue are available for mercury and selenium, and fish tissues from the study area were below these guideline values.

In 2018, 22 water samples from McGowan Lake and LA-6 were collected for analysis of environmental DNA, to evaluate this cutting-edge technology as a value-added tool to characterize fish community. However, this study remains inconclusive, potentially due to inhibition factors in the lake water. Future sampling events are recommended to overcome the inhibition issues, and provide archivable samples for biodiversity analysis throughout different stage of the mine life cycle.

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ACRONYMS

ALS	ALS Canada Ltd
B-C	Bray-Curtis Dissimilarity Index
BC MOE	British Columbia Ministry of Environment
Bq/L	Becquerel per Litre
CALA	Canadian Association for Laboratory Accreditation
CoC	Chain-of-custody
SEQG	Saskatchewan Environmental Quality Guidelines
$CaCO_3$	Calcium carbonate
CCME	Canadian Council of Ministers of the Environment
CWQG	Canadian Water Quality Guidelines
CPUE	Catch per unit effort
D	Simpson’s Diversity
DNA	Deoxyribonucleic Acid
DO	Dissolved oxygen
E	Evenness
eDNA	Environmental DNA
EEM	Environmental Effects Monitoring
ERFN	English River First Nation
dw	Dry weight
FPOM	Fine particulate organic matter
GPS	Global positioning system
ISO	International Organization for Standardization
ISQG	Interim Sediment Quality Guideline
LEL	Lowest effect level
masl	Meters above sea level
MDL	Method detection limit
NO_3	Nitrate
NSF	National Science Foundation
PCR	Polymerase Chain Reaction

QA	Quality assurance
QC	Quality control
QMS	Quality Management System
REF	Reference
RPD	Relative percent difference
SOP	Standard Operation Protocol
SRC	Saskatchewan Research Council
SSWQO	Saskatchewan Surface Water Quality Objective
TDS	Total dissolved solids
TKN	Total Kjeldahl Nitrogen
TSS	Total suspended solids
USEPA	United States Environmental Protection Agency
ww	Wet (or fresh) weight
YOY	Young-of-the-year

1.0 INTRODUCTION

1.1 Project Location and Setting

The Denison Mines Corp. (Denison) Wheeler River Project (Project) is located in north central Saskatchewan, in the eastern portion of the Athabasca Basin (**Figure 1-1)**. It is situated approximately 35 kilometres northeast of Cameco Corporation's Key Lake Operation and 35 kilometres southwest of Cameco Corporation's McArthur River Operation.

1.1.1 Ecozone and Ecoregion Setting

The Project area lies within the Boreal Shield ecozone (McLaughlan, 2010). Stretching 3,800 kilometres from Newfoundland to Alberta, the Boreal Shield includes parts of six provinces, covers more than 1.8 million square kilometres, and encompasses almost 20% of Canada's land mass and 10% of its fresh water. This ecozone is characterized as having thin acidic soils, cool temperatures, a short growing season, and frequent forest fires. The passage of forest fires has resulted in a mosaic of forests across the area characterized by different vegetation communities and successional stages. Historical scouring of the area by glaciers has left numerous localized areas of exposed bedrock colonized by lichen and ground hugging shrubs. The remainder of the area is covered by bogs, marshes and other wetlands.

The Athabasca Plain ecoregion of the Boreal Shield ecozone extends south from Lake Athabasca to Cree Lake (ESWG, 1996). This ecoregion is marked by short cool summers and very cold winters. The mean annual temperature is approximately -3.5°C. The mean summer temperature is 12°C and the mean winter temperature is -20.5°C. The mean annual precipitation ranges 350-450 mm. This ecoregion is classified as having a sub-humid high boreal ecoclimate. Stands of jack pine (*Pinus banksiana*) with an understory of ericaceous shrubs and lichen are dominant. Some paper birch (Betula papyrifera), white spruce (*Picea glauca*), black spruce (*Picea mariana*), balsam fir (*Abies balsamea*), trembling aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera*) and tamarack (*Larix laricina*) may also be found where conditions allow. Wildlife common in this area include moose (*Alces alces*), black bear (*Ursus americanus*), woodland caribou (*Rangifer tarandus caribou*), lynx (*Lynx canadensis*), wolf (*Canis lupis*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), snowshoe hare (*Lepus americanus*), waterfowl (including ducks, geese, common loon [*Gavia immer*], white pelican [*Pelecanus erythrorhynchos*], and sandhill crane [*Grus canadensis*]), spruce grouse (*Falcipennis canadensis*), and other birds (grey jay [*Perisoreus canadensis*], bald eagle [*Haliaeetus leucocephalus*] and American kestrel [*Falco sparverius*]). Large-bodied fish species commonly found in lakes and streams of northern Saskatchewan include Walleye (*Sander vitreus*), Yellow Perch (*Perca flavescens*), Northern Pike (*Esox lucius*), Lake Trout (*Salvelinus namaycush*), Arctic Grayling (*Thymallus arcticus*), Lake Whitefish (*Coregonus clupeaformis*), White Sucker

(*Catostomus commersonii*), Longnose Sucker (*Catostomus catostomus*), and Burbot (*Lota lota)* (SSRWS, 2010).

1.1.2 Regional and Local Hydrology

The Project site lies within the Wheeler River watershed, which is part of the Churchill River Basin. The Wheeler River has a watershed area of greater than 3,000 km^2.

Surface water on the Project site drains via two sub-basins of the Wheeler River, the Icelander River drainage and the Williams Lake drainage (**Figure 1-1**). Both drainages flow generally south into the northwest portion of Russell Lake. The estimated drainage areas of the Icelander River and Williams Lake drainage areas are 371 km^2 and 78 km^2, respectively (Golder, 2014). Downstream of Russell Lake, the Wheeler River flows into the Geikie River which subsequently discharges to Wollaston Lake.

1.1.3 Indigenous and Other Land Uses

The Wheeler River Project area lies within the traditional territories of English River First Nation (ERFN) and Kineepik Métis Local 9, as shown in **Figure 1-3**. **Figure 1-4** identifies traditional, recreational and industrial land uses in the Project area. **Figure 1-5** and **Figure** 1-6 provide information from an interview between Denison and a local resident who is a key local land/resource user (Bobby John) and is very knowledgeable about the local and regional ecology (Denison 2020). This information is also summarized below, along with other local and land user knowledge about this area.

1.1.3.1 **Cabins and Recreational Properties**

A property belonging to Bobby John is situated in the southwest portion of Russell Lake: Property No 602377 (**Figure 1-4**). Bobby John's cabin is located upstream of Russell Lake, along the Wheeler River, near Brown Lake. This is his primary cabin, and he has secondary cabins on Russell Lake and Phillips Lake and a family cabin on Cree Lake (**Figure 1-5**)

A cabin on the northern end of Kratchkowsky Lake and evidence of a camp at Mardoc Lake were noted by EcoMetrix field staff during the fall 2016 and spring 2017 field studies.

Recreational properties are situated on the northeast portion of Russell Lake and along the Wheeler River to the northeast of Russell Lake. Bobby John mentioned in his interview that twenty-plus tourist cabins are located on Russell Lake (Denison 2020).

There is one recreational property located on the southwest portion of McGowan Lake: Property No 302586 (**Figure 1-4**).

Generally, it is noted that there have been more recreational leases granted and more cabins established within the area in the last five to ten years; though there is currently a hold on further leases. Most of the more recently established properties are used seasonally, with use limited to a few weeks in the summer.

1.1.3.2 Commercial Fishing

Bobby John operates a commercial fishing business at Russell, McDougal, Moore, Kratchkowsky and Moon lakes (**Figure 1-5**). Generally, lakes are fished for one year and then left for the following two years.

Fish are targeted via netting and fishing occurs from late fall through April when the lakes are ice-covered. The preferred species is Walleye at this time based on price, but Northern Pike, Whitefish and trout are also collected. Fish are sold to the fish plant at Pinehouse, approximately 250 km south of the Project area.

1.1.3.3 Outfitting

Bobby John has identified that there are two active outfitters in the area. The Russell Lake Lodge is located on the southeast end of Russell Lake with an outcamp on Kowalchuk Lake (**Figure 1-4**). The Russell Lake Lodge that has been active since the 1950s. The Wheeler River Lodge is located on Moore Lake. The most prevalent activity associated with the lodges is fishing.

1.1.3.4 Winter Trails, Trapping, Foraging and Recreational Fishing

Two winter trails within or near the Project area have been identified: one passing through the Wheeler River Project area and the other passing south of the Wheeler River Project area (**Figure 1-3**). The first is identified as Bobby John's route, which is confirmed to be actively used. It runs southwest between LA-9 and LA-4, and continues southwest through Williams Lake (LB-3). The second is identified as Paul Sayzie's route. It follows the Wheeler River and crosses the southern portion of Russell Lake.

Trapping has been identified in the area southwest and south of Russell Lake (**Figure** 1-3). Trap lines are run from November through February. According to Mr. Bobby John, Marten is the preferred species based on recent fur prices but other fur bearers such as lynx, beaver and muskrat are also targeted. Generally, fur prices have been poor for the last number of years and therefore less effort has been expended on the trap lines.

Hunting and berry picking have been noted to the south of Russell Lake (**Figure 1-6**). Berry picking activities were also observed by EcoMetrix field staff during fall field work in 2016 when blueberries were noted throughout the Wheeler River Project area.

Recreational angling activities in the area occurs generally within the vicinity of established camps and cabins, and also is associated with the local outfitting operations. Recreational angling activities at Russell Lake were observed during fall field work in 2016. Access to Russell Lake by anglers was from boat launches situated within the northern embayment near the outlet of the Icelander River (LAB-1).

1.1.3.5 **Industrial Properties**

An industrial property that belongs to Rio Tinto Exploration is also located to the south of McGowan Lake: Property No 303242 ().

Two industrial properties that belongs to Saskatchewan Power Corporation (Property No: 303329 and Property No: 303261) are located just southwest of Bobby John's property at Russell Lake.

There is an area at the northwest end of Kratchkowsky Lake with old core boxes (**Figure 1-5**).

There is an abandoned exploration camp located west of Hwy 914 on the road the Wheeler River Project site.

1.2 Background Aquatic Environment Information

Previous baseline hydrology and aquatics investigations for the Project are reported in:

- Golder Associates. Denison Mines-Wheeler River Project. 2012-2014 Aquatic Baseline Summary Report. Prepared for Denison Mines Corporation. May 2014 (**Appendix F**).
- Golder Associated. Denison Mines-Wheeler River Project. 2012-2014 Baseline Hydrology Summary Report. Prepared for Denison Mines Corporation. May 2014 (Part of **Appendix G**).

The 2014 baseline aquatic study report summarizes surface water chemistry and limnology profiles for selected streams surveyed during spring, summer and fall of 2012 and 2013 and the winter of 2014 and lakes surveyed during summer 2012 and winter 2014. Bathymetric surveys and fish habitat assessments of selected lakes were undertaken during the summer of 2012. Lake investigations were completed at McGowan Lake (LA-1), Whitefish Lake (LA-5, LA-6)[1], Williams Lake (LB-3) and in the south arm of Kratchkowsky Lake (LA-7)

[1] Herein lakes LA-5 and LA-6 have been identified as separate water bodies connected by a stream. A local resource user, Bobby John, considers these as two basins of one lake (Whitefish Lake) separated by a narrows.

and Russell Lake (LAB-1) at the inflow from Icelander River. Stream investigations were conducted at SA-1, SA-2, SA-3, SA-4, SA-5, SA-6, SB--1, SB-2, SB-3, SB-4, and SB-5.

The 2014 baseline hydrological study report summarized data from three field programs completed during open water seasons in 2011, 2012 and 2013, as well as one additional winter field program completed between March 22 and April 1, 2014. Staff gauge readings and elevation surveys were conducted at eleven lake stations (McGowan Lake, LA-2, LA-3, Mardoc Lake (LA-4), Whitefish Lake (LA-5, LA-6), LA-7, Russell Lake (LAB-1), LB-1, LB-2 and Williams Lake (LB-3). Instantaneous discharge measurements, continuous water level recordings and elevation surveys were conducted at nine stream stations (SA-1, SA-2, SA-3, SA-4, SA-5, SA-6, SB-1, SB-2 and SB-3).

1.3 Scope of the 2016 to 2019 Baseline Studies

1.3.1 Overview

The overall objective of the 2016 through 2019 baseline aquatic environment studies was to build upon and supplement information collected during the period 2011 through 2014. Together, the results of these studies will support engineering studies, technical assessments and environmental approvals processes for the Project.

The scope of work for the 2016 through 2019 aquatic baseline field studies included:

- water elevation measurements, instantaneous discharge measurements, and continuous water level recording;
- bathymetry and aquatic habitat assessments and mapping;
- limnological, water quality, and sediment quality evaluations;
- benthic invertebrate community and tissue characterization;
- phytoplankton and zooplankton surveys; and,
- fish community and spawning surveys and tissue chemistry analysis.

Sampling was repeated at locations that were part of the 2011 to 2014 studies and new sampling locations were established. New lake stations were established in the northern arm of Kratchkowsky Lake (LA-7A), lakes LA-8 and LA-9, Russell Lake near the inlet of the Williams Lake drainage area (LAB-2), and ponds PA-2, and PA-3. Several stream locations were surveyed for the first time, including several inlets to Kratchkowsky Lake (SA-7, SA-8, SA-11), the outlet of Kratchkowsky Lake (RC-1), the outlet of LA-8 (SA-9) and the inlet to LA-9 (SA-10).

1.3.2 Study Area

The study area comprises surface waterbodies, lakes, ponds and streams, within drainage the Icelander River drainage and the Williams Lake drainage, as well as portions of Russell Lake adjacent to the inflows from these two drainage areas. The study area and aquatic monitoring locations are shown in **Figure 1-7**and **Figure 1-8**. Aquatic monitoring locations within the study area are described in **Table 1-2**.

1.3.3 2016-19 Lentic Stations (Lakes and Ponds) Assessment Program

Nine lakes and three ponds in the Icelander River drainage area, three lakes in the Williams Lake drainage area and two areas of Russell Lake were included in the 2016-19 baseline aquatic studies. The assessment program as it applies to each of these waterbodies is summarized in **Table 1-3.**

1.3.4 2016-19 Lotic Stations (Streams) Assessment Program

Twelve streams in the Icelander River drainage area and five streams in the Williams Lake drainage area were included in the 2016-19 aquatic baseline studies. The assessment program, as it applies to each of these waterbodies is summarized in **Table 1-4**.

1.4 Indigenous Assistance

In addition to the EcoMetrix team, Jobie Daigneault and Jayme George-Eaglechild, residents of the Eagle English River First Nation (ERFN) at Patuanak, SK, provided assistance during the field work program.

Jobie Daigneault participated in aquatic baseline studies undertaken in May-June 2017, March 2018, and June-July 2018. In spring 2017, Jobie provided assistance during a fish spawning survey. His responsibilities included safe operation of an ATV, setting and retrieving gillnets, length and weight measurement of fish, and collection of fish tissues for analysis. During the winter of 2018, Jobie assisted with limnological and hydrological studies involving measuring water chemistry and ice thickness, and collection of water samples from several lakes. His responsibilities included safe operation of a power ice auger and snowmobile. His experience with “trail breaking” in deep snow proved invaluable, enabling the EcoMetrix team to get work completed as efficiently as possible. During summer 2018, Jobie provided assistance with limnological and hydrological studies involving measuring water chemistry, flow discharge, water elevation, and collection of water samples for environmental DNA analysis from several lakes and streams. His responsibilities included safe operation of an ATV, surveying and collection of water.

Jayme George-Eaglechild participated in aquatic baseline studies undertaken in July 2019. He provided assistance with hydrological data collection including flow discharge measurements, water elevation surveys, and collection of water samples for analysis. His responsibilities included surveying and flow measurement.

1.5 Report Format

Following this introductory section, the remainder of the report is organized as follows. In **Section 2.0**, the methodology of each of the separate components of the 2016-19 baseline program is outlined. Baseline data for lentic stations, lake and ponds, are provided in **Section 3.0**, including the results of the 2016-19 aquatic surveys, as well as previous work conducted at the site (**Appendix F,** part of **Appendix G**). Information is presented on a lake-by-lake basis, beginning with lake and then pond stations in the Icelander River Drainage, lake stations in the Williams Lake Drainage, and finally stations in Russell Lake. Baseline data for stream stations are provided in **Section 4.0**, including the results of the 2016-19 aquatic surveys, as well as previous work conducted at the site (**Appendix F,** part of **Appendix G**). Information is presented on a stream-by-stream basis, beginning with stations in the Icelander River drainage area and then transitioning to stations in the Williams Lake drainage area. **Section 5.0** provides a summary of baseline characteristics for the Wheeler River Project study area. References consulted in the preparation of this report are provided in **Section 6.0**. Throughout the report, data and input from Indigenous and Local Land Users has been highlighted and compared to results from baseline investigations.

The appendices to this report include:

Appendix A: Baseline Aquatic Environment Data

Appendix B Analytical Laboratory Reports

Appendix C: Stream Station Photographs

Appendix D: Fish Species Photographs

Appendix E: Special Collection Permits

Appendix F: Golder Associates Ltd. 2014a. 2012-2014 Aquatic Baseline Summary Report.

Appendix G: EcoMetrix Incorporated. 2019. Denison Wheeler River Hydrology Baseline 2011 to 2019 Report

Appendix H: Milne Technologies. 2018 Denison Mines (Wheeler River Site) Multibeam Sonar Bathymetry and Habitat Mapping Report.

Tables

Table 1-1: Summary of 2011 to 2014 Hydrological and Aquatic Baseline Data for the Wheeler River Project

Station Name		Hydrological Study Data																Aquatics Study Data								
		Instantaneous Discharge Measurements				Continuous Water Level Recording				Staff Gauge				Elevation Survey				Limnology			Water Quality				Bathymetry	Fish Habitat
Drainage	Station	2011	2012	2013	2014	2011	2012	2013	2014	2011	2012	2013	2014	2011	2012	2013	2014	2012	2013	2014	2011	2012	2013	2014	2012	2012
Lentic Stations - Lakes and Ponds																										
Icelander River Drainage Area	McGowan Lake (LA-1)	·	·	·	·	·	·	·	·	√	√	√	·	√	√	√	√	√	·	√		√	·	√	√	√
	LA-2	·	·	·	·	·	·	·	·	√	√	√	·	√	√	√	√	·	·	√		·	·	√	·	·
	LA-3	·	·	·	·	·	·	·	·	√	√	√	·	√	√	√	√	·	·	√		·	·	√	·	·
	Mardoc Lake (LA-4)	·	·	·	·	·	·	·	·	√	√	√	·	√	√	√	√	·	·	√		·	·	√	·	·
	Whitefish Lake (LA-5)	·	·	·	·	·	·	·	·	√	√	√	·	√	√	√	√	√	·	√		√	·	√	√	√
	Whitefish Lake (LA-6)	·	·	·	·	·	·	·	·	√	√	√	·	√	√	√	√	√	·	√		√	·	√	√	√
	Kratchkowsky Lake (LA-7)	·	·	·	·	·	√	√	·	√	√	√	·	√	√	√	√	√	·	√		√	·	√	√	√
Williams Lake Drainage Area	LB-1	·	·	·	·	·	·	·	·	√	√	√	·	√	√	√	·	·	·	·		·	·	·	·	·
	LB-2	·	·	·	·	·	·	·	·	√	√	√	·	√	√	√	√	·	·	√		·	·	√	·	·
	Williams Lake (LB-3)	·	·	·	·	·	·	·	·	√	√	√	·	√	√	√	√	√	·	√		√	·	√	√	√
Russell Lake	LAB-1 (RL-A)	·	·	·	·	·	·	·	·	√	√	√	·	√	√	√	√	√	·	√		√	·	√	√	√
Lotic Stations - Streams																										
Icelander River Drainage Area	SA-1	√	√	√	√	√	√	√	√	·	·	·	·	√	√	√	√	√	√	√		√	√	√	·	·
	SA-2	√	√	√	√	√	√	√	√	·	·	·	·	√	√	√	√	√	√	√		√	√	√	·	·
	SA-3	√	√	√	√	√	√	√	√	·	·	·	·	√	√	√	√	√	√	√		√	√	√	·	·
	SA-4	√	√	√	√	·	√	√	√	·	·	·	·	√	√	√	√	√	√	√		√	√	√	·	·
	SA-5	√	√	√	√	·	√	√	√	·	·	·	·	√	√	√	√	√	√	√		√	√	√	·	·
	SA-6	√	√	√	√	√	√	√	√	·	·	·	·	√	√	√	√	√	√	√		√	√	√	·	·
Williams Lake Drainage Area	SB-1	√	√	√	√	√	√	√	√	·	·	·	·	√	√	√	√	√	√	√		√	√	√	·	·
	SB-2	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	√	√	√		√	√	√	·	·
	SB-3	√	√	√	√	√	√	√	√	·	·	·	·	√	√	√	√	√	√	√		√	√	√	·	·
	SB-4	√	√	√	√	·	√	√	√	·	·	·	·	√	√	√	√	√	√	√		√	√	√	·	·
	SB-5	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	√	√	√		√	√	√	·	·

Notes:

√ - indicates that sampling occurred

· - indicates that no sampling occurred

Aquatic and hydrologic programs were conducted:

2011 - May 11 to May 16, July 27 to July 31 and October 27 to October 31.

2012 - May 3 to May 9, August 5 to August 8, and October 21 to October 25.

2013 - May 18 to May 24, August 12 to August 15, and October 16 to October 19.

2014 - March 22 to April 1.

Table 1-2: 2016-19 Baseline Hydrological and Aquatic Study Assessment Locations

Drainage	Waterbody	Description
Lake and Pond Stations		
Icelander River Drainage Area	McGowan Lake (LA-1)	Situated within drainage area A, upstream of Russell Lake (LAB-1) and downstream of lakes LA-2 (via SA-3) and LA-5 (via SA-2)
	LA-2	Situated within the eastern sub-basin of drainage area A, upstream of lake LA-1 and downstream of lakes LA-3 and LA-4
	LA-3	Situated within the eastern sub-basin of drainage area A, upstream of LA-2
	Mardoc Lake (LA-4)	Situated within the eastern sub-basin of drainage area A, upstream of LA-2
	Whitefish Lake (LA-5)	Comprises of the southern basin of Whitefish Lake and is situated within drainage area A, upstream of lake LA-1 and downstream of lake LA-6 (via SA-6)
	Whitefish Lake (LA-6)	Comprises of the northern basin of Whitefish Lake and is situated within drainage area A, upstream of the south basin of Whitefish Lake and downstream of lakes LA-9 (via SA-5) and LA-7 (via SA-4)
	Kratchkowsky Lake (LA-7)	Comprises of the southeast portion of Kratchkowsky Lake and is situated within drainage area A, upstream of lake LA-6
	Kratchkowsky Lake (LA-7A)	Comprises of the northwest portion of Kratchkowsky Lake and is situated within drainage area A, upstream of lake LA-6
	LA-8	Situated within drainage area A, upstream of lake LA-9
	LA-9	Situated within drainage area A, upstream of lake LA-6 and downstream of LA-8 (via SA-9 and SA-10)
	PA-2	Headwater pond situated within drainage area A, upstream of pond PA-3
	PA-3	Situated within drainage area A, downstream of pond PA-2 and upstream of lake LA-6
Williams Lake Drainage Area	LB-1	Situated within drainage area B, upstream of Russell Lake (LAB-2) and downstream of lake LB-2 (via SB-3)
	LB-2	Situated within drainage area B, upstream of lake LB-1 and downstream of Williams Lake (LB-3) (via SB-5)
	Williams Lake (LB-3)	Headwater lake situated within drainage area B, upstream of lake LB-2, known locally as Williams Lake
Russell Lake	LAB-1 (RL-A)	Comprises a small portion of Russell Lake and is situated within the northern embayment at the outlet of the Icelander River (drainage area A), downstream of SA-1.
	LAB-2	Comprises a small portion of Russell Lake and is situated along the northwestern shore at the outlet of drainage area B, downstream of SB-1
Stream Stations		
Icelander River Drainage Area	SA-1	Most downstream monitoring station in Drainage Area A
	SA-2	Northwest tributary of lake LA-1 downstream of lake LA-6.
	SA-3	Situated upstream of lake LA-1 and downstream of lake LA-2
	SA-4	Situated upstream of lake LA-6 and downstream of the outlet from of Kratchkowsky Lake (LA-7), and drainage from ponds PA-2 and PA-3
	SA-5	Situated upstream of lake LA-6 on the northeastern tributary that provides drainage from lakes LA-8 and LA-9
	SA-6	Situated downstream of lake LA-6 and upstream of lake LA-5
	SA-7	Situated on the southwestern inlet tributary to Kratchkowsky Lake (LA-7)
	SA-8	Situated on the northwestern inlet tributary to Kratchkowsky Lake (LA-7)
	SA-9	Situated on the southeastern outlet tributary of lake LA-8
	SA-10	Situated on the northern inlet tributary to lake LA-9
	SA-11	Situated on the northeastern inlet tributary to Kratchkowsky Lake (LA-7)
	RC-1	Situated downstream of Kratchkowsky Lake (LA-7) and upstream of station SA-4
Williams Lake Drainage Area	SB-1	The most downstream station in Drainage Area B, situated at the Highway 914 Road crossing
	SB-2	Situated on a tributary that drains from the west, joining the watercourse immediately upstream of the Highway 914 Road crossing at SB-1
	SB-3	Situated downstream of lake LB-2.
	SB-4	Situated on the southwestern inlet tributary to Williams Lake (LB-3)
	SB-5	Situated on the outlet tributary from Williams Lake (LB-3), upstream of lake LB-2

Table 1-3: 2016-19 Hydrological and Aquatics Baseline Assessment Program Lakes and Ponds

Waterbody / Station Name	Water Elevation Survey	Bathymetry	Limnology	Water Quality	Sediment Chemistry	Benthic Invertebrate Community	Benthic Invertebrate Chemistry	Phytoplankton and Zooplankton	Fish Habitat	Fish Community[a]	Fish Spawning Survey	Fish Tissue Chemistry[b]
McGowan Lake (LA-1)	2016, 2018, 2019	2018	2018	2016, 2018	2016	2016	2016	2016	-	2016, 2018	2016, 2017	2016, 2017
LA-2	2016	-	-	2016	-	-	-	-	-	-	-	-
LA-3	2016	-	-	2016	-	-	-	-	-	-	-	-
Mardoc Lake (LA-4)	2016	-	-	2016	-	-	-	-	-	-	-	-
Whitefish Lake (LA-5)	2016	-	-	2016	2016	2016	2016	2016	-	2016	2016, 2017	2016, 2017
Whitefish Lake (LA-6)	2016, 2018, 2019	2018	2018	2016, 2018	2016	2016	2016	2016	-	2016, 2018	2016, 2017	2016, 2017
Kratchkowsky Lake (LA-7)	2016, 2017	-	-	2016	2016	2016	2016	2016 [a]	-	2016[c]	2016, 2017	2016, 2017[c]
Kratchkowsky Lake (LA-7A)	2016	2016	2016	2016	2016	2016	2016		2016		2016, 2017	
LA-8	2016, 2017	2016	2016	2016	2016	2016	2016	-	2016	2016	-	-
LA-9	2016, 2017	2016	2016	2016	2016	2016	2016	-	2016	2016	-	-
LB-1	2016	-	-	2016	-	-	-	-	-	-	-	-
LB-2	2016	-	-	2016	-	-	-	-	-	-	-	-
Williams Lake (LB-3)	2016	-	-	2016	2016	2016	-	-	-	-	-	-
Russell Lake (LAB-1)	2016	-	-	2016	2016	2016	2016	2016	-	2016[d]	2016, 2017	2016, 2017[d]
Russell Lake (LAB-2)	2016	2016	2016	2016	2016	2016	2016	2016	2016		2016, 2017	
PA-2	2016, 2017	2016	2016	2016	-	-	-	-	2016	2016	-	-
PA-3	2016, 2017	2016	2016	2016	-	-	-	-	2016	2016	-	-

Notes:
"-" indicates that no sampling occurred
Aquatic and hydrologic programs were conducted: September 9-22, 2016; May 26-June 1, 2017; March 15-18, 2018; June 29-July 3, 2018; July 4-6, 2019; August 29-September 1, 2019
A – Included external health assessment on a sub-set of fish and eDNA analysis
b – Trace metal and radionuclide analysis in bone and flesh from n=5 predator fish (Northern Pike [*Esox lucius*]) and n=5 forage fish (White Sucker [*Catostomus commersonii*]) from each waterbody
c – For purposes of describing the fish community and fish tissue chemistry, Kratchkowsky Lake was considered a single study area and fish were collected throughout the lake
d – For purposes of describing the fish community and fish tissue chemistry, Russell Lake was considered a single study area and fish were collected from LAB-1 and LAB-2

Table 1-4: 2016-19 Hydrological and Aquatics Baseline Assessment Program Streams

Station Name	Instantaneous Discharge Measurements[a]	Continuous Water Level Recording	Elevation Survey	Water Quality	Spawning Habitat Survey	Fish Community
SA-1	2016, 2017, 2018, 2019	2016[b], 2017, 2018, 2019	2016, 2017, 2018, 2019	2019	2016, 2017	2016, 2017
SA-2	2016, 2019	2016	2016, 2019	2019	2016, 2017	2016, 2017
SA-3	2016, 2019	2016	2016, 2019	2019	-	-
SA-4	2016, 2017, 2018, 2019	2016, 2017, 2018, 2019	2016, 2017, 2018, 2019	2019	2016, 2017	2016, 2017
SA-5	2016, 2017, 2018, 2019	2016, 2017, 2018, 2019	2016, 2017, 2018, 2019	2019	2016, 2017	2016, 2017
SA-6	2016, 2017, 2018, 2019	2016[c], 2017, 2018, 2019	2016, 2017, 2018, 2019	2019	2016, 2017	2016, 2017
SA-7	2016	-	-	-	-	-
SA-8	2016, 2017, 2018, 2019	2016, 2017, 2018, 2017	2016, 2017, 2018, 2019	-	-	-
SA-9	2016, 2017, 2019	2016, 2017, 2018, 2019	2016, 2017, 2018, 2019	-	-	-
SA-10	2016, 2017, 2019	2016, 2017, 2018, 2019	2016, 2017, 2018, 2019	-	-	-
SA-11	2016, 2017, 2018, 2019	2016, 2017, 2018, 2019	2016, 2017, 2018, 2019	-	-	-
RC-1	2016, 2018, 2019	-	2016, 2019	2019	2017	2017
SB-1	2016	2016[c]	2016	-	2016	2016
SB-2	2016	2016	2016	-	-	-
SB-3	2016	2016	2016	-	-	-
SB-4	2016	2016[b]	2016	-	-	-
SB-5	2016	2016	2016, 2017	-	-	-

Notes:

"-" indicates that no sampling occurred

Aquatic and hydrologic programs were conducted: September 9-22, 2016; May 26-June 1, 2017; March 15-18, 2018; June 29-July 3, 2018; July 4-6, 2019; August 29-September 1, 2019

a – multiple readings of instantaneous discharge were taken during each sampling event

b – level logger was not found or was not functional in 2016

c – level logger installed by Golder was retrieved in 2016

Figures

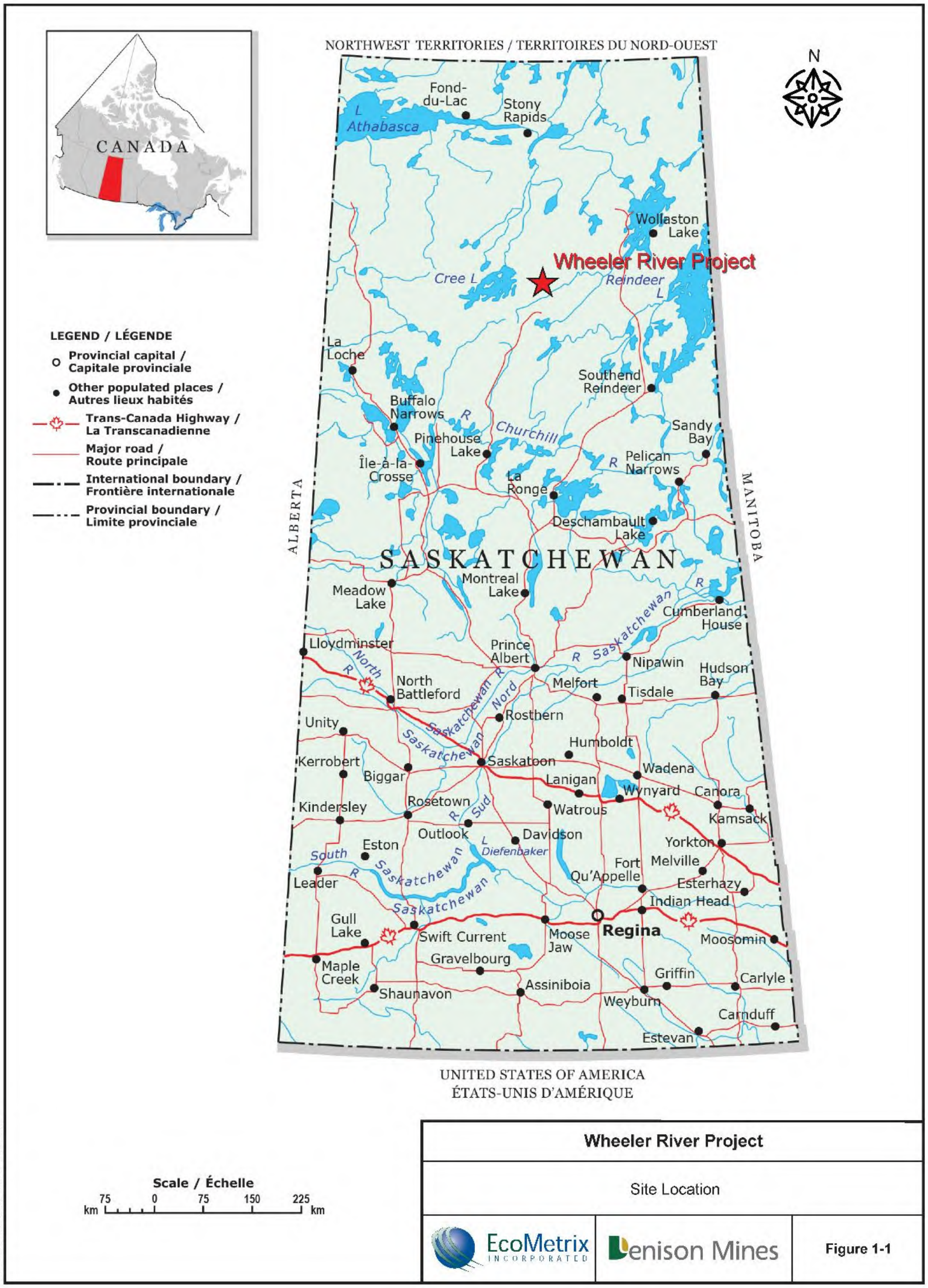


Figure 1-1: Site Location

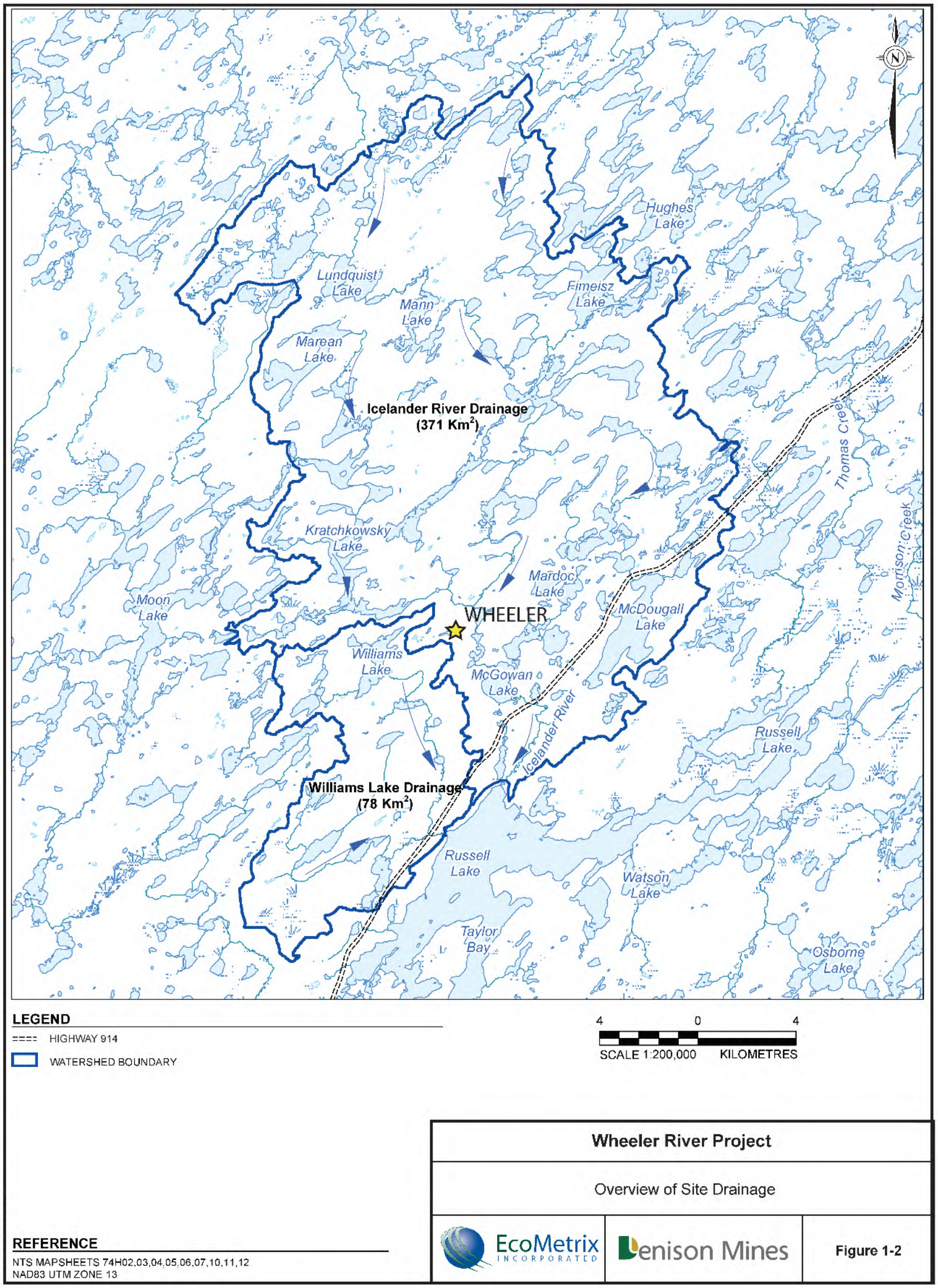
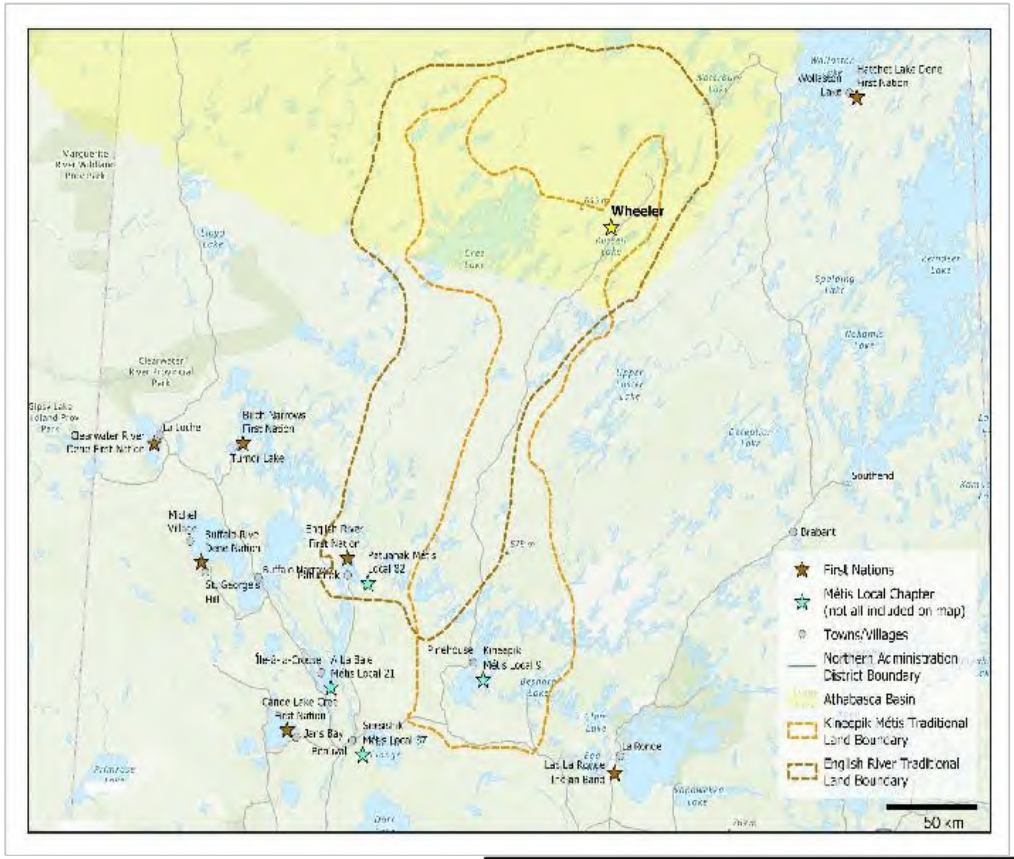


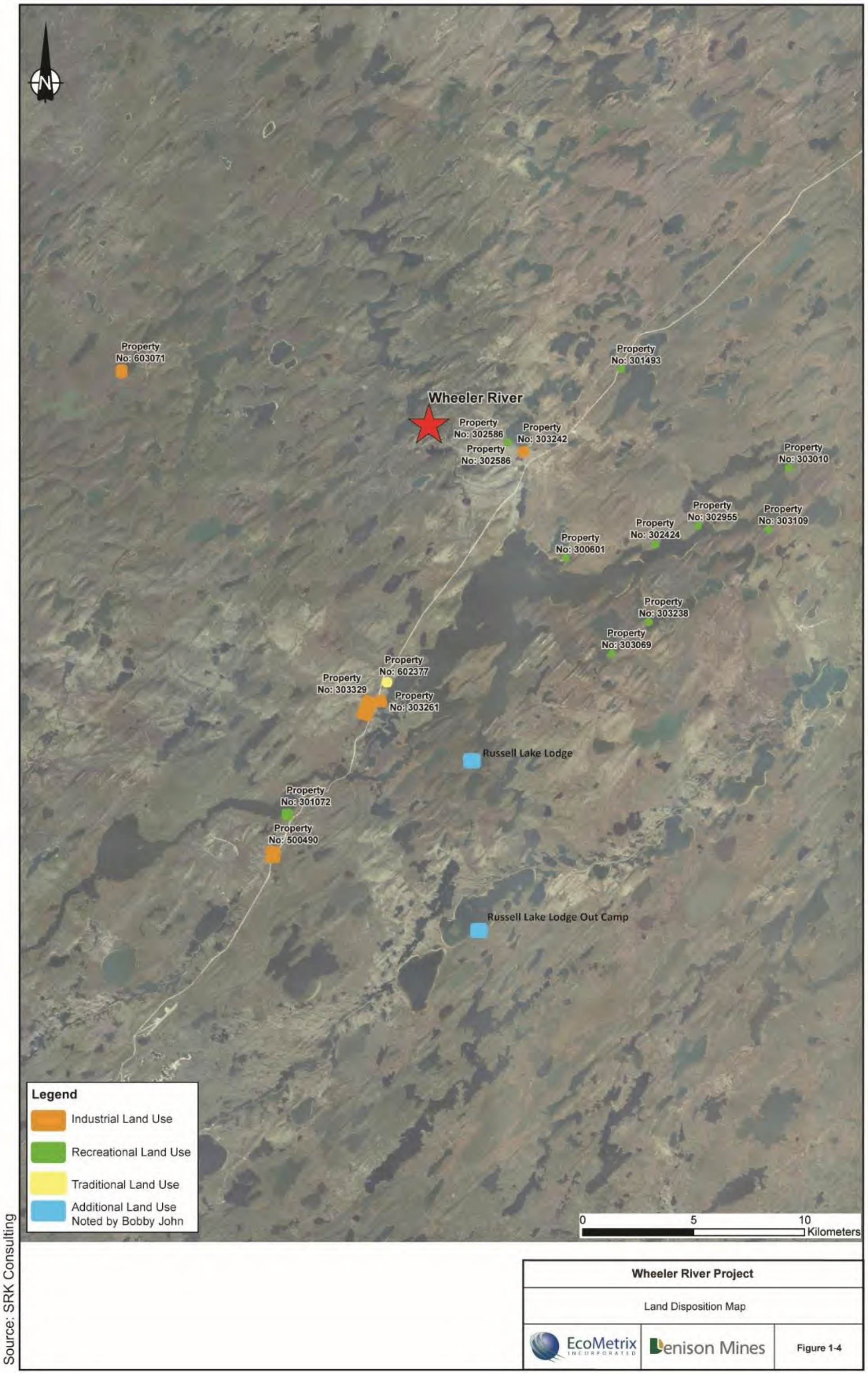
Figure 1-2: Overview of Site Drainage



Note: Not all Indigenous traditional territories are included on the map

Wheeler River Project		
Traditional Territoy Boundaries Provided by English River First Nation and Pinehouse Kineepik Métis		
EcoMetrix Incorporated	Denison Mines	**Figure 1-3**

Figure 1-3: Regional Traditional Territories (Denison 2019)



Source: SRK Consulting

Figure 1-4: Traditional, Recreational, and Industrial Land Use Leases in Proximity to the Wheeler River Project Area (Denison 2019, Denison 2020)

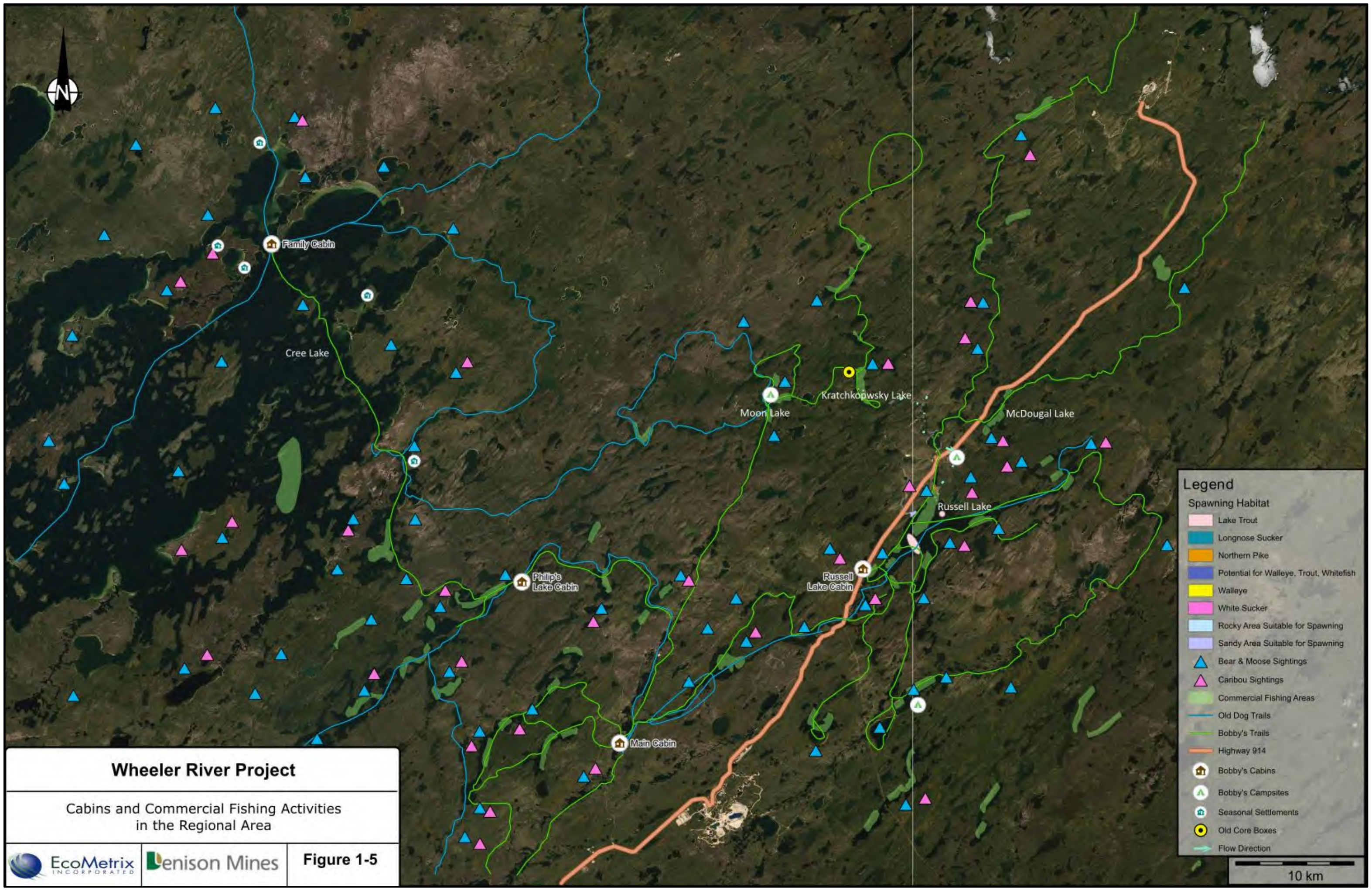
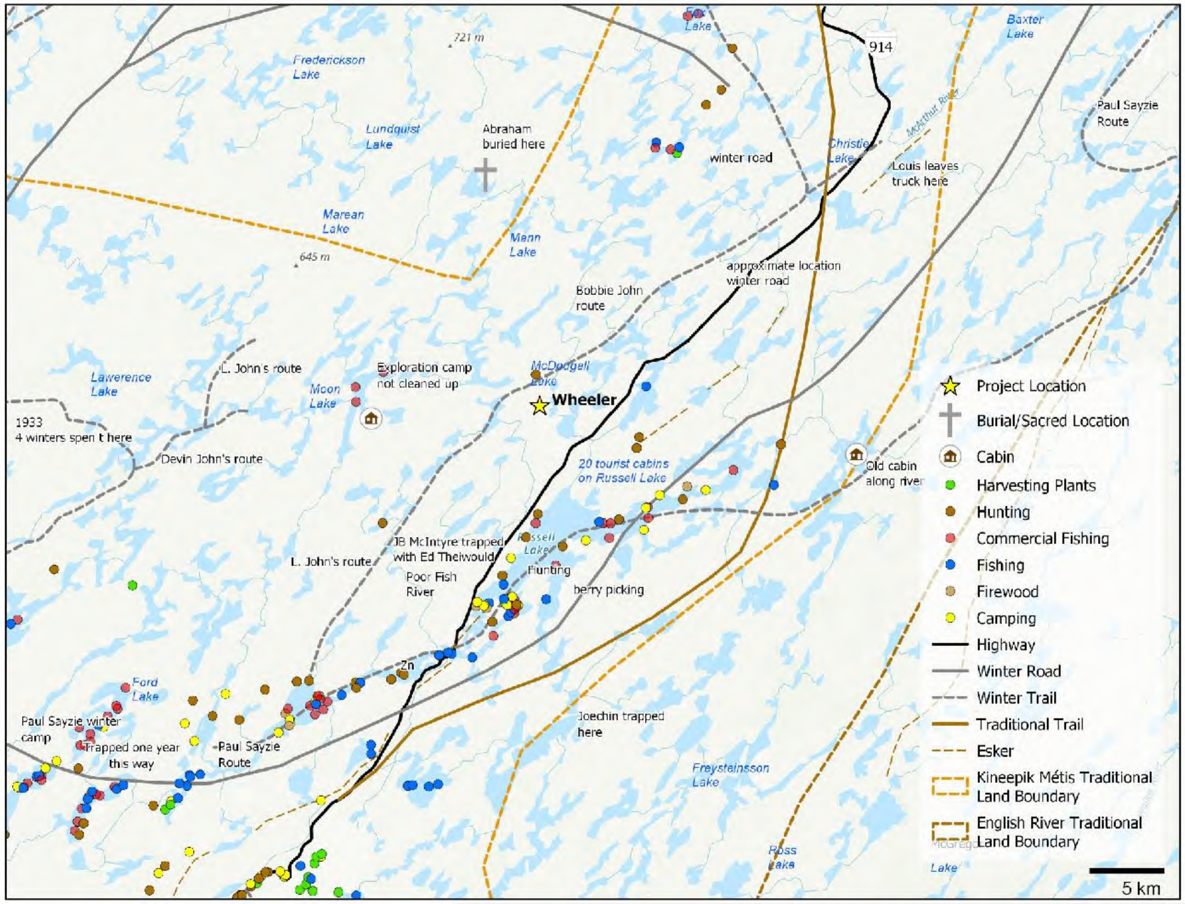


Figure 1-5 Regional Commercial Fishing Activities and Fish Spawning Area around Wheeler River Project Area (Denison 2020).



Note: Traditional territory boundaries provided by English River First Nation and Pinehouse Kineepik Métis

Wheeler River Project	Available Traditional Land Use Data Around Wheeler	
EcoMetrix INCORPORATED	Denison Mines	**Figure 1-6**

Figure 1-6 Available Knowledge about Traditional Land Use Around Wheeler River Project Area

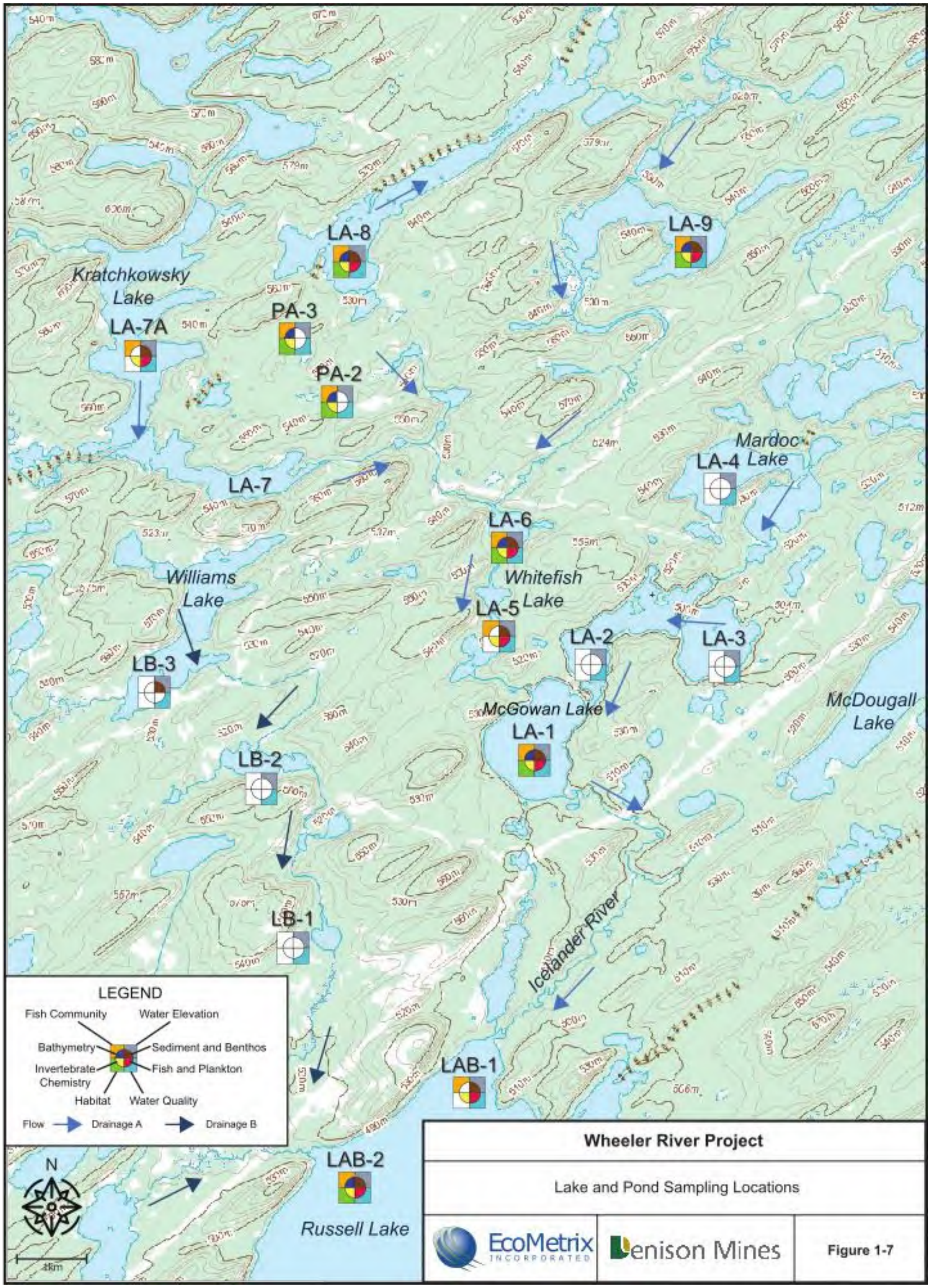


Figure 1-7: 2016-19 Baseline Hydrological and Aquatic Study Lake and Pond Sampling Locations

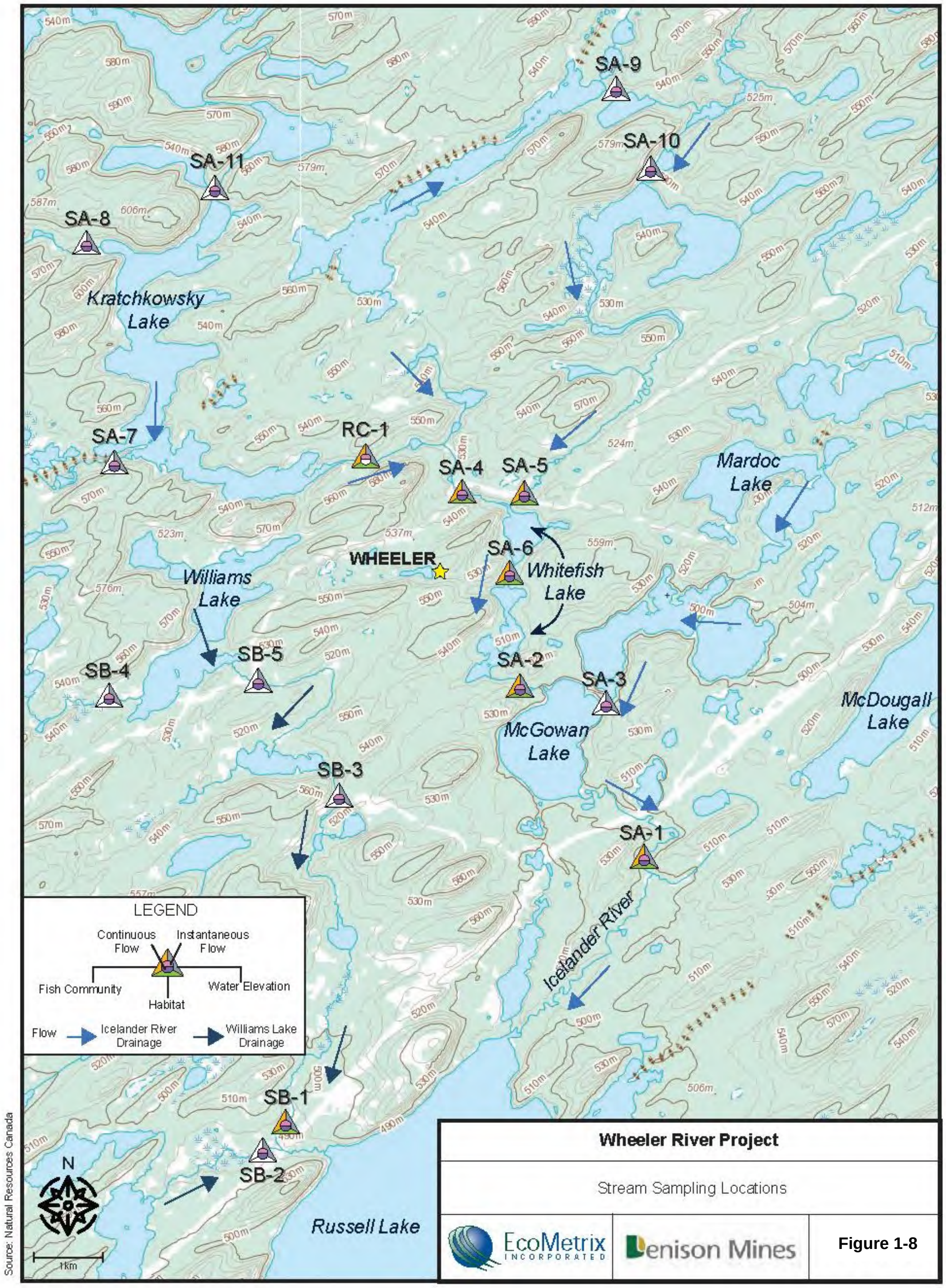


Figure 1-8: 2016-19 Baseline Hydrological and Aquatic Study Stream Sampling Locations

2.0 STUDY METHODOLOGY

The field and laboratory work that was conducted as part of the 2016 through 2019 baseline studies, as well as associated quality control and quality assurance procedures is discussed below. Where appropriate, sampling methodologies followed EcoMetrix Standard Operating Procedures, which are generally consistent with CCME (2011) *Protocols Manual for Water Quality Sampling in Canada,* as well as CCME (2016) *Guidance Manual for Environmental Site Characterization in Support of Environmental and Human Health Risk Assessment, Volume 3: Suggested Operating Procedures*.

2.1 Hydrology

2.1.1 Water Elevation and Discharge

Water level elevations were surveyed at a number of lakes (13), streams (17) and ponds (2) within the study area. In addition, manual stream flow measurements were taken at 17 stream locations. Continuous stream flow monitoring equipment was installed at eight locations.

2.1.1.1 **Water Elevation**

Water elevation surveys were undertaken between September 09 and 22, 2016; May 30 and June 1, 2017; March 15 and 18, 2018; June 29 and July 3, 2018, July 4 and 6, 2019 and August 28 and September 1, 2019. Where possible, water elevations were referenced to geodetic benchmarks established by Golder (**Appendix G**). New locations (LA-8, LA-9, PA-2 and PA-3) were referenced to temporary benchmarks, each with an assumed elevation of 100 masl, and subsequently converted to geodetic elevations using new benchmarks established in May 2017.

A description of how the geodetic elevations and benchmarks were established by Golder is presented in **Appendix G**.

2.1.1.2 **Stream Flow Measurement**

<u>Instantaneous Flow Measurements</u>

Between 2016 and 2019, streamflow measurements were recorded at seventeen watercourses within the study area using the mid-section method as detailed in **Appendix G**. The mid-section method involves measuring the channel area and water velocities of a stream at a cross section. The channel is divided into a number of vertical subsections, adequate to characterize the irregular geometry of the channel. The depth and average velocity are measured at each subsection and are applied to a sub-area whose width extends half way to the preceding and following observation points. The area of each subsection is determined by directly measuring width and depth. The average water velocity in each sub-section is estimated using the measured velocity at selected locations in the vertical. The total discharge within the stream is the sum of the individual subsection discharges.

Continuous Water Level Recording

Eight temporary stream flow monitoring stations (SA-1, SA-4, SA-5, SA-6, SA-8, SA-9, SA-10, and SA-11) were installed in the fall of 2016 (see **Appendix G**). The stream flow monitoring stations were established to obtain information on local watercourse flow characteristics.

The Solinst Levelogger instrumentation measures absolute pressure and therefore compensation is required for atmospheric pressure fluctuations. Barometric pressure compensation is achieved using an additional device (e.g., Barologger) to measure barometric pressure. A barologger was installed and deployed adjacent the SA-4 station. The data collected from the barologger was be used to apply barometric pressure compensation to data collected from the Solinst Levelogger instrumentation.

Loggers were installed by Golder in 2013 and left in place at the following locations: SB-1, SB-4, SA-1, and SA-6. In the fall of 2016, leveloggers were located and retrieved at SB-1 and SA-6; however, equipment was not found at SB-4 and SA-1. The logger at SA-6 was redeployed at SA-6 and the logger at SB-1 was redeployed at SA-1. Available data on the instruments included water level and temperature data from May 18, 2013 to August 30, 2015. As there were no manual measurements to calibrate the continuous flow measurements at SA-6 and SB-1 during this time period, the results for these locations are not included in this report.

Recorded data from the leveloggers deployed in the fall of 2016 at streams SA-1, SA-4, SA-5, SA-6, SA-8, SA-9 and SA-10 and the site barologgers were retrieved in the spring of 2017. All level data loggers were re-deployed after data downloading. Data were downloaded again in the summers of 2018 and 2019. Most level data loggers were re-deployed, except the logger at SA-6, which was replaced in 2019 due to depletion of battery life, and the logger at SA-8 was moved upstream to mitigate influence of backwater from the Kratchowsky Lake In July 2018, level data loggers were installed in McGowan Lake (LA-1) and Whitefish Lake (LA-6). In early October 2018, the level data logger was dislodged from McGowan Lake by ice, and hence was removed. The logger was reinstalled to LA-1 in August 2019. The level data logger installed in LA-6 was not located during the 2019 field survey.

Barometric compensation for the 2016-2019 field program was completed using the site barologger with any gaps filled using transformed data from the Key Lake Climate Station (Climate ID = 4063757) at 57°15'23.000" N, 105°37'03.000" W. Barometric compensation for the retrieved 2013 to 2015 data at SB-1 and SA-6 was completed using transformed data from the Key Lake Climate Station. The Key Lake Climate Station has an hourly barometric pressure record at 57°15'23.000" N, 105°37'03.000" W. The data were linearly interpolated to 15 minute and 30 minute-intervals to develop the barometric compensation for the levelogger data. A relationship between the barometric pressure at the site barologger and the Key Lake station was developed using the May 2017 data. This relationship was used to compensate for the barometric pressure with the project levelogger data.

Rating Curve Development

Rating curves are used to transform results from level data loggers installed in water courses to discharge rates. Golder (2014) presented rating curves for the stream stations SA-1, SA-2, SA-3, SA-4, SA-5, SA-6, SB-1, SB-3, and SB-4, and the lake stations McGowan Lake (LA-1), LA-2, Whitefish Lake (LA-5, LA-6), Kratchkowsky Lake (LA-7) and LB-2. The manual flow measurements taken as part of the 2016 to 2019 field program were graphed along with Golder's measurements and rating curves were reviewed for suitability for use with the new installations. For lake stations, discharge at the outlet stream was used to correlate to the water elevation. In 2019, the monitored stream discharge was greater at a few locations within the Icelander River Drainage, and therefore, rating curves were adjusted accordingly. Rating curves are presented in **Appendix G**.

Based on the data, manual flow measurements at SA-2 and SA-6 recorded between 2011 and 2019 appear to fit into the stage-discharge relationships. In 2016, the SA-5 hydrometric was installed upstream of the 2011-2014 site, at a location with similar channel width and gradient. The rating curve for SA-5 was shifted upstream based on the five manual flow measurements taken between 2016 and 2019. In addition, the equation describing stage-discharge relationship at SA-1, SA-3 and SA-4 was adjusted in 2019 to accommodate higher flow observed in this year (**Appendix G**). A preliminary stage-discharge relationship was developed at SA-11 based on 2019 updates to the baseline hydrology report.

The stage-discharge relationship at hydrometric stations were used to process hydrographs to reflect discharge at stream stations within each open water season. As the emphasis of this study was on the long-term discharge of streams, all flow rates were averaged for each day of monitoring.

For stream stations SA-8, SA-9, and SA-10, the number of manual flow measurements obtained to date were not sufficient to develop a rating curve for conversion from level to flow. Additional manual measurements are required to capture low and high flow conditions. For these streams, elevations from leveloggers were reported as part of this baseline report, which could be converted to flow at a later date, once additional data are collected.

2.1.1.3 Measurement of Ice Thickness

Ice thickness in McGowan Lake (LA-1), Whitefish Lake northern basin (LA-6) and Kratchkowsky Lake (LA-7) was measured between March 15 and 18, 2018, at the deepest point of the lake. An ice auger was used to drill through the ice and thickness was measured using a measuring tape.

2.1.2 Bathymetry

Detailed bathymetric surveys were undertaken on selected lakes and ponds in September 2016. Bathymetric surveys were completed following a standard method using an integrated recording depth sounder and global positioning system (GPS) with WAAS enabled receiver (HDS-8). A boat was operated along systematic transects to simultaneously collect depth and position data. Transects were appropriately spaced for the size of each of the waterbodies. The HDS-8 unit recorded GPS coordinates at the location of each depth measurement thereby providing a high degree of resolution of the bottom profile. Absolute positioning was accurate to within 2 to 3 m laterally, although relative positioning (i.e., the distance between point to point measurements) was accurate to within about 1 m.

Processing of the bathymetry data was completed using contouring and 3D surface mapping software (Surfer 10; Golden Software and Manifold 8) employing a kriging geostatistical technique to create bathymetric contours and to provide volume estimates for the lakes.

In June 2018, high resolution bathymetric surveys and bottom habitat imaging was conducted at McGowan Lake and Whitefish Lake north basin (LA-6) as described in **Section 2.4.2**.

2.2 Water Quality and Limnology

Surface water quality for each lake and pond (**Figure 1-7**, **Table 1-3**) was characterized by the measurement of both physical and chemical constituents obtained *in-situ* in the field and by laboratory analysis.

Field chemistry measurements at each lake station included:

- conductivity;
- pH;
- temperature;
- dissolved oxygen (DO); and
- water clarity.

A depth profile of these constituents was recorded in each lake, at its deepest location as identified during bathymetry investigations. Conductivity, pH, temperature and DO were measured at 1 m intervals from the surface to the bottom of the water column. These parameters were measured using a YSI 600 QS Sonde and YSI 650 MDS display-datalogger. The multimeter was calibrated to manufacturer's specifications prior to commencement of the study and calibration was verified periodically throughout the surveys. When necessary, re-calibration was undertaken. Water clarity at the lake profile location was assessed by measuring the Secchi Disk depth.

Samples were collected from McGowan Lake (LA-1), Whitefish Lake north basin (LA-6) and Kratchlowsky Lake (LA-7) for subsequent laboratory analysis of the following constituents:

- pH and conductivity;
- Total suspended solids (TSS) and total dissolved solids (TDS);
- Alkalinity, acidity and hardness;
- Nutrients (total and dissolved phosphorus, ammonia, and TKN);
- Total metals; and
- Radionuclides.

For each lake sampling location, a single surface water sample was collected for laboratory analysis from near the surface using a beta bottle. At stations where a distinct thermocline was observed at the time of the field sampling program (i.e., the water column was not well mixed), a second water sample was collected from below the thermocline using a beta bottle. These samples were named as "The name of the water body-"top" or "bottom". QA samples (field blank, trip blank, field duplicates) were collected as part of the sampling program.

Surface water quality for each stream (**Figure 1-8**, **Table 1-4**) was also characterized by the measurement of both physical and chemical constituents obtained in-situ in the field and by laboratory analysis. Field measurements at each stream station included:

- conductivity;
- pH;
- temperature; and
- dissolved oxygen.

These parameters were measured using a YSI 600 QS Sonde and YSI 650 MDS display-datalogger. The multimeter was calibrated to manufacturer's specifications prior to commencement of the study and calibration was verified periodically throughout the surveys. When necessary, re-calibration was undertaken.

Samples collected for subsequent laboratory analysis included the following constituents:

- pH and conductivity;
- Total suspended solids (TSS) and total dissolved solids (TDS);
- Alkalinity, acidity and hardness;
- Nutrients (total and dissolved phosphorus, ammonia, and TKN);
- Total metals; and
- Radionuclides.

Coordinates for each sampling location were obtained with a Garmin GPSmap 62s Global Positioning System (GPS). Coordinates were recorded at each sampling station and expressed as degrees, minutes and seconds (dd mm ss; World Geodetic System [WGS84] datum).

Water samples were conserved in laboratory prepared and labelled containers and the sampling location was inscribed on each container by the field staff. Water samples for dissolved constituents were filtered in the field by using 0.45-micron syringe filters. Water samples were stored in coolers until delivery to the camp site, and kept refrigerated until delivery to the laboratory for analysis.

Water samples were analyzed by Saskatchewan Research Council (SRC) Environmental Analytical Laboratories (Saskatoon, SK), a Canadian Association for Laboratory Accreditation Inc. (CALA) certified laboratories for the full series of constituents. Samples were analyzed with method detection limits at or below SSWQO and CWQG for each parameter.

2.3 Sediment Quality

Sediment samples were collected from selected lakes for analysis of metals, radionuclides, total organic carbon and particle size.

Sediment samples were collected coincident with benthic invertebrate sampling in depositional environments of selected lakes. Three replicate sediment samples were collected from each lake. Sampling location coordinates were obtained with a Global Positioning System (GPS). Coordinates were recorded at each sampling station and expressed as degrees, minutes and seconds (dd mm ss; WGS84 datum).

Wherever possible, surficial sediment samples were collected by coring. The surficial sediment (top 6 cm) of each core was sectioned into 2 cm increments with the 0-2 cm fraction sent for analysis. A minimum of 3 sectioned core samples were composited at each sampling location to ensure sufficient material for analysis. Where coring was not possible due to the nature of the sediments, surficial sediment samples were collected using a petit Ponar grab, and the top 0-2 cm was carefully collected manually for analysis. Sediments were stored in large Ziploc bags labelled with the date, depth fraction and sample location. Excess air was removed from the bags and they were kept in coolers until delivery to the Wheeler Project camp where they were kept refrigerated or frozen.

Sediment samples were analyzed by SRC Environmental Analytical Laboratories (Saskatoon, SK) for the full series of constituents. Samples were analyzed with method detection limits (MDL) at or below the Canadian Sediment Quality Guidelines (CSQG) or other relevant sediment quality benchmark values. Sediment particle size distribution was determined using a Beckman Coulter LS Particle Size Analyzer.

2.4 Aquatic Habitat

2.4.1 General Aquatic Habitat Characterization

The assessment of aquatic habitats was conducted during the fish and benthic collections throughout the EcoMetrix surveys at selected lakes, ponds and streams. Data collected during these surveys were used to characterize aquatic habitat and/or to supplement existing information. Aquatic habitat surveys were undertaken in September 2016, coincident with biological sampling (fish and benthos) that were conducted at that time. Habitat surveys included the collection of bathymetric and water quality data, as well as observations of physical shoreline and lake/pond/stream substrate features, and aquatic vegetation, fish and benthic communities. Lake and pond habitat observations were recorded in field books, whereas stream habitat data were recorded on assessment forms.

At lake and pond locations, aquatic habitat data collected included bathymetry, adjacent land uses and terrain, aquatic, riparian and adjacent vegetation, shoreline features including locations and descriptions of inlets and outlets and substrate characterization. The distribution of aquatic macrophyte species in the lake was documented, with distinction being made between emergent, floating and submergent communities. Photographic documentation demonstrating the nature of the aquatic habitats present within the subject waterbodies was obtained. Aquatic habitat maps were prepared for lentic environments (i.e., lakes and ponds) and are discussed in **Section 3.0**. These maps depict aquatic habitat features including bathymetry, substrate, field measured water chemistry, observed fish community, aquatic macrophytes, riparian vegetation, and direction of flow, as well as photographs depicting shoreline features.

At stream locations, aquatic habitat characterization involved the assessment of physical, biological and chemical characteristics. Recorded data included mean channel width, depth and flow velocity, bank stability, stream morphology (i.e., pool, riffle, run, and flat), stream gradient, channel type, canopy cover, instream cover and substrate type. Additional notes were made on the surrounding terrain characteristics, dominant terrestrial vegetation, dominant aquatic vegetation, adjacent land use, amount of sediment overlaying substrates, and the amount of algae overlaying substrates. Weather conditions including recent and current precipitation, air temperature and cloud cover were also recorded. Finally, water colour and clarity were noted, as well as qualitative observations of benthic invertebrates encountered during the fish survey. Water chemistry (see **Section 2.2**) was measured *in-situ* at all stations.

2.4.2 Multibeam Sonar Bathymetry and Habitat Mapping

High resolution bathymetric surveys and bottom habitat imaging were conducted at McGowan Lake (LA-1) and the north basin of Whitefish Lake (LA-6) in 2018 using a boat-mounted Kongsberg-Mesotech Ltd. M^3 multi-mode multibeam sonar system. These areas had been identified as potential locations for water intake and/or discharge locations for future mining operations and therefore it was deemed appropriate to gain more detailed and precise bathymetric and habitat information. A summary of these surveys is provided below and more detailed descriptions of survey and data analysis and interpretation methodologies are provided in **Appendix H**.

Bathymetric profiling and imaging were completed in “profiling mode” where the system delivers and subsequently receives sonar pulses on two independent transducers elements over a 120° swath of the water column. Post-processing of the survey data was completed to generate an XYZ surface using ArcGIS to develop a bathymetric model of the bottom as an ArcGIS GRID with a 30 cm by 30 cm grid size.

Bottom habitat imaging was collected in “eIQ imaging mode” whereby the unit translates the sonar data into high resolution images to illustrate lake bottom features (e.g., substrate types) and relief. In “eIQ imaging mode” sonar pulses were generated on four independent element arrays and received on a single transducer array over a 140° swath of the water column. Post-processing of the survey data was used to stitch the bottom image mosaic into a geo-referenced representation of the lake bottom identifying habitat types.

2.5 Plankton Community

Depth-integrated plankton samples were collected in selected lakes from the photic zone. Samples were collected at two locations within each sampling area and composited for biomass analysis.

Phytoplankton samples were collected with a bottle-sampler or tube sampler and preserved with Lugol`s solution. Zooplankton samples were collected via a vertical plankton tow net fitted with 63-micron mesh and preserved in the field with buffered formalin.

Depth-integrated water samples for analysis of chlorophyll α were collected coincident with the plankton samples. Chlorophyll α is a surrogate measure of primary productivity and complements the phytoplankton community data.

Phytoplankton and zooplankton taxonomy and biomass analysis and Chlorophyll α were conducted by ALS, Life Sciences Division (Saskatoon, SK).

2.6 Benthic Invertebrate Community

Benthic macroinvertebrate samples were collected from selected lakes for taxonomic analysis. Samples were collected at the same locations from which the sediment quality samples were collected. Supporting environmental/limnology measurements, including pH, water temperature, conductivity, Secchi depth, and general sediment descriptions, were recorded at each location. Sampling location coordinates were obtained with a GPS, and coordinates were recorded at each sampling station and expressed as degrees, minutes and seconds (dd mm ss; WGS84 datum).

Three to five replicate samples were collected, with each replicate sample comprised of a three-grab composite. Samples were collected using a petite Ponar, sieved through a 500 µm mesh and preserved in labelled (date, sampling area) containers to a level of 10% buffered formalin in the field. Collected samples were kept at ambient temperature until delivery to the taxonomic laboratory.

2.6.1 Benthic Invertebrate Taxonomy

Detailed taxonomic identification and enumeration were completed by Jack Zloty Ltd. (Summerland, BC), a laboratory which meets EEM QA/QC requirements for benthic invertebrate laboratory operations (Environment Canada, 2012).

Benthic invertebrate samples were processed according to standard protocols based on recommendations in Environment Canada (2002) and Gibbons *et al*. (1993). Benthic invertebrate samples were first washed through a 500-µm sieve to remove the preservative and fine sediments remaining after field sieving. Organic material was separated from inorganic material using elutriation, and the inorganic material was checked for any remaining shelled or cased invertebrates, which were removed and added to the organic material. The entire coarse fraction was sorted. Fine fractions of samples containing large amounts of detritus or large numbers of organisms were subsampled using the device described by Wrona *et a*l. (1982). As part of the QC program, the re-sorting of benthic sample residues was conducted on 10% of the samples to determine the level of sorting efficiency.

Invertebrates were identified to the levels recommended by Alberta Environment (1990) and Environment Canada (2010, 2012), typically genus for most invertebrates. Damaged organisms and early instar insects were identified to the lowest level possible, generally to family. The most common taxa should be distinguishable based on gross morphology and should require only a few slide mounts (five to ten) for verification. Organisms that required detailed microscopic examination for identification (i.e., Chironomidae and Oligocheata) were mounted on microscope slides using appropriate medium. All rare or less commonly occurring taxa were mounted on microscope slides for identification. Identifications were made using recognized taxonomic keys.

It is noted that Cladocera (water fleas) that were collected during benthic sampling, are not truly benthic organisms, but rather epi-benthic. However, they were reported by the taxonomist, and have been discussed within the report.

2.6.2 Benthic Invertebrate Metrics

The following benthic invertebrate community metrics were calculated:

- Total invertebrate density;
- Invertebrate richness;
- Simpson's Diversity (*D*);
- Bray-Curtis Dissimilarity Index (*B-C*);
- Evenness (*E*);
- Relative and absolute density of invertebrate taxa groups based on their feeding strategy (i.e., functional feeding groups);
- Density of major invertebrate taxonomic groups (sum of individuals are presented within each group); and,
- Relative density of major invertebrate taxonomic groups (proportion of individuals present within each group relative to the total).

Descriptive statistics (n, mean, median, maximum, minimum, standard error, standard deviation) were determined for each of the endpoints based on replicate samples collected in a defined sampling area (e.g., lake, pond).

Total invertebrate density was determined as the total number of individuals of all taxonomic categories collected at a location expressed per unit area (numbers/m^2).

Invertebrate richness was expressed as the total number of unique taxonomic categories (lowest practical level) collected at a sampling location.

Simpson's Diversity Index (*D*) is another measure of diversity within the benthic invertebrate community. This index places relatively little weight on rare taxa and more weight on common species (Krebs, 1994). Its values range from 0, indicating a low level of diversity, to a maximum of 1-1/*s*. *D* was calculated as follows:

$$D = 1 - \sum_{i=1}^{s} (p_i)^2$$

Where: s = the total number of taxa (family) at the station;
p_i = the proportion of the i^{th} taxon (family) at the station.

Evenness is an expression of how equitably taxa are represented within a given sample. In some cases, disturbance or stress can create conditions whereby relatively few taxa are favoured and those taxa become disproportionately abundant in that location. In this instance, the effect is manifested as relatively low evenness. Evenness ranges from zero to one (one representing a sample in which all taxa have the same abundance) and is calculated as in Smith and Wilson (1996):

$$E = 1/\sum_{i=1}^{s}(p_i)^2 \,/\, s$$

Where: E = Evenness
s = the total number of taxa (family) at the station
p_i = the proportion of the ith taxon at the station

The Bray-Curtis Dissimilarity Index (*B-C*) measures the difference in community structure between two stations. Values range between 0 (stations have identical community structure) and 1 (stations have entirely different community structures) and is calculated as per Environment Canada (2012):

$$B\text{–}C = \frac{\sum_{i=1}^{n}|y_{i1} - y_{i2}|}{\sum_{i=1}^{n}(y_{i1} + y_{i2})}$$

Where: B-C = Bray-Curtis distance between sites 1 and 2
Y_{i1} = count for taxon I at site 1
Y_{i2} = count for taxon I at site 2
n = total number of taxa present at the two sites

For the Bray-Curtis Index calculations, lake stations were grouped according to size (surface area and volume). Small lakes included LA-5 and LA-6, and the remainder of the lakes – McGowan Lake (LA-1), Kratchkowsky Lake (LA-7, LA-7A), LA-8, LA-9, Williams Lake (LB-3), Russell Lake (LAB-1 and LAB-2) were classified as large lakes. Since all the locations were sampled pre-development, the median reference (**Table A-8**) condition values for each lake group (i.e., small and large) were based on the median of the taxon counts for each replicate for each lake within its group.

The benthic invertebrate community was also assessed based on the major functional feeding groups - that is, behavioural mechanisms of food acquisition. The major functional feeding groups are scrapers, shredders, collector-gatherers, collector-filterers, predators, and other (e.g., parasites). Scrapers graze off algae or biofilm that grows on bottom substrates. Shredders eat coarse particulate organic matter such as leaves. Collector-gatherers collect fine particulate organic matter (FPOM) on bottom substrates. Collector-filterers filter FPOM from the water column. Predators eat other benthic invertebrates. Mandaville (2002) was used as a guide to classify each benthic invertebrate taxon into a functional feeding group. The densities from each of the functional groups were summed and the proportion of individuals present within each group relative to the total was determined.

2.7 Fish Community

2.7.1 Fish Collections

Fish community surveys were undertaken in each of the selected waterbodies to characterize fish species presence and community diversity. A variety of habitat types available within each waterbody were sampled. Fishing activities were undertaken by authority of Special Collection Permits (SCP-16-SC052; SCP17-INV04) issued by the Saskatchewan Ministry of Environment, Fish, Wildlife and Lands Branch (**Appendix E**).

In the lakes and ponds, offshore deeper areas were fished with short duration (4 to 8 hour) gill net sets. Where a distinct thermocline was evident (i.e., Kratchkowsky Lake) gill nets were set above and below the thermocline. Gill nets comprised varying mesh sizes, such that all types of fish and all age classes present could be collected. Nearshore fish collections were conducted by beach seines and/or minnow traps. Gear location coordinates were obtained with a GPS, and coordinates were recorded at each sampling station and expressed as degrees, minutes and seconds (dd mm ss; WGS84 datum). Fish were identified to species and assigned an age-class (i.e., young-of-year [YOY], juvenile or adult). Length (to nearest mm) and weight (to nearest 0.01 kg) were measured for all fish at each location. All fish, live or dead, were returned to the same waterbody in which they were captured, with the exception of specimens retained for fish tissue chemical analysis (see **Section 2.8.1**).

In streams, the fish community was surveyed using a backpack electrofisher (Smith-Root Model LR-24) and dip net. Up to 300 m of stream was fished at the selected locations and captured fish were retained in a 25-L pail until the completion of electrofishing within the reach. Upon completion of the reach, fish were identified to species and assigned an age-class (i.e., young-of-year (YOY), juvenile or adult), by an experienced biologist. Length (to nearest mm) and weight (to nearest 0.1 g) were measured for a subsample of each species at each location. With the exception of voucher specimens retained as a condition of the SCP, all fish were released to the same waterbody in which they were captured. Additional data were recorded including date, time, location (i.e., coordinates, map datum), electrofisher settings (i.e., frequency and volts), fishing effort (seconds), reach length, mean width, and water temperature. Data were recorded on Fish Collection Forms.

2.7.2 Fish Spawning

Large-bodied fish spawning surveys were undertaken during the fall of 2016 and spring of 2017 at selected lake and stream locations to determine the utilization of these areas for spawning. The fall survey was conducted during a period in which it was expected that fall spawners would be sexually mature. The spring survey was timed to take place shortly after ice-out, a period when spring spawning was expected to be underway.

Fall spawning species present within the study area include Lake Whitefish and Lake Trout. Lake Trout spawning usually occurs over a large boulder or rubble bottom in lakes at depths of less than 12.2 m (Scott and Crossman, 1973). Lake Whitefish spawning typically occurs over rocky reefs in lakes or shallows of rivers, at depths of less than 7.6 m (McPhail and Lindsey, 1970).

Spring spawning species present within the study area include Walleye, Northern Pike, Arctic Grayling, White Sucker, Longnose Sucker and Yellow Perch. Spawning habitats for Walleye include rocky areas in fast flowing rivers or boulder, to coarse-gravel shoals of lakes (Scott and Crossman, 1973). Optimal spawning habitat for Northern Pike consists of flooded vegetation in shallow, sheltered areas (Casselman and Lewis, 1996). Arctic Grayling spawn coincident with ice-out on lakes, in streams over a gravel or rocky bottom. White Suckers spawn in inlet or outlet streams, usually with a gravel bottom, often in the same areas as, but later than, Longnose Sucker (McPhail and Lindsey, 1970). Yellow Perch spawning usually takes place in lake shallows, near rooted aquatic vegetation, submerged brush or fallen trees (Scott and Crossman, 1973).

It is noted that Burbot, which are present in the study area, spawn during late winter in streams or lake shallows under ice (McPhail and Lindsey, 1970), usually at a depth of 0.3 to 1.2 m over sand or gravel bottom in shallow bays, or on gravel shoals 1.5 to 3 m deep (Scott and Crossman, 1973). No specific spawning surveys targeted Burbot though potential spawning areas occur within the study area.

Fishing activities were conducted in a manner to maximize data collection and minimize incidental fish mortalities (i.e., visual when possible). If spawning activity was not directly observed, attempts to capture fish were undertaken to assess sexual condition (degree of ripeness) using the most effective method(s) for the habitat present, include electrofishing, angling, gillnetting, or seining. Gillnets were employed as seine nets to capture large-bodied fish observed at stream stations during the spring spawning survey. Captured fish were identified to species, sexed (if possible for live fish), assigned to an age class (i.e., juvenile, adult), assessed for spawning condition (i.e., immature, green (early or late development), ripe, partially spent, spent), measured (length to nearest mm, weight to nearest g) and released. Ageing structures were collected, sex was determined and sexual condition was verified from incidental mortalities. All fish, live or dead, were returned to the same waterbody.

2.7.3 Environmental DNA (eDNA) Analysis

Environmental DNA (eDNA) analysis was also used to investigate fish communities in McGowan Lake (LA-1) and the north basin of Whitefish Lake (LA-6) as a non-consumptive alternative to conventional fish survey. eDNA is DNA that has been shed from an organism's body and can be in the form of scales, feces, mucous, eggs or other shed body parts. In eDNA analysis, water samples were collected instead of fish.

In McGowan and Whitefish Lakes, 200-400 ml water samples were passed through 0.45 µm cellulose nitrate filters. All filters were preserved in molecular grade ethanol and refrigerated before sending to Canadian Center for DNA Barcoding (CCDB) for analysis. In brief, DNA was extracted using QIAGEN DNEasy Power Water kit following manufacturer's instructions. The targeted fish genetic marker was amplified twice using polymerase chain reaction (PCR) to produce IonXpress MID-tag labeled libraries. The DNA library was pooled, purified, and diluted before being sequenced using Ion S5 system. The resulted DNA sequences were clustered using Uclust (Edgar 2010), and the representative sequence within each taxonomic unit was compared to publicly available marker gene sequences to identify fish species.

2.8 Tissue Chemistry

Fish tissue (flesh and bone) and benthic invertebrate tissue (whole body) samples were analyzed by SRC Environmental Analytical Laboratories (Saskatoon, SK) for the full series of constituents. Fifteen samples collected during September 2016 were destroyed at the laboratory during an ashing oven malfunction prior to radionuclide analyses. Additional fish tissue samples were collected during May-June 2017 and analyzed for both radionuclides and trace metals, to compensate for the lost samples.

2.8.1 Fish Tissue Chemistry

During the fish community assessment, five samples each from a predator species (Northern Pike) and from a forage species (White Sucker) were retained at the selected locations for the analysis of metals and radionuclides. In most cases each sample was comprised of a single fish; however, to ensure that a sufficient volume of tissues was retained for analysis, some samples were comprised of two or three fish. Lengths, weights and ages of fish comprising the samples are provided in **Appendix A**, **Table A-16**.

Fish were gutted at the location where they were collected and offal were returned to the waterbody. Flesh was removed from the bone by field staff either at the sampling location or at the camp the same day as capture. Flesh and bones were stored in individual Ziploc bags, labelled with the date, sampling location, fish species and specimen number and either "flesh" or "bone", and frozen until delivery to the analytical laboratory.

Constituent concentrations in fish tissues were determined on the "raw weight" basis, and compared to relevant guideline values. Guideline values for constituents in fish tissue are available for mercury (Health Canada, 2007) and selenium (BC MOE, 2014, and US EPA, 2016). Health Canada's standard of 0.5 µg/g ww is a human health risk-based maximum permissible concentration applied to most species of commercially-sold fish. The BC MOE (2014) guideline values of 4 µg/g dw and the US EPA (2016) criterion of 11.3 µg/g dw for fish muscle provide fish tissue concentrations for selenium that are protective of the health of freshwater aquatic life.

2.8.2 Benthic Invertebrate Chemistry

Benthic invertebrate tissue samples were collected for analysis of metals and radionuclides at selected locations in September 2016. Composite samples of multiple organisms of a common order were collected for each of the selected waterbodies. Sufficient fresh weight tissue samples of abundant macroinvertebrates were collected to ensure sufficient mass for dry weight tissue analysis. Caddisfly larvae were collected from McGowan Lake (LA-1), Whitefish Lake (LA-5, LA-6), Kratchkowsky Lake (LA-7, LA-7A), Russell Lake (LAB-1, LAB-2), and dragonfly nymphs were collected from LA-8 and LA-9. For caddisflies, only larvae tissue was retained for analyses; casings were manually removed and discarded. Tissue samples were collected in re-sealable plastic bags and frozen until delivery to the analytical laboratory.

2.9 Quality Management

Quality assurance procedures employed by EcoMetrix included the proper training of field staff, use of standard operating procedures when collecting samples, appropriate handling and storage of samples, submission of samples to accredited laboratories according to requirements, and the use of data management systems. Quality control procedures used to assess the quality of data included identifying the potential field or laboratory contamination through the use of field blanks, trip blanks, and field duplicates.

2.9.1 Field QA

Quality control samples (field blank, trip blank) were collected as part of the water quality sampling program. Field blanks and trip blanks were provided for each sampling crew by the analytical laboratory. The laboratory reports are provided in **Appendix B**.

2.9.2 Chain of Custody

Chain-of-custody (CoC) forms were completed to track samples from the time of collection to reception by the laboratory and through reporting of results. The CoC mechanism identifies any issues that may arise because of retention times or sample condition (i.e. temperature) upon reception at the laboratory which could affect the analysis.

SRC Environmental Analytical Laboratory CoC forms were completed for each cooler of water, sediment, fish tissue and benthic invertebrate tissue samples. Coolers were hand delivered to SRC laboratory in Saskatoon (SK) by EcoMetrix staff or Denison Mines staff.

ALS Life Sciences Division CoC forms were completed for plankton samples. Coolers were shipped to the Winnipeg (MB) office and reception was confirmed.

Preserved benthic community samples were shipped to J. Zloty, Summerland, BC.

2.9.3 Laboratory Analysis

Quality control samples (field duplicates) were collected as part of the water quality sampling program. Sample duplicates were collected for 10% of all samples. The precision of analysis was considered adequate if the relative percent difference (RPD) between the sample and the duplicate was less than 20%, or 2-times the method detection limit (MDL) where a constituent concentration was less than 5-times MDL, and if concentrations in field blanks were less than 2-times MDL. Laboratory QA included the analysis of laboratory blanks, run duplicates and the analysis of standard reference materials. The results of the analyses of the QA samples are provided along with the laboratory reports in **Appendix B**.

Laboratory QC for fish and benthic invertebrate tissue chemistry analysis included the analysis of laboratory blanks, run duplicates and the analysis of standard reference materials. The results of the analyses of the QC samples are provided along with the laboratory reports in **Appendix B**.

The ALS Certificate of Analysis for plankton community analyses and the data sheets provided by SRC Environmental Analytical Laboratories for sediment analysis are provided in **Appendix B**.

As part of the benthic community analysis QC program conducted by J. Zloty, re-sorting of benthic sample residues was conducted on 10% of the samples to determine the level of sorting efficiency. The results of the analyses of the QC samples are provided along with the laboratory reports in **Appendix B**.

2.9.4 Project Management and Documentation Controls

EcoMetrix is ISO 9001:2015 certified by NSF International Strategic Registrations (NSF-ISR), a well-known Quality Management System (QMS) registrar. EcoMetrix’ QMS is the framework for implementation of quality management policies.

Analyses (Certificate of Analyses, Datasheets) received directly from laboratories are handled following EcoMetrix SOP-00007 “*Sample Submission and Data QA/QC*”. Briefly, the original data, received electronically or scanned from original hardcopy, are stored on a regularly backed up server in a dedicated folder within a project specific folder. The project specific folder is identified by a specific project number and name. The content of the original or ‘raw’ files are not modified to ensure that original files are maintained and any manipulations of the data are done on original content.

3.0 LAKE ASSESSMENT RESULTS

Results of the EcoMetrix aquatic baseline survey at lake monitoring locations are presented on a watershed-by-watershed basis. **Figure 1-2** displays the watersheds as defined for the baseline studies.

The Icelander River basin flows in a southerly direction, discharging into the northwest portion of Russell Lake at Station LAB-1. Three sub-basins of the Icelander River are included in the study area. The northern sub-basin includes LA-8 and LA- 9, and the western sub-basin includes Kratchkowsky Lake (LA-7, LA-7A). These two sub-basins meet at Whitefish Lake (LA-6, LA-5). The third, eastern, sub-basin includes, from upstream to downstream, Mardoc Lake (LA-4), LA-3 and LA-2. All three sub-basins join at McGowan Lake (LA-1) before flowing into the north western portion of Russell Lake at LAB-1. Two ponds were included in the study areas: PA-2 and PA-3 are two interconnected ponds that eventually flow into the Icelander River drainage downstream of Kratchkowsky Lake (LA-7).

The Williams Lake drainage is located to the southwest of the Icelander River Drainage. It flows in a southerly and easterly direction into Russell Lake at LAB-2, approximately 3 km southwest of the Icelander River outlet into the lake. The Williams Lake drainage consists of two sub-basins, the most northerly of which is part of the study area and includes, from upstream to downstream, Williams Lake (LB-3), LB-2 and LB-1.

New stations that were part of the 2016-19baseline study and were not assessed in the previous baseline studies, included, the north arm of Kratchkowsky Lake (LA-7A), LA-8, LA-9, PA-2, PA-3, and Russell Lake (LAB-2). **Figure 1-7**shows the location of the lakes and ponds, and an overview of the type of data collected at each lentic station within the Project area during the 2016-17 studies. Baseline data from 2016-18 are summarized along with historical baseline data from Golder (2014 a, b) in **Table 3-1** to **Table 3-10**. Bathymetry and fish habitat for the north arm of Kratchkowsky Lake (LA-7A), LA-8, LA-9, PA-2, PA-3, and Russell Lake (LAB-2) are provided in **Figure 3-12** to **Figure 3-17**. McGowan Lake (LA-1), LA-2, Whitefish Lake (LA-5, LA-6), Kratchkowsky Lake (LA-7), Williams Lake (LB-3) and LAB-1 were surveyed in August 2012 and bathymetry and fish habitat maps were prepared by Golder (see **Appendix F**). In 2018, high resolution bathymetry and habitat characterization was carried out in McGowan Lake (LA-1) and LA-6, which provide updates and additional information to the previous results. On Oct 29, 2019, Denison performed a key person interview with a local residence, Mr. Bobby John, who is familiar with local and regional ecology. EcoMetrix reviewed the meeting notes provided by Denison (Denison 2020), and compared comments provided by Bobby John to field observations documented herein and incorporated his local knowledge into this report.

3.1 McGowan Lake (LA-1)

McGowan Lake (LA-1) is situated within the Icelander River Drainage, upstream of Russell Lake (LAB-1) and downstream of lakes LA-2 (via SA-3) and LA-5 (via SA-2) (see **Figure 1-7**).

Historical and 2016-19 baseline data for McGowan Lake have been compiled in **Table 3-1** through **Table 3-10**.

3.1.1 Hydrology

3.1.1.1 Water Elevation

Geodetic water levels at McGowan Lake were measured during open water conditions between 2011 and 2014 (**Appendix G**). The measured water level for McGowan Lake varied by approximately 0.25 m, between 494.19 masl and 494.45 masl.

The water level elevation measured between September 2016 and August 2019 varied by approximately 0.17 m, between 494.344 masl and 494.515 masl. **Table 3-1** and **Appendix G** presents a summary of baseline water level elevations at all lake and pond locations.

3.1.1.2 Ice Thickness

Ice thickness was observed at the deepest point of the waterbody, between March 23 and April 1, 2014 (**Appendix G**). The ice thickness at the end of March was 0.97 m and was considered to represent the maximum development of ice thickness of winter 2013-14 for McGowan Lake. The ice thickness was observed at 0.70 m at the same location between March 22 and April 1, 2018.

3.1.1.3 Bathymetry

McGowan Lake bathymetry was assessed by Golder in August 2012 (**Appendix F**). At that time, the lake elevation was 494.39 masl. The total surface area of the lake was 148.55 ha and total volume was 8,189,320 m^3. Maximum and mean depths were 9.7 m and 5.5 m, respectively.

The bathymetry of the western portion of McGowan Lake was assessed via multibeam sonar in 2018 to gain a more precise representation of the lake bottom relief (**Figure 3-1**, Milne, 2018; **Appendix H**). Within the area surveyed the mean depth was 6.8 m and the maximum depth was 9.8 m. The nearshore area on the west side of McGowan Lake is characterized by a shallow sand shelf that extends 15 m to 133 m out from shore. The shelf is relatively narrow along the mid-section of the lake and wider to the north (towards the lake inlet) and to the south (towards the lake outlet). The edge of the sand shelf is steep, falling away to a broad flat basin with a depth of on the order of 8 m. Several shore features and ridge-lines are apparent where depths are in the range of 2 to 4 m. Based on the 2018 survey results the shoal and ridge-line areas are more extensive and have a greater degree of connectivity than was indicated by the earlier bathymetry study.

3.1.2 Water Quality

Summary statistics for all water quality parameters collected during baseline studies at McGowan Lake are provided in **Table 3-3**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), all constituent concentrations were below their respective guideline limits. Annual baseline water quality data from 2012, 2014, 2016, and 2018 are provided in **Table 3-3, Table A-1**.

3.1.2.1 **Limnology**

Temperature and dissolved oxygen profiles were undertaken during August 2012 and March 2014 by Golder (**Appendix F**). McGowan Lake was not stratified during either survey. The Secchi depth in August was 1.5 m. During late winter, dissolved oxygen steadily decreased below 5 m, but the water column did not become anoxic and the Secchi depth was 2.5 m.

On 14 September 2016, the surface water temperature was 11.7 °C. *In-situ* dissolved oxygen (DO) was 9.97 mg/L (92.3% saturation), conductivity was 13 µS/cm, and pH was 7.56. The Secchi depth was 2.1 m. A water chemistry depth profile is presented in **Figure** 3-2. Thermal stratification of the water column was not observed during the 2016 survey.

On 16 March 2018, the surface water temperature was 0.08 °C. *In-situ* dissolved oxygen (DO) was 12.43 mg/L (81.8 % saturation), conductivity was 13 µS/cm, and pH was 6.78. At a depth of 8.6 metres below surface, the water temperature was 4.86 °C. *In-situ* dissolved oxygen (DO) was 0.36 mg/L (3.1 % saturation), conductivity was 19 µS/cm, and pH was 6.58. A water chemistry depth profile is presented in **Figure 3-3**. During this late winter 2018 survey, temperature increased steadily from near freezing at the surface to approaching 5 °C near the lake bottom. Within the hypolimnion, dissolved oxygen conditions were near anoxic and conductivity peaked to 23 µS/cm.

On 2 July 2018, the surface water temperature was 18.6 °C. *In-situ* dissolved oxygen (DO) was 9.24 mg/L (98.9 % saturation), conductivity was 15 µS/cm, and pH was 7.22. At a depth of 9.5 metres below surface, the water temperature was 11.1 °C. *In-situ* dissolved oxygen (DO) was 0.04 mg/L (0.4 % saturation). Measured at a depth of 7.5 metres below surface, conductivity was 16 µS/cm, and pH was 6.51. A water chemistry depth profile is presented in **Figure 3-4**. Notable trends included a sharp decrease in dissolved oxygen conditions at approximately 6.0 metres below surface where the water became anoxic.

3.1.3 Sediment Quality

Sediment data are summarized for the top 0-2 cm of sediment collected at McGowan Lake.

The sediment grain size distribution for sediments passing the 2000 µm sieve is summarized in **Table 3-4** for each individual sediment sample from McGowan Lake. Three samples were analysed for grain size. The samples from McGowan Lake demonstrated similar distributions. The sediments were generally clay (78-82%) with a small proportion of silt (18-22%) and some sand (0.1-0.3%).

Summary statistics for sediment quality parameters collected during baseline studies at McGowan Lake are provided in **Table 3-5.**. The sediment samples had an average percentage of total organic carbon of 16%. For parameters where sediment quality guidelines are available, all constituent concentrations were at or below their respective REF, ISQG or LEL value.

3.1.4 Aquatic Habitat

An aquatic habitat assessment was undertaken by Golder in August 2012 (**Appendix F**). Shoreline vegetation at McGowan Lake mainly consisted of shrubs and black spruce with upland jack pine forests. The typical substrate observed for McGowan Lake was sand and boulders. Shoreline slopes ranged from shallow to steep with the presence of old and active erosional areas. Cover types for aquatic biota included emergent vegetation, interstitial spaces in coarse substrate, and overhanging vegetation. Observations made during the 2016-19 baseline studies were similar.

Bottom habitat features in offshore areas in the western portion of the lake were assessed via multibeam sonar imaging in 2018 to gain a more precise representation of the lake bottom habitat (**Figure 3-5**; Milne, 2018; **Appendix H**). Beyond nearshore sand areas, the substrates in the flat inner lake basin are mud and detritus. The shoal and ridgeline features were more acoustically reflective than the flat basin, indicating harder substrates such as gravel and small cobble with few large rocks. These areas may represent spawning habitats for fall spawning Lake Whitefish and Lake Trout (see **Section 3.1.7.1**). The sonar imaging revealed very low densities of submerged vegetation stems within the area surveyed within the main basin, as well as on the shallow sand beach shelf of the western portion of the lake.

3.1.5 Plankton Community

Chlorophyll a concentrations were below the laboratory detection limit (< 0.60 µg/L) (**Table** 3-6), reflecting the oligotrophic state of McGowan Lake.

Thirty-seven phytoplankton taxa belonging to seven classes were identified at McGowan Lake (**Table 3-6**). Based on total biovolume (μm^3), 89.7% of phytoplankton at McGowan

Lake belonged to the class Bacillariophyceae (diatoms), with *Planktosphaeria* sp. comprising the vast majority of the total biovolume. Phytoplankton from the classes Cyanophyceae (cyanophytes) and Chlorophyceae (chlorophytes) comprised approximately 5.4% and 3.3% of the total biovolume, respectively. The remaining 1.6% of the total biovolume consisted of phytoplankton from the classes Chrysophyceae (chrysophytes), Crytophyceae (cryptophytes), Dinophyceae (dinoflagellates), and Euglenophyceae.

Twenty zooplankton taxa were identified at McGowan Lake (**Table 3-6**). Based on total biovolume (μm^3), the vast majority (93.7%) of zooplankton present at McGowan Lake belonged to the class Branchiopoda (**Figure 3-7**), with *Holopedium* sp. being the dominant species. Zooplankton from the class Copepoda comprised 5.8% of total biovolume, and unidentified rotifers and individuals from the class Monogononta comprised the remaining biovolume.

3.1.6 Benthic Invertebrate Community

Three replicate samples were collected at McGowan Lake. The mean invertebrate density was 981 individuals/m^2 with a range of 886 to 1,014 individuals/m^2 (**Table 3-7A**). A total of 15 unique taxa were identified at McGowan Lake. The mean number of taxa present per replicate sample was 9, with a range of 7 to 11. Simpson's Diversity Index at McGowan Lake ranged from 0.72 to 0.79, with a mean of 0.76, indicating a high level of diversity. Mean Evenness was 0.44 with a range of 0.38 to 0.51, indicating that relatively few taxa accounted for most of the invertebrate density. The mean Bray-Curtis index for McGowan Lake was 0.50, with a range of 0.38 to 0.58, indicating that the benthic community composition at McGowan Lake has some similarities to the community composition compared to the median reference condition of the large lakes group.

A total of 12 major taxonomic groups (Families) were identified at McGowan Lake, with the mean density within these groups ranging from 5 to 433 individuals/m^2 (**Table 3-7B**). Chironomids and phantom midges (Chaoboridae) comprised on average 44% and 33% of total invertebrate density, respectively, at McGowan Lake, and water fleas from the family Holopedidae comprised 11% of total invertebrate density (**Table 3-7C**).

The benthic invertebrate community at McGowan Lake comprised four functional feeding groups: predators, collector-gatherers, collector-filterers, and shredders. The mean invertebrate density for each of these groups ranged from 33 to 476 individuals/m^2 (**Table 3-7D**). Predators were the most abundant and on average comprised nearly half (48%) of total invertebrate density at McGowan Lake (**Figure 3-8**).

3.1.6.1 **Benthic Invertebrate Chemistry**

Radionuclide and metal concentrations for caddisfly larvae collected from McGowan Lake are presented in **Table 3-8**.

3.1.7 Fish Community

McGowan Lake was surveyed using a variety of gear including minnow traps, seine nets, gillnets and angling during the spring and fall. A summary of the fish community is presented in **Table 3-9**. Detailed fish catch data including fishing effort and numbers of each species collected is presented in **Appendix A, Table A-13, A-16**. In total, 126 fish from 8 species were collected in McGowan Lake. Adult and juvenile Walleye, Northern Pike, Lake Whitefish and White Sucker were most abundant. Adult Spottail Shiner (*Notropis hudsonius*), adult and juvenile Yellow Perch, juvenile and adult Longnose Sucker and adult Lake Trout were less commonly collected. This list is reviewed by Bobby John, and is considered comprehensive.

No aquatic vertebrate DNA was identified in water samples collected from McGowan Lake during June 2018. This was likely due to organic compounds, for instance, humic acid in the water, which inhibited DNA being successfully sequenced.

3.1.7.1 Fish Spawning

Spawning habitat for Northern Pike was observed in lake McGowan Lake, primarily along the northern shore in the vicinity of the (SA-3) tributary inlet and at the lake outlet, situated along the southeastern shore. Smaller patches of potential pike spawning habitat also occurred along the northwest shore (**Figure 3-9**).

Several rocky shoals are present within lake McGowan Lake, likely affording spawning habitats for fall spawning Lake Whitefish and Lake Trout. Spawning habitats for Walleye and White Sucker were observed within the inlet tributary (SA-2) from lake LA-5 (see **Section 4.2.4.1**).

The fish spawning area identified at McGowan Lake was reviewed by Bobby John, and the information that has been provided is considered comprehensive based on his experience.

3.1.7.2 Fish Tissue Chemistry

Fish tissue chemistry results are presented in **Table 3-10**. Radionuclide levels in bones were typically below lab DLs for both Northern Pike and White Sucker. Concentrations of Polonium-210 were low but measurable in some samples of fish flesh and bone.

Mercury concentrations in Northern Pike (mean 0.17 ug/g ww) and White Sucker (0.038 ug/g ww) tissue were below the federal guideline of 0.5 ug/g ww. Mercury concentrations were higher in Northern Pike than in White Sucker reflecting bioaccumulation through the aquatic food chain.

Selenium concentrations in both Northern Pike (mean 1.00 ug/g dw) and White Sucker (1.29 ug/g dw) were below both BCMOE and USEPA fish tissue guideline values.

3.2 LA-2

Lake LA-2 is situated within the eastern sub-basin of the Icelander River Drainage, upstream of McGowan Lake and downstream of lakes LA-3 and Mardoc Lake (LA-4).

3.2.1 Hydrology

3.2.1.1 Water Elevation

Geodetic water levels at LA-2 were measured during open water conditions between 2011 and 2014 (**Appendix G**). The measured water level for LA-2 varied by approximately 0.19 m, between 494.47 masl and 494.65 masl.

The water level elevation measured in September 2016 was 494.58 masl. A summary of water level elevations at LA-2 is provided in **Table 3-1** and **Appendix G**.

3.2.1.2 Ice Thickness

Ice thickness was observed at the deepest point of the waterbody, between March 23 and April 1, 2014 (**Appendix G**). The ice thickness at the end of March 2014 was 0.76 m and was considered to represent the maximum development of ice thickness of winter 2013-14 for LA-2.

3.2.2 Water Quality

Summary statistics for all water quality parameters collected during baseline studies at LA-2 are provided in **Table 3-3**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), all constituent concentrations were below guideline limits. Annual baseline water quality data from 2014 and 2016 are provided in **Appendix A**, **Table A-1**.

3.2.2.1 Limnology

Temperature and dissolved oxygen profiles were undertaken during March 2014 by Golder (**Appendix F**). During late winter, dissolved oxygen steadily decreased with depth but the water did not become anoxic. The Secchi depth was 3.5 m. Thermal stratification of the lake was not observed at that time.

On 21 September 2016, the surface water temperature was 11.4 °C. *In-situ* DO was 10.64 mg/L (97.6% saturation), conductivity was 15 µS/cm and pH was 6.67. The Secchi depth was measured at 3.5 m. A water chemistry depth profile is presented in **Figure 3-2**. Thermal stratification of the lake was not observed at that time.

3.3 LA-3

Lake LA-3 is situated within the eastern sub-basin of the Icelander River drainage area, upstream of LA-2 (see **Figure 1-7**).

3.3.1 Hydrology

3.3.1.1 Water Elevation

Geodetic water levels at LA-3 were measured during open water conditions between 2011 and 2014 (**Appendix F**). The measured water level for LA-3 varied by approximately 0.21 m, between 494.44 masl and 494.65 masl.

The water level elevation measured in September 2016 was 494.57 masl. A summary of water level elevations at LA-3 is provided in **Table 3-1** and **Appendix G**.

3.3.1.2 Ice Thickness

Ice thickness was observed at the deepest point of the waterbody, between March 23 and April 1, 2014 (**Appendix G**). The ice thickness at the end of March was 0.80 m and was considered to represent the maximum development of ice thickness of winter 2013-14 for LA-3.

3.3.2 Water Quality

Summary statistics for all water quality parameters collected during baseline studies at LA-3 are provided in **Table 3-3**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), all constituent concentrations were below guideline limits. Annual baseline water quality data from 2014 and 2016 are provided in **Appendix A**, **Table A-1**.

3.3.2.1 Limnology

A temperature and dissolved oxygen profile was undertaken during March 2014 by Golder (**Appendix F**). During late winter, dissolved oxygen steadily decreased with depth but the water did not become anoxic. The Secchi depth was 4.5 m. Thermal stratification was not apparent at that time.

On 21 September 2016, the surface water temperature was 11.7 °C. *In-situ* DO was 10.43 mg/L (96.2% saturation), conductivity was 15 µS/cm and pH was 6.60. The Secchi depth was 3.4 m. A water chemistry depth profile is presented in **Figure 3-2**. Thermal stratification of the lake was not observed at that time.

3.4 Mardoc Lake (LA-4)

Mardoc Lake is situated within the eastern sub-basin of the Icelander River drainage area, upstream of LA-2 (see **Figure 1-7**).

3.4.1 Hydrology

3.4.1.1 Water Elevation

Geodetic water levels at Mardoc Lake were measured during open water conditions between 2011 and 2014 (**Appendix G**). The measured water level for Mardoc Lake varied by approximately 0.14 m, between 498.51 masl and 498.65 masl.

The water level elevation measured in September 2016 was 498.62 masl. **Table 3-1** and **Appendix G** provide a summary of water level elevations at all lake and pond locations.

3.4.1.2 Ice Thickness

Ice thickness was observed at the deepest point of the waterbody, between March 23 and April 1, 2014 (**Appendix G**). The ice thickness at the end of March was 0.82 m and was considered to represent the maximum development of ice thickness of winter 2013-14 for Mardoc Lake.

3.4.2 Water Quality

Summary statistics for all water quality parameters collected during baseline studies at Mardoc Lake are provided in **Table 3-3**. For parameters where water quality guidelines (SEQG, CCME CWQG, and SSWQO) are available, all constituent concentrations were below guideline limits. Annual baseline water quality data from 2014 and 2016 are provided in **Appendix A**, **Table A-1**.

3.4.2.1 Limnology

A temperature and dissolved oxygen profile were undertaken during March 2014 by Golder (**Appendix F**). During late winter, dissolved oxygen steadily decreased with depth but the water did not become anoxic. The Secchi depth was 3.5 m. Thermal stratification was not apparent at that time.

On 21 September 2016, the surface water temperature was 12.2 °C. *In-situ* DO was 9.42 mg/L (88.0% saturation), conductivity was 17 µS/cm, and pH was 6.83. The Secchi depth was 5.0 m. A water chemistry depth profile is presented in **Figure 3-2**. Thermal stratification of the lake was not observed at that time.

3.5 Whitefish Lake, South Basin (LA-5)

The south basin of Whitefish Lake (LA-5) is situated within the Icelander River drainage area, upstream of McGowan Lake and downstream of the north basin of Whitefish Lake (LA-6), via SA-6 (see **Figure 1-7**).

Historical and 2016-19 baseline data for LA-5 have been compiled in **Tables 3-1** to **3-10**.

3.5.1 Hydrology

3.5.1.1 Water Elevation

Geodetic water levels at LA-5 were measured during open water conditions between 2011 and 2014 (**Appendix G**). The measured water level for LA-5 varied by approximately 0.13 m, between 499.95 masl and 500.08 masl.

The water level elevation measured in September 2016 was 500.06 masl. **Table 3-1** and **Appendix G** provides a summary of water level elevations at all lake and pond locations.

3.5.1.2 Ice Thickness

Ice thickness was observed at the deepest point of the waterbody, between March 23 and April 1, 2014 (**Appendix G**). The ice thickness at the end of March was 0.70 m and was considered to represent the maximum development of ice thickness of winter 2013-14 for LA-5.

3.5.1.3 Bathymetry

The south Whitefish Lake basin (LA-5) bathymetry was assessed by Golder in August 2012 (**Table 3-2, Appendix F**). At that time, the lake elevation was 500.04 masl. The total surface area of the basin was 32.40 ha and total volume was 332,502 m^3. Maximum and mean depths were 4.1 m and 1.1 m, respectively.

3.5.2 Water Quality

Summary statistics for all water quality parameters collected during baseline studies at LA-5 are provided in **Table 3-3**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), all constituent concentrations were below guideline limits. Annual baseline water quality data from 2012, 2014 and 2016 are provided in **Appendix A**, **Table A-1**.

3.5.2.1 **Limnology**

Temperature and dissolved oxygen profiles were undertaken during August 2012 and March 2014 by Golder (**Appendix F**). Whitefish Lake (LA-5) was not thermally stratified during August. The Secchi depth was 2.2 m.

On 10 September 2016, the surface water temperature was 11.7 °C *in-situ* DO was 9.24 mg/L (85.2% saturation), conductivity was 13 µS/cm, and pH was 9. The Secchi depth was 1.8 m. A water chemistry depth profile is presented in **Figure 3-2**. Thermal stratification of the lake was not observed at that time.

3.5.3 Sediment Quality

Sediment data are summarized for the top 0-2 cm of sediment collected at LA-5 in **Table 3-4**. Sediment grain size and chemistry data are provided in **Appendix A**, **Tables A-3 and A-4**.

Three of the five samples from LA-5, LA-5-1, LA-5-3 and LA-5-4, were generally clay (76-82%) with a small proportion of silt (18-22%) and some sand (0.1-2%). The sediment samples obtained from LA-5-2 and LA-5-5 had a higher percentage of sand (73-77%) with smaller percentages of silt (13-15%) and clay (10-12%).

Summary statistics for sediment quality parameters collected during baseline studies at LA-5 are provided in **Table 3-5**. The mean TOC levels in the samples was 11%. For parameters where sediment quality guidelines are available, all constituent concentrations were at or below their respective REF, ISQG or LEL value.

3.5.4 Aquatic Habitat

An aquatic habitat assessment was undertaken by Golder in August 2012 (**Appendix F**). Shoreline vegetation at LA-5 consisted mainly of shrubs and black spruce with upland jack pine forest. The typical substrate observed for LA-5 was sand and organic matter. Shoreline slopes ranged from shallow to steep. Cover types for aquatic biota included emergent and submergent vegetation, interstitial spaces in coarse substrate, overhanging vegetation and woody debris. Observations made during the 2016-19 baseline studies were similar, confirming the earlier survey data.

3.5.5 Plankton Community

Chlorophyll *a* concentrations were below the laboratory detection limit (< 0.60 µg/L) (**Table 3-6**), reflecting the oligotrophic nature of LA-5

Thirty-four phytoplankton taxa belonging to six classes were identified at LA-5 (**Table 3-6**). Based on total biovolume (μm^3), approximately half (49.3%) of the phytoplankton belonged to the class Bacillariophyceae (**Figure 3-6**), in particular by *Melosira* sp. Phytoplankton from the class Cyanophyceae comprised 29.2% – predominantly *Aphanothece* sp. – of the biovolume at LA-5. Phytoplankton belonging to the classes Dinophyceae, Chrysophyceae, Cryptophyceae, and Chlorophyceae comprised the remaining biovolume at LA-5.

Nineteen zooplankton taxa were identified at LA-5 (**Table 3-6**). Based on total biovolume (μm^3), approximately 90% of the zooplankton belonged to three classes: Branchiopoda (46.2%), unidentified rotifers (23.7%) and Monogononta (19.2%) (**Figure 3-7**). *Bosmina* sp. was the most abundant zooplankton from the class Branchiopoda and *Keratella* sp*.* was the most abundant zooplankton belonging to the class Monogononta.

3.5.6 Benthic Invertebrate Community

Five replicate samples were collected at LA-5. The mean invertebrate density was 9,597 individuals/m^2 with a range of 5,271 to 14,086 individuals/m^2 (**Table 3-7A**). A total of 46 unique taxa were identified at LA-5. The mean number of taxa present per replicate sample was 21, and ranged from 10 to 29. Simpson's Diversity Index at LA-5 ranged from 0.48 to 0.91, with a mean of 0.73, indicating a relatively high level of diversity. Mean Evenness was 0.23 with a range of 0.15 to 0.40, indicating that relatively few taxa accounted for most of the invertebrate density. The mean Bray-Curtis index for LA-5 was 0.39, with a range of 0.19 to 0.59, indicating that the benthic community composition at LA-5 has similarities to the to the median reference condition of the small lakes group.

A total of 22 major taxonomic groups (Families) were identified at LA-5, with the mean density within these groups ranging from 3 to 4,277 individuals/m^2 (**Table 3-7B**). *Chydoridae* comprised the majority (39%) of the benthic community composition, followed by *chironomids* (20%), and *Macrothricidae* (19%) (**Table 3-7C**).

The benthic invertebrate community at LA-5 comprised five functional feeding groups: collector-gatherers, predators, collector-filterers, shredders, and scrapers. The mean invertebrate density for these groups ranged from 11 to 6,886 individuals/m^2 (**Table 3-7D**). On average, collector-filterers were the most abundant, followed by collector-gatherers, comprising 66 and 26% of the community composition, respectively (**Figure 3-8**).

3.5.6.1 **Benthic Invertebrate Chemistry**

Radionuclide and metal concentrations for caddisfly larvae collected from LA-5 are presented in **Table 3-8**.

3.5.7 Fish Community

Whitefish Lake (LA-5) was surveyed using a variety of gear including minnow traps, seine nets, gillnets and angling during spring and fall seasons. A summary of the fish community is presented in **Table 3-9**. Detailed fish catch data including fishing effort and numbers of each species collected is presented in **Appendix A, Tables A-13, A-16.** In total 67 fish from six species were collected in LA-5. Adult and juvenile White Sucker, Northern Pike, Spottail Shiner and Walleye were most abundant. Juvenile Lake Whitefish and adult Ninespine Stickleback (*Pungitius pungitius*) were less commonly captured. This list has been reviewed by Bobby John, and is based on his local and regional knowledge is considered inclusive and comprehensive.

3.5.7.1 Fish Spawning

Spawning habitat for Northern Pike was observed in south basin of Whitefish Lake, including along the northern shore in the vicinity of the (SA-6) tributary inlet or connection to the north basin of Whitefish Lake from LA-6 (see **Section 4.6.4.1**). Other small patches of potential pike spawning habitat also occurred along the eastern shore at the lake narrows, as well as within the large western embayment (**Figure 3-9**). The information provided by Bobby John, as well as his review of the spawning area map provided by EcoMetrix, confirmed these observations.

3.5.7.2 Fish Tissue Chemistry

Fish tissue chemistry results are presented in **Table 3-10**. Radionuclide levels in bones were typically below lab DLs for both Northern Pike and White Sucker. Concentrations of Polonium-210 were low but measurable in some samples of fish flesh and bone.

Mercury concentrations in Northern Pike (mean 0.16 µg/g ww) and White Sucker (0.045 µg/g ww) tissue were below the federal guideline of 0.5 µg/g ww. Mercury concentrations were higher in Northern Pike than in White Sucker reflecting bioaccumulation through the aquatic food chain.

Selenium concentrations in both Northern Pike (mean 0.81 µg/g dw) and White Sucker (1.03 µg/g dw) were below both BCMOE and USEPA fish tissue guideline values.

3.6 Whitefish Lake, North Basin (LA-6)

Whitefish Lake north basin (LA-6) is situated within the Icelander River drainage area, upstream of Whitefish Lake south basin (LA-5) and downstream of lakes LA-9 (via SA-5) and Kratchkowsky Lake (via SA-4) (see **Figure 1-7**).

Historical and 2016-19 baseline data for LA-6 have been compiled in **Table 3-1** through **Table 3-10**.

3.6.1 Hydrology

3.6.1.1 Water Elevation

Geodetic water levels at LA-6 were measured during open water conditions between 2011 and 2014 (**Appendix G**). The measured water level for LA-6 varied by approximately 0.15 m, between 499.94 masl and 500.09 masl.

The water level elevation measured between September 2016 and August 2019 varied by approximately 0.05 m, between 500.07 masl and 500.118 masl. **Table 3-1** and **Appendix G** presents a summary of water level elevations at all lake and pond locations.

3.6.1.2 Ice Thickness

Ice thickness was observed at the deepest point of the waterbody, between March 23 and April 1, 2014. The ice thickness at the end of March was 0.94 m and was considered to represent the maximum development of ice thickness of winter 2013-14 for LA-6. Between March 22 to April 1, 2018, ice thickness was observed at 0.71 m at the same location, representing the maximum development of ice thickness of winter 2017-18 for LA-6.

3.6.1.3 Bathymetry

Whitefish Lake north basin (LA-6) bathymetry was assessed by Golder in August 2012 (**Table 3-2, Appendix F**). At that time, the lake elevation was 500.06 masl. The total surface area of the lake was 26.27 ha and total volume was 413,505 m^3. Maximum and mean depths were 2.7 m and 1.6 m, respectively.

The bathymetry of the LA-6 was assessed via multibeam sonar in 2018 to gain a more precise representation of the lake bottom relief (**Figure 3-10**; Milne, 2018; **Appendix H**). At the time that the 2018 survey was completed the mean depth was 1.7 m and the maximum depth was 2.3 m. Milne (2018) described the lake morphology as a “frying pan” shape, with a very shallow and flat bottom and a relatively short slope up to the shoreline. The lake basin bathymetry represented by the 2018 survey is similar to that of the previous work (**Appendix F**), and the difference in the maximum depth measured is interpreted as being reflective of normal lake level fluctuations.

3.6.2 Water Quality

Summary statistics for all water quality parameters collected during baseline studies at LA-6 are provided in **Table 3-3**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), most constituent concentrations were below guideline limits. Exceedances of CCME CWQG occurred for lead (1 of 3 samples), and one sample (of three) was below the CCME CWQG range for pH. One lead measurement (0.0012 mg/L) exceeded its guideline value of 0.001 mg/L. One of the pH measurements was 5.71, which is lower than the lower range of the CCME CWQG guideline of 6.5. Annual baseline water quality data from 2012, 2014, 2016, and 2018 are provided in **Appendix A**, **Table A-1**.

3.6.2.1 Limnology

Temperature and dissolved oxygen profiles were undertaken during August 2012 and March 2014 by Golder (**Appendix F**). The north basin of Whitefish Lake (LA-6) was not stratified during August and the Secchi depth was 2.0 m. During late winter, dissolved oxygen decreased below a water depth of 1.5 m but the water did not become anoxic. The Secchi depth was 2.0 m.

On 13 September 2016, the surface water temperature was 8.6 °C. *In-situ* DO was 10.78 mg/L (92.7% saturation), conductivity was 12 µS/cm, and pH was 6.85. The Secchi depth was 1.75 m. Thermal stratification of the lake was not observed at that time (**Figure 3-2**).

On 16 March 2018, the surface water temperature was 0.26 °C. *In-situ* dissolved oxygen (DO) was 11.09 mg/L (76.9 % saturation), conductivity was 9 µS/cm, and pH was 6.94. At a depth of 2.0 metres below surface, the water temperature was 1.8 °C, *in-situ* dissolved oxygen (DO) was 0.78 mg/L (5.81 % saturation), conductivity was 18 µS/cm, and pH was 6.89. During this survey, parameter measurements were obtained from near the surface (below the ice) and near the bottom. Near anoxic conditions were present at the bottom (**Figure 3-3**).

On 2 July 2018, the surface water temperature was 17.8 °C. *In-situ* dissolved oxygen (DO) was 9.22 mg/L (97.2 % saturation), conductivity was 18 µS/cm, and pH was 7.2. At a depth of 1.8 metres below surface, the water temperature was 17.5 °C, i*n-situ* dissolved oxygen (DO) was 0.19 mg/L (2.1 % saturation), conductivity was 24 µS/cm, and pH was 6.35. As such, thermal stratification was not observed during the summer 2018 survey as shown in **Figure 3-4**, however anoxic conditions were present within bottom waters. A sharp increase in conductivity at the lake bottom was also observed, reflecting potential groundwater discharge into the lake.

3.6.3 Sediment Quality

Sediment data are summarized for the top 0-2 cm of sediment collected at LA-6. Sediment grain size and chemistry data are provided in **Appendix A**, **Tables A-3 and A-4**.

The sediment grain size distribution for sediments passing the 2000 µm sieve is summarized in **Table 3-4** for each individual sediment sample from LA-6. Five sediment samples were analysed for grain size. Four of the samples from LA-6, LA-6-1, LA-6-3, LA-6-4 and LA-6-4, were generally clay (64-79%) with a small proportion of silt (21-31%) and some sand (0.4-5%). The sediment sample obtained from LA-6-2 was generally silt (42%) and clay (46%) with a smaller percentage of sand (12%).

Summary statistics for sediment quality parameters collected during baseline studies at LA-6 are provided in **Table 3-5**. On average, the TOC level was 17%. For parameters where sediment quality guidelines are available, all constituent concentrations were at or below their respective REF, ISQG or LEL value.

3.6.4 Aquatic Habitat

An aquatic habitat assessment was undertaken by Golder in August 2012 (**Appendix F**). Shoreline vegetation at LA-6 mainly consisted of shrubs and black spruce with upland jack pine forest. The typical nearshore substrate observed for LA-6 was sand and organic matter. Shoreline slopes ranged from shallow to steep with active erosional areas. Cover types for aquatic biota included emergent and submergent vegetation, interstitial spaces in coarse substrate, overhanging vegetation and woody debris. Observations made during the 2016-19 baseline studies were similar.

Bottom habitat features of the lake were assessed via multibeam sonar imaging in 2018 to gain a more precise representation of the lake bottom habitat (**Figure 3-11**; Milne, 2018; **Appendix H**). The dark colour of the sonar mosaics within the main basin indicates a relatively low acoustic backscattering strength that is consistent with a mud or detritus bottom with high water content. The relative acoustic backscattering strength at the outer edge of the inlet delta and near the outflow was much higher than that of the main basin, likely indicating harder substrate types such as a sand-gravel mix and sand, respectively. Dense patches of long-stemmed submergent vegetation were observed near the inlet delta edge on the west side of the lake. Some sparse submergent vegetation stems were observed in the mid-basin, however the stem heights were only approximately 10 to 20 cm. Emergent vegetation was limited to the nearshore and shoreline areas.

3.6.5 Plankton Community

Chlorophyll a concentrations were below the laboratory detection limit (< 0.60 µg/L) (**Table 3-6**), reflecting the oligotrophic state of LA-6.

Twenty-seven phytoplankton taxa belonging to six classes were identified at LA-6 (**Table 3-6**). Based on total biovolume (μm^3), 70.1% of the phytoplankton belonged to the class Bacillariophyceae (**Figure 3-6**), in particular *Melosira* sp. Phytoplankton from the classes Cyanophyceae (predominantly *Anabeana* sp.) and Dinophyceae (*Peridinium* sp.) comprised approximately 20% of the total biovolume. Phytoplankton belonging to the classes Chlorophyceae, Chrysophyceae, and Cryptophyceae comprised the remaining biovolume at LA-6.

Fifteen zooplankton taxa were identified at LA-6 (**Table 3-6**). More than 90% of the total biovolume consists of zooplankton belonging to three classes: Branchiopoda (55.3%), unidentified rotifers (21.4%) and Monogononta (15.3%) (**Figure 3-7**). *Bosmina* sp., *Diaphanosoma* sp. and *Holopedium* sp. predominantly zooplankton from the class

Branchiopoda, whereas *Keratella* sp. and *Gastropus* sp. predominantly zooplankton belonging to the class Monogononta. The remaining total biovolume consisted of zooplankton from four classes.

3.6.6 Benthic Invertebrate Community

Five replicate samples were collected at LA-6. The mean invertebrate density was 10,163 individuals/m^2 with a range of 3,171 to 19,143 individuals/m^2 (**Table 3-7A**). A total of 30 unique taxa were identified at LA-6. The mean number of taxa present per replicate sample was 17, and ranged from 14 to 21. Simpson's Diversity Index at LA-6 ranged from 0.50 to 0.83, with a mean of 0.65, indicating a relatively high level of diversity. Mean Evenness was 0.18 with a range of 0.13 to 0.28, indicating that a few taxa comprised a large proportion of the total invertebrate abundance. The mean Bray-Curtis index for LA-6 was 0.37, with a range of 0.13 to 0.47, indicating that the benthic community composition at LA-5 has similarities to the median reference condition of the small lakes group.

A total of 17 major taxonomic groups (Families) were identified at LA-6, with the mean density within these groups ranging from 3 to 5,434 individuals/m^2 (**Table 3-7B**). Chydoridae comprised the majority (54%) of the benthic community composition, followed by chironomids (16%), and Macrothricidae (11%) (**Table 3-7C**).

The benthic invertebrate community at LA-6 comprised four functional feeding groups: collector-gatherers, predators, collector-filterers, and shredders; the mean invertebrate density for these groups ranged from 63 to 7,563 individuals/m^2 (**Table 3-7D**). Collector-filterers were the most abundant, followed by collector-gatherers, comprising 75 and 21% of mean invertebrate density, respectively (**Figure 3-8**).

3.6.6.1 Benthic Invertebrate Chemistry

Radionuclide and metal concentrations for caddisfly larvae collected from LA-6 are presented in **Table 3-8**.

3.6.7 Fish Community

Whitefish Lake (LA-6) was surveyed using a variety of gear including minnow traps, gillnets and angling during spring and fall seasons. A summary of the fish community is presented in **Table 3-9**. Detailed fish catch data including fishing effort and numbers of each species collected is presented in **Appendix A, Tables A-13, A-16**. In total 78 fish from five species were collected in LA-6. Adult and juvenile White Sucker and Northern Pike were most abundant. Adult Spottail Shiner, adult Walleye and juvenile Lake Whitefish, were less commonly captured. This list of fish species was reviewed by Bobby John, and is considered inclusive and comprehensive.

No aquatic vertebrate DNA was identified in water samples from LA-6, likely due to organic compounds, for instance, humic acid in the water, which inhibited DNA being successfully sequenced.

3.6.7.1 Fish Spawning

Spawning habitat for Northern Pike was observed in Whitefish Lake (LA-6), exclusively within the northwestern embayment associated with the (SA-5) tributary inlet and the adjacent shore (**Figure 3-9**). Spawning habitats for Walleye and suckers occurs within the inlet tributary (SA-5) from lake LA-9 (see **Section 4.5.4.1**). The information provided by Bobby John, as well as his review of the spawning area map provided by EcoMetrix, confirmed these observations.

3.6.7.2 Fish Tissue Chemistry

Fish tissue chemistry results are presented in **Table 3-10**. Radionuclide levels in bones were typically below lab DLs for both Northern Pike and White Sucker. Concentrations of Polonium-210 were low but measurable in some samples of fish flesh and bone.

Mercury concentrations in Northern Pike (mean 0.19 µg/g ww) and White Sucker (0.04 µg/g ww) tissue were below the federal guideline of 0.5 µg/g ww. Mercury concentrations were higher in Northern Pike than in White Sucker reflecting bioaccumulation through the aquatic food chain.

Selenium concentrations in both Northern Pike (mean 0.92 µg/g dw) and White Sucker (0.97 µg/g dw) were below both BCMOE and USEPA fish tissue guideline values.

3.7 Kratchkowsky Lake (LA-7)

Monitoring location LA-7 is located in the southeast portion of Kratchkowsky Lake. Kratchkowsky Lake is situated within the Icelander River drainage area, upstream of lake LA-6 (see **Figure 1-7**).

Historical and 2016-19 baseline data for LA-7 have been compiled in **Table 3-1** through **Table 3-10**.

3.7.1 General Description

3.7.2 Hydrology

3.7.2.1 Water Elevation

Geodetic water levels at LA-7 were measured during open water conditions between 2011 and 2014 (**Appendix G**). The measured water level for Kratchkowsky Lake (LA-7) varied by approximately 0.11 m, between 520.42 masl and 520.54 masl.

The water level elevations measured in September 2016 and May 2017 were 520.53 masl on both occasions. **Table 3-1** and **Appendix G** presents a summary of water level elevations at all lake and pond locations.

3.7.2.2 Ice Thickness

Ice thickness was observed at the deepest point of the waterbody, between March 23 and April 1, 2014. The ice thickness at the end of March was 0.85 m and was considered to represent the maximum development of ice thickness of winter 2013-14 for LA-7.

3.7.2.3 Bathymetry

Bathymetry of the southeast portion of Kratchkowsky Lake (LA-7) was assessed by Golder in August 2012 (**Table 3-2**, **Appendix F**). At that time, the lake elevation was 520.48 masl. The total surface area of the lake was 79.59 ha and total volume was not reported. Maximum and mean depths were 6.8 m and 2.9 m, respectively.

3.7.3 Water Quality

Summary statistics for all water quality parameters collected during baseline studies at Kratchkowsky Lake (LA-7) are provided in **Table 3-3**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), most constituent concentrations were below guideline limits. Exceedances of SEQG guideline limits occurred for aluminum (1 of 3 samples). Ammonia was slightly above the conservatively calculated CCME CWQG of 0.103 mg/L during March 2014. Annual baseline water quality data from 2012, 2014 and 2016 are provided in **Appendix A**, **Table A-1**.

3.7.3.1 Limnology

Temperature and dissolved oxygen profiles were undertaken during August 2012 and March 2014 by Golder (**Appendix F**). Kratchkowsky Lake (LA-7) was not stratified during August, although oxygen levels were decreased near the bottom. The Secchi depth was 1.75 m. During the late winter, dissolved oxygen steadily decreased with depth but did not become anoxic and the Secchi depth was 3.5 m.

On 10 September 2016, the surface water temperature was 12.8 °C. *In-situ* DO was 9.31 mg/L (88.0% saturation), conductivity was 15 µS/cm, and pH was 6.70. The Secchi depth was 1.8 m. A water chemistry depth profile during the September 2016 survey is presented in **Figure 3-2**. Thermal stratification was not observed at that time.

On 16 March 2018, the surface water temperature was 0.77 °C, *in-situ* dissolved oxygen (DO) was 11.3 mg/L (79.3 % saturation), conductivity was 12 µS/cm, and pH was 6.16. At a depth of 3.7 metres below surface, the water temperature was 4.52 °C, *in-situ* dissolved oxygen (DO) was 0.15 mg/L (1.1 % saturation), conductivity was 16 µS/cm, and pH was

6.0. Notable trends included a steady decrease in dissolved oxygen to anoxic conditions in bottom waters. Temperature increased slightly from near freezing at surface to approaching 5 °C at lake bottom. Conductivity fluctuated slightly with an overall increase within the bottom waters. A water chemistry depth profile during the March 2018 survey is presented in **Figure 3-3**.

3.7.4 Sediment Quality

Sediment data are summarized for the top 0-2 cm of sediment collected at LA-7. Sediment grain size and chemistry data are provided in **Appendix A**, **Tables A-3 and A-4**.

The sediment grain size distribution for sediments passing the 2000 µm sieve is summarized in **Table 3-4** for each individual sediment sample from LA-7. Three sediment samples were analysed for grain size. Two of the three samples from LA-7, LA-7-1, and LA-7-2, were generally clay (57-68%) with a smaller proportion of silt (23-36%) and some sand (7-9%). The sediment sample obtained from LA-7-3 had a higher percentage of sand (49%) with smaller percentages of silt (30%) and clay (22%).

Summary statistics for sediment quality parameters collected during baseline studies at LA-7 are provided in **Table 3-5**. The three sediment samples had an average percentage of total organic carbon of 22%. For parameters where sediment quality guidelines are available, all constituent concentrations were at or below the REF, ISQG or LEL value.

3.7.5 Aquatic Habitat

An aquatic habitat assessment was undertaken by Golder in August 2012 (**Appendix F**). Shoreline vegetation at LA-7 mainly consisted of shrubs and black spruce with upland jack pine forest. The typical nearshore substrates observed for LA-7 were boulders and sand. Shoreline slopes ranged from shallow to steep. Cover types for aquatic biota included emergent and submergent vegetation, interstitial spaces in coarse substrate, overhanging vegetation and woody debris. Observations made during the 2016-19 baseline studies were similar, confirming the previous habitat characterization.

3.7.6 Plankton Community

Plankton community sampling was conducted in the north arm of Kratchkowsky Lake (LA-7A) and the results are reported in **Section 3.8.1.7**.

3.7.7 Benthic Invertebrate Community

Three replicate samples were collected at LA-7. The mean invertebrate density was 1848 individuals/m^2 with a range of 800 to 2529 individuals/m^2 (**Table 3-7A**). A total of 18 unique taxa were identified at LA-7. The mean number of taxa present per replicate was 11. Simpson's Diversity Index at LA-7 ranged from 0.60 to 0.84, with a mean of 0.69, indicating a relatively high level of diversity. Mean Evenness was 0.31 with a range of 0.21 to 0.49, indicating that few taxa comprised a large proportion of the total invertebrate abundance. The mean Bray-Curtis index for LA-7 was 0.57, with a range of 0.46 to 0.63, indicating that the benthic community composition at LA-7 has some similarities to the median reference condition of the large lakes group.

A total of 11 major taxonomic groups (Families) were identified at LA-7, with the mean density within these groups ranging from 5 to 1562 individuals/m^2 (**Table 3-7B**). Chironomids comprised the majority (81%) of the benthic community composition. Seed shrimps (Ostracoda) were the second-most abundant, comprising 8% of the community composition (**Table 3-7C)**.

The benthic invertebrate community at LA-7 comprised four functional feeding groups: collector-gatherers, predators, collector-filterers and shredders; the mean invertebrate density for these groups ranged from 100 to 1138 individuals/m^2 (**Table 3-7D**). Collector-gatherers were the most abundant, comprising 60% of the community, followed by shredders, comprising 21% of the community (**Figure 3-8**).

3.7.7.1 **Benthic Invertebrate Chemistry**

Radionuclide and metal concentrations for caddisfly larvae collected from LA-7 are presented in **Table 3-8**.

3.7.8 Fish Community

For purposes of describing the fish community, Kratchkowsky Lake was considered a single study area and fish were collected throughout the lake. Kratchkowsky Lake was surveyed using a variety of gear including minnow traps, gillnets and angling during spring and fall seasons. A summary of the fish community is presented in **Table 3-9**. Detailed fish catch data including fishing effort and numbers of each species collected is presented in **Appendix A, Tables A-13, A-16**. In total seven species have been documented from Kratchkowsky Lake. Adult and juvenile White Sucker, Northern Pike and Lake Whitefish were most abundant. Adult and juvenile Spottail Shiner and Walleye were slightly less abundant. Ninespine Stickleback and Yellow Perch were observed in lake but not collected in any of the gear that was deployed. The list of fish species identified was reviewed by Bobby John, and is considered inclusive and comprehensive.

3.7.8.1 **Fish Spawning**

Spawning habitat for Northern Pike was observed in Kratchkowsky Lake. Patches of emergent vegetation occurred in several areas, often associated with embayments including the north shores of the eastern embayments (LA-7A) (**Figure 3-12**), as well as south shore within the vicinity of access point (Kratchkowsky Lake) (**Appendix F**). Smaller patches of potential pike spawning habitat also occurred along the north shore of the outlet embayment (**Figure 3-12**).

Several rocky shoals are present within Kratchkowsky Lake, likely affording spawning habitat for fall spawning Lake Whitefish. Spawning habitats for Walleye and White Sucker likely occurs within the north inlet tributary (SA-11). Bobby John is particularly familiar with this area as he fishes commercially in Kratchkowsky Lake. Based on his local knowledge he identified two specific rocky areas potentially suitable for fish spawning (**Figure 3-9**).

3.7.8.2 Fish Tissue Chemistry

For purposes of collecting fish tissues for chemical analysis, Kratchkowsky Lake was considered a single study area and fish were collected throughout the lake.

Fish tissue chemistry results are presented in **Table 3-10**. Radionuclide levels in bones were typically below lab DLs for both Northern Pike and White Sucker. Concentrations of Polonium-210 were low but measurable in some samples of fish flesh and bone.

Mercury concentrations in Northern Pike (mean 0.15 µg/g ww) and White Sucker (0.019 µg/g ww) tissue were below the federal guideline of 0.5 µg/g ww. Mercury concentrations were higher in Northern Pike than in White Sucker reflecting bioaccumulation through the aquatic food chain.

Selenium concentrations in both Northern Pike (mean 0.89 µg/g dw) and White Sucker (0.97 µg/g dw) were below both BCMOE and USEPA fish tissue guideline values.

3.8 Kratchkowsky Lake (LA-7A)

Monitoring station LA-7A is located in the northwest portion of Kratchkowsky Lake (see **Figure 1-7**).

2016-19 baseline data for LA-7A have been compiled in **Table 3-1** to **Table 3-10**.

3.8.1 Hydrology

3.8.1.1 Water Elevation

Kratchkowsky Lake water levels were measured in the southeast portion of the lake (LA-7) (see **Section 3.7.2.1**).

3.8.1.2 Bathymetry

Bathymetry of the north basin of Kratchkowsky Lake (LA-7A) was assessed in September 2016 (**Table 3-2**). At that time, the lake elevation was 520.53 masl. The total surface area of the lake was 243.34 ha and total volume was 12,712,684 m^3. Maximum and mean depths were 21.8 m and 5.2 m, respectively (see **Figure 3-12**).

3.8.2 Water Quality

The north basin of Kratchkowsky Lake (LA-7A) was stratified at the time of sampling in September 2016 (see **Section 3.8.3.1**). Thus, in addition to a water sample collected from the surface, a water sample was taken from below the thermocline near the bottom of the lake and analyzed separately. Summary statistics for all water quality parameters collected during baseline studies at LA-7A-top and LA-7A-bottom are provided in **Table 3-3**. Annual baseline water quality data from 2016 are provided in **Appendix A**, **Table A-1**.

All concentrations were below guideline limits for water collected at the surface (LA-7A-top), for parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO) (**Table 3-3**).

Most concentrations were within guideline values for water collected from below the thermocline (LA-7A-bottom), for parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), with the exception of iron, mercury, ammonia and pH (**Table 3-3**). Iron concentrations exceeded the SEQG guideline value by an order of magnitude whereas mercury concentrations exceeded the CCME CWQG limit by more than 2-times. Ammonia also exceeded the CCME CWQG by an order of magnitude. The pH (6.46) was marginally lower than the CCME CWQG lower limit of 6.5.

3.8.2.1 **Limnology**

On 10 September 2016, the water depth at the LA-7A at the profile location was approximately 17.7 m, and a thermocline was present at a depth of approximately 10 m. The Secchi depth was 2.2 m. Near surface conditions were characterized by a temperature of 12.5 °C, dissolved oxygen levels of 8.54 mg/L and 80.2 % saturation, conductivity of 15 µS/cm, and pH of 7.03.

In comparison, water below the thermocline, near the bottom of LA-7A, was characterized by a cooler temperature (6.4 °C), a reduced oxygen level (0.69 mg/L; 5.6 %), elevated conductivity (56 µS/cm) and lower pH (5.42). A water chemistry depth profile is presented in **Figure 3-2**.

3.8.3 Sediment Quality

Sediment data are summarized for the top 0-2 cm of sediment collected at LA-7A. Sediment grain size and chemistry data are provided in **Appendix A**, **Tables A-3 and A-4**.

The sediment grain size distribution for sediments passing the 2000 µm sieve is summarized in **Table 3-4** for each individual sediment sample from LA-7A. Three sediment samples were analysed for grain size. All samples from LA-7A had the same general grain size distribution. The sediments were generally clay (37-42%) and silt (44-48%) with some sand (12-18%).

Summary statistics for sediment quality parameters collected during baseline studies at LA-7A are provided in **Table 3-5**. The three sediment samples had an average percentage of total organic carbon of 26%. For parameters where sediment quality guidelines are available, all constituent concentrations were at or below the REF, ISQG or LEL value.

3.8.4 Aquatic Habitat

An aquatic habitat assessment was undertaken during September 2016 and maps were prepared. The shoreline generally consisted of rocks with overhanging shrubs, transitioning from small boulder and cobble to sand or silty bottom, with sparse emergent or submergent aquatic vegetation (see **Figure 3-12**). Within several embayments with tributary inlets, the nearshore consisted of sandy beach. Larger emergent and submergent macrophyte beds were also generally limited to embayments.

The aquatic habitat map prepared by EcoMetrix was reviewed by Bobby John, who identified two additional rocky areas that are potentially suitable for spawning (**Figure 3-9**).

3.8.5 Plankton Community

Chlorophyll a concentrations were below the laboratory detection limit (< 0.60 µg/L), reflecting the oligotrophic nature of Kratchkowsky Lake (**Table 3-6**).

Twenty-nine phytoplankton taxa belonging to seven classes were identified at LA-7A (**Table** 3-6). Based on total biovolume (µm3), more than 90% of the phytoplankton present belong to the classes Bacillariophyceae (40.5%, predominantly *Melosira* sp.), Cryptophyceae (22.2%, consisting of Cryptomonas sp.), Cyanophyceae (16.3%, predominantly *Aphanothece* sp.), and Dinophyceae (11.6%, predominantly *Gymnodinium* sp.) (**Figure** 3-2). Phytoplankton belonging to three other classes comprised the remaining biovolume at LA-7A.

Twenty-one zooplankton taxa were identified at LA-7A (**Table 3-6**). Based on total biovolume, 61.9% of zooplankton belong to the class Branchiopoda (predominantly *Holopedium* sp.), 29.3% belong to the class Copepoda (predominantly *Skistodiaptomus* sp.), and 8.4% by the class Monogononta (predominantly *Conochilus* sp.). Other zooplankton present included unidentified rotifers and those belonging to classes Ciliata, Euglenoidea, and Lobosa.

3.8.6 Benthic Invertebrate Community

Three replicate samples were collected at LA-7A. The mean invertebrate density was 800 individuals/m^2 with a range of 543 to 1,171 individuals/m^2 (**Table 3-7A**). A total of 11 unique taxa were identified at LA-7. The mean number of taxa present per replicate was 7, and ranged from 6 to 8. Simpson's Diversity Index at LA-7A ranged from 0.61 to 0.71, with a mean of 0.67, indicating a relatively high level of diversity. Mean Evenness was 0.43 with a range of 0.32 to 0.53, indicating that few taxa comprised a large proportion of the total invertebrate abundance. The mean Bray-Curtis index for LA-7A was 0.36, with a range of 0.20 to 0.58, indicating that the benthic community composition at LA-7A has some similarities to the median reference condition of the large lakes group.

A total of 7 major taxonomic groups (Families) were identified at LA-7, with the mean density within these groups ranging from 5 to 6,522 individuals/m^2 (**Table 3-7B**). Chironomids comprised the majority (85%) of the benthic community composition. Copepoda-Cyclopoida were the second-most abundant, comprising 7% of the community composition (**Table 3-7C**).

The benthic invertebrate community at LA-7A comprised four functional feeding groups: collector-gatherers, predators, collector-filterers and shredders; the mean invertebrate density for these groups ranged from 105 to 319 individuals/m^2 (**Table 3-7B**). Collector-gatherers and predators were the dominant species comprising 33 and 35% of the community composition, respectively (**Table 3-7D**).

3.8.6.1 **Benthic Invertebrate Chemistry**

Radionuclide and metal concentrations for caddisfly larvae collected from LA-7A are presented in **Table 3-8**.

3.8.7 Fish Community

For purposes of describing the fish community, Kratchkowsky Lake was considered a single study area and fish were collected throughout the lake. See **Section 3.7.8** for a discussion of the Kratchkowsky Lake fish community.

3.8.7.1 **Fish Spawning**

For purposes of evaluating fish spawning, Kratchkowsky Lake was considered a single study area and spawning was assessed throughout the lake. See **Section 3.7.8.1** for a discussion of the Kratchkowsky Lake fish spawning habitat.

3.8.7.2 Fish Tissue Chemistry

For purposes of collecting fish tissues for chemical analysis, Kratchkowsky Lake was considered a single study area and fish were collected throughout the lake. See **Section 3.7.8.2** for a discussion of the Kratchkowsky Lake fish tissue chemistry results.

3.9 LA-8

Lake LA-8 is situated within the Icelander River drainage area, upstream of lake LA-9 (see **Figure 1-7**).

2016-19 baseline data for LA-8 have been compiled in **Table 3-1** through **Table 3-9**.

3.9.1 Hydrology

3.9.1.1 Water Elevation

The water level elevations measured in September 2016 and June 2017 were 520.86 and 530.80 masl, respectively. Please refer to **Appendix G** for a summary of water level elevations at all lake and pond locations.

3.9.1.2 Bathymetry

Bathymetry of lake LA-8 was assessed in September 2016 (**Table 3-2**). At that time, the lake elevation was 520.86 masl. The total surface area of the lake was 208.21 ha and total volume was estimated to be 7,467,381 m^3. Maximum and mean depths were 10.2 m and 3.6 m, respectively (see **Figure 3-13**).

3.9.2 Water Quality

Summary statistics for all water quality parameters collected during baseline studies at LA-8 are provided in Table 3-3. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), all constituent concentrations were below guideline limits. Annual baseline water quality data from 2016 are provided in **Appendix A**, **Table A-1**.

3.9.2.1 Limnology

On 14 September 2016, the surface water temperature was 11.7 °C. *In-situ* DO was 9.65 mg/L (89.3% saturation), conductivity was 12 µS/cm, and pH was 6.72. The Secchi depth was 1.6 m. A water chemistry depth profile is presented in **Figure 3-2**. Thermal stratification was not observed at that time.

3.9.3 Sediment Quality

Sediment data are summarized for the top 0-2 cm of sediment collected at LA-8. Sediment grain size and chemistry data are provided in **Appendix A**, **Tables A-2 and A-3**.

The sediment grain size distribution for sediments passing the 2000 µm sieve is summarized in **Table 3-4** for each individual sediment sample from LA-8. Three sediment samples were analysed for grain size. Two of the three samples from LA-8, LA-8-2, and LA-8-3, were generally sand (33-40%) with a smaller proportion of silt (39-40%) and some clay (20-28%). The sediment sample obtained from LA-8-1 had a higher percentage of clay (73%) with smaller percentages of silt (26%) and sand (1%).

Summary statistics for sediment quality parameters collected during baseline studies at LA-8 are provided in **Table 3-5**. The three sediment samples had an average percentage of total organic carbon of 16%. For parameters where sediment quality guidelines are available, all constituent concentrations were at or below the REF, ISQG or LEL value.

3.9.4 Aquatic Habitat

An aquatic habitat assessment was undertaken during September 2016 and maps were prepared. Typical shoreline consisted of rocky shore with overhanging shrubs and submerged tree trunks, transitioning to soft organic silt bottom, with little to no aquatic vegetation (see **Figure 3-13**). Patches of sandy beach shoreline occurred in several areas throughout the lake and a large sandbar was present along the south shore. Emergent and submergent macrophyte beds were also patchy, distributed mainly along the north shore of the lake.

3.9.5 Benthic Invertebrate Community

Three replicate samples were collected at LA-8. The mean invertebrate density was 671 individuals/m^2 with a range of 557 to 843 individuals/m^2 (**Table 3-7A**). A total of 18 unique taxa were identified at LA-8. The mean number of taxa present per replicate was 10, and ranged from 7 to 12. Simpson's Diversity Index at LA-8 ranged from 0.69 to 0.75, with a mean of 0.72, indicating a relatively high level of diversity. Mean Evenness was 0.37 with a range of 0.25 to 0.54, indicating that few taxa comprised a large proportion of the total invertebrate abundance. The mean Bray-Curtis index for LA-8 was 0.41, with a range of 0.34 to 0.50, indicating that the benthic community composition at LA-8 has some similarities to the median reference condition of the large lakes group.

A total of 9 major taxonomic groups (Families) were identified at LA-8, with the mean density within these groups ranging from 5 to 652 individuals/m^2 (**Table 3-4**). Chironomids comprised the majority (84%) of the benthic community composition, followed by phantom midges (Chaoboridae) (10%). (**Table 3-7C**).

The benthic invertebrate community at LA-8 comprised four functional feeding groups: collector-gatherers, predators, collector-filterers and shredders; the mean invertebrate density for these groups ranged from 24 to 286 individuals/m^2 (**Table 3-7D**). Predators and shredders were most abundant, comprising 42 and 41% of the community composition, respectively (**Figure 3-8**).

3.9.5.1 Benthic Invertebrate Chemistry

Radionuclide and metal concentrations for dragonfly nymphs collected from LA-8 are presented in **Table 3-1**.

3.9.6 Fish Community

LA-8 was surveyed using gillnets during the fall season. A summary of the fish community is presented in **Table 3-9**. Detailed fish catch data including fishing effort and numbers of each species collected is presented in **Appendix A, Tables A-13, A-16**. In total 31 fish, from five species were documented from LA-8. Adult and juvenile Lake Whitefish and Northern Pike were most abundant. Juvenile White Sucker and adult Ninespine Stickleback were much less commonly captured. One juvenile Yellow Perch was visually observed. The list of fish species identified was reviewed by Bobby John, and is considered inclusive and comprehensive.

3.9.6.1 Fish Spawning

Potential spawning habitat for Northern Pike was observed in lake LA-8. Patches of emergent vegetation occurred in several areas, including the north shore at the eastern end of the lake, as well as embayments at the western end of the lake (see **Figure 3-13**).

Rocky shoals, associated with an esker, likely afford spawning habitat for fall spawning Lake Whitefish. Spawning for White Sucker likely occurs within the inlet and outlet tributaries.

The information provided by Bobby John, as well as his review of the spawning area map provided by EcoMetrix, confirmed these observations.

3.10 LA-9

Lake LA-9 is situated within the Icelander River Drainage, upstream of lake LA-6 and downstream of LA-8 (via SA-9 and SA-10**) (Figure 1-7)**.

The 2016-19 baseline data for LA-9 have been compiled in **Table 3-1** through **Table 3-9**.

3.10.1 Hydrology

3.10.1.1 Water Elevation

The water level elevations measured in September 2016 and May 2017 were 514.25 and 514.28 masl, respectively. Please refer to **Appendix G** for a summary of water level elevations at all lake and pond locations.

3.10.1.2 Bathymetry

Bathymetry of lake LA-9 was assessed in September 2016 (**Table 3-2**). At that time, the lake elevation was 514.25 masl. The total surface area of the lake was 137.94 ha and total volume was 6,410,916 m^3. Maximum and mean depths were 11.2 m and 4.6 m, respectively (see **Figure 3-14**).

3.10.2 Water Quality

Summary statistics for all water quality parameters collected during baseline studies at LA-9 are provided in **Table 3-3**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), all constituent concentrations were below guideline limits. Annual baseline water quality data from 2016 are provided in **Appendix A**, **Table A-1**.

3.10.2.1 Limnology

On 16 September 2016, the surface water temperature was 12.3 °C. *In-situ* DO was 9.31 mg/L (87.0% saturation), conductivity was 12 µS/cm, and pH was 6.97. The Secchi depth was 1.5 m. A water chemistry depth profile is presented in **Figure 3-14**. Thermal stratification was not observed at that time.

3.10.3 Sediment Quality

Sediment data are summarized for the top 0-2 cm of sediment collected at LA-9. Sediment grain size and chemistry data are provided in **Appendix A**, **Tables A-3 and A-4**.

The sediment grain size distribution for sediments passing the 2000 µm sieve is summarized in **Table 3-4** for each individual sediment sample from LA-9. Three sediment samples were analysed for grain size. Two of the three samples from LA-9, LA-9-1, and LA-9-2, were generally silt (47-51%) with a smaller proportions of clay (25-28%) and sand (24-25%). The sediment sample obtained from LA-9-3 had a higher percentage of clay (77%) with smaller percentages of silt (21%) and sand (1%).

Summary statistics for sediment quality parameters collected during baseline studies at LA-9 are provided in **Table 3-5**. The three sediment samples had an average percentage of total organic carbon of 12%. For parameters where sediment quality guidelines are available, all constituent concentrations were at or below the REF, ISQG or LEL value.

3.10.4 Aquatic Habitat

An aquatic habitat assessment was undertaken during September 2016 and habitat maps were prepared. Typical shoreline consisted of rocky shore with overhanging shrubs, quickly transitioning to sandy bottom, and shallow sandy beaches with patchy emergent vegetation nearshore and submergent aquatic beds on the deeper slopes (see **Figure 3-14**). The shoreline near the lake inlet and outlet, consisted of bog and most of the larger aquatic macrophyte beds occurred within the western (outlet) basin of the lake.

3.10.5 Benthic Invertebrate Community

Three replicate samples were collected at LA-9. The mean invertebrate density was 1,633 individuals/m^2 with a range of 1,386 to 1,986 individuals/m^2 (**Table 3-7A**). A total of 24 unique taxa were identified at LA-9. The mean number of taxa present per replicate was 11, and ranged from 6 to 21. Simpson's Diversity Index at LA-9 ranged from 0.63 to 0.79, with a mean of 0.69, indicating a relatively high level of diversity. Mean Evenness was 0.36 with a range of 0.23 to 0.45, indicating that few taxa comprised a large proportion of the total invertebrate abundance. The mean Bray-Curtis index for LA-9 was 0.57, with a range of 0.53 to 0.63, indicating that the benthic community composition at LA-9 has some similarities to the median reference condition of the large lakes group.

A total of 14 major taxonomic groups (Families) were identified at LA-9, with the mean density within these groups ranging from 5 to 943 individuals/m^2 (**Table 3-2B**). Chironomids comprised the majority (56%) of the benthic community composition, followed by phantom midges (32%). (**Table 3-2C**).

The benthic invertebrate community at LA-9 comprised four functional feeding groups: collector-gatherers, predators, collector-filterers and shredders; the mean invertebrate density for these groups ranged from 24 to 986 individuals/m^2 (**Table 3-7D**). Predators and collector-gatherers were most abundant, comprising 61 and 30% of the community composition, respectively (**Figure 3-8**).

3.10.5.1 **Benthic Invertebrate Chemistry**

Radionuclide and metal concentrations for caddisfly larvae collected from LA-9 are presented in **Table 3-8**.

3.10.6 Fish Community

LA-9 was surveyed using gillnets and dip nets during the fall season in 2016. A summary of the fish community is presented in **Table 3-9**. Detailed fish catch data including fishing effort and numbers of each species collected is presented in **Appendix A, Tables A-13, A-16**. In total 45 fish, from seven species were documented from LA-9. Adult and juvenile Lake Whitefish, Spottail Shiner and adult Ninespine Stickleback were most abundant. Adult and juvenile White Sucker and Walleye, and juvenile Yellow Perch and Northern Pike were less commonly captured. Bobby John confirmed that the fish species identified in baseline studies in LA-9 are those present in the lake based on his local knowledge.

3.10.6.1 Fish Spawning

Potential spawning habitat for Northern Pike was observed in lake LA-9, primarily occurring within the outlet embayment at the southwest end of the lake (**Figure 3-14**). Emergent vegetation also occurred along the south shore of the eastern embayment.

Rocky shoals likely afford spawning habitat for fall spawning Lake Whitefish. Spawning habitats for Walleye and White Sucker may occur within the inlet tributaries. The information provided by Bobby John, as well as his review of the spawning area map (**Figure 3-9**) provided by EcoMetrix, confirmed these observations.

3.11 PA-2

Pond PA-2 is situated within Icelander River drainage area, downstream of pond PA-3 and upstream of lake LA-6 (see **Figure 1-7**).

The 2016-19 baseline data for PA-2 have been compiled in **Table 3-1, Table 3-2, Table 3-3** and **Table 3-9**.

3.11.1 Hydrology

3.11.1.1 Water Elevation

The water level elevation measured in September 2016 was 510.46 masl. Please refer to **Table 3-1** and **Appendix G** for a summary of water level elevations at all lake and pond locations.

3.11.1.2 Bathymetry

Bathymetry of pond PA-2 was assessed in September 2016 (**Table 3-2**). At that time, the pond elevation was 510.46 masl. The total surface area of the pond was 8.43 ha and total volume was 122,617 m^3. Maximum and mean depths were 3.2 m and 1.5 m, respectively (see **Figure 3-15**).

3.11.2 Water Quality

Summary statistics for all water quality parameters collected during baseline studies PA-2 are provided in **Table 3-3**. For parameters where water quality guidelines are available

(SEQG, CCME CWQG, and SSWQO), all constituent concentrations were below guideline limits. Annual baseline water quality data from 2016 are provided in **Appendix A**, **Table A-1**.

3.11.2.1 Limnology

On 19 September 2016, the surface water temperature was 11.7 °C. *In-situ* DO was 9.31 mg/L (86.1% saturation), conductivity was 9 µS/cm, and pH was 6.84. The Secchi depth was bottom (2 m). A water chemistry depth profile is presented in **Figure 3-15**. Thermal stratification was not observed at that time.

3.11.3 Aquatic Habitat

An aquatic habitat assessment was undertaken during September 2016 and maps were prepared. Typical shoreline consisted of rocky shore with overhanging shrubs, transitioning to sandy or silt bottom (see **Figure 3-15**). Much of the nearshore supported emergent, submergent and floating aquatic macrophyte beds.

3.11.4 Fish Community

PA-2 was surveyed using gillnets during the fall season of 2016. A summary of the fish community is presented in **Table 3-9**. Detailed fish catch data including fishing effort and numbers of each species collected is presented in **Appendix A, Tables A-13, A-16**. In total 21 fish, from three species were documented from PA-2. Adult and juvenile Lake Whitefish were most abundant. Adult Northern Pike and White Sucker were less commonly captured.

3.12 PA-3

Pond PA-3 is a headwater pond situated within the Icelander River drainage area, upstream of pond PA-2 (see **Figure 1-7**).

The 2016-19 baseline data for PA-3 have been compiled in **Table 3-1, Table 3-2, Table 3-3** and **Table 3-9**.

3.12.1 Hydrology

3.12.1.1 Water Elevation

The water level elevation measured in September 2016 was 517.36 masl. Please refer to **Table 3-1** and **Appendix G** for a summary of water level elevations at all lake and pond locations.

3.12.1.2 Bathymetry

Bathymetry of pond PA-3 was assessed in September 2016 (**Table 3-2**). At that time, the pond elevation was 517.36 masl. The total surface area of the pond was 4.49 ha and total volume was 38,845 m^3. Maximum and mean depths were 2.7 m and 0.9 m, respectively (see **Figure 3-16**).

3.12.2 Water Quality

Summary statistics for all water quality parameters collected during baseline studies PA-3 are provided in **Table 3-3**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), all constituent concentrations were below guideline limits. Annual baseline water quality data from 2016 are provided in **Appendix A**, **Table A-1**.

3.12.2.1 Limnology

On 20 September 2016, the surface water temperature was 10.9 °C. *In-situ* DO was 9.22 mg/L (83.4% saturation), conductivity was 8 µS/cm, and pH was 6.56. The Secchi depth was 1.6 m. A water chemistry depth profile is presented in **Figure 3-16**. Thermal stratification was not observed at that time.

3.12.3 Aquatic Habitat

An aquatic habitat assessment was undertaken during September 2016 and maps were prepared. Typical shoreline consisted of rocky shore with overhanging shrubs, transitioning to silt bottom (see **Figure 3-16**). Nearly the entire waterbody supported emergent, submergent and floating aquatic macrophyte beds.

3.12.4 Fish Community

PA-3 was surveyed using gillnets during the fall season in 2016. A summary of the fish community is presented in **Table 3-9**. Detailed fish catch data including fishing effort and numbers of each species collected is presented in **Appendix A, Tables A-13, A-16**. No fish were collected.

3.13 LB-1

Lake LB-1 is situated within the Williams Lake drainage area, upstream of Russell Lake (LAB-2) and downstream of lake LB-2 (via SB-3) (see **Figure 1-7**).

Historical and 2016-19 baseline data for LB-1 have been compiled in **Table 3-1** and **Table 3-3**.

3.13.1 Hydrology

3.13.1.1 **Water Elevation**

Geodetic water levels at LB-1 were measured during open water conditions between 2011 and 2013 (**Appendix G**). The measured water level for LB-1 varied by approximately 0.37 m, between 503.71 masl and 504.08 masl.

The water level elevation measured in September 2016 was 503.66 masl. Please refer to **Table 3-1** and **Appendix G** for a summary of water level elevations at all lake and pond locations.

3.13.2 Water Quality

Summary statistics for all water quality parameters collected during baseline studies at LB-1 are provided in **Table 3-3**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), all constituent concentrations were below guideline limits. Annual baseline water quality data from 2016 are provided in **Appendix A**, **Table A-1**.

3.13.2.1 **Limnology**

On 13 September 2016, the surface water temperature was 8.8 °C. *In-situ* DO was 9.22 mg/L (88.2% saturation), conductivity was 12 µS/cm, and pH was 8.0. The Secchi depth was bottom (2.1 m). A water chemistry depth profile is presented in **Figure 3-2**. Thermal stratification was not observed at that time

3.14 LB-2

Lake LB-2 is situated within the Williams Lake drainage area, upstream of lake LB-1 and downstream of Williams Lake (LB-3) (via SB-5) (see **Figure 1-7**).

Historical and 2016-19 baseline data for LB-2 have been compiled in **Table 3-1** and **Table** 3-3.

3.14.1 Hydrology

3.14.1.1 **Water Elevation**

Geodetic water levels at LB-2 were measured during open water conditions between 2011 and 2014 (**Appendix G**). The measured water level for LB-2 varied by approximately 0.18 m, between 510.39 masl and 510.57 masl.

The water level elevation measured in September 2016 was 510.54 masl (**Appendix G**). Please refer to **Table 3-1** and **Appendix G** for a summary of water level elevations at all lake and pond locations.

3.14.1.2 Ice Thickness

Ice thickness was measured at the deepest point of the waterbody, between March 23 and April 1, 2014. The ice thickness at the end of March was 0.78 m and was considered to represent the maximum development of ice thickness of winter 2013-14.

3.14.2 Water Quality

Summary statistics for all water quality parameters collected during baseline studies at LB-2 are provided in **Table 3-3**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), all constituent concentrations were below guideline limits. Annual baseline water quality data from 2014 and 2016 are provided in **Appendix A**, **Table A-1**.

3.14.2.1 Limnology

Temperature and dissolved oxygen profiles were undertaken during April 2014 by Golder (**Appendix F**). During late winter, dissolved oxygen steadily decreased below 2 m but did not become anoxic and the Secchi depth was 2.5 m.

On 13 September 2016, the surface water temperature was 10.8 °C. In-situ DO was 9.47 mg/L (85.8% saturation), conductivity was 13 µS/cm, and pH was 7.13. The Secchi depth was 2.2 m. A water chemistry depth profile is presented in **Figure 3-2**. Thermal stratification was not observed at that time.

3.15 Williams Lake (LB-3)

Williams Lake (LB-3) is a headwater lake situated within the drainage area, upstream of lake LB-2 (see **Figure 1-7**).

Historical and 2016-19 baseline data for Williams Lake (LB-3) have been compiled in **Table** 3-1 through **Table 3-5**, **Table 3-7** and **Table 3-9**.

3.15.1 Hydrology

3.15.1.1 Water Elevation

Geodetic water levels at Williams Lake (LB-3) were measured during open water conditions between 2011 and 2014 (**Appendix G**). The measured water level for LB-3 varied by approximately 0.22 m, between 518.36 masl and 518.58 masl.

The water level elevation measured in September 2016 was 518.57 masl (**Appendix G**). Please refer to **Table 3-1** and **Appendix G** for a summary of water level elevations at all lake and pond locations.

3.15.1.2 Ice Thickness

Ice thickness was observed at the deepest point of the waterbody, between March 23 and April 1, 2014. The ice thickness at the end of March was 0.82 m and was considered to represent the maximum development of ice thickness of winter 2013-14.

3.15.1.3 Bathymetry

Williams Lake (LB-3) bathymetry was assessed by Golder (**Appendix F**) in August 2012 (**Table 3-2**). At that time, the lake elevation was 518.52 masl. The total surface area of the lake was 152.30 ha and total volume was 6,933,788 m^3. Maximum and mean depths were 17.8 m and 4.6 m, respectively.

3.15.2 Water Quality

Williams Lake (LB-3) was stratified at the time of sampling in September 2016 (see **Section 3.15.3.1**). Thus, in addition to a water sample collected from the surface, a water sample was taken from below the thermocline near the bottom of the lake and analyzed separately. Descriptive statistics for all water quality parameters at are provided in **Table 3-3**. Annual baseline water quality data from 2012, 2014 and 2016 are provided in **Appendix A**, **Table A-1**.

For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), all constituent concentrations were below guideline limits for water collected at the surface of the water column.

For water collected at the lake bottom, most constituent concentrations were below guideline limits for parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO). There was an exceedance of the CCME CWQG ammonia guideline value by an order of magnitude and the pH concentration (6.42) was marginally lower than the CCME CWQG lower limit of 6.5 (**Table 3-3**). Iron concentrations exceeded the SEQG guideline value by an order of magnitude.

3.15.2.1 Limnology

Temperature and dissolved oxygen profiles were undertaken during August 2012 and April 2014 by Golder (**Appendix F**). Williams Lake (LB-3) was stratified during August with oxygen and temperature rapidly decreasing below 6 m. Anoxia occurred below 11 m and the Secchi depth was 4.0 m. Dissolved oxygen conditions in bottom waters during April were similarly anoxic, and the Secchi depth was 4.0 m.

On 14 September 2016, the water depth at the Williams Lake (LB-3) profile location was 17 m and a thermocline was present at a depth of approximately 10 m. The Secchi depth was 3.5 m. Near surface conditions were characterized by a temperature of 14.2 °C, dissolved oxygen levels of 8.97 mg/L and 87.5 % saturation, conductivity of 13 µS/cm, and a pH of 6.80. In comparison, water below the thermocline, near the bottom, was characterized by a water temperature of 7.3 °C, a dissolved oxygen level 1.08 mg/L or 9.0% saturation, conductivity was 51 µS/cm, respectively, and a pH of 6.36. A water chemistry depth profile is presented in **Figure 3-2**.

3.15.3 Sediment Quality

Sediment data are summarized for the top 0-2 cm of sediment collected at Williams Lake (LB-3). Sediment grain size and chemistry data are provided in **Appendix A**, **Tables A-3 and A-4**.

The sediment grain size distribution for sediments passing the 2000 µm sieve is summarized in **Table 3-4** for each individual sediment sample from Williams Lake (LB-3). Three sediment samples were analysed for grain size. Two of the three samples from Williams Lake (LB-3-, LB-3-2, and LB-3-3), were generally silt (42-55%) with smaller proportions of clay (31-37%) and sand (14-22%). The sediment sample obtained from LB-3-1 had a higher percentage of clay (78%) with smaller percentages of silt (22%) and sand (0.3%).

Summary statistics for sediment quality parameters collected during baseline studies at Williams Lake (LB-3) are provided in **Table 3-5**. The three sediment samples had an average percentage of total organic carbon of 13%. For parameters where sediment quality guidelines are available, all constituent concentrations were at or below the REF, ISQG or LEL value.

3.15.4 Aquatic Habitat

An aquatic habitat assessment was undertaken by Golder in August 2012 (**Appendix F**). Shoreline vegetation at Williams Lake (LB-3) mainly consisted of shrubs and black spruce with upland jack pine forests. The typical substrate observed for LB-3 was boulder and sand. Shoreline slopes ranged from shallow to steep. Cover types for aquatic biota included emergent and submerged vegetation, interstitial spaces in coarse substrate, overhanging vegetation and woody debris.

3.15.5 Benthic Community

Three replicate samples were collected at Williams Lake (LB-3). The mean invertebrate density was 10,457 individuals/m^2 with a range of 3029 to 25,114 individuals/m^2 (**Table 3-7A**). A total of 26 unique taxa were identified at LB-3. The mean number of taxa present per replicate was 15, and ranged from 13 to 18. Simpson's Diversity Index at LB-3 ranged from 0.45 to 0.79, with a mean of 0.68, indicating a relatively high level of diversity. Mean Evenness was 0.25 with a range of 0.09 to 0.35, indicating that few taxa comprised a large proportion of the total invertebrate abundance. The mean Bray-Curtis index for LB-3 was 0.76, with a range of 0.64 to 0.95, indicating that the benthic community composition at LB-3 was relatively different compared to median reference condition of the large lakes group.

A total of 15 major taxonomic groups (Families) were identified at Williams Lake (LB-3), with the mean density within these groups ranging from 5 to 8643 individuals/m^2 (**Table** 3-7**B**). Chironomids comprised the majority (60%) of the benthic community composition, followed by Naididae (16%) (**Table 3-7C**).

The benthic invertebrate community at Williams Lake (LB-3) comprised five functional feeding groups: collector-gatherers, predators, collector-filterers, shredders, and scrapers; the mean invertebrate density for these groups ranged from 5 to 7019 individuals/m^2 (**Table** 3-7**B**). Collector-gatherers, predators and collector-filterers were almost equally abundant, comprising 97% of the community composition (**Table 3-7D**).

3.15.6 Fish Community

A summary of the fish community is presented in **Table 3-9**. Detailed fish catch data including fishing effort and numbers of each species collected is presented in **Appendix A, Tables A-13, A-16**. Juvenile Northern Pike, juvenile and adult Yellow Perch, Spottail Shiner and Lake Chub (*Couesius plumbeus*) were observed in August 2012 (**Appendix F**). Adult Walleye and Northern Pike were captured by angling during May 2017.

Bobby John noted that he has attempted commercially fishing at Williams Lake, but based on his experience the lake has low Walleye numbers and consequently he does not fish there regularly.

3.16 Russell Lake (LAB-1)

Monitoring location LAB-1 comprises a small portion of Russell Lake and is situated within the northern embayment at the outlet of the Icelander River, downstream of SA-1.

Historical and 2016-19 baseline data for LAB-1 have been compiled in **Table 3-1** through **Table 3-10**.

3.16.1 Hydrology

3.16.1.1 Water Elevation

Geodetic water levels at LAB-1 were measured during open water conditions between 2011 and 2014 (**Appendix G**). The measured water level for LAB-1 varied by approximately 0.39 m, between 487.99 masl and 488.38 masl.

The water level elevation measured in September 2016 was 488.26 masl (**Appendix G**). Please refer to **Table 3-1** and **Appendix G** for a summary of water level elevations at all lake and pond locations.

3.16.1.2 Ice Thickness

Ice thickness was measured at the deepest point of the embayment, between March 23 and April 1, 2014. The ice thickness at the end of March was 0.83 m and was considered to represent the maximum development of ice thickness of winter 2013-14 for LAB-1.

3.16.1.3 Bathymetry

Bathymetry of Russell Lake near the inlet of the Icelander River was assessed by Golder in August 2012 (**Table 3-2, Appendix F**). At that time, the lake elevation was 488.17 masl. The total surface area of the LAB-1 study area was 75.15 ha and total volume was not reported. Maximum and mean depths were 18.8 m and 3.0 m, respectively.

3.16.2 Water Quality

Summary statistics for all water quality parameters collected during baseline studies at LAB-1 are provided in **Table 3-3**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), all constituent concentrations were within guideline values. Annual baseline water quality data from 2012, 2014 and 2016 are provided in **Appendix A**, **Table A-1**.

3.16.2.1 Limnology

Temperature and dissolved oxygen profiles were undertaken during August 2012 and March 2014 by Golder (**Appendix F**). Russell Lake at LAB-1 was stratified during August with oxygen and temperature rapidly decreasing in the bottom 1.5 m. The Secchi depth was 3.5 m. During late winter, dissolved oxygen steadily decreased below 10 m but the water column did not become anoxic. Secchi depth was 3.5 m.

On 15 September 2016, the surface water temperature was 12.6 °C. *In-situ* DO was 9.67 mg/L (91.0% saturation), conductivity was 30 µS/cm, and pH was 7.02. The Secchi depth was 3.1 m. A water chemistry depth profile is presented in **Figure 3-2**. Thermal stratification was not observed at that time.

3.16.3 Sediment Quality

Sediment data are summarized for the top 0-2 cm of sediment collected at LAB-1. Sediment grain size and chemistry data are provided in **Appendix A**, **Tables A-3 and A-4**.

The sediment grain size distribution for sediments passing the 2000 µm sieve is summarized in **Table 3-4** for each individual sediment sample from LAB-1. Three sediment samples were analysed for grain size. Samples from LAB-1 were generally clay (70-78%) with a smaller proportion of silt (22-27%) and some sand (0.3-3%).

Summary statistics for sediment quality parameters collected during baseline studies at LAB-1 are provided in **Table 3-5**. The three sediment samples had an average percentage of total organic carbon of 14%. For parameters where sediment quality guidelines are available, all constituent concentrations were at or below the REF, ISQG or LEL value.

3.16.4 Aquatic Habitat

An aquatic habitat assessment was undertaken by Golder in August 2012 (**Appendix F**). Shoreline vegetation at LAB-1 mainly consisted of shrubs and black spruce with upland jack pine forests. The typical substrate observed for LAB-1 was sand and cobble. Shoreline slopes ranged from shallow to steep and active erosional areas were noted. Cover types for aquatic biota included emergent and submergent vegetation, interstitial spaces in coarse substrate, and overhanging vegetation.

3.16.5 Plankton Community

Chlorophyll *a* concentrations were below the laboratory detection limit (< 0.60 µg/L) (**Table 3-6**), reflecting the oligotrophic state of LAB-1.

Twenty-nine phytoplankton taxa belonging to seven classes were identified at LAB-1 (**Table** 3-6). Based on total biovolume (μm^3), more than 95% of the phytoplankton present belong to the classes Cryptophyceae (36.6%, predominantly *Cryptomonas* sp.), Bacillariophyceae (33.0%, predominantly *Melosira* sp.), Dinophyceae (13.3%, predominantly *Gymnodinium* sp.), and Cyanophyceae (12.6%, predominantly *Gomphosphaeria* sp.) (**Figure 3-6**). Phytoplankton belonging to three other classes comprised the remaining biovolume at LAB-1.

Twenty-one zooplankton taxa were identified at LAB-1 (**Table 3-6**). Based on total biovolume, approximately half (46.5%) of zooplankton belong to the class Branchiopoda (predominantly *Chydorus* sp. *and Bosmina* sp.), 31.9% belong to the class Copepoda (predominantly those that are too young to be identified), and approximately 20% by unidentified rotifers and the class Monogononta (predominantly *Asplanchna* sp.) (**Figure** 3-7). Other zooplankton present included those belonging to classes Ciliata, Insecta, and Lobosa.

3.16.6 Benthic Invertebrate Community

Three replicate samples were collected at LAB-1. The mean invertebrate density was 3,505 individuals/m^2 with a range of 2,471 to 5,286 individuals/m^2 (**Table 3-7A**). A total of 30 unique taxa were identified at LAB-1. The mean number of taxa present per replicate was 19, and ranged from 15 to 24. Simpson's Diversity Index at LAB-1 ranged from 0.84 to 0.86, with a mean of 0.85, indicating a high level of diversity. Mean Evenness was 0.34 with a range of 0.28 to 0.40, indicating that few taxa comprised a large proportion of the total invertebrate abundance. The mean Bray-Curtis index for LAB-1 was 0.71, with a range of 0.63 to 0.85, indicating that the benthic community composition at LAB-1 was relatively different compared to the median reference condition of the large lakes group.

A total of 16 major taxonomic groups (Families) were identified at LAB-1, with the mean density within these groups ranging from 5 to 2,190 individuals/m^2 (**Table 3-7B**). Chironomids comprised the majority (59%) of the benthic community composition, followed by Naididae (19%) (**Table 3-7C**).

The benthic invertebrate community at LAB-1 comprised five functional feeding groups: collector-gatherers, predators, collector-filterers, shredders, and scrapers; the mean invertebrate density for these groups ranged from 5 to 1,752 individuals/m^2 (**Table 3-7D**). Collector-gatherers were the most abundant, followed by collector-filterers, comprising 55 and 27% of the community composition, respectively (**Figure 3-8**).

3.16.6.1 **Benthic Invertebrate Chemistry**

Radionuclide and metal concentrations for caddisfly larvae collected from LAB-1 are presented in **Table 3-8**.

3.16.7 Fish Community

For the purposes of describing the fish community, Russell Lake was considered a single study area and fish were collected from monitoring locations LAB-1 and LAB-2 (see **Section 3.17**). Russell Lake was surveyed using gillnets during spring and fall seasons. A summary of the fish community is presented in **Table 3-9**. Detailed fish catch data including fishing effort and numbers of each species collected is presented in **Appendix A Tables A-13, A-16**. In total 97 fish, from eight species were documented from Russell Lake. Adult and juvenile Walleye, Lake Whitefish and White Sucker, and adult Northern Pike were most abundant. Adult Spottail Shiner and Lake Trout were less abundant. Adult Ninespine Stickleback and juvenile Burbot were visually observed.

Bobby John noted in his interview that he has observed that some walleye in Russell Lake have large cysts.

3.16.7.1 **Fish Spawning**

Spawning habitat for Northern Pike was observed in Russell Lake at LAB-1, within the embayment associated with the inlet of the Icelander River. Several adult pike were observed in this area during May 2017, shortly after ice-out.

Spawning habitats for fall spawning Lake Whitefish and Lake Trout were not observed within the LAB-1 area of Russell Lake. Spawning habitats for Walleye and suckers likely occur within the Icelander River (SA-1) (see **Section 4.1.4.1**).

In addition to the observations made by EcoMetrix, Bobby John identified a Lake Trout spawning area located south of baseline study area represented by LAB. The spawning area extends both north and south off an island in Russel Lake (Denison 2020).

3.16.7.2 **Fish Tissue Chemistry**

For purposes of collecting fish tissues for chemical analysis, Russell Lake was considered a single study area and fish were collected at Russell Lake Stations LAB-1 and LAB-2.

Fish tissue chemistry results are presented in **Table 3-10**. Radionuclide levels in bones were typically below lab DLs for both Northern Pike and White Sucker. Concentrations of Polonium-210 were low but measurable in some samples of fish flesh and bone.

Mercury concentrations in Northern Pike (mean 0.27 µg/g ww) and White Sucker (0.027 µg/g ww) tissue were below the federal guideline of 0.5 µg/g ww. Mercury concentrations were higher in Northern Pike than in White Sucker reflecting bioaccumulation through the aquatic food chain.

Selenium concentrations in both Northern Pike (mean 1.62 µg/g dw) and White Sucker (2.15 µg/g dw) were below both BCMOE and USEPA fish tissue guideline values.

3.17 Russell Lake (LAB-2)

Monitoring location LAB-2 comprises a small portion of Russell Lake and is situated along the northwestern shore at the outlet of the Williams Lake drainage area, downstream of SB-1.

The 2016-19 baseline data for LAB-2 have been compiled in **Table 3-1** to **Table 3-8**.

3.17.1 Hydrology

3.17.1.1 **Bathymetry**

Bathymetry of Russell Lake near the inlet of the Williams Lake drainage area (LAB-2) were assessed in September 2016 (**Table 3-1**). At that time, the lake elevation was 488.26 masl.

The total surface area of the LAB-2 study area was 151.66 ha and total volume was 6,079,370 m^3. Maximum and mean depths were 20.6 m and 4.0 m, respectively (see **Figure 3-17**).

3.17.2 Water Quality

Summary statistics for all water quality parameters collected during baseline studies at LAB-2 are provided in **Table 3-3**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), all constituent concentrations were below guideline limits. Annual baseline water quality data from 2016 are provided in **Appendix A**, **Table A-1**.

3.17.2.1 **Limnology**

On 21 September 2016, the surface water temperature was 12.2 °C. *In-situ* DO was 9.47 mg/L (88.4% saturation), conductivity was 30 µS/cm, and pH was 6.90. The Secchi depth was 2.9 m. A water chemistry depth profile is presented in **Figure 3-17**. Thermal stratification was not observed at that time.

3.17.3 Sediment Quality

One sample was obtained at LAB-2 which allowed the top 0-2 cm of sediment to be collected for analysis. Sediment grain size and chemistry data are provided in **Appendix A**, **Tables A-3 and A-4**.

The sediment grain size distribution for sediments passing the 2000 µm sieve is summarized in **Table 3-4** for the sediment sample from LAB-2. The sediment sample from LAB-2 was generally clay (59%) with a smaller proportion of silt (38%) and some sand (3%).

Summary statistics for sediment quality parameters collected during baseline studies at LAB-2 are provided in **Table 3-5**. The sediment sample had a percentage of total organic carbon of 12%. For parameters where sediment quality guidelines are available, all constituent concentrations were at or below the REF, ISQG or LEL value.

3.17.4 Aquatic Habitat

An aquatic habitat assessment was undertaken during September 2016 and maps were prepared. Typical shoreline consisted of rocky shore with overhanging shrubs that quickly transitioned to sand bottom, with little to no emergent vegetation (see **Figure 3-17**). Submergent vegetation was sparse between 0.7 and 1 m depth, but formed dense mats on the bottom at depths greater 1 m.

3.17.5 Plankton Community

Chlorophyll a concentrations were below the laboratory detection limit (< 0.60 µg/L) (**Table** 3-6), reflecting the oligotrophic state of LAB-2.

Twenty-one phytoplankton taxa belonging to seven classes were identified at LAB-2 (**Table 3-6**). Based on total biovolume (μm^3), the majority of phytoplankton present belong to the classes Cryptophyceae (54.1%, predominantly *Cryptomonas* sp.), Bacillariophyceae (27.9%, predominantly *Melosira* sp.), and Dinophyceae (11.2%, predominantly *Gymnodinium* sp.) (**Figure 3-6**). Phytoplankton belonging to four other classes comprised the remaining biovolume at LAB-2.

Twenty-two zooplankton taxa were identified at LAB-2 (**Table 3-6**). Based on total biovolume, almost 90% of zooplankton at LAB-2 belong to the classes Monogononta (38.6%, predominantly *Asplanchna* sp.), Branchiopoda (30.9%, predominantly *Chydorus* sp. and *Bosmina* sp.), and Copepoda (18.8%, predominantly individuals that were too young to identify). Other zooplankton present included those belonging to classes Ciliata, Filosia, Heliozoa, and Insecta, as well as unidentified rotifers.

3.17.5.1 Benthic Invertebrate Community

Three replicate samples were collected at LAB-2. The mean invertebrate density was 5,295 individuals/m^2 with a range of 2,600 to 10,557 individuals/m^2 (**Table 3-7A**). A total of 40 unique taxa were identified at LAB-2. The mean number of taxa present per replicate was 24, and ranged from 20 to 27. Simpson's Diversity Index at LAB-2 ranged from 0.75 to 0.88, with a mean of 0.82, indicating a high level of diversity. Mean Evenness was 0.25 with a range of 0.14 to 0.31, indicating that few taxa comprised a large proportion of the total invertebrate abundance. The mean Bray-Curtis index for LAB-2 was 0.87, with a range of 0.77 to 0.93, indicating that the benthic community composition at LAB-2 is largely different than the median reference condition of the large lakes group.

A total of 21 major taxonomic groups (Families) were identified at LAB-2, with the mean density within these groups ranging from 5 to 2,190 individuals/m^2 (**Table 3-7B**). Chironomids comprised the majority (75%) of the benthic community composition, followed by Pisidiidae (13%) (**Table 3-7C**).

The benthic invertebrate community at LAB-1 comprised five functional feeding groups: collector-gatherers, predators, collector-filterers, shredders, and scrapers; the mean invertebrate density for these groups ranged from 14 to 2,500 individuals/m^2 (**Table 3-7D**). Collector-gatherers were the most abundant, followed by collector-filterers, comprising 59 and 29% of the community composition, respectively (**Figure 3-8**).

3.17.5.2 Benthic Invertebrate Chemistry

Radionuclide and metal concentrations for caddisfly larvae collected from LAB-2 are presented in **Table 3-8**.

3.17.6 Fish Community

For purposes of describing the fish community, Russell Lake was considered a single study area and fish were collected at both LAB-1 and LAB-2. See **Section 3.16.8** for a discussion of the Russell Lake fish community.

3.17.6.1 Fish Spawning

Potential spawning habitat for Northern Pike was observed in Russell Lake at LAB-2, within the small embayment associated with the inlet of the Williams Lake Drainage (SB-1) (**Figure 3-17**).

Potential spawning habitats for fall spawning Lake Whitefish and Lake Trout were not noted within the LAB-2 area of Russell Lake.

3.17.6.2 Fish Tissue Chemistry

For purposes of collecting fish tissues for chemical analysis, Russell Lake was considered a single study area and fish were collected at LAB-1 and LAB-2. See **Section 3.16.7.2** for a discussion of the Russell Lake fish tissue chemistry results.

Tables

Table 3-1: Baseline Water Elevations

Waterbody	Date	Water Level (m)
McGowan Lake (LA-1)	September 16, 2016 July 2, 2018 July 5, 2019 August 30, 2019	494.39 494.344 494.515 494.476
LA-2	September 13, 2016	494.58
LA-3	September 18, 2016	494.57
Mardoc Lake (LA-4)	September 13, 2016	498.62
Whitefish Lake (LA-5)	September 12, 2016	500.06
Whitefish Lake (LA-6)	September 12, 2016 June 30, 2018 August 29, 2019	500.07 500.106 500.118
Kratchkowsky Lake (LA-7)	September 12, 2016 May 30, 2017	520.53 520.53
LA-8	September 13, 2016 June 1, 2017	520.86 520.80
LA-9	September 13, 2016 May 31, 2017	514.25 514.28
PA-2	September 15, 2016	510.46
PA-3	September 15, 2016	517.36
LB-1	September 11, 2016	503.66
LB-2	September 11, 2016	510.54
Williams Lake (LB-3)	September 11, 2016	518.57
Russell Lake (LAB-1)	September 22, 2016	488.26

Notes:

- Water level elevations are referenced to benchmarks with geodetic elevations established by Golder Associates, except for LA8, LA9, PA2 and PA3 which are referenced to geodetic elevations established as part of the 2016-2019 Wheeler River Project Baseline Study.
- Water level elevation surveys conducted for the 2016-2019 Wheeler River Project Baseline Study by Calder Engineering Ltd., Ecometrix Incorporated and Missinipi Water Solutions Inc.

Table 3-2: Baseline Lake Bathymetric Features Summary

Location	Survey Date	Key Bathymetric Features				
		Lake Elevation (m)	Surface Area (ha)	Volume (m^3)	Maximum Depth (m)	Mean Depth (m)
McGowan Lake (LA-1)	12-Aug-12	494.37	148.55	8,189,320	9.7	5.5
Whitefish Lake (LA-5)	13-Aug-12	500.04	32.40	332,502	4.1	1.1
Whitefish Lake (LA-6)	13-Aug-12	500.06	26.27	413,505	2.7	1.6
Kratchkowsky Lake (LA-7)	09-Aug-12	520.48	79.59	-	6.8	2.9
Kratchkowsky Lake (LA-7A)	11-Sep-16	520.53	243.34	12,712,684	21.8	5.2
LA-8	15-Sep-16	520.86	208.21	7,647,381	10.2	3.6
LA-9	17-Sep-16	514.25	137.94	6,410,916	11.2	4.6
PA-2	19-Sep-16	510.46	8.43	122,617	3.2	1.5
PA-3	20-Sep-16	517.36	4.49	38,845	2.7	0.9
Williams Lake (LB-3)	08-Aug-12	518.52	152.30	6,933,788	17.8	4.6
Russell Lake (LAB-1)*	12-Aug-12	488.17	75.15	-	18.8	3.0
Russell Lake (LAB-2)*	20-Sep-16	488.26	151.66	6,079,370	20.6	4.0

Notes:

* The summary of features pertain to the assessed portions of Russell Lake

Table 3-3: Baseline Water Quality Summary

Location	Parameter	Units	Benchmark Value	Benchmark Reference	Total Count	Count less than RDL	Minimum	Maximum	Arithmetic Mean
McGowan Lake (LA-1)	Alkalinity	mg/L			4	0	2	10	6.0
	Aluminum	mg/L	0.1	SEQG	6	0	0.001	0.0051	0.0034
	Ammonia as N	mg/L	0.103	CCME CWQG	6	4	<0.01	0.09	<0.027
	Antimony	mg/L			6	6	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	6	3	0.0001	0.0001	<0.0001
	Barium	mg/L			6	0	0.0023	0.0038	0.003
	Beryllium	mg/L			6	6	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			6	0	2	12	7.8
	Boron	mg/L	1.5	CCME CWQG	6	6	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	6	3	<0.00001	0.00003	<0.000015
	Calcium	mg/L			6	0	1.1	1.7	1.35
	Carbonate	mg/L			6	6	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	6	0	0.4	0.5	0.43
	Chromium	mg/L	0.001	CCME CWQG	6	6	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			6	6	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	6	6	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			6	0	2	2.6	2.23
	Dissolved Phosphorus	mg/L			4	4	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	6	1	<0.01	0.08	<0.032
	Hardness	mg/L			4	0	5	6	5.5
	Hydroxide	mg/L			6	6	<1	<1	<1
	Iron	mg/L	0.3	SEQG	6	0	0.037	0.27	0.12
	Lead	mg/L	0.001	CCME CWQG	6	5	<0.0001	0.0004	<0.00015
	Lead-210	Bq/L			6	6	<0.02	<0.02	<0.02
	Magnesium	mg/L			6	0	0.3	0.5	0.42
	Manganese	mg/L			6	0	0.0039	0.029	0.016
	Mercury	mg/L	0.000026	CCME CWQG	6	5	<0.0000001	<0.00001	<0.000006
	Molybdenum	mg/L	31	SEQG	6	6	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	6	6	<0.0001	<0.0001	<0.0001
	Nitrate	mg/L	13.29	SEQG	5	3	<0.04	0.49	<0.18
	P. Alkalinity	mg/L			6	6	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	6	0	6.52	6.94	6.77
	Phosphorus	mg/L			6	6	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			6	6	<0.005	<0.005	<0.005
	Potassium	mg/L			6	0	0.2	0.5	0.37
	Radium-226	Bq/L	0.11	SSWQO	6	6	<0.005	<0.005	<0.005
	Selenium	mg/L	0.001	CCME CWQG	6	6	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	6	6	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			6	0	1.4	1.8	1.5
	Specific Conductivity	µS/cm			6	0	9	24	16.8
	Strontium	mg/L			6	0	0.012	0.016	0.014
	Sulphate	mg/L	128	SEQG	6	0	0.7	0.8	0.75
	Sum of Ions				6	0	6	18	12.5
	Thallium	mg/L	0.0008	CCME CWQG	6	6	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			3	3	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			6	6	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			3	3	<0.01	<0.01	<0.01
	Tin	mg/L			6	4	<0.0001	0.0013	<0.0004
	Titanium	mg/L			6	6	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			6	0	18	26	22.167
	Total Kjeldahl Nitrogen	mg/L			6	0	0.17	0.38	0.27333
	Total Organic Carbon	mg/L			6	0	2.2	2.6	2.3667
	Total Suspended Solids	mg/L			6	2	<1	4	<2.5
	Uranium	mg/L	0.015	CCME CWQG	6	6	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			6	6	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	6	5	<0.0005	0.001	<0.0006
McGowan Lake (LA-1 Bottom)	Aluminum	mg/L	0.1	SEQG	2	0	0.0034	0.004	0.0037
	Ammonia as N	mg/L	0.103	CCME CWQG	2	1	<0.01	0.02	<0.015
	Antimony	mg/L			2	2	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	2	0	0.0001	0.0001	0.0001
	Barium	mg/L			2	0	0.0026	0.0031	0.00285
	Beryllium	mg/L			2	2	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			2	0	5	6	5.5
	Boron	mg/L	1.5	CCME CWQG	2	2	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	2	2	<0.00001	<0.00001	<0.00001
	Calcium	mg/L			2	0	1.1	1.4	1.25
	Carbonate	mg/L			2	2	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	2	0	0.4	0.5	0.45
	Chromium	mg/L	0.001	CCME CWQG	2	2	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			2	2	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	2	2	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			2	0	1.9	2.2	2.05
	Fluoride	mg/L	0.12	CCME CWQG	2	0	0.02	0.08	0.05
	Hardness	mg/L			2	0	4	5	4.5
	Hydroxide	mg/L			2	2	<1	<1	<1
	Iron	mg/L	0.3	SEQG	2	0	0.036	0.13	0.083
	Lead	mg/L	0.001	CCME CWQG	2	2	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			2	1	<0.02	0.03	<0.025
	Magnesium	mg/L			2	0	0.3	0.4	0.35
	Manganese	mg/L			2	0	0.0053	0.013	0.00915
	Mercury	mg/L	0.000026	CCME CWQG	2	0	0.0000009	0.000007	0.00000395
	Molybdenum	mg/L	31	SEQG	2	2	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	2	2	<0.0001	<0.0001	<0.0001
	Nitrate	mg/L	13.29	SEQG	2	1	<0.04	0.6	<0.32
	P. Alkalinity	mg/L			2	2	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	2	0	6.62	6.8	6.71
	Phosphorus	mg/L			2	2	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			2	2	<0.005	<0.005	<0.005
	Potassium	mg/L			2	0	0.3	0.4	0.35
	Radium-226	Bq/L	0.11	SSWQO	2	2	<0.005	<0.005	<0.005
	Selenium	mg/L	0.001	CCME CWQG	2	2	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	2	2	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			2	0	1.4	1.6	1.5
	Specific Conductivity	µS/cm			2	0	10	14	12
	Strontium	mg/L			2	0	0.013	0.014	0.0135
	Sulphate	mg/L	128	SEQG	2	0	0.7	0.8	0.75
	Sum of Ions				2	0	9	12	10.5
	Thallium	mg/L	0.0008	CCME CWQG	2	2	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			1	1	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			2	1	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			1	1	<0.01	<0.01	<0.01
	Tin	mg/L			2	2	<0.0001	<0.0001	<0.0001
	Titanium	mg/L			2	2	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			2	0	22	24	23
	Total Kjeldahl Nitrogen	mg/L			2	0	0.14	0.23	0.185
	Total Organic Carbon	mg/L			2	0	2	2.2	2.1
	Total Suspended Solids	mg/L			2	1	<1	2	<1.5
	Uranium	mg/L	0.015	CCME CWQG	2	2	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			2	2	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	2	0	0.0013	0.0016	0.00145

Table 3-3 Cont'd: Baseline Water Quality Summary

Location	Parameter	Units	Benchmark		Total Count	Count less than RDL	Minimum	Maximum	Arithmetic Mean
			Value	Reference					
LA-2	Alkalinity	mg/L			3	0	4.0	12	8.3
	Aluminum	mg/L	0.1	SEQG	3	0	0.001	0.0024	0.0019
	Ammonia as N	mg/L	0.103	CCME CWQG	3	2	<0.01	0.04	<0.02
	Antimony	mg/L			3	3	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	3	2	<0.0001	<0.0001	<0.0001
	Barium	mg/L			3	0	0.0027	0.0043	0.0033
	Beryllium	mg/L			3	3	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			3	0	5.0	15	10
	Boron	mg/L	1.5	CCME CWQG	3	3	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	3	2	<0.00001	<0.00001	<0.00001
	Calcium	mg/L			3	0	1.3	1.9	1.6
	Carbonate	mg/L			3	3	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	3	0	0.50	0.70	0.63
	Chromium	mg/L	0.001	CCME CWQG	3	3	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			3	3	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	3	3	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			3	0	2.1	2.3	2.2
	Dissolved Phosphorus	mg/L			3	3	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	3	1	<0.01	0.07	<0.033
	Hardness	mg/L			3	0	5	7	5.6667
	Hydroxide	mg/L			3	3	<1	<1	<1
	Iron	mg/L	0.3	SEQG	3	0	0.054	0.081	0.066
	Lead	mg/L	0.001	CCME CWQG	3	2	<0.0001	0.0002	<0.00013
	Lead-210	Bq/L			3	3	<0.02	<0.02	<0.02
	Magnesium	mg/L			3	0	0.40	0.60	0.47
	Manganese	mg/L			3	0	0.0064	0.030	0.014733
	Mercury	mg/L	0.000026	CCME CWQG	3	3	<0.000000	<0.000010	<0.000007
	Molybdenum	mg/L	31	SEQG	3	3	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	3	2	<0.0001	0.0003	<0.00017
	Nitrate	mg/L	13.29	SEQG	3	1	<0.04	0.53	<0.21
	P. Alkalinity	mg/L			3	3	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	3	0	6.9	7.19	7.03
	Phosphorus	mg/L			3	3	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			3	3	<0.005	<0.005	<0.005
	Potassium	mg/L			3	0	0.30	0.50	0.40
	Radium-226	Bq/L	0.11	SSWQO	3	2	<0.005	0.006	<0.0053
	Selenium	mg/L	0.001	CCME CWQG	3	3	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	3	3	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			3	0	1.5	1.8	1.6
	Specific Conductivity	µS/cm			3	0	18	25	22
	Strontium	mg/L			3	0	0.013	0.018	0.015333
	Sulphate	mg/L	128	SEQG	3	0	0.60	0.80	0.70
	Sum of Ions				3	0	10	22	16
	Thallium	mg/L	0.0008	CCME CWQG	3	3	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			2	2	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			3	3	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			2	2	<0.01	<0.01	<0.01
	Tin	mg/L			3	1	<0.0001	0.0006	<0.00037
	Titanium	mg/L			3	3	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			3	0	22	26	23
	Total Kjeldahl Nitrogen	mg/L			3	0	0.15	0.22	0.197
	Total Organic Carbon	mg/L			3	0	2.2	2.5	2.3
	Total Suspended Solids	mg/L			3	1	<1	2.0	<1.7
	Uranium	mg/L	0.015	CCME CWQG	3	3	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			3	3	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	3	2	<0.0005	0.0011	<0.0007
LA-3	Alkalinity	mg/L			3	0	3.0	10	6.7
	Aluminum	mg/L	0.1	SEQG	3	0	0.0014	0.0033	0.0023
	Ammonia as N	mg/L	0.103	CCME CWQG	3	2	<0.01	0.04	<0.02
	Antimony	mg/L			3	3	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	3	2	<0.0001	<0.0001	<0.0001
	Barium	mg/L			3	0	0.003	0.0041	0.0035
	Beryllium	mg/L			3	3	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			3	0	4.0	12	8.0
	Boron	mg/L	1.5	CCME CWQG	3	3	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	3	3	<0.00001	<0.00001	<0.00001
	Calcium	mg/L			3	0	1.2	1.8	1.5
	Carbonate	mg/L			3	3	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	3	0	0.7	0.9	0.8
	Chromium	mg/L	0.001	CCME CWQG	3	3	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			3	3	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	3	3	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			3	0	2.2	2.7	2.4
	Dissolved Phosphorus	mg/L			3	3	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	3	1	<0.01	0.07	<0.033
	Hardness	mg/L			3	0	5.0	6.0	5.3
	Hydroxide	mg/L			3	3	<1	<1	<1
	Iron	mg/L	0.3	SEQG	3	0	0.066	0.19	0.11
	Lead	mg/L	0.001	CCME CWQG	3	2	<0.0001	0.0007	<0.0003
	Lead-210	Bq/L			3	3	<0.02	<0.02	<0.02
	Magnesium	mg/L			3	0	0.40	0.50	0.43
	Manganese	mg/L			3	0	0.0086	0.014	0.0112
	Mercury	mg/L	0.000026	CCME CWQG	3	3	<0.000000	<0.000010	<0.000007
	Molybdenum	mg/L	31	SEQG	3	3	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	3	2	<0.0001	0.0002	<0.00013
	Nitrate	mg/L	13.29	SEQG	3	1	<0.04	0.40	<0.16
	P. Alkalinity	mg/L			3	3	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	3	0	6.9	7.2	7.0
	Phosphorus	mg/L			3	3	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			3	3	<0.005	<0.005	<0.005
	Potassium	mg/L			3	0	0.30	0.80	0.53
	Radium-226	Bq/L	0.11	SSWQO	3	2	<0.005	0.006	<0.0053
	Selenium	mg/L	0.001	CCME CWQG	3	3	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	3	3	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			3	0	1.5	1.8	1.6
	Specific Conductivity	µS/cm			3	0	20	24	22
	Strontium	mg/L			3	0	0.014	0.018	0.016
	Sulphate	mg/L	128	SEQG	3	0	0.60	0.90	0.80
	Sum of Ions				3	0	9.0	19	14
	Thallium	mg/L	0.0008	CCME CWQG	3	3	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			2	2	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			3	3	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			2	2	<0.01	<0.01	<0.01
	Tin	mg/L			3	1	<0.0001	0.001	<0.0005
	Titanium	mg/L			3	3	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			3	0	22	25	24
	Total Kjeldahl Nitrogen	mg/L			3	0	0.16	0.27	0.23
	Total Organic Carbon	mg/L			3	0	2.3	2.8	2.5
	Total Suspended Solids	mg/L			3	1	<1	4.0	<2.7
	Uranium	mg/L	0.015	CCME CWQG	3	3	<0.0001	0.0	<0.0001
	Vanadium	mg/L			3	3	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	3	1	<0.0005	<0.0005	<0.0005

Table 3-3 Cont'd: Baseline Water Quality Summary

Location	Parameter	Units	Benchmark Value	Benchmark Reference	Total Count	Count less than RDL	Minimum	Maximum	Arithmetic Mean
Mardoc Lake (LA-4)	Alkalinity	mg/L			2	0	12	16	14
	Aluminum	mg/L	0.1	SEQG	2	0	0.0009	0.0017	0.0013
	Ammonia as N	mg/L	0.103	CCME CWQG	2	1	<0.01	0.07	<0.04
	Antimony	mg/L			2	2	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	2	0	0.0001	0.0001	0.0001
	Barium	mg/L			2	0	0.003	0.0039	0.0035
	Beryllium	mg/L			2	2	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			2	0	15	20	17.5
	Boron	mg/L	1.5	CCME CWQG	2	2	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	2	1	<0.00001	<0.00001	<0.00001
	Calcium	mg/L			2	0	1.4	2.0	1.7
	Carbonate	mg/L			2	2	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	2	0	0.6	0.6	0.6
	Chromium	mg/L	0.001	CCME CWQG	2	2	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			2	2	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	2	2	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			2	0	1.4	1.6	1.5
	Dissolved Phosphorus	mg/L			2	1	0.01	0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	2	0	0.01	0.02	0.015
	Hardness	mg/L			2	0	5.0	7.0	6.0
	Hydroxide	mg/L			2	2	<1	<1	<1
	Iron	mg/L	0.3	SEQG	2	0	0.0087	0.02	0.01435
	Lead	mg/L	0.001	CCME CWQG	2	2	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			2	2	<0.02	<0.02	<0.02
	Magnesium	mg/L			2	0	0.40	0.50	0.45
	Manganese	mg/L			2	0	0.025	0.029	0.027
	Mercury	mg/L	0.000026	CCME CWQG	2	2	<0.0000001	<0.000010	<0.000005
	Molybdenum	mg/L	31	SEQG	2	2	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	2	1	<0.0001	<0.0001	<0.0001
	Nitrate	mg/L	13.29	SEQG	2	0	0.05	0.18	0.12
	P. Alkalinity	mg/L			2	2	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	2	0	7.0	7.2	7.1
	Phosphorus	mg/L			2	2	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			2	2	<0.005	<0.005	<0.005
	Potassium	mg/L			2	0	0.5	0.6	0.55
	Radium-226	Bq/L	0.11	SSWQO	2	2	<0.005	<0.005	<0.005
	Selenium	mg/L	0.001	CCME CWQG	2	2	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	2	2	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			2	0	1.7	2.0	1.9
	Specific Conductivity	µS/cm			2	0	24	26	25
	Strontium	mg/L			2	0	0.015	0.017	0.016
	Sulphate	mg/L	128	SEQG	2	0	1.3	1.3	1.3
	Sum of Ions				2	0	21	27	24
	Thallium	mg/L	0.0008	CCME CWQG	2	2	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			2	2	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			2	2	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			2	2	<0.01	<0.01	<0.01
	Tin	mg/L			2	1	<0.0001	0.0012	<0.00065
	Titanium	mg/L			2	2	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			2	0	26	36	31
	Total Kjeldahl Nitrogen	mg/L			2	0	0.08	0.24	0.16
	Total Organic Carbon	mg/L			2	0	1.4	1.5	1.5
	Total Suspended Solids	mg/L			2	1	<1	3.0	<2
	Uranium	mg/L	0.015	CCME CWQG	2	2	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			2	2	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	2	2	<0.0005	<0.0005	<0.0005
Whitefish Lake (LA-5)	Alkalinity	mg/L			3	0	3.0	13	7.7
	Aluminum	mg/L	0.1	SEQG	3	0	0.0048	0.0078	0.0061
	Ammonia as N	mg/L	0.103	CCME CWQG	3	1	<0.01	0.07	<0.043
	Antimony	mg/L			3	2	<0.0002	0.0003	<0.00023
	Arsenic	mg/L	0.005	SEQG	3	1	0.0001	0.0001	<0.0001
	Barium	mg/L			3	0	0.0021	0.0032	0.0027
	Beryllium	mg/L			3	3	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			3	0	4.0	16	9.3
	Boron	mg/L	1.5	CCME CWQG	3	3	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	3	1	<0.00001	0.00002	<0.000013
	Calcium	mg/L			3	0	1.2	1.6	1.4
	Carbonate	mg/L			3	3	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	3	0	0.30	0.40	0.33
	Chromium	mg/L	0.001	CCME CWQG	3	3	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			3	3	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	3	3	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			3	0	2.0	2.5	2.2
	Dissolved Phosphorus	mg/L			3	3	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	3	0	0.02	0.07	0.037
	Hardness	mg/L			3	0	5.0	6.0	5.3
	Hydroxide	mg/L			3	3	<1	<1	<1
	Iron	mg/L	0.3	SEQG	3	0	0.04	0.19	0.11
	Lead	mg/L	0.001	CCME CWQG	3	3	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			3	3	<0.02	<0.02	<0.02
	Magnesium	mg/L			3	0	0.4	0.4	0.4
	Manganese	mg/L			3	0	0.0046	0.02	0.0142
	Mercury	mg/L	0.000026	CCME CWQG	3	3	<0.000001	<0.000010	<0.000007
	Molybdenum	mg/L	31	SEQG	3	3	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	3	3	<0.0001	<0.0001	<0.0001
	Nitrate	mg/L	13.29	SEQG	2	1	<0.04	0.26	<0.15
	P. Alkalinity	mg/L			3	3	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	3	0	6.6	7.0	6.8
	Phosphorus	mg/L			3	3	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			3	1	<0.005	0.008	<0.006
	Potassium	mg/L			3	0	0.20	0.40	0.33
	Radium-226	Bq/L	0.11	SSWQO	3	1	<0.005	0.01	<0.0077
	Selenium	mg/L	0.001	CCME CWQG	3	3	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	3	2	0.00005	0.00005	<0.00005
	Sodium	mg/L			3	0	1.4	1.7	1.5
	Specific Conductivity	µS/cm			3	0	16	22	19
	Strontium	mg/L			3	0	0.012	0.015	0.013
	Sulphate	mg/L	128	SEQG	3	0	0.60	0.70	0.63
	Sum of Ions				3	0	8.0	22	14
	Thallium	mg/L	0.0008	CCME CWQG	3	3	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			3	3	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			3	2	<0.01	0.02	<0.013
	Thorium-232	Bq/L			3	3	<0.01	<0.01	<0.01
	Tin	mg/L			3	2	<0.0001	0.0008	<0.00033
	Titanium	mg/L			3	3	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			3	0	22	29	24
	Total Kjeldahl Nitrogen	mg/L			3	0	0.14	0.34	0.22
	Total Organic Carbon	mg/L			3	0	1.9	4.3	2.8
	Total Suspended Solids	mg/L			3	1	<1	4	<2.7
	Uranium	mg/L	0.015	CCME CWQG	3	3	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			3	3	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	3	3	<0.0005	<0.0005	<0.0005

Table 3-3 Cont'd: Baseline Water Quality Summary

Location	Parameter	Units	Benchmark		Total Count	Count less than RDL	Minimum	Maximum	Arithmetic Mean
			Value	Reference					
Whitefish Lake (LA-6)	Alkalinity	mg/L			3	0	3	38	15
	Aluminum	mg/L	0.1	SEQG	5	0	0.005	0.073	0.0201
	Ammonia as N	mg/L	0.103	CCME CWQG	5	2	<0.01	0.05	<0.026
	Antimony	mg/L			5	5	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	5	1	0.0001	0.0001	<0.0001
	Barium	mg/L			5	0	0.0024	0.0051	0.00328
	Beryllium	mg/L			5	5	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			5	0	4	46	13.4
	Boron	mg/L	1.5	CCME CWQG	5	4	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	5	4	<0.00001	0.00004	<0.000016
	Calcium	mg/L			5	0	1.1	1.5	1.24
	Carbonate	mg/L			5	5	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	5	0	0.3	0.4	0.32
	Chromium	mg/L	0.001	CCME CWQG	5	5	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			5	5	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	5	4	<0.0002	0.0004	<0.00024
	Dissolved Organic Carbon	mg/L			5	0	2	2.5	2.22
	Dissolved Phosphorus	mg/L			3	3	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	5	0	0.02	0.08	0.042
	Hardness	mg/L			3	0	5	5	5
	Hydroxide	mg/L			5	5	<1	<1	<1
	Iron	mg/L	0.3	SEQG	5	0	0.031	0.21	0.1064
	Lead	mg/L	0.001	CCME CWQG	5	4	<0.0001	**0.0012**	<0.00032
	Lead-210	Bq/L			5	5	<0.02	<0.02	<0.02
	Magnesium	mg/L			5	0	0.2	0.4	0.36
	Manganese	mg/L			5	0	0.0024	0.019	0.01232
	Mercury	mg/L	0.000026	CCME CWQG	5	4	<0.0000001	<0.00001	<0.000006
	Molybdenum	mg/L	31	SEQG	5	5	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	5	4	<0.0001	0.0004	<0.00016
	Nitrate	mg/L	13.29	SEQG	4	2	<0.04	0.31	<0.173
	P. Alkalinity	mg/L			5	5	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	5	0	5.71	6.79	6.502
	Phosphorus	mg/L			5	4	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			5	5	<0.005	<0.005	<0.005
	Potassium	mg/L			5	0	0.2	0.4	0.32
	Radium-226	Bq/L	0.11	SSWQO	5	4	0.005	0.005	<0.005
	Selenium	mg/L	0.001	CCME CWQG	5	5	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	5	5	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			5	0	1.4	1.8	1.52
	Specific Conductivity	µS/cm			5	0	9	21	15.2
	Strontium	mg/L			5	0	0.011	0.014	0.0126
	Sulphate	mg/L	128	SEQG	5	0	0.5	0.7	0.64
	Sum of Ions				5	0	8	51	18
	Thallium	mg/L	0.0008	CCME CWQG	5	5	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			3	3	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			5	5	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			3	3	<0.01	<0.01	<0.01
	Tin	mg/L			5	4	<0.0001	0.0011	<0.0003
	Titanium	mg/L			5	4	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			5	0	14	29	22.2
	Total Kjeldahl Nitrogen	mg/L			5	0	0.24	0.43	0.306
	Total Organic Carbon	mg/L			5	0	2.2	2.9	2.36
	Total Suspended Solids	mg/L			5	2	<1	4	<2
	Uranium	mg/L	0.015	CCME CWQG	5	5	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			5	4	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	5	3	<0.0005	0.02	<0.00474
Kratchkowsky Lake (LA-7)	Alkalinity	mg/L			3	0	8.0	21	16
	Aluminum	mg/L	0.1	SEQG	3	0	0.0006	0.0051	0.0031
	Ammonia as N	mg/L	0.103	CCME CWQG	3	1	<0.01	**0.12**	<0.047
	Antimony	mg/L			3	3	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	3	0	0.0001	0.0001	0.0001
	Barium	mg/L			3	0	0.0024	0.0038	0.0029
	Beryllium	mg/L			3	3	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			3	0	10	26	20
	Boron	mg/L	1.5	CCME CWQG	3	3	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	3	1	<0.00001	0.00003	<0.000017
	Calcium	mg/L			3	0	1.4	2.0	1.6
	Carbonate	mg/L			3	3	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	3	0	0.40	0.70	0.53
	Chromium	mg/L	0.001	CCME CWQG	3	3	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			3	3	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	3	3	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			3	0	2.1	2.8	2.4
	Dissolved Phosphorus	mg/L			3	2	0.01	0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	3	0	0.02	0.06	0.033
	Hardness	mg/L			3	0	5.0	7.0	6.0
	Hydroxide	mg/L			3	3	<1	<1	<1
	Iron	mg/L	0.3	SEQG	3	0	0.13	0.15	0.14
	Lead	mg/L	0.001	CCME CWQG	3	3	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			3	3	<0.02	<0.02	<0.02
	Magnesium	mg/L			3	0	0.40	0.50	0.47
	Manganese	mg/L			3	0	0.015	0.026	0.02
	Mercury	mg/L	0.000026	CCME CWQG	3	3	<0.000001	<0.000010	<0.000007
	Molybdenum	mg/L	31	SEQG	3	3	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	3	3	<0.0001	<0.0001	<0.0001
	Nitrate	mg/L	13.29	SEQG	2	1	<0.04	0.26	<0.15
	P. Alkalinity	mg/L			3	3	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	3	0	6.7	7.1	6.9
	Phosphorus	mg/L			3	3	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			3	2	0.005	0.005	<0.005
	Potassium	mg/L			3	0	0.20	0.50	0.37
	Radium-226	Bq/L	0.11	SSWQO	3	3	<0.005	<0.005	<0.005
	Selenium	mg/L	0.001	CCME CWQG	3	3	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	3	3	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			3	0	1.6	2.0	1.7
	Specific Conductivity	µS/cm			3	0	18	26	22
	Strontium	mg/L			3	0	0.014	0.019	0.016
	Sulphate	mg/L	128	SEQG	3	0	0.40	0.60	0.50
	Sum of Ions				3	0	14	32	25
	Thallium	mg/L	0.0008	CCME CWQG	3	3	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			3	3	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			3	2	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			3	3	<0.01	<0.01	<0.01
	Tin	mg/L			3	2	<0.0001	0.0009	<0.00037
	Titanium	mg/L			3	1	0.0002	0.0003	<0.00023
	Total Dissolved Solids	mg/L			3	0	22	29	26
	Total Kjeldahl Nitrogen	mg/L			3	0	0.32	0.44	0.37
	Total Organic Carbon	mg/L			3	0	2.0	3.2	2.5
	Total Suspended Solids	mg/L			3	1	<1	4.0	<2.6667
	Uranium	mg/L	0.015	CCME CWQG	3	3	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			3	2	0.0001	0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	3	3	<0.0005	<0.0005	<0.0005

Table 3-3 Cont'd: Baseline Water Quality Summary

Location	Parameter	Units	Benchmark Value	Benchmark Reference	Total Count	Count less than RDL	Minimum	Maximum	Arithmetic Mean
Kratchkowsky Lake (LA-7A-Bottom)	Alkalinity	mg/L			1	0	13	13	13
	Aluminum	mg/L	0.1	SEQG	1	0	0.0033	0.0033	0.0033
	Ammonia as N	mg/L	0.103	CCME CWQG	1	0	**0.91**	**0.91**	**0.91**
	Antimony	mg/L			1	1	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	1	0	0.0002	0.0002	0.0002
	Barium	mg/L			1	0	0.0036	0.0036	0.0036
	Beryllium	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			1	0	16	16	16
	Boron	mg/L	1.5	CCME CWQG	1	1	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	1	1	<0.00001	<0.00001	<0.00001
	Calcium	mg/L			1	0	2.1	2.1	2.1
	Carbonate	mg/L			1	1	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	1	0	0.6	0.6	0.6
	Chromium	mg/L	0.001	CCME CWQG	1	1	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	1	1	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			1	0	2.6	2.6	2.6
	Dissolved Phosphorus	mg/L			1	0	0.1	0.1	0.1
	Fluoride	mg/L	0.12	CCME CWQG	1	1	<0.01	<0.01	<0.01
	Hardness	mg/L			1	0	7.0	7.0	7.0
	Hydroxide	mg/L			1	1	<1	<1	<1
	Iron	mg/L	0.3	SEQG	1	0	**5.2**	**5.2**	**5.2**
	Lead	mg/L	0.001	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			1	1	<0.02	<0.02	<0.02
	Magnesium	mg/L			1	0	0.5	0.5	0.5
	Manganese	mg/L			1	0	0.25	0.25	0.25
	Mercury	mg/L	0.000026	CCME CWQG	1	0	**0.000068**	**0.000068**	**0.000068**
	Molybdenum	mg/L	31	SEQG	1	1	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Nitrate	mg/L	13.29	SEQG	1	1	<0.04	<0.04	<0.04
	P. Alkalinity	mg/L			1	1	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	1	0	6.5	6.5	6.5
	Phosphorus	mg/L			1	0	0.11	0.11	0.11
	Polonium-210	Bq/L			1	0	0.008	0.008	0.008
	Potassium	mg/L			1	0	0.2	0.2	0.2
	Radium-226	Bq/L	0.11	SSWQO	1	0	0.01	0.01	0.01
	Selenium	mg/L	0.001	CCME CWQG	1	0	0.0002	0.0002	0.0002
	Silver	mg/L	0.0001	CCME CWQG	1	1	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			1	0	1.7	1.7	1.7
	Specific Conductivity	µS/cm			1	0	32	32	32
	Strontium	mg/L			1	0	0.018	0.018	0.018
	Sulphate	mg/L	128	SEQG	1	0	0.5	0.5	0.5
	Sum of Ions				1	0	23	23	23
	Thallium	mg/L	0.0008	CCME CWQG	1	1	<0.0002	<0.0002	<0.0002
	Thorium-230	Bq/L			1	1	<0.01	<0.01	<0.01
	Tin	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Titanium	mg/L			1	1	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			1	0	29	29	29
	Total Kjeldahl Nitrogen	mg/L			1	0	1.2	1.2	1.2
	Total Organic Carbon	mg/L			1	0	2.6	2.6	2.6
	Total Suspended Solids	mg/L			1	0	13	13	13
	Uranium	mg/L	0.015	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			1	0	0.0003	0.0003	0.0003
	Zinc	mg/L	0.007	CCME CWQG	1	0	0.0014	0.0014	0.0014
Kratchkowsky Lake (LA-7A-Top)	Alkalinity	mg/L			1	0	6.0	6.0	6.0
	Aluminum	mg/L	0.1	SEQG	1	0	0.0015	0.0015	0.0015
	Ammonia as N	mg/L	0.103	CCME CWQG	1	1	<0.01	<0.01	<0.01
	Antimony	mg/L			1	1	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	1	1	<0.0001	<0.0001	<0.0001
	Barium	mg/L			1	0	0.0025	0.0025	0.0025
	Beryllium	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			1	0	7.0	7.0	7.0
	Boron	mg/L	1.5	CCME CWQG	1	1	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	1	1	<0.00001	<0.00001	<0.00001
	Calcium	mg/L			1	0	1.4	1.4	1.4
	Carbonate	mg/L			1	1	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	1	0	0.6	0.6	0.6
	Chromium	mg/L	0.001	CCME CWQG	1	1	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	1	1	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			1	0	2.1	2.1	2.1
	Dissolved Phosphorus	mg/L			1	1	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	1	1	<0.01	<0.01	<0.01
	Hardness	mg/L			1	0	5.0	5.0	5.0
	Hydroxide	mg/L			1	1	<1	<1	<1
	Iron	mg/L	0.3	SEQG	1	0	0.085	0.085	0.085
	Lead	mg/L	0.001	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			1	1	<0.02	<0.02	<0.02
	Magnesium	mg/L			1	0	0.4	0.4	0.4
	Manganese	mg/L			1	0	0.013	0.013	0.013
	Mercury	mg/L	0.000026	CCME CWQG	1	1	<0.000001	<0.000001	<0.000001
	Molybdenum	mg/L	31	SEQG	1	1	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Nitrate	mg/L	13.29	SEQG	1	1	<0.04	<0.04	<0.04
	P. Alkalinity	mg/L			1	1	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	1	0	6.9	6.9	6.9
	Phosphorus	mg/L			1	1	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			1	1	<0.005	<0.005	<0.005
	Potassium	mg/L			1	0	0.2	0.2	0.2
	Radium-226	Bq/L	0.11	SSWQO	1	1	<0.005	<0.005	<0.005
	Selenium	mg/L	0.001	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	1	1	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			1	0	1.7	1.7	1.7
	Specific Conductivity	µS/cm			1	0	21	21	21
	Strontium	mg/L			1	0	0.014	0.014	0.014
	Sulphate	mg/L	128	SEQG	1	0	0.3	0.3	0.3
	Sum of Ions				1	0	12	12	12
	Thallium	mg/L	0.0008	CCME CWQG	1	1	<0.0002	<0.0002	<0.0002
	Thorium-230	Bq/L			1	1	<0.01	<0.01	<0.01
	Tin	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Titanium	mg/L			1	1	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			1	0	22	22	22
	Total Kjeldahl Nitrogen	mg/L			1	0	0.34	0.34	0.34
	Total Organic Carbon	mg/L			1	0	2.1	2.1	2.1
	Total Suspended Solids	mg/L			1	0	3.0	3.0	3.0
	Uranium	mg/L	0.015	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	1	1	<0.0005	<0.0005	<0.0005

Table 3-3 Cont'd: Baseline Water Quality Summary

Location	Parameter	Units	Benchmark		Total Count	Count less than RDL	Minimum	Maximum	Arithmetic Mean
			Value	Reference					
LA-8	Alkalinity	mg/L			1	0	2.0	2.0	2.0
	Aluminum	mg/L	0.1	SEQG	1	0	0.0046	0.0046	0.0046
	Ammonia as N	mg/L	0.103	CCME CWQG	1	1	<0.01	<0.01	<0.01
	Antimony	mg/L			1	1	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	1	1	<0.0001	<0.0001	<0.0001
	Barium	mg/L			1	0	0.0029	0.0029	0.0029
	Beryllium	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			1	0	2.0	2.0	2.0
	Boron	mg/L	1.5	CCME CWQG	1	1	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	1	0	1.00E-05	1.00E-05	1.00E-05
	Calcium	mg/L			1	0	1.2	1.2	1.2
	Carbonate	mg/L			1	1	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	1	0	0.3	0.3	0.3
	Chromium	mg/L	0.001	CCME CWQG	1	1	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	1	1	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			1	0	2.0	2.0	2.0
	Dissolved Phosphorus	mg/L			1	1	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	1	1	<0.01	<0.01	<0.01
	Hardness	mg/L			1	0	5.0	5.0	5.0
	Hydroxide	mg/L			1	1	<1	<1	<1
	Iron	mg/L	0.3	SEQG	1	0	0.14	0.14	0.14
	Lead	mg/L	0.001	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			1	1	<0.02	<0.02	<0.02
	Magnesium	mg/L			1	0	0.40	0.40	0.40
	Manganese	mg/L			1	0	0.028	0.028	0.028
	Mercury	mg/L	0.000026	CCME CWQG	1	1	<0.000001	<0.000001	<0.000001
	Molybdenum	mg/L	26	SEQG	1	1	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Nitrate	mg/L	13.29	SEQG	1	1	<0.04	<0.04	<0.04
	P. Alkalinity	mg/L			1	1	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	1	0	6.8	6.8	6.8
	Phosphorus	mg/L			1	1	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			1	1	<0.005	<0.005	<0.005
	Potassium	mg/L			1	0	0.20	0.20	0.20
	Radium-226	Bq/L	0.11	SSWQO	1	0	0.01	0.01	0.01
	Selenium	mg/L	0.001	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	1	1	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			1	0	1.3	1.3	1.3
	Specific Conductivity	µS/cm			1	0	17	17	17
	Strontium	mg/L			1	0	0.012	0.012	0.012
	Sulphate	mg/L	128	SEQG	1	0	0.60	0.60	0.60
	Sum of Ions				1	0	6.0	6.0	6.0
	Thallium	mg/L	0.0008	CCME CWQG	1	1	<0.0002	<0.0002	<0.0002
	Thorium-230	Bq/L			1	1	<0.01	<0.01	<0.01
	Tin	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Titanium	mg/L			1	1	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			1	0	21	21	21
	Total Kjeldahl Nitrogen	mg/L			1	0	0.61	0.61	0.61
	Total Organic Carbon	mg/L			1	0	2.2	2.2	2.2
	Total Suspended Solids	mg/L			1	0	4.0	4.0	4.0
	Uranium	mg/L	0.015	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	1	1	<0.0005	<0.0005	<0.0005
LA-9	Alkalinity	mg/L			1	0	4.0	4.0	4.0
	Aluminum	mg/L	0.1	SEQG	1	0	0.0016	0.0016	0.0016
	Ammonia as N	mg/L	0.103	CCME CWQG	1	1	<0.01	<0.01	<0.01
	Antimony	mg/L			1	1	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	1	0	0.0001	0.0001	0.0001
	Barium	mg/L			1	0	0.0024	0.0024	0.0024
	Beryllium	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			1	0	5.0	5.0	5.0
	Boron	mg/L	1.5	CCME CWQG	1	1	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	1	0	<0.00001	<0.00001	<0.00001
	Calcium	mg/L			1	0	1.1	1.1	1.1
	Carbonate	mg/L			1	1	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	1	0	0.20	0.20	0.20
	Chromium	mg/L	0.001	CCME CWQG	1	1	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	1	1	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			1	0	2.1	2.1	2.1
	Dissolved Phosphorus	mg/L			1	1	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	1	0	0.01	0.01	0.01
	Hardness	mg/L			1	0	4.0	4.0	4.0
	Hydroxide	mg/L			1	1	<1	<1	<1
	Iron	mg/L	0.3	SEQG	1	0	0.071	0.071	0.071
	Lead	mg/L	0.001	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			1	1	<0.02	<0.02	<0.02
	Magnesium	mg/L			1	0	0.30	0.30	0.30
	Manganese	mg/L			1	0	0.011	0.011	0.011
	Mercury	mg/L	0.000026	CCME CWQG	1	1	<0.000001	<0.000001	<0.000001
	Molybdenum	mg/L	31	SEQG	1	0	0.0002	0.0002	0.0002
	Nickel	mg/L	0.025	CCME CWQG	1	0	0.0001	0.0001	0.0001
	Nitrate	mg/L	13.29	SEQG	1	0	0.04	0.04	0.04
	P. Alkalinity	mg/L			1	1	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	1	0	6.9	6.9	6.9
	Phosphorus	mg/L			1	1	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			1	1	<0.005	<0.005	<0.005
	Potassium	mg/L			1	0	0.10	0.10	0.10
	Radium-226	Bq/L	0.11	SSWQO	1	1	<0.005	<0.005	<0.005
	Selenium	mg/L	0.001	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	1	1	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			1	0	1.4	1.4	1.4
	Specific Conductivity	µS/cm			1	0	17	17	17
	Strontium	mg/L			1	0	0.011	0.011	0.011
	Sulphate	mg/L	128	SEQG	1	0	0.60	0.60	0.60
	Sum of Ions				1	0	9.0	9.0	9.0
	Thallium	mg/L	0.0008	CCME CWQG	1	1	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			1	1	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			1	1	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			1	1	<0.01	<0.01	<0.01
	Tin	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Titanium	mg/L			1	1	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			1	0	11	11	11
	Total Kjeldahl Nitrogen	mg/L			1	0	0.28	0.28	0.28
	Total Organic Carbon	mg/L			1	0	2.2	2.2	2.2
	Total Suspended Solids	mg/L			1	0	3.0	3.0	3.0
	Uranium	mg/L	0.015	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	1	1	<0.0005	<0.0005	<0.0005

Table 3-3 Cont'd: Baseline Water Quality Summary

Location	Parameter	Units	Benchmark		Total Count	Count less than RDL	Minimum	Maximum	Arithmetic Mean
			Value	Reference					
PA-2	Alkalinity	mg/L			1	0	6.0	6.0	6.0
	Aluminum	mg/L	0.1	SEQG	1	0	0.0096	0.0096	0.0096
	Ammonia as N	mg/L	0.103	CCME CWQG	1	1	<0.01	<0.01	<0.01
	Antimony	mg/L			1	1	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	1	1	<0.0001	<0.0001	<0.0001
	Barium	mg/L			1	0	0.0026	0.0026	0.0026
	Beryllium	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			1	0	7.0	7.0	7.0
	Boron	mg/L	1.5	CCME CWQG	1	1	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	1	1	<0.00001	<0.00001	<0.00001
	Calcium	mg/L			1	0	1.2	1.2	1.2
	Carbonate	mg/L			1	1	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	1	0	0.30	0.30	0.30
	Chromium	mg/L	0.001	CCME CWQG	1	1	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	1	1	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			1	0	3.4	3.4	3.4
	Dissolved Phosphorus	mg/L			1	1	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	1	0	0.06	0.06	0.06
	Hardness	mg/L			1	0	5.0	5.0	5.0
	Hydroxide	mg/L			1	1	<1	<1	<1
	Iron	mg/L	0.3	SEQG	1	0	0.044	0.044	0.044
	Lead	mg/L	0.001	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			1	1	<0.02	<0.02	<0.02
	Magnesium	mg/L			1	0	0.40	0.40	0.40
	Manganese	mg/L			1	0	0.0026	0.0026	0.0026
	Mercury	mg/L	0.000026	CCME CWQG	1	1	<0.0000001	<0.0000001	<0.0000001
	Molybdenum	mg/L	31	SEQG	1	1	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	1	0	0.0002	0.0002	0.0002
	Nitrate	mg/L	13.29	SEQG	1	0	0.04	0.04	0.04
	P. Alkalinity	mg/L			1	1	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	1	0	7.0	7.0	7.0
	Phosphorus	mg/L			1	1	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			1	0	0.007	0.007	0.007
	Potassium	mg/L			1	0	0.20	0.20	0.20
	Radium-226	Bq/L	0.11	SSWQO	1	1	<0.005	<0.005	<0.005
	Selenium	mg/L	0.001	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	1	1	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			1	0	1.4	1.4	1.4
	Specific Conductivity	µS/cm			1	0	20	20	20
	Strontium	mg/L			1	0	0.012	0.012	0.012
	Sulphate	mg/L	128	SEQG	1	0	1.1	1.1	1.1
	Sum of Ions				1	0	12	12	12
	Thallium	mg/L	0.0008	CCME CWQG	1	1	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			1	1	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			1	1	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			1	1	<0.01	<0.01	<0.01
	Tin	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Titanium	mg/L			1	1	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			1	0	22	22	22
	Total Kjeldahl Nitrogen	mg/L			1	0	0.22	0.22	0.22
	Total Organic Carbon	mg/L			1	0	3.4	3.4	3.4
	Total Suspended Solids	mg/L			1	0	2.0	2.0	2.0
	Uranium	mg/L	0.015	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			1	0	0.0001	0.0001	0.0001
	Zinc	mg/L	0.007	CCME CWQG	1	1	<0.0005	<0.0005	<0.0005
PA-3	Alkalinity	mg/L			1	0	4.0	4.0	4.0
	Aluminum	mg/L	0.1	SEQG	1	0	0.027	0.027	0.027
	Ammonia as N	mg/L	0.103	CCME CWQG	1	1	<0.01	<0.01	<0.01
	Antimony	mg/L			1	1	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	1	1	<0.0001	<0.0001	<0.0001
	Barium	mg/L			1	0	0.0026	0.0026	0.0026
	Beryllium	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			1	0	5.0	5.0	5.0
	Boron	mg/L	1.5	CCME CWQG	1	1	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	1	1	<0.00001	<0.00001	<0.00001
	Calcium	mg/L			1	0	1.0	1.0	1.0
	Carbonate	mg/L			1	1	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	1	0	0.4	0.4	0.4
	Chromium	mg/L	0.001	CCME CWQG	1	1	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	1	1	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			1	0	8.4	8.4	8.4
	Dissolved Phosphorus	mg/L			1	1	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	1	0	0.02	0.02	0.02
	Hardness	mg/L			1	0	4.0	4.0	4.0
	Hydroxide	mg/L			1	1	<1	<1	<1
	Iron	mg/L	0.3	SEQG	1	0	0.098	0.098	0.098
	Lead	mg/L	0.001	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			1	1	<0.02	<0.02	<0.02
	Magnesium	mg/L			1	0	0.30	0.30	0.30
	Manganese	mg/L			1	0	0.0025	0.0025	0.0025
	Mercury	mg/L	0.000026	CCME CWQG	1	0	0.0000001	0.0000001	0.0000001
	Molybdenum	mg/L	31	SEQG	1	1	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	1	0	0.0002	0.0002	0.0002
	Nitrate	mg/L	13.29	SEQG	1	1	<0.04	<0.04	<0.04
	P. Alkalinity	mg/L			1	1	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	1	0	6.7	6.7	6.7
	Phosphorus	mg/L			1	1	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			1	1	<0.005	<0.005	<0.005
	Potassium	mg/L			1	0	0.50	0.50	0.50
	Radium-226	Bq/L	0.11	SSWQO	1	0	0.006	0.006	0.006
	Selenium	mg/L	0.001	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	1	1	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			1	0	1.3	1.3	1.3
	Specific Conductivity	µS/cm			1	0	18	18	18
	Strontium	mg/L			1	0	0.01	0.01	0.01
	Sulphate	mg/L	128	SEQG	1	0	1.1	1.1	1.1
	Sum of Ions				1	0	10	10	10
	Thallium	mg/L	0.0008	CCME CWQG	1	1	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			1	1	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			1	1	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			1	1	<0.01	<0.01	<0.01
	Tin	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Titanium	mg/L			1	0	0.0003	0.0003	0.0003
	Total Dissolved Solids	mg/L			1	0	29	29	29
	Total Kjeldahl Nitrogen	mg/L			1	0	0.33	0.33	0.33
	Total Organic Carbon	mg/L			1	0	8.4	8.4	8.4
	Total Suspended Solids	mg/L			1	0	2.0	2.0	2.0
	Uranium	mg/L	0.015	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	1	0	0.0006	0.0006	0.0006

Table 3-3 Cont'd: Baseline Water Quality Summary

Location	Parameter	Units	Benchmark		Total Count	Count less than RDL	Minimum	Maximum	Arithmetic Mean
			Value	Reference					
LB-1	Alkalinity	mg/L			1	0	4.0	4.0	4.0
	Aluminum	mg/L	0.1	SEQG	1	0	0.011	0.011	0.011
	Ammonia as N	mg/L	0.103	CCME CWQG	1	1	<0.01	<0.01	<0.01
	Antimony	mg/L			1	1	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	1	0	0.0001	0.0001	0.0001
	Barium	mg/L			1	0	0.0033	0.0033	0.0033
	Beryllium	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			1	0	5.0	5.0	5.0
	Boron	mg/L	1.5	CCME CWQG	1	1	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	1	0	0.00002	0.00002	0.00002
	Calcium	mg/L			1	0	1.2	1.2	1.2
	Carbonate	mg/L			1	1	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	1	0	0.1	0.1	0.1
	Chromium	mg/L	0.001	CCME CWQG	1	1	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	1	1	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			1	0	3.6	3.6	3.6
	Dissolved Phosphorus	mg/L			1	1	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	1	0	0.02	0.02	0.02
	Hardness	mg/L			1	0	5.0	5.0	5.0
	Hydroxide	mg/L			1	1	<1	<1	<1
	Iron	mg/L	0.3	SEQG	1	0	0.084	0.084	0.084
	Lead	mg/L	0.001	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			1	1	<0.02	<0.02	<0.02
	Magnesium	mg/L			1	0	0.40	0.40	0.40
	Manganese	mg/L			1	0	0.0044	0.0044	0.0044
	Mercury	mg/L	0.000026	CCME CWQG	1	1	<0.000001	<0.000001	<0.000001
	Molybdenum	mg/L	31	SEQG	1	1	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	1	0	0.0001	0.0001	0.0001
	Nitrate	mg/L	13.29	SEQG	1	1	<0.04	<0.04	<0.04
	P. Alkalinity	mg/L			1	1	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	1	0	6.7	6.7	6.7
	Phosphorus	mg/L			1	1	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			1	1	<0.005	<0.005	<0.005
	Potassium	mg/L			1	0	0.20	0.20	0.20
	Radium-226	Bq/L	0.11	SSWQO	1	1	<0.005	<0.005	<0.005
	Selenium	mg/L	0.001	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	1	1	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			1	0	1.4	1.4	1.4
	Specific Conductivity	µS/cm			1	0	18	18	18
	Strontium	mg/L			1	0	0.013	0.013	0.013
	Sulphate	mg/L	128	SEQG	1	0	0.70	0.70	0.70
	Sum of Ions				1	0	9.0	9.0	9.0
	Thallium	mg/L	0.0008	CCME CWQG	1	1	<0.0002	<0.0002	<0.0002
	Thorium-230	Bq/L			1	1	<0.01	<0.01	<0.01
	Tin	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Titanium	mg/L			1	1	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			1	0	19	19	19
	Total Kjeldahl Nitrogen	mg/L			1	0	0.28	0.28	0.28
	Total Organic Carbon	mg/L			1	0	3.4	3.4	3.4
	Total Suspended Solids	mg/L			1	0	2.0	2.0	2.0
	Uranium	mg/L	0.015	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			1	0	0.0001	0.0001	0.0001
	Zinc	mg/L	0.007	CCME CWQG	1	1	<0.0005	<0.0005	<0.0005
LB-2	Alkalinity	mg/L			2	0	7.0	12	9.5
	Aluminum	mg/L	0.1	SEQG	2	0	0.0067	0.0096	0.0082
	Ammonia as N	mg/L	0.103	CCME CWQG	2	1	<0.01	0.04	<0.025
	Antimony	mg/L			2	2	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	2	0	0.0001	0.0001	0.0001
	Barium	mg/L			2	0	0.0033	0.0046	0.0040
	Beryllium	mg/L			2	2	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			2	0	8.0	15	12
	Boron	mg/L	1.5	CCME CWQG	2	2	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	2	1	<0.00001	<0.00001	<0.00001
	Calcium	mg/L			2	0	1.3	1.8	1.6
	Carbonate	mg/L			2	2	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	2	0	0.2	0.2	0.2
	Chromium	mg/L	0.001	CCME CWQG	2	2	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			2	2	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	2	2	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			2	0	2.6	3.5	3.1
	Dissolved Phosphorus	mg/L			2	1	<0.01	0.03	<0.02
	Fluoride	mg/L	0.12	CCME CWQG	2	1	<0.01	0.07	<0.04
	Hardness	mg/L			2	0	5.0	6.0	5.5
	Hydroxide	mg/L			2	2	<1	<1	<1
	Iron	mg/L	0.3	SEQG	2	0	0.15	0.15	0.15
	Lead	mg/L	0.001	CCME CWQG	2	2	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			2	2	<0.02	<0.02	<0.02
	Magnesium	mg/L			2	0	0.40	0.40	0.40
	Manganese	mg/L			2	0	0.0094	0.037	0.0232
	Mercury	mg/L	0.000026	CCME CWQG	2	2	<0.000001	<0.000010	<0.000006
	Molybdenum	mg/L	31	SEQG	2	2	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	2	0	0.0001	0.0002	0.00015
	Nitrate	mg/L	13.29	SEQG	2	1	<0.04	0.66	<0.35
	P. Alkalinity	mg/L			2	2	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	2	0	6.7	6.8	6.8
	Phosphorus	mg/L			2	2	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			2	2	<0.005	<0.005	<0.005
	Potassium	mg/L			2	0	0.20	0.40	0.30
	Radium-226	Bq/L	0.11	SSWQO	2	1	<0.005	0.008	<0.0065
	Selenium	mg/L	0.001	CCME CWQG	2	2	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	2	2	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			2	0	1.4	1.6	1.5
	Specific Conductivity	µS/cm			2	0	20	22	21
	Strontium	mg/L			2	0	0.013	0.016	0.0145
	Sulphate	mg/L	128	SEQG	2	0	0.50	0.80	0.65
	Sum of Ions				2	0	12	21	16.5
	Thallium	mg/L	0.0008	CCME CWQG	2	2	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			1	1	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			2	2	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			1	1	<0.01	<0.01	<0.01
	Tin	mg/L			2	1	<0.0001	0.0008	<0.00045
	Titanium	mg/L			2	2	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			2	0	19	30	24.5
	Total Kjeldahl Nitrogen	mg/L			2	0	0.13	0.35	0.24
	Total Organic Carbon	mg/L			2	0	2.7	3.6	3.2
	Total Suspended Solids	mg/L			2	2	<1	<1	<1
	Uranium	mg/L	0.015	CCME CWQG	2	2	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			2	2	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	2	1	<0.0005	0.0018	<0.00115

Table 3-3 Cont'd: Baseline Water Quality Summary

Location	Parameter	Units	Benchmark Value	Benchmark Reference	Total Count	Count less than RDL	Minimum	Maximum	Arithmetic Mean
Williams Lake (LB-3-Bottom)	Alkalinity	mg/L			1	0	14	14	14
	Aluminum	mg/L	0.1	SEQG	1	0	0.0086	0.0086	0.0086
	Ammonia as N	mg/L	0.103	CCME CWQG	1	0	**1.2**	**1.2**	**1.2**
	Antimony	mg/L			1	1	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	1	0	0.0003	0.0003	0.0003
	Barium	mg/L			1	0	0.0095	0.0095	0.0095
	Beryllium	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			1	0	17	17	17
	Boron	mg/L	1.5	CCME CWQG	1	1	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	1	0	0.00002	0.00002	0.00002
	Calcium	mg/L			1	0	1.8	1.8	1.8
	Carbonate	mg/L			1	1	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	1	0	0.80	0.80	0.80
	Chromium	mg/L	0.001	CCME CWQG	1	1	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			1	0	0.0002	0.0002	0.0002
	Copper	mg/L	0.002	CCME CWQG	1	1	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			1	0	4.2	4.2	4.2
	Dissolved Phosphorus	mg/L			1	0	0.15	0.15	0.15
	Fluoride	mg/L	0.12	CCME CWQG	1	0	0.02	0.02	0.02
	Hardness	mg/L			1	0	6.0	6.0	6.0
	Hydroxide	mg/L			1	1	<1	<1	<1
	Iron	mg/L	0.3	SEQG	1	0	**9.5**	**9.5**	**9.5**
	Lead	mg/L	0.001	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			1	1	<0.02	<0.02	<0.02
	Magnesium	mg/L			1	0	0.50	0.50	0.50
	Manganese	mg/L			1	0	0.34	0.34	0.34
	Mercury	mg/L	0.000026	CCME CWQG	1	0	0.00001	0.00001	0.00001
	Molybdenum	mg/L	31	SEQG	1	1	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	1	0	0.0003	0.0003	0.0003
	Nitrate	mg/L	13.29	SEQG	1	1	<0.04	<0.04	<0.04
	P. Alkalinity	mg/L			1	1	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	1	0	6.4	6.4	6.4
	Phosphorus	mg/L			1	0	0.17	0.17	0.17
	Polonium-210	Bq/L			1	0	0.02	0.02	0.02
	Potassium	mg/L			1	0	0.30	0.30	0.30
	Radium-226	Bq/L	0.11	SSWQO	1	0	0.007	0.007	0.007
	Selenium	mg/L	0.001	CCME CWQG	1	0	0.0001	0.0001	0.0001
	Silver	mg/L	0.0001	CCME CWQG	1	1	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			1	0	1.6	1.6	1.6
	Specific Conductivity	µS/cm			1	0	32	32	32
	Strontium	mg/L			1	0	0.016	0.016	0.016
	Sulphate	mg/L	128	SEQG	1	0	0.50	0.50	0.50
	Sum of Ions				1	0	24	24	24
	Thallium	mg/L	0.0008	CCME CWQG	1	1	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			1	1	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			1	1	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			1	1	<0.01	<0.01	<0.01
	Tin	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Titanium	mg/L			1	1	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			1	0	33	33	33
	Total Kjeldahl Nitrogen	mg/L			1	0	1.6	1.6	1.6
	Total Organic Carbon	mg/L			1	0	4.4	4.4	4.4
	Total Suspended Solids	mg/L			1	0	23	23	23
	Uranium	mg/L	0.015	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			1	0	0.0005	0.0005	0.0005
	Zinc	mg/L	0.007	CCME CWQG	1	0	0.0029	0.0029	0.0029
Williams Lake (LB-3-Top)	Alkalinity	mg/L			3	0	6.0	14	9.3
	Aluminum	mg/L	0.1	SEQG	3	0	0.0016	0.0035	0.0023
	Ammonia as N	mg/L	0.103	CCME CWQG	3	1	<0.01	0.04	<0.023
	Antimony	mg/L			3	3	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	3	0	0.0001	0.0001	0.0001
	Barium	mg/L			3	0	0.0028	0.0041	0.0035
	Beryllium	mg/L			3	3	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			3	0	7.0	17	11.333
	Boron	mg/L	1.5	CCME CWQG	3	3	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	3	2	<1.00E-05	0.00002	<0.000013
	Calcium	mg/L			3	0	1.3	1.7	1.5
	Carbonate	mg/L			3	3	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	3	0	0.20	0.20	0.20
	Chromium	mg/L	0.001	CCME CWQG	3	3	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			3	3	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	3	3	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			3	0	2.6	2.9	2.8
	Dissolved Phosphorus	mg/L			3	3	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	3	0	0.02	0.07	0.037
	Hardness	mg/L			3	0	5.0	6.0	5.3
	Hydroxide	mg/L			3	3	<1	<1	<1
	Iron	mg/L	0.3	SEQG	3	0	0.045	0.24	0.12
	Lead	mg/L	0.001	CCME CWQG	3	2	0.0001	0.0001	<0.0001
	Lead-210	Bq/L			3	3	<0.02	<0.02	<0.02
	Magnesium	mg/L			3	0	0.40	0.40	0.40
	Manganese	mg/L			3	0	0.0025	0.028	0.014
	Mercury	mg/L	0.000026	CCME CWQG	3	2	<0.0000010	<0.0000100	<0.0000070
	Molybdenum	mg/L	31	SEQG	3	3	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	3	3	<0.0001	<0.0001	<0.0001
	Nitrate	mg/L	13.29	SEQG	2	1	<0.04	0.44	<0.24
	P. Alkalinity	mg/L			3	3	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	3	0	6.6	7.1	6.9
	Phosphorus	mg/L			3	3	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			3	3	<0.005	<0.005	<0.005
	Potassium	mg/L			3	0	0.20	0.50	0.37
	Radium-226	Bq/L	0.11	SSWQO	3	3	<0.005	<0.005	<0.005
	Selenium	mg/L	0.001	CCME CWQG	3	3	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	3	3	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			3	0	1.4	1.8	1.5
	Specific Conductivity	µS/cm			3	0	17	22	19
	Strontium	mg/L			3	0	0.011	0.015	0.013
	Sulphate	mg/L	128	SEQG	3	0	0.70	0.80	0.77
	Sum of Ions				3	0	12	23	16
	Thallium	mg/L	0.0008	CCME CWQG	3	3	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			3	3	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			3	3	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			3	3	<0.01	<0.01	<0.01
	Tin	mg/L			3	2	<0.0001	0.0016	<0.0006
	Titanium	mg/L			3	3	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			3	0	22	24	23
	Total Kjeldahl Nitrogen	mg/L			3	0	0.18	0.34	0.24
	Total Organic Carbon	mg/L			3	0	2.7	3.1	2.9
	Total Suspended Solids	mg/L			3	1	<1	2.0	<1.7
	Uranium	mg/L	0.015	CCME CWQG	3	3	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L	0.007		3	3	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	3	1	<0.0005	0.0031	<0.0019

Table 3-3 Cont'd: Baseline Water Quality Summary

Location	Parameter	Units	Benchmark Value	Benchmark Reference	Total Count	Count less than RDL	Minimum	Maximum	Arithmetic Mean
Russell Lake (LAB-1)	Alkalinity	mg/L			3	0	2.0	14	7.7
	Aluminum	mg/L	0.1	SEQG	3	0	0.0023	0.0025	0.0024
	Ammonia as N	mg/L	0.103	CCME CWQG	3	2	<0.01	0.05	<0.023
	Antimony	mg/L			3	3	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	3	2	0.0001	0.0001	<0.0001
	Barium	mg/L			3	0	0.0033	0.0039	0.0036
	Beryllium	mg/L			3	3	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			3	0	2.0	17	9.0
	Boron	mg/L	1.5	CCME CWQG	3	3	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	3	0	<0.00001	<0.00001	<0.00001
	Calcium	mg/L			3	0	2.7	3.9	3.5
	Carbonate	mg/L			3	3	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	3	1	<0.1	0.50	<0.33
	Chromium	mg/L	0.001	CCME CWQG	3	3	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			3	3	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	3	3	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			3	0	2.1	2.5	2.3
	Dissolved Phosphorus	mg/L			3	3	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	3	0	0.02	0.07	0.04
	Hardness	mg/L			3	0	9.0	13	11
	Hydroxide	mg/L			3	3	<1	<1	<1
	Iron	mg/L	0.3	SEQG	3	0	0.056	0.08	0.070667
	Lead	mg/L	0.001	CCME CWQG	3	3	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			3	3	<0.02	<0.02	<0.02
	Magnesium	mg/L			3	0	0.50	0.70	0.60
	Manganese	mg/L			3	0	0.029	0.064	0.045
	Mercury	mg/L	0.000026	CCME CWQG	3	2	<0.000001	<0.000010	<0.000007
	Molybdenum	mg/L	31	SEQG	3	0	0.0003	0.0013	0.00077
	Nickel	mg/L	0.025	CCME CWQG	3	1	0.0001	0.0001	<0.0001
	Nitrate	mg/L	13.29	SEQG	2	0	0.05	0.44	0.25
	P. Alkalinity	mg/L			3	3	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	3	0	6.7	7.0	6.9
	Phosphorus	mg/L			3	3	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			3	3	<0.005	<0.005	<0.005
	Potassium	mg/L			3	0	0.30	0.60	0.50
	Radium-226	Bq/L	0.11	SSWQO	3	2	<0.005	0.006	<0.0053
	Selenium	mg/L	0.001	CCME CWQG	3	3	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	3	3	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			3	0	1.7	2.0	1.8
	Specific Conductivity	µS/cm			3	0	30	47	38
	Strontium	mg/L			3	0	0.017	0.018	0.017
	Sulphate	mg/L	128	SEQG	3	0	3.7	8.1	6.5
	Sum of Ions				3	0	18	28	23
	Thallium	mg/L	0.0008	CCME CWQG	3	3	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			3	3	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			3	3	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			3	3	<0.01	<0.01	<0.01
	Tin	mg/L			3	2	<0.0001	0.001	<0.0004
	Titanium	mg/L			3	3	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			3	0	30	35	32
	Total Kjeldahl Nitrogen	mg/L			3	0	0.14	0.22	0.17
	Total Organic Carbon	mg/L			3	0	2.2	2.6	2.4
	Total Suspended Solids	mg/L			3	1	1.0	1.0	<1.0
	Uranium	mg/L	0.015	CCME CWQG	3	3	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			3	3	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	3	3	<0.0005	<0.0005	<0.0005
Russell Lake (LAB-2)	Alkalinity	mg/L			1	0	8.0	8.0	8.0
	Aluminum	mg/L	0.1	SEQG	1	0	0.0029	0.0029	0.0029
	Ammonia as N	mg/L	0.103	CCME CWQG	1	1	<0.01	<0.01	<0.01
	Antimony	mg/L			1	1	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	1	0	0.0001	0.0001	0.0001
	Barium	mg/L			1	0	0.0034	0.0034	0.0034
	Beryllium	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			1	0	10	10	10
	Boron	mg/L	1.5	CCME CWQG	1	1	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	1	1	<0.00001	<0.00001	<0.00001
	Calcium	mg/L			1	0	3.5	3.5	3.5
	Carbonate	mg/L			1	1	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	1	0	0.40	0.40	0.40
	Chromium	mg/L	0.001	CCME CWQG	1	1	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	1	1	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			1	0	2.2	2.2	2.2
	Dissolved Phosphorus	mg/L			1	1	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	1	0	0.03	0.03	0.03
	Hardness	mg/L			1	0	12	12	12
	Hydroxide	mg/L			1	1	<1	<1	<1
	Iron	mg/L	0.3	SEQG	1	0	0.039	0.039	0.039
	Lead	mg/L	0.001	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			1	1	<0.02	<0.02	<0.02
	Magnesium	mg/L			1	0	0.70	0.70	0.70
	Manganese	mg/L			1	0	0.019	0.019	0.019
	Mercury	mg/L	0.000026	CCME CWQG	1	1	<0.0000001	<0.0000001	<0.0000001
	Molybdenum	mg/L	31	SEQG	1	0	0.0011	0.0011	0.0011
	Nickel	mg/L	0.025	CCME CWQG	1	0	0.0003	0.0003	0.0003
	Nitrate	mg/L	13.29	SEQG	1	0	0.05	0.05	0.05
	P. Alkalinity	mg/L			1	1	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	1	0	7.2	7.2	7.2
	Phosphorus	mg/L			1	1	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			1	1	<0.005	<0.005	<0.005
	Potassium	mg/L			1	0	0.80	0.80	0.80
	Radium-226	Bq/L	0.11	SSWQO	1	0	0.007	0.007	0.007
	Selenium	mg/L	0.001	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	1	1	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			1	0	1.7	1.7	1.7
	Specific Conductivity	µS/cm			1	0	42	42	42
	Strontium	mg/L			1	0	0.016	0.016	0.016
	Sulphate	mg/L	128	SEQG	1	0	8.3	8.3	8.3
	Sum of Ions				1	0	25	25	25
	Thallium	mg/L	0.0008	CCME CWQG	1	1	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			1	1	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			1	1	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			1	1	<0.01	<0.01	<0.01
	Tin	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Titanium	mg/L			1	1	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			1	0	35	35	35
	Total Kjeldahl Nitrogen	mg/L			1	0	0.29	0.29	0.29
	Total Organic Carbon	mg/L			1	0	2.2	2.2	2.2
	Total Suspended Solids	mg/L			1	0	4.0	4.0	4.0
	Uranium	mg/L	0.015	CCME CWQG	1	1	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			1	1	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	1	1	<0.0005	<0.0005	<0.0005

Notes:
Summary of baseline water quality data from 2011 to 2019
SEQG - Saskatchewan Environmental Quality Guideline - Water Quality Guideline for Freshwater Aquatic Life (Government of Saskachewan, 2019)
CCME CWQG - Canadian Water Quality Guideline for the Protection of Aquatic Life (CCME, 1999)
SSWQO - Saskatchewan Surface Water Quality Objective (Water Security Agency, 2015)
Mean values are indicated as "less than", "<", when one or more of the samples were below the analytical detection limit for the parameter
Ammonia guideline assumes a maximum pH of 8.5 and temperature of 25°C

Table 3-4: Baseline Sediment Grain Size Distribution Summary

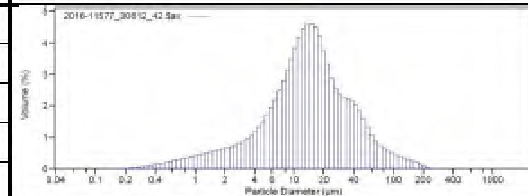
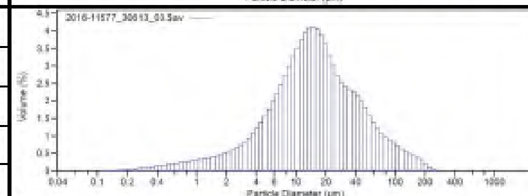
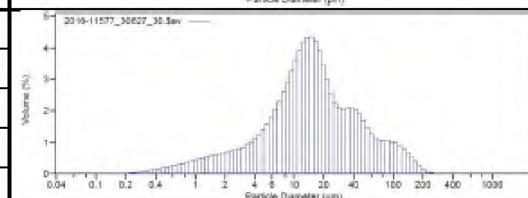
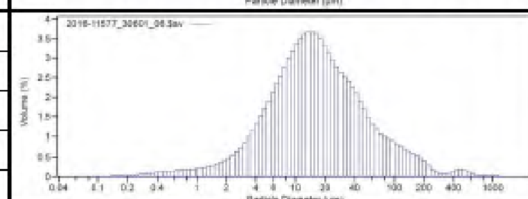
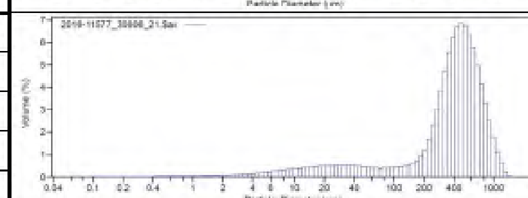
Location	Lab ID	Particle Diameter (µm)	Percent Passing %	Soil Classification	Percentage %	Histogram
McGowan Lake, LA-1-1 (0-2)'	30612	0.04	13.2	Gravel	0.0	
		4	94.4	Sand	0.1	
		63	99.9	Silt	17.7	
		200	100.0	Clay	82.2	
		2000	100.0			
McGowan Lake, LA-1-2 (0-2)	30613	0.04	11.7	Gravel	0.0	
		4	91.1	Sand	0.3	
		63	99.7	Silt	20.6	
		200	100.0	Clay	79.1	
		2000	100.0			
McGowan Lake, LA-1-3 (0-2)	30627	0.04	13.5	Gravel	0.0	
		4	89.7	Sand	0.2	
		63	99.8	Silt	21.6	
		200	100.0	Clay	78.2	
		2000	100.0			
Whitefish Lake, LA-5-1 (0-2)	30601	0.04	10.6	Gravel	0.0	
		4	87.9	Sand	2.1	
		63	97.8	Silt	21.7	
		200	100.1	Clay	76.3	
		2000	100.1			
Whitefish Lake , LA-5-2 (0-2)	30606	0.04	1.8	Gravel	0.0	
		4	13.8	Sand	72.5	
		63	20.5	Silt	15.4	
		200	100.0	Clay	12.0	
		2000	100.0			

Table 3-4 Cont'd: Baseline Sediment Grain Size Distribution Summary

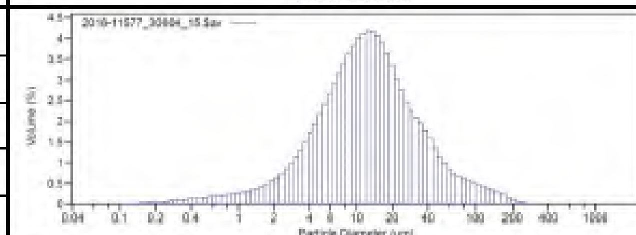
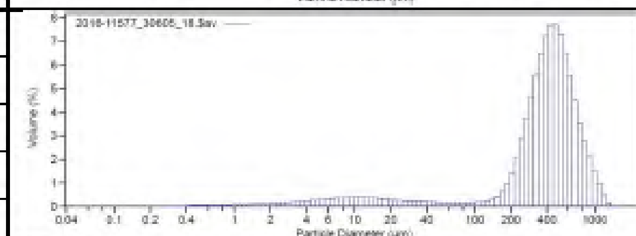
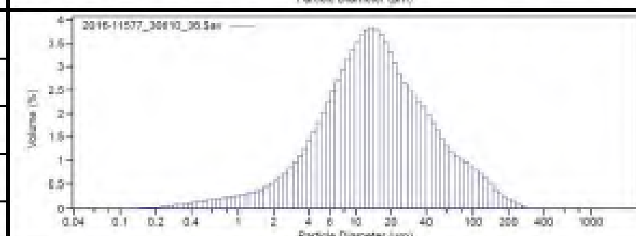
Location	Lab ID	Particle Diameter (µm)	Percent Passing %	Soil Classification	Percentage %	Histogram
Whitefish Lake, LA-5-3 (0-2)	30607	0.04	12.0	Gravel	0.0	
		4	88.0	Sand	1.9	
		63	97.3	Silt	20.9	
		200	99.4	Clay	76.6	
		2000	99.4			
Whitefish Lake, LA-5-4 (0-2)	30604	0.04	13.4	Gravel	0.0	
		4	94.2	Sand	0.1	
		63	99.8	Silt	17.8	
		200	100.0	Clay	82.0	
		2000	100.0			
Whitefish Lake, LA-5-5 (0-2)	30605	0.04	2.7	Gravel	0.0	
		4	11.3	Sand	77.2	
		63	15.4	Silt	12.8	
		200	100.0	Clay	10.0	
		2000	100.0			
Whtefish Lake, LA 6-1 (0-2)	30610	0.04	12.2	Gravel	0.0	
		4	90.6	Sand	0.4	
		63	99.5	Silt	20.8	
		200	100.0	Clay	78.8	
		2000	100.0			

Table 3-4 Cont'd: Baseline Sediment Grain Size Distribution Summary

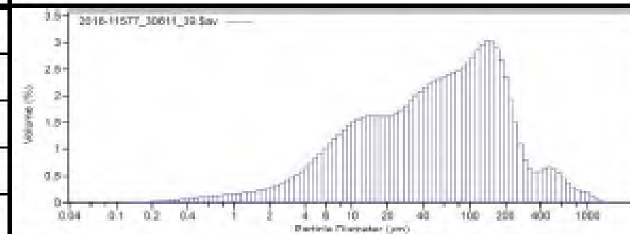
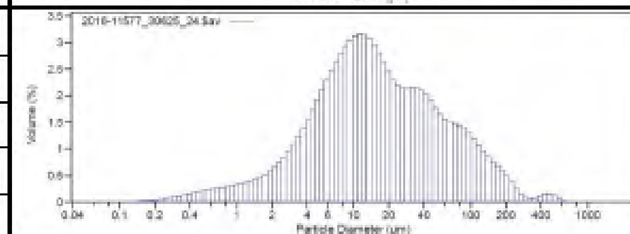
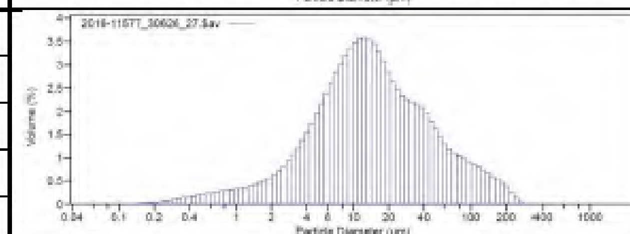
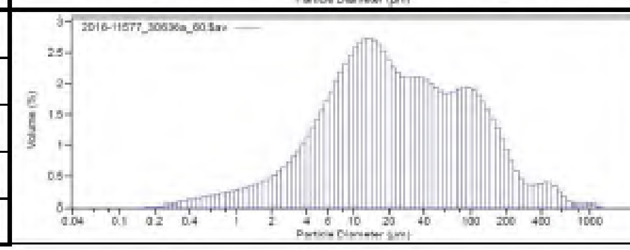
Location	Lab ID	Particle Diameter (µm)	Percent Passing %	Soil Classification	Percentage %	Histogram
Whitefish Lake, LA-6-2 (0-2)	30611	0.04	6.1	Gravel	0.0	
		4	53.3	Sand	12.0	
		63	86.8	Silt	41.8	
		200	100.0	Clay	46.2	
		2000	100.0			
Whitefish Lake, LA-6-3 (0-2)	30625	0.04	14.0	Gravel	0.0	
		4	84.4	Sand	1.8	
		63	98.0	Silt	24.4	
		200	100.0	Clay	73.8	
		2000	100.0			
Whitefish Lake, LA-6-4 (0-2)	30626	0.04	13.9	Gravel	0.0	
		4	89.2	Sand	0.7	
		63	99.3	Silt	21.5	
		200	100.1	Clay	77.9	
		2000	100.1			
Whitefish Lake, LA-6-5 (0-2)	30636	0.04	10.5	Gravel	0.0	
		4	73.6	Sand	5.2	
		63	94.3	Silt	30.7	
		200	100.0	Clay	64.1	
		2000	100.0			

Table 3-4 Cont'd: Baseline Sediment Grain Size Distribution Summary

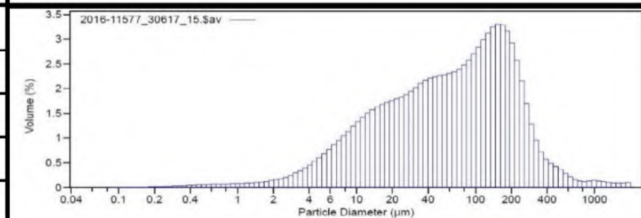
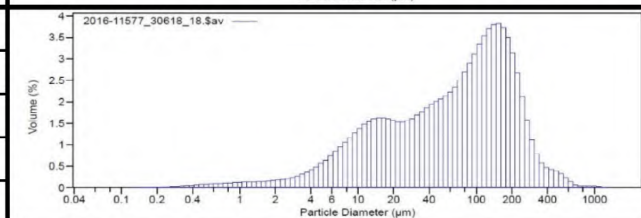
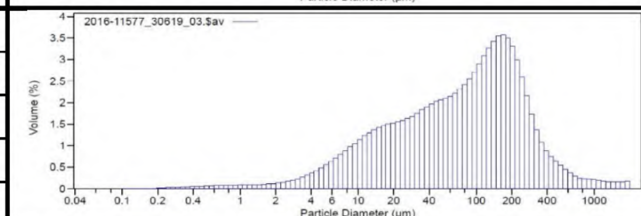
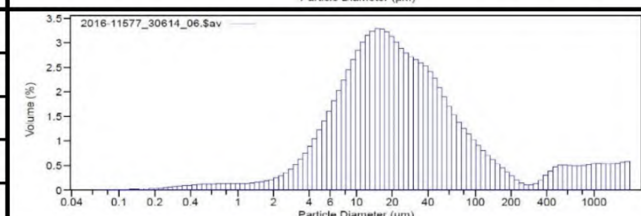
Location	Lab ID	Particle Diameter (µm)	Percent Passing %	Soil Classification	Percentage %	Histogram
Kratchowsky Lake, LA-7A-1 (0-2)	30617	0.04	3.7	Gravel	0.0	
		4	49.3	Sand	13.9	
		63	84.8	Silt	43.7	
		200	100.0	Clay	42.4	
		2000	100.0			
Kratchowsky Lake, LA 7A-2 (0-2)	30618	0.04	4.2	Gravel	0.0	
		4	46.5	Sand	12.2	
		63	86.6	Silt	47.6	
		200	100.0	Clay	40.2	
		2000	100.0			
Kratchowsky Lake, LA 7A-3 (0-2)	30619	0.04	3.4	Gravel	0.0	
		4	43.2	Sand	18.4	
		63	79.8	Silt	44.4	
		200	100.0	Clay	37.2	
		2000	100.0			
Kratchowsky Lake, LA-7-1 (0-2)	30614	0.04	6.8	Gravel	0.0	
		4	78.7	Sand	9.4	
		63	89.7	Silt	22.7	
		200	100.0	Clay	67.9	
		2000	100.0			

Table 3-4 Cont'd: Baseline Sediment Grain Size Distribution Summary

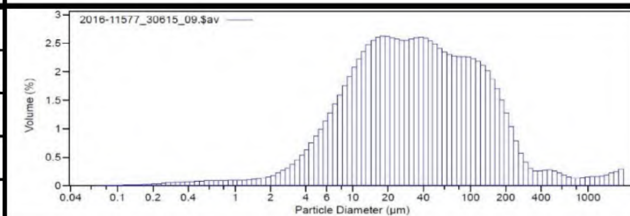
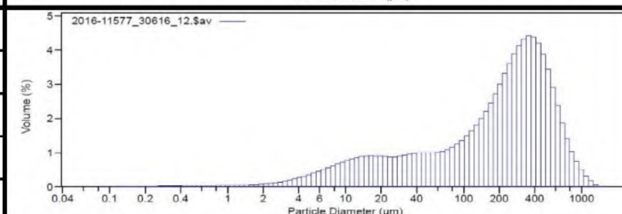
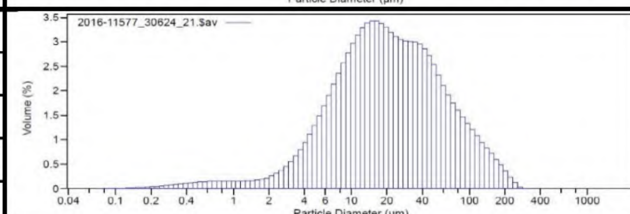
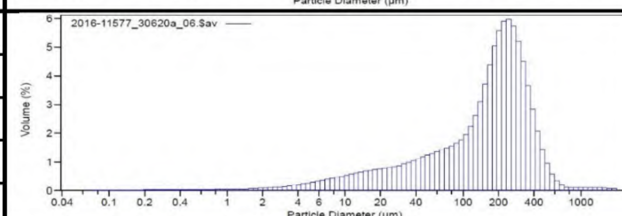
Location	Lab ID	Particle Diameter	Percent Passing	Soil Classification	Percentage	Histogram
		(µm)	%		%	
Kratchowsky Lake, LA-7-2 (0-2)	30615	0.04	4.8	Gravel	0.0	
		4	66.7	Sand	7.1	
		63	92.2	Silt	35.5	
		200	100.0	Clay	57.3	
		2000	100.0			
Kratchowsky Lake, LA-7-3 (0-2)	30616	0.04	2.3	Gravel	0.0	
		4	25.5	Sand	48.5	
		63	46.8	Silt	29.5	
		200	100.0	Clay	22.0	
		2000	100.0			
LA-8-1 (0-2)	30620a	0.04	7.2	Gravel	0.0	
		4	85.2	Sand	0.6	
		63	99.4	Silt	26.0	
		200	100.0	Clay	73.4	
		2000	100.0			
LA-8-2 (0-2)	30620	0.04	2.2	Gravel	0.0	
		4	23.0	Sand	40.4	
		63	55.7	Silt	39.7	
		200	100.0	Clay	19.8	
		2000	100.0			

Table 3-4 Cont'd: Baseline Sediment Grain Size Distribution Summary

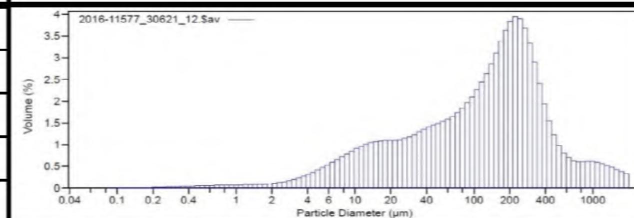
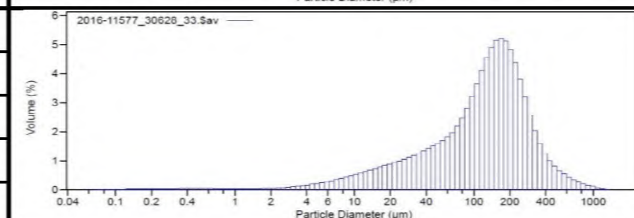
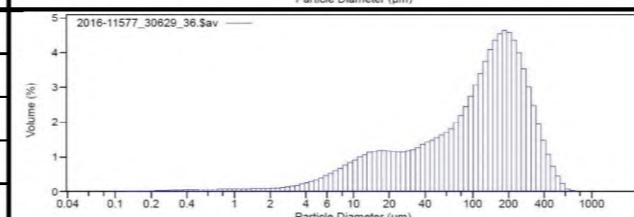
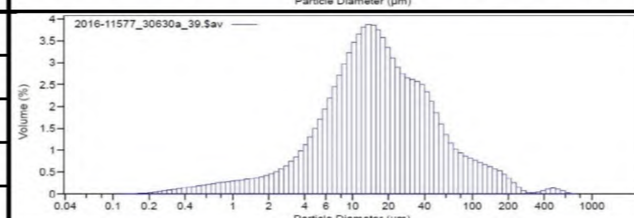
Location	Lab ID	Particle Diameter (µm)	Percent Passing %	Soil Classification	Percentage %	Histogram
LA-8-3 (0-2)	30621	0.04	2.9	Gravel	0.0	
		4	32.6	Sand	33.3	
		63	63.5	Silt	38.6	
		200	100.0	Clay	28.1	
		2000	100.0			
LA-9-1 (0-2)	30628	0.04	1.9	Gravel	0.0	
		4	26.3	Sand	24.5	
		63	73.2	Silt	50.8	
		200	100.0	Clay	24.7	
		2000	100.0			
LA-9-2 (0-2)	30629	0.04	2.9	Gravel	0.0	
		4	32.9	Sand	24.3	
		63	73.5	Silt	47.4	
		200	100.1	Clay	28.3	
		2000	100.1			
LA-9-3 (0-2)	30630	0.04	10.7	Gravel	0.0	
		4	89.1	Sand	1.3	
		63	98.5	Silt	21.3	
		200	99.9	Clay	77.3	
		2000	99.9			

Table 3-4 Cont'd: Baseline Sediment Grain Size Distribution Summary

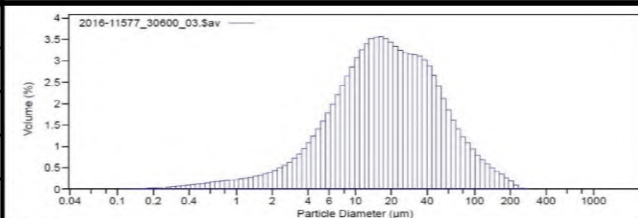
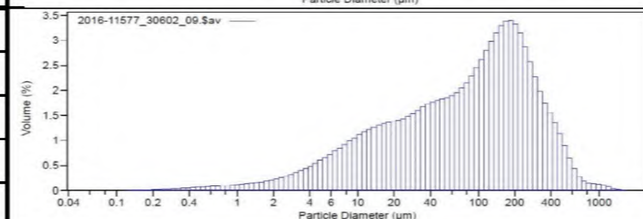
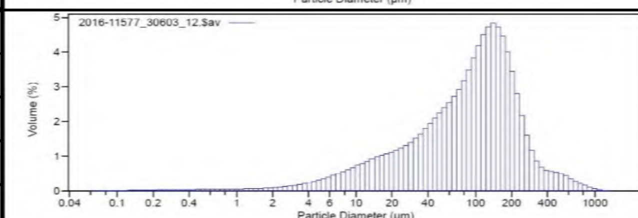
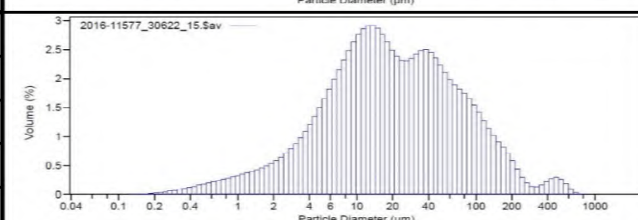
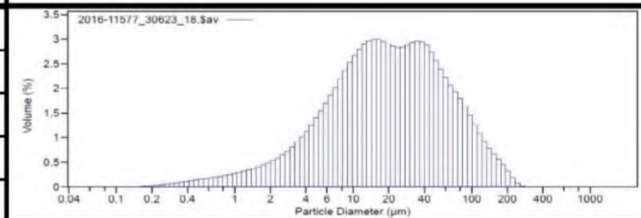
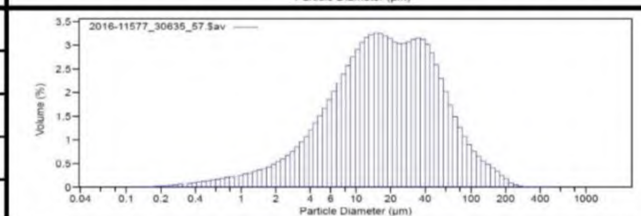
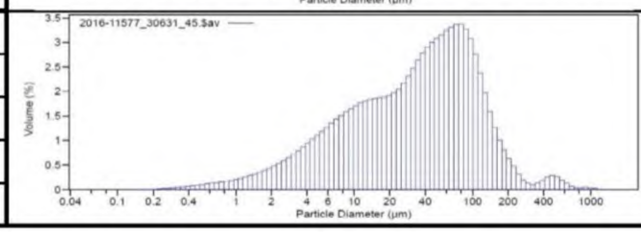
Location	Lab ID	Particle Diameter	Percent Passing	Soil Classification	Percentage	Histogram
		(µm)	%		%	
Williams Lake, LB-3-1 (0-2)	30600	0.04	9.4	Gravel	0.0	
		4	89.6	Sand	0.3	
		63	99.7	Silt	22.1	
		200	100.0	Clay	77.6	
		2000	100.0			
Williams Lake, LB-3-2 (0-2)	30602	0.04	4.8	Gravel	0.0	
		4	42.3	Sand	22.0	
		63	76.0	Silt	41.5	
		200	100.1	Clay	36.6	
		2000	100.1			
Williams Lake, LB-3-3 (0-2)	30603	0.04	2.7	Gravel	0.0	
		4	35.5	Sand	14.2	
		63	84.4	Silt	55.2	
		200	100.0	Clay	30.5	
		2000	100.0			
LAB-1-1 (0-2)	30622	0.04	12.0	Gravel	0.0	
		4	80.7	Sand	2.8	
		63	96.9	Silt	26.8	
		200	100.0	Clay	70.4	
		2000	100.0			

Table 3-4 Cont'd: Baseline Sediment Grain Size Distribution Summary

Location	Lab ID	Particle Diameter (µm)	Percent Passing %	Soil Classification	Percentage %	Histogram
Russell Lake, LAB-1-2 (0-2)	30623	0.04	10.8	Gravel	0.0	
		4	84.5	Sand	0.5	
		63	99.4	Silt	26.0	
		200	99.9	Clay	73.4	
		2000	99.9			
LAB-1-3 (0-2)	30635	0.04	10.9	Gravel	0.0	
		4	89.6	Sand	0.3	
		63	99.7	Silt	22.0	
		200	100.0	Clay	77.8	
		2,000	100.0			
Williams Lake, LAB-2-CORE (0-2)	30631	0.04	9.0	Gravel	0.0	
		4	68.0	Sand	3.1	
		63	96.7	Silt	37.9	
		200	100.1	Clay	59.1	
		2000	100.1			

Notes:
Analysis by Beckman Coulter LS Particle Size Analyser
Results on sediment fraction passing 2,000 µm seive

Table 3-5: Baseline Sediment Quality Summary

Location	Parameter	Unit	Sediment Quality Benchmarks			Total Count	Count Less than RDL	Minimum	Maximum	Arithmetic Mean
			REF/ISQG/ LEL	NE2/PEL/ SEL	Reference					
McGowan Lake (LA-1)	Moisture	%				3	0	97	97	97
	Total Organic Carbon	%				3	0	13	17	16
	Aluminum	µg/g				3	0	4010	4740	4397
	Antimony	µg/g				3	0	0.20	0.30	0.23
	Arsenic	µg/g	21	522	REF and NE2	3	0	5	5.7	5.3
	Barium	µg/g				3	0	30	42	35
	Beryllium	µg/g				3	0	0.20	0.30	0.27
	Boron	µg/g				3	0	5.0	8.0	7.0
	Cadmium	µg/g	0.6	3.5	ISQG and PEL	3	0	0.30	0.50	0.40
	Chromium	µg/g				3	0	6.7	16	11
	Cobalt	µg/g				3	0	1.6	2.3	2.0
	Copper	µg/g	22	269	LEL and SEL	3	0	2.7	4.6	3.6
	Iron	µg/g				3	0	7800	12100	9933
	Lead	µg/g	37	412	LEL and SEL	3	0	8.2	10	8.9
	Manganese	µg/g				3	0	140	170	153
	Molybdenum	µg/g	23	245	REF and NE2	3	0	0.80	2.0	1.2
	Nickel	µg/g	21	326	REF and NE2	3	0	6.0	12	8.9
	Selenium	µg/g	3.6	30	REF and NE2	3	0	1.0	1.5	1.3
	Silver	µg/g				3	2	<0.10	0.20	0.13
	Strontium	µg/g				3	0	21	25	23
	Thallium	µg/g				3	3	<0.20	<0.20	<0.20
	Tin	µg/g				3	0	0.20	0.20	0.20
	Titanium	µg/g				3	0	200	280	243
	Uranium	µg/g	97	2296	REF and NE2	3	0	0.70	0.80	0.77
	Vanadium	µg/g				3	0	18	22	20
	Zinc	µg/g	123	315	ISQG and PEL	3	0	20	27	24
	Lead-210	Bq/g	0.9	20.8	LEL and SEL	3	0	0.54	0.75	0.67
	Polonium-210	Bq/g	0.8	12.1	LEL and SEL	3	0	0.52	0.76	0.64
	Radium-226	Bq/g	0.6	14.4	LEL and SEL	3	0	0.020	0.040	0.027
	Thorium-228	Bq/g				3	3	<0.02	<0.02	<0.02
	Thorium-230	Bq/g				3	3	<0.02	<0.02	<0.02
	Thorium-232	Bq/g				3	3	<0.02	<0.02	<0.02
	Calcium	µg/g				3	0	1400	1600	1533
	Magnesium	µg/g				3	0	690	830	767
	Phosphorus	µg/g				3	0	1000	1400	1233
	Postassium	µg/g				3	0	820	1000	933
Whitefish Lake (LA-5)	Moisture	%				5	0	29	97	70
	Total Organic Carbon	%				5	0	0.44	19	11
	Aluminum	µg/g				5	0	1990	5800	4080
	Antimony	µg/g				5	5	<0.2	<0.2	<0.2
	Arsenic	µg/g	21	522	REF and NE2	5	0	0.60	4.4	2.6
	Barium	µg/g				5	0	33	49	43
	Beryllium	µg/g				5	2	<0.1	0.30	0.22
	Boron	µg/g				5	2	<1	6.0	3.0
	Cadmium	µg/g	0.6	3.5	ISQG and PEL	5	1	<0.1	0.40	0.30
	Chromium	µg/g				5	0	1.0	11	7.4
	Cobalt	µg/g				5	1	<0.2	2.3	1.3
	Copper	µg/g	22	269	LEL and SEL	5	2	<0.5	2.0	1.1
	Iron	µg/g				5	0	1980	23500	12486
	Lead	µg/g	37	412	LEL and SEL	5	0	1.3	7.5	4.9
	Manganese	µg/g				5	0	33	320	170
	Molybdenum	µg/g	23	245	REF and NE2	5	1	<0.1	0.70	0.40
	Nickel	µg/g	21	326	REF and NE2	5	0	0.90	6.3	4.1
	Selenium	µg/g	3.6	30	REF and NE2	5	2	<0.1	0.90	0.50
	Silver	µg/g				5	3	<0.1	0.70	0.24
	Strontium	µg/g				5	0	19	33	26
	Thallium	µg/g				5	5	<0.2	<0.2	<0.2
	Tin	µg/g				5	2	<0.1	0.20	0.12
	Titanium	µg/g				5	0	45	200	128
	Uranium	µg/g	97	2296	REF and NE2	5	0	0.20	0.80	0.58
	Vanadium	µg/g				5	0	1.3	20	12
	Zinc	µg/g	123	315	ISQG and PEL	5	1	<0.5	28	16
	Lead-210	Bq/g	0.9	20.8	LEL and SEL	5	2	<0.04	0.43	0.23
	Polonium-210	Bq/g	0.8	12.1	LEL and SEL	5	0	0.020	0.52	0.26
	Radium-226	Bq/g	0.6	14.4	LEL and SEL	5	1	0.010	0.030	0.024
	Thorium-228	Bq/g				5	4	<0.02	0.020	0.020
	Thorium-230	Bq/g				5	5	<0.02	<0.02	<0.02
	Thorium-232	Bq/g				5	5	<0.02	<0.02	<0.02
	Calcium	µg/g				5	0	270	2100	1186
	Magnesium	µg/g				5	0	110	910	524
	Phosphorus	µg/g				5	0	60	1600	800
	Postassium	µg/g				5	0	840	1400	1068

Table 3-5 Cont'd: Baseline Sediment Quality Summary

Location	Parameter	Unit	Sediment Quality Benchmarks			Total Count	Count Less than RDL	Minimum	Maximum	Arithmetic Mean
			REF/ISQG/ LEL	NE2/PEL/ SEL	Reference					
Whitefish Lake (LA-6)	Moisture	%				5	0	96	97	96
	Total Organic Carbon	%				5	0	16	19	17
	Aluminum	µg/g				5	0	3820	5900	4842
	Antimony	µg/g				5	1	<0.2	0.20	0.20
	Arsenic	µg/g	21	522	REF and NE2	5	0	3.1	4.2	3.6
	Barium	µg/g				5	0	37	56	45
	Beryllium	µg/g				5	0	0.30	0.30	0.30
	Boron	µg/g				5	0	4.0	7.0	5.8
	Cadmium	µg/g	0.6	3.5	ISQG and PEL	5	0	0.40	0.50	0.42
	Chromium	µg/g				5	0	8	10	9
	Cobalt	µg/g				5	0	1.4	2.1	1.7
	Copper	µg/g	22	269	LEL and SEL	5	0	1.4	3.0	2.0
	Iron	µg/g				5	0	13200	22600	15900
	Lead	µg/g	37	412	LEL and SEL	5	0	7.0	8.5	7.8
	Manganese	µg/g				5	0	140	390	226
	Molybdenum	µg/g	23	245	REF and NE2	5	0	0.40	0.70	0.50
	Nickel	µg/g	21	326	REF and NE2	5	0	4.2	6.4	5.1
	Selenium	µg/g	3.6	30	REF and NE2	5	0	0.80	0.90	0.84
	Silver	µg/g				5	1	<0.1	0.20	0.12
	Strontium	µg/g				5	0	26	34	29
	Thallium	µg/g				5	1	<0.2	0.20	0.20
	Tin	µg/g				5	0	0.20	0.20	0.20
	Titanium	µg/g				5	0	180	310	254
	Uranium	µg/g	97	2296	REF and NE2	5	0	0.60	0.70	0.66
	Vanadium	µg/g				5	0	18	19	18
	Zinc	µg/g	123	315	ISQG and PEL	5	0	22	28	25
	Lead-210	Bq/g	0.9	20.8	LEL and SEL	5	0	0.31	0.59	0.44
	Polonium-210	Bq/g	0.8	12.1	LEL and SEL	5	0	0.31	0.57	0.45
	Radium-226	Bq/g	0.6	14.4	LEL and SEL	5	0	0.010	0.04	0.028
	Thorium-228	Bq/g				5	1	<0.02	0.020	0.020
	Thorium-230	Bq/g				5	1	<0.02	0.020	0.020
	Thorium-232	Bq/g				5	1	<0.02	0.020	0.020
	Calcium	µg/g				5	0	1700	2500	1960
	Magnesium	µg/g				5	0	650	880	758
	Phosphorus	µg/g				5	0	960	1500	1232
	Postassium	µg/g				5	0	800	970	906
Kratchkowsky Lake (LA-7)	Moisture	%				3	0	94	95	94
	Total Organic Carbon	%				3	0	19	24	22
	Aluminum	µg/g				3	0	3660	4530	4127
	Antimony	µg/g				3	0	0.20	0.30	0.23
	Arsenic	µg/g	21	522	REF and NE2	3	0	3.3	5.0	3.9
	Barium	µg/g				3	0	33	38	35
	Beryllium	µg/g				3	0	0.2	0.2	0.2
	Boron	µg/g				3	0	5.0	6.0	5.7
	Cadmium	µg/g	0.6	3.5	ISQG and PEL	3	0	0.4	0.4	0.4
	Chromium	µg/g				3	0	7	10	8.8
	Cobalt	µg/g				3	0	1.2	2.2	1.6
	Copper	µg/g	22	269	LEL and SEL	3	0	3.4	4.6	3.8
	Iron	µg/g				3	0	6800	10000	8067
	Lead	µg/g	37	412	LEL and SEL	3	0	7.8	10	8.8
	Manganese	µg/g				3	0	120	160	140
	Molybdenum	µg/g	23	245	REF and NE2	3	0	0.8	1.3	1.0
	Nickel	µg/g	21	326	REF and NE2	3	0	3.6	6.2	4.6
	Selenium	µg/g	3.6	30	REF and NE2	3	0	1.0	1.3	1.1
	Silver	µg/g				3	3	<0.1	<0.1	<0.1
	Strontium	µg/g				3	0	30	36	33
	Thallium	µg/g				3	3	<0.2	<0.2	<0.2
	Tin	µg/g				3	0	0.20	0.20	0.20
	Titanium	µg/g				3	0	190	230	213
	Uranium	µg/g	97	2296	REF and NE2	3	0	0.60	0.80	0.67
	Vanadium	µg/g				3	0	16	24	19
	Zinc	µg/g	123	315	ISQG and PEL	3	0	22	23	23
	Lead-210	Bq/g	0.9	20.8	LEL and SEL	3	0	0.35	0.44	0.40
	Polonium-210	Bq/g	0.8	12.1	LEL and SEL	3	0	0.38	0.51	0.42
	Radium-226	Bq/g	0.6	14.4	LEL and SEL	3	2	<0.01	0.030	0.017
	Thorium-228	Bq/g				3	3	<0.02	<0.02	<0.02
	Thorium-230	Bq/g				3	2	<0.02	0.020	0.020
	Thorium-232	Bq/g				3	3	<0.02	<0.02	<0.02
	Calcium	µg/g				3	0	2100	3300	2700
	Magnesium	µg/g				3	0	760	970	843
	Phosphorus	µg/g				3	0	1200	1500	1333
	Postassium	µg/g				3	0	920	1000	953

Table 3-5 Cont'd: Baseline Sediment Quality Summary

Location	Parameter	Unit	Sediment Quality Benchmarks			Total Count	Count Less than RDL	Minimum	Maximum	Arithmetic Mean
			REF/ISQG/ LEL	NE2/PEL/ SEL	Reference					
Kratchkowsky Lake (LA-7A)	Moisture	%				3	0	95	97	96
	Total Organic Carbon	%				3	0	26	26	26
	Aluminum	µg/g				3	0	3340	3860	3677
	Antimony	µg/g				3	0	0.20	0.30	0.23
	Arsenic	µg/g	21	522	REF and NE2	3	0	3.5	3.6	3.6
	Barium	µg/g				3	0	36	43	38
	Beryllium	µg/g				3	0	0.2	0.2	0.2
	Boron	µg/g				3	0	6.0	7.0	6.3
	Cadmium	µg/g	0.6	3.5	ISQG and PEL	3	0	0.3	0.4	0.4
	Chromium	µg/g				3	0	7.3	21	12
	Cobalt	µg/g				3	0	1.4	1.9	1.6
	Copper	µg/g	22	269	LEL and SEL	3	0	3.6	4.0	3.8
	Iron	µg/g				3	0	6900	8500	7800
	Lead	µg/g	37	412	LEL and SEL	3	0	7.2	8.3	7.8
	Manganese	µg/g				3	0	120	130	123
	Molybdenum	µg/g	23	245	REF and NE2	3	0	1.2	2.8	1.8
	Nickel	µg/g	21	326	REF and NE2	3	0	3.9	12	6.8
	Selenium	µg/g	3.6	30	REF and NE2	3	0	1.0	1.2	1.1
	Silver	µg/g				3	3	<0.1	<0.1	<0.1
	Strontium	µg/g				3	0	31	38	36
	Thallium	µg/g				3	3	<0.2	<0.2	<0.2
	Tin	µg/g				3	0	0.20	0.20	0.20
	Titanium	µg/g				3	0	170	200	190
	Uranium	µg/g	97	2296	REF and NE2	3	0	0.60	0.70	0.63
	Vanadium	µg/g				3	0	15	16	16
	Zinc	µg/g	123	315	ISQG and PEL	3	0	22	29	27
	Lead-210	Bq/g	0.9	20.8	LEL and SEL	3	0	0.29	0.55	0.38
	Polonium-210	Bq/g	0.8	12.1	LEL and SEL	3	0	0.30	0.56	0.40
	Radium-226	Bq/g	0.6	14.4	LEL and SEL	3	1	<0.01	0.020	0.017
	Thorium-228	Bq/g				3	3	<0.02	<0.02	<0.02
	Thorium-230	Bq/g				3	3	<0.02	<0.02	<0.02
	Thorium-232	Bq/g				3	3	<0.02	<0.02	<0.02
	Calcium	µg/g				3	0	2900	3200	3067
	Magnesium	µg/g				3	0	890	1000	937
	Phosphorus	µg/g				3	0	1200	2500	1700
	Postassium	µg/g				3	0	870	1300	1057
LA-8	Moisture	%				3	0	88	97	93
	Total Organic Carbon	%				3	0	7.8	24	16
	Aluminum	µg/g				3	0	1950	4470	3577
	Antimony	µg/g				3	0	0.20	0.30	0.23
	Arsenic	µg/g	21	522	REF and NE2	3	0	1.5	3.6	2.9
	Barium	µg/g				3	0	20	39	30
	Beryllium	µg/g				3	0	0.10	0.30	0.23
	Boron	µg/g				3	0	3.0	8.0	5.0
	Cadmium	µg/g	0.6	3.5	ISQG and PEL	3	0	0.30	0.40	0.37
	Chromium	µg/g				3	0	1.6	8.0	5.6
	Cobalt	µg/g				3	0	0.20	1.7	1.0
	Copper	µg/g	22	269	LEL and SEL	3	0	0.5	4.1	2.6
	Iron	µg/g				3	0	9700	14500	11467
	Lead	µg/g	37	412	LEL and SEL	3	0	3.7	10	6.4
	Manganese	µg/g				3	0	100	230	177
	Molybdenum	µg/g	23	245	REF and NE2	3	0	0.20	1.2	0.77
	Nickel	µg/g	21	326	REF and NE2	3	0	1.2	7.2	5.0
	Selenium	µg/g	3.6	30	REF and NE2	3	0	0.4	1.2	0.93
	Silver	µg/g				3	0	0.10	0.20	0.13
	Strontium	µg/g				3	0	20	29	25
	Thallium	µg/g				3	0	0.20	0.20	0.20
	Tin	µg/g				3	0	0.10	0.20	0.17
	Titanium	µg/g				3	0	80	250	193
	Uranium	µg/g	97	2296	REF and NE2	3	0	0.30	0.80	0.60
	Vanadium	µg/g				3	0	7.3	20	16
	Zinc	µg/g	123	315	ISQG and PEL	3	0	10	30	22
	Lead-210	Bq/g	0.9	20.8	LEL and SEL	3	0	0.17	0.58	0.32
	Polonium-210	Bq/g	0.8	12.1	LEL and SEL	3	0	0.21	0.44	0.30
	Radium-226	Bq/g	0.6	14.4	LEL and SEL	3	0	0.010	0.020	0.013
	Thorium-228	Bq/g				3	0	0.020	0.020	0.020
	Thorium-230	Bq/g				3	0	0.020	0.020	0.020
	Thorium-232	Bq/g				3	0	0.020	0.020	0.020
	Calcium	µg/g				3	0	900	2500	1733
	Magnesium	µg/g				3	0	330	890	613
	Phosphorus	µg/g				3	0	480	1700	987
	Postassium	µg/g				3	0	530	1000	763

Table 3-5 Cont'd: Baseline Sediment Quality Summary

Location	Parameter	Unit	Sediment Quality Benchmarks REF/ISQG/ LEL	NE2/PEL/ SEL	Reference	Total Count	Count Less than RDL	Minimum	Maximum	Arithmetic Mean
LA-9	Moisture	%				3	0	66	95	85
	Total Organic Carbon	%				3	0	2.6	17	12
	Aluminum	µg/g				3	0	1860	4410	3507
	Antimony	µg/g				3	1	<0.2	0.30	0.27
	Arsenic	µg/g	21	522	REF and NE2	3	0	0.90	3.8	2.8
	Barium	µg/g				3	0	20	36	30
	Beryllium	µg/g				3	1	<0.1	0.30	0.20
	Boron	µg/g				3	1	<1	6.0	4.3
	Cadmium	µg/g	0.6	3.5	ISQG and PEL	3	0	0.20	0.50	0.37
	Chromium	µg/g				3	0	1.1	8.5	6.0
	Cobalt	µg/g				3	1	<0.2	1.4	0.93
	Copper	µg/g	22	269	LEL and SEL	3	1	<0.5	3.5	2.3
	Iron	µg/g				3	0	2670	6100	4523
	Lead	µg/g	37	412	LEL and SEL	3	0	1.5	10	7.2
	Manganese	µg/g				3	0	51	160	117
	Molybdenum	µg/g	23	245	REF and NE2	3	1	<0.1	1.1	0.7
	Nickel	µg/g	21	326	REF and NE2	3	1	<0.1	6.8	4.3
	Selenium	µg/g	3.6	30	REF and NE2	3	0	0.20	1.3	0.9
	Silver	µg/g				3	0	0.10	0.40	0.2
	Strontium	µg/g				3	0	16	27	23
	Thallium	µg/g				3	3	<0.2	<0.2	<0.2
	Tin	µg/g				3	1	<0.1	0.20	0.17
	Titanium	µg/g				3	0	230	290	260
	Uranium	µg/g	97	2296	REF and NE2	3	0	0.30	0.70	0.57
	Vanadium	µg/g				3	0	5.5	23	16
	Zinc	µg/g	123	315	ISQG and PEL	3	0	4.3	28	20
	Lead-210	Bq/g	0.9	20.8	LEL and SEL	3	1	<0.04	0.58	0.36
	Polonium-210	Bq/g	0.8	12.1	LEL and SEL	3	0	0.040	0.54	0.34
	Radium-226	Bq/g	0.6	14.4	LEL and SEL	3	0	0.030	0.050	0.037
	Thorium-228	Bq/g				3	3	<0.02	<0.02	<0.02
	Thorium-230	Bq/g				3	3	<0.02	<0.02	<0.02
	Thorium-232	Bq/g				3	3	<0.02	<0.02	<0.02
	Calcium	µg/g				3	0	600	2000	1500
	Magnesium	µg/g				3	0	260	780	583
	Phosphorus	µg/g				3	0	120	1100	773
	Postassium	µg/g				3	0	610	940	800
Williams Lake (LB-3)	Moisture	%				3	0	68	94	85
	Total Organic Carbon	%				3	0	2.6	20	13
	Aluminum	µg/g				3	0	2790	7800	5630
	Antimony	µg/g				3	0	0.20	0.40	0.30
	Arsenic	µg/g	21	522	REF and NE2	3	0	1.5	6.5	4.3
	Barium	µg/g				3	0	27	57	43
	Beryllium	µg/g				3	0	0.10	0.50	0.33
	Boron	µg/g				3	1	<1	9.0	5.3
	Cadmium	µg/g	0.6	3.5	ISQG and PEL	3	0	0.30	0.60	0.47
	Chromium	µg/g				3	0	8.4	17	12
	Cobalt	µg/g				3	0	1.2	3.8	2.8
	Copper	µg/g	22	269	LEL and SEL	3	1	0.5	8.4	5.1
	Iron	µg/g				3	0	5700	24800	15967
	Lead	µg/g	37	412	LEL and SEL	3	0	2.4	12	7.7
	Manganese	µg/g				3	0	58	160	119
	Molybdenum	µg/g	23	245	REF and NE2	3	0	0.30	1.2	0.90
	Nickel	µg/g	21	326	REF and NE2	3	0	4.2	13	10
	Selenium	µg/g	3.6	30	REF and NE2	3	0	0.30	1.8	1.1
	Silver	µg/g				3	2	<0.1	0.20	0.13
	Strontium	µg/g				3	0	16	32	26
	Thallium	µg/g				3	3	<0.2	<0.2	<0.2
	Tin	µg/g				3	0	0.10	0.30	0.20
	Titanium	µg/g				3	0	130	270	210
	Uranium	µg/g	97	2296	REF and NE2	3	0	0.30	1.0	0.73
	Vanadium	µg/g				3	0	7.9	33	22
	Zinc	µg/g	123	315	ISQG and PEL	3	0	12	43	31
	Lead-210	Bq/g	0.9	20.8	LEL and SEL	3	0	0.04	0.61	0.34
	Polonium-210	Bq/g	0.8	12.1	LEL and SEL	3	0	0.05	0.50	0.30
	Radium-226	Bq/g	0.6	14.4	LEL and SEL	3	0	0.01	0.04	0.02
	Thorium-228	Bq/g				3	2	<0.02	0.020	0.020
	Thorium-230	Bq/g				3	3	<0.02	<0.02	<0.02
	Thorium-232	Bq/g				3	3	<0.02	<0.02	<0.02
	Calcium	µg/g				3	0	680	2000	1527
	Magnesium	µg/g				3	0	350	870	647
	Phosphorus	µg/g				3	0	150	1300	817
	Postassium	µg/g				3	0	720	1100	910

Table 3-5 Cont'd: Baseline Sediment Quality Summary

Location	Parameter	Unit	Sediment Quality Benchmarks REF/ISQG/LEL	NE2/PEL/SEL	Reference	Total Count	Count Less than RDL	Minimum	Maximum	Arithmetic Mean
Russell Lake (LAB-1)	Moisture	%				3	0	93	95	94
	Total Organic Carbon	%				3	0	13	15	14
	Aluminum	µg/g				3	0	4810	9200	7137
	Antimony	µg/g				3	1	<0.2	0.30	0.23
	Arsenic	µg/g	21	522	REF and NE2	3	0	2.6	5.6	4.3
	Barium	µg/g				3	0	45	71	59
	Beryllium	µg/g				3	0	0.30	0.4	0.33
	Boron	µg/g				3	0	7.0	11	10
	Cadmium	µg/g	0.6	3.5	ISQG and PEL	3	0	0.30	0.5	0.43
	Chromium	µg/g				3	0	8.0	15	12
	Cobalt	µg/g				3	0	1.4	2.7	2.0
	Copper	µg/g	22	269	LEL and SEL	3	0	1.7	5.0	3.2
	Iron	µg/g				3	0	11900	33000	23967
	Lead	µg/g	37	412	LEL and SEL	3	0	5.4	13	9.1
	Manganese	µg/g				3	0	290	360	317
	Molybdenum	µg/g	23	245	REF and NE2	3	0	6.3	13	10
	Nickel	µg/g	21	326	REF and NE2	3	0	6.5	12	9
	Selenium	µg/g	3.6	30	REF and NE2	3	0	1.0	1.6	1.3
	Silver	µg/g				3	2	<0.1	0	0
	Strontium	µg/g				3	0	28	42	35
	Thallium	µg/g				3	1	<0.2	<0.2	<0.2
	Tin	µg/g				3	0	0.30	0.40	0.37
	Titanium	µg/g				3	0	380	480	437
	Uranium	µg/g	97	2296	REF and NE2	3	0	1.1	1.5	1.3
	Vanadium	µg/g				3	0	16	27	22
	Zinc	µg/g	123	315	ISQG and PEL	3	0	18	44	31
	Lead-210	Bq/g	0.9	20.8	LEL and SEL	3	0	0.55	0.63	0.58
	Polonium-210	Bq/g	0.8	12.1	LEL and SEL	3	0	0.55	0.68	0.59
	Radium-226	Bq/g	0.6	14.4	LEL and SEL	3	0	0.030	0.050	0.040
	Thorium-228	Bq/g				3	2	<0.02	0.020	0.020
	Thorium-230	Bq/g				3	2	<0.02	0.030	0.023
	Thorium-232	Bq/g				3	3	<0.02	<0.02	<0.02
	Calcium	µg/g				3	0	2800	3500	3100
	Magnesium	µg/g				3	0	960	1200	1087
	Phosphorus	µg/g				3	0	820	1200	993
	Postassium	µg/g				3	0	960	1400	1153
Russell Lake (LAB-2)	Moisture	%				1	0	93	93	93
	Total Organic Carbon	%				1	0	12	12	12
	Aluminum	µg/g				1	0	9300	9300	9300
	Antimony	µg/g				1	1	<0.20	<0.20	<0.20
	Arsenic	µg/g	21	522	REF and NE2	1	0	7.2	7.2	7.2
	Barium	µg/g				1	0	100	100	100
	Beryllium	µg/g				1	0	0.50	0.5	0.50
	Boron	µg/g				1	0	12.0	12	12
	Cadmium	µg/g	0.6	3.5	ISQG and PEL	1	0	0.60	0.6	0.60
	Chromium	µg/g				1	0	13.0	13	13
	Cobalt	µg/g				1	0	3.8	3.8	3.8
	Copper	µg/g	22	269	LEL and SEL	1	0	3.9	3.9	3.9
	Iron	µg/g				1	0	91300	91300	91300
	Lead	µg/g	37	412	LEL and SEL	1	0	10.0	10	10.0
	Manganese	µg/g				1	0	1270	1270	1270
	Molybdenum	µg/g	23	245	REF and NE2	1	0	12	12	12
	Nickel	µg/g	21	326	REF and NE2	1	0	9.9	10	10
	Selenium	µg/g	3.6	30	REF and NE2	1	0	1.3	1.3	1.3
	Silver	µg/g				1	0	0.1	0.1	0.1
	Strontium	µg/g				1	0	40	40	40
	Thallium	µg/g				1	1	<0.2	<0.2	<0.2
	Tin	µg/g				1	0	0.40	0.40	0.40
	Titanium	µg/g				1	0	360	360	360
	Uranium	µg/g	97	2296	REF and NE2	1	0	1.4	1.4	1.4
	Vanadium	µg/g				1	0	30	30	30
	Zinc	µg/g	123	315	ISQG and PEL	1	0	62	62	62
	Lead-210	Bq/g	0.9	20.8	LEL and SEL	1	0	0.45	0.45	0.45
	Polonium-210	Bq/g	0.8	12.1	LEL and SEL	1	0	0.42	0.42	0.42
	Radium-226	Bq/g	0.6	14.4	LEL and SEL	1	0	0.050	0.050	0.050
	Thorium-228	Bq/g				1	1	<0.02	<0.02	<0.02
	Thorium-230	Bq/g				1	0	0.020	0.020	0.020
	Thorium-232	Bq/g				1	1	<0.02	<0.02	<0.02
	Calcium	µg/g				1	0	2800	2800	2800
	Magnesium	µg/g				1	0	1000	1000	1000
	Phosphorus	µg/g				1	0	1400	1400	1400
	Postassium	µg/g				1	0	1200	1200	1200

Notes:

Chemical analysis is reported on a dry weight basis

Sediment samples are composites of 3 or more 0-2 cm fraction core samples

REF and NE2 values are from: Burnett-Seidel and Liber (2013) - Sediment quality values derived for application at Saskatchewan uranium operations; reference (REF) values based on reference sites unaffected by mining and milling (representing background), and no-effect level (NE2) values based on sites with no significant difference in benthic invertebrate community effects criteria of abundance, richness and evenness between reference and exposure locations.

LEL and SEL values are from: Thompson et al. (2005) – Sediment quality guidelines derived for application to uranium ore bearing regions of northern Saskatchewan and Ontario; lowest effect levels (LELs) and severe effect levels (SELs) from the "weighted method".

ISQG and PEL values are from: Canadian Council of Ministers of the Environment (CCME) – Canadian Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME 1999; updated September 2007; accessed June 2017: http://ceqg-rcqe.ccme.ca/). ISQG are Interim Sediment Quality Guidelines, PEL are Probable Effects Levels.

Mean values are indicated as "less than", "<", when one or more of the samples were below the analytical detection limit for the parameter

Table 3-6: Baseline Plankton Community Biomass and Chlorophyll a Summary

Class	Location					
	McGowan Lake (LA-1)	**Whitefish Lake (LA-5)**	**Whitefish Lake (LA-6)**	**Kratchkowsky Lake (LA-7)**	**Russell Lake (LAB-1)**	**Russell Lake (LAB-2)**
	14-Sep-16	**10-Sep-16**	**13-Sep-16**	**12-Sep-16**	**15-Sep-16**	**21-Sep-16**
Phytoplankton						
Chlorophyll a						
µg/L	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60
Biovolume (μm^3/L) by Class						
Bacillariophyceae	12,554,840,000	512,790,000	486,690,000	455,440,000	621,090,000	429,210,000
Chlorophyceae	465,610,000	36,264,000	30,886,000	79,848,000	23,936,000	5,584,000
Chrysophyceae	10,832,000	58,424,000	23,804,000	21,924,000	29,888,000	11,228,000
Cryptophyceae	152,226,000	42,444,000	17,388,000	249,750,000	688,200,000	834,144,000
Cyanophyceae	753,000,000	303,840,000	75,600,000	183,346,000	236,880,000	61,200,000
Dinophyceae	46,875,000	87,000,000	60,000,000	130,000,000	250,000,000	172,500,000
Euglenophyceae	9,000,000	-	-	4,500,000	31,500,000	27,000,000
Total	**13,992,383,000**	**1,040,762,000**	**694,368,000**	**1,124,808,000**	**1,881,494,000**	**1,540,866,000**
Percentage of Total Biovolume by Class						
Bacillariophyceae	90%	49%	70%	40%	33%	28%
Chlorophyceae	3.3%	3.5%	4.4%	7.1%	1.3%	0.4%
Chrysophyceae	0.1%	5.6%	3.4%	1.9%	1.6%	0.7%
Cryptophyceae	1.1%	4.1%	2.5%	22%	37%	54%
Cyanophyceae	5.4%	29%	11%	16%	13%	4.0%
Dinophyceae	0.3%	8.4%	8.6%	12%	13%	11%
Euglenophyceae	0.1%	0.0%	0.0%	0.4%	1.7%	1.8%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Zooplankton						
Biovolume (μm^3/L) by Class						
Unidentified Rotifers	1,556,000,000	3,700,000,000	2,140,000,000	584,000,000	12,240,000,000	14,200,000,000
Branchiopoda	2,071,112,000,000	7,204,000,000	5,516,000,000	389,320,000,000	68,760,000,000	98,900,000,000
Ciliata	7,170,000,000	529,200,000	260,000,000	1,128,400,000	2,988,000,000	14,017,600,000
Copepoda	128,900,000,000	680,000,000	162,000,000	184,440,000,000	47,180,000,000	60,160,000,000
Euglenoidea	-	-	-	21,600,000	-	-
Filosia	90,000,000	11,260,000	101,400,000	0	0	172,800,000
Heliozoa	-	36,400,000	-	-	-	346,000,000
Insecta	-	260,000,000	-	-	260,000,000	8,560,000,000
Lobosa	312,000,000	187,000,000	277,400,000	212,000,000	81,000,000	-
Monogononta	2,192,400,000	2,996,200,000	1,524,000,000	52,862,000,000	16,464,000,000	123,372,000,000
Total	**2,211,332,400,000**	**15,604,060,000**	**9,980,800,000**	**628,568,000,000**	**147,973,000,000**	**319,728,400,000**
Percentage of Total Biovolume by Class						
Unidentified Rotifers	0.1%	24%	21%	0.1%	8.3%	4.4%
Branchiopoda	94%	46%	55%	62%	46%	31%
Ciliata	0.3%	3.4%	2.6%	0.2%	2.0%	4.4%
Copepoda	5.8%	4.4%	1.6%	29%	32%	19%
Euglenoidea	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Filosia	0.0%	0.1%	1.0%	0.0%	0.0%	0.1%
Heliozoa	0.0%	0.2%	0.0%	0.0%	0.0%	0.1%
Insecta	0.0%	1.7%	0.0%	0.0%	0.2%	2.7%
Lobosa	0.0%	1.2%	2.8%	0.0%	0.1%	0.0%
Monogononta	0.1%	19%	15%	8.4%	11%	39%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Note:
Coloured cells indicate the most abundant class observed

Table 3-7A: Baseline Benthic Invertebrate Community Summary

Benthic Invertebrate Community Metrics

Location	Metric	Mean	Median	Maximum	Minimum	SE	SD
McGowan Lake (LA-1)	*Density*	981	1,014	1,043	886	39	68
	Taxa Richness	9	10	11	7	1	2
	Simpson's Evenness	0.44	0.43	0.51	0.38	0.03	0.05
	Simpson's Diversity	0.76	0.76	0.79	0.72	0.02	0.03
	Bray-Curtis Dissimilarity	0.50	0.53	0.58	0.38	0.05	0.08
Whitefish Lake (LA-5)	Density	9,597	9,929	14,086	5,271	1,289	2,882
	Taxa Richness	21	22	29	10	3	7
	Simpson's Evenness	0.23	0.17	0.40	0.15	0.04	0.09
	Simpson's Diversity	0.73	0.74	0.91	0.48	0.07	0.16
	Bray-Curtis Dissimilarity	0.39	0.40	0.59	0.19	0.08	0.17
Whitefish Lake (LA-6)	Density	10,163	8,571	19,143	3,171	2,335	5,222
	Taxa Richness	17	16	21	14	1	3
	Simpson's Evenness	0.18	0.15	0.28	0.13	0.02	0.05
	Simpson's Diversity	0.65	0.64	0.83	0.50	0.05	0.11
	Bray-Curtis Dissimilarity	0.37	0.44	0.47	0.13	0.06	0.12
Kratchkowsky Lake (LA-7)	Density	1,848	2,214	2,529	800	434	752
	Taxa Richness	11	11	11	11	0	0
	Simpson's Evenness	0.31	0.23	0.49	0.21	0.07	0.13
	Simpson's Diversity	0.69	0.63	0.84	0.60	0.06	0.11
	Bray-Curtis Dissimilarity	0.57	0.62	0.63	0.46	0.04	0.08
Kratchkowsky Lake (LA-7A)	Density	800	686	1,171	543	155	269
	Taxa Richness	7	8	8	6	1	1
	Simpson's Evenness	0.43	0.43	0.53	0.32	0.05	0.08
	Simpson's Diversity	0.67	0.68	0.71	0.61	0.02	0.04
	Bray-Curtis Dissimilarity	0.36	0.31	0.58	0.20	0.09	0.16
LA-8	Density	671	614	843	557	71	123
	Taxa Richness	10	11	12	7	1	2
	Simpson's Evenness	0.37	0.34	0.54	0.25	0.07	0.12
	Simpson's Diversity	0.72	0.73	0.75	0.69	0.02	0.03
	Bray-Curtis Dissimilarity	0.41	0.40	0.50	0.34	0.04	0.07
LA-9	Density	1,633	1,529	1,986	1,386	148	256
	Taxa Richness	11	6	21	6	4	7
	Simpson's Evenness	0.36	0.41	0.45	0.23	0.06	0.10
	Simpson's Diversity	0.69	0.66	0.79	0.63	0.04	0.07
	Bray-Curtis Dissimilarity	0.57	0.56	0.63	0.53	0.02	0.04
Williams Lake (LB-3)	Density	10,457	3,229	25,114	3,029	5,984	10,364
	Taxa Richness	15	14	18	13	1	2
	Simpson's Evenness	0.25	0.31	0.35	0.09	0.07	0.11
	Simpson's Diversity	0.68	0.79	0.79	0.45	0.09	0.16
	Bray-Curtis Dissimilarity	0.76	0.69	0.95	0.64	0.08	0.14
Russell Lake (LAB-1)	Density	3,505	2,757	5,286	2,471	730	1,265
	Taxa Richness	19	19	24	15	2	4
	Simpson's Evenness	0.34	0.33	0.40	0.28	0.03	0.05
	Simpson's Diversity	0.85	0.85	0.86	0.84	0.00	0.01
	Bray-Curtis Dissimilarity	0.71	0.64	0.85	0.63	0.06	0.10
Russell Lake (LAB-2)	Density	5,295	2,729	10,557	2,600	2,148	3,721
	Taxa Richness	24	26	27	20	2	3
	Simpson's Evenness	0.25	0.29	0.31	0.14	0.04	0.08
	Simpson's Diversity	0.82	0.85	0.88	0.75	0.03	0.05
	Bray-Curtis Dissimilarity	0.87	0.91	0.93	0.77	0.04	0.07

Notes:
SE - Standard Error
SD - Standard deviation

Table 3-7B: Baseline Benthic Invertebrate Community Summary
Abundance of Major Taxonomic Groups

Location	Major Taxonomic Groups		Relative Abundance					
	Major Taxon	Family	Mean	Median	Maximum	Minimum	SE	SD
McGowan Lake (LA-1)	Nematoda	Nematoda	0	0	0	0	0	0
	Microturbellaria	Microturbellaria	0	0	0	0	0	0
	Hirudinea	Erpobdellidae	0	0	0	0	0	0
	Oligochaeta	Naididae	14	0	43	0	12	20
	Gastropoda	Lymnaeidae	0	0	0	0	0	0
	Gastropoda	Planorbidae	0	0	0	0	0	0
	Gastropoda	Valvatidae	0	0	0	0	0	0
	Pelecypoda	Pisidiidae	10	0	29	0	8	13
	Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0	0	0	0	0	0
	Acari - Hydrachnidia	Arenuridae	0	0	0	0	0	0
	Acari - Hydrachnidia	Hygrobaetidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Lebertiidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Limnesiidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Oxidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Pionidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Unionicolidae	0	0	0	0	0	0
	Ostracoda	Ostracoda	19	29	29	0	8	13
	Copepoda-Cyclopoida	Copepoda-Cyclopoida	48	57	71	14	14	24
	Cladocera	Holopedidae	110	57	257	14	61	106
	Cladocera	Chydoridae	5	0	14	0	4	7
	Cladocera	Ilyocryptidae	0	0	0	0	0	0
	Cladocera	Macrothricidae	0	0	0	0	0	0
	Cladocera	Polyphemidae	5	0	14	0	4	7
	Cladocera	Sididae	5	0	14	0	4	7
	Amphipoda	Gammaridae	0	0	0	0	0	0
	Amphipoda	Hyalellidae	0	0	0	0	0	0
	Ephemeroptera	Baetiscidae	0	0	0	0	0	0
	Ephemeroptera	Caenidae	0	0	0	0	0	0
	Ephemeroptera	Ephemeridae	5	0	14	0	4	7
	Trichoptera	Hydroptilidae	5	0	14	0	4	7
	Trichoptera	Lepidosomatidae	0	0	0	0	0	0
	Trichoptera	Leptoceridae	0	0	0	0	0	0
	Trichoptera	Molannidae	0	0	0	0	0	0
	Trichoptera	Phryganeidae	0	0	0	0	0	0
	Megaloptera	Sialidae	0	0	0	0	0	0
	Diptera	Ceratopogonidae	0	0	0	0	0	0
	Diptera	Chaoboridae	324	343	371	257	28	49
	Diptera	Chironomidae	433	457	543	300	58	101
Whitefish Lake (LA-5)	Nematoda	Nematoda	17	0	71	0	12	28
	Microturbellaria	Microturbellaria	6	0	14	0	3	7
	Hirudinea	Erpobdellidae	0	0	0	0	0	0
	Oligochaeta	Naididae	40	29	114	0	19	43
	Gastropoda	Lymnaeidae	0	0	0	0	0	0
	Gastropoda	Planorbidae	11	0	57	0	10	23
	Gastropoda	Valvatidae	0	0	0	0	0	0
	Pelecypoda	Pisidiidae	391	214	1071	43	171	383
	Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0	0	0	0	0	0
	Acari - Hydrachnidia	Arenuridae	6	0	14	0	3	7
	Acari - Hydrachnidia	Hygrobaetidae	37	0	171	0	30	67
	Acari - Hydrachnidia	Lebertiidae	11	0	57	0	10	23
	Acari - Hydrachnidia	Limnesiidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Oxidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Pionidae	17	0	71	0	12	28
	Acari - Hydrachnidia	Unionicolidae	31	14	114	0	19	43
	Ostracoda	Ostracoda	280	257	571	57	74	166
	Copepoda-Cyclopoida	Copepoda-Cyclopoida	311	229	586	114	80	180
	Cladocera	Holopedidae	0	0	0	0	0	0
	Cladocera	Chydoridae	4277	4186	9871	771	1476	3301
	Cladocera	Ilyocryptidae	46	0	114	0	25	56
	Cladocera	Macrothricidae	1877	2171	3214	571	421	940
	Cladocera	Polyphemidae	0	0	0	0	0	0
	Cladocera	Sididae	34	0	114	0	20	46
	Amphipoda	Gammaridae	0	0	0	0	0	0
	Amphipoda	Hyalellidae	3	0	14	0	3	6
	Ephemeroptera	Baetiscidae	0	0	0	0	0	0
	Ephemeroptera	Caenidae	357	400	686	0	114	254
	Ephemeroptera	Ephemeridae	109	0	271	0	59	133
	Trichoptera	Hydroptilidae	0	0	0	0	0	0
	Trichoptera	Lepidosomatidae	0	0	0	0	0	0
	Trichoptera	Leptoceridae	11	0	57	0	10	23
	Trichoptera	Molannidae	0	0	0	0	0	0
	Trichoptera	Phryganeidae	0	0	0	0	0	0
	Megaloptera	Sialidae	0	0	0	0	0	0
	Diptera	Ceratopogonidae	26	29	43	0	7	17
	Diptera	Chaoboridae	0	0	0	0	0	0
	Diptera	Chironomidae	1697	1429	3414	1057	392	877

Table 3-7B Cont'd: Baseline Benthic Invertebrate Community Summary
Abundance of Major Taxonomic Groups

Location	Major Taxonomic Groups		Relative Abundance					
	Major Taxon	Family	Mean	Median	Maximum	Minimum	SE	SD
Whitefish Lake (LA-6)	Nematoda	Nematoda	43	43	114	0	19	42
	Microturbellaria	Microturbellaria	0	0	0	0	0	0
	Hirudinea	Erpobdellidae	0	0	0	0	0	0
	Oligochaeta	Naididae	106	0	343	0	62	139
	Gastropoda	Lymnaeidae	0	0	0	0	0	0
	Gastropoda	Planorbidae	0	0	0	0	0	0
	Gastropoda	Valvatidae	0	0	0	0	0	0
	Pelecypoda	Pisidiidae	174	143	357	29	50	112
	Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0	0	0	0	0	0
	Acari - Hydrachnidia	Arenuridae	0	0	0	0	0	0
	Acari - Hydrachnidia	Hygrobaetidae	23	14	71	0	12	26
	Acari - Hydrachnidia	Lebertiidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Limnesiidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Oxidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Pionidae	17	0	86	0	15	34
	Acari - Hydrachnidia	Unionicolidae	0	0	0	0	0	0
	Ostracoda	Ostracoda	706	371	2514	57	410	917
	Copepoda-Cyclopoida	Copepoda-Cyclopoida	174	114	343	0	64	142
	Cladocera	Holopedidae	0	0	0	0	0	0
	Cladocera	Chydoridae	5434	4357	10871	2214	1442	3225
	Cladocera	Ilyocryptidae	117	14	343	0	64	142
	Cladocera	Macrothricidae	1143	1029	1943	57	309	690
	Cladocera	Polyphemidae	0	0	0	0	0	0
	Cladocera	Sididae	26	0	114	0	20	45
	Amphipoda	Gammaridae	114	0	571	0	102	229
	Amphipoda	Hyalellidae	3	0	14	0	3	6
	Ephemeroptera	Baetiscidae	0	0	0	0	0	0
	Ephemeroptera	Caenidae	569	143	2443	0	420	939
	Ephemeroptera	Ephemeridae	14	14	43	0	7	16
	Trichoptera	Hydroptilidae	0	0	0	0	0	0
	Trichoptera	Lepidosomatidae	0	0	0	0	0	0
	Trichoptera	Leptoceridae	3	0	14	0	3	6
	Trichoptera	Molannidae	0	0	0	0	0	0
	Trichoptera	Phryganeidae	0	0	0	0	0	0
	Megaloptera	Sialidae	0	0	0	0	0	0
	Diptera	Ceratopogonidae	0	0	0	0	0	0
	Diptera	Chaoboridae	0	0	0	0	0	0
	Diptera	Chironomidae	1497	1157	2829	671	341	762
Kratchkowsky Lake (LA-7)	Nematoda	Nematoda	0	0	0	0	0	0
	Microturbellaria	Microturbellaria	0	0	0	0	0	0
	Hirudinea	Erpobdellidae	0	0	0	0	0	0
	Oligochaeta	Naididae	0	0	0	0	0	0
	Gastropoda	Lymnaeidae	0	0	0	0	0	0
	Gastropoda	Planorbidae	0	0	0	0	0	0
	Gastropoda	Valvatidae	0	0	0	0	0	0
	Pelecypoda	Pisidiidae	29	29	43	14	7	12
	Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0	0	0	0	0	0
	Acari - Hydrachnidia	Arenuridae	0	0	0	0	0	0
	Acari - Hydrachnidia	Hygrobaetidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Lebertiidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Limnesiidae	5	0	14	0	4	7
	Acari - Hydrachnidia	Oxidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Pionidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Unionicolidae	10	14	14	0	4	7
	Ostracoda	Ostracoda	129	100	243	43	49	84
	Copepoda-Cyclopoida	Copepoda-Cyclopoida	29	14	57	14	12	20
	Cladocera	Holopedidae	0	0	0	0	0	0
	Cladocera	Chydoridae	48	43	86	14	17	29
	Cladocera	Ilyocryptidae	0	0	0	0	0	0
	Cladocera	Macrothricidae	10	0	29	0	8	13
	Cladocera	Polyphemidae	0	0	0	0	0	0
	Cladocera	Sididae	10	0	29	0	8	13
	Amphipoda	Gammaridae	0	0	0	0	0	0
	Amphipoda	Hyalellidae	0	0	0	0	0	0
	Ephemeroptera	Baetiscidae	0	0	0	0	0	0
	Ephemeroptera	Caenidae	5	0	14	0	4	7
	Ephemeroptera	Ephemeridae	0	0	0	0	0	0
	Trichoptera	Hydroptilidae	0	0	0	0	0	0
	Trichoptera	Lepidosomatidae	0	0	0	0	0	0
	Trichoptera	Leptoceridae	0	0	0	0	0	0
	Trichoptera	Molannidae	0	0	0	0	0	0
	Trichoptera	Phryganeidae	0	0	0	0	0	0
	Megaloptera	Sialidae	0	0	0	0	0	0
	Diptera	Ceratopogonidae	0	0	0	0	0	0
	Diptera	Chaoboridae	14	14	29	0	7	12
	Diptera	Chironomidae	1562	2000	2143	543	417	723

Table 3-7B Cont'd: Baseline Benthic Invertebrate Community Summary
Abundance of Major Taxonomic Groups

Location	Major Taxonomic Groups		Relative Abundance					
	Major Taxon	Family	Mean	Median	Maximum	Minimum	SE	SD
Kratchkowsky Lake (LA-7A)	Nematoda	Nematoda	5	0	14	0	4	7
	Microturbellaria	Microturbellaria	0	0	0	0	0	0
	Hirudinea	Erpobdellidae	0	0	0	0	0	0
	Oligochaeta	Naididae	5	0	14	0	4	7
	Gastropoda	Lymnaeidae	0	0	0	0	0	0
	Gastropoda	Planorbidae	0	0	0	0	0	0
	Gastropoda	Valvatidae	0	0	0	0	0	0
	Pelecypoda	Pisidiidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0	0	0	0	0	0
	Acari - Hydrachnidia	Arenuridae	0	0	0	0	0	0
	Acari - Hydrachnidia	Hygrobaetidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Lebertiidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Limnesiidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Oxidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Pionidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Unionicolidae	0	0	0	0	0	0
	Ostracoda	Ostracoda	24	0	71	0	19	34
	Copepoda-Cyclopoida	Copepoda-Cyclopoida	76	29	200	0	51	88
	Cladocera	Holopedidae	0	0	0	0	0	0
	Cladocera	Chydoridae	0	0	0	0	0	0
	Cladocera	Ilyocryptidae	0	0	0	0	0	0
	Cladocera	Macrothricidae	0	0	0	0	0	0
	Cladocera	Polyphemidae	0	0	0	0	0	0
	Cladocera	Sididae	24	14	57	0	14	24
	Amphipoda	Gammaridae	0	0	0	0	0	0
	Amphipoda	Hyalellidae	0	0	0	0	0	0
	Ephemeroptera	Baetiscidae	0	0	0	0	0	0
	Ephemeroptera	Caenidae	0	0	0	0	0	0
	Ephemeroptera	Ephemeridae	0	0	0	0	0	0
	Trichoptera	Hydroptilidae	0	0	0	0	0	0
	Trichoptera	Lepidosomatidae	0	0	0	0	0	0
	Trichoptera	Leptoceridae	0	0	0	0	0	0
	Trichoptera	Molannidae	0	0	0	0	0	0
	Trichoptera	Phryganeidae	0	0	0	0	0	0
	Megaloptera	Sialidae	0	0	0	0	0	0
	Diptera	Ceratopogonidae	0	0	0	0	0	0
	Diptera	Chaoboridae	14	14	14	14	0	0
	Diptera	Chironomidae	652	629	814	514	71	124
LA-8	Nematoda	Nematoda	0	0	0	0	0	0
	Microturbellaria	Microturbellaria	0	0	0	0	0	0
	Hirudinea	Erpobdellidae	0	0	0	0	0	0
	Oligochaeta	Naididae	5	0	14	0	4	7
	Gastropoda	Lymnaeidae	0	0	0	0	0	0
	Gastropoda	Planorbidae	0	0	0	0	0	0
	Gastropoda	Valvatidae	0	0	0	0	0	0
	Pelecypoda	Pisidiidae	10	14	14	0	4	7
	Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0	0	0	0	0	0
	Acari - Hydrachnidia	Arenuridae	0	0	0	0	0	0
	Acari - Hydrachnidia	Hygrobaetidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Lebertiidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Limnesiidae	5	0	14	0	4	7
	Acari - Hydrachnidia	Oxidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Pionidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Unionicolidae	5	0	14	0	4	7
	Ostracoda	Ostracoda	0	0	0	0	0	0
	Copepoda-Cyclopoida	Copepoda-Cyclopoida	0	0	0	0	0	0
	Cladocera	Holopedidae	0	0	0	0	0	0
	Cladocera	Chydoridae	5	0	14	0	4	7
	Cladocera	Ilyocryptidae	0	0	0	0	0	0
	Cladocera	Macrothricidae	10	14	14	0	4	7
	Cladocera	Polyphemidae	0	0	0	0	0	0
	Cladocera	Sididae	0	0	0	0	0	0
	Amphipoda	Gammaridae	0	0	0	0	0	0
	Amphipoda	Hyalellidae	0	0	0	0	0	0
	Ephemeroptera	Baetiscidae	0	0	0	0	0	0
	Ephemeroptera	Caenidae	5	0	14	0	4	7
	Ephemeroptera	Ephemeridae	0	0	0	0	0	0
	Trichoptera	Hydroptilidae	0	0	0	0	0	0
	Trichoptera	Lepidosomatidae	0	0	0	0	0	0
	Trichoptera	Leptoceridae	0	0	0	0	0	0
	Trichoptera	Molannidae	0	0	0	0	0	0
	Trichoptera	Phryganeidae	0	0	0	0	0	0
	Megaloptera	Sialidae	0	0	0	0	0	0
	Diptera	Ceratopogonidae	0	0	0	0	0	0
	Diptera	Chaoboridae	67	71	86	43	10	18
	Diptera	Chironomidae	562	500	714	471	63	108

**Table 3-7B Cont'd: Baseline Benthic Invertebrate Community Summary
Abundance of Major Taxonomic Groups**

Location	Major Taxonomic Groups		Relative Abundance					
	Major Taxon	Family	Mean	Median	Maximum	Minimum	SE	SD
LA-9	Nematoda	Nematoda	0	0	0	0	0	0
	Microturbellaria	Microturbellaria	0	0	0	0	0	0
	Hirudinea	Erpobdellidae	0	0	0	0	0	0
	Oligochaeta	Naididae	19	0	57	0	16	27
	Gastropoda	Lymnaeidae	0	0	0	0	0	0
	Gastropoda	Planorbidae	0	0	0	0	0	0
	Gastropoda	Valvatidae	0	0	0	0	0	0
	Pelecypoda	Pisidiidae	10	14	14	0	4	7
	Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0	0	0	0	0	0
	Acari - Hydrachnidia	Arenuridae	10	0	29	0	8	13
	Acari - Hydrachnidia	Hygrobaetidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Lebertiidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Limnesiidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Oxidae	5	0	14	0	4	7
	Acari - Hydrachnidia	Pionidae	19	0	57	0	16	27
	Acari - Hydrachnidia	Unionicolidae	5	0	14	0	4	7
	Ostracoda	Ostracoda	62	0	186	0	51	88
	Copepoda-Cyclopoida	Copepoda-Cyclopoida	43	57	57	14	12	20
	Cladocera	Holopedidae	0	0	0	0	0	0
	Cladocera	Chydoridae	0	0	0	0	0	0
	Cladocera	Ilyocryptidae	0	0	0	0	0	0
	Cladocera	Macrothricidae	0	0	0	0	0	0
	Cladocera	Polyphemidae	0	0	0	0	0	0
	Cladocera	Sididae	0	0	0	0	0	0
	Amphipoda	Gammaridae	0	0	0	0	0	0
	Amphipoda	Hyalellidae	0	0	0	0	0	0
	Ephemeroptera	Baetiscidae	0	0	0	0	0	0
	Ephemeroptera	Caenidae	14	0	43	0	12	20
	Ephemeroptera	Ephemeridae	14	0	43	0	12	20
	Trichoptera	Hydroptilidae	0	0	0	0	0	0
	Trichoptera	Lepidosomatidae	0	0	0	0	0	0
	Trichoptera	Leptoceridae	0	0	0	0	0	0
	Trichoptera	Molannidae	0	0	0	0	0	0
	Trichoptera	Phryganeidae	0	0	0	0	0	0
	Megaloptera	Sialidae	5	0	14	0	4	7
	Diptera	Ceratopogonidae	10	0	29	0	8	13
	Diptera	Chaoboridae	476	586	729	114	152	262
	Diptera	Chironomidae	943	914	1314	600	169	292
Williams Lake (LB-3)	Nematoda	Nematoda	0	0	0	0	0	0
	Microturbellaria	Microturbellaria	0	0	0	0	0	0
	Hirudinea	Erpobdellidae	0	0	0	0	0	0
	Oligochaeta	Naididae	543	400	1100	129	236	409
	Gastropoda	Lymnaeidae	0	0	0	0	0	0
	Gastropoda	Planorbidae	0	0	0	0	0	0
	Gastropoda	Valvatidae	5	0	14	0	4	7
	Pelecypoda	Pisidiidae	476	343	971	114	209	362
	Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	38	0	114	0	31	54
	Acari - Hydrachnidia	Arenuridae	0	0	0	0	0	0
	Acari - Hydrachnidia	Hygrobaetidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Lebertiidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Limnesiidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Oxidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Pionidae	38	0	114	0	31	54
	Acari - Hydrachnidia	Unionicolidae	5	0	14	0	4	7
	Ostracoda	Ostracoda	43	14	114	0	29	51
	Copepoda-Cyclopoida	Copepoda-Cyclopoida	57	57	114	0	27	47
	Cladocera	Holopedidae	0	0	0	0	0	0
	Cladocera	Chydoridae	38	0	114	0	31	54
	Cladocera	Ilyocryptidae	0	0	0	0	0	0
	Cladocera	Macrothricidae	38	0	114	0	31	54
	Cladocera	Polyphemidae	0	0	0	0	0	0
	Cladocera	Sididae	10	0	29	0	8	13
	Amphipoda	Gammaridae	0	0	0	0	0	0
	Amphipoda	Hyalellidae	0	0	0	0	0	0
	Ephemeroptera	Baetiscidae	0	0	0	0	0	0
	Ephemeroptera	Caenidae	5	0	14	0	4	7
	Ephemeroptera	Ephemeridae	0	0	0	0	0	0
	Trichoptera	Hydroptilidae	0	0	0	0	0	0
	Trichoptera	Lepidosomatidae	0	0	0	0	0	0
	Trichoptera	Leptoceridae	0	0	0	0	0	0
	Trichoptera	Molannidae	0	0	0	0	0	0
	Trichoptera	Phryganeidae	0	0	0	0	0	0
	Megaloptera	Sialidae	5	0	14	0	4	7
	Diptera	Ceratopogonidae	0	0	0	0	0	0
	Diptera	Chaoboridae	514	200	1143	200	257	444
	Diptera	Chironomidae	8643	1500	23229	1200	5955	10314

Table 3-7B Cont'd: Baseline Benthic Invertebrate Community Summary
Abundance of Major Taxonomic Groups

Location	Major Taxonomic Groups		Relative Abundance					
	Major Taxon	Family	Mean	Median	Maximum	Minimum	SE	SD
Russell Lake (LAB-1)	Nematoda	Nematoda	57	43	129	0	31	53
	Microturbellaria	Microturbellaria	5	0	14	0	4	7
	Hirudinea	Erpobdellidae	5	0	14	0	4	7
	Oligochaeta	Naididae	586	586	686	486	47	82
	Gastropoda	Lymnaeidae	0	0	0	0	0	0
	Gastropoda	Planorbidae	0	0	0	0	0	0
	Gastropoda	Valvatidae	0	0	0	0	0	0
	Pelecypoda	Pisidiidae	438	386	671	257	100	173
	Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	5	0	14	0	4	7
	Acari - Hydrachnidia	Arenuridae	0	0	0	0	0	0
	Acari - Hydrachnidia	Hygrobaetidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Lebertiidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Limnesiidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Oxidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Pionidae	14	14	14	14	0	0
	Acari - Hydrachnidia	Unionicolidae	19	14	29	14	4	7
	Ostracoda	Ostracoda	29	14	57	14	12	20
	Copepoda-Cyclopoida	Copepoda-Cyclopoida	129	157	200	29	42	73
	Cladocera	Holopedidae	0	0	0	0	0	0
	Cladocera	Chydoridae	0	0	0	0	0	0
	Cladocera	Ilyocryptidae	5	0	14	0	4	7
	Cladocera	Macrothricidae	10	0	29	0	8	13
	Cladocera	Polyphemidae	0	0	0	0	0	0
	Cladocera	Sididae	5	0	14	0	4	7
	Amphipoda	Gammaridae	0	0	0	0	0	0
	Amphipoda	Hyalellidae	0	0	0	0	0	0
	Ephemeroptera	Baetiscidae	0	0	0	0	0	0
	Ephemeroptera	Caenidae	0	0	0	0	0	0
	Ephemeroptera	Ephemeridae	0	0	0	0	0	0
	Trichoptera	Hydroptilidae	0	0	0	0	0	0
	Trichoptera	Lepidosomatidae	0	0	0	0	0	0
	Trichoptera	Leptoceridae	0	0	0	0	0	0
	Trichoptera	Molannidae	5	0	14	0	4	7
	Trichoptera	Phryganeidae	0	0	0	0	0	0
	Megaloptera	Sialidae	0	0	0	0	0	0
	Diptera	Ceratopogonidae	0	0	0	0	0	0
	Diptera	Chaoboridae	5	0	14	0	4	7
	Diptera	Chironomidae	2190	1643	3814	1114	675	1168
Russell Lake (LAB-2)	Nematoda	Nematoda	86	100	129	29	24	42
	Microturbellaria	Microturbellaria	0	0	0	0	0	0
	Hirudinea	Erpobdellidae	0	0	0	0	0	0
	Oligochaeta	Naididae	52	71	71	14	16	27
	Gastropoda	Lymnaeidae	5	0	14	0	4	7
	Gastropoda	Planorbidae	0	0	0	0	0	0
	Gastropoda	Valvatidae	0	0	0	0	0	0
	Pelecypoda	Pisidiidae	524	543	771	257	121	210
	Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0	0	0	0	0	0
	Acari - Hydrachnidia	Arenuridae	0	0	0	0	0	0
	Acari - Hydrachnidia	Hygrobaetidae	29	29	57	0	13	23
	Acari - Hydrachnidia	Lebertiidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Limnesiidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Oxidae	0	0	0	0	0	0
	Acari - Hydrachnidia	Pionidae	10	14	14	0	4	7
	Acari - Hydrachnidia	Unionicolidae	5	0	14	0	4	7
	Ostracoda	Ostracoda	5	0	14	0	4	7
	Copepoda-Cyclopoida	Copepoda-Cyclopoida	33	43	57	0	14	24
	Cladocera	Holopedidae	0	0	0	0	0	0
	Cladocera	Chydoridae	14	0	43	0	12	20
	Cladocera	Ilyocryptidae	0	0	0	0	0	0
	Cladocera	Macrothricidae	19	0	57	0	16	27
	Cladocera	Polyphemidae	0	0	0	0	0	0
	Cladocera	Sididae	10	0	29	0	8	13
	Amphipoda	Gammaridae	0	0	0	0	0	0
	Amphipoda	Hyalellidae	0	0	0	0	0	0
	Ephemeroptera	Baetiscidae	5	0	14	0	4	7
	Ephemeroptera	Caenidae	5	0	14	0	4	7
	Ephemeroptera	Ephemeridae	176	100	429	0	106	183
	Trichoptera	Hydroptilidae	0	0	0	0	0	0
	Trichoptera	Lepidosomatidae	5	0	14	0	4	7
	Trichoptera	Leptoceridae	43	29	71	29	12	20
	Trichoptera	Molannidae	10	0	29	0	8	13
	Trichoptera	Phryganeidae	5	0	14	0	4	7
	Megaloptera	Sialidae	0	0	0	0	0	0
	Diptera	Ceratopogonidae	10	0	29	0	8	13
	Diptera	Chaoboridae	0	0	0	0	0	0
	Diptera	Chironomidae	4248	1986	9014	1743	1947	3372

Notes:
SE - Standard Error
SD - Standard deviation

Table 3-7C: Baseline Benthic Invertebrate Community Summary
Percent Relative Abundance of Major Taxonomic Groups

Location	Major Taxonomic Groups		Percent Relative Abundance					
	Major Taxon	Family	Mean	Median	Maximum	Minimum	SE	SD
McGowan Lake (LA-1)	Nematoda	Nematoda	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Microturbellaria	Microturbellaria	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Hirudinea	Erpobdellidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Oligochaeta	Naididae	1.6%	0.0%	4.8%	0.0%	1.3%	2.3%
	Gastropoda	Lymnaeidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Gastropoda	Planorbidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Gastropoda	Valvatidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Pelecypoda	Pisidiidae	0.9%	0.0%	2.7%	0.0%	0.7%	1.3%
	Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Arenuridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Hygrobaetidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Lebertiidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Limnesiidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Oxidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Pionidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Unionicolidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ostracoda	Ostracoda	1.9%	2.7%	2.8%	0.0%	0.8%	1.3%
	Copepoda-Cyclopoida	Copepoda-Cyclopoida	5.0%	5.5%	8.1%	1.4%	1.6%	2.7%
	Cladocera	Holopedidae	11.1%	6.5%	25.4%	1.4%	6.0%	10.3%
	Cladocera	Chydoridae	0.5%	0.0%	1.4%	0.0%	0.4%	0.7%
	Cladocera	Ilyocryptidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Macrothricidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Polyphemidae	0.5%	0.0%	1.4%	0.0%	0.4%	0.7%
	Cladocera	Sididae	0.5%	0.0%	1.4%	0.0%	0.4%	0.7%
	Amphipoda	Gammaridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Amphipoda	Hyalellidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ephemeroptera	Baetiscidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ephemeroptera	Caenidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ephemeroptera	Ephemeridae	0.5%	0.0%	1.4%	0.0%	0.4%	0.6%
	Trichoptera	Hydroptilidae	0.5%	0.0%	1.4%	0.0%	0.4%	0.6%
	Trichoptera	Lepidosomatidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Leptoceridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Molannidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Phryganeidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Megaloptera	Sialidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Diptera	Ceratopogonidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Diptera	Chaoboridae	32.8%	32.9%	36.6%	29.0%	1.8%	3.1%
	Diptera	Chironomidae	44.4%	51.6%	52.1%	29.6%	6.1%	10.5%
Whitefish Lake (LA-5)	Nematoda	Nematoda	0.2%	0.0%	0.7%	0.0%	0.1%	0.3%
	Microturbellaria	Microturbellaria	0.1%	0.0%	0.2%	0.0%	0.0%	0.1%
	Hirudinea	Erpobdellidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Oligochaeta	Naididae	0.5%	0.5%	1.1%	0.0%	0.2%	0.4%
	Gastropoda	Lymnaeidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Gastropoda	Planorbidae	0.1%	0.0%	0.7%	0.0%	0.1%	0.3%
	Gastropoda	Valvatidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Pelecypoda	Pisidiidae	5.3%	2.0%	13.0%	0.3%	2.4%	5.3%
	Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Arenuridae	0.1%	0.0%	0.2%	0.0%	0.0%	0.1%
	Acari - Hydrachnidia	Hygrobaetidae	0.5%	0.0%	2.1%	0.0%	0.4%	0.8%
	Acari - Hydrachnidia	Lebertiidae	0.1%	0.0%	0.7%	0.0%	0.1%	0.3%
	Acari - Hydrachnidia	Limnesiidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Oxidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Pionidae	0.3%	0.0%	1.4%	0.0%	0.2%	0.5%
	Acari - Hydrachnidia	Unionicolidae	0.3%	0.1%	0.8%	0.0%	0.1%	0.3%
	Ostracoda	Ostracoda	2.9%	2.9%	4.3%	0.7%	0.6%	1.3%
	Copepoda-Cyclopoida	Copepoda-Cyclopoida	4.2%	2.2%	11.1%	0.8%	1.6%	3.7%
	Cladocera	Holopedidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Chydoridae	38.6%	40.0%	70.1%	14.2%	9.8%	21.9%
	Cladocera	Ilyocryptidae	0.4%	0.0%	1.1%	0.0%	0.2%	0.5%
	Cladocera	Macrothricidae	18.8%	15.4%	30.7%	10.8%	3.3%	7.4%
	Cladocera	Polyphemidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Sididae	0.4%	0.0%	1.4%	0.0%	0.2%	0.5%
	Amphipoda	Gammaridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Amphipoda	Hyalellidae	0.0%	0.0%	0.2%	0.0%	0.0%	0.1%
	Ephemeroptera	Baetiscidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ephemeroptera	Caenidae	4.9%	4.9%	13.0%	0.0%	2.0%	4.5%
	Ephemeroptera	Ephemeridae	1.7%	0.0%	5.1%	0.0%	1.0%	2.1%
	Trichoptera	Hydroptilidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Lepidosomatidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Leptoceridae	0.1%	0.0%	0.7%	0.0%	0.1%	0.3%
	Trichoptera	Molannidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Phryganeidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Megaloptera	Sialidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Diptera	Ceratopogonidae	0.4%	0.3%	0.8%	0.0%	0.1%	0.3%
	Diptera	Chaoboridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Diptera	Chironomidae	20.2%	14.3%	41.4%	7.7%	5.6%	12.5%

**Table 3-7C Cont'd: Baseline Benthic Invertebrate Community Summary
Percent Relative Abundance of Major Taxonomic Groups**

Location	Major Taxonomic Groups		Percent Relative Abundance					
	Major Taxon	Family	Mean	Median	Maximum	Minimum	SE	SD
Whitefish Lake (LA-6)	Nematoda	Nematoda	0.5%	0.6%	1.4%	0.0%	0.2%	0.5%
	Microturbellaria	Microturbellaria	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Hirudinea	Erpobdellidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Oligochaeta	Naididae	0.8%	0.0%	2.2%	0.0%	0.4%	1.0%
	Gastropoda	Lymnaeidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Gastropoda	Planorbidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Gastropoda	Valvatidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Pelecypoda	Pisidiidae	1.8%	1.3%	3.1%	0.7%	0.4%	1.0%
	Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Arenuridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Hygrobaetidae	0.3%	0.1%	0.8%	0.0%	0.1%	0.3%
	Acari - Hydrachnidia	Lebertiidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Limnesiidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Oxidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Pionidae	0.1%	0.0%	0.4%	0.0%	0.1%	0.2%
	Acari - Hydrachnidia	Unionicolidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ostracoda	Ostracoda	5.2%	4.3%	13.1%	1.0%	1.9%	4.3%
	Copepoda-Cyclopoida	Copepoda-Cyclopoida	1.9%	1.8%	4.0%	0.0%	0.6%	1.3%
	Cladocera	Holopedidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Chydoridae	54.1%	56.8%	69.8%	30.3%	6.0%	13.4%
	Cladocera	Ilyocryptidae	1.1%	0.5%	4.0%	0.0%	0.7%	1.5%
	Cladocera	Macrothricidae	10.6%	10.1%	21.5%	1.8%	2.9%	6.4%
	Cladocera	Polyphemidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Sididae	0.4%	0.0%	1.3%	0.0%	0.2%	0.5%
	Amphipoda	Gammaridae	0.6%	0.0%	3.0%	0.0%	0.5%	1.2%
	Amphipoda	Hyalellidae	0.0%	0.0%	0.2%	0.0%	0.0%	0.1%
	Ephemeroptera	Baetiscidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ephemeroptera	Caenidae	6.4%	0.9%	28.5%	0.0%	5.0%	11.1%
	Ephemeroptera	Ephemeridae	0.1%	0.1%	0.5%	0.0%	0.1%	0.2%
	Trichoptera	Hydroptilidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Lepidosomatidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Leptoceridae	0.0%	0.0%	0.2%	0.0%	0.0%	0.1%
	Trichoptera	Molannidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Phryganeidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Megaloptera	Sialidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Diptera	Ceratopogonidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Diptera	Chaoboridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Diptera	Chironomidae	16.2%	13.5%	24.8%	9.5%	2.6%	5.8%
Kratchkowsky Lake (LA-7)	Nematoda	Nematoda	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Microturbellaria	Microturbellaria	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Hirudinea	Erpobdellidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Oligochaeta	Naididae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Gastropoda	Lymnaeidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Gastropoda	Planorbidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Gastropoda	Valvatidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Pelecypoda	Pisidiidae	2.4%	1.1%	5.4%	0.6%	1.2%	2.1%
	Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Arenuridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Hygrobaetidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Lebertiidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Limnesiidae	0.2%	0.0%	0.6%	0.0%	0.2%	0.3%
	Acari - Hydrachnidia	Oxidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Pionidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Unionicolidae	0.8%	0.6%	1.8%	0.0%	0.4%	0.7%
	Ostracoda	Ostracoda	8.0%	9.6%	12.5%	1.9%	2.6%	4.5%
	Copepoda-Cyclopoida	Copepoda-Cyclopoida	2.8%	0.6%	7.1%	0.6%	1.8%	3.1%
	Cladocera	Holopedidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Chydoridae	2.5%	1.8%	3.9%	1.7%	0.6%	1.0%
	Cladocera	Ilyocryptidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Macrothricidae	0.4%	0.0%	1.1%	0.0%	0.3%	0.5%
	Cladocera	Polyphemidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Sididae	1.2%	0.0%	3.6%	0.0%	1.0%	1.7%
	Amphipoda	Gammaridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Amphipoda	Hyalellidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ephemeroptera	Baetiscidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ephemeroptera	Caenidae	0.2%	0.0%	0.6%	0.0%	0.2%	0.3%
	Ephemeroptera	Ephemeridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Hydroptilidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Lepidosomatidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Leptoceridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Molannidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Phryganeidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Megaloptera	Sialidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Diptera	Ceratopogonidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Diptera	Chaoboridae	0.6%	0.6%	1.3%	0.0%	0.3%	0.5%
	Diptera	Chironomidae	81.0%	84.7%	90.3%	67.9%	5.5%	9.6%

Table 3-7C Cont'd: Baseline Benthic Invertebrate Community Summary
Percent Relative Abundance of Major Taxonomic Groups

Location	Major Taxonomic Groups		Percent Relative Abundance					
	Major Taxon	Family	Mean	Median	Maximum	Minimum	SE	SD
Kratchkowsky Lake (LA-7A)	Nematoda	Nematoda	0.4%	0.0%	1.2%	0.0%	0.3%	0.6%
	Microturbellaria	Microturbellaria	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Hirudinea	Erpobdellidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Oligochaeta	Naididae	0.9%	0.0%	2.6%	0.0%	0.7%	1.2%
	Gastropoda	Lymnaeidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Gastropoda	Planorbidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Gastropoda	Valvatidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Pelecypoda	Pisidiidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Arenuridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Hygrobaetidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Lebertiidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Limnesiidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Oxidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Pionidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Unionicolidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ostracoda	Ostracoda	2.0%	0.0%	6.1%	0.0%	1.7%	2.9%
	Copepoda-Cyclopoida	Copepoda-Cyclopoida	7.1%	4.2%	17.1%	0.0%	4.2%	7.3%
	Cladocera	Holopedidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Chydoridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Ilyocryptidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Macrothricidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Polyphemidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Sididae	2.3%	2.1%	4.9%	0.0%	1.2%	2.0%
	Amphipoda	Gammaridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Amphipoda	Hyalellidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ephemeroptera	Baetiscidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ephemeroptera	Caenidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ephemeroptera	Ephemeridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Hydroptilidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Lepidosomatidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Leptoceridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Molannidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Phryganeidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Megaloptera	Sialidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Diptera	Ceratopogonidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Diptera	Chaoboridae	2.0%	2.1%	2.6%	1.2%	0.3%	0.6%
	Diptera	Chironomidae	85.3%	91.7%	94.7%	69.5%	6.5%	11.2%
LA-8	Nematoda	Nematoda	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Microturbellaria	Microturbellaria	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Hirudinea	Erpobdellidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Oligochaeta	Naididae	0.6%	0.0%	1.7%	0.0%	0.5%	0.8%
	Gastropoda	Lymnaeidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Gastropoda	Planorbidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Gastropoda	Valvatidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Pelecypoda	Pisidiidae	1.3%	1.7%	2.3%	0.0%	0.6%	1.0%
	Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Arenuridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Hygrobaetidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Lebertiidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Limnesiidae	0.8%	0.0%	2.3%	0.0%	0.6%	1.1%
	Acari - Hydrachnidia	Oxidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Pionidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Unionicolidae	0.9%	0.0%	2.6%	0.0%	0.7%	1.2%
	Ostracoda	Ostracoda	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Copepoda-Cyclopoida	Copepoda-Cyclopoida	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Holopedidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Chydoridae	0.6%	0.0%	1.7%	0.0%	0.5%	0.8%
	Cladocera	Ilyocryptidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Macrothricidae	1.4%	1.7%	2.6%	0.0%	0.6%	1.1%
	Cladocera	Polyphemidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Sididae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Amphipoda	Gammaridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Amphipoda	Hyalellidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ephemeroptera	Baetiscidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ephemeroptera	Caenidae	0.9%	0.0%	2.6%	0.0%	0.7%	1.2%
	Ephemeroptera	Ephemeridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Hydroptilidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Lepidosomatidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Leptoceridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Molannidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Phryganeidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Megaloptera	Sialidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Diptera	Ceratopogonidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Diptera	Chaoboridae	10.0%	8.5%	14.0%	7.7%	1.6%	2.8%
	Diptera	Chironomidae	83.6%	84.6%	84.7%	81.4%	0.9%	1.5%

Table 3-7C Cont'd: Baseline Benthic Invertebrate Community Summary
Percent Relative Abundance of Major Taxonomic Groups

Location	Major Taxonomic Groups		Percent Relative Abundance					
	Major Taxon	Family	Mean	Median	Maximum	Minimum	SE	SD
LA-9	Nematoda	Nematoda	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Microturbellaria	Microturbellaria	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Hirudinea	Erpobdellidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Oligochaeta	Naididae	1.0%	0.0%	2.9%	0.0%	0.8%	1.4%
	Gastropoda	Lymnaeidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Gastropoda	Planorbidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Gastropoda	Valvatidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Pelecypoda	Pisidiidae	0.6%	0.7%	0.9%	0.0%	0.2%	0.4%
	Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Arenuridae	0.5%	0.0%	1.4%	0.0%	0.4%	0.7%
	Acari - Hydrachnidia	Hygrobaetidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Lebertiidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Limnesiidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Oxidae	0.2%	0.0%	0.7%	0.0%	0.2%	0.3%
	Acari - Hydrachnidia	Pionidae	1.0%	0.0%	2.9%	0.0%	0.8%	1.4%
	Acari - Hydrachnidia	Unionicolidae	0.2%	0.0%	0.7%	0.0%	0.2%	0.3%
	Ostracoda	Ostracoda	3.1%	0.0%	9.4%	0.0%	2.5%	4.4%
	Copepoda-Cyclopoida	Copepoda-Cyclopoida	2.6%	2.9%	4.1%	0.9%	0.8%	1.3%
	Cladocera	Holopedidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Chydoridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Ilyocryptidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Macrothricidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Polyphemidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Sididae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Amphipoda	Gammaridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Amphipoda	Hyalellidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ephemeroptera	Baetiscidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ephemeroptera	Caenidae	0.7%	0.0%	2.2%	0.0%	0.6%	1.0%
	Ephemeroptera	Ephemeridae	0.7%	0.0%	2.2%	0.0%	0.6%	1.0%
	Trichoptera	Hydroptilidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Lepidosomatidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Leptoceridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Molannidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Phryganeidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Megaloptera	Sialidae	0.2%	0.0%	0.7%	0.0%	0.2%	0.3%
	Diptera	Ceratopogonidae	0.5%	0.0%	1.4%	0.0%	0.4%	0.7%
	Diptera	Chaoboridae	32.2%	38.3%	52.6%	5.8%	11.3%	19.6%
	Diptera	Chironomidae	56.4%	59.8%	66.2%	43.3%	5.6%	9.6%
Williams Lake (LB-3)	Nematoda	Nematoda	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Microturbellaria	Microturbellaria	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Hirudinea	Erpobdellidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Oligochaeta	Naididae	15.9%	13.2%	34.1%	0.5%	8.0%	13.8%
	Gastropoda	Lymnaeidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Gastropoda	Planorbidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Gastropoda	Valvatidae	0.2%	0.0%	0.5%	0.0%	0.1%	0.2%
	Pelecypoda	Pisidiidae	6.1%	3.9%	10.6%	3.8%	1.9%	3.2%
	Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0.2%	0.0%	0.5%	0.0%	0.1%	0.2%
	Acari - Hydrachnidia	Arenuridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Hygrobaetidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Lebertiidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Limnesiidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Oxidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Pionidae	0.2%	0.0%	0.5%	0.0%	0.1%	0.2%
	Acari - Hydrachnidia	Unionicolidae	0.1%	0.0%	0.4%	0.0%	0.1%	0.2%
	Ostracoda	Ostracoda	0.3%	0.5%	0.5%	0.0%	0.1%	0.2%
	Copepoda-Cyclopoida	Copepoda-Cyclopoida	1.8%	1.8%	3.8%	0.0%	0.9%	1.5%
	Cladocera	Holopedidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Chydoridae	0.2%	0.0%	0.5%	0.0%	0.1%	0.2%
	Cladocera	Ilyocryptidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Macrothricidae	0.2%	0.0%	0.5%	0.0%	0.1%	0.2%
	Cladocera	Polyphemidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Sididae	0.3%	0.0%	0.9%	0.0%	0.3%	0.4%
	Amphipoda	Gammaridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Amphipoda	Hyalellidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ephemeroptera	Baetiscidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ephemeroptera	Caenidae	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
	Ephemeroptera	Ephemeridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Hydroptilidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Lepidosomatidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Leptoceridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Molannidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Phryganeidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Megaloptera	Sialidae	0.1%	0.0%	0.4%	0.0%	0.1%	0.2%
	Diptera	Ceratopogonidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Diptera	Chaoboridae	14.9%	6.2%	37.7%	0.8%	9.4%	16.3%
	Diptera	Chironomidae	59.5%	46.5%	92.5%	39.6%	13.6%	23.5%

Table 3-7C Cont'd: Baseline Benthic Invertebrate Community Summary
Percent Relative Abundance of Major Taxonomic Groups

Location	Major Taxonomic Groups		Percent Relative Abundance					
	Major Taxon	Family	Mean	Median	Maximum	Minimum	SE	SD
Russell Lake (LAB-1)	Nematoda	Nematoda	1.4%	1.7%	2.4%	0.0%	0.6%	1.0%
	Microturbellaria	Microturbellaria	0.2%	0.0%	0.5%	0.0%	0.1%	0.2%
	Hirudinea	Erpobdellidae	0.1%	0.0%	0.3%	0.0%	0.1%	0.1%
	Oligochaeta	Naididae	19.4%	21.2%	27.7%	9.2%	4.4%	7.7%
	Gastropoda	Lymnaeidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Gastropoda	Planorbidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Gastropoda	Valvatidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Pelecypoda	Pisidiidae	12.5%	12.7%	15.6%	9.3%	1.5%	2.6%
	Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0.1%	0.0%	0.3%	0.0%	0.1%	0.1%
	Acari - Hydrachnidia	Arenuridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Hygrobaetidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Lebertiidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Limnesiidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Oxidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Pionidae	0.5%	0.5%	0.6%	0.3%	0.1%	0.1%
	Acari - Hydrachnidia	Unionicolidae	0.6%	0.5%	1.2%	0.3%	0.2%	0.4%
	Ostracoda	Ostracoda	0.7%	0.6%	1.1%	0.5%	0.1%	0.3%
	Copepoda-Cyclopoida	Copepoda-Cyclopoida	4.7%	6.4%	7.3%	0.5%	1.7%	3.0%
	Cladocera	Holopedidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Chydoridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Ilyocryptidae	0.2%	0.0%	0.6%	0.0%	0.2%	0.3%
	Cladocera	Macrothricidae	0.2%	0.0%	0.5%	0.0%	0.1%	0.3%
	Cladocera	Polyphemidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Sididae	0.2%	0.0%	0.6%	0.0%	0.2%	0.3%
	Amphipoda	Gammaridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Amphipoda	Hyalellidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ephemeroptera	Baetiscidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ephemeroptera	Caenidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ephemeroptera	Ephemeridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Hydroptilidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Lepidosomatidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Leptoceridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Molannidae	0.1%	0.0%	0.3%	0.0%	0.1%	0.1%
	Trichoptera	Phryganeidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Megaloptera	Sialidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Diptera	Ceratopogonidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Diptera	Chaoboridae	0.2%	0.0%	0.5%	0.0%	0.1%	0.2%
	Diptera	Chironomidae	58.9%	59.6%	72.2%	45.1%	6.4%	11.1%
Russell Lake (LAB-2)	Nematoda	Nematoda	2.0%	1.2%	3.7%	1.1%	0.7%	1.2%
	Microturbellaria	Microturbellaria	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Hirudinea	Erpobdellidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Oligochaeta	Naididae	1.8%	2.6%	2.7%	0.1%	0.7%	1.2%
	Gastropoda	Lymnaeidae	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%
	Gastropoda	Planorbidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Gastropoda	Valvatidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Pelecypoda	Pisidiidae	12.5%	9.4%	20.9%	7.3%	3.4%	6.0%
	Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Arenuridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Hygrobaetidae	1.1%	1.0%	2.2%	0.0%	0.5%	0.9%
	Acari - Hydrachnidia	Lebertiidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Limnesiidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Oxidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Acari - Hydrachnidia	Pionidae	0.2%	0.1%	0.5%	0.0%	0.1%	0.2%
	Acari - Hydrachnidia	Unionicolidae	0.2%	0.0%	0.5%	0.0%	0.1%	0.3%
	Ostracoda	Ostracoda	0.2%	0.0%	0.5%	0.0%	0.1%	0.2%
	Copepoda-Cyclopoida	Copepoda-Cyclopoida	0.7%	0.5%	1.6%	0.0%	0.4%	0.7%
	Cladocera	Holopedidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Chydoridae	0.5%	0.0%	1.6%	0.0%	0.4%	0.7%
	Cladocera	Ilyocryptidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Macrothricidae	0.7%	0.0%	2.1%	0.0%	0.6%	1.0%
	Cladocera	Polyphemidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cladocera	Sididae	0.3%	0.0%	1.0%	0.0%	0.3%	0.5%
	Amphipoda	Gammaridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Amphipoda	Hyalellidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ephemeroptera	Baetiscidae	0.2%	0.0%	0.5%	0.0%	0.1%	0.3%
	Ephemeroptera	Caenidae	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%
	Ephemeroptera	Ephemeridae	2.6%	3.8%	4.1%	0.0%	1.1%	1.9%
	Trichoptera	Hydroptilidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Trichoptera	Lepidosomatidae	0.2%	0.0%	0.5%	0.0%	0.1%	0.2%
	Trichoptera	Leptoceridae	0.9%	1.0%	1.1%	0.7%	0.1%	0.2%
	Trichoptera	Molannidae	0.3%	0.0%	1.0%	0.0%	0.3%	0.5%
	Trichoptera	Phryganeidae	0.2%	0.0%	0.5%	0.0%	0.1%	0.2%
	Megaloptera	Sialidae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Diptera	Ceratopogonidae	0.1%	0.0%	0.3%	0.0%	0.1%	0.1%
	Diptera	Chaoboridae	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Diptera	Chironomidae	75.1%	72.8%	85.4%	67.0%	4.4%	7.7%

Notes:
SE - Standard Error
SD - Standard deviation

Table 3-7D: Baseline Benthic Invertebrate Community Summary
Absolute and Relative Abundance of Functional Feeding Groups

Location	Benthic Invertebrate Functional Feeding Group	Abundance					
		Mean	Median	Maximum	Minimum	SE	SD
McGowan Lake (LA-1)	**Absolute Density**						
	Collector-Filterer	205	143	343	129	56	98
	Collector-Gatherer	267	200	414	186	60	105
	Omnivore	0	0	0	0	0	0
	Predator	476	471	629	329	71	123
	Scraper	0	0	0	0	0	0
	Shredder	33	0	100	0	27	47
	Relative Density						
	Collector-Filterer	20.8%	16.1%	33.8%	12.3%	5.4%	9.4%
	Collector-Gatherer	28.1%	19.7%	46.8%	17.8%	7.6%	13.2%
	Omnivore	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Predator	47.9%	46.5%	60.3%	37.1%	5.5%	9.5%
	Scraper	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Shredder	3.2%	0.0%	9.6%	0.0%	2.6%	4.5%
Whitefish Lake (LA-5)	**Absolute Density**						
	Collector-Filterer	6886	8357	12271	2286	1682	3761
	Collector-Gatherer	2037	1343	4157	886	540	1207
	Omnivore	0	0	0	0	0	0
	Predator	540	471	814	343	72	162
	Scraper	11	0	57	0	10	23
	Shredder	123	57	271	0	55	123
	Relative Density						
	Collector-Filterer	66.5%	79.9%	87.1%	35.7%	10.0%	22.3%
	Collector-Gatherer	25.9%	11.6%	50.4%	8.9%	8.7%	19.5%
	Omnivore	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Predator	6.1%	5.9%	9.9%	3.2%	1.0%	2.2%
	Scraper	0.1%	0.0%	0.7%	0.0%	0.1%	0.3%
	Shredder	1.4%	1.1%	3.3%	0.0%	0.6%	1.3%
Whitefish Lake (LA-6)	**Absolute Density**						
	Collector-Filterer	7563	7000	15014	2643	1888	4223
	Collector-Gatherer	2169	2314	3743	357	573	1281
	Omnivore	0	0	0	0	0	0
	Predator	369	386	514	157	52	116
	Scraper	0	0	0	0	0	0
	Shredder	63	14	229	0	38	85
	Relative Density						
	Collector-Filterer	74.6%	78.4%	83.3%	54.7%	4.7%	10.5%
	Collector-Gatherer	20.6%	19.6%	38.7%	11.3%	4.3%	9.7%
	Omnivore	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Predator	4.2%	4.5%	6.0%	2.0%	0.6%	1.4%
	Scraper	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Shredder	0.7%	0.5%	2.0%	0.0%	0.3%	0.7%
Kratchkowsky Lake (LA-7)	**Absolute Density**						
	Collector-Filterer	100	100	114	86	7	12
	Collector-Gatherer	1138	1200	1786	429	321	556
	Omnivore	0	0	0	0	0	0
	Predator	210	200	300	129	41	70
	Scraper	0	0	0	0	0	0
	Shredder	395	357	700	129	136	235
	Relative Density						
	Collector-Filterer	7.1%	5.2%	12.7%	3.4%	2.3%	4.0%
	Collector-Gatherer	59.8%	54.5%	70.6%	54.2%	4.4%	7.7%
	Omnivore	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Predator	12.4%	11.9%	16.4%	9.0%	1.7%	3.0%
	Scraper	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Shredder	20.7%	16.4%	31.6%	14.1%	4.5%	7.8%
Kratchkowsky Lake (LA-7A)	**Absolute Density**						
	Collector-Filterer	105	57	257	0	64	110
	Collector-Gatherer	319	129	757	71	179	311
	Omnivore	0	0	0	0	0	0
	Predator	233	271	300	129	43	75
	Scraper	0	0	0	0	0	0
	Shredder	143	114	286	29	62	107
	Relative Density						
	Collector-Filterer	10.1%	8.3%	22.0%	0.0%	5.2%	9.0%
	Collector-Gatherer	32.9%	23.7%	64.6%	10.4%	13.3%	23.1%
	Omnivore	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Predator	35.3%	39.6%	55.3%	11.0%	10.6%	18.3%
	Scraper	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Shredder	21.7%	21.1%	41.7%	2.4%	9.3%	16.0%

**Table 3-7D Cont'd: Baseline Benthic Invertebrate Community Summary
Absolute and Relative Abundance of Functional Feeding Groups**

Location	Benthic Invertebrate Functional Feeding Group	Abundance Mean	Median	Maximum	Minimum	SE	SD
LA-8	**Absolute Density**						
	Collector-Filterer	24	29	43	0	10	18
	Collector-Gatherer	95	114	129	43	22	37
	Omnivore	0	0	0	0	0	0
	Predator	262	229	329	229	27	47
	Scraper	0	0	0	0	0	0
	Shredder	286	257	457	143	75	130
	Relative Density						
	Collector-Filterer	3.4%	5.1%	5.3%	0.0%	1.4%	2.4%
	Collector-Gatherer	14.1%	13.6%	20.9%	7.9%	3.1%	5.3%
	Omnivore	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Predator	41.6%	37.2%	60.5%	27.1%	8.1%	14.0%
	Scraper	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Shredder	40.8%	41.9%	54.2%	26.3%	6.6%	11.4%
LA-9	**Absolute Density**						
	Collector-Filterer	138	57	329	29	78	135
	Collector-Gatherer	486	429	657	371	71	123
	Omnivore	0	0	0	0	0	0
	Predator	986	957	1157	843	75	130
	Scraper	0	0	0	0	0	0
	Shredder	24	0	71	0	19	34
	Relative Density						
	Collector-Filterer	7.5%	4.1%	16.5%	1.9%	3.7%	6.5%
	Collector-Gatherer	30.5%	26.8%	43.0%	21.6%	5.3%	9.1%
	Omnivore	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Predator	60.8%	58.3%	69.1%	55.1%	3.4%	6.0%
	Scraper	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Shredder	1.2%	0.0%	3.6%	0.0%	1.0%	1.7%
Williams Lake (LB-3)	**Absolute Density**						
	Collector-Filterer	7019	171	20714	171	5591	9684
	Collector-Gatherer	1662	2043	2100	843	335	580
	Omnivore	0	0	0	0	0	0
	Predator	1600	1786	2100	914	290	502
	Scraper	5	0	14	0	4	7
	Shredder	171	214	257	43	53	93
	Relative Density						
	Collector-Filterer	31.2%	5.7%	82.5%	5.3%	21.0%	36.3%
	Collector-Gatherer	33.7%	27.8%	65.0%	8.1%	13.6%	23.6%
	Omnivore	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Predator	31.9%	28.3%	59.0%	8.4%	12.0%	20.8%
	Scraper	0.2%	0.0%	0.5%	0.0%	0.1%	0.2%
	Shredder	3.1%	1.3%	7.1%	1.0%	1.6%	2.8%
Russell Lake (LAB-1)	**Absolute Density**						
	Collector-Filterer	1129	500	2514	371	567	981
	Collector-Gatherer	1752	1757	1857	1643	51	88
	Omnivore	0	0	0	0	0	0
	Predator	376	414	414	300	31	54
	Scraper	5	0	14	0	4	7
	Shredder	242.9	200.0	485.7	42.9	105.8	183.3
	Relative Density						
	Collector-Filterer	26.9%	18.1%	47.6%	15.0%	8.5%	14.7%
	Collector-Gatherer	55.1%	63.7%	66.5%	35.1%	8.2%	14.2%
	Omnivore	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Predator	11.8%	10.9%	16.8%	7.8%	2.1%	3.7%
	Scraper	0.1%	0.0%	0.3%	0.0%	0.1%	0.1%
	Shredder	6.1%	7.3%	9.2%	1.7%	1.8%	3.2%
Russell Lake (LAB-2)	**Absolute Density**						
	Collector-Filterer	2243	557	5843	329	1471	2547
	Collector-Gatherer	2500	2029	3786	1686	531	920
	Omnivore	0	0	0	0	0	0
	Predator	519	414	900	243	161	278
	Scraper	14	14	29	0	7	12
	Shredder	19	14	43	0	10	18
	Relative Density						
	Collector-Filterer	29.5%	20.4%	55.3%	12.6%	10.7%	18.6%
	Collector-Gatherer	58.6%	61.8%	78.0%	35.9%	10.0%	17.4%
	Omnivore	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Predator	11.0%	9.3%	15.2%	8.5%	1.7%	3.0%
	Scraper	0.4%	0.1%	1.0%	0.0%	0.3%	0.5%
	Shredder	0.6%	0.1%	1.6%	0.0%	0.4%	0.7%

Notes:
SE - Standard Error
SD - Standard deviation

Table 3-8: Baseline Benthic Invertebrate Chemistry Summary

Parameters	Unit	Location								
		McGowan Lake (LA-1)	Whitefish Lake (LA-5)	Whitefish Lake (LA-6)	Kratchkowsky Lake (LA-7)	Kratchkowsky Lake (LA-7A)	LA-8	LA-9	Russell Lake (LAB-1)	Russell Lake (LAB-2)
Moisture	%	91	87	87	87	89	84	82	89	89
Aluminum	µg/g	93	120	140	78	150	39	62	250	220
Antimony	µg/g	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Arsenic	µg/g	1.8	1.5	2.6	0.74	1.2	0.43	0.68	0.9	0.81
Barium	µg/g	142	85	167	49	80	4.7	4.8	111	164
Beryllium	µg/g	0.01	<0.01	0.02	<0.01	0.01	<0.01	<0.01	0.03	0.01
Boron	µg/g	4.0	1.0	3.0	2.0	3.0	<1	1.0	6.0	7.0
Cadmium	µg/g	0.19	0.18	0.25	0.13	0.22	0.13	0.1	0.16	0.2
Chromium	µg/g	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt	µg/g	0.99	0.48	0.68	0.16	0.44	0.12	0.18	2	3.7
Copper	µg/g	7.1	6.3	5.3	6.9	8.5	15	14	6.8	6.6
Iron	µg/g	1300	1000	1800	410	1200	390	500	1800	1400
Lead	µg/g	0.17	0.34	0.33	0.08	0.2	0.05	0.06	0.16	0.13
Manganese	µg/g	1900	790	1030	146	385	88	57	1850	1710
Molybdenum	µg/g	0.5	0.4	0.6	0.5	0.6	0.1	0.2	1.2	0.7
Nickel	µg/g	2.7	0.75	1.3	0.19	0.85	0.17	0.2	2.3	2.7
Selenium	µg/g	0.53	0.5	0.52	0.5	0.67	0.91	1	0.37	0.36
Silver	µg/g	0.02	0.06	0.03	0.05	0.05	0.12	0.11	0.02	0.03
Strontium	µg/g	10	11	10	7.5	11	3.6	5.3	14	20
Thallium	µg/g	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Tin	µg/g	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Titanium	µg/g	2.6	3.0	4.1	3.0	9.1	1.0	1.4	5.6	6.4
Uranium	µg/g	0.081	0.062	0.087	0.023	0.08	0.012	0.014	0.099	0.16
Vanadium	µg/g	0.4	0.4	0.4	0.2	0.5	0.1	0.2	0.7	0.7
Zinc	µg/g	150	150	110	150	160	91	92	150	190
Lead-210	Bq/g	<0.05	<0.04	<0.02	<0.04	<0.06	<0.02	<0.02	0.03	<0.04
Polonium-210	Bq/g	0.06	0.09	0.061	0.08	0.12	0.06	0.1	0.06	0.03
Radium-226	Bq/g	0.02	0.01	0.015	<0.01	<0.01	<0.005	0.008	0.02	0.02
Thorium-228	Bq/g	<0.02	<0.02	<0.009	<0.02	<0.03	<0.01	<0.01	<0.02	<0.02
Thorium-230	Bq/g	<0.02	<0.02	<0.009	<0.02	<0.03	<0.01	<0.01	<0.02	<0.02
Thorium-232	Bq/g	<0.02	<0.02	<0.009	<0.02	<0.03	<0.01	<0.01	<0.02	<0.02

Notes:
Results are for one sample per lake assessed.
Samples were collected between September 18 and 21, 2016.
Results are on a dry weight basis.

Table 3-9: Baseline Lake Fish Community Summary

Fish Species	Station										
	McGowan Lake (LA-1)	Whitefish Lake (LA-5)	Whitefish Lake (LA-6)	Kratchkowsky Lake (LA-7, LA-7A)	LA-8	LA-9	PA-2	PA-3	Williams Lake (LB-3)	Russell Lake (LAB-1)	Russell Lake (LAB-2)
Lake Chub	-	-	-	-	-	-	-	-	x	-	-
Spottail Shiner	x	x	x	x	-	x	-	-	x	x	-
Longnose Sucker	x	-	-	-	-	-	-	-	-	-	-
White Sucker	x	x	x	x	x	x	x	-	-	x	x
Lake Whitefish	x	x	x	x	x	x	x	-	-	x	x
Lake Trout	x	-	-	-	-	-	-	-	-	x	x
Northern Pike	x	x	x	x	x	x	x	-	x	x	x
Burbot	-	-	-	-	-	-	-	-	-	-	x
Ninespine Stickleback	-	x	-	x	x	x	-	-	-	x	x
Yellow Perch	x	-	-	x	x	x	-	-	x	-	-
Walleye	x	x	x	x	-	x	-	-	x	-	x

Notes:
Results presented herein are only from traditional fish survey. No eDNA analysis results are included.
x indicates that the species was either captured or observed
- indicates that the species was neither captured nor observed

Table 3-10: Baseline Fish Tissue Chemistry Summary

Location/ Species/ Tissue	Aluminum					Antimony					Arsenic					Barium					Beryllium					Boron				
	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)
McGowan Lake (LA-1)																														
Northern Pike																														
Bone	9	5	0.5	1.3	0.7	9	9	0.05	0.05	0.05	9	7	0.02	0.03	0.02	9	0	2.2	9.8	4.9	9	9	0.01	0.01	0.01	9	9	0.5	0.5	0.5
Flesh	9	6	0.5	1.0	0.6	9	9	0.02	0.02	0.02	9	9	0.01	0.01	0.01	9	1	0.01	0.1	0.03	9	9	0.002	0.002	0.002	9	9	0.2	0.2	0.2
White Sucker																														
Bone	6	2	0.5	1.4	0.8	6	6	0.05	0.05	0.05	6	5	0.02	0.03	0.02	6	0	3.2	7.3	4.8	6	6	0.01	0.01	0.01	6	6	0.5	0.5	0.5
Flesh	6	3	0.5	0.8	0.6	6	6	0.02	0.02	0.02	6	1	0.01	0.05	0.03	6	0	0.06	0.25	0.14	6	6	0.002	0.002	0.002	6	6	0.2	0.2	0.2
Whitefish Lake (LA-5)																														
Northern Pike																														
Bone	5	2	0.5	1.3	0.8	5	5	0.05	0.05	0.05	5	0	0.02	0.03	0.02	5	0	6.4	7.2	6.9	5	5	0.01	0.01	0.01	5	5	0.5	0.5	0.5
Flesh	5	1	0.5	1.3	0.7	5	5	0.02	0.02	0.02	5	4	0.01	0.01	0.01	5	3	0.01	0.06	0.02	5	5	0.002	0.002	0.002	5	5	0.2	0.2	0.2
White Sucker																														
Bone	6	0	0.7	1.7	1.1	6	6	0.05	0.05	0.05	6	0	0.02	0.06	0.05	6	0	3	8.5	5.6	6	6	0.01	0.01	0.01	6	6	0.5	0.5	0.5
Flesh	7	2	0.5	0.9	0.6	7	7	0.02	0.02	0.02	7	0	0.02	0.04	0.03	7	1	0.01	0.17	0.07	7	7	0.002	0.002	0.002	7	7	0.2	0.2	0.2
Whitefish Lake (LA-6)																														
Northern Pike																														
Bone	6	0	0.8	1.5	1.1	6	6	0.05	0.05	0.05	6	2	0.02	0.03	0.02	6	0	2.9	8	5.8	6	6	0.01	0.01	0.01	6	6	0.5	0.5	0.5
Flesh	6	1	0.5	1.1	0.8	6	6	0.02	0.02	0.02	6	5	0.01	0.02	0.01	6	0	0.01	0.09	0.05	6	6	0.002	0.002	0.002	6	6	0.2	0.2	0.2
White Sucker																														
Bone	6	1	0.5	1.0	0.8	6	6	0.05	0.05	0.05	6	1	0.02	0.07	0.05	6	0	3.6	5.6	4.5	6	6	0.01	0.01	0.01	6	6	0.5	0.5	0.5
Flesh	6	1	0.5	0.9	0.7	6	6	0.02	0.02	0.02	6	0	0.02	0.06	0.04	6	0	0.02	0.05	0.04	6	6	0.002	0.002	0.002	6	6	0.2	0.2	0.2
Kratchowsky Lake (LA-7)																														
Northern Pike																														
Bone	8	2	0.5	0.9	0.7	8	8	0.05	0.05	0.05	8	7	0.02	0.02	0.02	8	0	3.4	6.5	4.6	8	8	0.01	0.01	0.01	8	8	0.5	0.5	0.5
Flesh	8	4	0.5	1.0	0.6	8	8	0.02	0.02	0.02	8	8	0.01	0.01	0.01	8	0	0.01	0.1	0.05	8	8	0.002	0.002	0.002	8	8	0.2	0.2	0.2
White Sucker																														
Bone	7	2	0.5	1.6	0.8	7	7	0.05	0.05	0.05	7	2	0.02	0.04	0.02	7	0	2.6	5.2	4.1	7	7	0.01	0.01	0.01	7	7	0.5	0.5	0.5
Flesh	7	5	0.5	0.5	0.5	7	7	0.02	0.02	0.02	7	0	0.02	0.05	0.04	7	0	0.03	0.24	0.11	7	7	0.002	0.002	0.002	7	7	0.2	0.2	0.2
Russell Lake (LAB)																														
Northern Pike																														
Bone	6	0	0.8	1.3	1.1	6	6	0.05	0.05	0.05	6	3	0.02	0.05	0.03	6	0	1.9	3.7	2.8	6	6	0.01	0.01	0.01	6	6	0.5	0.5	0.5
Flesh	6	6	0.5	0.5	0.5	6	6	0.02	0.02	0.02	6	1	0.01	0.02	0.02	6	2	0.01	0.18	0.06	6	6	0.002	0.002	0.002	6	6	0.2	0.2	0.2
White Sucker																														
Bone	5	1	0.5	1.4	0.8	5	5	0.05	0.05	0.05	5	3	0.02	0.03	0.02	5	0	1.3	2.4	2.1	5	5	0.01	0.01	0.01	5	5	0.5	0.5	0.5
Flesh	5	5	0.5	0.5	0.5	5	5	0.02	0.02	0.02	5	1	0.01	0.05	0.03	5	0	0.02	0.04	0.03	5	5	0.002	0.002	0.002	5	5	0.2	0.2	0.2

Table 3-10 Cont'd: Baseline Fish Tissue Chemistry Summary

Location/ Species/ Tissue	Cadmium					Chromium					Cobalt					Copper					Iron					Lead				
	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)
McGowan Lake (LA-1)																														
Northern Pike																														
Bone	9	9	0.01	0.01	0.01	9	9	0.2	0.2	0.2	9	0	0.05	0.16	0.09	9	0	0.16	0.82	0.46	9	0	2.7	7.7	5.1	9	3	0.01	0.04	0.022
Flesh	9	9	0.002	0.002	0.002	9	9	0.1	0.2	0.1	9	6	0.002	0.005	0.003	9	0	0.14	0.55	0.28	9	0	1.9	6.4	3.5	9	7	0.002	0.003	0.0021
White Sucker																														
Bone	6	6	0.01	0.01	0.01	6	6	0.2	0.2	0.2	6	0	0.06	0.14	0.09	6	0	0.27	0.46	0.40	6	0	4.1	9.8	7.4	6	2	0.01	0.03	0.013
Flesh	6	6	0.002	0.002	0.002	6	5	0.1	0.2	0.1	6	4	0.002	0.014	0.005	6	0	0.17	0.62	0.28	6	0	2.2	4.6	3.2	6	1	0.002	0.009	0.0038
Whitefish Lake (LA-5)																														
Northern Pike																														
Bone	5	5	0.01	0.01	0.01	5	5	0.2	0.2	0.2	5	0	0.06	0.10	0.09	5	0	0.08	0.16	0.10	5	0	1.4	11	4.8	5	2	0.01	0.01	0.01
Flesh	5	5	0.002	0.002	0.002	5	5	0.1	0.1	0.1	5	2	0.002	0.014	0.007	5	0	0.09	0.14	0.11	5	0	0.8	2.3	1.2	5	4	0.002	0.004	0.002
White Sucker																														
Bone	6	6	0.01	0.01	0.01	6	6	0.2	0.2	0.2	6	0	0.05	0.17	0.11	6	0	0.26	1.6	0.99	6	0	6.7	18	10	6	0	0.01	0.09	0.05
Flesh	7	7	0.002	0.002	0.002	7	7	0.1	0.1	0.1	7	2	0.002	0.009	0.004	7	0	0.16	0.42	0.32	7	0	2.3	6.2	4.0	7	1	0.002	0.006	0.003
Whitefish Lake (LA-6)																														
Northern Pike																														
Bone	6	6	0.01	0.01	0.01	6	6	0.2	0.2	0.2	6	0	0.04	0.13	0.10	6	0	0.26	0.63	0.52	6	0	3.3	8.6	5.1	6	1	0.01	0.03	0.02
Flesh	6	6	0.002	0.002	0.002	6	6	0.1	0.1	0.1	6	5	0.002	0.01	0.003	6	0	0.15	0.23	0.17	6	0	1.4	2.4	1.6	6	2	0.002	0.004	0.002
White Sucker																														
Bone	6	6	0.01	0.01	0.01	6	6	0.2	0.2	0.2	6	0	0.06	0.13	0.10	6	0	0.42	0.93	0.75	6	0	4	16	9.3	6	1	0.01	0.04	0.03
Flesh	6	6	0.002	0.002	0.002	6	6	0.1	0.1	0.1	6	1	0.002	0.056	0.02	6	0	0.2	0.42	0.30	6	0	1.7	3.5	2.7	6	3	0.002	0.003	0.002
Kratchowsky Lake (LA-7)																														
Northern Pike																														
Bone	8	8	0.01	0.01	0.01	8	7	0.2	0.4	0.2	8	0	0.07	0.14	0.10	8	0	0.21	0.43	0.30	8	0	3.5	13	6.8	8	4	0.01	0.02	0.01
Flesh	8	8	0.002	0.002	0.002	8	8	0.1	0.1	0.1	8	5	0.002	0.034	0.007	8	0	0.18	0.5	0.27	8	0	1	4.2	2.7	8	4	0.002	0.011	0.005
White Sucker																														
Bone	7	7	0.01	0.01	0.01	7	7	0.2	0.2	0.2	7	0	0.05	0.15	0.07	7	0	0.2	0.5	0.35	7	0	6.4	150	45	7	5	0.01	0.02	0.01
Flesh	7	7	0.002	0.002	0.002	7	7	0.1	0.1	0.1	7	5	0.002	0.004	0.002	7	0	0.17	0.66	0.31	7	0	2.2	5.3	3.3	7	4	0.002	0.005	0.003
Russell Lake (LAB)																														
Northern Pike																														
Bone	6	6	0.01	0.01	0.01	6	6	0.2	0.2	0.2	6	0	0.12	0.18	0.14	6	0	0.06	0.44	0.26	6	0	3.3	150	29	6	3	0.01	0.03	0.01
Flesh	6	6	0.002	0.002	0.002	6	6	0.1	0.1	0.1	6	5	0.002	0.008	0.003	6	0	0.08	0.46	0.18	6	0	0.8	4.7	2.3	6	4	0.002	0.002	0.002
White Sucker																														
Bone	5	5	0.01	0.01	0.01	5	5	0.2	0.2	0.2	5	0	0.05	0.13	0.09	5	0	0.38	0.66	0.51	5	0	6.8	12	9.3	5	1	0.01	0.1	0.03
Flesh	5	5	0.002	0.002	0.002	5	5	0.1	0.1	0.1	5	3	0.002	0.018	0.007	5	0	0.16	0.32	0.23	5	0	1.3	2.3	1.9	5	5	0.002	0.002	0.002

Table 3-10 Cont'd: Baseline Fish Tissue Chemistry Summary

Location/ Species/ Tissue	Manganese					Mercury					Molybdenum					Nickel					Selenium							
																							wet weight			dry weight		
	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	Min (ug/g)	Max (ug/g)	Average (ug/g)
McGowan Lake (LA-1)																												
Northern Pike																												
Bone	9	0	5.7	20	15	9	0	0.02	0.2	0.06	9	9	0.05	0.05	0.05	9	4	0.02	0.09	0.04	9	0	0.12	0.2	0.16	0.30	0.53	0.41
Flesh	9	0	0.08	0.13	0.10	9	0	0.075	0.43	0.17	9	9	0.02	0.02	0.02	9	7	0.01	0.03	0.01	9	0	0.19	0.25	0.22	0.85	1.16	1.00
White Sucker																												
Bone	6	0	10	35	23	6	1	0.01	0.02	0.02	6	6	0.05	0.05	0.05	6	3	0.02	0.12	0.04	6	0	0.13	0.26	0.19	0.27	0.59	0.45
Flesh	6	0	0.12	1.1	0.36	6	0	0.022	0.068	0.038	6	6	0.02	0.02	0.02	6	4	0.01	0.11	0.03	6	0	0.21	0.3	0.27	0.88	1.48	1.29
Whitefish Lake (LA-5)																												
Northern Pike																												
Bone	5	0	12	17	14	5	0	0.02	0.06	0.04	5	5	0.05	0.05	0.05	5	4	0.02	0.03	0.02	5	0	0.09	0.17	0.11	0.22	0.41	0.28
Flesh	5	0	0.08	0.12	0.11	5	0	0.047	0.23	0.16	5	5	0.02	0.02	0.02	5	3	0.01	0.02	0.01	5	0	0.15	0.19	0.17	0.71	0.9	0.81
White Sucker																												
Bone	6	0	18	38	26	6	1	0.01	0.03	0.02	6	6	0.05	0.05	0.05	6	2	0.02	0.07	0.05	6	0	0.14	0.23	0.19	0.29	0.50	0.41
Flesh	7	0	0.12	0.70	0.23	7	0	0.014	0.076	0.045	7	7	0.02	0.02	0.02	7	1	0.01	0.03	0.02	7	0	0.17	0.28	0.22	0.83	1.27	1.03
Whitefish Lake (LA-6)																												
Northern Pike																												
Bone	6	0	6	15	11	6	0	0.03	0.08	0.05	6	6	0.05	0.05	0.05	6	4	0.02	0.09	0.04	6	0	0.11	0.16	0.14	0.22	0.41	0.31
Flesh	6	0	0.08	0.23	0.13	6	0	0.074	0.3	0.19	6	6	0.02	0.02	0.02	6	5	0.01	0.02	0.01	6	0	0.19	0.23	0.21	0.85	1.04	0.92
White Sucker																												
Bone	6	0	17	36	26	6	0	0.02	0.03	0.02	6	6	0.05	0.05	0.05	6	1	0.02	0.08	0.04	6	0	0.15	0.22	0.18	0.32	0.52	0.40
Flesh	6	0	0.09	0.28	0.16	6	0	0.024	0.07	0.04	6	6	0.02	0.02	0.02	6	3	0.01	0.08	0.03	6	0	0.18	0.24	0.22	0.84	1.12	0.97
Kratchowsky Lake (LA-7)																												
Northern Pike																												
Bone	8	0	5.4	11	7.8	8	0	0.01	0.07	0.04	8	8	0.05	0.05	0.05	8	5	0.02	0.13	0.04	8	0	0.12	0.15	0.13	0.27	0.42	0.3
Flesh	8	0	0.07	0.15	0.11	8	0	0.067	0.31	0.15	8	8	0.02	0.02	0.02	8	6	0.01	0.07	0.02	8	0	0.17	0.23	0.20	0.75	1.03	0.89
White Sucker																												
Bone	7	0	6.4	16	12	7	4	0.01	0.02	0.01	7	7	0.05	0.05	0.05	7	5	0.02	0.13	0.04	7	0	0.15	0.2	0.18	0.34	0.46	0.42
Flesh	7	0	0.09	0.33	0.17	7	0	0.012	0.027	0.019	7	7	0.02	0.02	0.02	7	6	0.01	0.01	0.01	7	0	0.15	0.23	0.20	0.75	1.12	0.97
Russell Lake (LAB)																												
Northern Pike																												
Bone	6	0	17	41	26	6	0	0.02	0.14	0.05	6	6	0.05	0.05	0.05	6	4	0.02	0.06	0.03	6	0	0.2	0.27	0.23	0.39	0.69	0.52
Flesh	6	0	0.08	0.2	0.13	6	0	0.14	0.48	0.27	6	6	0.02	0.02	0.02	6	6	0.01	0.01	0.01	6	0	0.25	0.53	0.35	1.32	2.34	1.62
White Sucker																												
Bone	5	0	41	68	54	5	4	0.01	0.02	0.01	5	0	0.13	0.23	0.18	5	5	0.02	0.02	0.02	5	0	0.32	0.59	0.44	0.81	1.51	1.16
Flesh	5	0	0.16	0.42	0.24	5	0	0.021	0.043	0.027	5	5	0.02	0.02	0.02	5	5	0.01	0.01	0.01	5	0	0.33	0.56	0.44	1.69	2.15	2.66

Table 3-10 Cont'd: Baseline Fish Tissue Chemistry Summary

Location/ Species/ Tissue	Silver					Strontium					Thallium					Tin					Titanium					Uranium				
	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)
McGowan Lake (LA-1)																														
Northern Pike																														
Bone	9	9	0.01	0.01	0.01	9	0	41	173	112	9	9	0.02	0.02	0.02	9	9	0.02	0.02	0.02	9	0	0.02	0.33	0.14	9	9	0.01	0.01	0.01
Flesh	9	8	0.002	0.002	0.002	9	0	0.07	0.58	0.23	9	9	0.01	0.01	0.01	9	9	0.01	0.01	0.01	9	0	0.01	0.04	0.02	9	9	0.001	0.001	0.001
White Sucker																														
Bone	6	5	0.01	0.02	0.01	6	0	111	188	138	6	6	0.02	0.02	0.02	6	6	0.02	0.02	0.02	6	0	0.04	0.52	0.19	6	6	0.01	0.01	0.01
Flesh	6	5	0.002	0.018	0.005	6	0	0.22	2.5	0.85	6		0.01	0.01	0.01	6		0.01	0.01	0.01	6	0	0.01	0.03	0.02	6	6	0.001	0.001	0.001
Whitefish Lake (LA-5)																														
Northern Pike																														
Bone	5	5	0.01	0.01	0.01	5	0	121	162	150	5	5	0.02	0.02	0.02	5	5	0.02	0.02	0.02	5	0	0.03	0.06	0.05	5	5	0.01	0.01	0.01
Flesh	5	5	0.002	0.002	0.002	5	0	0.1	0.37	0.21	5	5	0.01	0.01	0.01	5	5	0.01	0.01	0.01	5	4	0.01	0.04	0.02	5	5	0.001	0.001	0.001
White Sucker																														
Bone	6	6	0.01	0.01	0.01	6	0	87	211	149	6	6	0.02	0.02	0.02	6	6	0.02	0.02	0.02	6	0	0.02	0.25	0.07	6	6	0.01	0.01	0.01
Flesh	7	7	0.002	0.002	0.002	7	0	0.06	2.5	0.57	7	7	0.01	0.01	0.01	7	7	0.01	0.01	0.01	7	2	0.01	0.07	0.02	7	6	0.001	0.006	0.002
Whitefish Lake (LA-6)																														
Northern Pike																														
Bone	6	6	0.01	0.01	0.01	6	0	50	128	106	6	6	0.02	0.02	0.02	6	6	0.02	0.02	0.02	6	0	0.02	0.24	0.08	6	6	0.01	0.01	0.01
Flesh	6	6	0.002	0.002	0.002	6	0	0.09	1.1	0.39	6	6	0.01	0.01	0.01	6	6	0.01	0.01	0.01	6	0	0.01	0.02	0.02	6	5	0.001	0.002	0.001
White Sucker																														
Bone	6	6	0.01	0.01	0.01	6	0	92	165	127	6	6	0.02	0.02	0.02	6	6	0.02	0.02	0.02	6	0	0.03	0.23	0.07	6	6	0.01	0.01	0.01
Flesh	6	6	0.002	0.002	0.002	6	0	0.12	0.68	0.30	6	6	0.01	0.01	0.01	6	6	0.01	0.01	0.01	6	3	0.01	0.02	0.01	6	6	0.001	0.001	0.001
Kratchowsky Lake (LA-7)																														
Northern Pike																														
Bone	8	8	0.01	0.01	0.01	8	0	97	149	125	8	8	0.02	0.02	0.02	8	7	0.02	0.05	0.02	8	0	0.03	0.33	0.115	8	8	0.01	0.01	0.01
Flesh	8	8	0.002	0.002	0.002	8	0	0.07	1.1	0.34	8	8	0.01	0.01	0.01	8	7	0.01	0.02	0.01	8	0	0.01	0.04	0.0225	8	8	0.001	0.001	0.001
White Sucker																														
Bone	7	7	0.01	0.01	0.01	7	0	67	172	128	7	7	0.02	0.02	0.02	7	6	0.02	0.02	0.02	7	1	0.02	1.7	0.342857143	7	7	0.01	0.01	0.01
Flesh	7	7	0.002	0.002	0.002	7	0	0.14	0.61	0.29	7	7	0.01	0.01	0.01	7	7	0.01	0.01	0.01	7	2	0.01	0.02	0.012857143	7	7	0.001	0.001	0.001
Russell Lake (LAB)																														
Northern Pike																														
Bone	6	6	0.01	0.01	0.01	6	0	39	100	72	6	6	0.02	0.02	0.02	6	6	0.02	0.02	0.02	6	0	0.02	0.46	0.148333333	6	6	0.01	0.01	0.01
Flesh	6	6	0.002	0.002	0.002	6	0	0.04	0.43	0.15	6	6	0.01	0.01	0.01	6	6	0.01	0.01	0.01	6	4	0.01	0.02	0.013333333	6	6	0.001	0.001	0.001
White Sucker																														
Bone	5	5	0.01	0.01	0.01	5	0	40	75	63	5	5	0.02	0.02	0.02	5	5	0.02	0.02	0.02	5	0	0.03	0.11	0.062	5	4	0.01	0.01	0.01
Flesh	5	5	0.002	0.002	0.002	5	0	0.05	0.33	0.14	5	5	0.01	0.01	0.01	5	5	0.01	0.01	0.01	5	3	0.01	0.02	0.012	5	5	0.001	0.001	0.001

Table 3-10 Cont'd: Baseline Fish Tissue Chemistry Summary

Location/ Species/ Tissue	Vanadium					Zinc					Lead-210					Polonium-210					Radium-226					Thorium-230				
	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (ug/g)	Max (ug/g)	Average (ug/g)	n	#DL	Min (Bq/g)	Max (Bq/g)	Mean (Bq/g)	n	#DL	Min (Bq/g)	Max (Bq/g)	Mean (Bq/g)	n	#DL	Min (Bq/g)	Max (Bq/g)	Mean (Bq/g)	n	#DL	Min (Bq/g)	Max (Bq/g)	Mean (Bq/g)
McGowan Lake (LA-1)																														
Northern Pike																														
Bone	9	9	0.05	0.05	0.05	9	0	32	64	48	9	9	0.002	0.002	0.002	9	2	0.0005	0.001	0.0007	9	9	0.0007	0.001	0.0009	9	9	0.001	0.003	0.002
Flesh	9	9	0.02	0.02	0.02	9	0	3.5	9.7	6.5	9	8	0.001	0.001	0.001	9	1	0.0002	0.0015	0.0008	5	4	0.00006	0.0002	0.0001	5	5	0.0001	0.0004	0.00022
White Sucker																														
Bone	6	6	0.05	0.05	0.05	6	0	16	21	19	6	5	0.002	0.007	0.003	6	0	0.001	0.004	0.003	6	6	0.0009	0.001	0.001	6	6	0.002	0.002	0.002
Flesh	6	6	0.02	0.02	0.02	6	0	3.6	4.9	4.2	6	5	0.001	0.001	0.001	6	0	0.0006	0.0015	0.001	5	5	0.00008	0.0002	0.0001	5	5	0.0002	0.0003	0.00022
Whitefish Lake (LA-5)																														
Northern Pike																														
Bone	5	5	0.05	0.05	0.05	5	0	30	54	39	5	5	0.002	0.002	0.002	5	1	0.0005	0.003	0.0012	5	4	0.0008	0.002	0.001	5	5	0.002	0.002	0.002
Flesh	5	5	0.02	0.02	0.02	5	0	3.1	4.4	3.6	5	5	0.001	0.001	0.001	5	0	0.0002	0.0021	0.0007	5	5	0.00006	0.0002	0.0001	5	5	0.0001	0.0002	0.0001
White Sucker																														
Bone	6	6	0.05	0.05	0.05	6	0	15	33	23	6	6	0.002	0.002	0.002	6	0	0.001	0.003	0.002	6	5	0.0008	0.001	0.001	6	6	0.002	0.002	0.002
Flesh	7	7	0.02	0.02	0.02	7	0	2.8	6.5	4.5	7	7	0.001	0.001	0.001	7	0	0.0006	0.0016	0.001	6	6	0.00006	0.00009	0.00008	6	6	0.0001	0.0002	0.0002
Whitefish Lake (LA-6)																														
Northern Pike																														
Bone	6	6	0.05	0.05	0.05	6	0	34	56	42	6	6	0.002	0.002	0.002	6	1	0.0005	0.002	0.001	6	6	0.0009	0.001	0.001	6	6	0.002	0.003	0.002
Flesh	6	6	0.02	0.02	0.02	6	0	3.1	4.6	4.0	6	6	0.001	0.001	0.001	6	0	0.0006	0.0026	0.001	5	5	0.00006	0.00009	0.00007	5	4	0.0001	0.0002	0.0002
White Sucker																														
Bone	6	6	0.05	0.05	0.05	6	0	16	22	19	6	6	0.002	0.002	0.002	6	0	0.002	0.004	0.003	6	6	0.0008	0.001	0.001	6	5	0.002	0.003	0.002
Flesh	6	6	0.02	0.02	0.02	6	0	3	4.3	3.6	6	6	0.001	0.001	0.001	6	0	0.0008	0.0018	0.001	5	5	0.00006	0.0001	0.00008	5	5	0.0001	0.0002	0.0002
Kratchowsky Lake (LA-7)																														
Northern Pike																														
Bone	8	8	0.05	0.05	0.05	8	0	31	85	54	8	7	0.002	0.002	0.002	8	1	0.0005	0.002	0.0009	8	6	0.0006	0.003	0.001	8	8	0.001	0.003	0.002
Flesh	8	8	0.02	0.02	0.02	8	0	4.2	7.4	5.5	8	8	0.001	0.001	0.001	8	0	0.0006	0.0015	0.001	5	5	0.00007	0.0002	0.0001	5	5	0.0001	0.0003	0.0002
White Sucker																														
Bone	7	7	0.05	0.05	0.05	7	0	11	22	18	7	6	0.002	0.005	0.002	7	0	0.001	0.007	0.004	7	6	0.0009	0.001	0.0010	7	7	0.002	0.002	0.002
Flesh	7	7	0.02	0.02	0.02	7	0	2.7	5.8	4.0	7	7	0.001	0.002	0.001	7	0	0.0008	0.0025	0.002	5	5	0.00007	0.00008	0.00008	5	5	0.0001	0.0002	0.0002
Russell Lake (LAB)																														
Northern Pike																														
Bone	6	6	0.05	0.05	0.05	6	0	31	75	54	6	6	0.002	0.002	0.002	6	0	0.0005	0.001	0.0008	6	6	0.0007	0.001	0.0010	6	6	0.001	0.003	0.002
Flesh	6	6	0.02	0.02	0.02	6	0	3.7	9.8	6.1	6	6	0.001	0.001	0.001	6	0	0.001	0.003	0.002	5	4	0.00003	0.001	0.0002	5	5	0.00006	0.0002	0.0001
White Sucker																														
Bone	5	5	0.05	0.05	0.05	5	0	16	26	22	5	5	0.002	0.002	0.002	5	1	0.0005	0.005	0.003	5	5	0.0008	0.001	0.0009	5	5	0.002	0.002	0.002
Flesh	5	5	0.02	0.02	0.02	5	0	3	3.9	3.4	5	4	0.001	0.001	0.001	5	0	0.0008	0.0021	0.001	4	3	0.00007	0.0004	0.0002	4	4	0.0001	0.0002	0.0002

Notes:

Results are presented on a wet weight basis, except where indicated otherwise.
Dry weight selenium concentrations in fish flesh and bone were calculated from wet weight concentrations for individual samples, as follows: ww concentration*(100/(100-% moisture content))
Health Canada (2007) human health standard applied to commercially-sold fish 0.5 µg/g ww
BC MOE (2014) guideline 4 µg/g dw and US EPA (2016) criterion of 11.3 µg/g dw for selenium in fish muscle

Figures

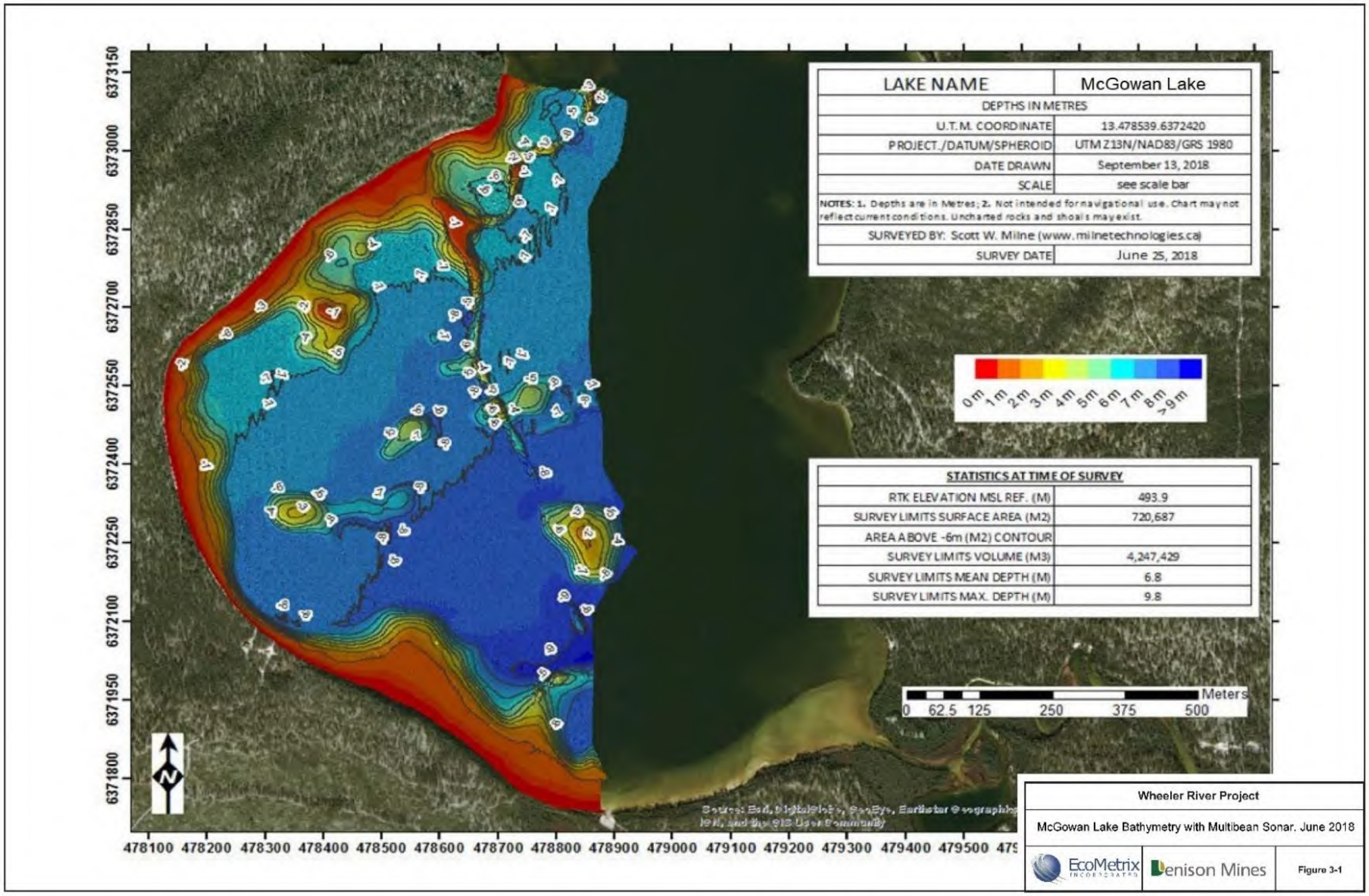


Figure 3-1: McGowan Lake Bathymetry Characterized with Multibeam Sonar, June 2018

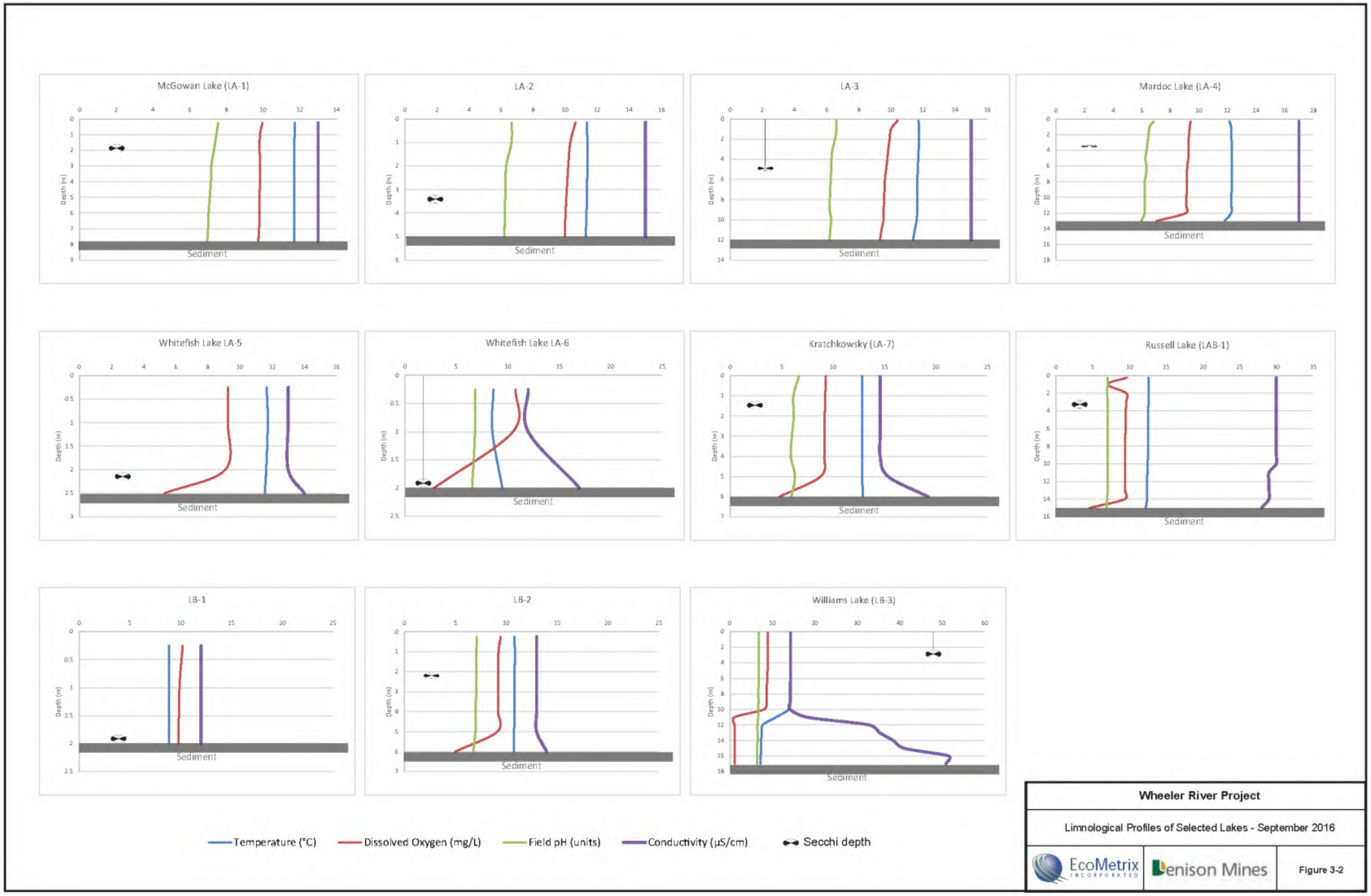


Figure 3-2: Limnological Profiles of Selected Lakes – September 2016. Coordinates of each sampling location is shown in Table A2.

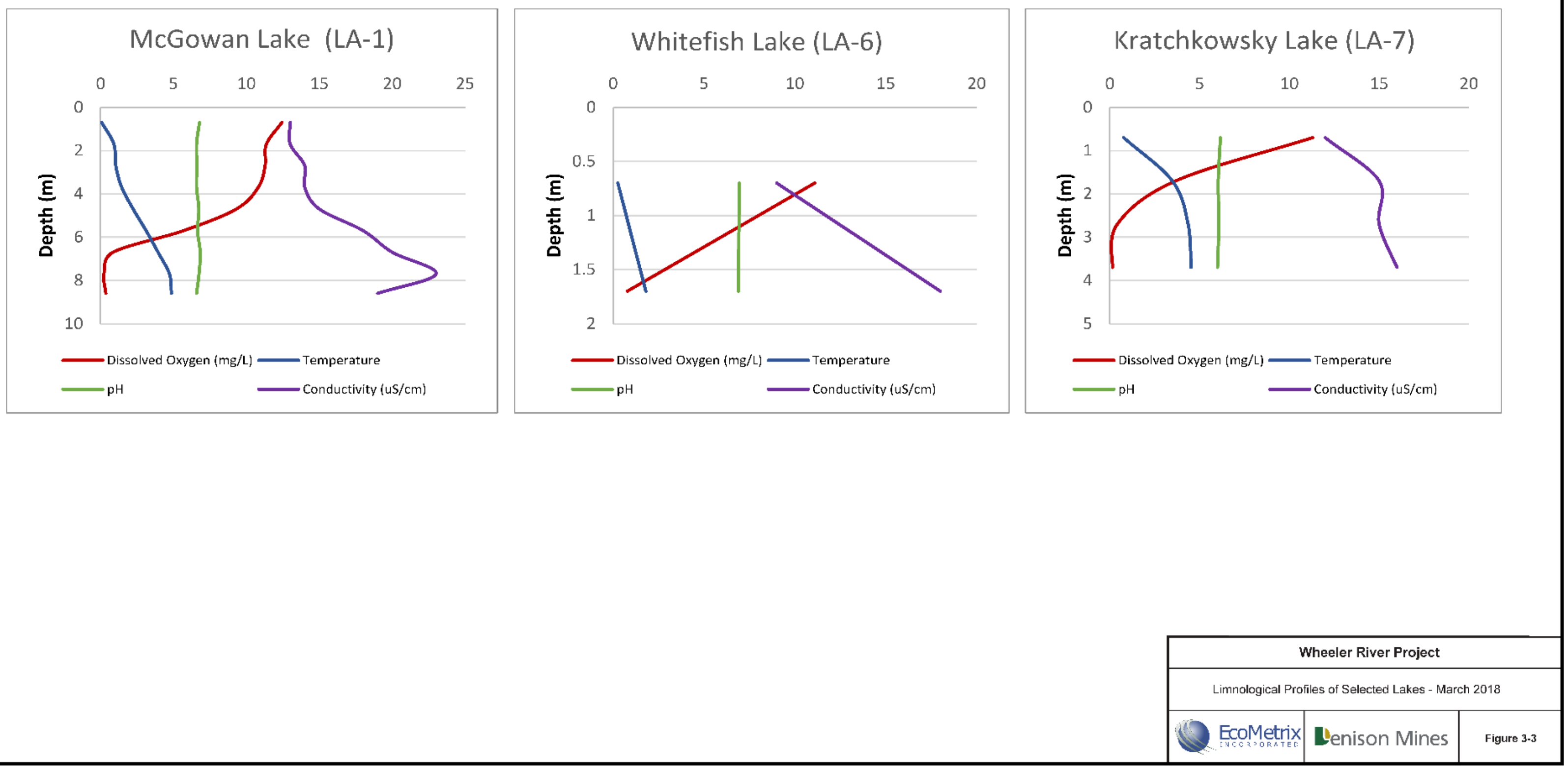


Figure 3-3: Limnological Profiles of Selected Lakes – March 2018. Coordinates of each sampling location is shown in Table A2.

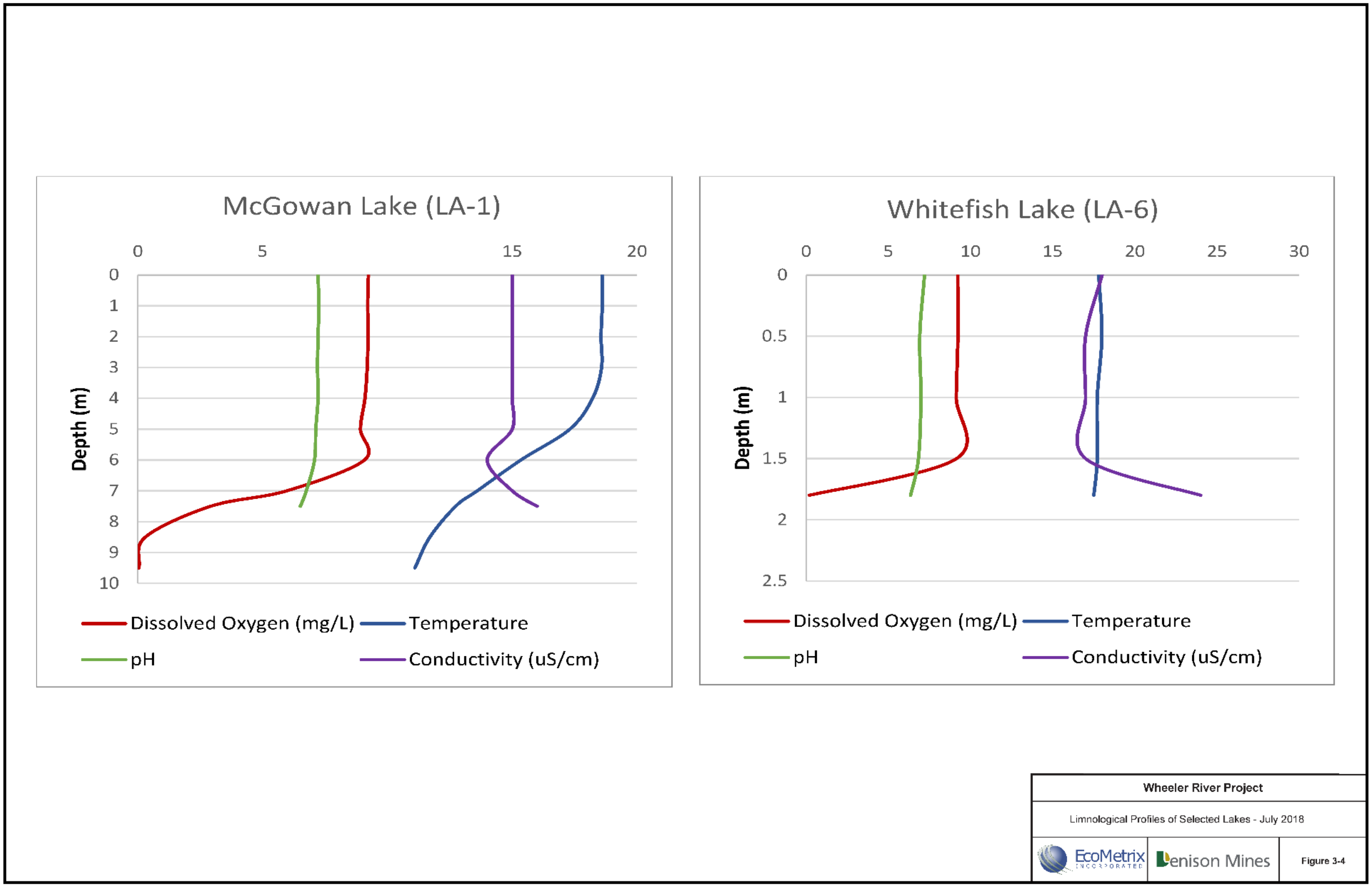


Figure 3-4: Limnological Profiles of Selected Lakes – July 2018. Coordinates of each sampling location is shown in Table A2.

Figure 3-5: McGowan Lake Habitat Characterized with Multibeam Sonar, June 2018

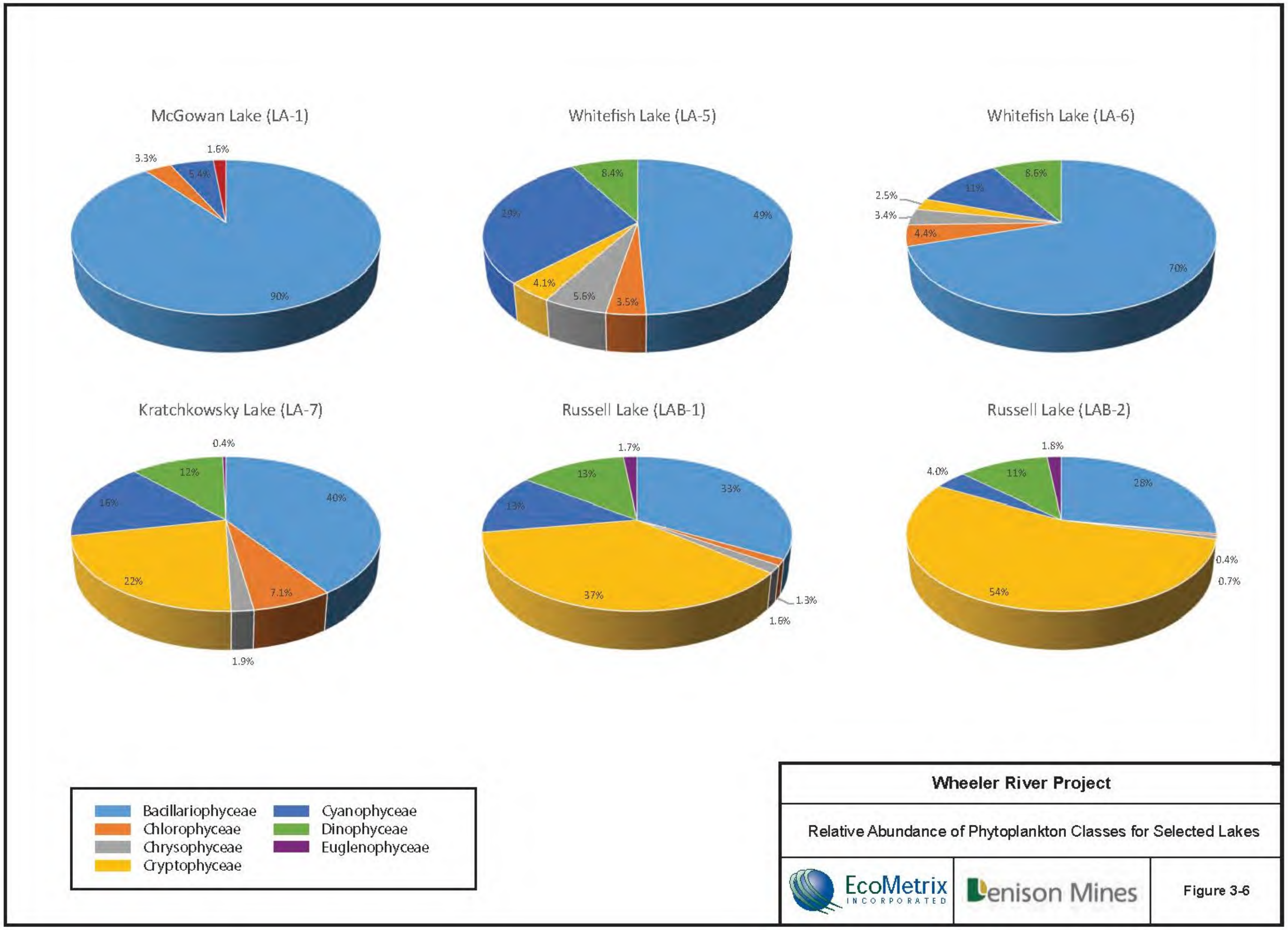
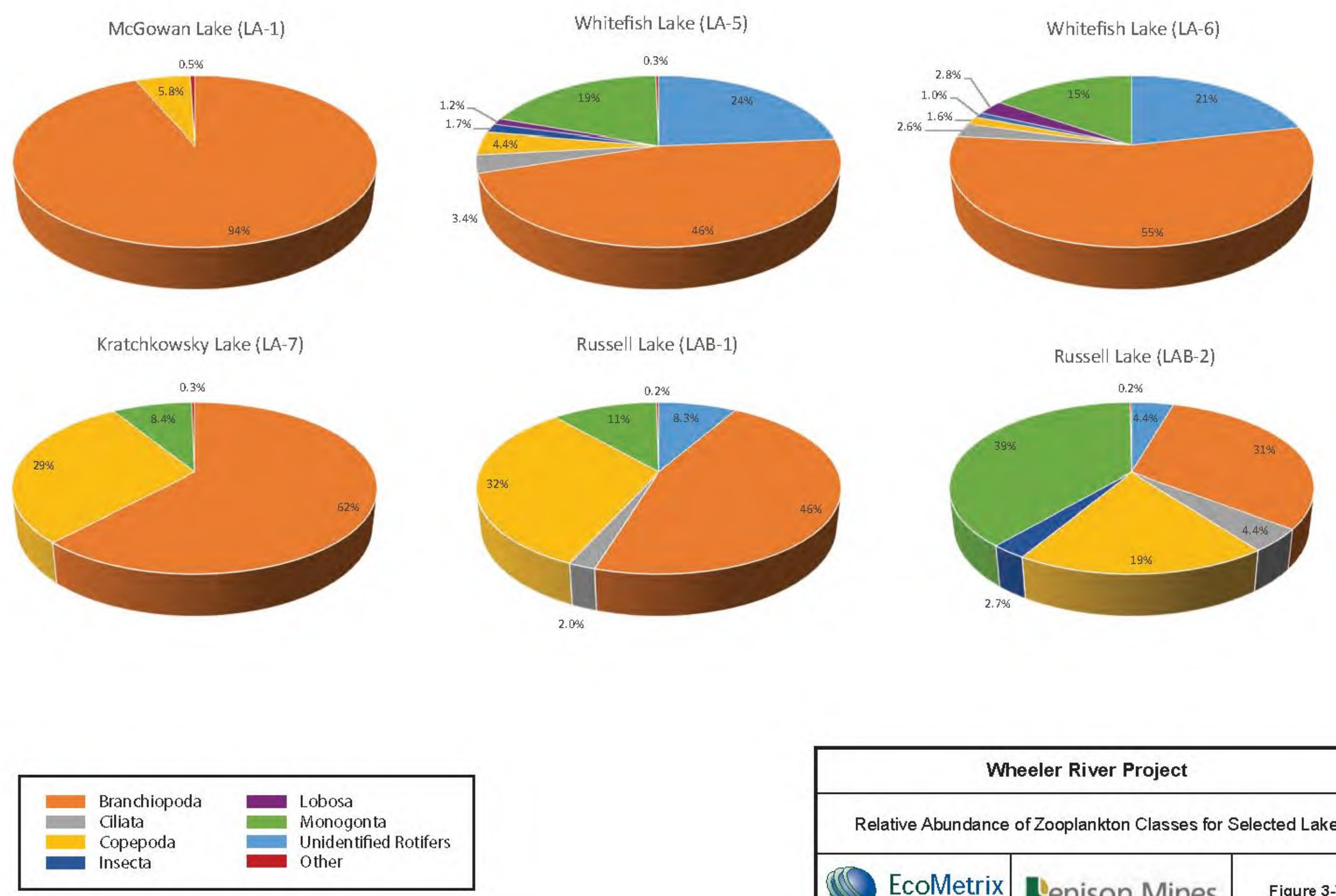


Figure 3-6: Relative Abundance of Phytoplankton Classes for Selected Lakes



Wheeler River Project		
Relative Abundance of Zooplankton Classes for Selected Lakes		
EcoMetrix INCORPORATED	Denison Mines	Figure 3-7

Figure 3-7: Relative Abundance of Zooplankton Classes for Selected Lakes

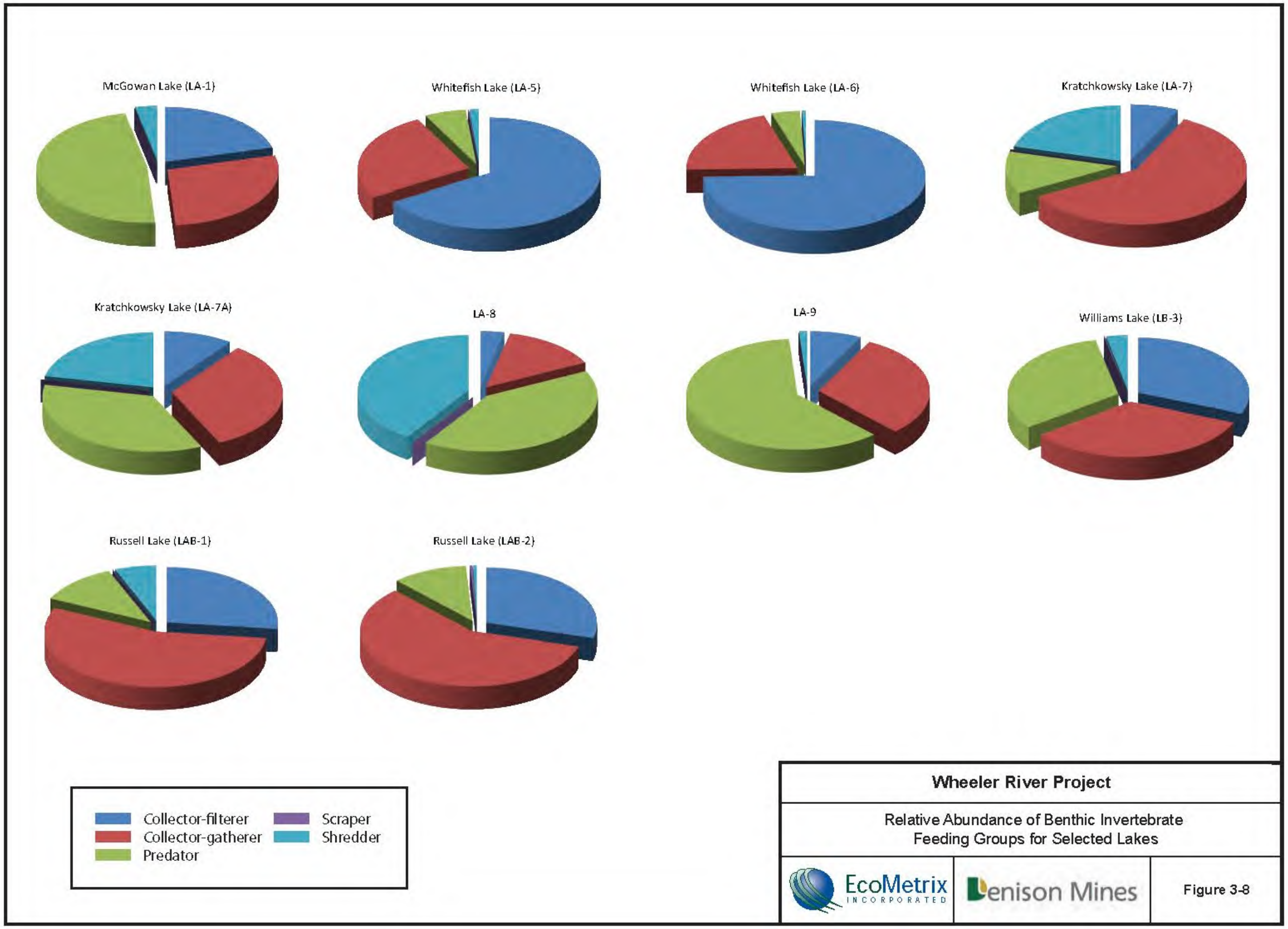


Figure 3-8: Relative Abundance of Benthic Invertebrate Feeding Groups for Selected Lakes

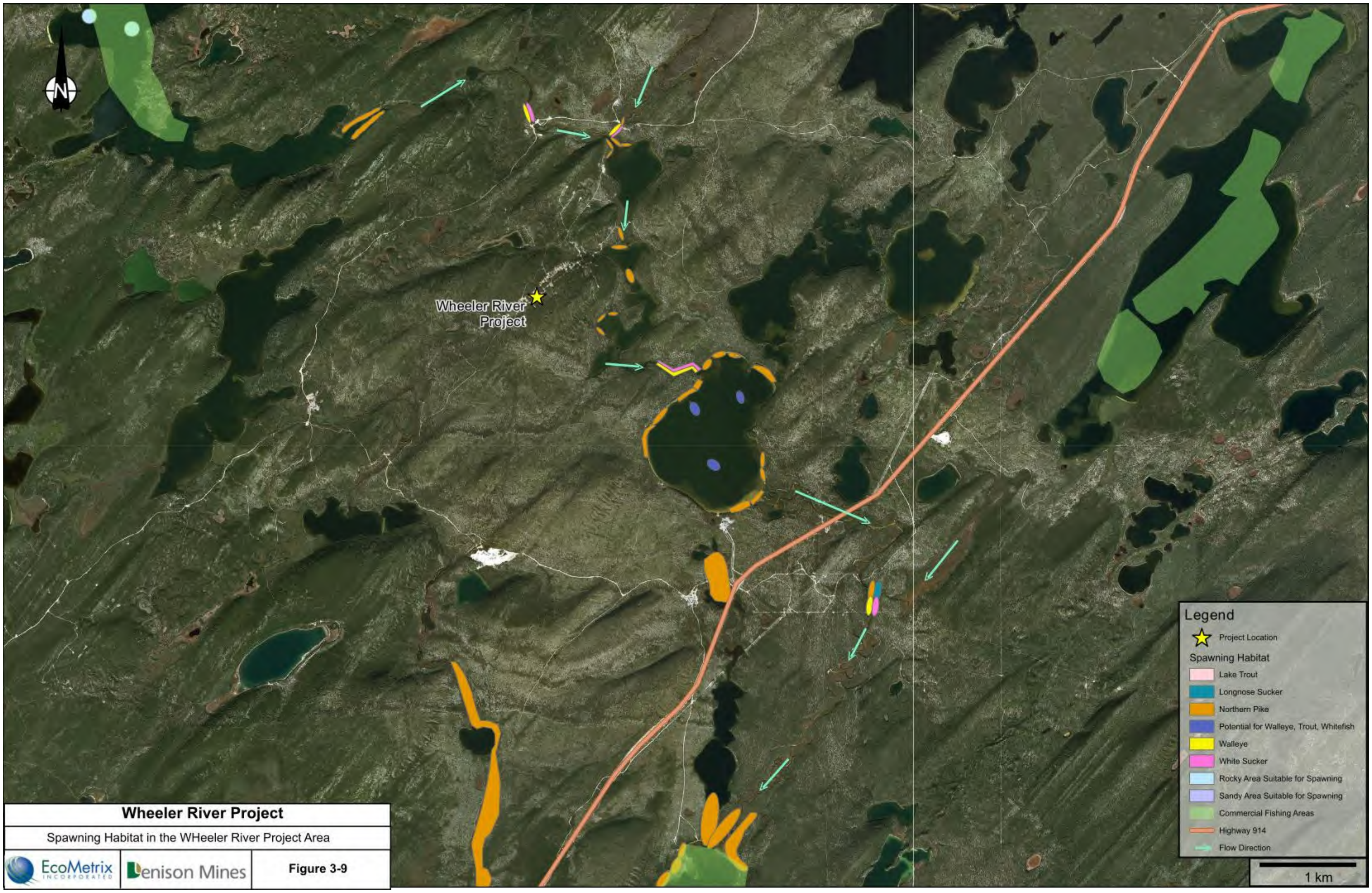


Figure 3-9 Fish Spawning Area at the Wheeler River Project Area

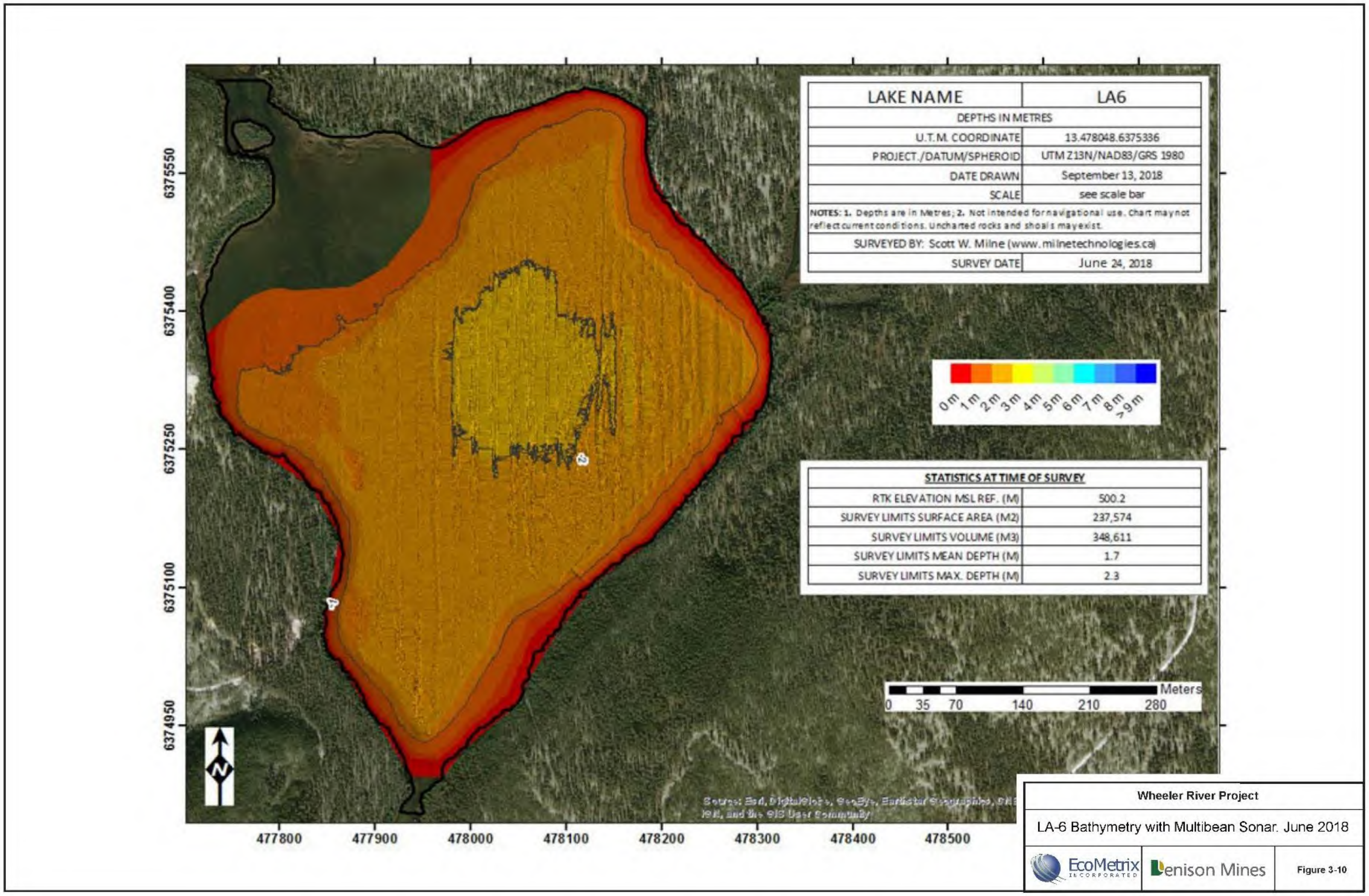


Figure 3-10: Whitefish Lake, North Basin (LA-6) Bathymetry Characterized with Multibeam Sonar, June 2018

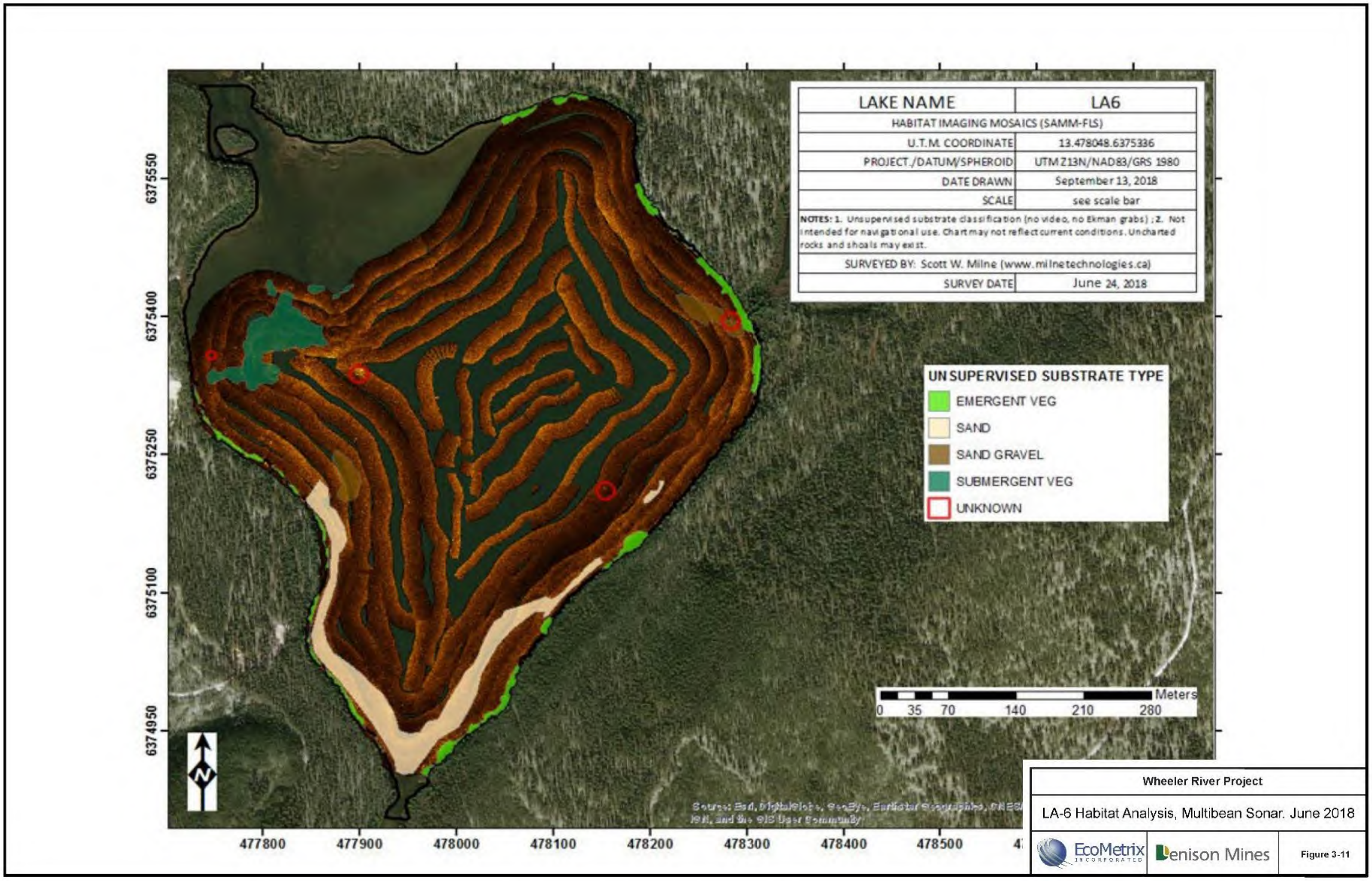


Figure 3-11: Whitefish Lake, North Basin (LA-6) Habitat Characterized with Multibeam Sonar, June 2018

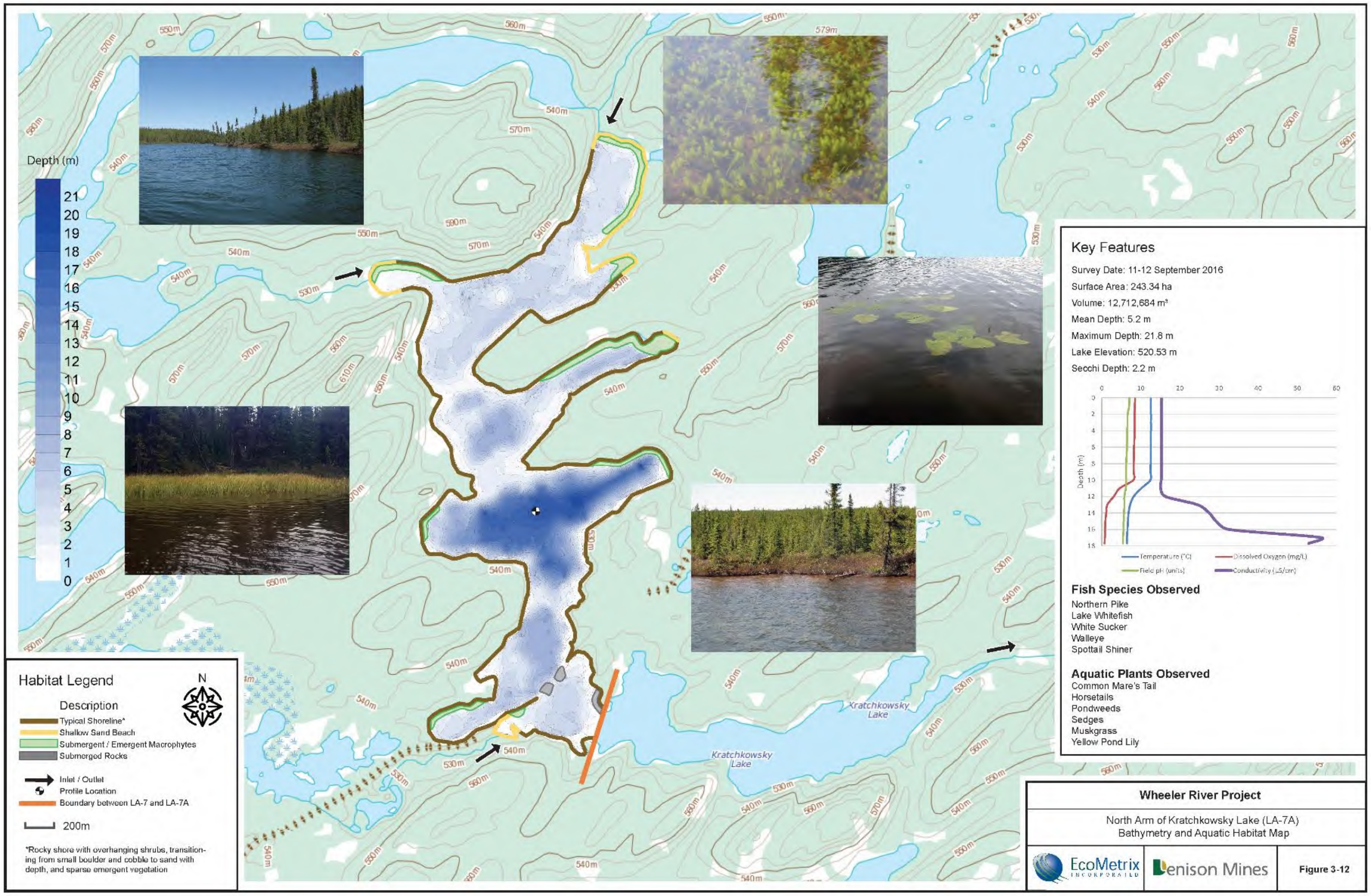


Figure 3-12: North Arm of Kratchkowsky Lake (LA-7A) Bathymetry and Aquatic Habitat Map. Typical shorelines are depicted with photographs taken within the vicinity of the Lake.

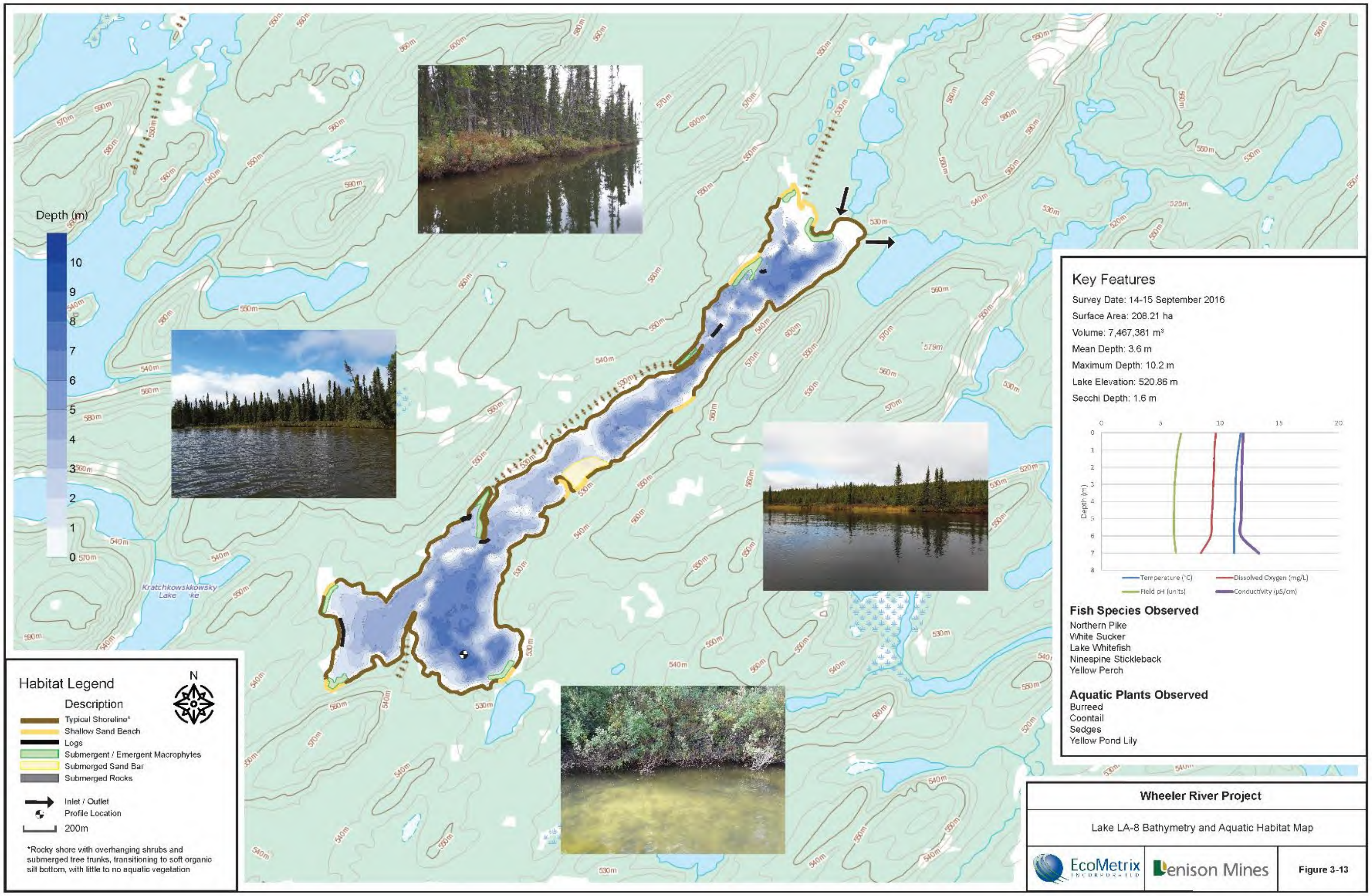


Figure 3-13: Lake LA-8 Bathymetry and Aquatic Habitat Map. Typical shorelines are depicted with photographs taken within the vicinity of the Lake.

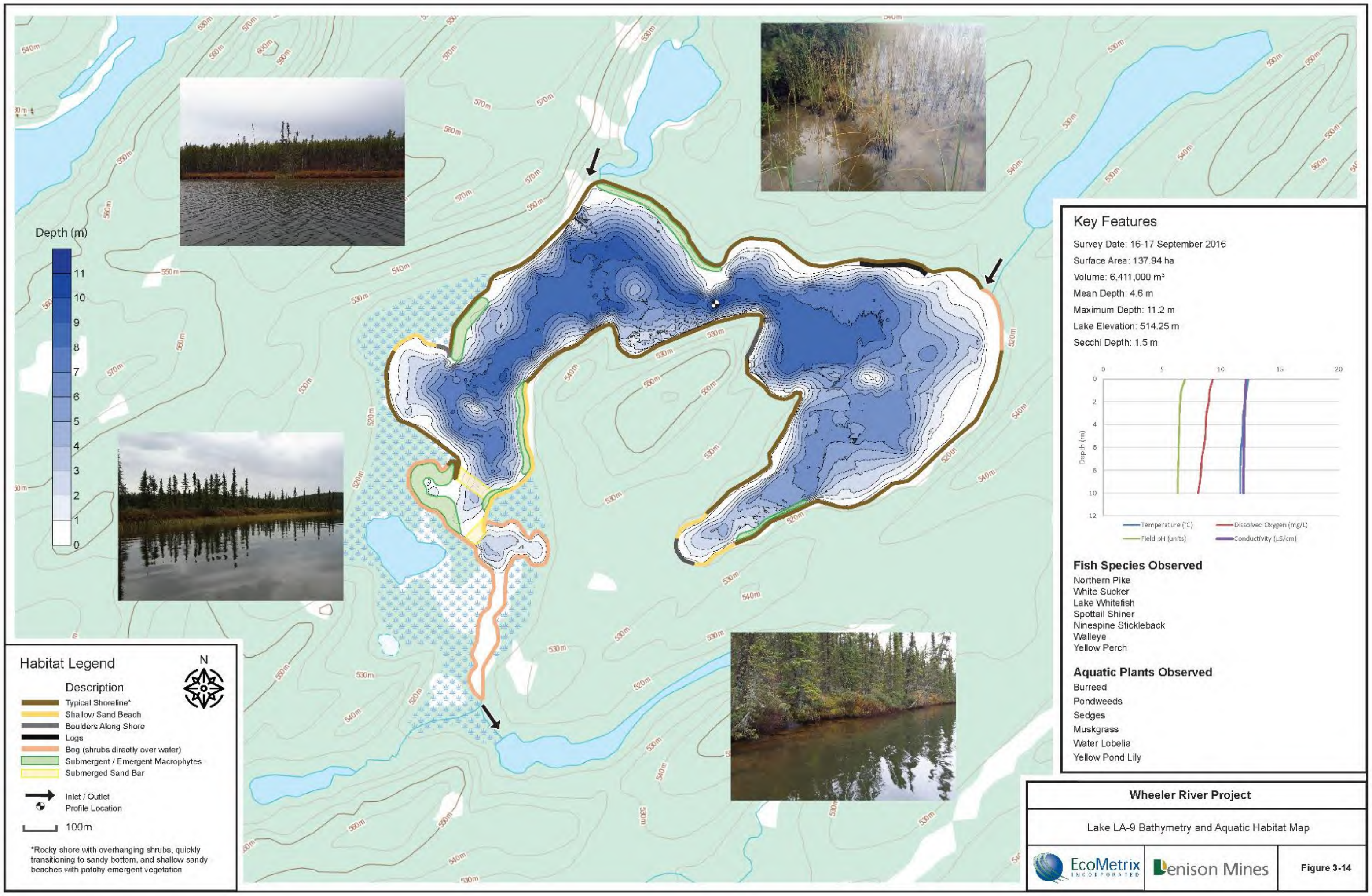


Figure 3-14: Lake LA-9 Bathymetry and Aquatic Habitat Map. Typical shorelines are depicted with photographs taken within the vicinity of the Lake.

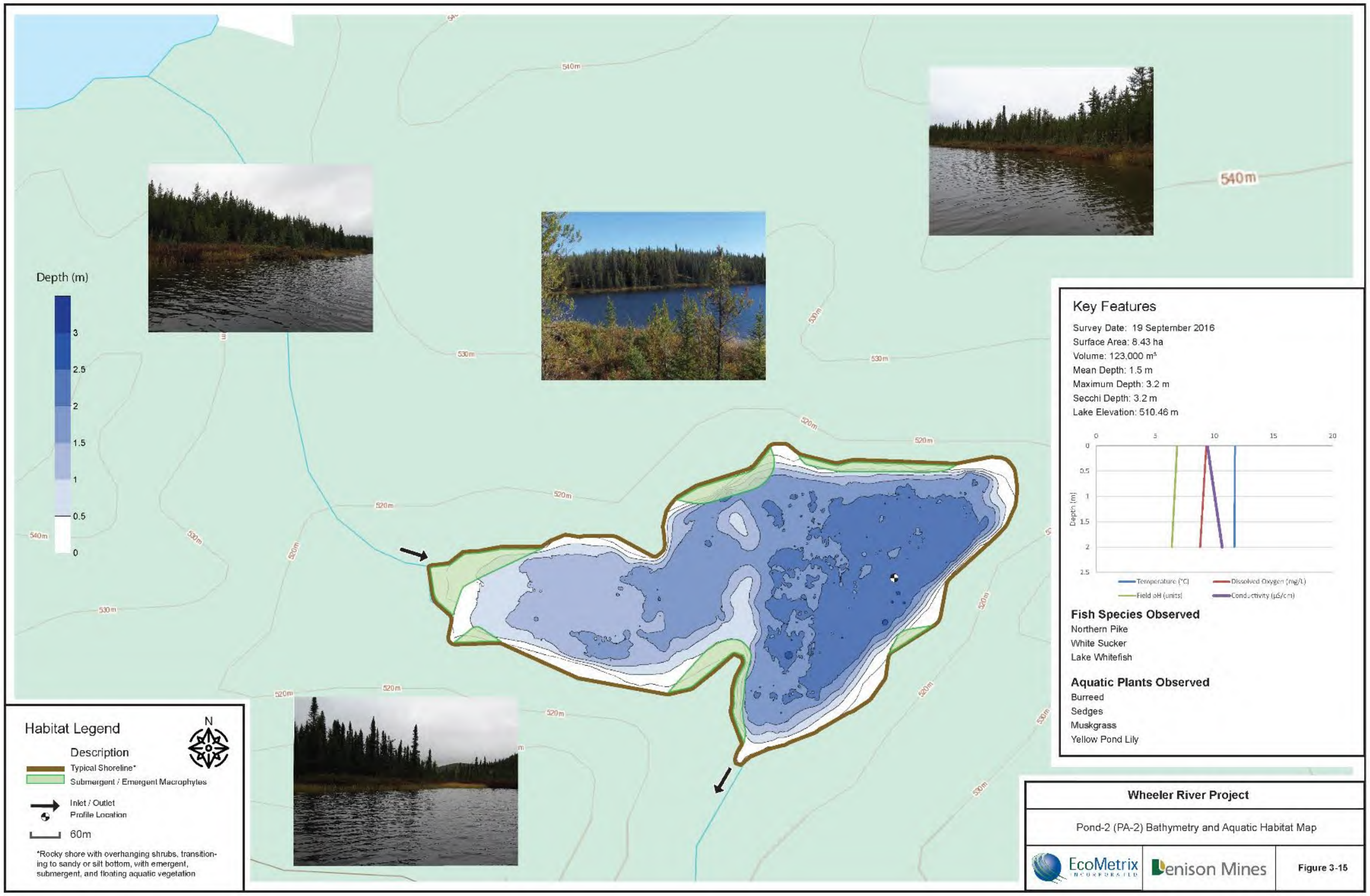


Figure 3-15: Pond-(PA-2) Bathymetry and Aquatic Habitat Map. Typical shorelines are depicted with photographs taken within the vicinity of the Lake.

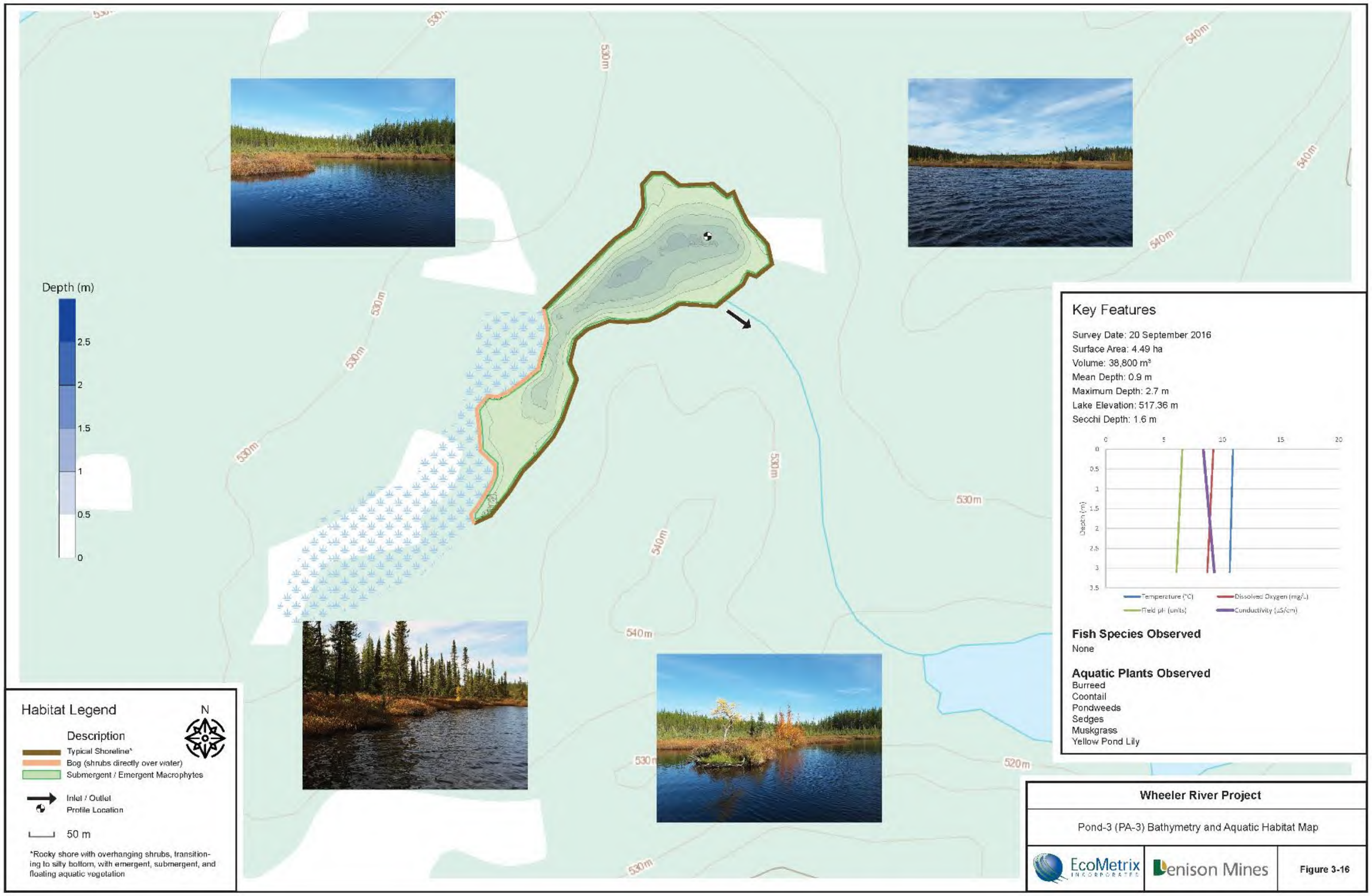


Figure 3-16: Pond (PA-3) Bathymetry and Aquatic Habitat Map. Typical shorelines are depicted with photographs taken within the vicinity of the Lake.

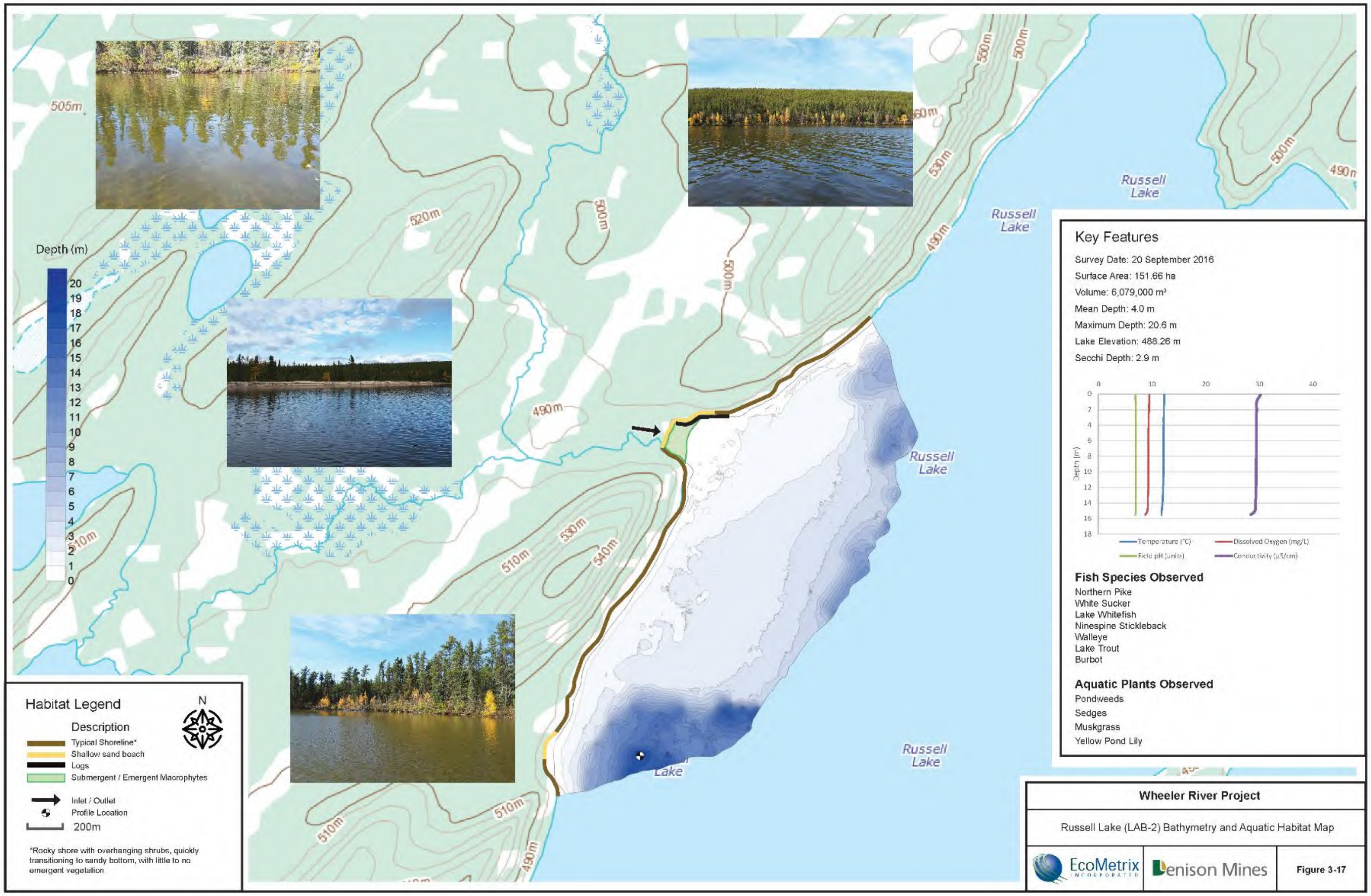


Figure 3-17: Russell Lake (LAB-2) Bathymetry and Aquatic Habitat Map. Typical shorelines are depicted with photographs taken within the vicinity of the Lake.

4.0 STREAM ASSESSMENT RESULTS

Results of the EcoMetrix aquatic baseline survey at stream monitoring locations are presented for the two principal watersheds. **Figure 1-2** displays the watersheds as defined for the baseline studies.

The Icelander River drainage flows in a southerly direction, discharging into the northwest portion of Russell Lake. Three sub-basins of the Icelander River are included in the study area. The northern sub-basin includes stream monitoring stations SA-5, SA-9 and SA-10, and the western sub-basin includes stations SA-4, SA-7, SA-8, SA-11 and RC-1. These two sub-basins are combined at SA-2 and SA-6. The eastern sub-basin includes station SA-3. All three sub-basins join at SA-1, upstream of Russell Lake.

The William Lake drainage, is situated to the southwest of the Icelander River drainage. It flows in a southerly and easterly direction into Russell Lake, approximately 3 km southwest of the Icelander River outlet. The William Lake drainage consists of two sub-basins, the most northerly of which is part of the study area and includes stream monitoring stations SB-1, SB-3, SB4 and SB-5. Station SB-2 is situated on the western sub-basin of the Williams Lake Drainage.

New stations, which were part of the 2016-19 baseline study that were not assessed in the previous baseline studies, include the inlets to Kratchkowsky Lake (SA-7, SA-8, SA 11), the outlet of LA-8 (SA-9) and the inlet to LA-9 (SA-10). **Figure 1-8** shows the locations of hydrological and aquatic monitoring stations on streams within the study area. Baseline data from 2016-19 are summarized along with historical baseline data from Golder in **Table 4-1** through **Table 4-5** and **Appendix G**.

As indicated previously, on Oct 29, 2019, Denison interviewed a local residence, Mr. Bobby John, who is familiar with local and regional ecology. EcoMetrix reviewed the meeting notes provided by Denison (Denison 2020), and compared comments provided by Bobby John to field observations at stream stations documented herein and incorporated his local knowledge into this report.

4.1 SA-1

Stream station SA-1 is the most downstream monitoring station in Icelander River basin with an estimated upstream drainage area of approximately 371 km^2 (**Figure 1-2**). The Icelander River at SA-1 is a 3rd order stream, outletting from McGowan Lake approximately 2 km upstream and discharging to Russell Lake approximately 3 km downstream (see **Figure 1-8**).

Historical and 2016-19 baseline data for SA-1 have been compiled in **Table 4-1** through **Table 4-5**.

4.1.1 Hydrology

4.1.1.1 Water Elevation and Discharge

Water level elevations measured at SA-1 between September 2016 and August 2019 ranged from 492.71 to 492.744 masl, respectively, and measured stream flows (discharge) ranged from 2.34 to 3.06 cubic metres per second (m^3/s), respectively (**Table 4-1**).

Stage and discharge measurements collected during the 2011, 2012 and 2013 monitoring seasons were used to create a stage-discharge curve for SA-1 (**Appendix G**). Manual flow measurements taken in 2019 was greater than previous years, and the stage-discharge curve was adjusted to accommodate a larger range of discharge. The updated flow measurements are plotted to the rating curve in **Appendix G**.

A summary of stream water elevations and manual stream flow measurements for all stream locations in the 2011-2019 surveys is presented in **Table 4-1.**

4.1.1.2 Continuous Water Level Recording

Continuous water level recording was available from September 2016, when a Solinst levelogger was installed in SA-1. The results are presented in **Appendix G**. In 2016, the fall discharge at SA-1 surpassed the spring peak flow measured in previous years, likely in response to the high volume of summer precipitation. The spring peak flow in 2017 was captured in mid-May, and the flow decreased steadily to late August, when in subsequently increased till end of the open-water season. During the period between May and early July 2018, stream discharge at SA-1 was in the same range as previously measured in 2013. In 2019, flow measured in both summer and fall was greater than in all previous years.

4.1.2 Water Quality

Descriptive statistics for all water quality parameters at SA-1 are provided in **Table 4-2**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), most constituent concentrations were below guideline limits. There was an exceedance of guideline limits iron (1 of 10 samples) and of the lower guideline limit for pH (1 of 10 samples). Annual baseline water quality data from 2011 to 2019 are provided in **Appendix A**, **Table A-1**.

4.1.2.1 Limnology

Water temperature, dissolved oxygen, conductivity and pH were measured at SA-1 by Golder during May, August and October 2012 and 2013, and March 2014 (see **Appendix F**).

Water temperature, conductivity, pH and dissolved oxygen measured at SA-1 during September 2016, May 2017, July 2019 and August 2019 are presented in **Table 4-3**. Over this period, *in-situ* water temperature, conductivity, pH and dissolved oxygen were in the order of 12 °C, 13 µS/cm, 6.8 and 9.7 mg/L (91% saturation), respectively.

4.1.3 Aquatic Habitat

Mean wetted channel width, water depth and water velocity for the 195 m long surveyed reach were 10 m, 0.35 m and 1.25 m/s, respectively. The stream banks were stable and the channel was meandering with some braiding. Within the surveyed reach, the stream gradient was mainly high with some moderate and low gradient sections (see **Appendix C**, Photo 1). The stream morphology was mostly riffles (65%), with some runs (20%) and pools (15%), and minor flats (5%). The canopy was mostly to partly open and instream cover was primarily afforded by deep pools, boulders, aquatic macrophytes and undercut banks. Substrates were comprised of 55% boulder, 25% cobble, 5% gravel and 15% sand, with minor amounts of detritus. Aquatic vegetation included sedges (*Carex* spp.). Slight amounts of algae and sediment were observed overlying the substrate. No barriers to fish migration were observed in the surveyed reach. The surrounding terrain was 75% upland and 25% lowland forest and riparian vegetation included jack pine, black spruce, sweet gale (*Myrica gale*) and willow (*Salix* spp.). Stonefly nymphs (Plecoptera) were observed on bottom substrates. Stream habitat characteristics are detailed in **Appendix A**, **Table A-15**.

4.1.4 Fish Community

A summary of the fish community is presented in **Table 4-4**. Detailed fish catch data including fishing effort and numbers of each species collected are presented in **Appendix A**, **Tables A-13, A-15**. Within a 75-m stream reach during the fall 2016 survey, 1,144 seconds of electrofishing effort was expended, resulting in the capture of 42 fish from 5 species. One additional species, Arctic Grayling, was observed but not captured. Eleven young-of-the-year (YOY) and 12 juvenile Burbot, 1 juvenile and 9 adult Lake Chub, 4 juvenile Longnose Sucker, 4 adult Slimy Sculpin (*Cottus cognatus*), and 1 juvenile White Sucker were captured. Catch-per-unit-effort (CPUE) was 2.20 fish/minute of electrofishing. Ten Northern Pike and one Lake Whitefish were captured by angling at the lower end of the reach, below the rapids, during the spring 2017 survey. Twelve adult Longnose Sucker were captured by gillnet and two adult Northern Pike were observed within the ponded area above the rapids. The list of fish species identified was reviewed by Bobby John, and is considered inclusive and comprehensive.

4.1.4.1 Fish Spawning

During the fall 2016 survey, potential spawning habitat was identified for Arctic Grayling, Walleye, Northern Pike and suckers in the station reach. A spring spawning survey was undertaken at this location during late May 2017 and Longnose Sucker and Northern Pike were observed within the reach (**Table 4-5**). The water temperature was 10°C, within the range reported for Longnose Sucker spawning (Scott and Crossman, 1973). Nine male and 3 female Longnose Sucker were collected. The sexual condition of the some of the males was ripe, but the females were not, indicating that spawning was imminent but had not yet occurred. Two adult Northern Pike exhibiting courtship behaviour were observed adjacent suitable spawning habitat, within the ponded area upstream of the rapids (see **Appendix C**, **Photo 2**). Suitable spawning habitats for Walleye and White Sucker were also observed but species use was not confirmed. No additional spawning areas in the vicinity of SA-1 were noted by Bobby John during his interview with Denison (Denison 2020).

4.2 SA-2

Stream station SA-2 is situated within the Icelander River watershed, on the northwest tributary of McGowan Lake (LA-1), immediately upstream of the lake, approximately 800 m downstream of Whitefish Lake (LA-6) (see **Figure 1-8**). At this location the stream is 3rd order.

Historical and 2016-19 baseline data for SA-2 have been compiled in **Table 4-1**through **Table 4-5.**

4.2.1 Hydrology

4.2.1.1 **Water Elevation and Discharge**

Between September 2016 and August 2019, water level elevation and stream flow measured at SA-2 ranged from 496.75 to 496.77 masl; and 1.95 to 2.24 m^3/s, respectively (**Appendix G**).

Stage and discharge measurements collected during the 2011, 2012 and 2013 monitoring seasons were used to create a stage-discharge curve for SA-2 (**Appendix G**). During the 2019 monitoring survey, it was determined that water level elevations recorded in September 2016 and July 2019 were not measured at the original Golder cross-section location, creating a discrepancy in water levels. The old cross section was identified during the August field program and sufficient data were available to correct the July 2019 measurement. The original cross section location will be used for measurements in future field monitoring programs.

A summary of stream water elevations and manual stream flow measurements for all stream locations in the 2011-2019 surveys is found in **Table 4-1**.

4.2.2 Water Quality

Descriptive statistics for all water quality parameters at SA-2 are provided in **Table 4-2**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), most constituent concentrations were below guideline limits. There was an exceedance of CCME CWQG guideline limit for zinc (1 of 10 samples). This exceedance was only slightly above the 0.007 mg/L value based on dissolved zinc. Annual baseline water quality data from 2011 to 2019 are provided in **Appendix A**, **Table A-1**.

4.2.2.1 **Limnology**

Water temperature, dissolved oxygen, conductivity, and pH were measured at SA-2 by Golder during May, August and October 2012 and 2013, and March 2014 (see **Appendix F**).

Water temperature, conductivity, pH and dissolved oxygen measured at SA-2 during September 2016, May 2017, July 2019 and August 2019 are presented in **Table 4-3**. Over this period, *in-situ* water temperature, conductivity, pH and dissolved oxygen were in the order of 14 °C, 13 µS/cm, 6.8 and 9.7 mg/L (93% saturation), respectively.

4.2.3 Aquatic Habitat

Mean wetted channel width, water depth and water velocity for the 285 m long surveyed reach were 9 m, 0.35 m and 1 m/s, respectively. The stream banks were stable and the channel was meandering with some braiding (see **Appendix C**, **Photo 3**). Within the surveyed reach, the stream gradient was mainly high to moderate. The stream morphology was mostly riffles (90%), with minor runs (5%) and pools (5%). The canopy was dense to partly open. Instream cover was primarily afforded by boulders and undercut banks, with minor contributions from logs and trees, deep pools and aquatic macrophytes. Substrates were comprised of 45% boulder, 40% cobble and 5% gravel, with trace amounts of sand and silt. Aquatic vegetation included sedges and horsetail (*Equisetum* sp.). Algal growth was moderate and no sediment were observed overlying the substrate. No barriers to fish migration were observed in the reach. The surrounding terrain was 90% upland and 10% lowland forest and observed riparian vegetation included jack pine, black spruce, alder (*Alnus* sp.), sweet gale, Labrador tea (*Ledum groenlandicum*) and willow. Stonefly nymphs and caddisfly larvae (Trichoptera) were observed. Stream habitat characteristics are detailed in **Appendix A**, **Table A-15**.

4.2.4 Fish Community

A summary of the fish community is presented in **Table 4-4**. Detailed fish catch data including fishing effort and numbers of each species collected are presented in **Appendix A, Tables A-13, A-16**. During the fall 2016 survey, 1,271 seconds of electrofishing effort was expended within a 285-m reach, resulting in the capture of 97 fish from 6 species. Slimy Sculpin were the most abundant species encountered, with 16 YOY, 19 juveniles and 35 adults collected. One YOY, 7 juvenile and 5 adult Lake Chub, 2 YOY and 5 juvenile Burbot, 2 YOY and 1 juvenile Northern Pike, 1 juvenile and 1 adult Arctic Grayling and 2 juvenile White Sucker were also captured. In addition, Walleye was observed but not captured. CPUE was 4.58 fish/minute of electrofishing.

Eighteen adult White Suckers were captured by gillnet at this location during the spring 2017 survey.

The list of fish species identified was reviewed by Bobby John, and is considered inclusive and comprehensive.

4.2.4.1 Fish Spawning

During the fall 2016 survey, potential spawning habitat was identified for Walleye and suckers in the vicinity of the station. A spring spawning survey was undertaken at this location during late May 2017 and use of the reach by White Sucker and Walleye was observed (**Table 4-5**) (see **Appendix C**, **Photo 4**). Fifteen male and three female White Sucker were collected. All suckers were ripe to partially spent indicating that spawning was occurring. Use of the area by Walleye was confirmed by the presence of scale piles on the stream banks left by predators. In addition, a female Walleye in post-spawning condition was captured in McGowan Lake. The water temperature was 12.4°C, above the reported spawning temperature range of 5.6 to 11.1°C for Walleye (Scott and Crossman, 1973), suggesting that spawning had already taken place.

No additional spawning areas in the vicinity of SA-2 were noted by Bobby John during his interview with Denison (Denison 2020).

4.3 SA-3

Stream station SA-3 is situated on a shallow, wide, slow-flowing, sandy-bottom stream with vertical banks, upstream of lake McGowan Lake and downstream of lake LA-2 (see **Figure** 1-8; **Appendix C**, Photos 5 and 6).

Historical and 2016-19 baseline data for SA-3 have been compiled in **Table 4-1** and **Table** 4-2.

4.3.1 Hydrology

4.3.1.1 Water Elevation and Discharge

Between September 2016 and August 2019, water level elevation and stream flow measured at SA-3 ranged from 494.43 to 494.54 masl; and 0.44 to 0.62 m^3/s, respectively (**Table 4-1**).

Stage and discharge measurements collected during the 2011, 2012 and 2013 monitoring seasons were used to create a stage-discharge curve for SA-3 (**Appendix G**). This curve was adjusted in 2019 for a better fit of updated manual stream flows taken between 2016 and 2019. The updated flow measurements are plotted to the updated rating curve in **Appendix G**.

A summary of stream water elevations and manual stream flow measurements for all stream locations in the 2011-2019 surveys is found in **Table 4-1**.

4.3.2 Water Quality

Descriptive statistics for all water quality parameters at SA-3 are provided in **Table 4-2**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), most constituent concentrations were below guideline limits. There was one exceedance of the guideline lower limit for pH (1 of 10 samples). Annual baseline water quality data from 2011 to 2019 are provided in **Appendix A**, **Table A-1**.

4.3.2.1 **Limnology**

Water temperature, dissolved oxygen, conductivity, and pH were measured at SA-3 by Golder during May, August and October 2012 and 2013, and March 2014 (see **Appendix F**).

Water temperature, conductivity, pH and dissolved oxygen measured at SA-3 during July 2019 and August 2019 are presented in **Table 4-3**. Over this period, *in-situ* water temperature, conductivity, pH and dissolved oxygen were in the order of 16 °C, 16 µS/cm, 6.7 and 8.9 mg/L (91% saturation), respectively.

4.4 SA-4

Stream station SA-4 is situated about 800 m upstream of Whitefish Lake (LA-6) and approximately 2 km downstream of the outlet of Kratchkowsky Lake (LA-7), and drainage from ponds PA-2 and PA-3 (see **Figure 1-8** and **Appendix C,** Photo 7 and 8). At this location the stream is 2nd order.

Historical and 2016-19 baseline data for SA-4 have been compiled in **Table 4-1** through **Table 4-5.**

4.4.1 Hydrology

4.4.1.1 **Water Elevation and Discharge**

Between September 2016 and August 2019, water level elevation and stream flow measured at SA-4 ranged from 506.35 to 506.39 masl; and 0.48 to 0.63 m^3/s, respectively (**Table 4-1**).

Stage and discharge measurements collected during the 2011, 2012 and 2013 monitoring seasons were used to create a stage-discharge curve for SA-4. Manual flow measurements taken in 2016-19 appeared to fit the existing rating curve and the rating curve can be applied to the level data. The updated flow measurements are plotted to the previously established rating curve in **Appendix G.**

A summary of stream water elevations and manual stream flow measurements for all stream locations in the 2011-2019 surveys is found in **Table 4-1** and **Appendix G.**

4.4.1.2 Continuous Water Level Recording

A Solinst levelogger was installed within a pool in this reach in September 2016, and continuous flow measurements are thus available from that time, and results are presented in **Appendix G**. In 2016, the fall discharge in SA-4 surpassed the spring peak flow in all previous monitored years, likely in response to the high volume of summer precipitation. The spring peak flow in 2017 was captured in early May, and the flow decreased gradually to mid-September, after which it increased till end of the open-water season. In May-early July, 2018, spring peak flow was observed in mid-May at approximately 0.6 m^3/s and slightly decreased in the following month. In 2019, there was no apparent spring freshet discharge peak, likely owing to low precipitation over the winter. Stream discharge was highest in early July, corresponding to the highest manual measured flow compared to previous years.

4.4.2 Water Quality

Descriptive statistics for all water quality parameters at SA-4 are provided in **Table 4-2**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), most constituent concentrations were below guideline limits. There was an exceedance of the guideline limit for cadmium (1 of 10 samples). Annual baseline water quality data from 2011 to 2019 are provided in **Appendix A**, **Table A-1**.

4.4.2.1 Limnology

Water temperature, dissolved oxygen, conductivity, and pH were measured at SA-4 by Golder during May, August and October 2012 and 2013, and March 2014 (see **Appendix F**).

Water temperature, conductivity, pH and dissolved oxygen measured at SA-4 during September 2016, May 2017, July 2019 and August 2019 are presented in **Table 4-3**. Over this period, *in-situ* water temperature, conductivity, pH and dissolved oxygen were on the order of 12 °C, 14 µS/cm, 6.7 and 8.8 mg/L (83% saturation), respectively.

4.4.3 Aquatic Habitat

Mean wetted channel width, water depth and water velocity for the 200 m long surveyed reach were 7 m, 0.25 m and 0.5 m/s, respectively. The stream banks were stable and the portions of the channel were braided, meandering, straight reach and ponded. The stream gradient was 50% high, 35% moderate and 15% low within the surveyed reach. The stream morphology was mostly riffles (60%), with some runs (20%) and pools (20%). The canopy was dense to partly open, with some open areas. Instream cover was abundant, afforded by boulders, aquatic macrophytes, deep pools, logs and trees, and undercut banks (see **Appendix C**, Photo 7). Substrates were comprised of 80% boulder, 10% cobble, 5% gravel, and 5% sand. Observed aquatic vegetation included sedges, pondweed (*Potamogeton* sp.), spike rush (*Eleocharis* sp.), burreed (*Sparganium* sp.) and horsetail. Algae growth was slight and no sediment were observed overlying the substrate. No barriers to fish migration were observed in the surveyed reach. The surrounding terrain was 70% upland and 30% lowland forest and observed riparian vegetation included jack pine, black spruce, alder, sweet gale, Labrador tea and willow. Stonefly nymphs, dragonfly nymphs (Anisoptera) and caddisfly larvae were observed. Stream habitat characteristics are detailed in **Appendix A**, **Table A-15**.

4.4.4 Fish Community

A summary of the fish community is presented in **Table 4-4**. Detailed fish catch data including fishing effort and numbers of each species collected are presented in **Appendix A, Tables A-13, A-16**. A total of 1,749 seconds of electrofishing effort was expended during the fall 2016 survey, resulting in the capture of 81 fish from 8 species. Ninespine Stickleback, White Sucker and Slimy Sculpin were the most abundant species encountered, with 23 adult stickleback, 2 YOY and 19 juvenile suckers, and 7 YOY, 6 juvenile and 6 adult sculpins collected. Three YOY and 6 juvenile Burbot, 2 YOY and 3 adult Lake Club, 1 juvenile and 1 adult Arctic Grayling, 1 juvenile Longnose Sucker, and 1 YOY Northern Pike were also captured. CPUE was 2.78 fish/minute of electrofishing. Sixteen adult White Sucker were captured by electrofishing during the spring 2017 survey. Other species observed included juvenile and adult Lake Chub, juvenile White Sucker, adult Spottail Shiner and adult Northern Pike.

The list of fish species identified during the baseline surveys was reviewed and confirmed by Bobby John (Denison, 2020).

4.4.4.1 **Fish Spawning**

During the fall 2016 survey, potential spawning habitat was identified for Arctic Grayling, Northern Pike and suckers within the station reach. A spring spawning survey was undertaken at this location during late May 2017 and use of the reach by White Sucker and Lake Chub was observed (**Table 4-5).** On 26 May 2016, the water temperature was 11°C, within the range reported for White Sucker spawning (Scott and Crossman, 1973) and hundreds of White Suckers were observed (see **Appendix C**, Photo 8). Sixteen suckers were collected, including 11 males and 5 females. Male spawning condition ranged from ripe to spent, whereas female condition ranged from ripe to partially spent, indicating that spawning was occurring. Sucker spawning activity was primarily confined to the portion of the reach downstream of the Fox Lake Tote Road, below the rapids, whereas no fish were observed above the road crossing. On 01 June 2017, large schools of Lake Chub were observed at the road crossing, suggesting that spawning was imminent or occurring nearby (**Figure 3-9**).

The fish spawning map prepared by EcoMetrix was reviewed by Bobby John and no additional spawning areas were noted in the vicinity of SA-4.

4.5 SA-5

Stream station SA-5 is situated immediately upstream of Whitefish Lake (LA-6) on the northeastern tributary into which drainage from lakes LA-8 and LA-9 reports (see **Figure** 1-8 and **Appendix C,** Photo 9 and 10). At this location the stream is 3rd order.

Historical and 2016-19 baseline data for SA-5 have been compiled in **Table 4-1** through **Table 4-5.**

4.5.1 Hydrology

4.5.1.1 Water Elevation and Discharge

Between September 2016 and August 2019, water level elevation and stream flow measured at SA-5 ranged from 500.89 to 500.96 masl; and 1.27 to 1.95 m^3/s, respectively (**Table 4-1**).

Stage and discharge measurements collected during the 2011, 2012 and 2013 monitoring seasons were used to create a stage-discharge curve for SA-5. Based on the 2016-19 data, it is apparent that the new station for SA-5 was installed upstream of the previous location. The stream bed in this area is of consistent width and gradient. Considering this, the rating curve has been adjusted to accommodate the slight change in elevation and more recent manual monitoring data. The manual flow measurements appear to be within an acceptable fit of the updated rating curve, and the rating curve could be applied to the level data but future data collection is also recommended. The updated flow measurements are plotted to the updated rating curve in **Appendix G.**

A summary of stream water elevations and manual stream flow measurements for all stream locations in the 2011-2019 surveys is found in **Table 4-1.**

4.5.1.2 Continuous Water Level Recording

A levelogger was installed on a straight run downstream of the Fox Lake Tote Road crossing, and slightly upstream of the previous continuous flow monitoring station. Results from the continuous water level recording is presented in **Appendix G**. In 2016, the fall discharge in SA-5 surpassed the spring peak flow in all previous monitored years, likely in response to the high volume of summer precipitation. The spring peak flow in 2017 was captured in early and mid-May. The flow decreased gradually to mid-September, and increased in the fall till end of the open-water season. In May-early July, 2018, the flow of SA-5 was observed higher than any previously monitored level in the spring, and the peak flow occurred in mid-May at approximately 2.5 m^3/s.

4.5.2 Water Quality

Descriptive statistics for all water quality parameters at SA-5 are provided in **Table 4-2**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), most constituent concentrations were below guideline limits. There was an exceedance of the lower guideline limit for pH (1 of 10 samples). Annual baseline water quality data from 2011 to 2019 are provided in **Appendix A**, **Table A-1**.

4.5.2.1 Limnology

Water temperature, dissolved oxygen, conductivity, pH were measured at SA-5 by Golder during May, August and October 2012 and 2013, and March 2014 (see **Appendix F**).

Water temperature, conductivity, pH and dissolved oxygen measured at SA-5 during September 2016, May 2017, July 2019 and August 2019 are presented in **Table 4-3**. Over this period, *in-situ* water temperature, conductivity, pH and dissolved oxygen were on the order of 12 °C, 13 µS/cm, 6.5 and 9.3 mg/L (87% saturation), respectively.

4.5.3 Aquatic Habitat

Mean wetted channel width, water depth and water velocity for the 300 m long surveyed reach were 15 m, 0.4 m and 0.4 m/s, respectively. The stream banks were stable and the channel was mainly a straight ponded reach, with some braiding. The stream gradient was 70% moderate and 30% low. The stream morphology was a combination of runs (40%), riffles (30%), and pools (25%), with some flats (5%) (see **Appendix C**, **Photo 9**). The canopy was partly open. Instream cover was abundant, primarily afforded by deep pools, aquatic macrophytes, boulders, and undercut banks. Substrates were comprised of 50% boulder, 25% cobble and 25% sand. Observed aquatic vegetation included sedges, pondweeds (*Potamogeton* spp.), wild calla and burreed. No algae growth or sediment were observed overlying the substrate and no barriers to fish migration were observed in the surveyed reach. The surrounding terrain was 70% upland and 30% lowland forest and observed riparian vegetation included jack pine, black spruce, alder, sweet gale, and Labrador tea. Stonefly and dragonfly nymphs were observed. Stream habitat characteristics are detailed in **Appendix A, Table A-15**.

4.5.4 Fish Community

A summary of the fish community is presented in **Table 4-4**. Detailed fish catch data including fishing effort and numbers of each species collected is presented in **Appendix A**

Tables A-13, A-16. A total of 2,314 seconds of electrofishing effort was expended during the fall 2016 survey, resulting in the capture of 54 fish from 5 species. One additional species, Walleye (adult), was observed but not captured. Three YOY and 23 juvenile Burbot, 10 YOY and 7 adult Slimy Sculpin, 2 juvenile and 4 adult Lake Chub, 1 YOY and 3 juvenile White Sucker, and 1 adult Ninespine Stickleback were captured. CPUE was 1.40 fish/minute of electrofishing.

Eighteen adult White Sucker and 1 adult Longnose Sucker were captured by gillnet during the spring 2017 survey.

The list of fish species identified during the baseline surveys was reviewed and confirmed by Bobby John (Denison, 2020).

4.5.4.1 Fish Spawning

During the fall 2016 survey, potential spawning habitat was identified for Walleye, suckers and Northern Pike within the station reach. A spring spawning survey was undertaken at this location during late May 2017 and use of the reach by White Sucker, Longnose Sucker, Walleye and Lake Chub was observed (**Table 4-5**). On May 29th the water temperature was 10.6°C, within the range reported for sucker spawning (Scott and Crossman, 1973). Eleven male and seven female White Sucker, and 1 male Longnose Sucker were collected. All suckers were ripe to spent indicating that spawning was occurring. Use of the area by Walleye was confirmed by the presence of scale piles left by predators on the stream banks. Sucker spawning activity was observed within the portion of the reach downstream of the Fox Lake Tote Road, to the outlet at lake LA-6. A large school of White Suckers was observed in the ponded area immediately upstream of the road (see **Appendix C**, **Photo 10**). On 01 June 2017, the water temperature was 19°C, within the range reported for Lake Chub spawning (Scott and Crossman, 1973) and large schools of Lake Chub were observed in the vicinity of the crossing, suggesting that spawning was imminent or occurring nearby. Many suckers were also observed in the ponded area upstream of the road but fish were no longer tightly grouped in schools, exhibiting post-spawning behaviour (**Figure 3-9**).

The fish spawning map prepared by EcoMetrix was reviewed by Bobby John and no additional spawning areas were noted in the vicinity of SA-5.

4.6 SA-6

Station SA-6 is situated on the connecting channel between the north and south basins of Whitefish Lake, LA-6 (upstream) and LA-5 (downstream), respectively (see **Figure 1-8**). At this location the watercourse is 3rd order.

Historical and 2016-19 baseline data for SA-6 have been compiled in **Table 4-1** through **Table 4-5.**

4.6.1 Hydrology

4.6.1.1 Water Elevation and Discharge

Between September 2016 and August 2019, water level elevation and stream flow measured at SA-6 ranged from 500.07 to 500.13 masl and 1.56 to 2.27 m^3/s, respectively (**Table 4-1**). Elevation of SA-6 corresponds well with the elevation of the north basin of Whitefish Lake (LA-6).

Stage and discharge measurements collected during the 2011, 2012 and 2013 monitoring seasons were used to create a stage-discharge curve for SA-6. This curve was adjusted in 2019 to accommodate greater discharge manually measured in 2019. The updated flow measurements are plotted to the rating curve in **Appendix G**.

A summary of stream water elevations and manual stream flow measurements for all stream locations in the 2011-2019 surveys is found in **Table 4-1**.

4.6.1.2 Continuous Water Level Recording

The logger installed by Golder Associates was retrieved and reinstalled at the same location. The stream gauging equipment was located approximately halfway between the two Whitefish Lake basins (LA-5 and LA-6). In 2016, the fall discharge in SA-6 surpassed the spring peak flow in all previous monitored years, likely in response to the high volume of summer precipitation. The spring peak flow in 2017 was captured in early and mid-May. The flow decreased gradually to mid-September, and increased in the fall till the end of the open-water season. In May-early July, 2018, the flow at SA-6 was fluctuating around 1.7 m^3/s till end of May before decreasing.

4.6.2 Water Quality

Descriptive statistics for all water quality parameters at SA-6 are provided in **Table 4-2**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), most constituent concentrations were below guideline limits. There were exceedances of guideline limits for cadmium (1 of 9 samples), as well as the lower guideline limit for pH (1 of 9 samples). Annual baseline water quality data from 2011 to 2019 are provided in **Appendix A**, **Table A-1**.

4.6.2.1 Limnology

Water temperature, dissolved oxygen, conductivity, pH were measured at SA-6 by Golder during May, August and October 2012 and 2013, and April 2014 (see **Appendix G**).

Water temperature, conductivity, pH and dissolved oxygen measured at SA-6 during September 2016, May 2017, July 2019 and August 2019 are presented in **Table 4-3**. Over this period, *in-situ* water temperature, conductivity, pH and dissolved oxygen were on the order of 12 °C, 14 µS/cm, 6.3 and 9.2 mg/L (86% saturation), respectively.

4.6.3 Aquatic Habitat

The surveyed reach (390 m) included the entire length of stream between the two lake basins. Mean wetted channel width, water depth and water velocity were 14 m, 0.7 m and 0.2 m/s, respectively. The banks were stable and the channel was meandering (see **Appendix C**, Photo 11). The stream gradient was low and stream morphology was primarily runs (75%) and pools (20%), with some flats (5%). The canopy was partly open. Instream cover was diverse, afforded by deep pools, aquatic macrophytes, boulders, logs and trees, and undercut banks. Substrates were comprised of 85% sand, 10% boulder and 2% silt. Observed aquatic vegetation included sedges, pondweed and horsetail (see **Appendix C**, Photo 12). Moderate algae growth and slight sediment were observed overlying the substrate and no barriers to fish migration were observed. The surrounding terrain was 50% upland and 50% lowland forest and observed riparian vegetation included jack pine, black spruce, sweet gale, and Labrador tea. Snails (Gastropoda), mayfly nymphs (*Hexagenia* sp.) and dragonfly nymphs were observed. Stream habitat characteristics are detailed in **Appendix A**, **Table A-15**.

4.6.4 Fish Community

A summary of the fish community is presented in **Table 4-4**. Detailed fish catch data including fishing effort and numbers of each species collected are presented in **Appendix A, Tables A-13, A-16**. Within a 150-m stretch of the reach, 1,531 seconds of electrofishing effort was expended during the fall 2016 survey, resulting in the capture of 24 fish from species. Twelve YOY and 3 adult Spottail Shiner, 4 YOY and 2 juvenile Burbot, 2 adult Ninespine Stickleback and 1 YOY Longnose Sucker were captured. The CPUE was 0.94 fish/minute of electrofishing.

Three adult White Sucker, 1 adult Walleye, and 3 juvenile and 3 adult Northern Pike were captured by gillnet during the spring 2017 survey. In addition, 6 adult Northern Pike and 2 adult White Sucker were observed.

The list of fish species identified during baseline surveys was reviewed by Bobby John, and is considered inclusive and comprehensive (Denison, 2020).

4.6.4.1 Fish Spawning

Potential spawning habitat for Northern Pike was observed during the fall 2016 survey within the lower reaches of the station. A spring spawning survey was undertaken during late May 2017 and White Sucker, Walleye and Northern Pike were observed (**Table 4-5**). Suitable spawning habitat for Northern Pike was noted near the inlet to the south Whitefish Lake basin (LA-5), and adult pike were observed in this vicinity (see **Appendix C**, Photo

12). On May 29th the water temperature was 12.4°C and 1 male (ripe) and 2 female White Sucker (ripe and spent), 1 male Walleye (spent), and 3 juvenile and 3 adult Northern Pike were collected. Pike spawning typically occurs immediately after ice melt at temperatures between 4.4 and 11.1° C (Scott and Crossman, 1973), suggesting that spawning had already taken place. No suitable spawning habitats for suckers or Walleye were observed within the station SA-6 reach between the two lakes (LA-5 and LA-6, **Figure 3-9**).

The fish spawning map prepared by EcoMetrix was reviewed by Bobby John and no additional spawning areas were noted in the vicinity of SA-6.

4.7 SA-7

Stream station SA-7 is situated on the southwestern inlet tributary to Kratchkowsky Lake (LA-7A) approximately 60 m upstream of the lake (see **Figure 1-8**). At this location, the watercourse is a narrow, marshy stream with vertical banks (see **Appendix C**, Photos 13 and 14).

The 2016 baseline data for SA-7 have been compiled in **Table 4-1**.

4.7.1 Hydrology

4.7.1.1 Water Elevation and Discharge

The measured stream flow in September 2016 was 0.04 m^3/s (**Table 4-1**). A summary of stream water elevations and manual stream flow measurements for all stream locations is found in **Table 4-1**.

4.7.1.2 Continuous Water Level Recording

Flow at SA-7 is slow and the channel is deep, with significant undercut banks. The gradient in the area is low, allowing backwater from Kratchkowsky Lake to influence stream water levels. SA7 was identified for continuous water level monitoring, however no logger was installed at this location. Although the water levels at this stream could be monitored, it is unlikely that a reliable rating curve could be developed for this location to convert levels to flows due to the site conditions.

4.8 SA-8

Stream station SA-8 is situated on the northwestern inlet tributary to Kratchkowsky Lake (LA-7A) approximately 15 m upstream of the lake (see **Figure 1-8**). The stream in this area is meandering, narrow, and has a sandy-bottom with steep banks (see **Appendix C**, Photos 15 and 16). Some areas of the bank were undercut.

The 2016-19 baseline data for SA-8 have been compiled in **Table 4-1**.

4.8.1 Hydrology

4.8.1.1 Water Elevation and Discharge

Between September 2016 and August 2019, water level elevation and stream flow measured at SA-8 ranged from 500.07 to 500.13 masl; and 1.56 to 2.27 m^3/s, respectively(**Table 4-1**).

It was believed that stage measurements in taken at SA-8 during September 2016, May 2017 and July 2018 were influenced by Kratchkowsky Lake water level and not representative of the hydraulics of the inflow channel. Therefore, in August 2019, the cross-section was moved upstream and surveyed to new local benchmarks.

A summary of stream water elevations and manual stream flow measurements for all stream locations in the 2016-2019 surveys is found in **Table 4-1**.

4.8.1.2 Continuous Water Level Recording

A continuous water level recording device was installed in a relatively straight faster section of the stream immediately upstream of the lake in September 2016. As noted above, the station was moved upstream in August 2019 and the levelogger was re installed at the new location. As a rating curve is not yet available, elevation results were compiled and presented in **Appendix G**.

4.9 SA-9

4.9.1 General Description

Stream station SA-9 is situated on the southeastern outlet tributary of lake LA-8, approximately 50 m downstream of the lake (see **Figure 1-8**). The stream in this area is shallow and the stream bottom is comprised mainly of sand, gravel, and cobbles (see **Appendix C**, **Photos 17** and **18**).

The 2016-19 baseline data for SA-9 have been compiled in **Table 4-1**.

4.9.2 Hydrology

4.9.2.1 Water Elevation and Discharge

Between September 2016 and August 2019, water level elevation and stream flow measured at SA-9 ranged from 520.49 to 520.55 masl; and 0.15 to 0.18 m^3/s, respectively (**Table 4-1**).

The manual flow measurements taken at SA-9 to date were not sufficient to develop a rating curve.

A summary of stream water elevations and manual stream flow measurements for all stream locations in the 2016-2019 surveys is found in **Table 4-1**.

4.9.2.2 **Continuous Water Level Recording**

A continuous water level recording device was installed in a pool upstream of an access trail crossing along this stretch of the stream in September 2016. Stream banks are low and the surrounding land is relatively flat. The stage-discharge data collected in 2016, 2017 and 2019 were not sufficient to develop a rating curve. Elevation results were compiled and presented in **Appendix G**.

4.10 SA-10

Stream station SA-10 is situated on the northern inlet tributary to lake LA-9, approximately 150 m upstream of the lake (see **Figure 1-8**). At this location, the watercourse is a wide, with a sandy-bottom and steep, vertical bank. The water is deep and slow flowing (see **Appendix C**, Photos 19 and 20).

The 2016-19 baseline data for SA-10 have been compiled in **Table 4-1**.

4.10.1 Hydrology

4.10.1.1 **Water Elevation and Discharge**

Between September 2016 and August 2019, water level elevation and stream flow measured at SA-10 ranged from 514.31 to 514.35 masl; and 1.22 to 1.55 m^3/s, respectively (**Table 4-1**).

The manual flow measurements taken to date at SA-10 were not sufficient to develop a rating curve.

A summary of stream water elevations and manual stream flow measurements for all stream locations in the 2016-2019 surveys is found in **Table 4-1.**

4.10.1.2 **Continuous Water Level Recording**

A continuous water level recording device was installed in a relatively straight section of the stream in an area with wadeable depths at the time of installation in September 2016. The stage-discharge data collected in 2016, 2017 and 2019 were not sufficient to develop a rating curve yet. Elevation results were compiled and presented in **Appendix G**. These data could be converted to discharge after more extreme stage results are recorded.

4.11 SA-11

Stream station SA-11 is situated on the northeastern inlet tributary to Kratchkowsky Lake (LA-7A) approximately 25 m upstream of the lake (see **Figure 1-8**). The stream bottom is comprised primarily of gravel and cobbles and the stream channel is braided (see **Appendix C**, Photos 21 and 22).

The 2016-19 baseline data for SA-11 have been compiled in **Table 4-1**.

4.11.1 Hydrology

4.11.1.1 Water Elevation and Discharge

Between September 2016 and August 2019, water level elevation and stream flow measured at SA-11 ranged from 520.56 to 520.73 masl; and 0.31 to 0.42 m^3/s, respectively (**Table 4-1**).

The manual flow measurements taken to date at SA-11 were used to develop a preliminary rating curve (**Appendix G**). However, due to the limited number of data points, caution is advised when using this curve especially for extrapolation above the highest measured discharge.

A summary of stream water elevations and manual stream flow measurements for all stream locations in the 2016-2019 surveys are found in **Table 4-1**.

4.11.1.2 Continuous Water Level Recording

A continuous water level recording device was installed in an unbraided section of the stream immediately upstream of the lake in September 2016. The stage-discharge data collected in 2016, 2017 and 2019 were not yet sufficient to develop a rating curve. Elevation results were compiled and presented in **Appendix G**.

4.12 RC-1

Stream station RC-1 is situated immediately downstream of Kratchkowsky Lake (LA-7), approximately 2 km upstream of station SA-4 (see **Figure 1-8,** and **Appendix C,** Photo 23 and 24). At this location the stream is 2nd order. This station encompasses the stream reach in the vicinity of the proposed mine road crossing.

The 2016-19 baseline data for RC-1 have been compiled in **Table 4-1** through **Table 4.5**.

4.12.1 Hydrology

4.12.1.1 Water Elevation and Discharge

Between September 2016 and August 2019, water level elevation and stream flow measured at RC-1 ranged from 520.30 to 520.56 masl; and 0.23 to 0.60 m^3/s, respectively (**Table 4-1**).

A summary of stream water elevations and manual stream flow measurements for all stream locations is found in **Table 4-1**.

4.12.2 Water Quality

Descriptive statistics for all water quality parameters at RC-1 are provided in **Table 4-2**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), all constituent concentrations were below guideline limits. Baseline water quality data from 2019 are provided in **Appendix A**, **Table A-1**.

4.12.2.1 Limnology

Water temperature, conductivity, pH and dissolved oxygen measured at RC-1 during September 2016, May 2017, July 2019 and August 2019 are presented in **Table 4-3**. Over this period, *in-situ* water temperature, conductivity, pH and dissolved oxygen were on the order of 13 °C, 16 µS/cm, 7.0 and 9.7 mg/L (93% saturation), respectively.

4.12.3 Aquatic Habitat

Mean wetted channel width, water depth and water velocity for the 305 m long reach were 3.5 m, 0.3 m and 0.75 m/s, respectively. The stream banks were stable and the channel was meandering. The stream gradient was 70% high, 25% moderate and 5% low within the surveyed reach. The stream morphology was a combination of runs (60%), riffles (30%), and pools (10%), with some flats and cascades also present (see **Appendix C**, Photo 23). The canopy was mostly dense with some partly open areas. Instream cover was diverse, afforded by boulders, deep pools, aquatic macrophytes, logs and trees, and undercut banks. Substrates were comprised of 55% cobble, 35% boulder, 5% gravel and 5% sand. Aquatic vegetation included sedges and burreed. Slight algae growth and sediment were observed overlying the substrate and no barriers to fish migration were observed. The surrounding terrain was forested upland and observed riparian vegetation included jack pine, black spruce, alder, willow, sweet gale, and Labrador tea. Stonefly nymphs, caddisfly larvae and snails were observed. Stream habitat characteristics are detailed in **Appendix A, Table A-15**.

4.12.4 Fish Community

A summary of the fish community is presented in **Table 4-4**. Detailed fish catch data including fishing effort and numbers of each species collected is presented in **Appendix A, Tables A-13, A-16**. Within a 190-m reach, 1,719 seconds of electrofishing effort was expended during the fall 2016 survey, resulting in the capture of 101 fish from 6 species. Two YOY, 10 juvenile and 48 adult Lake Chub, 22 juvenile White Sucker, 1 YOY and 15 juvenile Burbot, 2 YOY Yellow Perch, 1 adult Slimy Sculpin, and 1 juvenile Northern Pike were captured. The CPUE was 3.53 fish/minute of electrofishing.

Fourteen juvenile White Sucker, 1 juvenile Northern Pike, 27 juvenile and 6 adult Lake Chub, and 5 juvenile Burbot were captured by electrofishing during the spring 2017 survey.

4.12.4.1 Fish Spawning

During the fall 2016 survey, potential spawning habitat was identified for Walleye and suckers in the vicinity of the location. A spring spawning survey was undertaken at this location on two occasions during late May 2017 but no spawning activity, nor signs of spawning activity, were observed for any species (**Table 4-5**, **Appendix C**, Photo 24).

4.13 SB-1

Stream station SB-1 is the most downstream station in the Williams Lake drainage area, situated at the Highway 914 crossing, approximately 650 m upstream of Russell Lake (see **Figure 1-8**; **Appendix C**, **Photo 25** and **26**). At this location the stream is 3rd order.

Historical and 2016-19 baseline data for SB-1 have been compiled in **Table 4-1** through **Table 4-4**.

4.13.1 Hydrology

4.13.1.1 Water Elevation and Discharge

Water level elevation and stream flow at SB-1 in September 2016 were 488.55 masl and 0.64 m^3/s, respectively (**Table 4-1**). A summary of stream water elevations and manual stream flow measurements for all stream locations is found in **Table 4-1**.

Stage and discharge measurements collected during the 2011, 2012 and 2013 monitoring seasons were used to create a stage-discharge curve for SB-1. The rating curve for SB-1 is presented in **Appendix G.**

4.13.1.2 Continuous Water Level Recording

The monitoring station was located immediately upstream of the culverts at the McArthur River haul road. The logger deployed 2013 by Golder Associates was retrieved from this location and redeployed at SA-1. Data retrieved from the instrument included water level and temperature data from May 18, 2013 to August 30, 2015.

4.13.2 Water Quality

Descriptive statistics for all water quality parameters at SB-1 are provided in **Table 4-2**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), most constituent concentrations were below guideline limits. There were exceedances of guideline limits for iron (2 of 8 samples), as well as the guideline lower limit for pH (3 of 8 samples). Annual baseline water quality data from 2011 to 2014 are provided in **Appendix A**, **Table A-1**.

4.13.2.1 **Limnology**

Water temperature, dissolved oxygen, conductivity, pH were measured at SB-1 by Golder during May, August and October 2012 and 2013, and March 2014 (see **Appendix F**)

On 17 September 2016, the water was a clear, yellow/brown colour, and the temperature was 10.6 °C. In-situ DO was 8.41 mg/L (75.2% saturation), conductivity was 15 µS/cm, and pH was 5.98 (**Table 4-3**).

4.13.3 Aquatic Habitat

Mean wetted channel width, water depth and water velocity for the 280 m long surveyed reach were 8 m, 0.5 m and 0.2 m/s, respectively. The stream banks were stable and the channel was ponded, meandering and braided (see **Appendix C**, Photo 26). The stream gradient was 75% low and 25% moderate within the surveyed reach. The stream morphology was mostly pools (50%) and runs (40%), with flats (10%). The canopy was mostly open with some partly open. Instream cover was dense, afforded primarily by aquatic macrophytes, with some boulders and log jams. Substrates were soft and comprised of 85% muck, 10% sand and 5% boulder. Aquatic vegetation included sedges, pondweed, wild calla, yellow pond lily (*Nuphar lutea*) and burreed. No algae growth was observed overlying the substrate. Beaver dams were observed in the surveyed reach, but did not pose a barrier to fish migration. The surrounding terrain was forested lowland and riparian vegetation included tamarack, black spruce, and sweet gale. Stream habitat characteristics are detailed in **Appendix A, Table A-15**.

4.13.4 Fish Community

A summary of the fish community is presented in **Table 4-4**. Detailed fish catch data including fishing effort and numbers of each species collected is presented in **Appendix A, Table A-13**. A total of 752 seconds of electrofishing effort was expended at this location, resulting in the capture of 8 fish from a single species. Five YOY and three juvenile Burbot were captured. The CPUE was 0.64 fish/minute of electrofishing.

4.13.4.1 Fish Spawning

Suitable spawning habitat for Northern Pike was observed within the vicinity of SB-1 and pike spawning is reported to occur along the creek (B. John, pers comm, 29 October 2019).

4.14 SB-2

Stream station SB-2 is situated on a tributary that drains from the west, and joins the primary Williams Lake drainage watercourse immediately upstream of the Highway 914 crossing (see **Figure 1-8**; **Appendix C**, Photo 27). The area in the vicinity of the survey location is marshy with a thick organic base impacted by the road construction. There were signs of beaver activity in the area.

Historical and 2016-19 baseline data for SB-2 have been compiled in **Table 4-1** and **Table 4-2**.

4.14.1 Hydrology

4.14.1.1 Water Elevation and Discharge

At the time of the September 2016 field survey, no surface water connection to SB-1 was observed at this location (see **Appendix C**, Photo 28 of the Golder report located with **Appendix G** of this report). It is suspected that water either flows laterally towards SB-1 or seeps under the road embankment.

4.14.2 Water Quality

Descriptive statistics for all water quality parameters at SB-2 are provided in **Table 4-2**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), most constituent concentrations were below guideline limits. Exceedances of guideline limits occurred for iron (6 of 7 samples), as well as the lower limit guideline for pH (6 of 7 samples). All exceedances were small in magnitude. Annual baseline water quality data from 2011 to 2013 are provided in **Appendix A**, **Table A-**1.

4.14.2.1 Limnology

Water temperature, dissolved oxygen, conductivity, pH were measured at SB-2 by Golder during May, August and October 2012 and 2013 (see **Appendix F**).

4.15 SB-3

Stream station SB-3 is situated approximately 100 m downstream of lake LB-2. The stream bottom is comprised of organic material, sand, cobbles and boulders. The stream banks are nearly vertical (see **Figure 1-8**; **Appendix C**, Photos 29 and 30).

Historical and 2016-19 baseline data for SB-3 have been compiled in **Table 4-1** and **Table 4-2**.

4.15.1 Hydrology

4.15.1.1 Water Elevation and Discharge

Water level elevation and stream flow at SB-3 in September 2016 were 510.47 masl and 0.12 m^3/s, respectively. A summary of stream water elevations and manual stream flow measurements for all stream locations is found in **Table 4-1**.

Stage and discharge measurements collected during the 2011, 2012 and 2013 monitoring seasons were used to create a stage-discharge curve for SB-3. The rating curve for SB-3 is presented in **Appendix G**.

4.15.2 Water Quality

Descriptive statistics for all water quality parameters at SB-3 are provided in **Table 4-2**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), most constituent concentrations were below guideline limits. An exceedance of the lower limit guideline for pH occurred (1 of 8 samples). Annual baseline water quality data from 2011 to 2014 are provided in **Appendix A**, **Table A-1**.

4.15.2.1 Limnology

Water temperature, dissolved oxygen, conductivity, and pH were measured at SB-3 by Golder during May, August and October 2012 and 2013, and March 2014 (see **Appendix F**).

4.16 SB-4

Stream station SB-4 is situated on the southwestern inlet tributary to Williams Lake (LB-3), approximately 160 m upstream of the lake. The stream banks are shallow and poorly defined. The stream bottom is primarily boulders and large cobbles (see **Figure 1-8**; **Appendix C**, Photos 31 and 32).

Historical and 2016-19 baseline data for SB-4 have been compiled in **Tables**

Table 4-1: and **Table 4-2**.

4.16.1 Hydrology

4.16.1.1 **Water Elevation and Discharge**

Water level elevation and stream flow at SB-4 in September 2016 were 519.21 masl and 0.12 m^3/s, respectively. A summary of stream water elevations and manual stream flow measurements for all stream locations is found in **Table 4-1**.

Stage and discharge measurements collected during the 2011, 2012 and 2013 monitoring seasons were used to create a stage-discharge curve for SB-4. The rating curve for SB-4 is presented in **Appendix G**.

4.16.2 Water Quality

Descriptive statistics for all water quality parameters at SB-4 are provided in **Table 4-2**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), most constituent concentrations were below guideline limits. Exceedances of the lower limit guideline for pH (4 of 7 samples) occurred. Annual baseline water quality data from 2011 to 2013 are provided in **Appendix A, Table A-1**.

4.16.2.1 **Limnology**

Water temperature, dissolved oxygen, conductivity, and pH were measured at SB-4 by Golder during May, August and October 2012 and 2013 (see **Appendix F**).

4.17 SB-5

Stream station SB-5 is situated on the outlet tributary from Williams Lake (LB-3), approximately 350 m downstream of the lake and 2.6 km upstream of lake LB-2. The stream bottom was composed of sand, gravel and cobbles (see **Figure 1-8**; **Appendix C**, Photos 33 and 34).

Historical and 2016-19 baseline data for SB-5 have been compiled in **Table 4-1** and **Table 4-2.**

4.17.1 Hydrology

4.17.1.1 **Water Elevation and Discharge**

Water level elevation and stream flow at SB-5 in September 2016 were 518.33 masl and 0.14 m^3/s, respectively. A summary of stream water elevations and manual stream flow measurements for all stream locations is found in **Table 4-1**.

4.17.2 Water Quality

Descriptive statistics for all water quality parameters at SB-5 are provided in **Table 4-2**. For parameters where water quality guidelines are available (SEQG, CCME CWQG, and SSWQO), most constituent concentrations were below guideline limits. An exceedance of the lower limit guideline for pH (1 of 7 samples) occurred. Annual baseline water quality data from 2012 to 2014 are provided in **Appendix A**, **Table A-1**.

4.17.2.1 **Limnology**

Water temperature, dissolved oxygen, conductivity, pH were measured at SB-5 by Golder during May, August and October 2012 and 2013, and March 2014 (see **Appendix F**).

Tables

Table 4-1: Baseline Stream Water Elevations and Flow Measurements

Site	Number of Measurements	Minimum Elevation (masl)	Maximum Elevation (masl)	Minimum Discharge (m^3/s)	Maximum Discharge (m^3/s)
SA-1*	15	492.554	492.869	0.887	3.06
SA-2	13	496.46	496.805	0.741	2.24
SA-3	13	494.243	494.541	0.051	0.6219
SA-4*	15	506.249	506.387	0.199	0.6336
SA-5*	16	500.609	500.955	0.476	1.95
SA-6*	15	499.956	500.125	0.717	2.27
SA-7	1	No BM Set		0.04	0.04
SA-8*	5	520.54	520.62	0.01	0.056
SA-9*	3	520.49	520.55	0.16	0.18
SA-10*	3	514.31	514.35	1.22	1.55
SA-11*	4	520.71	520.84	0.31	0.42
RC-1	4**	520.3	520.56	0.23	0.58
SB-1	11	488.335	489.027	0.16	0.64
SB-2	No Measurements Taken				
SB-3	11	510.389	510.517	0.08	0.255
SB-4	10	518.964	519.245	0.007	0.12
SB-5	1	518.33	518.33	0.14	0.14

Notes:

- Units: masl = metres above sea level.
- BM - benchmark
- Refer to Figure 4-1 for location of streamflow monitoring stations
- Water level elevations are referenced to benchmarks with geodetic elevations established by Golder Associates, except for SA8, SA9, SA10, SA11, and SB5 which are referenced to geodetic elevations established as part of the 2016-17 Baseline Study
- Water level elevations and stream flows for 2011 to 2014 are from Golder (2014)
- Water level elevations and stream flows for 2016, 2018 and 2019 were collected during the 2016-19 Baseline Study conducted by Calder Engineering Ltd., EcoMetrix Incorporated and Missinipi Water Solutions

* - indicates that continuous monitoring equipment was installed during the 2016-19 Baseline Study
** - 2 elevation measurements; 4 discharge measurements

Table 4-2: Baseline Stream Water Quality Summary

Location	Parameter	Units	Benchmark Value	Benchmark Reference	Total Count	Count Less Than RDL	Minimum	Maximum	Arithmetic Mean
SA-1	Alkalinity	mg/L			10	0	2	13	5.8
	Aluminum	mg/L	0.1	SEQG	10	0	0.0022	0.0056	0.00391
	Ammonia as N	mg/L	0.103	CCME CWQG	10	7	<0.01	0.04	<0.015
	Antimony	mg/L			10	10	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	10	3	<0.0001	<0.0001	<0.0001
	Barium	mg/L			10	0	0.0022	0.0035	0.00267
	Beryllium	mg/L			10	10	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			10	0	2	16	7
	Boron	mg/L	1.5	CCME CWQG	10	10	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	10	8	<1.00E-05	0.00002	<0.000012
	Calcium	mg/L			10	0	1.2	1.7	1.37
	Carbonate	mg/L			10	10	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	10	0	0.4	0.5	0.42
	Chromium	mg/L	0.001	CCME CWQG	10	10	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			10	10	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	10	10	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			10	0	1.7	2.4	2.19
	Dissolved Phosphorus	mg/L			8	8	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	10	0	0.01	0.07	0.023
	Hardness	mg/L			8	0	5	6	5.25
	Hydroxide	mg/L			10	10	<1	<1	<1
	Iron	mg/L	0.3	SEQG	10	0	0.031	**0.31**	0.1286
	Lead	mg/L	0.001	CCME CWQG	10	10	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			10	9	<0.02	<0.02	<0.02
	Magnesium	mg/L			10	0	0.3	0.5	0.41
	Manganese	mg/L			10	0	0.0041	0.025	0.01477
	Mercury	mg/L	0.000026	CCME CWQG	10	8	2.00E-06	<1.00E-05	<8.60E-06
	Molybdenum	mg/L	31	SEQG	10	10	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	10	10	<0.0001	<0.0001	<0.0001
	Nitrate	mg/L	13.29	SEQG	7	6	<0.04	0.26	<0.071429
	P. Alkalinity	mg/L			10	10	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	10	0	**6.34**	7.06	6.789
	Phosphorus	mg/L			10	10	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			10	9	<0.005	0.01	<0.0055
	Potassium	mg/L			10	0	0.2	0.5	0.36
	Radium-226	Bq/L	0.11	SSWQO	10	7	<0.005	0.009	<0.0058
	Selenium	mg/L	0.001	CCME CWQG	10	10	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	10	10	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			10	0	1.4	1.7	1.5
	Specific Conductivity	µS/cm			12	0	13	22	17.35
	Strontium	mg/L			10	0	0.011	0.015	0.0126
	Sulphate	mg/L	128	SEQG	10	0	0.4	0.9	0.68
	Sum of Ions				10	0	6	22	11.7
	Thallium	mg/L	0.0008	CCME CWQG	10	10	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			9	9	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			10	10	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			9	9	<0.01	<0.01	<0.01
	Tin	mg/L			10	10	<0.0001	<0.0001	<0.0001
	Titanium	mg/L			10	10	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			10	0	20	33	23.5
	Total Kjeldahl Nitrogen	mg/L			10	0	0.11	0.48	0.257
	Total Organic Carbon	mg/L			10	0	1.8	2.6	2.24
	Total Suspended Solids	mg/L			10	1	<1.	4	<2.2
	Uranium	mg/L	0.015	CCME CWQG	10	10	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			10	10	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	10	7	<0.0005	0.0028	<0.00086
SA-2	Alkalinity	mg/L			10	0	2	11	6.6
	Aluminum	mg/L	0.1	SEQG	10	0	0.0039	0.081	0.01355
	Ammonia as N	mg/L	0.103	CCME CWQG	10	8	<0.01	0.04	<0.014
	Antimony	mg/L			10	10	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	10	4	<0.0001	<0.0001	<0.0001
	Barium	mg/L			10	0	0.0019	0.0041	0.00256
	Beryllium	mg/L			10	10	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			10	1	<1	13	<7.1
	Boron	mg/L	1.5	CCME CWQG	10	10	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	10	7	<1.00E-05	0.00002	<0.000012
	Calcium	mg/L			10	0	1.1	1.7	1.29
	Carbonate	mg/L			10	9	<1.	<1.	<1.
	Chloride	mg/L	120	CCME CWQG	10	0	0.2	0.4	0.32
	Chromium	mg/L	0.001	CCME CWQG	10	10	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			10	10	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	10	9	<0.0002	0.0008	<0.00026
	Dissolved Organic Carbon	mg/L			10	0	1.9	2.7	2.3
	Dissolved Phosphorus	mg/L			8	8	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	10	0	0.01	0.03	0.016
	Hardness	mg/L			8	0	4	6	4.75
	Hydroxide	mg/L			10	9	<1	2	<1.1
	Iron	mg/L	0.3	SEQG	10	0	0.041	0.11	0.0767
	Lead	mg/L	0.001	CCME CWQG	10	9	<0.0001	0.0003	<0.00012
	Lead-210	Bq/L			10	9	<0.02	0.05	<0.023
	Magnesium	mg/L			10	0	0.3	0.6	0.37
	Manganese	mg/L			10	0	0.0044	0.017	0.01064
	Mercury	mg/L	0.000026	CCME CWQG	10	8	2.00E-06	<1.00E-05	<8.60E-06
	Molybdenum	mg/L	31	SEQG	10	10	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	10	9	<0.0001	<0.0001	<0.0001
	Nitrate	mg/L	13.29	SEQG	7	6	<0.04	0.31	<0.078571
	P. Alkalinity	mg/L			10	9	<1	7	<1.6
	pH	units	6.5–9	CCME CWQG	10	0	6.58	7.04	6.818
	Phosphorus	mg/L			10	10	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			10	10	<0.005	<0.005	<0.005
	Potassium	mg/L			10	0	0.1	0.4	0.34
	Radium-226	Bq/L	0.11	SSWQO	10	7	<0.005	0.01	<0.0059
	Selenium	mg/L	0.001	CCME CWQG	10	10	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	10	10	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			10	0	1.2	1.8	1.44
	Specific Conductivity	µS/cm			12	0	9	22	15.75
	Strontium	mg/L			10	0	0.01	0.015	0.0118
	Sulphate	mg/L	128	SEQG	10	1	<0.2	0.7	<0.59
	Sum of Ions				10	0	6	19	11.6
	Thallium	mg/L	0.0008	CCME CWQG	10	10	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			9	9	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			10	9	<0.01	0.02	<0.011
	Thorium-232	Bq/L			9	9	<0.01	<0.01	<0.01
	Tin	mg/L			10	10	<0.0001	<0.0001	<0.0001
	Titanium	mg/L			10	8	<0.0002	0.0015	<0.00034
	Total Dissolved Solids	mg/L			10	0	12	30	20.8
	Total Kjeldahl Nitrogen	mg/L			10	1	<0.05	0.58	<0.24
	Total Organic Carbon	mg/L			10	0	2.1	2.4	2.28
	Total Suspended Solids	mg/L			10	3	<1	6	<1.9
	Uranium	mg/L	0.015	CCME CWQG	10	10	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			10	8	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	10	6	<0.0005	**0.0096**	<0.00163

Table 4-2 Cont'd: Baseline Stream Water Quality Summary

Location	Parameter	Units	Benchmark		Total Count	Count Less Than RDL	Minimum	Maximum	Arithmetic Mean
			Value	Reference					
SA-3	Alkalinity	mg/L			10	0	1	23	6.9
	Aluminum	mg/L	0.1	SEQG	10	0	0.0013	0.016	0.00411
	Ammonia as N	mg/L	0.103	CCME CWQG	10	7	<0.01	0.04	<0.014
	Antimony	mg/L			10	10	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	10	4	<0.0001	<0.0001	<0.0001
	Barium	mg/L			10	0	0.0025	0.004	0.00312
	Beryllium	mg/L			10	10	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			10	1	<1	28	<7.5
	Boron	mg/L	1.5	CCME CWQG	10	10	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	10	8	<1.00E-05	0.00002	<0.000011
	Calcium	mg/L			10	0	1.4	1.9	1.55
	Carbonate	mg/L			10	10	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	10	0	0.5	0.7	0.62
	Chromium	mg/L	0.001	CCME CWQG	10	10	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			10	10	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	10	10	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			10	0	1.7	2.7	2.35
	Dissolved Phosphorus	mg/L			8	8	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	10	1	<0.01	0.07	<0.023
	Hardness	mg/L			8	0	5	7	5.75
	Hydroxide	mg/L			10	9	<1	2	<1.1
	Iron	mg/L	0.3	SEQG	10	0	0.036	0.13	0.0794
	Lead	mg/L	0.001	CCME CWQG	10	10	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			10	9	<0.02	0.03	<0.021
	Magnesium	mg/L			10	0	0.4	0.5	0.44
	Manganese	mg/L			10	0	0.0063	0.023	0.01197
	Mercury	mg/L	0.000026	CCME CWQG	10	8	2.00E-06	<1.00E-05	<8.80E-06
	Molybdenum	mg/L	31	SEQG	10	10	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	10	9	<0.0001	0.0002	<0.00011
	Nitrate	mg/L	13.29	SEQG	7	6	<0.04	0.26	<0.071429
	P. Alkalinity	mg/L			10	9	<1	7	<1.6
	pH	units	6.5–9	CCME CWQG	10	0	**6.42**	7.02	6.801
	Phosphorus	mg/L			10	10	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			10	8	<0.005	0.01	<0.0056
	Potassium	mg/L			10	0	0.3	0.5	0.4
	Radium-226	Bq/L	0.11	SSWQO	10	5	<0.005	0.01	<0.0062
	Selenium	mg/L	0.001	CCME CWQG	10	10	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	10	10	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			10	0	1.4	1.8	1.54
	Specific Conductivity	µS/cm			12	0	14	24	18.758
	Strontium	mg/L			10	0	0.013	0.018	0.0145
	Sulphate	mg/L	128	SEQG	10	0	0.4	0.8	0.73
	Sum of Ions				10	0	6	33	12.7
	Thallium	mg/L	0.0008	CCME CWQG	10	10	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			9	9	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			10	10	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			9	8	<0.01	<0.01	<0.01
	Tin	mg/L			10	9	<0.0001	0.0009	<0.00018
	Titanium	mg/L			10	9	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			10	0	17	26	21.6
	Total Kjeldahl Nitrogen	mg/L			10	0	0.13	0.3	0.237
	Total Organic Carbon	mg/L			10	0	1.8	2.6	2.35
	Total Suspended Solids	mg/L			10	3	<1	3	<1.7
	Uranium	mg/L	0.015	CCME CWQG	10	10	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			10	10	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	10	6	<0.0005	0.0021	<0.00078
SA-4	Alkalinity	mg/L			10	0	2	15	7.6
	Aluminum	mg/L	0.1	SEQG	10	0	0.0025	0.0099	0.00568
	Ammonia as N	mg/L	0.103	CCME CWQG	10	8	<0.01	0.05	<0.015
	Antimony	mg/L			10	10	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	10	5	<0.0001	<0.0001	<0.0001
	Barium	mg/L			10	0	0.0021	0.0032	0.0025
	Beryllium	mg/L			10	10	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			10	0	2	18	9.2
	Boron	mg/L	1.5	CCME CWQG	10	10	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	10	8	<1.00E-05	**0.00007**	<0.000016
	Calcium	mg/L			10	0	1.3	2	1.52
	Carbonate	mg/L			10	10	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	10	0	0.4	0.6	0.46
	Chromium	mg/L	0.001	CCME CWQG	10	10	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			10	10	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	10	10	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			10	0	2	3.1	2.37
	Dissolved Phosphorus	mg/L			8	8	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	10	0	0.01	0.07	0.025
	Hardness	mg/L			8	0	5	7	5.625
	Hydroxide	mg/L			10	10	<1	<1	<1
	Iron	mg/L	0.3	SEQG	10	0	0.034	0.13	0.0789
	Lead	mg/L	0.001	CCME CWQG	10	10	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			10	9	<0.02	0.03	<0.021
	Magnesium	mg/L			10	0	0.4	0.6	0.43
	Manganese	mg/L			10	0	0.0029	0.019	0.0112
	Mercury	mg/L	0.000026	CCME CWQG	10	8	2.00E-06	<1.00E-05	<8.60E-06
	Molybdenum	mg/L	31	SEQG	10	9	<0.0001	0.0002	<0.00011
	Nickel	mg/L	0.025	CCME CWQG	10	10	<0.0001	<0.0001	<0.0001
	Nitrate	mg/L	13.29	SEQG	7	5	<0.04	0.35	<0.091429
	P. Alkalinity	mg/L			10	10	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	10	0	6.58	7.16	6.88
	Phosphorus	mg/L			10	10	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			10	9	<0.005	0.007	<0.0052
	Potassium	mg/L			10	0	0.2	0.6	0.38
	Radium-226	Bq/L	0.11	SSWQO	10	6	<0.005	0.009	<0.006
	Selenium	mg/L	0.001	CCME CWQG	10	10	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	10	10	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			10	0	1.4	2.1	1.62
	Specific Conductivity	µS/cm			12	0	11	25	18.301
	Strontium	mg/L			10	0	0.012	0.018	0.0138
	Sulphate	mg/L	128	SEQG	10	0	0.4	0.7	0.53
	Sum of Ions				10	0	7	25	14.2
	Thallium	mg/L	0.0008	CCME CWQG	10	10	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			9	9	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			10	10	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			9	9	<0.01	<0.01	<0.01
	Tin	mg/L			10	9	<0.0001	0.0002	<0.00011
	Titanium	mg/L			10	10	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			10	0	21	40	26.6
	Total Kjeldahl Nitrogen	mg/L			10	0	0.13	0.3	0.227
	Total Organic Carbon	mg/L			10	0	2	2.6	2.35
	Total Suspended Solids	mg/L			10	1	<1.	5	<2.2
	Uranium	mg/L	0.015	CCME CWQG	10	10	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			10	8	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	10	5	<0.0005	0.0015	<0.00068

Table 4-2 Cont'd: Baseline Stream Water Quality Summary

Location	Parameter	Units	Benchmark		Total Count	Count Less Than RDL	Minimum	Maximum	Arithmetic Mean
			Value	Reference					
SA-5	Alkalinity	mg/L			10	0	2	9	5.5
	Aluminum	mg/L	0.1	SEQG	10	0	0.004	0.014	0.00673
	Ammonia as N	mg/L	0.103	CCME CWQG	10	8	<0.01	0.05	<0.014
	Antimony	mg/L			10	10	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	10	4	<0.0001	<0.0001	<0.0001
	Barium	mg/L			10	0	0.0021	0.0031	0.00251
	Beryllium	mg/L			10	10	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			10	0	2	11	6.6
	Boron	mg/L	1.5	CCME CWQG	10	10	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	10	8	<1.00E-05	0.00004	<0.000014
	Calcium	mg/L			10	0	1.1	1.4	1.22
	Carbonate	mg/L			10	10	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	10	0	0.2	0.3	0.24
	Chromium	mg/L	0.001	CCME CWQG	10	10	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			10	10	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	10	10	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			10	0	1.8	2.8	2.29
	Dissolved Phosphorus	mg/L			8	8	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	10	1	<0.01	0.08	<0.023
	Hardness	mg/L			8	0	4	5	4.625
	Hydroxide	mg/L			10	10	<1	<1	<1
	Iron	mg/L	0.3	SEQG	10	0	0.03	0.11	0.0746
	Lead	mg/L	0.001	CCME CWQG	10	10	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			10	10	<0.02	<0.02	<0.02
	Magnesium	mg/L			10	0	0.2	0.4	0.33
	Manganese	mg/L			10	0	0.0025	0.018	0.00876
	Mercury	mg/L	0.000026	CCME CWQG	10	8	2.00E-06	<1.00E-05	<8.70E-06
	Molybdenum	mg/L	31	SEQG	10	10	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	10	10	<0.0001	<0.0001	<0.0001
	Nitrate	mg/L	13.29	SEQG	7	5	<0.04	0.31	<0.085714
	P. Alkalinity	mg/L			10	10	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	10	0	**6.17**	6.99	6.757
	Phosphorus	mg/L			10	10	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			10	10	<0.005	<0.005	<0.005
	Potassium	mg/L			10	0	0.2	0.4	0.33
	Radium-226	Bq/L	0.11	SSWQO	10	6	<0.005	0.007	<0.0055
	Selenium	mg/L	0.001	CCME CWQG	10	10	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	10	10	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			10	0	1.3	1.6	1.4
	Specific Conductivity	µS/cm			12	0	8	20	14.842
	Strontium	mg/L			10	0	0.0097	0.013	0.01107
	Sulphate	mg/L	128	SEQG	10	0	0.4	0.8	0.62
	Sum of Ions				10	0	6	15	11
	Thallium	mg/L	0.0008	CCME CWQG	10	10	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			9	9	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			10	10	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			9	8	<0.01	<0.01	<0.01
	Tin	mg/L			10	10	<0.0001	<0.0001	<0.0001
	Titanium	mg/L			10	10	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			10	0	13	36	20.9
	Total Kjeldahl Nitrogen	mg/L			10	0	0.11	0.29	0.21
	Total Organic Carbon	mg/L			10	0	1.9	2.7	2.29
	Total Suspended Solids	mg/L			10	3	<1	4	<2
	Uranium	mg/L	0.015	CCME CWQG	10	10	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			10	10	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	10	8	<0.0005	0.0024	<0.00079
SA-6	Alkalinity	mg/L			9	0	3	13	6.3333
	Aluminum	mg/L	0.1	SEQG	9	0	0.0032	0.02	0.010011
	Ammonia as N	mg/L	0.103	CCME CWQG	9	7	<0.01	0.04	<0.014444
	Antimony	mg/L			9	9	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	9	3	<0.0001	<0.0001	<0.0001
	Barium	mg/L			9	0	0.0021	0.0032	0.0026444
	Beryllium	mg/L			9	9	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			9	0	4	16	7.7778
	Boron	mg/L	1.5	CCME CWQG	9	9	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	9	3	<1.00E-05	**0.00005**	<0.000017778
	Calcium	mg/L			9	0	1.2	1.8	1.3333
	Carbonate	mg/L			9	9	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	9	0	0.3	0.5	0.34444
	Chromium	mg/L	0.001	CCME CWQG	9	9	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			9	9	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	9	9	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			9	0	1.9	2.8	2.3444
	Dissolved Phosphorus	mg/L			7	7	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	9	1	<0.01	0.07	<0.0233333
	Hardness	mg/L			7	0	4	6	5.1429
	Hydroxide	mg/L			9	9	<1	<1	<1
	Iron	mg/L	0.3	SEQG	9	0	0.036	0.16	0.093889
	Lead	mg/L	0.001	CCME CWQG	9	9	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			9	9	<0.02	<0.02	<0.02
	Magnesium	mg/L			9	0	0.3	0.5	0.38889
	Manganese	mg/L			9	0	0.0037	0.029	0.012711
	Mercury	mg/L	0.000026	CCME CWQG	9	7	2.00E-06	<1.00E-05	<8.56E-06
	Molybdenum	mg/L	31	SEQG	9	9	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	9	8	<0.0001	<0.0001	<0.0001
	Nitrate	mg/L	13.29	SEQG	6	5	<0.04	0.35	<0.091667
	P. Alkalinity	mg/L			9	9	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	9	0	**6.48**	7.07	6.8111
	Phosphorus	mg/L			9	9	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			9	6	<0.005	0.007	<0.0053
	Potassium	mg/L			9	0	0.2	0.4	0.35556
	Radium-226	Bq/L	0.11	SSWQO	9	7	<0.005	0.006	<0.0051
	Selenium	mg/L	0.001	CCME CWQG	9	9	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	9	9	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			9	0	1.3	1.9	1.4667
	Specific Conductivity	µS/cm			11	0	9	23	15.745
	Strontium	mg/L			9	0	0.01	0.016	0.012
	Sulphate	mg/L	128	SEQG	9	0	0.3	0.8	0.61111
	Sum of Ions				9	0	8	22	12.222
	Thallium	mg/L	0.0008	CCME CWQG	9	9	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			9	9	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			9	9	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			9	9	<0.01	<0.01	<0.01
	Tin	mg/L			9	9	<0.0001	<0.0001	<0.0001
	Titanium	mg/L			9	7	<0.0002	0.0003	<0.00022222
	Total Dissolved Solids	mg/L			9	0	15	35	21.333
	Total Kjeldahl Nitrogen	mg/L			9	0	0.15	0.41	0.27889
	Total Organic Carbon	mg/L			9	0	1.9	2.6	2.2889
	Total Suspended Solids	mg/L			9	2	<1	6	<3.2222
	Uranium	mg/L	0.015	CCME CWQG	9	9	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			9	8	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	9	6	<0.0005	0.0016	<0.00063333

Table 4-2 Cont'd: Baseline Stream Water Quality Summary

Location	Parameter	Units	Benchmark		Total Count	Count Less Than RDL	Minimum	Maximum	Arithmetic Mean
			Value	Reference					
SB-1	Alkalinity	mg/L			8	0	3	20	7
	Aluminum	mg/L	0.1	SEQG	8	0	0.012	0.025	0.017125
	Ammonia as N	mg/L	0.103	CCME CWQG	8	6	<0.01	0.1	<0.0275
	Antimony	mg/L			8	8	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	8	4	<0.0001	<0.0001	<0.0001
	Barium	mg/L			8	0	0.002	0.0039	0.00265
	Beryllium	mg/L			8	8	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			8	0	4	24	8.5
	Boron	mg/L	1.5	CCME CWQG	8	8	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	8	5	<1.00E-05	0.00004	<0.00001375
	Calcium	mg/L			8	0	1.1	2.2	1.3875
	Carbonate	mg/L			8	8	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	8	0	0.1	0.4	0.225
	Chromium	mg/L	0.001	CCME CWQG	8	8	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			8	8	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	8	7	<0.0002	0.0004	<0.000225
	Dissolved Organic Carbon	mg/L			8	0	2.5	4.6	3.7
	Dissolved Phosphorus	mg/L			8	8	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	8	1	<0.01	0.07	<0.02375
	Hardness	mg/L			8	0	3	8	5
	Hydroxide	mg/L			8	8	<1	<1	<1
	Iron	mg/L	0.3	SEQG	8	0	0.1	**0.64**	0.24375
	Lead	mg/L	0.001	CCME CWQG	8	8	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			8	8	<0.02	<0.02	<0.02
	Magnesium	mg/L			8	1	<0.1	0.7	<0.4125
	Manganese	mg/L			8	0	0.0071	0.036	0.013138
	Mercury	mg/L	0.000026	CCME CWQG	8	8	<1.00E-05	<1.00E-05	<1.00E-05
	Molybdenum	mg/L	31	SEQG	8	8	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	8	2	<0.0001	0.0006	<0.000175
	Nitrate	mg/L	13.29	SEQG	5	4	<0.04	0.31	<0.094
	P. Alkalinity	mg/L			8	8	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	8	0	**6.27**	6.9	6.5725
	Phosphorus	mg/L			8	8	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			8	4	<0.005	0.006	<0.005375
	Potassium	mg/L			8	0	0.2	0.5	0.325
	Radium-226	Bq/L	0.11	SSWQO	8	6	<0.005	0.01	<0.005625
	Selenium	mg/L	0.001	CCME CWQG	8	8	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	8	8	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			8	0	1.2	2.1	1.3875
	Specific Conductivity	µS/cm			8	0	14	26	17
	Strontium	mg/L			8	0	0.011	0.021	0.013375
	Sulphate	mg/L	128	SEQG	8	0	0.5	1.1	0.8
	Sum of Ions				8	0	8	31	13
	Thallium	mg/L	0.0008	CCME CWQG	8	8	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			7	7	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			8	8	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			7	7	<0.01	<0.01	<0.01
	Tin	mg/L			8	7	<0.0001	0.0007	<0.000175
	Titanium	mg/L			8	1	<0.0002	0.001	<0.0003875
	Total Dissolved Solids	mg/L			8	0	18	36	23.5
	Total Kjeldahl Nitrogen	mg/L			8	0	0.15	0.28	0.22625
	Total Organic Carbon	mg/L			8	0	2.8	4.6	3.8375
	Total Suspended Solids	mg/L			8	2	<1	4	<1.625
	Uranium	mg/L	0.015	CCME CWQG	8	8	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			8	1	<0.0001	0.0002	<0.0001125
	Zinc	mg/L	0.007	CCME CWQG	8	6	<0.0005	0.0007	<0.000525
SB-2	Alkalinity	mg/L			7	0	3	8	4.7143
	Aluminum	mg/L	0.1	SEQG	7	0	0.02	0.051	0.027857
	Ammonia as N	mg/L	0.103	CCME CWQG	7	7	<0.01	<0.01	<0.01
	Antimony	mg/L			7	7	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	7	3	<0.0001	0.0002	<0.00012857
	Barium	mg/L			7	0	0.0017	0.0036	0.0023714
	Beryllium	mg/L			7	7	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			7	0	4	10	5.8571
	Boron	mg/L	1.5	CCME CWQG	7	7	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	7	2	<1.00E-05	0.00003	<0.000015714
	Calcium	mg/L			7	0	1.1	1.8	1.4
	Carbonate	mg/L			7	7	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	7	0	0.3	0.6	0.5
	Chromium	mg/L	0.001	CCME CWQG	7	7	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			7	5	<0.0001	0.0002	<0.00011429
	Copper	mg/L	0.002	CCME CWQG	7	7	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			7	0	2	6.4	4.8429
	Dissolved Phosphorus	mg/L			7	7	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	7	1	<0.01	0.03	<0.017143
	Hardness	mg/L			7	0	4	7	5.2857
	Hydroxide	mg/L			7	7	<1	<1	<1
	Iron	mg/L	0.3	SEQG	7	0	0.25	**1.34**	0.62429
	Lead	mg/L	0.001	CCME CWQG	7	6	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			7	6	<0.02	0.04	<0.022857
	Magnesium	mg/L			7	0	0.2	0.6	0.42857
	Manganese	mg/L			7	0	0.0085	0.054	0.025643
	Mercury	mg/L	0.000026	CCME CWQG	7	7	<1.00E-05	<1.00E-05	<1.00E-05
	Molybdenum	mg/L	31	SEQG	7	7	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	7	0	0.0001	0.0003	0.00022857
	Nitrate	mg/L	13.29	SEQG	4	4	<0.04	<0.04	<0.04
	P. Alkalinity	mg/L			7	7	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	7	0	**6.05**	6.78	6.3343
	Phosphorus	mg/L			7	4	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			7	1	<0.005	0.01	<0.0074286
	Potassium	mg/L			7	0	0.2	0.4	0.28571
	Radium-226	Bq/L	0.11	SSWQO	7	3	<0.005	0.009	<0.0064286
	Selenium	mg/L	0.001	CCME CWQG	7	7	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	7	7	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			7	0	1	1.5	1.1857
	Specific Conductivity	µS/cm			7	0	14	21	16.429
	Strontium	mg/L			7	0	0.01	0.019	0.013714
	Sulphate	mg/L	128	SEQG	7	0	0.6	0.9	0.74286
	Sum of Ions				7	0	8	16	10.429
	Thallium	mg/L	0.0008	CCME CWQG	7	7	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			6	5	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			7	7	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			6	6	<0.01	<0.01	<0.01
	Tin	mg/L			7	7	<0.0001	<0.0001	<0.0001
	Titanium	mg/L			7	0	0.0003	0.0018	0.00081429
	Total Dissolved Solids	mg/L			7	0	19	31	24.857
	Total Kjeldahl Nitrogen	mg/L			7	0	0.18	0.4	0.28286
	Total Organic Carbon	mg/L			7	0	2.4	7.6	5.1571
	Total Suspended Solids	mg/L			7	0	1	8	3
	Uranium	mg/L	0.015	CCME CWQG	7	6	<0.0001	0.0002	<0.00011429
	Vanadium	mg/L			7	0	0.0001	0.0003	0.00018571
	Zinc	mg/L	0.007	CCME CWQG	7	4	<0.0005	0.0032	<0.00097143

Table 4-2 Cont'd: Baseline Stream Water Quality Summary

Location	Parameter	Units	Benchmark		Total Count	Count Less Than RDL	Minimum	Maximum	Arithmetic Mean
			Value	Reference					
SB-3	Alkalinity	mg/L			8	0	3	24	7.5
	Aluminum	mg/L	0.1	SEQG	8	0	0.0052	0.012	0.0086
	Ammonia as N	mg/L	0.103	CCME CWQG	8	7	<0.01	0.04	<0.01375
	Antimony	mg/L			8	8	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	8	4	<0.0001	<0.0001	<0.0001
	Barium	mg/L			8	0	0.0025	0.0041	0.0031375
	Beryllium	mg/L			8	8	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			8	0	4	29	9.25
	Boron	mg/L	1.5	CCME CWQG	8	8	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	8	7	<1.00E-05	0.00002	<0.00001125
	Calcium	mg/L			8	0	1.1	1.7	1.4
	Carbonate	mg/L			8	8	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	8	0	0.1	0.2	0.175
	Chromium	mg/L	0.001	CCME CWQG	8	8	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			8	8	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	8	8	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			8	0	2.2	3.4	3.025
	Dissolved Phosphorus	mg/L			8	8	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	8	0	0.01	0.07	0.02375
	Hardness	mg/L			8	0	4	6	5.125
	Hydroxide	mg/L			8	8	<1	<1	<1
	Iron	mg/L	0.3	SEQG	8	0	0.042	0.22	0.096375
	Lead	mg/L	0.001	CCME CWQG	8	8	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			8	8	<0.02	<0.02	<0.02
	Magnesium	mg/L			8	0	0.3	0.5	0.3875
	Manganese	mg/L			8	0	0.0053	0.02	0.011213
	Mercury	mg/L	0.000026	CCME CWQG	8	8	<1.00E-05	<1.00E-05	<1.00E-05
	Molybdenum	mg/L	31	SEQG	8	8	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	8	2	<0.0001	0.0002	<0.0001125
	Nitrate	mg/L	13.29	SEQG	5	3	<0.04	0.4	<0.13
	P. Alkalinity	mg/L			8	8	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	8	0	**6.18**	6.99	6.6838
	Phosphorus	mg/L			8	8	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			8	6	<0.005	0.008	<0.0055
	Potassium	mg/L			8	0	0.2	0.5	0.35
	Radium-226	Bq/L	0.11	SSWQO	8	5	<0.005	0.01	<0.006
	Selenium	mg/L	0.001	CCME CWQG	8	8	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	8	8	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			8	0	1.2	1.7	1.425
	Specific Conductivity	µS/cm			8	0	15	22	17
	Strontium	mg/L			8	0	0.011	0.015	0.012625
	Sulphate	mg/L	128	SEQG	8	0	0.3	0.9	0.6875
	Sum of Ions				8	0	8	34	13.75
	Thallium	mg/L	0.0008	CCME CWQG	8	8	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			7	7	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			8	8	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			7	7	<0.01	<0.01	<0.01
	Tin	mg/L			8	8	<0.0001	<0.0001	<0.0001
	Titanium	mg/L			8	8	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			8	0	14	26	20.5
	Total Kjeldahl Nitrogen	mg/L			8	0	0.16	0.34	0.2575
	Total Organic Carbon	mg/L			8	0	2.4	3.6	3.1125
	Total Suspended Solids	mg/L			8	1	<1	4	<2.5
	Uranium	mg/L	0.015	CCME CWQG	8	8	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			8	8	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	8	6	<0.0005	0.0012	<0.0006
SB-4	Alkalinity	mg/L			7	0	2	7	3.7143
	Aluminum	mg/L	0.1	SEQG	7	0	0.019	0.033	0.026286
	Ammonia as N	mg/L	0.103	CCME CWQG	7	7	<0.01	<0.01	<0.01
	Antimony	mg/L			7	7	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	7	1	<0.0001	0.0002	<0.00012857
	Barium	mg/L			7	0	0.0025	0.0036	0.0031429
	Beryllium	mg/L			7	7	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			7	0	2	8	4.4286
	Boron	mg/L	1.5	CCME CWQG	7	7	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	7	4	<1.00E-05	0.00002	<0.000011429
	Calcium	mg/L			7	0	1	1.5	1.2714
	Carbonate	mg/L			7	7	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	7	6	<0.1	<0.1	<0.1
	Chromium	mg/L	0.001	CCME CWQG	7	7	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			7	6	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	7	7	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			7	1	<0.2	5.9	<4.1714
	Dissolved Phosphorus	mg/L			7	6	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	7	1	<0.01	0.03	<0.017143
	Hardness	mg/L			7	0	4	5	4.7143
	Hydroxide	mg/L			7	7	<1	<1	<1
	Iron	mg/L	0.3	SEQG	7	0	0.095	0.29	0.19214
	Lead	mg/L	0.001	CCME CWQG	7	7	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			7	7	<0.02	<0.02	<0.02
	Magnesium	mg/L			7	0	0.2	0.4	0.34286
	Manganese	mg/L			7	0	0.0036	0.016	0.0089
	Mercury	mg/L	0.000026	CCME CWQG	7	7	<1.00E-05	<1.00E-05	<1.00E-05
	Molybdenum	mg/L	31	SEQG	7	7	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	7	2	<0.0001	0.0003	<0.00015714
	Nitrate	mg/L	13.29	SEQG	4	3	<0.04	0.26	<0.095
	P. Alkalinity	mg/L			7	7	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	7	0	**6.07**	6.84	6.4743
	Phosphorus	mg/L			7	6	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			7	2	<0.005	0.01	<0.0061429
	Potassium	mg/L			7	0	0.1	0.4	0.24286
	Radium-226	Bq/L	0.11	SSWQO	7	6	<0.005	0.007	<0.0052857
	Selenium	mg/L	0.001	CCME CWQG	7	7	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	7	7	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			7	0	0.9	1.3	1.1429
	Specific Conductivity	µS/cm			7	0	12	17	14.429
	Strontium	mg/L			7	0	0.0089	0.014	0.0117
	Sulphate	mg/L	128	SEQG	7	0	0.4	0.7	0.51429
	Sum of Ions				7	0	5	11	7.8571
	Thallium	mg/L	0.0008	CCME CWQG	7	7	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			6	6	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			7	7	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			6	6	<0.01	<0.01	<0.01
	Tin	mg/L			7	7	<0.0001	<0.0001	<0.0001
	Titanium	mg/L			7	1	<0.0002	0.0006	<0.00038571
	Total Dissolved Solids	mg/L			7	0	18	27	22.571
	Total Kjeldahl Nitrogen	mg/L			7	0	0.22	0.65	0.33571
	Total Organic Carbon	mg/L			7	0	4	5.9	4.7571
	Total Suspended Solids	mg/L			7	1	<1	4	<2.4286
	Uranium	mg/L	0.015	CCME CWQG	7	7	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			7	0	0.0001	0.0002	0.00015714
	Zinc	mg/L	0.007	CCME CWQG	7	5	<0.0005	0.0042	<0.0010571

Table 4-2 Cont'd: Baseline Stream Water Quality Summary

Location	Parameter	Units	Benchmark		Total Count	Count Less Than RDL	Minimum	Maximum	Arithmetic Mean
			Value	Reference					
SB-5	Alkalinity	mg/L			7	0	3	13	6.7143
	Aluminum	mg/L	0.1	SEQG	7	0	0.0016	0.0086	0.0055857
	Ammonia as N	mg/L	0.103	CCME CWQG	7	6	<0.01	0.04	<0.014286
	Antimony	mg/L			7	7	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	7	1	<0.0001	<0.0001	<0.0001
	Barium	mg/L			7	0	0.0026	0.004	0.0030857
	Beryllium	mg/L			7	7	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			7	0	4	16	8.1429
	Boron	mg/L	1.5	CCME CWQG	7	7	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	7	3	<1.00E-05	0.00004	<0.000017143
	Calcium	mg/L			7	0	1.2	1.7	1.3714
	Carbonate	mg/L			7	7	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	7	0	0.1	0.2	0.18571
	Chromium	mg/L	0.001	CCME CWQG	7	7	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			7	7	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	7	7	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			7	0	2.6	3.2	2.9429
	Dissolved Phosphorus	mg/L			7	7	<0.01	<0.01	<0.01
	Fluoride	mg/L	0.12	CCME CWQG	7	0	0.01	0.07	0.025714
	Hardness	mg/L			7	0	4	6	4.8571
	Hydroxide	mg/L			7	7	<1	<1	<1
	Iron	mg/L	0.3	SEQG	7	0	0.036	0.16	0.10014
	Lead	mg/L	0.001	CCME CWQG	7	7	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			7	7	<0.02	<0.02	<0.02
	Magnesium	mg/L			7	0	0.2	0.5	0.37143
	Manganese	mg/L			7	0	0.0071	0.016	0.010729
	Mercury	mg/L	0.000026	CCME CWQG	7	7	<1.00E-05	<1.00E-05	<1.00E-05
	Molybdenum	mg/L	31	SEQG	7	7	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	7	7	<0.0001	<0.0001	<0.0001
	Nitrate	mg/L	13.29	SEQG	4	3	<0.04	0.4	<0.13
	P. Alkalinity	mg/L			7	7	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	7	0	**6.47**	6.99	6.7157
	Phosphorus	mg/L			7	7	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			7	7	<0.005	<0.005	<0.005
	Potassium	mg/L			7	0	0.2	0.5	0.35714
	Radium-226	Bq/L	0.11	SSWQO	7	6	<0.005	0.006	<0.0051429
	Selenium	mg/L	0.001	CCME CWQG	7	7	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	7	7	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			7	0	1.3	1.7	1.4429
	Specific Conductivity	µS/cm			7	0	15	23	17.429
	Strontium	mg/L			7	0	0.011	0.015	0.012
	Sulphate	mg/L	128	SEQG	7	0	0.5	1	0.71429
	Sum of Ions				7	0	8	22	12.571
	Thallium	mg/L	0.0008	CCME CWQG	7	7	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			7	6	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			7	7	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			7	7	<0.01	<0.01	<0.01
	Tin	mg/L			7	7	<0.0001	<0.0001	<0.0001
	Titanium	mg/L			7	7	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			7	0	16	24	19.286
	Total Kjeldahl Nitrogen	mg/L			7	0	0.18	0.3	0.26143
	Total Organic Carbon	mg/L			7	0	2.7	3.2	2.9714
	Total Suspended Solids	mg/L			7	2	<1	3	<1.8571
	Uranium	mg/L	0.015	CCME CWQG	7	7	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			7	7	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	7	5	<0.0005	0.0016	<0.00067143
RC-1	Alkalinity	mg/L			2	0	13	15	14
	Aluminum	mg/L	0.1	SEQG	2	0	0.0041	0.0046	0.00435
	Ammonia as N	mg/L	0.103	CCME CWQG	2	1	<0.01	0.04	<0.025
	Antimony	mg/L			2	2	<0.0002	<0.0002	<0.0002
	Arsenic	mg/L	0.005	SEQG	2	2	<0.0001	<0.0001	<0.0001
	Barium	mg/L			2	0	0.002	0.0023	0.00215
	Beryllium	mg/L			2	2	<0.0001	<0.0001	<0.0001
	Bicarbonate	mg/L			2	0	16	18	17
	Boron	mg/L	1.5	CCME CWQG	2	2	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.00004	CCME CWQG	2	2	<1.00E-05	<1.00E-05	<1.00E-05
	Calcium	mg/L			2	0	1.4	1.4	1.4
	Carbonate	mg/L			2	2	<1	<1	<1
	Chloride	mg/L	120	CCME CWQG	2	0	0.5	0.6	0.55
	Chromium	mg/L	0.001	CCME CWQG	2	2	<0.0005	<0.0005	<0.0005
	Cobalt	mg/L			2	2	<0.0001	<0.0001	<0.0001
	Copper	mg/L	0.002	CCME CWQG	2	2	<0.0002	<0.0002	<0.0002
	Dissolved Organic Carbon	mg/L			2	0	2.6	2.6	2.6
	Fluoride	mg/L	0.12	CCME CWQG	2	0	0.01	0.02	0.015
	Hydroxide	mg/L			2	2	<1	<1	<1
	Iron	mg/L	0.3	SEQG	2	0	0.048	0.081	0.0645
	Lead	mg/L	0.001	CCME CWQG	2	2	<0.0001	<0.0001	<0.0001
	Lead-210	Bq/L			2	2	<0.02	<0.02	<0.02
	Magnesium	mg/L			2	0	0.4	0.4	0.4
	Manganese	mg/L			2	0	0.0073	0.013	0.01015
	Mercury	mg/L	0.000026	CCME CWQG	2	0	2.00E-06	5.00E-06	3.50E-06
	Molybdenum	mg/L	31	SEQG	2	2	<0.0001	<0.0001	<0.0001
	Nickel	mg/L	0.025	CCME CWQG	2	2	<0.0001	<0.0001	<0.0001
	Nitrate	mg/L	13.29	SEQG	2	2	<0.04	<0.04	<0.04
	P. Alkalinity	mg/L			2	2	<1	<1	<1
	pH	units	6.5–9	CCME CWQG	2	0	7.03	7.18	7.105
	Phosphorus	mg/L			2	2	<0.01	<0.01	<0.01
	Polonium-210	Bq/L			2	2	<0.005	<0.005	<0.005
	Potassium	mg/L			2	0	0.4	0.4	0.4
	Radium-226	Bq/L	0.11	SSWQO	2	2	<0.005	<0.005	<0.005
	Selenium	mg/L	0.001	CCME CWQG	2	2	<0.0001	<0.0001	<0.0001
	Silver	mg/L	0.0001	CCME CWQG	2	2	<0.00005	<0.00005	<0.00005
	Sodium	mg/L			2	0	1.6	1.6	1.6
	Specific Conductivity	µS/cm			4	0	12	20.1	15.925
	Strontium	mg/L			2	0	0.013	0.014	0.0135
	Sulphate	mg/L	128	SEQG	2	0	0.4	0.5	0.45
	Sum of Ions				2	0	21	23	22
	Thallium	mg/L	0.0008	CCME CWQG	2	2	<0.0002	<0.0002	<0.0002
	Thorium-228	Bq/L			2	2	<0.01	<0.01	<0.01
	Thorium-230	Bq/L			2	2	<0.01	<0.01	<0.01
	Thorium-232	Bq/L			2	2	<0.01	<0.01	<0.01
	Tin	mg/L			2	2	<0.0001	<0.0001	<0.0001
	Titanium	mg/L			2	2	<0.0002	<0.0002	<0.0002
	Total Dissolved Solids	mg/L			2	0	26	38	32
	Total Kjeldahl Nitrogen	mg/L			2	0	0.26	0.29	0.275
	Total Organic Carbon	mg/L			2	0	2.2	2.2	2.2
	Total Suspended Solids	mg/L			2	0	2	5	3.5
	Uranium	mg/L	0.015	CCME CWQG	2	2	<0.0001	<0.0001	<0.0001
	Vanadium	mg/L			2	2	<0.0001	<0.0001	<0.0001
	Zinc	mg/L	0.007	CCME CWQG	2	1	<0.0005	0.0029	<0.0017

Notes:
Summary of baseline water quality data from 2011 to 2019
SEQG - Saskatchewan Environmental Quality Guideline - Water Quality Guideline for Freshwater Aquatic Life (Government of Saskachewan, 2019)
CCME CWQG - Canadian Water Quality Guideline for the Protection of Aquatic Life (CCME, 1999)
SSWQO - Saskatchewan Surface Water Quality Objective (Water Security Agency, 2015)
Mean values are indicated as "less than", "<", when one or more of the samples were below the analytical detection limit for the parameter
Ammonia guideline assumes a maximum pH of 8.5 and temperature of 25°C

Table 4-3: Baseline Stream Water Chemistry 2016-2019

Station	Date (dd/mm/yy)	Parameter				
		Temperature (°C)	Conductivity (µS/cm)	pH	Dissolved Oxygen (mg/L)	Oxygen Saturation (%)
SA-1	17/09/16	12.3	15	7.01	10.63	99.4
	28/05/17	10.0	10	-	10.83	96.0
	05/07/19	14.0	13.4	6.69	8.53	83.0
	30/08/19	12.8	14.0	6.82	8.91	84.1
SA-2	16/09/16	12.1	15	6.89	10.64	98.9
	27/05/17	12.4	11	-	10.29	96.9
	05/07/19	15.5	12.8	6.53	8.80	88.1
	30/08/19	14.0	13.7	6.98	9.11	88.2
SA-3	05/07/19	17.7	16.0	6.70	8.62	89.8
	30/08/19	15.2	16.7	6.76	9.21	92.3
SA-4	10/09/16	11.0	16	6.71	9.58	87.0
	26/05/17	11.0	11	-	10.21	92.4
	04/07/19	13.8	13.9	6.56	8.30	80.5
	29/08/19	14.1	15.8	6.93	7.15	70.2
SA-5	09/09/16	13.6	20	5.96	9.52	91.6
	29/05/17	10.6	9	-	11.14	100.7
	04/07/19	12.9	11.5	6.64	8.58	81.3
	29/08/19	12.4	12.3	6.75	7.81	73.2
SA-6	12/09/16	8.9	22	5.83	10.92	93.6
	29/05/17	12.4	11	-	10.51	98.3
	04/07/19	13.7	10.8	6.25	8.12	79.2
	29/08/19	13.8	13.7	6.86	7.33	71.1
RC-1	14/09/16	10.6	21	6.92	10.23	92.0
	29/05/17	13.1	11	-	10.71	101.7
	06/07/19	15.8	15.4	7.18	8.94	90.2
	01/09/19	12.8	15.4	7.04	9.09	86.1
SB-1	17/09/16	10.6	15	5.98	8.41	75.2

Table 4-4: Baseline Stream Fish Community Summary

Fish Species	Station						
	SA1	SA2	SA4	SA5	SA6	RC1	SB1
Lake Chub	x	x	x	x	-	x	-
Spottail Shiner	-	-	x	-	x	-	-
Longnose Sucker	x	-	x	x	x	-	-
White Sucker	x	x	x	x	x	x	-
Arctic Grayling	x	x	x	-	-	-	-
Northern Pike	x	x	x	-	x	x	-
Burbot	x	x	x	x	x	x	x
Ninespine Stickleback	-	-	x	x	x	-	-
Slimy Sculpin	x	x	x	x	-	x	-
Yellow Perch	-	-	-	-	-	x	-
Walleye	-	x	-	x	x	-	-

Notes:

Results presented in this table is from fish survey performed between 2016 and 2017.

x indicates that the species was either captured or observed

- indicates that the species was neither captured nor observed

Table 4-5: Baseline Stream Fish Spawning Summary

Station		Units	SA-1	SA-2	SA-4	SA-5	SA-6	RC-1
			28-May-17	27-May-17	26-May-17	29-May-17	29-May-17	26-May-17
Notes/Observations		-	Northern Pike spawning habitat present in upper reach. Suitable sucker and Walleye spawning habitat.	Spawning habitat for White Sucker and Walleye; limited Northern Pike spawning habitat upstream.	White Sucker and Lake Chub spawning confirmed. No quality Northern Pike spawning habitat.	Spawning habitat for suckers, Lake Chub and Walleye; limited Northern Pike spawning habitat upstream.	Northern Pike spawning habitat present in lower reach.	No large-bodied fish spawning observed.
Station Details	Location	-	Icelander River u/s of Russell Lake, d/s of LA-1	u/s of LA-1	d/s of LA-7, u/s of LA-6	u/s of LA-6	between LA-6 and LA-5	d/s of LA-7
	Coordinates	Lat	57° 28' 56.8"	57° 30' 05.0"	57° 31' 25.1"	57° 31' 26.7"	57° 30' 56.6"	57° 31' 32.7"
		Long	-105° 19' 38.6"	-105° 21' 26.7"	-105° 23' 02.1"	-105° 22' 10.6"	-105° 22' 06.4"	-105° 24' 34.7"
Habitat Features			Coolwater	Coolwater	Coolwater	Coolwater	Coolwater	Coolwater
Water Quality	Temperature	°C	9.99	12.41	10.95	10.59	12.35	13.09
	Conductivity	µS/cm	10	11	11	9	11	11
	Specific Conductivity	µS/cm	14	14	15	13	14	16
	Dissolved Oxygen	mg/L	10.83	10.29	10.21	11.14	10.51	10.71
	Dissolved Oxygen	%	96	96.9	92.4	100.7	98.3	101.7
	Water Colour	-	Colourless	Colourless	Colourless	Colourless	Colourless	Colourless
	Water Clarity	-	Clear	Clear	Clear	Clear	Clear	Clear
Physical Qualities	Reach Length	m	215	200	70	160	200	120
	Stream Width (wet)	m	12	7	8	6.5	15	8
	Mean Depth	m	0.5	0.5	0.25	0.3	0.7	0.2
	Mean Flow Velocity	m/s	0.6-0.95	0.7-1.0	0.5-0.7	0.5	0.2	0.5
	Barriers	-	None	None	None	None	None	None
Reach Morphology	Riffle	-	85	65	70	60	-	60
	Run	-	10	30	10	35	85	20
	Pool	-	5	5	20	5	10	15
	Flat	-	-	-	-	-	5	5
Substrate	Bedrock	-	-	-	-	-	-	-
	Boulder (>25cm)	-	60	30	5	15	5	10
	Cobble	-	25	50	70	70	-	20
	Gravel	-	10	20	10	5	-	50
	Sand	-	5	-	15	10	95	20
Aquatic Vegetation	Emergent	-	Sedges	Sedges	Sedges, horsetail	Sedges	Sedges	Sedges

Notes:
u/s - upstream
d/s - downstream

5.0 SUMMARY OF BASELINE AQUATIC ENVIRONMENT CONDITIONS FOR THE WHEELER RIVER MINE PROJECT AREA

Baseline aquatic environment studies were undertaken at the Wheeler River Project site between 2011 and 2019. The studies included surveying of lentic (lakes and ponds) and lotic (streams) environments within two sub-basins of the Wheeler River in the Churchill River basin, the Icelander River drainage and the Williams Lake drainage. The estimated drainage areas for the Icelander River and Williams Lake drainage areas are 371 km^2 and 78 km^2, respectively. Both drainages flow into the northwest portion of Russell Lake. Downstream of Russell Lake, the Wheeler River flows into the Geikie River which subsequently discharges to Wollaston Lake.

The scope of the baseline studies included:

- water elevation measurements, instantaneous discharge measurements, and continuous water level recording;
- bathymetry and aquatic habitat assessments and mapping;
- limnological, water quality, and sediment quality evaluations;
- benthic invertebrate community and tissue characterization;
- phytoplankton and zooplankton surveys; and,
- fish community and spawning surveys and tissue chemistry analysis.

A summary of the aquatic baseline information presented in this current report is provided below.

5.1 Water Elevation and Stream Discharge

Water level elevations were surveyed at thirteen lakes and two ponds in from 2011 to 2019. Stream flow measurements were taken on seventeen watercourses and continuous stream flow monitoring equipment has been installed at thirteen lotic locations and two lentic locations. Details are provided in **Table 4-1** and **Appendix G**.

In the 2016 surveys, lake and pond surface water elevations in the Icelander River drainage ranged from 520.86 masl at the headwater lake LA-8 to 487.94 masl at Russell Lake. Water level elevations at the stream locations ranged from 520.84 masl at the most upstream station (SA-11), to 492.55 masl at the most downstream station (SA-1), in September 2016. In Williams Lake drainage area, water levels at stream locations ranged from 519.24 masl at SB-4 to 488.34 masl at the most downstream station, SB-1. The average daily streamflow at the most downstream location in the Icelander River and the Williams Lake drainage areas ranged from 0.655 to 3.23 m^3/s and 0.067 to 1.5 m^3/s, respectively. The difference in stream flows for the two basins reflects the difference in the catchment areas of each drainage area that are estimated at 371 km^2 for the Icelander River Drainage and 78 km^2 for the Williams Lake Drainage.

Rating curves were developed for five locations: SA-1, SA-4, SA-5, SA-6 and SA-11 in the Icelander River drainage area, and SB-1, SB-3 and SB-4 in the Williams Lake drainage area (see **Appendix G**).

5.2 Surface Water Quality and Limnology

Water quality was assessed at 17 lentic locations and 12 lotic stations within the study area. Baseline water quality data were compiled for the years 2011, 2012, 2013, 2014, 2016, 2018 and 2019. The baseline water quality for all stations within the baseline study area are summarized in **Appendix A**, **Table A-1**.

Surface water within the study area is characterized by very soft water, low alkalinity, low nutrient levels (nitrate and phosphorus), low conductivity, and low concentrations of total dissolved solids and total suspended solids.

The highest hardness levels were found at Russell Lake (maximum of 12 and 13 mg/L $CaCO_3$ at LAB-2 and LAB-1, respectively). At all other locations, mean and maximum hardness concentrations were < 10 mg/L $CaCO_3$. The pH range for surface water within the study area is slightly acidic to neutral, ranging from 5.7 to 7.2. The pH was measured below the lower CWQG value of 6.5 at three (3) lentic stations including a water sample collected in Whitefish Lake (LA-6), the two (2) water samples collected below the thermocline in Kratchkowsky Lake (LA-7-A) and Williams Lake (LB-3), and at 9 lotic stations (19 samples).

Total alkalinity measured at lentic and lotic locations within the study area was generally low, ranging between 1.0 and 38 mg/L. Alkalinity is a measure of the buffering capacity of water or the ability to neutralize acids. Surface water with an alkalinity level < 25 mg/L is considered to be poorly buffered (Bain, 1999).

- A maximum concentration of 38 mg/L was measured at Whitefish Lake northern basin (LA-6) for lentic stations, and the mean concentration of 16 mg/L was calculated at Kratchkowsky Lake (LA-7) based on three samples.
- A maximum concentration of 24 mg/L was measured at SB-3 for lotic stations, and the mean concentration of 6.7 mg/L was calculated at SB-5 based on seven samples.

- The average alkalinity of all water samples at each station was less than 20 mg/L.

Nutrient levels in surface water, including nitrate (as NO_3) and phosphorus (total and dissolved) concentrations, were low within the study area.

- Nitrate measurements were below the laboratory detection limit of 0.04 mg/L for more than half of the surface water samples (68 of 103 samples).
- Where measurable in surface water, nitrate concentrations were well below SEQG guideline value of 13.29 mg/L, with a maximum measured nitrate concentration of 0.66 mg/L measured at LB-2.
- The majority of phosphorus measurements (total and dissolved) were less than the laboratory detection limit of 0.01 mg/L (135 of 142, and 136 of 142, respectively).
- The highest phosphorus concentrations were measured at depth, below the thermocline in stratified lakes. These included total and dissolved concentrations of phosphorus at Karchkowsky Lake (LA-7A) of 0.11 mg/L and 0.10 mg/L, and at Williams Lake (LB-3) of 0.17 mg/L and 0.15 mg/L, respectively.

Ammonia (NH_3-N) and total Kjeldahl nitrogen (TKN) concentrations in surface water within the study area were low, ranging from <0.01 to 1.2 mg NH_3-N/L and <0.05 and 1.6 mg TKN/L.

- Ammonia and TKN concentrations were highest in water below the thermocline at stratified lakes: Krachkowsky Lake (LA-7A) (0.91 and 1.2 mg/L, respectively) and Williams Lake (LB-3) (1.2 and 1.6 mg/L, respectively).
- Maximum concentrations of ammonia and TKN in water samples collected at the surface of lakes and ponds and at streams stations within the study area were max 0.12 mg NH_3-N/L and 0.65 mg TKN/L.

Total dissolved solids (TDS) and specific conductivity measurements in surface water were low within the study area, ranging from 11 to 40 mg TDS/L and 8 to 47 µS/cm.

- The maximum TDS value measured in surface water within the study area was 40 mg/L, measured at SA-4.
- The highest conductivity measurements were measured at Russell Lake: 47 µs/cm at LAB-1 and 42 µs/cm at LAB-2.

Total suspended solid (TSS) concentrations in surface water were low within the study area, ranging from <1 to 23 mg/L.

- The most elevated TSS concentrations were measured in water below the thermocline at Karchkowsky Lake (LA-7A) (13 mg/L) and Williams Lake (LB-3) (23 mg/L).
- Concentrations of TSS in water collected from the surface of lakes and ponds and at stream stations were <10 mg/L with the majority being <5 mg/L.

Total organic carbon (TOC) and dissolved organic carbon (DOC) concentrations were low in surface water within the study area, ranging from 1.4 to 8.4 mg TOC/L and <0.2 to 8.4 mg DOC/L.

- The highest concentrations of TOC of 8.4 mg/L and DOC of 8.4 mg/L were measured at pond PA-3.
- Mean concentrations for TOC and DOC across all stations were 2.9 mg/L and 2.8 mg/L, respectively.

In general, metals and metalloids had similar concentrations in surface water across the study area. For metal and metalloid parameters where water quality benchmarks from SEQG or CCME CWQO were available, most were below the guideline limits with a few exceptions, including cadmium, iron, lead, mercury and zinc.

- One exceedance each of the cadmium SEQG value of 0.00004 mg/L was measured at SA-4 and SA-6.
- Exceedances of the iron SEQG value of 0.3 mg/L occurred at 5 surface water stations including in water samples collected at two lentic stations below the thermocline, Kratchkowsky Lake (LA-7A) and Williams Lake (LB-3), and at three lotic stations, SA-1, SB-1 and SB-2.
- One exceedance of the lead CWQG value of 0.001 mg/L was measured at Whitefish Lake northern basin (LA-6).
- One exceedance of the mercury CWQG value of 0.000026 mg/L was measured at Kratchkowsky Lake (LA-7A), in water below the thermocline.
- Two exceedances of the zinc CWQG value of 0.007 mg/L were measured in surface waters at Whitefish Lake northern basin (LA-6) and SA-2.

Radionuclide concentrations in surface water were low within the study area, and generally below the laboratory detection limits of 0.02 Bq/L for lead-210, 0.005 Bq/L for polonium-210, 0.005 Bq/L for radium-226, 0.01 Bq/L for thorium-228, thorium-230 and thorium-232.

5.3 Lake Sediment Quality

Sediment samples were collected in 2016 for grain size and chemical analysis. Sediment data for the top 0-2 cm of sediment were summarized to characterize the baseline conditions in the Wheeler River Project area. Sediment samples were collected from depositional areas within lakes, including McGowan Lake (LA-1), Whitefish Lake (LA-5 and LA-6), Kratchkowsky Lake (LA-7 and LA-7A), LA-8, LA-9, Williams Lake (LB-3), and Russell Lake (LAB-1 and LAB-2). Three to five sediment samples were obtained from each waterbody, with the exception of LAB-2 where only one core sample was obtained.

The baseline sediment grain size and chemistry analysis for all stations within the baseline study area are summarized in **Tables A-3** and **A-4** of **Appendix A**, respectively.

Lake sediments were generally silty-clay or sandy-silt. The proportion of clay ranged from 10% to 82% with a mean value of 56%. The proportion of silt ranged from 13% to 55% with a mean value of 30%. The proportion of sand ranged from 0.1% to 77% with a mean value of 14%. The proportion of total organic carbon in the sediments ranged from 0.44% to 26%, with a mean value of 16%. For parameters where sediment quality guidelines are available, all constituent concentrations were at or below their respective REF, ISQG or LEL value.

5.4 Aquatic Habitat and Bathymetry

Shoreline vegetation at most lakes primarily consisted of shrubs and black spruce with upland jack pine forests. The shoreline generally consisted of rocks with overhanging shrubs, transitioning from small boulder and cobble to a sand or silty bottom, with patches of sandy beach and sparse emergent or submergent aquatic vegetation. The shoreline near the LA-9 lake inlet and outlet, consisted of bog. At some lakes submerged tree trunks were found in localized areas nearshore. Typical nearshore substrates included, boulders, cobble, sand and organic matter. Shoreline slopes ranged from shallow to steep with the presence of old and active erosional areas. Cover types for aquatic biota included emergent and submergent vegetation, interstitial spaces in coarse substrate, overhanging vegetation and woody debris. The ponds supported emergent, submergent and floating aquatic macrophyte beds along much of the nearshore, and nearly the entire waterbody at PA-3 supported emergent, submergent and floating aquatic macrophyte beds.

The stream habitats surveyed as part of the baseline study included 2nd (SA-4, RC-1) and 3rd (SA-1, SA-1, SA-5, SA-6, SB-1) order streams in the Icelander River basin and the Williams Lake drainage. Stream channels were generally stable and portions of the channels within any of the reaches surveyed were braided, meandering, straight or ponded.

Stream gradients within any reach surveyed were high to low and characterized by riffles, runs or pools, with some flats. No barriers to fish migration were observed.

The surface areas of the lakes within the study area ranged from 26.3 ha for the north basin of Whitefish Lake (LA-6) to 323 ha for Kratchkowsky Lake (LA-7 and LA-7A) combined. A total area of approximately 227 ha of Russell Lake (LAB-1 and LAB-2) was surveyed. The mean depth of the lakes surveyed ranged from 1.1 m for the south basin of Whitefish Lake (LA-5) to 5.5 m for McGowan Lake. Lake volumes, excluding LAB-1 and LAB-2 which are small portions of the larger Russell Lake, were estimated to range from 333,000 m^3 for Whitefish Lake (LA-5) to 12,700,000 m^3 for Kratchkowsky Lake (LA-7 and LA-7A combined).

The pond surface areas ranged from 4.5 ha to 8.4 ha for PA-3 and PA-2, respectively. Mean pond depths were 0.9 m for PA-3 and 1.5 m for PA-2. Pond volumes were estimated to be 39,000 m^3 for PA-3 and 123,000 m^3 for PA-2.

5.5 Lake Plankton Community

Phytoplankton and zooplankton samples were collected in September 2016 at six locations: McGowan Lake (LA-1), Whitefish Lake (LA-5 and LA-6), Kratchkowsky Lake (LA-7), and Russell Lake (LAB-1 and LAB-2). The detailed data are presented and summarized in **Appendix A, Tables A-5** and **A-6** for phytoplankton and zooplankton communities, respectively. The results for chlorophyll analysis are presented in **Appendix A, Table A-7**.

For phytoplankton, total biovolume (μm^3) was greatest at McGowan Lake, $1.4\times10^{10}\mu m^3/L$. The total biovolume for phytoplankton was an order of magnitude or more less at all other sampling areas. In total, 55 phytoplankton taxa were identified from 7 classes. The number of taxa present in September 2016 ranged from 21 to 37, and at least 6 classes were identified in each of the waterbodies sampled. Diatoms (Bacilliarophyceae) were dominant at all locations representing more than one-quarter (LAB-2) and up to 90% (McGowan Lake) of total biovolume at each location. Other dominant classes present at some of the locations were cryptophytes (Cryptophyceae), cyanophytes (Cyanophyceae), and dinoflagellates (Dinophyceae).

For zooplankton, total biovolume in September 2016 ranged from approximately 1.0×10^{10} $\mu m^3/L$ at LA-6 to 2.2×10^{12} $\mu m^3/L$ at McGowan Lake. A total of 32 taxa belonging to 10 classes were identified. Within each of the waterbodies sampled, 15 to 22 taxa were present and 7 to 9 classes were identified. Branchiopods (Branchiopoda) were dominant at all locations representing approximately one-third (at LAB-2) to 94% (McGowan Lake) of zooplankton biovolume at each location. Other dominant classes present at some of the locations were copepods (Copepoda) and Monogononta.

At all locations, chlorophyll-a concentrations were below the laboratory method detection limit (< 0.60 µg/L); the low levels of chlorophyll-a suggest that there is low primary productivity in the lakes, reflecting the oligotrophic state of lakes within the Wheeler River Project study area.

5.6 Lake Benthic Invertebrate Community and Chemistry

5.6.1 Benthic Invertebrate Community

Benthic invertebrate samples were collected in 2016 at lake locations McGowan Lake, Whitefish Lake (LA-5 and LA-6), Kratchkowsky Lake (LA-7 and LA-7A), LA-8, LA-9, Williams Lake (LB-3) and Russell Lake (LAB-1 and LAB-2). Baseline benthic invertebrate community data are provided in **Appendix A**, **Tables A-8** through **A-10**, for abundance and relative abundance of major taxonomic groups (family). **Appendix A**, **Table A-11** presents benthic community metrics and abundance and relative abundance of feeding groups for each station.

Total invertebrate density was variable among locations; three locations, LA-8, LA-7A and McGowan Lake, had total invertebrate densities less than 1,000 individuals/m^2 (mean densities of 671, 800 and 981 individuals/m^2, respectively). Three locations, LA-5, LA-6, and Williams Lake (LB-3), had total invertebrate densities nearing or greater than 10,000 individuals/m^2 (mean densities of 9597, 10,163, and 10,457 individuals/m^2). Total invertebrate densities at the remaining four locations, LA-7, LA-9, LAB-1, and LAB-2, ranged between 1,633 and 5,295 individuals/m^2.

A total of 78 taxa were identified in the study area. Mean invertebrate richness ranged from 7 to 24 taxa per sample. Mean richness was lowest at the three locations with the lowest invertebrate densities (richness of 10, 7, and 9 at LA-8, LA-7A, and McGowan Lake, respectively), and highest at two of the locations with highest total invertebrate densities (17 and 21 at LA-6 and LA-5, respectively), as well as Russell Lake (19 and 24 taxa at LAB-1 and LAB-2, respectively).

Simpson's Diversity Index (*D*) values suggested that the benthic communities were relatively diverse at all locations. Mean Diversity index values ranged from 0.65 at LA-6 to 0.85 at LAB-1. Russell Lake had the highest diversity among all locations (D = 0.82 at LAB-2 and D = 0.85 at LAB-1).

Simpson's Evenness Index (*E*) values suggested that few taxa comprised a large proportion of total invertebrate density at any given sampling location. Evenness was lowest at LA-6 (mean E = 0.18) and highest at McGowan Lake (mean E = 0.44).

The benthic communities at Whitefish Lake (LA-5 and LA-6), shared many of the same taxa compared to the reference location as indicated by the Bray-Curtis (*B-C*) dissimilarity index. The mean *B-C* index was 0.39 and 0.37 at LA-5 and LA-6, respectively. At the remainder of the lakes (McGowan Lake, Kracthkowsky Lake [LA-7 and LA-7A], LA-8, LA-9, Williams Lake (LB-3), and Russell Lake [LAB-1 and LAB-2]), mean *B-C* indices suggested that some locations shared the same taxa as the median reference condition of the large lakes group more so than others and that other locations did not share the same taxa. The mean *B-C* index ranged from 0.36 (LA-7A at north arm of Kratchkowsky Lake) to 0.87 (LAB-2 at Russell Lake). In general, the lakes locations with higher taxa richness [Williams Lake (LB-3), Russell Lake (LAB-1 and LAB-2)] tended to not share the same taxa as the median reference condition group.

Thirty-eight major taxonomic groups (Families) were present in the study area. Chironomids were the most prevalent, comprising between 16 to 85% of the total benthic invertebrate density at each location. Furthermore, chironomids were the most numerically dominant taxon at all locations except lakes LA-5 and LA-6, where they were the second-most dominant taxon. At Whitefish Lake (LA-5 and LA-6), the numerically dominant taxon was the Chydoridae family of water fleas (Cladocera). At the locations where chironomids were the numerically dominant taxon, they comprised a minimum of 44% of the benthic invertebrate density (McGowan Lake); at each of the remainder of the locations, they comprised more than half of the benthic invertebrate density and even comprised more than 80% of the density at Kratchkowsky Lake (LA-7 and LA-7A) and at LA-8. Other major taxonomic groups that represented more than 10% of the total benthic invertebrate density at a sampling location were detritus worms (Naididae), pill clams (Pisidiidae), water fleas from the families Holopedidae and Macrothricidae, and phantom midges (Chaoboridae). Seed shrimps (Ostracoda) and cyclopoid copepod did not represent more than 8% and 7% of the invertebrate density at a given location but were the second-most common taxon present at Kratchkowksy Lake locations LA-7 and LA-7A, respectively.

Benthic macroinvertebrates from the following functional feeding groups were present at all locations sampled in the study area: scrapers, shredders, collector-gatherers, collector-filterers, and predators. There was variation in the dominant functional feeding group at each location but scrapers were the least abundant at each location, comprising less than 1% of total invertebrate density. Predators were numerically dominant at four locations (McGowan Lake, LA-7A, LA-8, and LA-9; range, 35 to 61% of total invertebrate density), collector-gatherers were also numerically dominant at four locations (LA-7, Williams Lake (LB-3), LAB-1, and LAB-2; range, 34 to 60% of total invertebrate density), and collector-filterers were numerically dominant at two locations (LA-5 and LA-6; range, 66 to 75% of Total invertebrate density). At most locations, one functional feeding group was numerically dominant over others; however, at LA-7A, LA-8 and Williams Lake (LB-3), two or more functional feeding groups were represented almost equally.

5.6.2 Benthic Invertebrate Tissue Chemistry

Dragonfly nymphs from LA-8 and LA-9, and caddisfly larvae collected in 2016 from lakes McGowan Lake, LA-5, LA-6, Kratchkowsky Lake (LA-7 [south arm], LA-7A [north arm]), and Russell Lake (LAB-1 and LAB-2) were analyzed for metals and radionuclides. The 2016 baseline benthic invertebrate tissue chemistry and summary statistics for the study area are presented in **Appendix A**, **Table A-12**.

Metal concentrations were similar for dragonfly nymphs collected from LA-8 and LA-9. Radionuclide levels in dragonfly nymph tissues from LA-8 and LA-9 were generally below the laboratory method detection limit with the exception of Po-210 which ranged from 0.06 Bq/g at LA-8 to 0.1 Bq/g at LA-9, and Ra-226 at LA-9 (0.008 Bq/g).

Metal concentrations were generally similar in caddisfly larvae tissues at all locations, with concentrations within an order of magnitude of each other. Cobalt and nickel concentrations were more variable. Cobalt concentrations ranged from 0.16 (LA-7) to 3.7 µg/g (LAB-2) and nickel concentrations ranged from 0.19 (LA-7) to 2.7 µg/g (LAB-2 and McGowan Lake). Caddisflies from Russell Lake location LAB-2 had higher concentrations of some metals, including aluminum, cobalt, and uranium. Radionuclide concentrations were generally below the laboratory method detection limit in caddisfly larvae tissue with the following exceptions: Po-210 ranged from 0.03 Bg/g at LAB-2 to 0.12 Bg/g at LA-7A, and Ra-226 ranged from 0.01 Bg/g at LA-5 to 0.02 Bq/g at McGowan Lake, LAB-1 and LAB-2.

5.7 Fish Community, Spawning and Fish Tissue Chemistry

5.7.1 Fish Community

The fish community and fish habitat for the study area are described in **Appendix A**, **Tables A-13** to **A-16**, which present fish catch data for 2016 and 2017 (**Table A-13**), describe key lake features (**Table A-14**), stream spawning habitat (**Table A-15**), and fish condition for fish captured during the 2016-2017 aquatic study (**Table A-16**). Photographs depicting aquatic habitat at stream sampling locations, and fish species observed within the study area during the 2016-2017 aquatic study are provided in **Appendix C** and **Appendix D**, respectively.

A total of 13 species of fish were collected within the study area during baseline surveys. All waterbodies sampled, except one headwater pond, supported fish.

Eleven fish species were collected within study area lakes including representative forage and sport fish species. The species captured included Lake Chub, Spottail Shiner, Longnose Sucker, White Sucker, Lake Whitefish, Lake Trout, Northern Pike, Burbot, Ninespine Stickleback, Yellow Perch and Walleye.

Eleven fish species were also collected at stream stations across the study area. These included Lake Chub, Spottail Shiner, Longnose Sucker, White Sucker, Arctic Grayling, Northern Pike, Burbot, Ninespine Stickleback, Slimy Sculpin, Yellow Perch and Walleye.

Results from eDNA analysis is described in **Section 3.0**. Only human reads were detected in environmental samples; no other vertebrate DNA (e.g. no fish DNA) was detected. Environmental DNA platforms has been successfully applied in various stream systems as well as inland lakes, and the results have been demonstrated to be consistent with traditional fishing approaches. Technical challenges occasionally occur, including DNA extraction and downstream processing being inhibited by tannins and humic acid present in environmental samples. EcoMetrix staff noticed that the lake water samples appeared tea color in the summer, demonstrated the potential presence of inhibition factors. Further eDNA sampling is recommended to overcome inhibition issues, and provide archivable biodiversity reference point to evaluate environmental impact of the mine through different cycles of the life stage.

5.7.2 Fish Spawning

Large-bodied fish spawning surveys were undertaken during the fall of 2016 and spring of 2017 at selected lake and stream locations to determine the utilization of these areas for spawning. The fall survey was conducted during a period in which it was expected that fall spawners would be sexually mature. The spring survey was timed to take place shortly after ice-out, a period when spring spawning was expected to be underway.

Fall spawning species present within the study area include Lake Whitefish and Lake Trout. Potential spawning habitat for Lake Whitefish was identified in Kratchkowsky Lake, as well as McGowan Lake, and lakes LA-8 and LA-9. Spawning habitat for Lake Whitefish is also present within riverine habitats proximate to the lakes. Potential spawning habitat for Lake Trout was identified in McGowan Lake and Russell Lake.

Spring spawning species present within the study area include Walleye, Northern Pike, Arctic Grayling, White Sucker, Longnose Sucker and Yellow Perch. Spawning habitats for Walleye were observed at SA-1, SA-2 and SA-5. Sucker spawning habitat was observed at SA-1, SA-2, SA-4, and SA-5. Northern Pike spawning habitats were observed in Kratchkowsky Lake, Russell Lake, McGowan Lake, and Whitefish Lake, as well as stream stations SA-1, SA-2, SA-5 and SA-6 within the Icelander River Drainage, as well as SB-1 within the Williams Lake Drainage. Burbot spawn during late winter in streams or lake shallows under ice (McPhail and Lindsey, 1970). No specific spawning surveys targeted Burbot, however potential spawning habitat occurs within the study area.

5.7.3 Fish Tissue Chemistry

Northern Pike and White Sucker were collected in 2016 and 2017 from McGowan Lake (LA-1), Whitefish Lake (LA-5 and LA-6), Kratchkowsky Lake (LA-7) and Russell Lake (LAB) for fish chemistry analysis. Northern Pike represented a predator species whereas White Sucker represented a forage species. Fish tissue and bone were analyzed for metals and radionuclides. **Appendix A**, **Tables A-17** and **A-18** present baseline data and summary statistics for fish tissue and bone chemistry, respectively, for the study area.

Guideline values for constituents in fish tissue are available for mercury (Health Canada, 2007) and selenium (BC MOE, 2014). Health Canada's standard is a human health risk - based maximum permissible concentration applied to most species of commercially-sold fish. The BC MOE and US EPA (2016) provide fish tissue concentrations (muscle) for selenium that are protective of the health of freshwater aquatic life.

- Mercury concentrations in both Northern Pike and White Sucker tissue were below the Health Canada standard of 0.5 µg/g ww for commercially sold fish. In general, mercury concentrations were higher in Northern Pike (mean, 0.18 µg/g ww; range, 0.047 to 0.48 µg/g ww) than in White Sucker (mean, 0.034 µg/g ww; range, 0.012 to 0.076 µg/g ww). This is expected because mercury is known to bioaccumulate in higher trophic levels in the aquatic food chain.

- Selenium concentrations in both Northern Pike and White Sucker tissue were below the BC MOE (2014) guideline of 4 µg/g dw and the USEPA (2016) criterion of 11.3 µg/g dw for fish muscle. The mean concentration for Northern Pike and White Sucker tissue were 1.0 µg/g dw and 1.2 µg/g dw, respectively. The highest concentrations of selenium in fish muscle of 0.53 µg/g dw was measured in a Northern Pike sample collected at Russell Lake (LAB). Selenium concentrations in fish tissue from Russell Lake for both Northern Pike and Lake Whitefish were consistently higher than selenium concentrations in fish tissue from all locations in the Icelander River Basin and the Williams Lake Drainage, within the study area.

5.8 Incorporation of Local Land User Information into the Aquatic Resources Baseline Program

This report incorporates information provided by Mr. Bobby John, a local resident who fishes commercially in the area and has extensive local and regional knowledge of the area. Bobby graciously agreed to be interviewed by Denison in order to document his local knowledge (Denison, 2020) and this information was subsequently provided to EcoMetrix. Bobby provided invaluable information about local and indigenous land use and the local environment. In addition, Bobby reviewed key information derived from the baseline surveys documented herein, including information associated with aquatic habitats, fish communities, and fish spawning areas, and provided further insights.

Overall, based on his interview and through his review of the baseline survey information, Bobby was able to confirm that the majority of information collected was comprehensive in nature and reflected his own local knowledge and vast experience in the area. In particular he noted that the list of fish species collected at the various locations was inclusive of his understanding of species distribution and mentioned that EcoMetrix has "*… identified all the fish species in the area. Even those little ones with the spiny backs.*". The following additional information is noted through the documentation provided by Bobby John that was not identified specifically by the baseline surveys:

- There are additional Northern Pike spawning areas outside the specific bounds of SB-1 along a reach of the creek north of Russel Lake;
- There are additional Lake Trout spawning areas in Russell Lake, south of the study area; and,
- There are two additional rocky areas in Kratchkowsky Lake that may potentially provide spawning habitat.

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Appendix A Baseline Aquatic Environment Quality Data

Parameter		Bicarbonate	Carbonate	Chloride	Hydroxide	P. Alkalinity	pH	Specific Conductivity	Sum of Ions	Total Alkalinity	Hardness	Ammonia as N	Nitrate	Total Kjeldahl Nitrogen	Mercury	Total Organic Carbon
Unit		mg/L	mg/L	mg/L	mg/L	mg/L	units	µS/cm		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Water Quality Benchmarks	SEQG/SSWQO											0.103	13.29			
	CCME CWQG			120			6.5 - 9								0.000026	
	Reference			CWQG			CWQG					SEQG	SEQG		CWQG	
Baseline Water Quality Characteristics	Count	142	142	142	142	142	142	142	142	142	142	142	103	142	142	142
	#DL	0	142	7	142	142	0	0	0	0	0	95	68	1	138	0
	Min	1	<1	<0.1	<1	<1	**5.7**	8	5	1.0	3	<0.01	<0.04	<0.05	<0.0000001	1.4
	Mean	8.5	1	0.37	1.014084507	1.084507042	6.8	18	14	7.1	5.3	0.033	0.11	0.27	8.4E-06	2.8
	75th	10	1	0.50	1	1	7.0	20	16	8.3	6.0	0.013	0.09	0.3	0.00001	3.1
	95th	20	1	0.70	1	1	7.1	26	28	16	7.0	0.068	0.44	0.44	0.00001	5.255
	Max	46	1	0.90	2	7	7.2	47	51	38	13	**1.2**	0.66	1.6	**0.000068**	8.4
	Geomean	6.7	1	0.32	1.009810446	1.027786217	6.7	17	12	5.8	5.2	0.015	0.067	0.25	5.9E-06	2.7
	SD	6.3	0	0.18	0.118256572	0.709539435	0.26	5.5	7.0	5.1	1.4	0.13	0.15	0.16	6.2E-06	1.1
Location	Sample Date															
LA-1	08-Jun-2011	2	<1	0.4	<1	<1	6.94	17	6.0	2.0	5.0	<0.01	<0.04	0.25	<0.00001	2.5
LA-1	12-Aug-2012	5	<1	0.4	<1	<1	6.52	17	10	4.0	6.0	<0.01		0.31	<0.00001	2.6
LA-1	29-Mar-2014	12	<1	0.5	<1	<1	6.83	24	18	10	6.0	0.09	0.49	0.17	<0.00001	2.3
LA-1	14-Sep-2016	10	<1	0.4	<1	<1	6.79	19	14	8.0	5.0	<0.01	<0.04	0.38	<0.000001	2.3
LA-1	02-Jul-2018	8	<1	0.4	<1	<1	6.71	9	12	7	4	<0.01	<0.04	0.33	<0.0000001	2.2
LA-1	16-Mar-2018	10	<1	0.5	<1	<1	6.82	15	15	8	5	0.03	0.29	0.2	0.000004	2.3
LA-1-Bottom	02-Jul-2018	5	<1	0.4	<1	<1	6.62	10	9	4	4	<0.01	<0.04	0.23	0.0000009	2
LA-1-Bottom	16-Mar-2018	6	<1	0.5	<1	<1	6.8	14	12	5	5	0.02	0.6	0.14	0.000007	2.2
LA-2	06-Jun-2011	5	<1	0.5	<1	<1	7.00	18	10	4.0	5.0	<0.01	<0.04	0.22	<0.00001	2.5
LA-2	28-Mar-2014	15	<1	0.7	<1	<1	6.9	25	22	12	7.0	0.04	0.53	0.15	<0.00001	2.2
LA-2	21-Sep-2016	11	<1	0.7	<1	<1	7.19	22	16	9.0	5.0	<0.01	0.05	0.22	<0.000001	2.2
LA-3	07-Jun-2011	4	<1	0.7	<1	<1	6.95	20	9.0	3.0	5.0	<0.01	<0.04	0.27	<0.00001	2.8
LA-3	28-Mar-2014	12	<1	0.9	<1	<1	6.92	24	19	10	6.0	0.04	0.4	0.16	<0.00001	2.3
LA-3	21-Sep-2016	8	<1	0.8	<1	<1	7.15	22	14	7.0	5.0	<0.01	0.05	0.25	<0.000001	2.3
LA-4	29-Mar-2014	20	<1	0.6	<1	<1	6.98	26	27	16	7.0	0.07	0.18	0.08	<0.00001	1.5
LA-4	21-Sep-2016	15	<1	0.6	<1	<1	7.19	24	21	12	5.0	<0.01	0.05	0.24	<0.000001	1.4
LA-5	08-Aug-2012	4	<1	0.3	<1	<1	6.57	16	8.0	3.0	5.0	<0.01		0.34	<0.00001	4.3
LA-5	01-Apr-2014	16	<1	0.4	<1	<1	7.01	22	22	13	6.0	0.05	0.26	0.14	<0.00001	1.9
LA-5	10-Sep-2016	8	<1	0.3	<1	<1	6.95	19	12	7.0	5.0	0.07	<0.04	0.19	<0.000001	2.2
LA-6	13-Aug-2012	5	<1	0.3	<1	<1	6.55	16	10	4.0	5.0	<0.01		0.29	<0.00001	2.9
LA-6	30-Mar-2014	46	<1	0.3	<1	<1	**5.71**	21	51	38	5.0	0.05	0.31	0.24	<0.00001	2.2
LA-6	12-Sep-2016	4	<1	0.4	<1	<1	6.71	18	8.0	3.0	5.0	0.04	<0.04	0.43	<0.000001	2.3
LA-6	02-Jul-2018	8	<1	0.3	<1	<1	6.75	9	12	7	4	<0.01	<0.04	0.28	<0.0000001	2.2
LA-6	17-Mar-2018	4	<1	0.3	<1	<1	6.79	12	9	3	4	0.02	0.3	0.29	0.000007	2.2
LA-7	09-Aug-2012	26	<1	0.4	<1	<1	6.73	18	32	21	6.0	<0.01		0.34	<0.00001	3.2
LA-7	29-Mar-2014	23	<1	0.7	<1	<1	6.82	26	30	19	7.0	**0.12**	0.26	0.44	<0.00001	2.0
LA-7	10-Sep-2016	10	<1	0.5	<1	<1	7.14	21	14	8.0	5.0	0.01	<0.04	0.32	<0.000001	2.4
LA-7A	12-Sep-2016	7	<1	0.6	<1	<1	6.89	21	12	6.0	5.0	<0.01	<0.04	0.34	<0.000001	2.1
LA-7A-bottom	12-Sep-2016	16	<1	0.6	<1	<1	**6.46**	32	23	13	7.0	**0.91**	<0.04	1.2	**0.000068**	2.6
LA-8	14-Sep-2016	2	<1	0.3	<1	<1	6.79	17	6.0	2.0	5.0	<0.01	<0.04	0.61	<0.000001	2.2
LA-9	16-Sep-2016	5	<1	0.2	<1	<1	6.88	17	9.0	4.0	4.0	<0.01	0.04	0.28	<0.000001	2.2
LAB-1	10-Aug-2012	2	<1	0.4	<1	<1	6.65	38	18	2.0	13	<0.01		0.22	<0.00001	2.6
LAB-1	31-Mar-2014	17	<1	0.5	<1	<1	6.98	30	28	14	9.0	0.05	0.44	0.14	0.00001	2.2
LAB-1	15-Sep-2016	8	<1	<0.1	<1	<1	6.96	47	23	7.0	12	<0.01	0.05	0.15	<0.000001	2.4
LAB-2	21-Sep-2016	10	<1	0.4	<1	<1	7.17	42	25	8.0	12	<0.01	0.05	0.29	<0.0000001	2.2
LB-1	13-Sep-2016	5	<1	0.1	<1	<1	6.7	18	9.0	4.0	5.0	<0.01	<0.04	0.28	<0.000001	3.4
LB-2	01-Apr-2014	15	<1	0.2	<1	<1	6.82	22	21	12	6.0	0.04	0.66	0.13	<0.00001	2.7
LB-2	13-Sep-2016	8	<1	0.2	<1	<1	6.74	20	12	7.0	5.0	<0.01	<0.04	0.35	<0.000001	3.6
LB-3-Top	11-Aug-2012	7	<1	0.2	<1	<1	6.58	17	12	6.0	5.0	<0.01		0.34	<0.00001	3.0
LB-3-Top	01-Apr-2014	17	<1	0.2	<1	<1	7.00	22	23	14	6.0	0.04	0.44	0.18	0.00001	3.1
LB-3-Top	10-Sep-2016	10	<1	0.2	<1	<1	7.11	18	14	8.0	5.0	0.02	<0.04	0.2	<0.000001	2.7
LB-3-bottom	10-Sep-2016	17	<1	0.8	<1	<1	**6.42**	32	24	14	6.0	**1.2**	<0.04	1.6	0.00001	4.4
PA-2	20-Sep-2016	7	<1	0.3	<1	<1	7.03	20	12	6.0	5.0	<0.01	0.04	0.22	<0.0000001	3.4
PA-3	19-Sep-2016	5	<1	0.4	<1	<1	6.74	18	10	4.0	4.0	<0.01	<0.04	0.33	0.0000001	8.4
SA-1	05-Jun-2011	2	<1	0.4	<1	<1	6.93	17	6.0	2.0	5.0	<0.01	<0.04	0.25	<0.00001	2.5
SA-1	08-May-2012	5	<1	0.4	<1	<1	6.6	20	10	4.0	6.0	<0.01		0.28	<0.00001	2.2
SA-1	07-Aug-2012	5	<1	0.4	<1	<1	6.55	16	10	4.0	5.0	<0.01		0.24	<0.00001	2.5
SA-1	24-Oct-2012	12	<1	0.4	<1	<1	6.78	17	16	10	5.0	<0.01		0.28	<0.00001	2.6
SA-1	22-May-2013	10	<1	0.4	<1	<1	**6.34**	19	14	8.0	5.0	0.02	<0.04	0.19	<0.00001	1.8
SA-1	15-Aug-2013	2	<1	0.4	<1	<1	6.68	18	7.0	2.0	5.0	<0.01	<0.04	0.21	<0.00001	2.2
SA-1	18-Oct-2013	5	<1	0.4	<1	<1	6.95	18	10	4.0	5.0	<0.01	<0.04	0.28	<0.00001	2.2
SA-1	30-Mar-2014	16	<1	0.5	<1	<1	6.98	22	22	13	6.0	0.04	0.26	0.11	<0.00001	2.1
SA-1	05-Jul-2019	8	<1	0.5	<1	<1	7.02	13	13	7	5	<0.01	<0.04	0.48	<0.000002	2.2
SA-1	30-Aug-2019	5	<1	0.4	<1	<1	7.06	13	9	4	5.0	0.02	0.04	0.25	<0.000004	2.1
SA-2	06-Jun-2011	11	<1	0.3	<1	<1	6.89	16	15	9.0	5.0	<0.01	<0.04	0.23	<0.00001	2.3
SA-2	08-May-2012	2	<1	0.3	<1	<1	6.77	16	6.0	2.0	4.0	<0.01		0.16	<0.00001	2.4
SA-2	08-Aug-2012	2	<1	0.3	<1	<1	6.58	14	6.0	2.0	4.0	<0.01		0.24	<0.00001	2.4
SA-2	24-Oct-2012	10	<1	0.3	<1	<1	6.79	16	14	8.0	4.0	<0.01		0.2	<0.00001	2.4
SA-2	22-May-2013	11	<1	0.2	<1	<1	6.59	16	14	9.0	4.0	<0.01	<0.04	0.25	<0.00001	2.1
SA-2	15-Aug-2013	10	<1	0.4	<1	<1	6.72	18	15	8.0	5.0	<0.01	<0.04	0.31	<0.00001	2.4
SA-2	18-Oct-2013	6	<1	0.3	<1	<1	7.01	18	11	5.0	6.0	<0.01	<0.04	<0.05	<0.00001	2.2
SA-2	29-Mar-2014	13	<1	0.4	<1	<1	6.87	22	19	11	6.0	0.04	0.31	0.12	<0.00001	2.1
SA-2	05-Jul-2019	5	<1	0.4	<1	<1	7.04	9	9	4	4.0	<0.01	<0.04	0.58	<0.000002	2.3
SA-2	30-Aug-2019	<1	<1	0.3	<2	<7	6.92	11	7	8	4.0	0.02	<0.04	0.26	<0.000004	2.2
SA-3	05-Jun-2011	2	<1	0.6	<1	<1	6.93	18	7.0	2.0	5.0	<0.01	<0.04	0.23	<0.00001	2.5
SA-3	08-May-2012	2	<1	0.6	<1	<1	6.60	20	7.0	2.0	6.0	<0.01		0.25	<0.00001	2.2
SA-3	07-Aug-2012	1	<1	0.6	<1	<1	6.60	18	6.0	1.0	5.0	<0.01		0.25	<0.00001	2.6
SA-3	24-Oct-2012	28	<1	0.6	<1	<1	6.85	19	33	23	6.0	<0.01		0.28	<0.00001	2.6
SA-3	22-May-2013	8	<1	0.5	<1	<1	**6.42**	20	13	7.0	6.0	<0.01	<0.04	0.16	<0.00001	1.8
SA-3	15-Aug-2013	5	<1	0.7	<1	<1	6.66	19	10	4.0	5.0	<0.01	<0.04	0.3	<0.00001	2.5
SA-3	18-Oct-2013	7	<1	0.6	<1	<1	7.02	20	12	6.0	6.0	<0.01	<0.04	0.27	<0.00001	2.5
SA-3	31-Mar-2014	16	<1	0.7	<1	<1	6.99	24	22	13	7.0	0.04	0.26	0.13	<0.00001	2.3
SA-3	05-Jul-2019	5	<1	0.6	<1	<1	6.96	14	10	4	5.0	0.02	0.04	0.24	<0.000002	2.3
SA-3	30-Aug-2019	<1	<1	0.7	<2	<7	6.98	14	7	7	5.0	0.01	<0.04	0.26	<0.000006	2.2
SA-4	05-Jun-2011	10	<1	0.4	<1	<1	6.92	17	14	8.0	5.0	<0.01	<0.04	0.22	<0.00001	2.4
SA-4	08-May-2012	10	<1	0.5	<1	<1	6.8	20	15	8.0	6.0	<0.01		0.22	<0.00001	2.6
SA-4	07-Aug-2012	4	<1	0.4	<1	<1	6.58	17	8.0	3.0	5.0	<0.01		0.19	<0.00001	2.5
SA-4	24-Oct-2012	13	<1	0.4	<1	<1	6.88	18	18	11	5.0	<0.01		0.28	<0.00001	2.4
SA-4	22-May-2013	2	<1	0.4	<1	<1	6.67	19	7.0	2.0	6.0	<0.01	0.09	0.16	<0.00001	2.0
SA-4	15-Aug-2013	6	<1	0.5	<1	<1	6.76	19	11	5.0	5.0	<0.01	<0.04	0.3	<0.00001	2.4
SA-4	18-Oct-2013	10	<1	0.4	<1	<1	7.02	20	15	8.0	6.0	<0.01	<0.04	0.22	<0.00001	2.2
SA-4	30-Mar-2014	18	<1	0.6	<1	<1	7.16	25	25	15	7.0	0.05	0.35	0.13	<0.00001	2.1
SA-4	04-Jul-2019	11	<1	0.5	<1	<1	7.04	11	16	9	5.0	0.01	<0.04	0.27	<0.000002	2.6
SA-4	29-Aug-2019	8	<1	0.5	<1	<1	6.97	16	13	7	5.0	0.02	<0.04	0.28	<0.000004	2.3
SA-5	05-Jun-2011	6	<1	0.2	<1	<1	6.86	16	10	5.0	5.0	<0.01	<0.04	0.25	<0.00001	2.6
SA-5	08-May-2012	2	<1	0.2	<1	<1	6.76	16	6.0	2.0	5.0	<0.01		0.28	<0.00001	2.7
SA-5	07-Aug-2012	5	<1	0.2	<1	<1	6.57	14	12	4.0	4.0	<0.01		0.18	<0.00001	2.3
SA-5	24-Oct-2012	10	<1	0.2	<1	<1	6.78	15	14	8.0	4.0	<0.01		0.29	<0.00001	2.5
SA-5	22-May-2013	7	<1	0.2	<1	<1	**6.17**	16	11	6.0	5.0	<0.01	0.09	0.18	<0.00001	1.9
SA-5	15-Aug-2013	5	<1	0.3	<1	<1	6.66	15	9.0	4.0	4.0	<0.01	<0.04	0.27	<0.00001	2.3
SA-5	18-Oct-2013	5	<1	0.3	<1	<1	6.92	17	9.0	4.0	5.0	<0.01	<0.04	0.11	<0.00001	2.2
SA-5	30-Mar-2014	8	<1	0.3	<1	<1	6.97	20	13	7.0	5.0	0.05	0.31	0.11	<0.00001	2.1
SA-5	04-Jul-2019	7	<1	0.3	<1	<1	6.99	8	11	6.0	4.0	<0.01	<0.04	0.21	<0.000002	2.2
SA-5	29-Aug-2019	11	<1	0.2	<1	<1	6.89	10	15	9.0	4.0	0.01	<0.04	0.22	<0.000005	2.1
SA-6	08-May-2012	4	<1	0.3	<1	<1	6.74	17	8.0	3.0	5.0	<0.01		0.3	<0.00001	2.6
SA-6	07-Aug-2012	4	<1	0.3	<1	<1	6.54	14	8.0	3.0	4.0	<0.01		0.32	<0.00001	2.4
SA-6	24-Oct-2012	10	<1	0.3	<1	<1	6.82	16	14	8.0	5.0	<0.01		0.41	<0.00001	2.5
SA-6	22-May-2013	6	<1	0.3	<1	<1	**6.48**	16	10	5.0	5.0	<0.01	<0.04	0.17	<0.00001	2.0
SA-6	15-Aug-2013	7	<1	0.3	<1	<1	6.75	18	12	6.0	5.0	<0.01	<0.04	0.35	<0.00001	2.5
SA-6	18-Oct-2013	5	<1	0.4	<1	<1	6.94	18	10	4.0	6.0	<0.01	<0.04	0.27	<0.00001	2.1
SA-6	01-Apr-2014	16	<1	0.5	<1	<1	7.07	23	22	13	6.0	0.04	0.35	0.15	<0.00001	1.9
SA-6	04-Jul-2019	6	<1	0.4	<1	<1	7.03	9	10	5	4.0	<0.01	<0.04	0.25	<0.000002	2.3
SA-6	29-Aug-2019	12	<1	0.3	<1	<1	6.93	11	16	10	5.0	0.02	<0.04	0.29	<0.000005	2.3
RC-1	06-Jul-2019	16	<1	0.6	<1	<1	7.18	12	21	13	5.0	<0.01	<0.04	0.26	<0.000002	2.2
RC-1	01-Sep-2019	18	<1	0.5	<1	<1	7.03	13	23	15	5.0	0.04	<0.04	0.29	<0.000005	2.2
SB-1	09-Jun-2011	5	<1	0.1	<1	<1	6.90	17	9.0	4.0	5.0	<0.01	<0.04	0.17	<0.00001	2.8
SB-1	09-May-2012	4	<1	0.2	<1	<1	6.54	16	8.0	3.0	5.0	<0.01		0.25	<0.00001	4.6
SB-1	07-Aug-2012	6	<1	0.1	<1	<1	**6.38**	14	10	5.0	4.0	<0.01		0.25	<0.00001	4.6
SB-1	25-Oct-2012	10	<1	0.2	<1	<1	6.64	15	15	8.0	5.0	0.06		0.27	<0.00001	4.5
SB-1	22-May-2013	5	<1	0.2	<1	<1	**6.27**	14	9.0	4.0	4.0	<0.01	<0.04	0.15	<0.00001	3.1
SB-1	15-Aug-2013	7	<1	0.2	<1	<1	6.53	18	11	6.0	6.0	<0.01	<0.04	0.24	<0.00001	4.0
SB-1	19-Oct-2013	7	<1	0.4	<1	<1	**6.46**	16	11	6.0	3.0	<0.01	<0.04	0.28	<0.00001	3.8
SB-1	31-Mar-2014	24	<1	0.4	<1	<1	6.86	26	31	20	8.0	0.1	0.31	0.2	<0.00001	3.3
SB-2	09-Jun-2011	10	<1	0.6	<1	<1	6.78	21	16	8.0	6.0	<0.01	<0.04	0.18	<0.00001	2.4
SB-2	09-May-2012	6	<1	0.5	<1	<1	**6.21**	15	10	5.0	5.0	<0.01		0.27	<0.00001	6.7
SB-2	07-Aug-2012	6	<1	0.5	<1	<1	**6.05**	15	11	5.0	6.0	<0.01		0.31	<0.00001	5.3
SB-2	25-Oct-2012	6	<1	0.5	<1	<1	**6.41**	14	10	5.0	4.0	<0.01		0.35	<0.00001	7.6
SB-2	22-May-2013	5	<1	0.3	<1	<1	**6.08**	16	9.0	4.0	5.0	<0.01	<0.04	0.18	<0.00001	4.2
SB-2	15-Aug-2013	4	<1	0.5	<1	<1	**6.44**	19	9.0	3.0	7.0	<0.01	<0.04	0.4	<0.00001	5.3
SB-2	19-Oct-2013	4	<1	0.6	<1	<1	**6.37**	15	8.0	3.0	4.0	<0.01	<0.04	0.29	<0.00001	4.6
SB-3	05-Jun-2011	4	<1	0.2	<1	<1	6.87	15	8.0	3.0	4.0	<0.01	<0.04	0.26	<0.00001	3.1
SB-3	09-May-2012	4	<1	0.1	<1	<1	6.50	17	8.0	3.0	5.0	<0.01		0.34	<0.00001	2.4
SB-3	08-Aug-2012	4	<1	0.2	<1	<1	6.61	15	8.0	3.0	6.0	<0.01		0.24	<0.00001	3.4
SB-3	25-Oct-2012	29	<1	0.2	<1	<1	6.78	16	34	24	5.0	<0.01		0.32	<0.00001	3.6
SB-3	22-May-2013	8	<1	0.1	<1	<1	**6.18**	16	12	7	5.0	<0.01	0.13	0.16	<0.00001	2.8
SB-3	15-Aug-2013	5	<1	0.2	<1	<1	6.68	17	10	4.0	5.0	<0.01	<0.04	0.28	<0.00001	3.4
SB-3	18-Oct-2013	5	<1	0.2	<1	<1	6.99	18	9.0	4.0	5.0	<0.01	<0.04	0.26	<0.00001	3.0
SB-3	31-Mar-2014	15	<1	0.2	<1	<1	6.86	22	21	12	6.0	0.04	0.4	0.2	<0.00001	3.2
SB-4	05-Jun-2011	2	<1	<0.1	<1	<1	6.84	17	6.0	2.0	5.0	<0.01	0.26	0.27	<0.00001	4.0
SB-4	08-May-2012	2	<1	<0.1	<1	<1	**6.37**	15	5.0	2.0	5.0	<0.01		0.26	<0.00001	5.8
SB-4	07-Aug-2012	5	<1	<0.1	<1	<1	**6.35**	12	8.0	4.0	4.0	<0.01		0.3	<0.00001	5.0
SB-4	24-Oct-2012	8	<1	<0.1	<1	<1	6.50	12	11	7.0	4.0	<0.01		0.65	<0.00001	5.9
SB-4	22-May-2013	5	<1	<0.1	<1	<1	**6.07**	13	8.0	4.0	5.0	<0.01	<0.04	0.22	<0.00001	4.5
SB-4	15-Aug-2013	4	<1	0.1	<1	<1	**6.49**	16	8.0	3.0	5.0	<0.01	<0.04	0.3	<0.00001	4.1
SB-4	18-Oct-2013	5	<1	<0.1	<1	<1	6.70	16	9.0	4.0	5.0	<0.01	<0.04	0.35	<0.00001	4.0
SB-5	09-May-2012	6	<1	0.2	<1	<1	6.61	18	10	5.0	5.0	<0.01		0.28	<0.00001	2.9
SB-5	07-Aug-2012	5	<1	0.2	<1	<1	6.59	15	9.0	4.0	5.0	<0.01		0.22	<0.00001	3.2
SB-5	25-Oct-2012	11	<1	0.2	<1	<1	6.77	16	16	9.0	5.0	<0.01		0.3	<0.00001	3.2
SB-5	22-May-2013	7	<1	0.1	<1	<1	**6.47**	16	11	6.0	4.0	<0.01	<0.04	0.25	<0.00001	2.7
SB-5	15-Aug-2013	4	<1	0.2	<1	<1	6.62	16	8.0	3.0	5.0	<0.01	<0.04	0.3	<0.00001	3.1
SB-5	18-Oct-2013	8	<1	0.2	<1	<1	6.99	18	12	7.0	4.0	<0.01	<0.04	0.3	<0.00001	2.8
SB-5	31-Mar-2014	16	<1	0.2	<1	<1	6.96	23	22	13	6.0	0.04	0.4	0.18	<0.00001	2.9

Parameter		Dissolved Organic Carbon	Fluoride	Total Dissolved Solids	Total Suspended Solids	Lead-210	Polonium-210	Radium-226	Thorium-228	Thorium-230	Thorium-232	Calcium	Magnesium	Potassium
Unit		mg/L	mg/L	mg/L	mg/L	Bq/L	Bq/L	Bq/L	Bq/L	Bq/L	Bq/L	mg/L	mg/L	mg/L
Water Quality Benchmarks	SEQG/SSWQO							0.11						
	CCME CWQG		0.12											
	Reference		CWQG					SSWQO						
Baseline Water Quality Characteristics	Count	142	142	142	142	142	142	142	120	142	120	142	142	142
	#DL	1	13	0	26	138	108	96	104	139	103	0	1	0
	Min	<0.2	<0.01	11	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1	<0.1	0.1
	Mean	2.7	0.025211268	23	2.4	0.021	0.0055	0.0057	0.01	0.010	0.01	1.4	0.40	0.352816901
	75th	2.9	0.030	26	3.0	0.020	0.0050	0.0060	0.01	0.01	0.01	1.5	0.40	0.40
	95th	5.1	0.070	35	5.0	0.020	0.0088	0.010	0.01	0.01	0.01	2.0	0.60	0.50
	Max	8.4	0.080	40	23	0.050	0.020	0.010	0.01	0.02	0.01	3.9	0.70	0.80
	Geomean	2.6	0.020	23	2.0	0.020	0.0054	0.0056	0.01	0.010	0.01	1.4	0.39	0.33
	SD	1.1	0.020	5.3	2.3	0.003	0.0017	0.0014	7.0E-18	0.0012	7.0E-18	0.42	0.094	0.12
Location	Sample Date													
LA-1	08-Jun-2011	2.6	0.02	22	4	<0.02	<0.005	<0.005		<0.01		1.3	0.4	0.3
LA-1	12-Aug-2012	2.4	0.02	23	3	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.4	0.5	0.4
LA-1	29-Mar-2014	2.1	0.03	22	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.7	0.5	0.5
LA-1	14-Sep-2016	2.1	<0.01	18	4	<0.02	<0.005	<0.005		<0.01		1.2	0.4	0.2
LA-1	02-Jul-2018	2	0.08	26	2	<0.02	<0.005	<0.005		<0.01		1.1	0.3	0.4
LA-1	16-Mar-2018	2.2	0.03	22	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.4	0.4	0.4
LA-1-Bottom	02-Jul-2018	1.9	0.08	24	2	<0.02	<0.005	<0.005		<0.01		1.1	0.3	0.3
LA-1-Bottom	16-Mar-2018	2.2	0.02	22	<1	0.03	<0.005	<0.005	<0.01	0.01	<0.01	1.4	0.4	0.4
LA-2	06-Jun-2011	2.3	0.02	22	2	<0.02	<0.005	<0.005		<0.01		1.5	0.4	0.3
LA-2	28-Mar-2014	2.1	0.07	26	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.9	0.6	0.5
LA-2	21-Sep-2016	2.2	<0.01	22	2	<0.02	<0.005	0.006	<0.01	<0.01	<0.01	1.3	0.4	0.4
LA-3	07-Jun-2011	2.7	0.02	25	3	<0.02	<0.005	<0.005		<0.01		1.5	0.4	0.3
LA-3	28-Mar-2014	2.2	0.07	25	<1	<0.02	<0.005	0.006	<0.01	<0.01	<0.01	1.8	0.5	0.5
LA-3	21-Sep-2016	2.2	<0.01	22	4	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.2	0.4	0.8
LA-4	29-Mar-2014	1.6	0.01	36	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	2.0	0.5	0.5
LA-4	21-Sep-2016	1.4	0.02	26	3	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.4	0.4	0.6
LA-5	08-Aug-2012	2.5	0.02	22	3	<0.02	0.008	<0.005	<0.01	<0.01	<0.01	1.3	0.4	0.4
LA-5	01-Apr-2014	2.0	0.07	29	<1	<0.02	<0.005	0.010	<0.01	<0.01	<0.01	1.6	0.4	0.4
LA-5	10-Sep-2016	2.1	0.02	22	4	<0.02	0.005	0.008	<0.01	0.02	<0.01	1.2	0.4	0.2
LA-6	13-Aug-2012	2.5	0.02	24	2	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.3	0.4	0.3
LA-6	30-Mar-2014	2.0	0.07	29	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.5	0.4	0.4
LA-6	12-Sep-2016	2.2	0.02	14	4	<0.02	<0.005	<0.005		<0.01		1.2	0.4	0.2
LA-6	02-Jul-2018	2.2	0.08	23	2	<0.02	<0.005	0.005		<0.01		1.1	0.2	0.3
LA-6	17-Mar-2018	2.2	0.02	21	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.1	0.4	0.4
LA-7	09-Aug-2012	2.8	0.02	26	3	<0.02	0.005	<0.005	<0.01	<0.01	<0.01	1.5	0.5	0.4
LA-7	29-Mar-2014	2.1	0.06	29	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	2.0	0.5	0.5
LA-7	10-Sep-2016	2.2	0.02	22	4	<0.02	<0.005	<0.005	<0.01	0.01	<0.01	1.4	0.4	0.2
LA-7A	12-Sep-2016	2.1	<0.01	22	3	<0.02	<0.005	<0.005		<0.01		1.4	0.4	0.2
LA-7A-bottom	12-Sep-2016	2.6	<0.01	29	13	<0.02	0.008	0.010		<0.01		2.1	0.5	0.2
LA-8	14-Sep-2016	2.0	<0.01	21	4	<0.02	<0.005	0.010		<0.01		1.2	0.4	0.2
LA-9	16-Sep-2016	2.1	0.01	11	3	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.1	0.3	0.1
LAB-1	10-Aug-2012	2.5	0.03	35	1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	3.9	0.7	0.6
LAB-1	31-Mar-2014	2.1	0.07	31	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	2.7	0.5	0.6
LAB-1	15-Sep-2016	2.4	0.02	30	1	<0.02	<0.005	0.006	<0.01	<0.01	<0.01	3.8	0.6	0.3
LAB-2	21-Sep-2016	2.2	0.03	35	4	<0.02	<0.005	0.007	<0.01	<0.01	<0.01	3.5	0.7	0.8
LB-1	13-Sep-2016	3.6	0.02	19	2	<0.02	<0.005	<0.005		<0.01		1.2	0.4	0.2
LB-2	01-Apr-2014	2.6	0.07	30	<1	<0.02	<0.005	0.008	<0.01	<0.01	<0.01	1.8	0.4	0.4
LB-2	13-Sep-2016	3.5	<0.01	19	<1	<0.02	<0.005	<0.005		<0.01		1.3	0.4	0.2
LB-3-Top	11-Aug-2012	2.8	0.02	22	2	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.4	0.4	0.4
LB-3-Top	01-Apr-2014	2.9	0.07	23	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.7	0.4	0.5
LB-3-Top	10-Sep-2016	2.6	0.02	24	2	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.3	0.4	0.2
LB-3-bottom	10-Sep-2016	4.2	0.02	33	23	<0.02	0.02	0.007	<0.01	<0.01	<0.01	1.8	0.5	0.3
PA-2	20-Sep-2016	3.4	0.06	22	2	<0.02	0.007	<0.005	<0.01	<0.01	<0.01	1.2	0.4	0.2
PA-3	19-Sep-2016	8.4	0.02	29	2	<0.02	<0.005	0.006	<0.01	<0.01	<0.01	1.0	0.3	0.5
SA-1	05-Jun-2011	2.4	0.02	24	3	<0.02	<0.005	<0.005		<0.01		1.3	0.4	0.3
SA-1	08-May-2012	2.1	0.01	20	2	<0.02	<0.005	0.006	<0.01	<0.01	<0.01	1.6	0.5	0.3
SA-1	07-Aug-2012	2.3	0.02	21	3	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.3	0.4	0.2
SA-1	24-Oct-2012	2.2	0.01	25	2	<0.02	<0.005	0.008	<0.01	<0.01	<0.01	1.3	0.4	0.4
SA-1	22-May-2013	1.7	0.01	23	2	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.4	0.3	0.4
SA-1	15-Aug-2013	2.2	0.02	21	2	<0.02	0.01	<0.005	<0.01	<0.01	<0.01	1.4	0.4	0.5
SA-1	18-Oct-2013	2.2	0.04	22	2	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.3	0.4	0.3
SA-1	30-Mar-2014	2.0	0.07	24	<1	<0.02	<0.005	0.009	<0.01	<0.01	<0.01	1.7	0.5	0.4
SA-1	05-Jul-2019	2.4	0.02	33	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.2	0.4	0.4
SA-1	30-Aug-2019	2.4	0.01	22	<4	<0.02	<0.005	0.005	<0.01	<0.01	<0.01	1.2	0.4	0.4
SA-2	06-Jun-2011	2.5	0.02	24	1	<0.02	<0.005	<0.005		<0.01		1.3	0.4	0.3
SA-2	08-May-2012	2.2	0.01	13	2	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.3	0.3	0.1
SA-2	08-Aug-2012	2.4	0.02	19	3	<0.02	<0.005	0.010	<0.01	<0.01	<0.01	1.2	0.3	0.3
SA-2	24-Oct-2012	2.2	0.01	23	2	0.05	<0.005	0.006	<0.01	0.02	<0.01	1.2	0.3	0.4
SA-2	22-May-2013	2.0	0.01	21	1	<0.02	<0.005	0.008	<0.01	<0.01	<0.01	1.2	0.3	0.4
SA-2	15-Aug-2013	2.2	0.02	20	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.4	0.4	0.4
SA-2	18-Oct-2013	2.4	0.03	20	1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.4	0.6	0.4
SA-2	29-Mar-2014	1.9	0.01	30	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.7	0.4	0.4
SA-2	05-Jul-2019	2.7	0.02	12	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.1	0.3	0.3
SA-2	30-Aug-2019	2.5	0.01	26	<6	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.1	0.4	0.4
SA-3	05-Jun-2011	2.4	0.02	23	2	<0.02	<0.005	<0.005		<0.01		1.5	0.4	0.3
SA-3	08-May-2012	2.2	<0.01	17	2	<0.02	<0.005	0.006	<0.01	<0.01	<0.01	1.6	0.5	0.4
SA-3	07-Aug-2012	2.4	0.02	21	2	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.5	0.4	0.3
SA-3	24-Oct-2012	2.5	0.01	24	2	0.03	0.006	0.010	<0.01	<0.01	<0.01	1.5	0.5	0.4
SA-3	22-May-2013	1.7	0.01	19	<1	<0.02	<0.005	0.006	<0.01	<0.01	<0.01	1.6	0.5	0.4
SA-3	15-Aug-2013	2.4	0.02	21	1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.5	0.4	0.4
SA-3	18-Oct-2013	2.6	0.04	24	2	<0.02	0.01	0.010	<0.01	<0.01	0.01	1.6	0.4	0.5
SA-3	31-Mar-2014	2.2	0.07	26	<1	<0.02	<0.005	0.005	<0.01	<0.01	<0.01	1.9	0.5	0.5
SA-3	05-Jul-2019	2.7	0.02	17	<1	<0.02	<0.005	0.005	<0.01	<0.01	<0.01	1.4	0.4	0.4
SA-3	30-Aug-2019	2.4	0.01	24	<3	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.4	0.4	0.4
SA-4	05-Jun-2011	2.3	0.02	28	2	<0.02	<0.005	<0.005		<0.01		1.3	0.4	0.2
SA-4	08-May-2012	2.4	0.01	21	2	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.7	0.5	0.3
SA-4	07-Aug-2012	2.4	0.02	23	3	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.4	0.4	0.3
SA-4	24-Oct-2012	2.4	0.01	26	2	0.03	<0.005	0.006	<0.01	<0.01	<0.01	1.4	0.4	0.4
SA-4	22-May-2013	2.0	0.01	22	1	<0.02	<0.005	0.009	<0.01	<0.01	<0.01	1.5	0.6	0.6
SA-4	15-Aug-2013	2.4	0.03	24	3	<0.02	<0.005	0.007	<0.01	<0.01	<0.01	1.5	0.4	0.3
SA-4	18-Oct-2013	2.2	0.04	24	2	<0.02	0.007	<0.005	<0.01	<0.01	<0.01	1.7	0.4	0.4
SA-4	30-Mar-2014	2.1	0.07	32	<1	<0.02	<0.005	0.008	<0.01	<0.01	<0.01	2.0	0.4	0.5
SA-4	04-Jul-2019	3.1	0.02	40	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.3	0.4	0.4
SA-4	29-Aug-2019	2.4	0.02	26	<5	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.4	0.4	0.4
SA-5	05-Jun-2011	2.4	0.02	22	2	<0.02	<0.005	<0.005		<0.01		1.2	0.4	0.2
SA-5	08-May-2012	2.5	<0.01	17	2	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.3	0.4	0.2
SA-5	07-Aug-2012	2.3	0.02	13	2	<0.02	<0.005	0.007	<0.01	<0.01	0.01	1.2	0.2	0.3
SA-5	24-Oct-2012	2.4	0.01	20	3	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.2	0.3	0.4
SA-5	22-May-2013	1.8	0.01	20	2	<0.02	<0.005	0.005	<0.01	<0.01	<0.01	1.2	0.4	0.4
SA-5	15-Aug-2013	2.3	0.02	18	2	<0.02	<0.005	0.007	<0.01	<0.01	<0.01	1.2	0.3	0.4
SA-5	18-Oct-2013	2.3	0.03	19	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.3	0.4	0.4
SA-5	30-Mar-2014	2.0	0.08	28	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.4	0.3	0.4
SA-5	04-Jul-2019	2.8	0.02	36	<1	<0.02	<0.005	<0.006	<0.01	<0.01	<0.01	1.1	0.3	0.3
SA-5	29-Aug-2019	2.1	0.01	16	<4	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.1	0.3	0.3
SA-6	08-May-2012	2.5	<0.01	16	2	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.3	0.4	0.2
SA-6	07-Aug-2012	2.5	0.02	19	5	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.2	0.3	0.3
SA-6	24-Oct-2012	2.3	0.01	15	6	<0.02	0.006	<0.005	<0.01	<0.01	<0.01	1.3	0.4	0.4
SA-6	22-May-2013	2.0	0.01	20	3	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.2	0.4	0.4
SA-6	15-Aug-2013	2.3	0.02	20	5	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.4	0.4	0.4
SA-6	18-Oct-2013	2.2	0.04	21	1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.4	0.5	0.4
SA-6	01-Apr-2014	1.9	0.07	28	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.8	0.4	0.4
SA-6	04-Jul-2019	2.8	0.02	35	<1	<0.02	<0.007	<0.006	<0.01	<0.01	<0.01	1.2	0.3	0.4
SA-6	29-Aug-2019	2.6	0.01	18	<5	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.2	0.4	0.3
RC-1	06-Jul-2019	2.6	0.02	38	<2	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.4	0.4	0.4
RC-1	01-Sep-2019	2.6	0.01	26	<5	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.4	0.4	0.4
SB-1	09-Jun-2011	2.5	0.02	21	1	<0.02	0.006	<0.005		<0.01		1.3	0.4	0.2
SB-1	09-May-2012	4.5	<0.01	19	2	<0.02	0.006	<0.005	<0.01	<0.01	<0.01	1.2	0.4	0.3
SB-1	07-Aug-2012	4.6	0.02	22	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.3	0.3	0.3
SB-1	25-Oct-2012	4.3	0.01	25	4	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.2	0.6	0.4
SB-1	22-May-2013	2.8	0.01	18	1	<0.02	<0.005	0.005	<0.01	<0.01	<0.01	1.2	0.3	0.3
SB-1	15-Aug-2013	3.9	0.02	22	2	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.6	0.5	0.2
SB-1	19-Oct-2013	3.8	0.03	25	<1	<0.02	0.005	<0.005	<0.01	<0.01	<0.01	1.1	<0.1	0.4
SB-1	31-Mar-2014	3.2	0.07	36	1	<0.02	0.006	0.010	<0.01	<0.01	<0.01	2.2	0.7	0.5
SB-2	09-Jun-2011	2.0	0.02	31	3	<0.02	0.01	<0.005		<0.01		1.8	0.5	0.3
SB-2	09-May-2012	6.2	<0.01	19	2	<0.02	0.008	<0.005	<0.01	<0.01	<0.01	1.3	0.4	0.2
SB-2	07-Aug-2012	5.1	0.02	26	8	0.04	0.01	0.009	<0.01	<0.01	<0.01	1.4	0.5	0.3
SB-2	25-Oct-2012	6.4	0.01	28	1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.1	0.4	0.3
SB-2	22-May-2013	3.9	0.01	21	2	<0.02	0.005	0.006	<0.01	<0.01	<0.01	1.3	0.4	0.4
SB-2	15-Aug-2013	5.6	0.02	24	3	<0.02	0.005	0.008	0.01	<0.01	<0.01	1.8	0.6	0.2
SB-2	19-Oct-2013	4.7	0.03	25	2	<0.02	0.009	0.007	<0.01	<0.01	<0.01	1.1	0.2	0.3
SB-3	05-Jun-2011	3.1	0.01	24	3	<0.02	0.008	<0.005		<0.01		1.1	0.4	0.2
SB-3	09-May-2012	2.2	0.01	14	2	<0.02	<0.005	0.010	<0.01	<0.01	<0.01	1.4	0.4	0.2
SB-3	08-Aug-2012	3.4	0.02	18	3	<0.02	0.006	<0.005	<0.01	<0.01	<0.01	1.4	0.5	0.3
SB-3	25-Oct-2012	3.4	0.01	21	3	<0.02	<0.005	0.006	<0.01	<0.01	<0.01	1.4	0.4	0.4
SB-3	22-May-2013	2.6	0.01	22	2	<0.02	<0.005	0.007	<0.01	<0.01	<0.01	1.4	0.3	0.4
SB-3	15-Aug-2013	3.4	0.02	17	4	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.4	0.4	0.4
SB-3	18-Oct-2013	3.0	0.04	22	2	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.4	0.3	0.4
SB-3	31-Mar-2014	3.1	0.07	26	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.7	0.4	0.5
SB-4	05-Jun-2011	<0.2	0.02	27	3	<0.02	0.006	<0.005		<0.01		1.5	0.4	0.2
SB-4	08-May-2012	5.9	<0.01	19	2	<0.02	0.006	<0.005	<0.01	<0.01	<0.01	1.4	0.3	0.1
SB-4	07-Aug-2012	4.8	0.02	22	3	<0.02	0.005	<0.005	<0.01	<0.01	<0.01	1.2	0.2	0.3
SB-4	24-Oct-2012	5.6	0.01	26	2	<0.02	0.01	<0.005	<0.01	<0.01	<0.01	1.0	0.3	0.3
SB-4	22-May-2013	4.2	0.01	18	2	<0.02	0.006	<0.005	<0.01	<0.01	<0.01	1.2	0.4	0.3
SB-4	15-Aug-2013	4.5	0.02	22	4	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.4	0.4	0.1
SB-4	18-Oct-2013	4.0	0.03	24	<1	<0.02	<0.005	0.007	<0.01	<0.01	<0.01	1.2	0.4	0.4
SB-5	09-May-2012	2.9	0.01	16	2	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.4	0.4	0.2
SB-5	07-Aug-2012	3.1	0.02	20	2	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.2	0.4	0.3
SB-5	25-Oct-2012	3.2	0.01	19	2	<0.02	<0.005	0.006	<0.01	<0.01	<0.01	1.3	0.4	0.4
SB-5	22-May-2013	2.6	0.01	18	2	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.3	0.3	0.3
SB-5	15-Aug-2013	3.1	0.02	17	3	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.3	0.4	0.4
SB-5	18-Oct-2013	2.8	0.04	21	<1	<0.02	<0.005	<0.005	<0.01	<0.01	<0.01	1.4	0.2	0.4
SB-5	31-Mar-2014	2.9	0.07	24	<1	<0.02	<0.005	<0.005	0.01	<0.01	<0.01	1.7	0.5	0.5

Parameter		Sodium	Sulphate	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Molybdenum
Unit		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Water Quality Benchmarks	SEQG/SSWQO		128	0.1		0.005				0.00004				0.3			31
	CCME CWQG								1.5		0.001		0.002		0.001		
	Reference		SEQG	SEQG		SEQG			CWQG	SEQG	CWQG		CWQG	SEQG	CWQG		SEQG
Baseline Water Quality Characteristics	Count	142	142	142	142	142	142	142	142	72	142	142	142	142	142	142	142
	#DL	0	1	0	142	45	0	142	142	142	142	139	138	0	131	0	134
	Min	0.9	<0.2	0.0006	<0.0002	<0.0001	0.0017	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0001	0.0087	<0.0001	0.0024	<0.0001
	Mean	1.5	0.85	0.0094	0.00020	0.00010	0.0029	0.0001	0.01	1.3E-05	0.0005	0.00010	0.0002	0.23	0.00012	0.018	0.00012
	75th	1.6	0.80	0.010	0.00020	0.00010	0.0033	0.0001	0.01	0.00001	0.0005	0.00010	0.0002	0.15	0.00010	0.018	0.00010
	95th	1.8	1.1	0.029	0.00020	0.00010	0.0041	0.0001	0.01	3.0E-05	0.0005	0.00010	0.0002	**0.49**	0.00010	0.036	0.00010
	Max	2.1	8.3	0.081	0.00030	0.00030	0.0095	0.0001	0.01	**0.00007**	0.0005	0.00020	0.0008	**9.5**	**0.0012**	0.34	0.0013
	Geomean	1.5	0.69	0.0060	0.00020	0.00010	0.0028	0.0001	0.01	1.2E-05	0.0005	0.00010	0.00019	0.10	0.00011	0.012	0.00011
	SD	0.21	1.1	0.011	8.4E-06	2.5E-05	0.00084	2.2E-19	7.0E-18	8.7E-06	3.3E-19	8.4E-06	6.2E-05	0.90	0.00011	0.035	0.00014
Location	Sample Date																
LA-1	08-Jun-2011	1.4	0.7	0.0036	<0.0002	<0.0001	0.0027	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.11	0.0004	0.0084	<0.0001
LA-1	12-Aug-2012	1.5	0.8	0.001	<0.0002	0.0001	0.0027	<0.0001	<0.01	0.00002	<0.0005	<0.0001	<0.0002	0.22	<0.0001	0.029	<0.0001
LA-1	29-Mar-2014	1.8	0.8	0.0023	<0.0002	0.0001	0.0038	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	0.051	<0.0001	0.02	<0.0001
LA-1	14-Sep-2016	1.5	0.7	0.0039	<0.0002	<0.0001	0.0030	<0.0001	<0.01	0.00003	<0.0005	<0.0001	<0.0002	0.27	<0.0001	0.023	<0.0001
LA-1	02-Jul-2018	1.4	0.7	0.0051	<0.0002	<0.0001	0.0023	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.052	<0.0001	0.01	<0.0001
LA-1	16-Mar-2018	1.6	0.8	0.0046	<0.0002	0.0001	0.0032	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.037	<0.0001	0.0039	<0.0001
LA-1-Bottom	02-Jul-2018	1.4	0.7	0.004	<0.0002	<0.0001	0.0026	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.13	<0.0001	0.013	<0.0001
LA-1-Bottom	16-Mar-2018	1.6	0.8	0.0034	<0.0002	<0.0001	0.0031	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.036	<0.0001	0.0053	<0.0001
LA-2	06-Jun-2011	1.5	0.7	0.0024	<0.0002	<0.0001	0.0027	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.054	0.0002	0.0064	<0.0001
LA-2	28-Mar-2014	1.8	0.8	0.001	<0.0002	0.0001	0.0043	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	0.081	<0.0001	0.030	<0.0001
LA-2	21-Sep-2016	1.6	0.6	0.0022	<0.0002	<0.0001	0.0029	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.064	<0.0001	0.0078	<0.0001
LA-3	07-Jun-2011	1.5	0.6	0.0033	<0.0002	<0.0001	0.0034	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.19	0.0007	0.011	<0.0001
LA-3	28-Mar-2014	1.8	0.9	0.0014	<0.0002	0.0001	0.0041	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.066	<0.0001	0.014	<0.0001
LA-3	21-Sep-2016	1.5	0.9	0.0021	<0.0002	<0.0001	0.0030	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.072	<0.0001	0.0086	<0.0001
LA-4	29-Mar-2014	2.0	1.3	0.0009	<0.0002	0.0001	0.0039	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	0.0087	<0.0001	0.029	<0.0001
LA-4	21-Sep-2016	1.7	1.3	0.0017	<0.0002	0.0001	0.0030	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.02	<0.0001	0.025	<0.0001
LA-5	08-Aug-2012	1.5	0.6	0.0056	0.0003	0.0001	0.0021	<0.0001	<0.01	0.00002	<0.0005	<0.0001	<0.0002	0.10	<0.0001	0.018	<0.0001
LA-5	01-Apr-2014	1.7	0.7	0.0048	<0.0002	<0.0001	0.0032	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.04	<0.0001	0.0046	<0.0001
LA-5	10-Sep-2016	1.4	0.6	0.0078	<0.0002	0.0001	0.0027	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	0.19	<0.0001	0.020	<0.0001
LA-6	13-Aug-2012	1.5	0.7	0.073	<0.0002	0.0001	0.0051	<0.0001	0.01	0.00004	<0.0005	<0.0001	0.0004	0.11	**0.0012**	0.017	<0.0001
LA-6	30-Mar-2014	1.8	0.7	0.005	<0.0002	0.0001	0.0032	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.085	<0.0001	0.0062	<0.0001
LA-6	12-Sep-2016	1.4	0.5	0.0093	<0.0002	<0.0001	0.0027	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.21	<0.0001	0.017	<0.0001
LA-6	02-Jul-2018	1.4	0.6	0.0074	<0.0002	<0.0001	0.0024	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.096	<0.0001	0.019	<0.0001
LA-6	17-Mar-2018	1.5	0.7	0.0058	<0.0002	<0.0001	0.003	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.031	<0.0001	0.0024	<0.0001
LA-7	09-Aug-2012	1.6	0.6	0.0051	<0.0002	0.0001	0.0024	<0.0001	<0.01	0.00003	<0.0005	<0.0001	<0.0002	0.14	<0.0001	0.019	<0.0001
LA-7	29-Mar-2014	2.0	0.5	0.0006	<0.0002	0.0001	0.0038	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	0.15	<0.0001	0.026	<0.0001
LA-7	10-Sep-2016	1.6	0.4	0.0036	<0.0002	0.0001	0.0024	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.13	<0.0001	0.015	<0.0001
LA-7A	12-Sep-2016	1.7	0.3	0.0015	<0.0002	<0.0001	0.0025	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.085	<0.0001	0.013	<0.0001
LA-7A-bottom	12-Sep-2016	1.7	0.5	0.0033	<0.0002	0.0002	0.0036	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	**5.2**	<0.0001	0.25	<0.0001
LA-8	14-Sep-2016	1.3	0.6	0.0046	<0.0002	<0.0001	0.0029	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	0.14	<0.0001	0.028	<0.0001
LA-9	16-Sep-2016	1.4	0.6	0.0016	<0.0002	0.0001	0.0024	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	0.071	<0.0001	0.011	0.0002
LAB-1	10-Aug-2012	1.7	7.8	0.0023	<0.0002	0.0001	0.0033	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	0.056	<0.0001	0.029	0.0007
LAB-1	31-Mar-2014	2.0	3.7	0.0024	<0.0002	<0.0001	0.0039	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	0.080	<0.0001	0.064	0.0003
LAB-1	15-Sep-2016	1.8	8.1	0.0025	<0.0002	<0.0001	0.0035	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	0.076	<0.0001	0.041	0.0013
LAB-2	21-Sep-2016	1.7	8.3	0.0029	<0.0002	0.0001	0.0034	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.039	<0.0001	0.019	0.0011
LB-1	13-Sep-2016	1.4	0.7	0.011	<0.0002	0.0001	0.0033	<0.0001	<0.01	0.00002	<0.0005	<0.0001	<0.0002	0.084	<0.0001	0.0044	<0.0001
LB-2	01-Apr-2014	1.6	0.8	0.0067	<0.0002	0.0001	0.0046	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.15	<0.0001	0.037	<0.0001
LB-2	13-Sep-2016	1.4	0.5	0.0096	<0.0002	0.0001	0.0033	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	0.15	<0.0001	0.0094	<0.0001
LB-3-Top	11-Aug-2012	1.4	0.8	0.0035	<0.0002	0.0001	0.0041	<0.0001	<0.01	0.00002	<0.0005	<0.0001	<0.0002	0.24	0.0001	0.028	<0.0001
LB-3-Top	01-Apr-2014	1.8	0.8	0.0018	<0.0002	0.0001	0.0037	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.045	<0.0001	0.0025	<0.0001
LB-3-Top	10-Sep-2016	1.4	0.7	0.0016	<0.0002	0.0001	0.0028	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.062	<0.0001	0.012	<0.0001
LB-3-bottom	10-Sep-2016	1.6	0.5	0.0086	<0.0002	0.0003	0.0095	<0.0001	<0.01	0.00002	<0.0005	<0.0001	<0.0002	**9.5**	<0.0001	0.34	<0.0001
PA-2	20-Sep-2016	1.4	1.1	0.0096	<0.0002	<0.0001	0.0026	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.044	<0.0001	0.0026	<0.0001
PA-3	19-Sep-2016	1.3	1.1	0.027	<0.0002	<0.0001	0.0026	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.098	<0.0001	0.0025	<0.0001
SA-1	05-Jun-2011	1.4	0.7	0.004	<0.0002	<0.0001	0.0025	<0.0001	<0.01	0.00002	<0.0005	<0.0001	<0.0002	0.11	<0.0001	0.0086	<0.0001
SA-1	08-May-2012	1.6	0.8	0.004	<0.0002	0.0001	0.0035	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.14	<0.0001	0.021	<0.0001
SA-1	07-Aug-2012	1.4	0.9	0.0056	<0.0002	0.0001	0.0025	<0.0001	<0.01	0.00002	<0.0005	<0.0001	<0.0001	0.21	<0.0001	0.025	<0.0001
SA-1	24-Oct-2012	1.5	0.5	0.0022	<0.0002	0.0001	0.0026	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.081	<0.0001	0.012	<0.0001
SA-1	22-May-2013	1.4	0.4	0.0044	<0.0002	<0.0001	0.0030	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	**0.31**	<0.0001	0.023	<0.0001
SA-1	15-Aug-2013	1.6	0.9	0.0035	<0.0002	0.0001	0.0022	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.091	<0.0001	0.016	<0.0001
SA-1	18-Oct-2013	1.6	0.5	0.0037	<0.0002	0.0001	0.0026	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.073	<0.0001	0.011	<0.0001
SA-1	30-Mar-2014	1.7	0.8	0.0029	<0.0002	0.0001	0.0032	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.031	<0.0001	0.0041	<0.0001
SA-1	05-Jul-2019	1.4	0.7	0.0054	<0.0002	<0.0001	0.0022	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.12	<0.0001	0.012	<0.0001
SA-1	30-Aug-2019	1.4	0.6	0.0034	<0.0002	0.0001	0.0024	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.12	<0.0001	0.015	<0.0001
SA-2	06-Jun-2011	1.4	0.6	0.0054	<0.0002	0.0001	0.0019	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.056	<0.0001	0.0062	<0.0001
SA-2	08-May-2012	1.2	0.6	0.081	<0.0002	0.0001	0.0041	<0.0001	<0.01	0.00002	<0.0005	<0.0001	0.0008	0.11	0.0003	0.017	<0.0001
SA-2	08-Aug-2012	1.3	0.6	0.0068	<0.0002	0.0001	0.0029	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0001	0.091	<0.0001	0.017	<0.0001
SA-2	24-Oct-2012	1.4	0.7	0.0041	<0.0002	<0.0001	0.0023	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.063	<0.0001	0.0091	<0.0001
SA-2	22-May-2013	1.4	<0.2	0.0093	<0.0002	<0.0001	0.0023	<0.0001	<0.01	0.00002	<0.0005	<0.0001	<0.0002	0.074	<0.0001	0.0077	<0.0001
SA-2	15-Aug-2013	1.5	0.6	0.005	<0.0002	0.0001	0.0024	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.098	<0.0001	0.015	<0.0001
SA-2	18-Oct-2013	1.6	0.7	0.0039	<0.0002	<0.0001	0.0023	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.058	<0.0001	0.0062	<0.0001
SA-2	29-Mar-2014	1.8	0.7	0.0042	<0.0002	0.0001	0.0031	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.041	<0.0001	0.0044	<0.0001
SA-2	05-Jul-2019	1.4	0.6	0.0071	<0.0002	<0.0001	0.002	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.066	<0.0001	0.0098	<0.0001
SA-2	30-Aug-2019	1.4	0.6	0.0087	<0.0002	<0.0001	0.0023	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.11	<0.0001	0.014	<0.0001
SA-3	05-Jun-2011	1.4	0.8	0.0022	<0.0002	0.0001	0.0027	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	0.057	<0.0001	0.0066	<0.0001
SA-3	08-May-2012	1.5	0.8	0.0031	<0.0002	<0.0001	0.0039	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.072	<0.0001	0.018	<0.0001
SA-3	07-Aug-2012	1.5	0.7	0.0039	<0.0002	0.0001	0.0027	<0.0001	<0.01	0.00002	<0.0005	<0.0001	<0.0001	0.13	<0.0001	0.016	<0.0001
SA-3	24-Oct-2012	1.5	0.8	0.0018	<0.0002	0.0001	0.0030	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.062	<0.0001	0.0084	<0.0001
SA-3	22-May-2013	1.5	0.4	0.0018	<0.0002	<0.0001	0.0038	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.12	<0.0001	0.023	<0.0001
SA-3	15-Aug-2013	1.6	0.8	0.0017	<0.0002	0.0001	0.0025	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.084	<0.0001	0.013	<0.0001
SA-3	18-Oct-2013	1.6	0.7	0.006	<0.0002	0.0001	0.0035	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.096	<0.0001	0.011	<0.0001
SA-3	31-Mar-2014	1.8	0.8	0.0013	<0.0002	0.0001	0.0040	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.036	<0.0001	0.0098	<0.0001
SA-3	05-Jul-2019	1.5	0.8	0.0033	<0.0002	0.0001	0.0025	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.065	<0.0001	0.0076	<0.0001
SA-3	30-Aug-2019	1.5	0.7	0.016	<0.0002	<0.0001	0.0026	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.072	<0.0001	0.0063	<0.0001
SA-4	05-Jun-2011	1.4	0.5	0.0043	<0.0002	0.0001	0.0021	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	0.050	<0.0001	0.0067	0.0002
SA-4	08-May-2012	1.6	0.6	0.0099	<0.0002	<0.0001	0.0029	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.086	<0.0001	0.0095	<0.0001
SA-4	07-Aug-2012	1.4	0.4	0.0064	<0.0002	0.0001	0.0024	<0.0001	<0.01	**0.00007**	<0.0005	<0.0001	<0.0001	0.13	<0.0001	0.017	<0.0001
SA-4	24-Oct-2012	1.6	0.5	0.0033	<0.0002	<0.0001	0.0022	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.064	<0.0001	0.010	<0.0001
SA-4	22-May-2013	1.5	0.6	0.006	<0.0002	<0.0001	0.0028	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.077	<0.0001	0.0089	<0.0001
SA-4	15-Aug-2013	1.7	0.5	0.0065	<0.0002	0.0001	0.0024	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.12	<0.0001	0.019	<0.0001
SA-4	18-Oct-2013	1.7	0.4	0.0035	<0.0002	0.0001	0.0025	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.058	<0.0001	0.011	<0.0001
SA-4	30-Mar-2014	2.1	0.7	0.0025	<0.0002	0.0001	0.0032	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.034	<0.0001	0.0029	<0.0001
SA-4	04-Jul-2019	1.6	0.6	0.0084	<0.0002	<0.0001	0.0022	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.075	<0.0001	0.012	<0.0001
SA-4	29-Aug-2019	1.6	0.5	0.006	<0.0002	<0.0001	0.0023	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.095	<0.0001	0.015	<0.0001
SA-5	05-Jun-2011	1.3	0.6	0.0054	<0.0002	0.0001	0.0023	<0.0001	<0.01	0.00002	<0.0005	<0.0001	<0.0002	0.054	<0.0001	0.0064	<0.0001
SA-5	08-May-2012	1.4	0.7	0.014	<0.0002	0.0001	0.0030	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.11	<0.0001	0.0086	<0.0001
SA-5	07-Aug-2012	1.3	0.7	0.0071	<0.0002	0.0001	0.0031	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0001	0.11	<0.0001	0.018	<0.0001
SA-5	24-Oct-2012	1.4	0.8	0.0047	<0.0002	0.0001	0.0022	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.067	<0.0001	0.010	<0.0001
SA-5	22-May-2013	1.6	0.6	0.0078	<0.0002	<0.0001	0.0028	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.095	<0.0001	0.0063	<0.0001
SA-5	15-Aug-2013	1.4	0.5	0.0058	<0.0002	<0.0001	0.0021	<0.0001	<0.01	0.00004	<0.0005	<0.0001	<0.0002	0.086	<0.0001	0.012	<0.0001
SA-5	18-Oct-2013	1.4	0.4	0.004	<0.0002	0.0001	0.0022	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.035	<0.0001	0.0047	<0.0001
SA-5	30-Mar-2014	1.6	0.8	0.0044	<0.0002	0.0001	0.0030	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.030	<0.0001	0.0025	<0.0001
SA-5	04-Jul-2019	1.3	0.6	0.0078	<0.0002	<0.0001	0.0022	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.074	<0.0001	0.0094	<0.0001
SA-5	29-Aug-2019	1.3	0.5	0.0063	<0.0002	<0.0001	0.0022	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.085	<0.0001	0.0097	<0.0001
SA-6	08-May-2012	1.4	0.7	0.02	<0.0002	0.0001	0.0030	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	0.098	<0.0001	0.0095	<0.0001
SA-6	07-Aug-2012	1.3	0.6	0.016	<0.0002	0.0001	0.0029	<0.0001	<0.01	0.00002	<0.0005	<0.0001	<0.0001	0.16	<0.0001	0.029	<0.0001
SA-6	24-Oct-2012	1.4	0.5	0.014	<0.0002	0.0001	0.0029	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	0.14	<0.0001	0.018	<0.0001
SA-6	22-May-2013	1.4	0.3	0.0084	<0.0002	<0.0001	0.0024	<0.0001	<0.01	0.00003	<0.0005	<0.0001	<0.0002	0.061	<0.0001	0.0062	<0.0001
SA-6	15-Aug-2013	1.4	0.7	0.009	<0.0002	0.0001	0.0028	<0.0001	<0.01	**0.00005**	<0.0005	<0.0001	<0.0002	0.12	<0.0001	0.018	<0.0001
SA-6	18-Oct-2013	1.6	0.8	0.0044	<0.0002	<0.0001	0.0023	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.052	<0.0001	0.007	<0.0001
SA-6	01-Apr-2014	1.9	0.7	0.0032	<0.0002	0.0001	0.0032	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	0.036	<0.0001	0.0037	<0.0001
SA-6	04-Jul-2019	1.4	0.6	0.0079	<0.0002	<0.0001	0.0021	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.078	<0.0001	0.01	<0.0001
SA-6	29-Aug-2019	1.4	0.6	0.0072	<0.0002	0.0001	0.0022	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.1	<0.0001	0.013	<0.0001
RC-1	06-Jul-2019	1.6	0.5	0.0046	<0.0002	<0.0001	0.002	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.048	<0.0001	0.0073	<0.0001
RC-1	01-Sep-2019	1.6	0.4	0.0041	<0.0002	<0.0001	0.0023	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.081	<0.0001	0.013	<0.0001
SB-1	09-Jun-2011	1.3	0.7	0.012	<0.0002	<0.0001	0.0024	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.10	<0.0001	0.011	<0.0001
SB-1	09-May-2012	1.3	0.8	0.022	<0.0002	<0.0001	0.0025	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.20	<0.0001	0.0098	<0.0001
SB-1	07-Aug-2012	1.2	0.6	0.016	<0.0002	0.0001	0.0026	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0001	0.16	<0.0001	0.0071	<0.0001
SB-1	25-Oct-2012	1.4	0.9	0.025	<0.0002	0.0001	0.0023	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.16	<0.0001	0.0088	<0.0001
SB-1	22-May-2013	1.2	0.7	0.015	<0.0002	<0.0001	0.0023	<0.0001	<0.01	0.00004	<0.0005	<0.0001	<0.0002	0.18	<0.0001	0.010	<0.0001
SB-1	15-Aug-2013	1.3	0.5	0.018	<0.0002	0.0001	0.0032	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	**0.33**	<0.0001	0.014	<0.0001
SB-1	19-Oct-2013	1.3	1.1	0.015	<0.0002	0.0001	0.0020	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	0.18	<0.0001	0.0084	<0.0001
SB-1	31-Mar-2014	2.1	1.1	0.014	<0.0002	<0.0001	0.0039	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	0.0004	**0.64**	<0.0001	0.036	<0.0001
SB-2	09-Jun-2011	1.5	0.8	0.031	<0.0002	<0.0001	0.0020	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	**0.59**	<0.0001	0.035	<0.0001
SB-2	09-May-2012	1.0	0.6	0.051	<0.0002	<0.0001	0.0022	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	**0.49**	0.0001	0.011	<0.0001
SB-2	07-Aug-2012	1.1	0.8	0.024	<0.0002	0.0002	0.0036	<0.0001	<0.01	<0.00001	<0.0005	0.0002	0.0002	**1.34**	<0.0001	0.054	<0.0001
SB-2	25-Oct-2012	1.2	0.9	0.02	<0.0002	0.0001	0.0017	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	0.25	<0.0001	0.0085	<0.0001
SB-2	22-May-2013	1.0	0.6	0.023	<0.0002	<0.0001	0.0023	<0.0001	<0.01	0.00003	<0.0005	<0.0001	<0.0002	**0.46**	<0.0001	0.024	<0.0001
SB-2	15-Aug-2013	1.2	0.7	0.026	<0.0002	0.0002	0.0030	<0.0001	<0.01	0.00002	<0.0005	0.0001	<0.0002	**0.92**	<0.0001	0.036	<0.0001
SB-2	19-Oct-2013	1.3	0.8	0.02	<0.0002	0.0001	0.0018	<0.0001	<0.01	0.00002	<0.0005	<0.0001	<0.0002	**0.32**	<0.0001	0.011	<0.0001
SB-3	05-Jun-2011	1.2	0.6	0.01	<0.0002	<0.0001	0.0029	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.086	<0.0001	0.0063	<0.0001
SB-3	09-May-2012	1.3	0.8	0.0074	<0.0002	<0.0001	0.0035	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.11	<0.0001	0.020	<0.0001
SB-3	08-Aug-2012	1.2	0.6	0.0084	<0.0002	0.0001	0.0030	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0001	0.15	<0.0001	0.017	<0.0001
SB-3	25-Oct-2012	1.4	0.8	0.0081	<0.0002	0.0001	0.0029	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.059	<0.0001	0.0061	<0.0001
SB-3	22-May-2013	1.5	0.7	0.012	<0.0002	<0.0001	0.0035	<0.0001	<0.01	0.00002	<0.0005	<0.0001	<0.0002	0.22	<0.0001	0.015	<0.0001
SB-3	15-Aug-2013	1.7	0.8	0.0091	<0.0002	<0.0001	0.0025	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.062	<0.0001	0.010	<0.0001
SB-3	18-Oct-2013	1.4	0.3	0.0052	<0.0002	0.0001	0.0027	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.042	<0.0001	0.0053	<0.0001
SB-3	31-Mar-2014	1.7	0.9	0.0086	<0.0002	0.0001	0.0041	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.042	<0.0001	0.01	<0.0001
SB-4	05-Jun-2011	1.2	0.7	0.032	<0.0002	0.0001	0.0034	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	0.20	<0.0001	0.011	<0.0001
SB-4	08-May-2012	0.9	0.5	0.033	<0.0002	0.0001	0.0034	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0002	0.18	<0.0001	0.0066	<0.0001
SB-4	07-Aug-2012	1.1	0.4	0.022	<0.0002	0.0002	0.0031	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0001	0.22	<0.0001	0.011	<0.0001
SB-4	24-Oct-2012	1.1	0.4	0.026	<0.0002	0.0001	0.0025	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.095	<0.0001	0.0036	<0.0001
SB-4	22-May-2013	1.1	0.5	0.029	<0.0002	<0.0001	0.0035	<0.0001	<0.01	0.00002	<0.0005	<0.0001	<0.0002	0.25	<0.0001	0.0074	<0.0001
SB-4	15-Aug-2013	1.3	0.6	0.023	<0.0002	0.0002	0.0036	<0.0001	<0.01	<0.00001	<0.0005	0.0001	<0.0002	0.29	<0.0001	0.016	<0.0001
SB-4	18-Oct-2013	1.3	0.5	0.019	<0.0002	0.0001	0.0025	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.11	<0.0001	0.0067	<0.0001
SB-5	09-May-2012	1.4	0.7	0.0086	<0.0002	0.0001	0.0034	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.11	<0.0001	0.016	<0.0001
SB-5	07-Aug-2012	1.3	0.6	0.0074	<0.0002	0.0001	0.0028	<0.0001	<0.01	0.00001	<0.0005	<0.0001	<0.0001	0.084	<0.0001	0.010	<0.0001
SB-5	25-Oct-2012	1.4	1.0	0.0038	<0.0002	0.0001	0.0028	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.084	<0.0001	0.0071	<0.0001
SB-5	22-May-2013	1.4	0.6	0.0086	<0.0002	<0.0001	0.0033	<0.0001	<0.01	0.00004	<0.0005	<0.0001	<0.0002	0.16	<0.0001	0.012	<0.0001
SB-5	15-Aug-2013	1.4	0.8	0.0066	<0.0002	0.0001	0.0026	<0.0001	<0.01	0.00002	<0.0005	<0.0001	<0.0002	0.097	<0.0001	0.012	<0.0001
SB-5	18-Oct-2013	1.5	0.5	0.0025	<0.0002	0.0001	0.0027	<0.0001	<0.01	0.00002	<0.0005	<0.0001	<0.0002	0.13	<0.0001	0.009	<0.0001
SB-5	31-Mar-2014	1.7	0.8	0.0016	<0.0002	0.0001	0.0040	<0.0001	<0.01	<0.00001	<0.0005	<0.0001	<0.0002	0.036	<0.0001	0.009	<0.0001

Parameter		Nickel	Selenium	Silver	Strontium	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc	Phosphorus	Dissolved Phosphorus
Unit		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Water Quality Benchmarks	SEQG/SSWQO												
	CCME CWQG	0.025	0.001	0.0001		0.0008			0.015		0.007		
	Reference	CWQG	CWQG	CWQG		CWQG			CWQG		CWQG		
Baseline Water Quality Characteristics	Count	142	142	142	142	142	142	142	142	142	142	142	142
	#DL	102	140	141	0	142	121	107	135	108	105	135	136
	Min	<0.0001	<0.0001	<0.00005	0.0089	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
	Mean	0.00012	0.00010	0.00005	0.013	0.0002	0.00018	0.00026	0.00013	0.00011	0.00098	0.012	0.012
	75th	0.00010	0.00010	0.00005	0.014	0.0002	0.00010	0.00020	0.00010	0.00010	0.00060	0.010	0.010
	95th	0.00030	0.00010	0.00005	0.018	0.0002	0.00090	0.00060	0.00020	0.00020	0.0029	0.010	0.010
	Max	0.00060	0.00020	0.00005	0.021	0.0002	0.0016	0.0018	0.0018	0.00050	**0.02**	0.17	0.15
	Geomean	0.00011	0.00010	0.00005	0.013	0.0002	0.00013	0.00023	0.00011	0.00011	0.00068	0.010	0.010
	SD	6.8E-05	8.4E-06	1.1E-19	0.0022	4.4E-19	0.00027	0.00021	0.00019	4.7E-05	0.0019	0.016	0.014
Location	Sample Date												
LA-1	08-Jun-2011	<0.0001	<0.0001	<0.00005	0.012	<0.0002	0.0007	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LA-1	12-Aug-2012	<0.0001	<0.0001	<0.00005	0.014	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LA-1	29-Mar-2014	<0.0001	<0.0001	<0.00005	0.016	<0.0002	0.0013	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LA-1	14-Sep-2016	<0.0001	<0.0001	<0.00005	0.013	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LA-1	02-Jul-2018	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LA-1	16-Mar-2018	<0.0001	<0.0001	<0.00005	0.014	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	0.001	<0.01	<0.01
LA-1-Bottom	02-Jul-2018	<0.0001	<0.0001	<0.00005	0.013	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	0.0013	<0.01	<0.01
LA-1-Bottom	16-Mar-2018	<0.0001	<0.0001	<0.00005	0.014	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	0.0016	<0.01	<0.01
LA-2	06-Jun-2011	<0.0001	<0.0001	<0.00005	0.013	<0.0002	0.0006	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LA-2	28-Mar-2014	<0.0001	<0.0001	<0.00005	0.018	<0.0002	0.0004	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LA-2	21-Sep-2016	0.0003	<0.0001	<0.00005	0.015	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	0.0011	<0.01	<0.01
LA-3	07-Jun-2011	<0.0001	<0.0001	<0.00005	0.015	<0.0002	0.001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LA-3	28-Mar-2014	<0.0001	<0.0001	<0.00005	0.018	<0.0002	0.0004	<0.0002	<0.0001	<0.0001	0.0005	<0.01	<0.01
LA-3	21-Sep-2016	0.0002	<0.0001	<0.00005	0.014	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	0.0005	<0.01	<0.01
LA-4	29-Mar-2014	<0.0001	<0.0001	<0.00005	0.017	<0.0002	0.0012	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	0.01
LA-4	21-Sep-2016	0.0001	<0.0001	<0.00005	0.015	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LA-5	08-Aug-2012	<0.0001	<0.0001	0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LA-5	01-Apr-2014	<0.0001	<0.0001	<0.00005	0.015	<0.0002	0.0008	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LA-5	10-Sep-2016	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LA-6	13-Aug-2012	0.0004	<0.0001	<0.00005	0.014	<0.0002	<0.0001	0.0002	<0.0001	0.0001	**0.02**	0.01	<0.01
LA-6	30-Mar-2014	<0.0001	<0.0001	<0.00005	0.014	<0.0002	0.0011	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LA-6	12-Sep-2016	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LA-6	02-Jul-2018	<0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LA-6	17-Mar-2018	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	0.0022	<0.01	<0.01
LA-7	09-Aug-2012	<0.0001	<0.0001	<0.00005	0.014	<0.0002	<0.0001	0.0003	<0.0001	0.0001	<0.0005	<0.01	0.01
LA-7	29-Mar-2014	<0.0001	<0.0001	<0.00005	0.019	<0.0002	0.0009	0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LA-7	10-Sep-2016	<0.0001	<0.0001	<0.00005	0.014	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LA-7A	12-Sep-2016	<0.0001	<0.0001	<0.00005	0.014	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LA-7A-bottom	12-Sep-2016	<0.0001	0.0002	<0.00005	0.018	<0.0002	<0.0001	<0.0002	<0.0001	0.0003	0.0014	0.11	0.10
LA-8	14-Sep-2016	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LA-9	16-Sep-2016	0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LAB-1	10-Aug-2012	0.0001	<0.0001	<0.00005	0.018	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LAB-1	31-Mar-2014	<0.0001	<0.0001	<0.00005	0.017	<0.0002	0.001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LAB-1	15-Sep-2016	0.0001	<0.0001	<0.00005	0.017	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LAB-2	21-Sep-2016	0.0003	<0.0001	<0.00005	0.016	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LB-1	13-Sep-2016	0.0001	<0.0001	<0.00005	0.013	<0.0002	<0.0001	<0.0002	<0.0001	0.0001	<0.0005	<0.01	<0.01
LB-2	01-Apr-2014	0.0002	<0.0001	<0.00005	0.016	<0.0002	0.0008	<0.0002	<0.0001	<0.0001	0.0018	<0.01	<0.01
LB-2	13-Sep-2016	0.0001	<0.0001	<0.00005	0.013	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	0.03
LB-3-Top	11-Aug-2012	<0.0001	<0.0001	<0.00005	0.013	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	0.0031	<0.01	<0.01
LB-3-Top	01-Apr-2014	<0.0001	<0.0001	<0.00005	0.015	<0.0002	0.0016	<0.0002	<0.0001	<0.0001	0.002	<0.01	<0.01
LB-3-Top	10-Sep-2016	<0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
LB-3-bottom	10-Sep-2016	0.0003	0.0001	<0.00005	0.016	<0.0002	<0.0001	<0.0002	<0.0001	0.0005	0.0029	0.17	0.15
PA-2	20-Sep-2016	0.0002	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	0.0001	<0.0005	<0.01	<0.01
PA-3	19-Sep-2016	0.0002	<0.0001	<0.00005	0.010	<0.0002	<0.0001	0.0003	<0.0001	<0.0001	0.0006	<0.01	<0.01
SA-1	05-Jun-2011	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-1	08-May-2012	<0.0001	<0.0001	<0.00005	0.014	<0.0002	<0.0001	<0.0002	<0.0002	<0.0001	0.0028	<0.01	<0.01
SA-1	07-Aug-2012	<0.0001	<0.0001	<0.00005	0.013	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	0.0006	<0.01	<0.01
SA-1	24-Oct-2012	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-1	22-May-2013	<0.0001	<0.0001	<0.00005	0.013	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-1	15-Aug-2013	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-1	18-Oct-2013	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-1	30-Mar-2014	<0.0001	<0.0001	<0.00005	0.015	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-1	05-Jul-2019	<0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0017	<0.01	<0.01
SA-1	30-Aug-2019	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-2	06-Jun-2011	<0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-2	08-May-2012	0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	0.0015	0.0015	0.0001	**0.0096**	<0.01	<0.01
SA-2	08-Aug-2012	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	0.0008	<0.01	<0.01
SA-2	24-Oct-2012	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-2	22-May-2013	<0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	0.0003	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-2	15-Aug-2013	<0.0001	<0.0001	<0.00005	0.013	<0.0002	<0.0001	<0.0002	<0.0001	0.0001	<0.0005	<0.01	<0.01
SA-2	18-Oct-2013	<0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-2	29-Mar-2014	<0.0001	<0.0001	<0.00005	0.015	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-2	05-Jul-2019	<0.0001	<0.0001	<0.00005	0.01	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.002	<0.01	<0.01
SA-2	30-Aug-2019	<0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0009	<0.01	<0.01
SA-3	05-Jun-2011	<0.0001	<0.0001	<0.00005	0.013	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-3	08-May-2012	<0.0001	<0.0001	<0.00005	0.015	<0.0002	<0.0001	<0.0002	<0.0002	<0.0001	<0.0005	<0.01	<0.01
SA-3	07-Aug-2012	<0.0001	<0.0001	<0.00005	0.014	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-3	24-Oct-2012	<0.0001	<0.0001	<0.00005	0.014	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	0.0008	<0.01	<0.01
SA-3	22-May-2013	<0.0001	<0.0001	<0.00005	0.015	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-3	15-Aug-2013	<0.0001	<0.0001	<0.00005	0.014	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-3	18-Oct-2013	<0.0001	<0.0001	<0.00005	0.015	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-3	31-Mar-2014	<0.0001	<0.0001	<0.00005	0.018	<0.0002	<0.0001	0.0002	<0.0001	<0.0001	0.0011	<0.01	<0.01
SA-3	05-Jul-2019	<0.0001	<0.0001	<0.00005	0.013	<0.0002	<0.0001	0.0002	<0.0001	<0.0001	0.0021	<0.01	<0.01
SA-3	30-Aug-2019	<0.0002	<0.0001	<0.00005	0.014	<0.0002	<0.0009	<0.0002	<0.0001	<0.0001	0.0008	<0.01	<0.01
SA-4	05-Jun-2011	<0.0001	<0.0001	<0.00005	0.012	<0.0002	0.0002	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-4	08-May-2012	<0.0001	<0.0001	<0.00005	0.015	<0.0002	<0.0001	<0.0002	<0.0002	<0.0001	0.0005	<0.01	<0.01
SA-4	07-Aug-2012	<0.0001	<0.0001	<0.00005	0.013	<0.0002	<0.0001	<0.0002	<0.0001	0.0001	0.0012	<0.01	<0.01
SA-4	24-Oct-2012	<0.0001	<0.0001	<0.00005	0.013	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-4	22-May-2013	<0.0001	<0.0001	<0.00005	0.014	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-4	15-Aug-2013	<0.0001	<0.0001	<0.00005	0.014	<0.0002	<0.0001	<0.0002	<0.0001	0.0001	<0.0005	<0.01	<0.01
SA-4	18-Oct-2013	<0.0001	<0.0001	<0.00005	0.014	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-4	30-Mar-2014	<0.0001	<0.0001	<0.00005	0.018	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	0.0006	<0.01	<0.01
SA-4	04-Jul-2019	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	0.0015	<0.01	<0.01
SA-4	29-Aug-2019	<0.0001	<0.0001	<0.00005	0.013	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	0.0005	<0.01	<0.01
SA-5	05-Jun-2011	<0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	0.0015	<0.01	<0.01
SA-5	08-May-2012	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0002	<0.0001	<0.0005	<0.01	<0.01
SA-5	07-Aug-2012	<0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-5	24-Oct-2012	<0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-5	22-May-2013	<0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-5	15-Aug-2013	<0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-5	18-Oct-2013	<0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-5	30-Mar-2014	<0.0001	<0.0001	<0.00005	0.013	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-5	04-Jul-2019	<0.0001	<0.0001	<0.00005	0.0097	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0024	<0.01	<0.01
SA-5	29-Aug-2019	<0.0001	<0.0001	<0.00005	0.01	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-6	08-May-2012	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	0.0003	0.0003	<0.0001	<0.0005	<0.01	<0.01
SA-6	07-Aug-2012	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	0.0001	0.0005	<0.01	<0.01
SA-6	24-Oct-2012	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	0.0003	<0.0001	<0.0001	0.0006	<0.01	<0.01
SA-6	22-May-2013	<0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-6	15-Aug-2013	0.0001	<0.0001	<0.00005	0.013	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-6	18-Oct-2013	<0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-6	01-Apr-2014	<0.0001	<0.0001	<0.00005	0.016	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SA-6	04-Jul-2019	<0.0001	<0.0001	<0.00005	0.01	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0016	<0.01	<0.01
SA-6	29-Aug-2019	<0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
RC-1	06-Jul-2019	<0.0001	<0.0001	<0.00005	0.013	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0029	<0.01	<0.01
RC-1	01-Sep-2019	<0.0001	<0.0001	<0.00005	0.014	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SB-1	09-Jun-2011	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SB-1	09-May-2012	0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	0.0004	0.0004	0.0001	<0.0005	<0.01	<0.01
SB-1	07-Aug-2012	0.0001	<0.0001	<0.00005	0.013	<0.0002	<0.0001	0.0003	<0.0001	0.0001	0.0007	<0.01	<0.01
SB-1	25-Oct-2012	0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	0.001	<0.0001	0.0002	<0.0005	<0.01	<0.01
SB-1	22-May-2013	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	0.0002	<0.0001	0.0001	<0.0005	<0.01	<0.01
SB-1	15-Aug-2013	0.0002	<0.0001	<0.00005	0.016	<0.0002	<0.0001	0.0004	<0.0001	0.0001	<0.0005	<0.01	<0.01
SB-1	19-Oct-2013	0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	0.0003	<0.0001	0.0001	<0.0005	<0.01	<0.01
SB-1	31-Mar-2014	0.0006	<0.0001	<0.00005	0.021	<0.0002	0.0007	0.0003	<0.0001	0.0001	0.0005	<0.01	<0.01
SB-2	09-Jun-2011	0.0003	<0.0001	<0.00005	0.016	<0.0002	<0.0001	0.001	<0.0001	0.0003	0.001	<0.01	<0.01
SB-2	09-May-2012	0.0002	<0.0001	<0.00005	0.012	<0.0002	<0.0001	0.0018	0.0018	0.0002	0.0032	0.01	<0.01
SB-2	07-Aug-2012	0.0003	<0.0001	<0.00005	0.015	<0.0002	<0.0001	0.0009	<0.0001	0.0002	0.0006	0.01	<0.01
SB-2	25-Oct-2012	0.0002	<0.0001	<0.00005	0.010	<0.0002	<0.0001	0.0003	<0.0001	0.0001	<0.0005	<0.01	<0.01
SB-2	22-May-2013	0.0001	<0.0001	<0.00005	0.014	<0.0002	<0.0001	0.0006	<0.0001	0.0002	<0.0005	<0.01	<0.01
SB-2	15-Aug-2013	0.0003	<0.0001	<0.00005	0.019	<0.0002	<0.0001	0.0005	<0.0001	0.0002	<0.0005	0.01	<0.01
SB-2	19-Oct-2013	0.0002	<0.0001	<0.00005	0.01	<0.0002	<0.0001	0.0006	<0.0001	0.0001	<0.0005	<0.01	<0.01
SB-3	05-Jun-2011	0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SB-3	09-May-2012	0.0001	<0.0001	<0.00005	0.013	<0.0002	<0.0001	<0.0002	<0.0002	<0.0001	<0.0005	<0.01	<0.01
SB-3	08-Aug-2012	0.0001	<0.0001	<0.00005	0.013	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	0.0012	<0.01	<0.01
SB-3	25-Oct-2012	0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SB-3	22-May-2013	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SB-3	15-Aug-2013	0.0001	<0.0001	<0.00005	0.013	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SB-3	18-Oct-2013	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SB-3	31-Mar-2014	0.0002	<0.0001	<0.00005	0.015	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	0.0006	<0.01	<0.01
SB-4	05-Jun-2011	0.0002	<0.0001	<0.00005	0.014	<0.0002	<0.0001	0.0006	<0.0001	0.0002	0.0042	<0.01	0.01
SB-4	08-May-2012	0.0002	<0.0001	<0.00005	0.012	<0.0002	<0.0001	0.0004	0.0004	0.0002	<0.0005	<0.01	<0.01
SB-4	07-Aug-2012	0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	0.0003	<0.0001	0.0001	0.0007	<0.01	<0.01
SB-4	24-Oct-2012	<0.0001	<0.0001	<0.00005	0.0089	<0.0002	<0.0001	0.0003	<0.0001	0.0001	<0.0005	<0.01	<0.01
SB-4	22-May-2013	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	0.0005	<0.0001	0.0002	<0.0005	<0.01	<0.01
SB-4	15-Aug-2013	0.0003	<0.0001	<0.00005	0.013	<0.0002	<0.0001	0.0004	<0.0001	0.0002	<0.0005	0.01	<0.01
SB-4	18-Oct-2013	0.0001	<0.0001	<0.00005	0.010	<0.0002	<0.0001	<0.0002	<0.0001	0.0001	<0.0005	<0.01	<0.01
SB-5	09-May-2012	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0002	<0.0001	<0.0005	<0.01	<0.01
SB-5	07-Aug-2012	<0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	0.0016	<0.01	<0.01
SB-5	25-Oct-2012	<0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SB-5	22-May-2013	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SB-5	15-Aug-2013	<0.0001	<0.0001	<0.00005	0.011	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01
SB-5	18-Oct-2013	<0.0001	<0.0001	<0.00005	0.012	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	0.0006	<0.01	<0.01
SB-5	31-Mar-2014	<0.0001	<0.0001	<0.00005	0.015	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0005	<0.01	<0.01

Note:
Coloured cell with bold value indicates that the value is greater that the water quality benchmark value

Station	Sampling Date	Sample ID	Depth	Temperature	Dissolved Oxygen	Dissolved Oxygen	pH	Specific Conductivity	Conductivity
Unit			m	°C	%	mg/L	-	µS/cm	µS/cm
LA-1 13 V 478856 6371913	14-Sep-16	LA-1-0.25	0.25	11.73	92.3	9.97	7.56	18	13
		LA-1-1	1	11.722	90.7	9.84	7.46	18	13
		LA-1-2	2	11.71	90.6	9.82	7.33	18	13
		LA-1-3	3	11.71	90.8	9.85	7.19	18	13
		LA-1-4	4	11.71	90.8	9.84	7.16	18	13
		LA-1-5	5	11.7	90.5	9.81	7.1	18	13
		LA-1-6	6	11.7	90.3	9.8	7.04	18	13
		LA-1-7	7	11.71	90.2	9.79	7.01	18	13
		LA-1-7.8	7.8	11.7	89.9	9.75	6.97	18	13
	16-Mar-18	LA-1-0.7	0.7	0.08	81.8	12.43	6.78	25	13
		LA-1-1.7	1.7	0.91	79.7	11.37	6.58	25	13
		LA-1-2.7	2.7	1.04	79.5	11.28	6.6	26	14
		LA-1-3.7	3.7	1.45	76	10.81	6.58	26	14
		LA-1-4.7	4.7	2.23	67.6	9.31	6.74	27	15
		LA-1-5.7	5.7	3.12	41.4	5.69	6.65	28	18
		LA-1-6.7	6.7	3.94	6.5	0.85	6.83	34	20
		LA-1-7.7	7.7	4.72	1.8	0.23	6.75	38	23
		LA-1-8.6	8.6	4.86	3.1	0.36	6.58	30	19
	02-Jul-18	LA-1-0	0	18.6	98.9	9.24	7.22	17	15
		LA-1-0.5	0.5	18.62	98.8	9.22	7.24	17	15
		LA-1-1	1	18.61	98.7	9.21	7.26	17	15
		LA-1-2	2	18.56	98.6	9.22	7.22	17	15
		LA-1-3	3	18.58	98.3	9.19	7.2	17	15
		LA-1-4	4	18.22	96.7	9.1	7.22	17	15
		LA-1-5	5	17.31	93	8.92	7.13	17	15
		LA-1-6	6	15.35	92.1	9.08	7.08	18	14
		LA-1-7	7	13.6	58	5.97	6.75	19	15
		LA-1-7.5	7.5	12.73	28.4	2.91	6.51	20	16
		LA-1-8.5	8.5	11.7	3	0.3			
		LA-1-9.5	9.5	11.1	0.4	0.04			
LA-2 13 V 479354 6374020	21-Sep-16	LA-2-0.15	0.15	11.35	97.6	10.64	6.67	20	15
		LA-2-1	1	11.38	94.5	10.32	6.65	20	15
		LA-2-2	2	11.38	93.3	10.19	6.32	20	15
		LA-2-3	3	11.36	92.4	10.1	6.28	20	15
		LA-2-4	4	11.33	91.7	10.02	6.23	20	15
		LA-2-5	5	11.28	91	9.97	6.22	20	15
LA-3 13 V 480889 6374208	21-Sep-16	LA-3-0.15	0.15	11.72	96.2	10.43	6.6	20	15
		LA-3-1	1	11.75	92.5	10.01	6.61	20	15
		LA-3-2	2	11.75	91.6	9.92	6.52	20	15
		LA-3-3	3	11.73	90.7	9.84	6.37	20	15
		LA-3-4	4	11.7	90.2	9.78	6.3	20	15
		LA-3-5	5	11.67	89.4	9.7	6.28	20	15
		LA-3-6	6	11.65	88.7	9.63	6.26	20	15
		LA-3-7	7	11.65	88.5	9.6	6.22	20	15
		LA-3-8	8	11.65	88.2	9.58	6.2	20	15
		LA-3-9	9	11.64	88	9.55	6.19	20	15
		LA-3-10	10	11.6	88	9.54	6.28	20	15
		LA-3-11	11	11.49	86.5	9.42	6.23	20	15
		LA-3-12	12	11.38	85.4	9.32	6.18	20	15

Station	Sampling Date	Sample ID	Depth	Temperature	Dissolved Oxygen	Dissolved Oxygen	pH	Specific Conductivity	Conductivity
Unit			m	°C	%	mg/L	-	µS/cm	µS/cm
LA-4 13 V 480889 6376599	21-Sep-16	LA-4-0.3	0.3	12.15	88	9.42	6.83	22	17
		LA-4-1	1	12.25	87.4	9.36	6.55	22	17
		LA-4-2	2	12.27	86.9	9.31	6.48	22	17
		LA-4-3	3	12.29	86.6	9.27	6.4	22	17
		LA-4-4	4	12.29	86.4	9.26	6.34	22	17
		LA-4-5	5	12.29	86.6	9.26	6.25	22	17
		LA-4-6	6	12.29	85.9	9.19	6.32	22	17
		LA-4-7	7	12.29	85.6	9.17	6.3	22	17
		LA-4-8	8	12.29	85.6	9.17	6.21	22	17
		LA-4-9	9	12.29	85.6	9.16	6.2	22	17
		LA-4-10	10	12.28	85.2	9.13	6.22	22	17
		LA-4-11	11	12.28	85.1	9.11	6.19	22	17
		LA-4-12	12	12.26	84.8	9.08	6.2	22	17
		LA-4-13	13	11.8	66.8	7.03	5.98	23	17
LA-5 13 V 477925 6374453	10-Sep-16	LA-5-0.25	0	12	85	9	9	18	13
		LA-5-1	1	12	85	9	9	18	13
		LA-5-2	2	12	84	9	9	18	13
		LA-5-2.5	3	12	48	5	7	19	14
LA-6 13 V 478048 6375335	13-Sep-16	LA-6-0.25	0.25	8.61	92.7	10.78	6.85	17	12
		LA-6-1	1	8.51	89.8	10.5	6.82	17	12
		LA-6-2	2	9.47	26.7	2.83	6.53	24	17
	17-Mar-18	LA-6-0.7	0.7	0.26	76.9	11.09	6.94	17	9
		LA-6-1.7	1.7	1.8	5.81	0.78	6.89	32	18
	02-Jul-18	LA-6-0	0	17.8	97.2	9.22	7.2	14	18
		LA-6-0.5	0.5	17.99	97.5	9.23	6.91	15	17
		LA-6-1	1	17.71	96	9.13	6.98	14	17
		LA-6-1.5	1.5	17.71	95.9	9.14	6.83	14	17
		LA-6-1.8	1.8	17.5	2.1	0.19	6.35	21	24
		LA-6-2	2						
LA-7 13 V 473200 6375598	10-Sep-16	LA-7-0	0	12.82	88	9.31	6.7	19	15
		LA-7-1	1	12.83	87.4	9.24	6.15	19	15
		LA-7-2	2	12.83	87	9.19	6.18	19	15
		LA-7-3	3	12.82	80.6	9.15	6	19	15
		LA-7-4	4	12.82	86.4	9.15	5.89	19	15
		LA-7-5	5	12.83	82.1	8.79	6.3	20	15
		LA-7-6	6	12.91	49	4.8	5.95	25	19
	18-Mar-18	LA-7-0.7	0.7	0.77	79.3	11.3	6.16	23	12
		LA-7-1.7	1.7	3.48	27.5	3.67	6.04	25	15
		LA-7-2.7	2.7	4.36	3.2	0.42	6.07	25	15
		LA-7-3.7	3.7	4.52	1.1	0.15	6	26	16
		LA-7-4.2	4.2						
LA-7A 13 V 472632 6376868	12-Sep-16	LA-7A-0	0	12.5	80.2	8.54	7.03	20	15
		LA-7A-1	1	12.55	79.1	8.42	6.99	20	15
		LA-7A-2	2	12.56	78.8	8.38	6.61	20	15
		LA-7A-3	3	12.56	78.6	8.36	6.57	20	15
		LA-7A-4	4	12.56	78.4	8.34	6.5	20	15
		LA-7A-5	5	12.51	78.1	8.32	6.47	20	15
		LA-7A-6	6	12.5	77.7	8.23	6.42	20	15
		LA-7A-7	7	12.49	77.1	8.21	6.33	20	15
		LA-7A-8	8	12.49	76.6	8.16	6.23	20	15
		LA-7A-9	9	12.47	76.3	8.13	6.21	20	15
		LA-7A-10	10	12.41	75.4	8.05	6.19	20	15
		LA-7A-11	11	10.11	42.2	4.57	6.14	21	15
		LA-7A-12	12	8.15	25.8	3.05	5.75	24	16
		LA-7A-13	13	7.23	12.1	1.41	5.78	37	24
		LA-7A-14	14	6.84	9.1	1.11	5.67	42	27
		LA-7A-15	15	6.67	7.3	0.9	5.59	45	29
		LA-7A-16	16	6.56	6.8	0.83	5.56	50	32
		LA-7A-17	17	6.42	6.2	0.77	5.42	87	56
		LA-7A-17.7	17.7	6.43	5.6	0.69	5.44	82	53

Table A-2
Baseline Water Profile Data

Station	Sampling Date	Sample ID	Depth	Temperature	Dissolved Oxygen	Dissolved Oxygen	pH	Specific Conductivity	Conductivity
Unit			m	°C	%	mg/L	-	µS/cm	µS/cm
LA-8 13 V 475261 6378486	14-Sep-16	LA-8-0	0	11.74	89.3	9.65	6.72	16	12
		LA-8-1	1	11.54	87.4	9.52	6.43	16	12
		LA-8-2	2	11.38	86.9	9.5	6.29	16	12
		LA-8-3	3	11.31	86	9.42	6.17	16	12
		LA-8-4	4	11.29	85.6	9.38	6.13	16	12
		LA-8-5	5	11.2	84.8	9.29	6.11	16	12
		LA-8-6	6	11.18	83.8	9.21	6.12	16	12
		LA-8-7	7	11.18	77.8	8.38	6.28	18	13
LA-9 13 V 479328 6379952	16-Sep-16	LA-9-0	0	12.33	87	9.31	0.97	16	12
		LA-9-1	1	12.17	84.2	9.04	6.63	16	12
		LA-9-2	2	12.07	83.4	8.96	6.54	16	12
		LA-9-3	3	11.89	81.2	8.77	6.48	16	12
		LA-9-4	4	11.86	80.5	8.71	6.46	16	12
		LA-9-5	5	11.82	80.1	8.67	6.43	16	12
		LA-9-6	6	11.71	78.7	8.54	6.4	16	12
		LA-9-7	7	11.66	77.1	8.37	6.39	16	12
		LA-9-8	8	11.63	76.4	8.31	6.35	16	12
		LA-9-9	9	11.62	75.5	8.21	6.332	16	12
		LA-9-10	10	11.62	74	8.05	6.33	16	12
LAB-1 13 V 478549 6367476	15-Sep-16	LAB-1-0.25	0.25	12.6	91	9.67	7.02	39	30
		LAB-1-1	1	12.61	90.4	7.01	7.01	39	30
		LAB-1-2	2	12.59	90	9.57	6.98	39	30
		LAB-1-3	3	12.59	89.8	9.55	7.02	39	30
		LAB-1-4	4	12.57	89.5	9.51	7.01	30	30
		LAB-1-5	5	12.57	89.3	9.51	7.03	39	30
		LAB-1-6	6	12.55	88.9	9.46	7.04	39	30
		LAB-1-7	7	12.54	88.7	9.44	7.05	39	30
		LAB-1-8	8	12.54	88.5	9.42	7.04	39	30
		LAB-1-9	9	12.52	88.5	9.42	7.04	39	30
		LAB-1-10	10	12.49	88.3	9.41	7.05	39	30
		LAB-1-11	11	12.44	87.9	9.38	7.05	39	29
		LAB-1-12	12	12.4	87.7	9.37	7.03	38	29
		LAB-1-13	13	12.4	88	9.39	7.05	38	29
		LAB-1-14	14	12.39	87.8	9.38	6.94	38	29
		LAB-1-15	15	12.23	45.6	4.59	6.88	37	28
LAB-2 13 V 476445 6364956	21-Sep-16	LAB-2-0	0	12.24	88.4	9.47	6.9	40	30
		LAB-2-1	1	12.23	88.2	9.46	6.94	39	29
		LAB-2-2	2	12.21	87.8	9.41	6.94	39	29
		LAB-2-3	3	12.17	87.4	9.38	6.94	39	29
		LAB-2-4	4	12.17	87.1	9.35	6.96	39	29
		LAB-2-5	5	12.14	86.9	9.34	6.94	39	29
		LAB-2-6	6	12.13	86.7	9.32	6.97	39	29
		LAB-2-7	7	12.13	86.5	9.3	6.95	39	29
		LAB-2-8	8	12.13	86.7	9.32	6.94	39	29
		LAB-2-9	9	12.12	86.7	9.32	6.94	39	29
		LAB-2-10	10	12.12	86.7	9.32	6.95	39	29
		LAB-2-11	11	12.11	86.7	9.32	6.94	39	29
		LAB-2-12	12	12.05	86.6	9.31	6.95	39	29
		LAB-2-13	13	12.01	85.8	9.24	6.95	39	29
		LAB-2-14	14	11.95	85.5	9.23	6.95	39	29
		LAB-2-15	15	11.8	84.3	9.13	6.97	39	29
		LAB-2-15.5	15.5	11.78	80.6	8.73	6.9	38	28
LB-1 13 V 476447 6369460	13-Sep-16	LB-1-0.25	0	9	88	10	8	17	12
		LB-1-1	1	9	85	10	8	17	12
		LB-1-2	2	9	84	10	7	17	12

Station	Sampling Date	Sample ID	Depth	Temperature	Dissolved Oxygen	Dissolved Oxygen	pH	Specific Conductivity	Conductivity
Unit			m	°C	%	mg/L	-	µS/cm	µS/cm
LB-2 13 V 474928 6371569	13-Sep-16	LB-2-0.25	0	11	86	9	7	17	13
		LB-2-1	1	10.86	83.7	9.26	7.09	17	13
		LB-2-2	2	10.85	83.3	9.22	7.09	17	13
		LB-2-3	3	10.85	83.3	9.22	7.05	17	13
		LB-2-4	4	10.84	83.3	9.22	7.03	17	13
		LB-2-5	5	10.79	82.5	9.14	6.99	17	13
		LB-2-6	6	10.76	48.7	4.99	6.78	19	14
LB-3 13 V 473922 6373609	09-Sep-16	LB-3-0	0	14.23	87.5	8.97	6.8	18	14
		LB-3-1	1	14.24	87.3	8.96	6.81	18	14
		LB-3-2	2	14.23	87.1	8.94	6.8	18	14
		LB-3-3	3	14.23	86.9	8.92	6.8	18	14
		LB-3-4	4	14.23	86.6	8.89	6.79	18	14
		LB-3-5	5	14.22	86.3	8.88	6.79	18	14
		LB-3-6	6	14.18	85.3	8.78	6.78	18	14
		LB-3-7	7	14.16	85	8.73	6.76	18	14
		LB-3-8	8	14.11	84.4	8.68	6.75	18	14
		LB-3-9	9	14.11	84.1	8.65	6.76	18	14
		LB-3-10	10	13.88	77.7	8.01	6.73	18	14
		LB-3-11	11	10.87	9	1.08	6.66	25	18
		LB-3-12	12	7.74	9	1.08	6.5	49	33
		LB-3-13	13	7.54	9	1.08	6.5	53	35
		LB-3-14	14	7.37	9	1.08	6.5	58	38
		LB-3-15	15	7.32	9	1.08	6.46	62	41
		LB-3-16	16	7.28	9	1.08	6.4	78	52
		LB-3-17	17	7.26	9	1.08	6.36	77	51
PA-2 13 V 477064 6377074	19-Sep-16	PA-2-0	0	11.74	86.1	9.31	6.84	18	9
		PA-2-2	2	11.69	81	8.79	6.39	19	11
PA-3 13 V 476338 6377666	20-Sep-16	PA-3-0	0	10.91	83.4	9.22	6.56	16	8
		PA-3-3.1	3.1	10.63	78.3	8.71	6.06	16	9

Table A-3
Baseline Sediment Grainsize Analysis

Location		Percent Passing (%)					Soil Classification (%)			
		0.04 µm	4 µm	63 µm	200 µm	2000 µm	Gravel	Sand	Silt	Clay
Baseline	Count	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**
Lake Sediment	Min	**1.8**	**11**	**15**	**99**	**99**	**0.0**	**0.1**	**13**	**10**
Grain Size	Mean	**7.8**	**64**	**85**	**100**	**100**	**0.0**	**14**	**30**	**56**
Statistics	75th	**12**	**89**	**99**	**100**	**100**	**0**	**21**	**41**	**78**
	95th	**14**	**94**	**100**	**100**	**100**	**0**	**74**	**52**	**82**
	Max	**14**	**94**	**100**	**100**	**100**	**0**	**77**	**55**	**82**
	Geomean	**6.3**	**56**	**79**	**100**	**100**	**na**	**3.5**	**28**	**49**
	SD	**4.4**	**28**	**22**	**0.1**	**0.1**	**0.0**	**20**	**12**	**24**
Location	Date									
LA-1-1 (0-2)	14-Sep-2016	13.2	94.4	99.9	100.0	100.0	0.0	0.1	17.7	82.2
LA-1-2 (0-2)	14-Sep-2016	11.7	91.1	99.7	100.0	100.0	0.0	0.3	20.6	79.1
LA-1-3 (0-2)	17-Sep-2016	13.5	89.7	99.8	100.0	100.0	0.0	0.2	21.6	78.2
LA-5-1 (0-2)	09-Sep-2016	10.6	87.9	97.8	100.1	100.1	0.0	2.1	21.7	76.3
LA-5-2 (0-2)	11-Sep-2016	1.8	13.8	20.5	100.0	100.0	0.0	72.5	15.4	12.0
LA-5-3 (0-2)	11-Sep-2016	12.0	88.0	97.3	99.4	99.4	0.0	1.9	20.9	76.6
LA-5-4 (0-2)	10-Sep-2016	13.4	94.2	99.8	100.0	100.0	0.0	0.1	17.8	82.0
LA-5-5 (0-2)	10-Sep-2016	2.7	11.3	15.4	100.0	100.0	0.0	77.2	12.8	10.0
LA-6-1 (0-2)	12-Sep-2016	12.2	90.6	99.5	100.0	100.0	0.0	0.4	20.8	78.8
LA-6-2 (0-2)	12-Sep-2016	6.1	53.3	86.8	100.0	100.0	0.0	12.0	41.8	46.2
LA-6-3 (0-2)	16-Sep-2016	14.0	84.4	98.0	100.0	100.0	0.0	1.8	24.4	73.8
LA-6-4 (0-2)	16-Sep-2016	13.9	89.2	99.3	100.1	100.1	0.0	0.7	21.5	77.9
LA-6-5 (0-2)	18-Sep-2016	10.5	73.6	94.3	100.0	100.0	0.0	5.2	30.7	64.1
LA-7A-1 (0-2)	13-Sep-2016	3.7	49.3	84.8	100.0	100.0	0.0	13.9	43.7	42.4
LA-7A-2 (0-2)	13-Sep-2016	4.2	46.5	86.6	100.0	100.0	0.0	12.2	47.6	40.2
LA-7A-3 (0-2)	13-Sep-2016	3.4	43.2	79.8	100.0	100.0	0.0	18.4	44.4	37.2
LA-7-1 (0-2)	13-Sep-2016	6.8	78.7	89.7	100.0	100.0	0.0	9.4	22.7	67.9
LA-7-2 (0-2)	13-Sep-2016	4.8	66.7	92.2	100.0	100.0	0.0	7.1	35.5	57.3
LA-7-3 (0-2)	13-Sep-2016	2.3	25.5	46.8	100.0	100.0	0.0	48.5	29.5	22.0
LA-8-1 (0-2)	16-Sep-2016	7.2	85.2	99.4	100.0	100.0	0.0	0.6	26.0	73.4
LA-8-2 (0-2)	15-Sep-2016	2.2	23.0	55.7	100.0	100.0	0.0	40.4	39.7	19.8
LA-8-3 (0-2)	15-Sep-2016	2.9	32.6	63.5	100.0	100.0	0.0	33.3	38.6	28.1
LA-9-1 (0-2)	18-Sep-2016	1.9	26.3	73.2	100.0	100.0	0.0	24.5	50.8	24.7
LA-9-2 (0-2)	18-Sep-2016	2.9	32.9	73.5	100.1	100.1	0.0	24.3	47.4	28.3
LA-9-3 (0-2)	18-Sep-2016	10.7	89.1	98.5	99.9	99.9	0.0	1.3	21.3	77.3
LB-3-1 (0-2)	09-Sep-2016	9.4	89.6	99.7	100.0	100.0	0.0	0.3	22.1	77.6
LB-3-2 (0-2)	10-Sep-2016	4.8	42.3	76.0	100.1	100.1	0.0	22.0	41.5	36.6
LB-3-3 (0-2)	10-Sep-2016	2.7	35.5	84.4	100.0	100.0	0.0	14.2	55.2	30.5
LAB-1-1 (0-2)	19-Sep-2016	12.0	80.7	96.9	100.0	100.0	0.0	2.8	26.8	70.4
LAB-1-2 (0-2)	15-Sep-2016	10.8	84.5	99.4	99.9	99.9	0.0	0.5	26.0	73.4
LAB-1-3 (0-2)	15-Sep-2016	10.9	89.6	99.7	100.0	100.0	0.0	0.3	22.0	77.8
LAB-2-CORE (0-2)	21-Sep-2016	9.0	68.0	96.7	100.1	100.1	0.0	3.1	37.9	59.1

Notes:
Analysis by Beckman Coulter LS Particle Size Analyser
Results on sediment fraction passing 2,000 µm seive

Table A-4
Baseline Sediment Quality Data

Parameter		Moisture	Total Organic Carbon	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium
Unit		%	%	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Sediment Quality Benchmarks	**REF/ISQG/LEL**					21				0.6	
	NE2/PEL/SEL					522				3.5	
	Reference					REF and NE2				ISQG and PEL	
Baseline Lake Sediment Quality Statistics	**Count**	32	32	32	32	32	32	32	32	32	32
	#DL	0	0	0	15	0	0	3	3	1	0
	Min	29	0.44	1860	<0.2	0.60	20	<0.1	<1	<0.1	1.0
	Mean	89	16	4689	0.23	3.7	42	0.26	5.8	0.39	9.2
	75th	96	19	5275	0.30	4.9	45	0.30	7.0	0.48	11
	95th	97	26	9235	0.34	6.7	81	0.50	11	0.60	18
	Max	97	26	9300	0.40	7.2	100	0.50	12	0.60	21
	Geomean	87	12	4360	0.23	3.3	40	0.24	4.9	0.38	7.8
	SD	17	6.8	1817	0.054	1.5	15	0.10	2.8	0.10	4.3
Location	**Sample Date**										
LA-1-1	14-Sep-2016	97	17	4740	0.3	5.7	42	0.3	8.0	0.5	16
LA-1-2	14-Sep-2016	97	17	4440	0.2	5.0	34	0.3	8.0	0.4	9
LA-1-3	17-Sep-2016	97	13	4010	0.2	5.3	30	0.2	5.0	0.3	7
LA-5-1	09-Sep-2016	96	19	5300	<0.2	4.4	49	0.3	6.0	0.4	11
LA-5-2	11-Sep-2016	29	0.4	1990	<0.2	0.6	33	<0.1	<1.0	<0.1	4
LA-5-3	11-Sep-2016	94	16	4860	<0.2	3.9	42	0.3	3.0	0.3	10
LA-5-4	10-Sep-2016	97	18	5800	<0.2	3.1	45	0.3	4.0	0.3	11
LA-5-5	10-Sep-2016	34	0.6	2450	<0.2	1.2	45	<0.1	<1.0	0.4	1
LA-6-1	12-Sep-2016	97	19	5200	<0.2	3.3	45	0.3	6.0	0.4	10
LA-6-2	12-Sep-2016	96	19	4670	<0.2	3.1	43	0.3	6.0	0.4	8
LA-6-3	16-Sep-2016	96	17	5900	<0.2	4.2	42	0.3	7.0	0.5	10
LA-6-4	16-Sep-2016	96	16	4620	<0.2	3.8	37	0.3	6.0	0.4	8
LA-6-5	18-Sep-2016	96	17	3820	<0.2	3.4	56	0.3	4.0	0.4	8
LA-7A-1	13-Sep-2016	95	24	4190	0.2	3.3	38	0.2	6.0	0.4	10
LA-7A-2	13-Sep-2016	94	19	4530	0.3	5.0	33	0.2	6.0	0.4	10
LA-7A-3	13-Sep-2016	95	23	3660	0.2	3.4	33	0.2	5.0	0.4	7
LA-7-1	13-Sep-2016	97	26	3340	0.2	3.6	43	0.2	7.0	0.3	21
LA-7-2	13-Sep-2016	95	26	3830	0.2	3.5	36	0.2	6.0	0.4	7
LA-7-3	13-Sep-2016	96	26	3860	0.3	3.6	36	0.2	6.0	0.4	7
LA-8-1	16-Sep-2016	97	24	4470	0.3	3.6	39	0.3	8.0	0.4	8
LA-8-2	15-Sep-2016	88	8	1950	<0.2	1.5	20	0.1	3.0	0.3	2
LA-8-3	15-Sep-2016	95	16	4310	0.2	3.5	30	0.3	4.0	0.4	7
LA-9-1	18-Sep-2016	66	2.6	1860	<0.2	0.9	20	<0.1	<1.0	0.2	1
LA-9-2	18-Sep-2016	94	17	4410	0.3	3.6	36	0.2	6.0	0.5	9
LA-9-3	18-Sep-2016	95	17	4250	0.3	3.8	33	0.3	6.0	0.4	9
LB-3-1	09-Sep-2016	94	20	7800	0.4	6.5	57	0.5	9.0	0.6	17
LB-3-2	10-Sep-2016	92	18	6300	0.3	5.0	46	0.4	6.0	0.5	12
LB-3-3	10-Sep-2016	68	3	2790	<0.2	1.5	27	0.1	<1.0	0.3	8
LAB-1-1	19-Sep-2016	94	13	4810	<0.2	2.6	45	0.3	7.0	0.3	8
LAB-1-2	15-Sep-2016	93	13	7400	0.2	4.6	60	0.3	11.0	0.5	12
LAB-1-3	15-Sep-2016	95	15	9200	0.3	5.6	71	0.4	11.0	0.5	15
LAB-2-CORE	21-Sep-2016	93	12	9300	<0.2	7.2	100	0.5	12.0	0.6	13

Table A-4
Baseline Sediment Quality Data

Parameter		Cobalt	Copper	Iron	Lead	Manganese	Molybdenum	Nickel	Selenium	Silver	Strontium
Unit		µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Sediment Quality Benchmarks	**REF/ISQG/LEL**		22		37		23	21	3.6		
	NE2/PEL/SEL		269		412		245	326	30		
	Reference		LEL and SEL		LEL and SEL		REF and NE2	REF and NE2	REF and NE2		
Baseline Lake Sediment Quality Statistics	**Count**	32	32	32	32	32	32	32	32	32	32
	#DL	3	4	0	0	0	2	1	2	49	0
	Min	<0.2	<0.5	1980	1.3	33	<0.1	<0.1	<0.1	<0.1	16
	Mean	1.7	2.9	14950	7.5	209	2.1	6.3	1.0	0.15	29
	75th	2.2	3.9	17150	9.5	230	1.3	7.9	1.3	0.20	33
	95th	3.8	7.1	53405	12	698	12	12	1.7	0.50	41
	Max	3.8	8.4	91300	13	1270	13	13	1.8	0.70	42
	Geomean	1.4	2.3	10899	6.7	162	0.90	4.9	0.83	0.13	28
	SD	0.90	1.8	15815	2.9	212	3.4	3.4	0.42	0.12	6.5
Location	**Sample Date**										
LA-1-1	14-Sep-2016	2.3	4.6	9900	10	170	2.0	12.0	1.3	0.2	25
LA-1-2	14-Sep-2016	2.2	3.5	12100	9	150	0.9	8.8	1.5	<0.1	24
LA-1-3	17-Sep-2016	1.6	2.7	7800	8	140	0.8	6.0	1.0	<0.1	21
LA-5-1	09-Sep-2016	2.3	2.0	23500	8	320	0.7	6.3	0.9	<0.1	26
LA-5-2	11-Sep-2016	0.2	<0.5	2050	1	33	0.1	1.8	<0.1	0.2	19
LA-5-3	11-Sep-2016	2.1	1.2	16400	7	240	0.6	5.7	0.7	<0.1	27
LA-5-4	10-Sep-2016	1.8	1.4	18500	7	210	0.5	6.0	0.7	<0.1	33
LA-5-5	10-Sep-2016	<0.2	<0.5	1980	2	46	<0.1	0.9	<0.1	0.7	24
LA-6-1	12-Sep-2016	2.1	2.1	15100	9	140	0.7	6.4	0.9	<0.1	28
LA-6-2	12-Sep-2016	1.7	3.0	13200	8	190	0.4	4.7	0.9	<0.1	34
LA-6-3	16-Sep-2016	1.7	1.6	14600	8	230	0.6	5.5	0.8	0.2	28
LA-6-4	16-Sep-2016	1.4	1.7	14000	8	180	0.4	4.2	0.8	<0.1	26
LA-6-5	18-Sep-2016	1.5	1.4	22600	7	390	0.4	4.7	0.8	<0.1	27
LA-7A-1	13-Sep-2016	1.2	3.5	7400	10	160	0.8	4.0	1.0	<0.1	36
LA-7A-2	13-Sep-2016	2.2	4.6	10000	9	120	1.3	6.2	1.3	<0.1	30
LA-7A-3	13-Sep-2016	1.4	3.4	6800	8	140	1.0	3.6	1.0	<0.1	32
LA-7-1	13-Sep-2016	1.9	3.6	8500	7	130	2.8	12.0	1.0	0.1	31
LA-7-2	13-Sep-2016	1.4	4.0	6900	8	120	1.3	3.9	1.2	<0.1	38
LA-7-3	13-Sep-2016	1.4	3.9	8000	8	120	1.2	4.6	1.2	<0.1	38
LA-8-1	16-Sep-2016	1.0	4.1	14500	10	230	1.2	6.7	1.2	0.2	29
LA-8-2	15-Sep-2016	<0.2	<0.5	9700	4	100	0.2	1.2	0.4	<0.1	20
LA-8-3	15-Sep-2016	1.7	3.2	10200	6	200	0.9	7.2	1.2	<0.1	26
LA-9-1	18-Sep-2016	<0.2	<0.5	2670	2	51	<0.1	<0.1	0.2	0.2	16
LA-9-2	18-Sep-2016	1.4	3.5	4800	10	140	1.1	6.8	1.3	0.4	26
LA-9-3	18-Sep-2016	1.2	3.0	6100	10	160	1.0	6.1	1.3	0.1	27
LB-3-1	09-Sep-2016	3.3	8.4	24800	12	160	1.2	13.0	1.8	<0.1	32
LB-3-2	10-Sep-2016	3.8	6.4	17400	9	140	1.2	12.0	1.3	<0.1	29
LB-3-3	10-Sep-2016	1.2	<0.5	5700	2	58	0.3	4.2	0.3	0.2	16
LAB-1-1	19-Sep-2016	1.4	1.7	11900	5	290	6.3	6.5	1.0	<0.1	28
LAB-1-2	15-Sep-2016	2.0	2.8	27000	9	300	11.0	8.1	1.2	0.3	35
LAB-1-3	15-Sep-2016	2.7	5.0	33000	13	360	13.0	12.0	1.6	<0.1	42
LAB-2-CORE	21-Sep-2016	3.8	3.9	91300	10	1270	12.0	9.9	1.3	0.1	40

Table A-4
Baseline Sediment Quality Data

Parameter		Thallium	Tin	Titanium	Uranium	Vanadium	Zinc	Lead-210	Polonium-210	Radium-226	Thorium-228
Unit		µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	Bq/g	Bq/g	Bq/g	Bq/g
Sediment Quality Benchmarks	**REF/ISQG/LEL**				97		123	900	800	600	
	NE2/PEL/SEL				2296		315	20800	12100	14400	
	Reference				REF and NE2		ISQG and PEL	LEL and SEL	LEL and SEL	LEL and SEL	
Baseline Lake Sediment Quality Statistics	**Count**	32	32	32	32	32	32	32	32	32	32
	#DL	32	3	0	0	0	1	4	0	13	37
	Min	<0.2	<0.1	45	0.20	<1.3	<0.5	<0.04	0.02	<0.01	<0.02
	Mean	0.2	0.20	235	0.73	18	25	0.40	0.41	0.026	0.02
	75th	0.2	0.20	278	0.80	22	29	0.56	0.54	0.030	0.02
	95th	0.2	0.40	461	1.4	31	50	0.74	0.71	0.050	0.02
	Max	0.2	0.40	480	1.5	33	62	0.75	0.76	0.050	0.02
	Geomean	0.2	0.19	211	0.67	15	19	0.32	0.31	0.023	0.02
	SD	8.5E-17	0.08	97	0.29	7.1	12	0.20	0.19	0.013	7.0E-18
Location	**Sample Date**										
LA-1-1	14-Sep-2016	<0.2	0.20	200	0.8	22	27	0.73	0.64	0.04	<0.02
LA-1-2	14-Sep-2016	<0.2	0.20	250	0.8	21	26	0.75	0.76	0.02	<0.02
LA-1-3	17-Sep-2016	<0.2	0.20	280	0.7	18	20	0.54	0.52	0.02	<0.02
LA-5-1	09-Sep-2016	<0.2	0.20	200	0.7	20	28	0.43	0.52	0.03	0.02
LA-5-2	11-Sep-2016	<0.2	<0.1	45	0.2	1.5	0.8	<0.04	0.02	<0.01	<0.02
LA-5-3	11-Sep-2016	<0.2	0.10	180	0.6	18	26	0.25	0.32	0.03	<0.02
LA-5-4	10-Sep-2016	<0.2	0.10	170	0.6	17	24	0.40	0.40	0.03	<0.02
LA-5-5	10-Sep-2016	<0.2	<0.1	47	0.8	1.3	<0.5	<0.04	0.02	0.02	<0.02
LA-6-1	12-Sep-2016	<0.2	0.20	180	0.7	18	28	0.45	0.48	0.04	<0.02
LA-6-2	12-Sep-2016	<0.2	0.20	230	0.7	18	27	0.52	0.53	0.03	<0.02
LA-6-3	16-Sep-2016	<0.2	0.20	310	0.7	19	26	0.32	0.34	<0.01	<0.02
LA-6-4	16-Sep-2016	<0.2	0.20	250	0.6	18	24	0.31	0.31	0.03	<0.02
LA-6-5	18-Sep-2016	<0.2	0.20	300	0.6	18	22	0.59	0.57	0.03	<0.02
LA-7A-1	13-Sep-2016	<0.2	0.20	230	0.6	17	23	0.41	0.51	<0.01	<0.02
LA-7A-2	13-Sep-2016	<0.2	0.20	220	0.8	24	23	0.35	0.38	0.03	<0.02
LA-7A-3	13-Sep-2016	<0.2	0.20	190	0.6	16	22	0.44	0.38	<0.01	<0.02
LA-7-1	13-Sep-2016	<0.2	0.20	170	0.7	15	22	0.55	0.56	<0.01	<0.02
LA-7-2	13-Sep-2016	<0.2	0.20	200	0.6	16	29	0.29	0.30	0.02	<0.02
LA-7-3	13-Sep-2016	<0.2	0.20	200	0.6	16	29	0.29	0.35	0.02	<0.02
LA-8-1	16-Sep-2016	<0.2	0.20	250	0.7	20	30	0.58	0.44	<0.01	<0.02
LA-8-2	15-Sep-2016	<0.2	<0.1	80	0.3	7	10	0.17	0.21	0.01	0.02
LA-8-3	15-Sep-2016	<0.2	0.20	250	0.8	20	26	0.22	0.26	0.02	<0.02
LA-9-1	18-Sep-2016	<0.2	<0.1	230	0.3	5.5	4.3	<0.04	0.04	0.05	<0.02
LA-9-2	18-Sep-2016	<0.2	0.20	290	0.7	20	27	0.45	0.45	0.03	<0.02
LA-9-3	18-Sep-2016	<0.2	0.20	260	0.7	23	28	0.58	0.54	0.03	<0.02
LB-3-1	09-Sep-2016	<0.2	0.30	270	1.0	33	43	0.61	0.50	0.02	0.02
LB-3-2	10-Sep-2016	<0.2	0.20	230	0.9	25	39	0.36	0.36	0.01	<0.02
LB-3-3	10-Sep-2016	<0.2	0.10	130	0.3	8	12	<0.04	0.05	0.04	<0.02
LAB-1-1	19-Sep-2016	<0.2	0.30	380	1.1	16	18	0.63	0.55	0.03	<0.02
LAB-1-2	15-Sep-2016	<0.2	0.40	450	1.3	22	30	0.56	0.55	0.04	0.02
LAB-1-3	15-Sep-2016	<0.2	0.40	480	1.5	27	44	0.55	0.68	0.05	<0.02
LAB-2-CORE	21-Sep-2016	<0.2	0.40	360	1.4	30	62	0.45	0.42	0.05	<0.02

Table A-4
Baseline Sediment Quality Data

Parameter		Thorium-230	Thorium-232	Calcium	Magnesium	Phosphorus	Postassium	Sodium
Unit		Bq/g	Bq/g	µg/g	µg/g	µg/g	µg/g	µg/g
Sediment Quality Benchmarks	**REF/ISQG/LEL**							
	NE2/PEL/SEL							
	Reference							
Baseline Lake Sediment Quality Statistics	**Count**	32	32	32	32	32	32	32
	#DL	25	32	0	0	0	0	0
	Min	<0.02	<0.02	270	110	60	530	80
	Mean	0.020	0.02	2000	745	1096	962	205
	75th	0.020	0.02	2775	905	1400	1000	210
	95th	0.024	0.02	3370	1135	1980	1400	474
	Max	0.030	0.02	3500	1200	2500	1400	610
	Geomean	0.020	0.02	1745	668	864	943	190
	SD	0.002	7.0E-18	852	260	515	191	98
Location	**Sample Date**							
LA-1-1	14-Sep-2016	<0.02	<0.02	1600	780	1400	1000	210
LA-1-2	14-Sep-2016	<0.02	<0.02	1600	830	1300	980	170
LA-1-3	17-Sep-2016	<0.02	<0.02	1400	690	1000	820	160
LA-5-1	09-Sep-2016	<0.02	<0.02	1600	780	1600	1000	210
LA-5-2	11-Sep-2016	<0.02	<0.02	270	120	60	1000	400
LA-5-3	11-Sep-2016	<0.02	<0.02	1600	700	870	840	170
LA-5-4	10-Sep-2016	<0.02	<0.02	2100	910	1400	1100	210
LA-5-5	10-Sep-2016	<0.02	<0.02	360	110	70	1400	610
LA-6-1	12-Sep-2016	<0.02	<0.02	1800	750	1500	940	190
LA-6-2	12-Sep-2016	<0.02	<0.02	2500	880	1400	960	180
LA-6-3	16-Sep-2016	<0.02	<0.02	1900	800	960	970	190
LA-6-4	16-Sep-2016	<0.02	<0.02	1700	650	1000	860	140
LA-6-5	18-Sep-2016	<0.02	<0.02	1900	710	1300	800	120
LA-7A-1	13-Sep-2016	<0.02	<0.02	3300	970	1200	1000	190
LA-7A-2	13-Sep-2016	0.02	<0.02	2100	760	1300	920	170
LA-7A-3	13-Sep-2016	<0.02	<0.02	2700	800	1500	940	160
LA-7-1	13-Sep-2016	<0.02	<0.02	2900	1000	2500	1300	210
LA-7-2	13-Sep-2016	<0.02	<0.02	3200	890	1200	870	180
LA-7-3	13-Sep-2016	<0.02	<0.02	3100	920	1400	1000	200
LA-8-1	16-Sep-2016	<0.02	<0.02	2500	890	1700	1000	120
LA-8-2	15-Sep-2016	<0.02	<0.02	900	330	480	530	80
LA-8-3	15-Sep-2016	<0.02	<0.02	1800	620	780	760	120
LA-9-1	18-Sep-2016	<0.02	<0.02	600	260	120	610	240
LA-9-2	18-Sep-2016	<0.02	<0.02	2000	780	1100	940	200
LA-9-3	18-Sep-2016	<0.02	<0.02	1900	710	1100	850	170
LB-3-1	09-Sep-2016	<0.02	<0.02	2000	870	1300	1100	340
LB-3-2	10-Sep-2016	<0.02	<0.02	1900	720	1000	910	190
LB-3-3	10-Sep-2016	<0.02	<0.02	680	350	150	720	340
LAB-1-1	19-Sep-2016	0.03	<0.02	2800	960	960	960	150
LAB-1-2	15-Sep-2016	<0.02	<0.02	3000	1100	820	1100	210
LAB-1-3	15-Sep-2016	<0.02	<0.02	3500	1200	1200	1400	180
LAB-2-CORE	21-Sep-2016	0.02	<0.02	2800	1000	1400	1200	150

Notes:

Chemical analysis is reported on a dry weight basis

Sediment samples are composites of 3 or more 0-2 cm fraction core samples

REF and NE2 values are from: Burnett-Seidel and Liber (2013) - Sediment quality values derived for application at Saskatchewan uranium operations; reference (REF) values based on reference sites unaffected by mining and milling (representing background), and no-effect level (NE2) values based on sites with no significant difference in benthic invertebrate community effects criteria of abundance, richness and evenness between reference and exposure locations.

LEL and SEL values are from: Thompson *et al*. (2005) – Sediment quality guidelines derived for application to uranium ore bearing regions of northern Saskatchewan and Ontario; lowest effect levels (LELs) and severe effect levels (SELs) from the “weighted method”.

ISQG and PEL values are from: Canadian Council of Ministers of the Environment (CCME) – Canadian Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME 1999; updated September 2007; accessed June 2017: http://ceqg-rcqe.ccme.ca/). ISQG are Interim Sediment Quality Guidelines, PEL are Probable Effects Levels.

Table A-5
Baseline Phytoplankton Community Data Collected in September 2016

Class	Genus	Species	LA-1			LA-5			LA-6		
			Units/L	Biovolume Unit (µm^3)	Normalized Biovolume (µm^3/L)	Units/L	Biovolume Unit (µm^3)	Normalized Biovolume (µm^3/L)	Units/L	Biovolume Unit (µm^3)	Normalized Biovolume (µm^3/L)
Total			**988,000**	**601,447**	**13,992,383,000**	**808,000**	**318,682**	**1,040,762,000**	**481,000**	**62,712**	**694,368,000**
Bacillariophyceae	*Achnanthes*	*sp.*	-	-	-	12,000	180	2,160,000	-	-	-
Bacillariophyceae	*Asterionella*	*formosa*	94,000	810	76,140,000	7,000	810	5,670,000	8,000	810	6,480,000
Bacillariophyceae	*Cyclotella*	*sp.*	-	-	-	6,000	500	3,000,000	14,000	500	7,000,000
Bacillariophyceae	*Fragilaria*	*sp.*	18,000	640	11,520,000	170,000	320	54,400,000	90,000	320	28,800,000
Bacillariophyceae	*Melosira*	*sp.*	105,000	115,200	12,096,000,000	17,000	24,000	408,000,000	25,000	16,960	424,000,000
Bacillariophyceae	*Navicula*	*sp.*	6,000	4,000	24,000,000	-	-	-	-	-	-
Bacillariophyceae	*Nitzschia*	*sigmoidea*	-	-	-	-	-	-	-	-	-
Bacillariophyceae	*Nitzschia*	*sp.*	-	-	-	2,000	640	1,280,000	1,000	640	640,000
Bacillariophyceae	*Rhizosolenia*	*sp.*	-	-	-	37,000	540	19,980,000	19,000	540	10,260,000
Bacillariophyceae	*Stephanodiscus*	*sp.*	5,000	62,500	312,500,000	-	-	-	-	-	-
Bacillariophyceae	*Synedra*	*sp.*	12,000	810	9,720,000	6,000	810	4,860,000	7,000	810	5,670,000
Bacillariophyceae	*Tabellaria*	*sp.*	13,000	1,920	24,960,000	7,000	1,920	13,440,000	2,000	1,920	3,840,000
Chlorophyceae	*Botryococcus*	*sp.*	-	-	-	-	-	-	-	-	-
Chlorophyceae	*Cosmarium*	*sp.*	3,000	11,250	33,750,000	-	-	-	-	-	-
Chlorophyceae	*Crucigenia*	*quadrata*	56,000	12	672,000	-	-	-	-	-	-
Chlorophyceae	*Crucigenia*	*sp.*	25,000	12	300,000	16,000	12	192,000	-	-	-
Chlorophyceae	*Crucigenia*	*tetrapedia*	25,000	36	900,000	-	-	-	-	-	-
Chlorophyceae	*Dictyosphaerium*	*sp.*	2,000	27,000	54,000,000	-	-	-	-	-	-
Chlorophyceae	*Elakatothrix*	*sp.*	4,000	180	720,000	12,000	180	2,160,000	6,000	180	1,080,000
Chlorophyceae	*Monoraphidium*	*sp.*	12,000	120	1,440,000	12,000	120	1,440,000	6,000	120	720,000
Chlorophyceae	*Oocystis*	*sp.*	2,000	4,500	9,000,000	-	-	-	4,000	2,000	8,000,000
Chlorophyceae	*Pediastrum*	*Boryanum*	-	-	-	1,000	5,000	5,000,000	-	-	-
Chlorophyceae	*Pediastrum*	*privum*	12,000	450	5,400,000	6,000	450	2,700,000	-	-	-
Chlorophyceae	*Pediastrum*	*tetras*	6,000	200	1,200,000	-	-	-	-	-	-
Chlorophyceae	*Planktosphaeria*	*sp.*	12,000	27,000	324,000,000	-	-	-	-	-	-
Chlorophyceae	*Quadrigula*	*sp.*	24,000	180	4,320,000	8,000	180	1,440,000	4,000	180	720,000
Chlorophyceae	*Scenedesmus*	*acuminatus*	4,000	160	640,000	-	-	-	-	-	-
Chlorophyceae	*Scenedesmus*	*quadricauda*	4,000	160	640,000	-	-	-	25,000	160	4,000,000
Chlorophyceae	*Scenedesmus*	*sp.*	37,000	160	5,920,000	14,000	160	2,240,000	-	-	-
Chlorophyceae	*Spondylosium*	*sp.*	-	-	-	1,000	1,000	1,000,000	-	-	-
Chlorophyceae	*Staurastrum*	*sp.*	-	-	-	2,000	6,750	13,500,000	1,000	6,750	6,750,000
Chlorophyceae	*Staurodesmus*	*sp.*	-	-	-	-	-	-	6,000	900	5,400,000
Chlorophyceae	*Tetraedron*	*minimum*	-	-	-	1,000	256	256,000	-	-	-
Chlorophyceae	*Tetraedron*	*sp.*									
Chlorophyceae	*Tetraedron*	*trigonum*	1,000	1,200	1,200,000	-	-	-	-	-	-
Chlorophyceae	*Unidentified*	(filament)	1,000	2,500	2,500,000	-	-	-	1,000	3,000	3,000,000
Chlorophyceae	*Unidentified*	(single cell)	297,000	64	19,008,000	99,000	64	6,336,000	19,000	64	1,216,000
Chrysophyceae	*Bitrichia*	*sp.*	-	-	-	6,000	432	2,592,000	-	-	-
Chrysophyceae	*Dinobryon*	*bavaricum*	6,000	540	3,240,000	43,000	540	23,220,000	6,000	540	3,240,000
Chrysophyceae	*Dinobryon*	*sp.*	6,000	540	3,240,000	31,000	540	16,740,000	19,000	540	10,260,000
Chrysophyceae	*small chrysophytes*		68,000	64	4,352,000	248,000	64	15,872,000	161,000	64	10,304,000
Cryptophyceae	*Cryptomonas*	*sp.*	19,000	6,750	128,250,000	6,000	6,750	40,500,000	2,000	6,750	13,500,000
Cryptophyceae	*Unidentified*		74,000	324	23,976,000	6,000	324	1,944,000	12,000	324	3,888,000
Cyanophyceae	*Anabaena*	*sp.*	16,000	4,320	69,120,000	3,000	4,320	12,960,000	10,000	4,320	43,200,000
Cyanophyceae	*Aphanizomenon*	*sp.*	-	-	-	5,000	2,880	14,400,000	6,000	2,880	17,280,000
Cyanophyceae	*Aphanocapsa*	*sp.*	6,000	64,000	384,000,000	-	-	-	-	-	-
Cyanophyceae	*Aphanothece*	*sp.*	1,000	216,000	216,000,000	1,000	216,000	216,000,000	-	-	-
Cyanophyceae	*Gomphosphaeria*	*sp.*	3,000	27,000	81,000,000	2,000	27,000	54,000,000	-	-	-
Cyanophyceae	*Eucapsis*	*sp.*	-	-	-	-	-	-	-	-	-
Cyanophyceae	*Oscillatoria*	*sp.*	-	-	-	-	-	-	-	-	-
Cyanophyceae	*Planktolyngbya*	*sp.*	4,000	720	2,880,000	3,000	720	2,160,000	12,000	720	8,640,000
Cyanophyceae	*Pseudanabaena*	*sp.*	-	-	-	6,000	720	4,320,000	9,000	720	6,480,000
Dinophyceae	*Gymnodinium*	*sp.*	3,000	15,625	46,875,000	6,000	4,500	27,000,000	-	-	-
Dinophyceae	*Peridinium*	*sp.*	-	-	-	6,000	10,000	60,000,000	6,000	10,000	60,000,000
Euglenophyceae	*Trachelomonas*	*sp.*	2,000	4,500	9,000,000	-	-	-	-	-	-

Notes:
Samples were collected between September 10 and 21, 2016

Table A-5
Baseline Phytoplankton Community Data Collected in September 2016

Class	Genus	Species	LA-7			LAB-1			LAB-2		
			Units/L	Biovolume Unit (µm^3)	Normalized Biovolume (µm^3/L)	Units/L	Biovolume Unit (µm^3)	Normalized Biovolume (µm^3/L)	Units/L	Biovolume Unit (µm^3)	Normalized Biovolume (µm^3/L)
Total			**583,000**	**145,866**	**1,124,808,000**	**542,000**	**139,210**	**1,881,494,000**	**566,000**	**121,112**	**1,540,866,000**
Bacillariophyceae	*Achnanthes*	*sp.*	-	-	-	-	-	-	-	-	-
Bacillariophyceae	*Asterionella*	*formosa*	-	-	-	36,000	810	29,160,000	4,000	630	2,520,000
Bacillariophyceae	*Cyclotella*	*sp.*	81,000	500	40,500,000	4,000	1,800	7,200,000	12,000	500	6,000,000
Bacillariophyceae	*Fragilaria*	*sp.*	90,000	320	28,800,000	-	-	-	-	-	-
Bacillariophyceae	*Melosira*	*sp.*	22,000	15,680	344,960,000	23,000	24,000	552,000,000	16,000	21,120	337,920,000
Bacillariophyceae	*Navicula*	*sp.*	-	-	-	-	-	-	-	-	-
Bacillariophyceae	*Nitzschia*	*sigmoidea*	2,000	3,420	6,840,000	-	-	-	-	-	-
Bacillariophyceae	*Nitzschia*	*sp.*	2,000	640	1,280,000	6,000	640	3,840,000	6,000	640	3,840,000
Bacillariophyceae	*Rhizosolenia*	*sp.*	6,000	540	3,240,000	25,000	540	13,500,000	161,000	450	72,450,000
Bacillariophyceae	*Stephanodiscus*	*sp.*	-	-	-	-	-	-	-	-	-
Bacillariophyceae	*Synedra*	*sp.*	6,000	810	4,860,000	19,000	810	15,390,000	12,000	540	6,480,000
Bacillariophyceae	*Tabellaria*	*sp.*	13,000	1,920	24,960,000	-	-	-	-	-	-
Chlorophyceae	*Botryococcus*	*sp.*	1,000	64,000	64,000,000	-	-	-	-	-	-
Chlorophyceae	*Cosmarium*	*sp.*	6,000	500	3,000,000	-	-	-	-	-	-
Chlorophyceae	*Crucigenia*	*quadrata*	-	-	-	32,000	12	384,000	-	-	-
Chlorophyceae	*Crucigenia*	*sp.*	-	-	-	16,000	54	864,000	-	-	-
Chlorophyceae	*Crucigenia*	*tetrapedia*	-	-	-	-	-	-	-	-	-
Chlorophyceae	*Dictyosphaerium*	*sp.*	-	-	-	-	-	-	-	-	-
Chlorophyceae	*Elakatothrix*	*sp.*	-	-	-	2,000	180	360,000	1,000	180	180,000
Chlorophyceae	*Monoraphidium*	*sp.*	19,000	120	2,280,000	4,000	120	480,000	6,000	120	720,000
Chlorophyceae	*Oocystis*	*sp.*	-	-	-	-	-	-	-	-	-
Chlorophyceae	*Pediastrum*	*Boryanum*	-	-	-	-	-	-	-	-	-
Chlorophyceae	*Pediastrum*	*privum*	2,000	800	1,600,000	-	-	-	6,000	450	2,700,000
Chlorophyceae	*Pediastrum*	*tetras*	-	-	-	6,000	450	2,700,000	-	-	-
Chlorophyceae	*Planktosphaeria*	*sp.*	-	-	-	-	-	-	-	-	-
Chlorophyceae	*Quadrigula*	*sp.*	-	-	-	4,000	180	720,000	-	-	-
Chlorophyceae	*Scenedesmus*	*acuminatus*	-	-	-	-	-	-	-	-	-
Chlorophyceae	*Scenedesmus*	*quadricauda*	-	-	-	-	-	-	-	-	-
Chlorophyceae	*Scenedesmus*	*sp.*	-	-	-	-	-	-	-	-	-
Chlorophyceae	*Spondylosium*	*sp.*	2,000	1,000	2,000,000	-	-	-	-	-	-
Chlorophyceae	*Staurastrum*	*sp.*	-	-	-	2,000	6,750	13,500,000	-	-	-
Chlorophyceae	*Staurodesmus*	*sp.*	-	-	-	-	-	-	-	-	-
Chlorophyceae	*Tetraedron*	*minimum*	-	-	-	-	-	-	-	-	-
Chlorophyceae	*Tetraedron*	*sp.*				6,000	32	192,000	-	-	-
Chlorophyceae	*Tetraedron*	*trigonum*	-	-	-	-	-	-	-	-	-
Chlorophyceae	*Unidentified*	(filament)	2,000	1,500	3,000,000	-	-	-	-	-	-
Chlorophyceae	*Unidentified*	(single cell)	62,000	64	3,968,000	74,000	64	4,736,000	31,000	64	1,984,000
Chrysophyceae	*Bitrichia*	*sp.*	-	-	-	-	-	-	-	-	-
Chrysophyceae	*Dinobryon*	*bavaricum*	19,000	540	10,260,000	6,000	540	3,240,000	1,000	540	540,000
Chrysophyceae	*Dinobryon*	*sp.*	12,000	540	6,480,000	42,000	540	22,680,000	-	-	-
Chrysophyceae	*small chrysophytes*		81,000	64	5,184,000	62,000	64	3,968,000	167,000	64	10,688,000
Cryptophyceae	*Cryptomonas*	*sp.*	37,000	6,750	249,750,000	56,000	12,000	672,000,000	68,000	12,000	816,000,000
Cryptophyceae	*Unidentified*		-	-	-	50,000	324	16,200,000	56,000	324	18,144,000
Cyanophyceae	*Anabaena*	*sp.*	9,000	4,320	38,880,000	8,000	6,480	51,840,000	1,000	1,440	1,440,000
Cyanophyceae	*Aphanizomenon*	*sp.*	6,000	2,880	17,280,000	2,000	2,880	5,760,000	1,000	3,840	3,840,000
Cyanophyceae	*Aphanocapsa*	*sp.*	-	-	-	-	-	-	-	-	-
Cyanophyceae	*Aphanothece*	*sp.*	12,000	8,000	96,000,000	2,000	27,000	54,000,000	-	-	-
Cyanophyceae	*Gomphosphaeria*	*sp.*	-	-	-	4,000	27,000	108,000,000	2,000	27,000	54,000,000
Cyanophyceae	*Eucapsis*	*sp.*	32,000	8	256,000	-	-	-	-	-	-
Cyanophyceae	*Oscillatoria*	*sp.*	1,000	5,250	5,250,000	-	-	-	-	-	-
Cyanophyceae	*Planktolyngbya*	*sp.*	19,000	720	13,680,000	17,000	960	16,320,000	2,000	960	1,920,000
Cyanophyceae	*Pseudanabaena*	*sp.*	25,000	480	12,000,000	2,000	480	960,000	-	-	-
Dinophyceae	*Gymnodinium*	*sp.*	12,000	10,000	120,000,000	19,000	10,000	190,000,000	5,000	27,000	135,000,000
Dinophyceae	*Peridinium*	*sp.*	1,000	10,000	10,000,000	6,000	10,000	60,000,000	2,000	18,750	37,500,000
Euglenophyceae	*Trachelomonas*	*sp.*	1,000	4,500	4,500,000	7,000	4,500	31,500,000	6,000	4,500	27,000,000

Notes:
Samples were collected between September 10 and 21, 2016

Table A-6
Baseline Zooplankton Community Data Collected in September 2016

Class	Genus	Species	LA-1			LA-5			LA-6		
			Total no. per sample	Average biovolume (μm^3)	Biovolume per Litre (μm^3)	Total no. per sample	Average biovolume (μm^3)	Biovolume per Litre (μm^3)	Total no. per sample	Average biovolume (μm^3)	Biovolume per Litre (μm^3)
Total			**30,150**	**422,465,000**	**2,216,729,600,000**	**6,850**	**55,562,000**	**15,524,300,000**	**3,617**	**89,939,000**	**9,974,407,083**
Unidentified Rotifer	*Unidentified*		800	972,000	1,555,200,000	1,900	972,000	3,693,600,000	617	1,730,000	2,133,667,820
Branchiopoda	*Bosmina*	*sp.*	800	16,200,000	25,920,000,000	150	22,700,000	6,810,000,000	100	9,720,000	1,944,000,000
Branchiopoda	*Chydorus*	*sp.*	50	10,800,000	1,080,000,000	25	8,060,000	403,000,000	-	-	-
Branchiopoda	*Daphnia*	*sp.*	50	4,320,000	432,000,000	-	-	-	-	-	-
Branchiopoda	*Diaphanosoma*	*sp.*	300	72,600,000	43,560,000,000	-	-	-	50	17,300,000	1,730,000,000
Branchiopoda	*Holopedium*	*sp.*	4,600	218,000,000	2,005,600,000,000	-	-	-	17	55,300,000	1,843,337,020
Ciliata	*Epistylis*	*sp.*	3,800	96,000	729,600,000	-	-	-	-	-	-
Ciliata	*Unidentified*		600	1,730,000	2,076,000,000	750	324,000	486,000,000	400	324,000	259,200,000
Ciliata	*Vorticella*	*sp.*	10,100	216,000	4,363,200,000	100	216,000	43,200,000	-	-	-
Copepoda	*Acanthocyclops*	*sp.*	850	48,600,000	82,620,000,000	-	-	-	-	-	-
Copepoda	*Nauplii*		1,800	972,000	3,499,200,000	350	972,000	680,400,000	83	972,000	161,999,935
Copepoda	*Skistodiaptomus*	*sp.*	-	-	-	-	-	-	-	-	-
Copepoda	*Too young to ID*		2,600	6,750,000	35,100,000,000	-	-	-	-	-	-
Copepoda	*Too young to ID*		100	38,000,000	7,600,000,000	-	-	-	-	-	-
Euglenoidea	*Euglena*	*sp.*	-	-	-	-	-	-	-	-	-
Filosia	*Cyphoderia*	*sp.*	-	-	-	-	-	-	33	1,300,000	86,666,580
Filosia	*Euglypha*	*sp.*	200	225,000	90,000,000	25	225,000	11,250,000	33	225,000	14,999,985
Heliozoa	*Actinosphaerium*	*sp.*	-	-	-	25	729,000	36,450,000	-	-	-
Insecta	*Unidentified*		-	-	-	50	2,590,000	259,000,000	-	-	-
Lobosa	*Arcella*	*sp.*	150	500,000	150,000,000	25	500,000	25,000,000	33	500,000	33,333,300
Lobosa	*Difflugia*	*sp.*	100	810,000	162,000,000	100	810,000	81,000,000	150	810,000	243,000,000
Monogononta	*Asplanchna*	*sp.*	-	-	-	-	-	-	-	-	-
Monogononta	*Collotheca*	*sp.*	-	-	-	25	300,000	15,000,000	83	300,000	49,999,980
Monogononta	*Conochilus*	*sp.*	1,000	324,000	648,000,000	-	-	-	33	324,000	21,599,978
Monogononta	*Euchlanis*	*sp.*	-	-	-	25	12,000,000	600,000,000	-	-	-
Monogononta	*Gastropus*	*sp.*	200	486,000	194,400,000	275	486,000	267,300,000	517	486,000	502,200,324
Monogononta	*Kellicottia*	*longispina*	50	540,000	54,000,000	25	540,000	27,000,000	-	-	-
Monogononta	*Keratella*	*sp.*	2,000	324,000	1,296,000,000	2,200	324,000	1,425,600,000	1,167	324,000	756,002,160
Monogononta	*Ploesoma*	*sp.*	-	-	-	25	1,220,000	61,000,000	-	-	-
Monogononta	*Polyarthra*	*sp.*	-	-	-	750	324,000	486,000,000	300	324,000	194,400,000
Monogononta	*Trichocerca*	*sp.*	-	-	-	25	2,270,000	113,500,000	-	-	-
Monogononta	*Trichotria*	*sp.*	-	-	-	-	-	-	-	-	-

Notes:
Sample volume was 0.5 L.
Samples were collected between September 10 and 21, 2016

Table A-6
Baseline Zooplankton Community Data Collected in September 2016

Class	Genus	Species	LA-7			LAB-1			LAB-2		
			Total no. per sample	Average biovolume (µm^3)	Biovolume per Litre (µm^3)	Total no. per sample	Average biovolume (µm^3)	Biovolume per Litre (µm^3)	Total no. per sample	Average biovolume (µm^3)	Biovolume per Litre (µm^3)
Total			**86,200**	**434,744,000**	**628,107,600,000**	**33,850**	**135,268,000**	**147,913,600,000**	**50,650**	**303,642,000**	**319,664,000,000**
Unidentified Rotifer	*Unidentified*		900	324,000	583,200,000	6,300	972,000	12,247,200,000	7,300	972,000	14,191,200,000
Branchiopoda	*Bosmina*	*sp.*	-	-	-	900	16,200,000	29,160,000,000	1,000	16,200,000	32,400,000,000
Branchiopoda	*Chydorus*	*sp.*	150	13,500,000	4,050,000,000	1,400	10,800,000	30,240,000,000	2,400	10,800,000	51,840,000,000
Branchiopoda	*Daphnia*	*sp.*	-	-	-	200	9,600,000	3,840,000,000	150	25,900,000	7,770,000,000
Branchiopoda	*Diaphanosoma*	*sp.*	50	72,600,000	7,260,000,000	-	-	-	-	-	-
Branchiopoda	*Holopedium*	*sp.*	800	236,000,000	377,600,000,000	50	55,300,000	5,530,000,000	50	69,100,000	6,910,000,000
Ciliata	*Epistylis*	*sp.*	700	96,000	134,400,000	1,600	96,000	307,200,000	300	96,000	57,600,000
Ciliata	*Unidentified*		200	1,730,000	692,000,000	200	1,730,000	692,000,000	3,800	1,730,000	13,148,000,000
Ciliata	*Vorticella*	*sp.*	700	216,000	302,400,000	4,600	216,000	1,987,200,000	1,900	216,000	820,800,000
Copepoda	*Acanthocyclops*	*sp.*	-	-	-	-	-	-	-	-	-
Copepoda	*Nauplii*		6,300	972,000	12,247,200,000	4,100	972,000	7,970,400,000	5,000	972,000	9,720,000,000
Copepoda	*Skistodiaptomus*	*sp.*	650	75,600,000	98,280,000,000	-	-	-	-	-	-
Copepoda	*Too young to ID*		2,600	6,750,000	35,100,000,000	1,700	6,750,000	22,950,000,000	3,500	6,750,000	47,250,000,000
Copepoda	*Too young to ID*		1,000	19,400,000	38,800,000,000	500	16,200,000	16,200,000,000	100	16,200,000	3,240,000,000
Euglenoidea	*Euglena*	*sp.*	100	108,000	21,600,000	-	-	-	-	-	-
Filosia	*Cyphoderia*	*sp.*	-	-	-	-	-	-	200	432,000	172,800,000
Filosia	*Euglypha*	*sp.*	-	-	-	-	-	-	-	-	-
Heliozoa	*Actinosphaerium*	*sp.*	-	-	-	-	-	-	800	216,000	345,600,000
Insecta	*Unidentified*		-	-	-	50	2,590,000	259,000,000	50	85,500,000	8,550,000,000
Lobosa	*Arcella*	*sp.*	50	500,000	50,000,000	-	-	-	-	-	-
Lobosa	*Difflugia*	*sp.*	100	810,000	162,000,000	50	810,000	81,000,000	-	-	-
Monogononta	*Asplanchna*	*sp.*	-	-	-	300	9,450,000	5,670,000,000	800	65,300,000	104,480,000,000
Monogononta	*Collotheca*	*sp.*	-	-	-	100	300,000	60,000,000	500	300,000	300,000,000
Monogononta	*Conochilus*	*sp.*	38,800	324,000	25,142,400,000	1,400	324,000	907,200,000	1,800	324,000	1,166,400,000
Monogononta	*Euchlanis*	*sp.*	-	-	-	-	-	-	-	-	-
Monogononta	*Gastropus*	*sp.*	800	486,000	777,600,000	2,100	486,000	2,041,200,000	6,400	486,000	6,220,800,000
Monogononta	*Kellicottia*	*longispina*	3,800	540,000	4,104,000,000	500	540,000	540,000,000	1,100	540,000	1,188,000,000
Monogononta	*Keratella*	*sp.*	23,900	324,000	15,487,200,000	5,500	324,000	3,564,000,000	9,900	324,000	6,415,200,000
Monogononta	*Ploesoma*	*sp.*	-	-	-	-	-	-	-	-	-
Monogononta	*Polyarthra*	*sp.*	3,700	324,000	2,397,600,000	1,200	648,000	1,555,200,000	2,700	324,000	1,749,600,000
Monogononta	*Trichocerca*	*sp.*	800	2,920,000	4,672,000,000	1,100	960,000	2,112,000,000	900	960,000	1,728,000,000
Monogononta	*Trichotria*	*sp.*	100	1,220,000	244,000,000	-	-	-	-	-	-

Notes:

Sample volume was 0.5 L.

Samples were collected between September 10 and 21, 2

Table A-7
Plant Pigments in Surface Water Collected in September 2016

Parameter	DL	Unit	LA-1	LA-5	LA-6	LA-7	LAB-1	LAB-2
Chlorophyll a	0.60	ug/L	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60
ODb/Oda	1.0	ABS Ratio	1	1	1	1	1	1
Pheophytin a	0.60	ug/L	10.9	8.94	6.68	7.24	6.40	13.9

Notes:
Samples were collected between September 10 and 21, 2016

Table A-8
Baseline Benthic Invertebrate Community Collected in September 2016
Number of Individuals per Taxonomic Unit and Reference Median

EcoMetrix - Denison Mine 2016				Small Lakes										
				LA-5					LA-6					Reference Median
Major Taxon	Family	Subfamily/Tribe	Genus/Species	#1	#2	#3	#4	#5	#1	#2	#3	#4	#5	
Nematoda				1	0	5	0	0	3	0	4	8	0	0.50
Microturbellaria				1	0	0	0	1	0	0	0	0	0	0
Hirudinea	Erpobdellidae		*Erpobdella punctata*	0	0	0	0	0	0	0	0	0	0	0
Oligochaeta	Naididae	Tubificinae		0	2	0	0	4	0	0	1	0	0	0
Oligochaeta	Naididae	Naidinae		8	0	0	0	0	0	0	12	24	0	0
Gastropoda	Lymnaeidae		(i/d)	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Planorbidae		*Gyraulus*	0	0	0	0	4	0	0	0	0	0	0
Gastropoda	Valvatidae		*Valvata sincera*	0	0	0	0	0	0	0	0	0	0	0
Pelecypoda	Pisidiidae		(i/d)	8	28	6	3	72	2	22	2	4	10	7
Pelecypoda	Pisidiidae		*Pisidium*	7	10	0	0	3	0	3	6	6	6	4.5
Acari - Hydrachnidia			(i/d)	0	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	Arenuridae		*Arrenurus*	1	0	0	0	1	0	0	0	0	0	0
Acari - Hydrachnidia	Hygrobaetidae		*Hygrobates*	0	1	0	0	12	0	1	5	0	2	0.5
Acari - Hydrachnidia	Lebertiidae		*Lebertia*	0	0	0	0	4	0	0	0	0	0	0
Acari - Hydrachnidia	Limnesiidae		*Limnesia*	0	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	Oxidae		*Oxus*	0	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	Pionidae		*Piona*	0	5	1	0	0	0	0	0	6	0	0
Acari - Hydrachnidia	Unionicolidae		*Unionicola*	0	2	1	8	0	0	0	0	0	0	0
Ostracoda				18	16	20	40	4	4	8	33	176	26	19
Copepoda-Cyclopoida				16	41	32	8	12	5	0	8	24	24	14
Cladocera	Holopedidae		*Holopedium gibberum*	0	0	0	0	0	0	0	0	0	0	0
Cladocera	Chydoridae		-	0	0	0	0	0	0	8	8	0	32	0
Cladocera	Chydoridae		*Eurycercus*	293	54	377	691	82	155	491	297	761	150	295
Cladocera	Ilyocryptidae		*Ilyocryptus*	8	0	0	8	0	1	0	0	16	24	0.5
Cladocera	Macrothricidae			225	40	164	152	76	4	60	128	136	72	102
Cladocera	Polyphemidae		*Polyphemus pediculus*	0	0	0	0	0	0	0	0	0	0	0
Cladocera	Sididae		*Latona setifera*	0	0	4	0	8	1	0	8	0	0	0
Amphipoda	Gammaridae		*Gammarus lacustris*	0	0	0	0	0	0	0	0	40	0	0
Amphipoda	Hyalellidae		*Hyalella azteca*	0	0	0	0	1	0	0	0	0	1	0
Ephemeroptera	Baetiscidae		*Baetisca*	0	0	0	0	0	0	0	0	0	0	0
Ephemeroptera	Caenidae		*Caenis*	39	48	10	0	28	0	7	10	11	171	10.5
Ephemeroptera	Ephemeridae		*Ephemera*	0	0	0	0	19	0	1	3	1	0	0
Ephemeroptera	Ephemeridae		*Hexagenia limbata*	0	19	0	0	0	0	0	0	0	0	0
Trichoptera	Hydroptilidae		*Oxyethira*	0	0	0	0	0	0	0	0	0	0	0
Trichoptera	Lepidosomatidae		*Lepidostoma*	0	0	0	0	0	0	0	0	0	0	0
Trichoptera	Leptoceridae		*Mystacides*	0	0	0	0	4	0	0	0	0	0	0
Trichoptera	Leptoceridae		*Oecetis*	0	0	0	0	0	0	0	0	0	1	0
Trichoptera	Molannidae		*Molannodes / Molanna*	0	0	0	0	0	0	0	0	0	0	0
Trichoptera	Phryganeidae		*Agrypnia*	0	0	0	0	0	0	0	0	0	0	0

Table A-8
Baseline Benthic Invertebrate Community Collected in September 2016
Number of Individuals per Taxonomic Unit and Reference Median

EcoMetrix - Denison Mine 2016				Small Lakes										
				LA-5					LA-6					**Reference Median**
Major Taxon	Family	Subfamily/Tribe	Genus/Species	#1	#2	#3	#4	#5	#1	#2	#3	#4	#5	
Megaloptera	Sialidae		*Sialis*	0	0	0	0	0	0	0	0	0	0	0
Diptera	Ceratopogonidae	Ceratopogoninae	*Bezzia*	0	1	0	0	0	0	0	0	0	0	0
Diptera	Ceratopogonidae	Ceratopogoninae	*Probezzia*	2	2	1	0	3	0	0	0	0	0	0
Diptera	Chaoboridae		*Chaoborus*	0	0	0	0	0	0	0	0	0	0	0
Diptera	Chironomidae - pupa			0	0	0	0	0	0	0	0	0	0	0
Diptera	Chironomidae	Chironomini	*Chironomus*	3	0	19	51	0	18	121	4	0	6	5
Diptera	Chironomidae	Chironomini	*Cladopelma*	0	0	2	0	4	0	0	5	0	1	0
Diptera	Chironomidae	Chironomini	*Cryptochironomus*	8	3	10	21	20	2	9	7	10	14	9.5
Diptera	Chironomidae	Chironomini	*Cryptotendipes*	1	0	0	0	0	0	0	0	0	0	0
Diptera	Chironomidae	Chironomini	*Demicryptochironomus*	0	3	0	0	1	0	0	0	0	0	0
Diptera	Chironomidae	Chironomini	*Dicrotendipes*	1	0	0	0	0	0	0	0	0	9	0
Diptera	Chironomidae	Chironomini	*Endochironomus*	2	4	0	0	19	0	0	0	0	0	0
Diptera	Chironomidae	Chironomini	*Microtendipes*	0	0	0	0	0	0	0	0	0	0	0
Diptera	Chironomidae	Chironomini	*Nilothauma*	0	6	0	0	0	0	0	0	0	0	0
Diptera	Chironomidae	Chironomini	*Parachironomus*	1	2	0	0	4	0	0	0	0	0	0
Diptera	Chironomidae	Chironomini	*Paracladopelma*	0	0	0	0	4	0	0	0	0	0	0
Diptera	Chironomidae	Chironomini	*Polypedilum*	17	0	0	1	0	1	16	1	0	4	1
Diptera	Chironomidae	Chironomini	*Stenochironomus*	0	0	1	0	0	0	0	0	0	0	0
Diptera	Chironomidae	Chironomini	*Stictochironomus*	0	37	4	0	141	1	0	0	0	0	0
Diptera	Chironomidae	Chironomini	*Tribelos*	0	0	0	0	0	0	0	0	0	2	0
Diptera	Chironomidae	Pseudochironomini	*Pseudochironomus*	0	0	0	0	0	0	0	0	0	0	0
Diptera	Chironomidae	Tanypodinae	*Ablabesmyia*	0	0	0	0	4	0	0	0	0	0	0
Diptera	Chironomidae	Tanypodinae	*Guttipelopia guttipennis*	0	0	0	0	0	0	4	0	0	0	0
Diptera	Chironomidae	Tanypodinae	*Procladius*	29	8	15	3	8	6	14	11	3	19	9.5
Diptera	Chironomidae	Tanypodinae	*Tanypus*	0	0	0	0	0	0	0	0	0	0	0
Diptera	Chironomidae	Tanypodinae	*Thienemannimyia* gr.	0	0	0	0	0	0	0	0	0	0	0
Diptera	Chironomidae	Tanytarsini	*Cladotanytarsus*	2	1	13	0	1	5	4	33	65	25	4.5
Diptera	Chironomidae	Tanytarsini	*Corynocera*	0	0	0	0	0	0	0	0	0	0	0
Diptera	Chironomidae	Tanytarsini	*Neostempellina*	0	0	0	0	0	0	0	0	0	0	0
Diptera	Chironomidae	Tanytarsini	*Paratanytarsus*	0	0	0	0	0	0	0	0	0	0	0
Diptera	Chironomidae	Tanytarsini	*Tanytarsus*	41	24	10	0	27	14	30	8	49	1	19
Diptera	Chironomidae	Orthocladiinae	*Cricotopus/Orthocladius*	0	0	0	0	0	0	0	0	0	0	0
Diptera	Chironomidae	Orthocladiinae	*Epoicocladius*	0	3	0	0	0	0	0	2	0	0	0
Diptera	Chironomidae	Orthocladiinae	*Heterotanytarsus*	0	2	0	0	0	0	0	0	0	0	0
Diptera	Chironomidae	Orthocladiinae	*Heterotrissocladius*	0	0	0	0	0	0	0	0	0	0	0
Diptera	Chironomidae	Orthocladiinae	*Paracladius*	0	0	0	0	0	0	0	0	0	0	0
Diptera	Chironomidae	Orthocladiinae	*Psectrocladius*	0	1	0	0	0	0	0	0	0	0	0
Diptera	Chironomidae	Diamesinae	*Potthastia longimana* group	0	4	0	0	6	0	0	0	0	0	0
Diptera	Chironomidae	Prodiamesinae	*Monodiamesa*	0	2	0	0	0	0	0	0	0	0	0
Terrestrial				0	0	0	0	0	0	0	0	0	0	0

Table A-8
Baseline Benthic Invertebrate Community Collected in September 2016
Number of Individuals per Taxonomic Unit and Reference Median

EcoMetrix - Denison Mine 2016				Large Lakes																								
				LA-1			LA-7			LA-7A			LA-8			LA-9			LB-3			LAB-1			LAB-2			
Major Taxon	Family	Subfamily/Tribe	Genus/Species	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3	Reference Median
Nematoda				0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	9	3	0	7	2	9	0.00
Microturbellaria				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0.00
Hirudinea	Erpobdellidae		*Erpobdella punctata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0.00
Oligochaeta	Naididae	Tubificinae		0	0	3	0	0	0	1	0	0	0	1	0	4	0	0	25	9	77	14	45	41	5	5	1	1.00
Oligochaeta	Naididae	Naidinae		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	20	3	0	0	0	0	0.00
Gastropoda	Lymnaeidae		(i/d)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.00
Gastropoda	Planorbidae		*Gyraulus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Gastropoda	Valvatidae		*Valvata sincera*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.00
Pelecypoda	Pisidiidae		(i/d)	0	2	0	3	1	1	0	0	0	0	1	0	0	0	1	6	51	12	34	21	14	13	32	40	1.00
Pelecypoda	Pisidiidae		*Pisidium*	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	2	17	12	13	6	4	5	6	14	0.50
Acari - Hydrachnidia			(i/d)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	1	0	0	0	0	0	0.00
Acari - Hydrachnidia	Arenuridae		*Arrenurus*	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0.00
Acari - Hydrachnidia	Hygrobaetidae		*Hygrobates*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	0	0.00
Acari - Hydrachnidia	Lebertiidae		*Lebertia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Acari - Hydrachnidia	Limnesiidae		*Limnesia*	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Acari - Hydrachnidia	Oxidae		*Oxus*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.00
Acari - Hydrachnidia	Pionidae		*Piona*	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	8	0	1	1	1	1	0	1	0.00
Acari - Hydrachnidia	Unionicolidae		*Unionicola*	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	1	1	2	1	0	1	0	0.00
Ostracoda				2	2	0	7	17	3	0	5	0	0	0	0	13	0	0	1	8	0	4	1	1	1	0	0	1.00
Copepoda-Cyclopoida				1	4	5	4	1	1	0	14	2	0	0	0	4	4	1	8	0	4	2	11	14	3	0	4	2.50
Cladocera	Holopedidae		*Holopedium gibberum*	18	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Cladocera	Chydoridae		-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Cladocera	Chydoridae		*Eurycercus*	1	0	0	1	3	6	0	0	0	0	1	0	0	0	0	0	8	0	0	0	0	3	0	0	0.00
Cladocera	Ilyocryptidae		*Ilyocryptus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.00
Cladocera	Macrothricidae			0	0	0	0	2	0	0	0	0	1	1	0	0	0	0	0	8	0	2	0	0	4	0	0	0.00
Cladocera	Polyphemidae		*Polyphemus pediculus*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Cladocera	Sididae		*Latona setifera*	1	0	0	2	0	0	0	4	1	0	0	0	0	0	0	2	0	0	0	1	0	2	0	0	0.00
Amphipoda	Gammaridae		*Gammarus lacustris*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Amphipoda	Hyalellidae		*Hyalella azteca*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Ephemeroptera	Baetiscidae		*Baetisca*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0.00
Ephemeroptera	Caenidae		*Caenis*	0	0	0	0	0	1	0	0	0	1	0	0	3	0	0	0	1	0	0	0	0	0	0	1	0.00
Ephemeroptera	Ephemeridae		*Ephemera*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	29	0.00
Ephemeroptera	Ephemeridae		*Hexagenia limbata*	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0.00
Trichoptera	Hydroptilidae		*Oxyethira*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Trichoptera	Lepidosomatidae		*Lepidostoma*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0.00
Trichoptera	Leptoceridae		*Mystacides*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0.00
Trichoptera	Leptoceridae		*Oecetis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0.00
Trichoptera	Molannidae		*Molannodes / Molanna*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0.00
Trichoptera	Phryganeidae		*Agrypnia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0.00

Table A-8
Baseline Benthic Invertebrate Community Collected in September 2016
Number of Individuals per Taxonomic Unit and Reference Median

EcoMetrix - Denison Mine 2016				Large Lakes																								
				LA-1			LA-7			LA-7A			LA-8			LA-9			LB-3			LAB-1			LAB-2			
Major Taxon	Family	Subfamily/Tribe	Genus/Species	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3	Reference Median
Megaloptera	Sialidae		*Sialis*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0.00
Diptera	Ceratopogonidae	Ceratopogoninae	*Bezzia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Diptera	Ceratopogonidae	Ceratopogoninae	*Probezzia*	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0.00
Diptera	Chaoboridae		*Chaoborus*	26	24	18	0	1	2	1	1	1	3	5	6	8	51	41	80	14	14	0	0	1	0	0	0	2.50
Diptera	Chironomidae - pupa			0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Diptera	Chironomidae	Chironomini	*Chironomus*	12	7	26	17	106	79	8	48	5	1	5	8	4	24	45	16	17	46	3	35	54	7	1	2	14.00
Diptera	Chironomidae	Chironomini	*Cladopelma*	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	6	9	0	32	3	9	0	0	0	0.00
Diptera	Chironomidae	Chironomini	*Cryptochironomus*	1	0	0	2	2	1	2	0	3	2	2	1	3	0	0	0	3	2	2	1	5	6	5	7	2.00
Diptera	Chironomidae	Chironomini	*Cryptotendipes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Diptera	Chironomidae	Chironomini	*Demicryptochironomus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Diptera	Chironomidae	Chironomini	*Dicrotendipes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	0	8	0	0	49	53	126	0.00
Diptera	Chironomidae	Chironomini	*Endochironomus*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Diptera	Chironomidae	Chironomini	*Microtendipes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0.00
Diptera	Chironomidae	Chironomini	*Nilothauma*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.00
Diptera	Chironomidae	Chironomini	*Parachironomus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0.00
Diptera	Chironomidae	Chironomini	*Paracladopelma*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.00
Diptera	Chironomidae	Chironomini	*Polypedilum*	0	7	0	9	25	49	8	2	20	10	31	18	5	0	0	15	18	3	34	3	14	1	0	1	7.50
Diptera	Chironomidae	Chironomini	*Stenochironomus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Diptera	Chironomidae	Chironomini	*Stictochironomus*	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	33	23	24	0.00
Diptera	Chironomidae	Chironomini	*Tribelos*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0.00
Diptera	Chironomidae	Pseudochironomini	*Pseudochironomus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	11	0.00
Diptera	Chironomidae	Tanypodinae	*Ablabesmyia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0.00
Diptera	Chironomidae	Tanypodinae	*Guttipelopia guttipennis*	0	0	0	0	0	0	0	0	0	1	1	0	0	0	3	2	0	0	0	1	0	0	0	0	0.00
Diptera	Chironomidae	Tanypodinae	*Procladius*	6	20	5	0	17	10	18	7	15	16	8	8	59	16	15	43	114	44	12	21	12	10	3	44	15.00
Diptera	Chironomidae	Tanypodinae	*Tanypus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0.00
Diptera	Chironomidae	Tanypodinae	*Thienemannimyia* gr.	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Diptera	Chironomidae	Tanytarsini	*Cladotanytarsus*	0	0	0	0	0	1	0	0	0	0	1	0	4	0	0	0	8	0	58	1	3	4	1	49	0.00
Diptera	Chironomidae	Tanytarsini	*Corynocera*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1286	3	0	0	0	0	0	0	0.00
Diptera	Chironomidae	Tanytarsini	*Neostempellina*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0.00
Diptera	Chironomidae	Tanytarsini	*Paratanytarsus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	16	0.00
Diptera	Chironomidae	Tanytarsini	*Tanytarsus*	2	4	1	0	0	0	0	0	1	1	0	0	15	0	1	2	140	5	106	12	18	23	21	336	1.50
Diptera	Chironomidae	Orthocladiinae	*Cricotopus/Orthocladius*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0.00
Diptera	Chironomidae	Orthocladiinae	*Epoicocladius*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Diptera	Chironomidae	Orthocladiinae	*Heterotanytarsus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0.00
Diptera	Chironomidae	Orthocladiinae	*Heterotrissocladius*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0.00
Diptera	Chironomidae	Orthocladiinae	*Paracladius*	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Diptera	Chironomidae	Orthocladiinae	*Psectrocladius*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	2	0	0.00
Diptera	Chironomidae	Diamesinae	*Potthastia longimana* group	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	3	1	0.00
Diptera	Chironomidae	Prodiamesinae	*Monodiamesa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Terrestrial				0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0.00

Table A-9
Baseline Benthic Invertebrate Community Collected in September 2016
Number of Individuals per Taxonomic Group

Major Taxon	Family	LA-1			LA-5					LA-6				
		#1	#2	#3	#1	#2	#3	#4	#5	#1	#2	#3	#4	#5
Total		1014	1043	886	10457	5271	9929	14086	8243	3171	11414	8514	19143	8571
Average		981			9597					10163				
Standard deviation		84			3223					5838				
Nematoda	Nematoda	0	0	0	14	0	71	0	0	43	0	57	114	0
Microturbellaria	Microturbellaria	0	0	0	14	0	0	0	14	0	0	0	0	0
Hirudinea	Erpobdellidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Oligochaeta	Naididae	0	0	43	114	29	0	0	57	0	0	186	343	0
Gastropoda	Lymnaeidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Planorbidae	0	0	0	0	0	0	0	57	0	0	0	0	0
Gastropoda	Valvatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Pelecypoda	Pisidiidae	0	29	0	214	543	86	43	1,071	29	357	114	143	229
Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0	0	0	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	Arenuridae	0	0	0	14	0	0	0	14	0	0	0	0	0
Acari - Hydrachnidia	Hygrobaetidae	0	0	0	0	14	0	0	171	0	14	71	0	29
Acari - Hydrachnidia	Lebertiidae	0	0	0	0	0	0	0	57	0	0	0	0	0
Acari - Hydrachnidia	Limnesiidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	Oxidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	Pionidae	0	0	0	0	71	14	0	0	0	0	0	86	0
Acari - Hydrachnidia	Unionicolidae	0	0	0	0	29	14	114	0	0	0	0	0	0
Ostracoda	Ostracoda	29	29	0	257	229	286	571	57	57	114	471	2,514	371
Copepoda-Cyclopoida	Copepoda-Cyclopoida	14	57	71	229	586	457	114	171	71	0	114	343	343
Cladocera	Holopedidae	257	14	57	0	0	0	0	0	0	0	0	0	0
Cladocera	Chydoridae	14	0	0	4,186	771	5,386	9,871	1,171	2,214	7,129	4,357	10,871	2,600
Cladocera	Ilyocryptidae	0	0	0	114	0	0	114	0	14	0	0	229	343
Cladocera	Macrothricidae	0	0	0	3,214	571	2,343	2,171	1,086	57	857	1,829	1,943	1,029
Cladocera	Polyphemidae	14	0	0	0	0	0	0	0	0	0	0	0	0
Cladocera	Sididae	14	0	0	0	0	57	0	114	14	0	114	0	0
Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	571	0
Amphipoda	Hyalellidae	0	0	0	0	0	0	0	14	0	0	0	0	14
Ephemeroptera	Baetiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Ephemeroptera	Caenidae	0	0	0	557	686	143	0	400	0	100	143	157	2,443
Ephemeroptera	Ephemeridae	0	14	0	0	271	0	0	271	0	14	43	14	0
Trichoptera	Hydroptilidae	0	14	0	0	0	0	0	0	0	0	0	0	0
Trichoptera	Lepidosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Trichoptera	Leptoceridae	0	0	0	0	0	0	0	57	0	0	0	0	14
Trichoptera	Molannidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Trichoptera	Phryganeidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Megaloptera	Sialidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	Ceratopogonidae	0	0	0	29	43	14	0	43	0	0	0	0	0
Diptera	Chaoboridae	371	343	257	0	0	0	0	0	0	0	0	0	0
Diptera	Chironomidae	300	543	457	1,500	1,429	1,057	1,086	3,414	671	2,829	1,014	1,814	1,157

Note:
Samples were collected between September 10 and 21, 2016

Table A-9
Baseline Benthic Invertebrate Community Collected in September 2016
Number of Individuals per Taxonomic Group

Major Taxon	Family	LA-7			LA-7A			LA-8			LA-9		
		#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3
Total		800	2529	2214	543	1171	686	557	843	614	1986	1386	1529
Average		1848			800			671			1633		
Standard deviation		921			330			151			313		
Nematoda	Nematoda	0	0	0	0	14	0	0	0	0	0	0	0
Microturbellaria	Microturbellaria	0	0	0	0	0	0	0	0	0	0	0	0
Hirudinea	Erpobdellidae	0	0	0	0	0	0	0	0	0	0	0	0
Oligochaeta	Naididae	0	0	0	14	0	0	0	14	0	57	0	0
Gastropoda	Lymnaeidae	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Planorbidae	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Valvatidae	0	0	0	0	0	0	0	0	0	0	0	0
Pelecypoda	Pisidiidae	43	29	14	0	0	0	0	14	14	14	0	14
Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0	0	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	Arenuridae	0	0	0	0	0	0	0	0	0	29	0	0
Acari - Hydrachnidia	Hygrobaetidae	0	0	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	Lebertiidae	0	0	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	Limnesiidae	0	14	0	0	0	0	0	0	14	0	0	0
Acari - Hydrachnidia	Oxidae	0	0	0	0	0	0	0	0	0	14	0	0
Acari - Hydrachnidia	Pionidae	0	0	0	0	0	0	0	0	0	57	0	0
Acari - Hydrachnidia	Unionicolidae	14	0	14	0	0	0	14	0	0	14	0	0
Ostracoda	Ostracoda	100	243	43	0	71	0	0	0	0	186	0	0
Copepoda-Cyclopoida	Copepoda-Cyclopoida	57	14	14	0	200	29	0	0	0	57	57	14
Cladocera	Holopedidae	0	0	0	0	0	0	0	0	0	0	0	0
Cladocera	Chydoridae	14	43	86	0	0	0	0	14	0	0	0	0
Cladocera	Ilyocryptidae	0	0	0	0	0	0	0	0	0	0	0	0
Cladocera	Macrothricidae	0	29	0	0	0	0	14	14	0	0	0	0
Cladocera	Polyphemidae	0	0	0	0	0	0	0	0	0	0	0	0
Cladocera	Sididae	29	0	0	0	57	14	0	0	0	0	0	0
Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	0
Amphipoda	Hyalellidae	0	0	0	0	0	0	0	0	0	0	0	0
Ephemeroptera	Baetiscidae	0	0	0	0	0	0	0	0	0	0	0	0
Ephemeroptera	Caenidae	0	0	14	0	0	0	14	0	0	43	0	0
Ephemeroptera	Ephemeridae	0	0	0	0	0	0	0	0	0	43	0	0
Trichoptera	Hydroptilidae	0	0	0	0	0	0	0	0	0	0	0	0
Trichoptera	Lepidosomatidae	0	0	0	0	0	0	0	0	0	0	0	0
Trichoptera	Leptoceridae	0	0	0	0	0	0	0	0	0	0	0	0
Trichoptera	Molannidae	0	0	0	0	0	0	0	0	0	0	0	0
Trichoptera	Phryganeidae	0	0	0	0	0	0	0	0	0	0	0	0
Megaloptera	Sialidae	0	0	0	0	0	0	0	0	0	14	0	0
Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0	0	29	0	0
Diptera	Chaoboridae	0	14	29	14	14	14	43	71	86	114	729	586
Diptera	Chironomidae	543	2,143	2,000	514	814	629	471	714	500	1,314	600	914

Note:
Samples were collected between September 10 and 21, 2016

Table A-9
Baseline Benthic Invertebrate Community Collected in September 2016
Number of Individuals per Taxonomic Group

Major Taxon	Family	LB-3			LAB-1			LAB-2		
		#1	#2	#3	#1	#2	#3	#1	#2	#3
Total		3029	25114	3229	5286	2471	2757	2729	2600	10557
Average			10457			3505			5295	
Standard deviation			12694			1549			4557	
Nematoda	Nematoda	0	0	0	129	43	0	100	29	129
Microturbellaria	Microturbellaria	0	0	0	0	0	14	0	0	0
Hirudinea	Erpobdellidae	0	0	0	14	0	0	0	0	0
Oligochaeta	Naididae	400	129	1,100	486	686	586	71	71	14
Gastropoda	Lymnaeidae	0	0	0	0	0	0	0	0	14
Gastropoda	Planorbidae	0	0	0	0	0	0	0	0	0
Gastropoda	Valvatidae	14	0	0	0	0	0	0	0	0
Pelecypoda	Pisidiidae	114	971	343	671	386	257	257	543	771
Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	0	114	0	14	0	0	0	0	0
Acari - Hydrachnidia	Arenuridae	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	Hygrobaetidae	0	0	0	0	0	0	29	57	0
Acari - Hydrachnidia	Lebertiidae	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	Limnesiidae	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	Oxidae	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	Pionidae	0	114	0	14	14	14	14	0	14
Acari - Hydrachnidia	Unionicolidae	0	0	14	14	29	14	0	14	0
Ostracoda	Ostracoda	14	114	0	57	14	14	14	0	0
Copepoda-Cyclopoida	Copepoda-Cyclopoida	114	0	57	29	157	200	43	0	57
Cladocera	Holopedidae	0	0	0	0	0	0	0	0	0
Cladocera	Chydoridae	0	114	0	0	0	0	43	0	0
Cladocera	Ilyocryptidae	0	0	0	0	14	0	0	0	0
Cladocera	Macrothricidae	0	114	0	29	0	0	57	0	0
Cladocera	Polyphemidae	0	0	0	0	0	0	0	0	0
Cladocera	Sididae	29	0	0	0	14	0	29	0	0
Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0
Amphipoda	Hyalellidae	0	0	0	0	0	0	0	0	0
Ephemeroptera	Baetiscidae	0	0	0	0	0	0	0	14	0
Ephemeroptera	Caenidae	0	14	0	0	0	0	0	0	14
Ephemeroptera	Ephemeridae	0	0	0	0	0	0	0	100	429
Trichoptera	Hydroptilidae	0	0	0	0	0	0	0	0	0
Trichoptera	Lepidosomatidae	0	0	0	0	0	0	14	0	0
Trichoptera	Leptoceridae	0	0	0	0	0	0	29	29	71
Trichoptera	Molannidae	0	0	0	14	0	0	29	0	0
Trichoptera	Phryganeidae	0	0	0	0	0	0	14	0	0
Megaloptera	Sialidae	0	0	14	0	0	0	0	0	0
Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0	29
Diptera	Chaoboridae	1,143	200	200	0	0	14	0	0	0
Diptera	Chironomidae	1,200	23,229	1,500	3,814	1,114	1,643	1,986	1,743	9,014

Note:
Samples were collected between September 10 and 21, 2016

Table A-10
Baseline Benthic Invertebrate Community Collected in September 2016
Percent Abundance per Taxonomic Group

		LA-1			LA-5				
Major Taxon	**Family**	**#1**	**#2**	**#3**	**#1**	**#2**	**#3**	**#4**	**#5**
Total		**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Nematoda	Nematoda	-	-	-	0.1%	-	0.7%	-	-
Microturbellaria	Microturbellaria	-	-	-	0.1%	-	-	-	0.2%
Hirudinea	Erpobdellidae	-	-	-	-	-	-	-	-
Oligochaeta	Naididae	-	-	4.8%	1.1%	0.5%	-	-	0.7%
Gastropoda	Lymnaeidae	-	-	-	-	-	-	-	-
Gastropoda	Planorbidae	-	-	-	-	-	-	-	0.7%
Gastropoda	Valvatidae	-	-	-	-	-	-	-	-
Pelecypoda	Pisidiidae	-	2.7%	-	2.0%	10.3%	0.9%	0.3%	13.0%
Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	-	-	-	-	-	-	-	-
Acari - Hydrachnidia	Arenuridae	-	-	-	0.1%	-	-	-	0.2%
Acari - Hydrachnidia	Hygrobaetidae	-	-	-	-	0.3%	-	-	2.1%
Acari - Hydrachnidia	Lebertiidae	-	-	-	-	-	-	-	0.7%
Acari - Hydrachnidia	Limnesiidae	-	-	-	-	-	-	-	-
Acari - Hydrachnidia	Oxidae	-	-	-	-	-	-	-	-
Acari - Hydrachnidia	Pionidae	-	-	-	-	1.4%	0.1%	-	-
Acari - Hydrachnidia	Unionicolidae	-	-	-	-	0.5%	0.1%	0.8%	-
Ostracoda	Ostracoda	2.8%	2.7%	-	2.5%	4.3%	2.9%	4.1%	0.7%
Copepoda-Cyclopoida	Copepoda-Cyclopoida	1.4%	5.5%	8.1%	2.2%	11.1%	4.6%	0.8%	2.1%
Cladocera	Holopedidae	25.4%	1.4%	6.5%	-	-	-	-	-
Cladocera	Chydoridae	1.4%	-	-	40.0%	14.6%	54.2%	70.1%	14.2%
Cladocera	Ilyocryptidae	-	-	-	1.1%	-	-	0.8%	-
Cladocera	Macrothricidae	-	-	-	30.7%	10.8%	23.6%	15.4%	13.2%
Cladocera	Polyphemidae	1.4%	-	-	-	-	-	-	-
Cladocera	Sididae	1.4%	-	-	-	-	0.6%	-	1.4%
Amphipoda	Gammaridae	-	-	-	-	-	-	-	-
Amphipoda	Hyalellidae	-	-	-	-	-	-	-	0.2%
Ephemeroptera	Baetiscidae	-	-	-	-	-	-	-	-
Ephemeroptera	Caenidae	-	-	-	5.3%	13.0%	1.4%	-	4.9%
Ephemeroptera	Ephemeridae	-	1.4%	-	-	5.1%	-	-	3.3%
Trichoptera	Hydroptilidae	-	1.4%	-	-	-	-	-	-
Trichoptera	Lepidosomatidae	-	-	-	-	-	-	-	-
Trichoptera	Leptoceridae	-	-	-	-	-	-	-	0.7%
Trichoptera	Molannidae	-	-	-	-	-	-	-	-
Trichoptera	Phryganeidae	-	-	-	-	-	-	-	-
Megaloptera	Sialidae	-	-	-	-	-	-	-	-
Diptera	Ceratopogonidae	-	-	-	0.3%	0.8%	0.1%	-	0.5%
Diptera	Chaoboridae	36.6%	32.9%	29.0%	-	-	-	-	-
Diptera	Chironomidae	29.6%	52.1%	51.6%	14.3%	27.1%	10.6%	7.7%	41.4%

Note:
Samples were collected between September 10 and 21, 2016

Table A-10
Baseline Benthic Invertebrate Community Collected in September 2016
Percent Abundance per Taxonomic Group

		LA-6					LA-7		
Major Taxon	**Family**	**#1**	**#2**	**#3**	**#4**	**#5**	**#1**	**#2**	**#3**
Total		**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Nematoda	Nematoda	1.4%	-	0.7%	0.6%	-	-	-	-
Microturbellaria	Microturbellaria	-	-	-	-	-	-	-	-
Hirudinea	Erpobdellidae	-	-	-	-	-	-	-	-
Oligochaeta	Naididae	-	-	2.2%	1.8%	-	-	-	-
Gastropoda	Lymnaeidae	-	-	-	-	-	-	-	-
Gastropoda	Planorbidae	-	-	-	-	-	-	-	-
Gastropoda	Valvatidae	-	-	-	-	-	-	-	-
Pelecypoda	Pisidiidae	0.9%	3.1%	1.3%	0.7%	2.7%	5.4%	1.1%	0.6%
Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	-	-	-	-	-	-	-	-
Acari - Hydrachnidia	Arenuridae	-	-	-	-	-	-	-	-
Acari - Hydrachnidia	Hygrobaetidae	-	0.1%	0.8%	-	0.3%	-	-	-
Acari - Hydrachnidia	Lebertiidae	-	-	-	-	-	-	-	-
Acari - Hydrachnidia	Limnesiidae	-	-	-	-	-	-	0.6%	-
Acari - Hydrachnidia	Oxidae	-	-	-	-	-	-	-	-
Acari - Hydrachnidia	Pionidae	-	-	-	0.4%	-	-	-	-
Acari - Hydrachnidia	Unionicolidae	-	-	-	-	-	1.8%	-	0.6%
Ostracoda	Ostracoda	1.8%	1.0%	5.5%	13.1%	4.3%	12.5%	9.6%	1.9%
Copepoda-Cyclopoida	Copepoda-Cyclopoida	2.3%	-	1.3%	1.8%	4.0%	7.1%	0.6%	0.6%
Cladocera	Holopedidae	-	-	-	-	-	-	-	-
Cladocera	Chydoridae	69.8%	62.5%	51.2%	56.8%	30.3%	1.8%	1.7%	3.9%
Cladocera	Ilyocryptidae	0.5%	-	-	1.2%	4.0%	-	-	-
Cladocera	Macrothricidae	1.8%	7.5%	21.5%	10.1%	12.0%	-	1.1%	-
Cladocera	Polyphemidae	-	-	-	-	-	-	-	-
Cladocera	Sididae	0.5%	-	1.3%	-	-	3.6%	-	-
Amphipoda	Gammaridae	-	-	-	3.0%	-	-	-	-
Amphipoda	Hyalellidae	-	-	-	-	0.2%	-	-	-
Ephemeroptera	Baetiscidae	-	-	-	-	-	-	-	-
Ephemeroptera	Caenidae	-	0.9%	1.7%	0.8%	28.5%	-	-	0.6%
Ephemeroptera	Ephemeridae	-	0.1%	0.5%	0.1%	-	-	-	-
Trichoptera	Hydroptilidae	-	-	-	-	-	-	-	-
Trichoptera	Lepidosomatidae	-	-	-	-	-	-	-	-
Trichoptera	Leptoceridae	-	-	-	-	0.2%	-	-	-
Trichoptera	Molannidae	-	-	-	-	-	-	-	-
Trichoptera	Phryganeidae	-	-	-	-	-	-	-	-
Megaloptera	Sialidae	-	-	-	-	-	-	-	-
Diptera	Ceratopogonidae	-	-	-	-	-	-	-	-
Diptera	Chaoboridae	-	-	-	-	-	-	0.6%	1.3%
Diptera	Chironomidae	21.2%	24.8%	11.9%	9.5%	13.5%	67.9%	84.7%	90.3%

Note:

Samples were collected between September 10 and 21, 2016

Table A-10
Baseline Benthic Invertebrate Community Collected in September 2016
Percent Abundance per Taxonomic Group

		LA-7A			LA-8			LA-9		
Major Taxon	**Family**	**#1**	**#2**	**#3**	**#1**	**#2**	**#3**	**#1**	**#2**	**#3**
Total		**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Nematoda	Nematoda	-	1.2%	-	-	-	-	-	-	-
Microturbellaria	Microturbellaria	-	-	-	-	-	-	-	-	-
Hirudinea	Erpobdellidae	-	-	-	-	-	-	-	-	-
Oligochaeta	Naididae	2.6%	-	-	-	1.7%	-	2.9%	-	-
Gastropoda	Lymnaeidae	-	-	-	-	-	-	-	-	-
Gastropoda	Planorbidae	-	-	-	-	-	-	-	-	-
Gastropoda	Valvatidae	-	-	-	-	-	-	-	-	-
Pelecypoda	Pisidiidae	-	-	-	-	1.7%	2.3%	0.7%	-	0.9%
Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	-	-	-	-	-	-	-	-	-
Acari - Hydrachnidia	Arenuridae	-	-	-	-	-	-	1.4%	-	-
Acari - Hydrachnidia	Hygrobaetidae	-	-	-	-	-	-	-	-	-
Acari - Hydrachnidia	Lebertiidae	-	-	-	-	-	-	-	-	-
Acari - Hydrachnidia	Limnesiidae	-	-	-	-	-	2.3%	-	-	-
Acari - Hydrachnidia	Oxidae	-	-	-	-	-	-	0.7%	-	-
Acari - Hydrachnidia	Pionidae	-	-	-	-	-	-	2.9%	-	-
Acari - Hydrachnidia	Unionicolidae	-	-	-	2.6%	-	-	0.7%	-	-
Ostracoda	Ostracoda	-	6.1%	-	-	-	-	9.4%	-	-
Copepoda-Cyclopoida	Copepoda-Cyclopoida	-	17.1%	4.2%	-	-	-	2.9%	4.1%	0.9%
Cladocera	Holopedidae	-	-	-	-	-	-	-	-	-
Cladocera	Chydoridae	-	-	-	-	1.7%	-	-	-	-
Cladocera	Ilyocryptidae	-	-	-	-	-	-	-	-	-
Cladocera	Macrothricidae	-	-	-	2.6%	1.7%	-	-	-	-
Cladocera	Polyphemidae	-	-	-	-	-	-	-	-	-
Cladocera	Sididae	-	4.9%	2.1%	-	-	-	-	-	-
Amphipoda	Gammaridae	-	-	-	-	-	-	-	-	-
Amphipoda	Hyalellidae	-	-	-	-	-	-	-	-	-
Ephemeroptera	Baetiscidae	-	-	-	-	-	-	-	-	-
Ephemeroptera	Caenidae	-	-	-	2.6%	-	-	2.2%	-	-
Ephemeroptera	Ephemeridae	-	-	-	-	-	-	2.2%	-	-
Trichoptera	Hydroptilidae	-	-	-	-	-	-	-	-	-
Trichoptera	Lepidosomatidae	-	-	-	-	-	-	-	-	-
Trichoptera	Leptoceridae	-	-	-	-	-	-	-	-	-
Trichoptera	Molannidae	-	-	-	-	-	-	-	-	-
Trichoptera	Phryganeidae	-	-	-	-	-	-	-	-	-
Megaloptera	Sialidae	-	-	-	-	-	-	0.7%	-	-
Diptera	Ceratopogonidae	-	-	-	-	-	-	1.4%	-	-
Diptera	Chaoboridae	2.6%	1.2%	2.1%	7.7%	8.5%	14.0%	5.8%	52.6%	38.3%
Diptera	Chironomidae	94.7%	69.5%	91.7%	84.6%	84.7%	81.4%	66.2%	43.3%	59.8%

Note:
Samples were collected between September 10 and 21, 2016

Table A-10
Baseline Benthic Invertebrate Community Collected in September 2016
Percent Abundance per Taxonomic Group

		LB-3			LAB-1			LAB-2		
Major Taxon	**Family**	**#1**	**#2**	**#3**	**#1**	**#2**	**#3**	**#1**	**#2**	**#3**
Total		**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Nematoda	Nematoda	-	-	-	2.4%	1.7%	-	3.7%	1.1%	1.2%
Microturbellaria	Microturbellaria	-	-	-	-	-	0.5%	-	-	-
Hirudinea	Erpobdellidae	-	-	-	0.3%	-	-	-	-	-
Oligochaeta	Naididae	13.2%	0.5%	34.1%	9.2%	27.7%	21.2%	2.6%	2.7%	0.1%
Gastropoda	Lymnaeidae	-	-	-	-	-	-	-	-	0.1%
Gastropoda	Planorbidae	-	-	-	-	-	-	-	-	-
Gastropoda	Valvatidae	0.5%	-	-	-	-	-	-	-	-
Pelecypoda	Pisidiidae	3.8%	3.9%	10.6%	12.7%	15.6%	9.3%	9.4%	20.9%	7.3%
Acari - Hydrachnidia	Acari - Hydrachnidia (immature)	-	0.5%	-	0.3%	-	-	-	-	-
Acari - Hydrachnidia	Arenuridae	-	-	-	-	-	-	-	-	-
Acari - Hydrachnidia	Hygrobaetidae	-	-	-	-	-	-	1.0%	2.2%	-
Acari - Hydrachnidia	Lebertiidae	-	-	-	-	-	-	-	-	-
Acari - Hydrachnidia	Limnesiidae	-	-	-	-	-	-	-	-	-
Acari - Hydrachnidia	Oxidae	-	-	-	-	-	-	-	-	-
Acari - Hydrachnidia	Pionidae	-	0.5%	-	0.3%	0.6%	0.5%	0.5%	-	0.1%
Acari - Hydrachnidia	Unionicolidae	-	-	0.4%	0.3%	1.2%	0.5%	-	0.5%	-
Ostracoda	Ostracoda	0.5%	0.5%	-	1.1%	0.6%	0.5%	0.5%	-	-
Copepoda-Cyclopoida	Copepoda-Cyclopoida	3.8%	-	1.8%	0.5%	6.4%	7.3%	1.6%	-	0.5%
Cladocera	Holopedidae	-	-	-	-	-	-	-	-	-
Cladocera	Chydoridae	-	0.5%	-	-	-	-	1.6%	-	-
Cladocera	Ilyocryptidae	-	-	-	-	0.6%	-	-	-	-
Cladocera	Macrothricidae	-	0.5%	-	0.5%	-	-	2.1%	-	-
Cladocera	Polyphemidae	-	-	-	-	-	-	-	-	-
Cladocera	Sididae	0.9%	-	-	-	0.6%	-	1.0%	-	-
Amphipoda	Gammaridae	-	-	-	-	-	-	-	-	-
Amphipoda	Hyalellidae	-	-	-	-	-	-	-	-	-
Ephemeroptera	Baetiscidae	-	-	-	-	-	-	-	0.5%	-
Ephemeroptera	Caenidae	-	0.1%	-	-	-	-	-	-	0.1%
Ephemeroptera	Ephemeridae	-	-	-	-	-	-	-	3.8%	4.1%
Trichoptera	Hydroptilidae	-	-	-	-	-	-	-	-	-
Trichoptera	Lepidosomatidae	-	-	-	-	-	-	0.5%	-	-
Trichoptera	Leptoceridae	-	-	-	-	-	-	1.0%	1.1%	0.7%
Trichoptera	Molannidae	-	-	-	0.3%	-	-	1.0%	-	-
Trichoptera	Phryganeidae	-	-	-	-	-	-	0.5%	-	-
Megaloptera	Sialidae	-	-	0.4%	-	-	-	-	-	-
Diptera	Ceratopogonidae	-	-	-	-	-	-	-	-	0.3%
Diptera	Chaoboridae	37.7%	0.8%	6.2%	-	-	0.5%	-	-	-
Diptera	Chironomidae	39.6%	92.5%	46.5%	72.2%	45.1%	59.6%	72.8%	67.0%	85.4%

Note:
Samples were collected between September 10 and 21, 2016

Table A-11
Baseline Benthic Invertebrate Community Collected in September 2016
Feeding Groups Summary

Metric	Feeding Group		LA-1				LA-5					
			#1	#2	#3	Average	#1	#2	#3	#4	#5	Average
Density (individuals/m^3)			1,014	1,043	886	981	10,457	5,271	9,929	14,086	8,243	9,597
Taxa Richness			11	10	7	9.3	22	27	18	10	29	21
Simpson's Evenness			0.38	0.43	0.51	0.44	0.16	0.40	0.15	0.17	0.27	0.23
Simpson's Diversity			0.76	0.79	0.72	0.76	0.74	0.91	0.64	0.48	0.88	0.73
Bray-Curtis Dissimilarity			0.58	0.38	0.53	0.50	0.20	0.59	0.19	0.40	0.57	0.39
	Feeding Group											
Number of Individuals	Collector-Filterer	CF	343	129	143	205	8357	2286	8571	12271	2943	6886
	Collector-Gatherer	CG	200	186	414	267	1214	2586	886	1343	4157	2037
	Omnivore	OMN	0	0	0	0	0	0	0	0	0	0
	Predator	PRED	471	629	329	476	614	343	471	457	814	540
	Scraper	SCR	0	0	0	0	0	0	0	0	57	11
	Shredder	SHR	0	100	0	33	271	57	0	14	271	123
	Total		1014	1043	886	981	10457	5271	9929	14086	8243	9597
Relative Abundance	Collector-Filterer	CF	34%	12%	16%	21%	80%	43%	86%	87%	36%	66%
	Collector-Gatherer	CG	20%	18%	47%	28%	12%	49%	9%	10%	50%	26%
	Omnivore	OMN	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Predator	PRED	46%	60%	37%	48%	6%	7%	5%	3%	10%	6%
	Scraper	SCR	0%	0%	0%	0%	0%	0%	0%	0%	0.69%	0.14%
	Shredder	SHR	0%	10%	0%	3%	3%	1%	0%	0%	3%	1%
	Total		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Major Taxon	**Genus/Species/Feeding Group**											
Nematoda		PRED	0	0	0	0	14	0	71	0	0	17
Microturbellaria		PRED	0	0	0	0	14	0	0	0	14	6
Hirudinea	*Erpobdella punctata*	PRED	0	0	0	0	0	0	0	0	0	0
Oligochaeta		CG	0	0	43	14	0	29	0	0	57	17
Oligochaeta		CG	0	0	0	0	114	0	0	0	0	23
Gastropoda	(i/d)	SCR	0	0	0	0	0	0	0	0	0	0
Gastropoda	*Gyraulus*	SCR	0	0	0	0	0	0	0	0	57	11
Gastropoda	*Valvata sincera*	SCR	0	0	0	0	0	0	0	0	0	0
Pelecypoda	(i/d)	CG	0	29	0	10	114	400	86	43	1,029	334
Pelecypoda	*Pisidium*	CG	0	0	0	0	100	143	0	0	43	57
Acari - Hydrachnidia	(i/d)	PRED	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	*Arrenurus*	PRED	0	0	0	0	14	0	0	0	14	6
Acari - Hydrachnidia	*Hygrobates*	PRED	0	0	0	0	0	14	0	0	171	37
Acari - Hydrachnidia	*Lebertia*	PRED	0	0	0	0	0	0	0	0	57	11
Acari - Hydrachnidia	*Limnesia*	PRED	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	*Oxus*	PRED	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	*Piona*	PRED	0	0	0	0	0	71	14	0	0	17
Acari - Hydrachnidia	*Unionicola*	PRED	0	0	0	0	0	29	14	114	0	31
Ostracoda		CG	29	29	0	19	257	229	286	571	57	280
Copepoda-Cyclopoida		CF	14	57	71	48	229	586	457	114	171	311
Cladocera	*Holopedium gibberum*	CF	257	14	57	110	0	0	0	0	0	0
Cladocera	-	CF	0	0	0	0	0	0	0	0	0	0
Cladocera	*Eurycercus*	CF	14	0	0	5	4,186	771	5,386	9,871	1,171	4,277
Cladocera	*Ilyocryptus*	CF	0	0	0	0	114	0	0	114	0	46
Cladocera		CF	0	0	0	0	3,214	571	2,343	2,171	1,086	1,877
Cladocera	*Polyphemus pediculus*	CF	14	0	0	5	0	0	0	0	0	0
Cladocera	*Latona setifera*	CF	14	0	0	5	0	0	57	0	114	34
Amphipoda	*Gammarus lacustris*	CG	0	0	0	0	0	0	0	0	0	0
Amphipoda	*Hyalella azteca*	CG	0	0	0	0	0	0	0	0	14	3
Ephemeroptera	*Baetisca*	CG	0	0	0	0	0	0	0	0	0	0
Ephemeroptera	*Caenis*	CG	0	0	0	0	557	686	143	0	400	357
Ephemeroptera	*Ephemera*	CG	0	14	0	5	0	0	0	0	271	54
Ephemeroptera	*Hexagenia limbata*	CG	0	0	0	0	0	271	0	0	0	54
Trichoptera	*Oxyethira*	CG	0	14	0	5	0	0	0	0	0	0
Trichoptera	*Lepidostoma*	SHR	0	0	0	0	0	0	0	0	0	0
Trichoptera	*Mystacides*	CG	0	0	0	0	0	0	0	0	57	11
Trichoptera	*Oecetis*	PRED	0	0	0	0	0	0	0	0	0	0
Trichoptera	*Molannodes / Molanna*	SCR	0	0	0	0	0	0	0	0	0	0
Trichoptera	*Agrypnia*	SHR	0	0	0	0	0	0	0	0	0	0
Megaloptera	*Sialis*	PRED	0	0	0	0	0	0	0	0	0	0
Diptera	*Bezzia*	PRED	0	0	0	0	0	14	0	0	0	3
Diptera	*Probezzia*	PRED	0	0	0	0	29	29	14	0	43	23
Diptera	*Chaoborus*	PRED	371	343	257	324	0	0	0	0	0	0
Diptera	*Chironomus*	CG	171	100	371	214	43	0	271	729	0	209
Diptera	*Cladopelma*	CG	0	0	0	0	0	0	29	0	57	17
Diptera	*Cryptochironomus*	PRED	14	0	0	5	114	43	143	300	286	177
Diptera	*Cryptotendipes*	CG	0	0	0	0	14	0	0	0	0	3
Diptera	*Demicryptochironomus*	CG	0	0	0	0	0	43	0	0	14	11
Diptera	*Dicrotendipes*	CG	0	0	0	0	14	0	0	0	0	3
Diptera	*Endochironomus*	SHR	0	0	0	0	29	57	0	0	271	71
Diptera	*Microtendipes*	CF	0	0	0	0	0	0	0	0	0	0
Diptera	*Nilothauma*	CG	0	0	0	0	0	86	0	0	0	17
Diptera	*Parachironomus*	PRED	0	0	0	0	14	29	0	0	57	20
Diptera	*Paracladopelma*	CG	0	0	0	0	0	0	0	0	57	11
Diptera	*Polypedilum*	SHR	0	100	0	33	243	0	0	14	0	51
Diptera	*Stenochironomus*	CG	0	0	0	0	0	0	14	0	0	3
Diptera	*Stictochironomus*	CG	0	0	0	0	0	529	57	0	2,014	520
Diptera	*Tribelos*	CG	0	0	0	0	0	0	0	0	0	0
Diptera	*Pseudochironomus*	CG	0	0	0	0	0	0	0	0	0	0
Diptera	*Ablabesmyia*	PRED	0	0	0	0	0	0	0	0	57	11
Diptera	*Guttipelopia guttipennis*	PRED	0	0	0	0	0	0	0	0	0	0
Diptera	*Procladius*	PRED	86	286	71	148	414	114	214	43	114	180
Diptera	*Tanypus*	PRED	0	0	0	0	0	0	0	0	0	0
Diptera	*Thienemannimyia* gr.	PRED	0	0	0	0	0	0	0	0	0	0
Diptera	*Cladotanytarsus*	CF	0	0	0	0	29	14	186	0	14	49
Diptera	*Corynocera*	CF	0	0	0	0	0	0	0	0	0	0
Diptera	*Neostempellina*	CF	0	0	0	0	0	0	0	0	0	0
Diptera	*Paratanytarsus*	CF	0	0	0	0	0	0	0	0	0	0
Diptera	*Tanytarsus*	CF	29	57	14	33	586	343	143	0	386	291
Diptera	*Cricotopus/Orthocladius*	CG	0	0	0	0	0	0	0	0	0	0
Diptera	*Epoicocladius*	CG	0	0	0	0	0	43	0	0	0	9
Diptera	*Heterotanytarsus*	CG	0	0	0	0	0	29	0	0	0	6
Diptera	*Heterotrissocladius*	CG	0	0	0	0	0	0	0	0	0	0
Diptera	*Paracladius*	CG	0	0	0	0	0	0	0	0	0	0
Diptera	*Psectrocladius*	CG	0	0	0	0	0	14	0	0	0	3
Diptera	*Potthastia longimana* group	CG	0	0	0	0	0	57	0	0	86	29
Diptera	*Monodiamesa*	CG	0	0	0	0	0	29	0	0	0	6

Note:
Samples were collected between September 10 and 21, 2016

Table A-11
Baseline Benthic Invertebrate Community Collected in September 2016
Feeding Groups Summary

Metric	Feeding Group		LA-6 #1	LA-6 #2	LA-6 #3	LA-6 #4	LA-6 #5	LA-6 Average	LA-7 #1	LA-7 #2	LA-7 #3	LA-7 Average
Density (individuals/m^3)			3,171	11,414	8,514	19,143	8,571	10,163	786	2,529	2,214	1,843
Taxa Richness			14	15	21	16	20	17	10	11	11	11
Simpson's Evenness			0.13	0.15	0.15	0.17	0.28	0.18	0.51	0.21	0.23	0.32
Simpson's Diversity			0.50	0.59	0.70	0.64	0.83	0.65	0.84	0.60	0.63	0.69
Bray-Curtis Dissimilarity			0.44	0.34	0.13	0.47	0.44	0.37	0.46	0.62	0.63	0.57
	Feeding Group											
Number of Individuals	Collector-Filterer	CF	2643	8471	7000	15014	4686	7563	100	86	114	100
	Collector-Gatherer	CG	357	2314	1114	3743	3314	2169	429	1786	1200	1138
	Omnivore	OMN	0	0	0	0	0	0	0	0	0	0
	Predator	PRED	157	400	386	386	514	369	129	300	200	210
	Scraper	SCR	0	0	0	0	0	0	0	0	0	0
	Shredder	SHR	14	229	14	0	57	63	129	357	700	395
	Total		3171	11414	8514	19143	8571	10163	786	2529	2214	1843
Relative Abundance	Collector-Filterer	CF	83%	74%	82%	78%	55%	75%	13%	3%	5%	7%
	Collector-Gatherer	CG	11%	20%	13%	20%	39%	21%	55%	71%	54%	60%
	Omnivore	OMN	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Predator	PRED	5%	4%	5%	2%	6%	4%	16%	12%	9%	12%
	Scraper	SCR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Shredder	SHR	0%	2%	0%	0%	1%	1%	16%	14%	32%	21%
	Total		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Major Taxon	**Genus/Species/Feeding Group**											
Nematoda		PRED	43	0	57	114	0	43	0	0	0	0
Microturbellaria		PRED	0	0	0	0	0	0	0	0	0	0
Hirudinea	*Erpobdella punctata*	PRED	0	0	0	0	0	0	0	0	0	0
Oligochaeta		CG	0	0	14	0	0	3	0	0	0	0
Oligochaeta		CG	0	0	171	343	0	103	0	0	0	0
Gastropoda	(i/d)	SCR	0	0	0	0	0	0	0	0	0	0
Gastropoda	*Gyraulus*	SCR	0	0	0	0	0	0	0	0	0	0
Gastropoda	*Valvata sincera*	SCR	0	0	0	0	0	0	0	0	0	0
Pelecypoda	(i/d)	CG	29	314	29	57	143	114	43	14	14	24
Pelecypoda	*Pisidium*	CG	0	43	86	86	86	60	0	14	0	5
Acari - Hydrachnidia	(i/d)	PRED	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	*Arrenurus*	PRED	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	*Hygrobates*	PRED	0	14	71	0	29	23	0	0	0	0
Acari - Hydrachnidia	*Lebertia*	PRED	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	*Limnesia*	PRED	0	0	0	0	0	0	0	14	0	5
Acari - Hydrachnidia	*Oxus*	PRED	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	*Piona*	PRED	0	0	0	86	0	17	0	0	0	0
Acari - Hydrachnidia	*Unionicola*	PRED	0	0	0	0	0	0	14	0	14	10
Ostracoda		CG	57	114	471	2,514	371	706	100	243	43	129
Copepoda-Cyclopoida		CF	71	0	114	343	343	174	57	14	14	29
Cladocera	*Holopedium gibberum*	CF	0	0	0	0	0	0	0	0	0	0
Cladocera	-	CF	0	114	114	0	457	137	0	0	0	0
Cladocera	*Eurycercus*	CF	2,214	7,014	4,243	10,871	2,143	5,297	14	43	86	48
Cladocera	*Ilyocryptus*	CF	14	0	0	229	343	117	0	0	0	0
Cladocera		CF	57	857	1,829	1,943	1,029	1,143	0	29	0	10
Cladocera	*Polyphemus pediculus*	CF	0	0	0	0	0	0	0	0	0	0
Cladocera	*Latona setifera*	CF	14	0	114	0	0	26	29	0	0	10
Amphipoda	*Gammarus lacustris*	CG	0	0	0	571	0	114	0	0	0	0
Amphipoda	*Hyalella azteca*	CG	0	0	0	0	14	3	0	0	0	0
Ephemeroptera	*Baetisca*	CG	0	0	0	0	0	0	0	0	0	0
Ephemeroptera	*Caenis*	CG	0	100	143	157	2,443	569	0	0	14	5
Ephemeroptera	*Ephemera*	CG	0	14	43	14	0	14	0	0	0	0
Ephemeroptera	*Hexagenia limbata*	CG	0	0	0	0	0	0	0	0	0	0
Trichoptera	*Oxyethira*	CG	0	0	0	0	0	0	0	0	0	0
Trichoptera	*Lepidostoma*	SHR	0	0	0	0	0	0	0	0	0	0
Trichoptera	*Mystacides*	CG	0	0	0	0	0	0	0	0	0	0
Trichoptera	*Oecetis*	PRED	0	0	0	0	14	3	0	0	0	0
Trichoptera	*Molannodes / Molanna*	SCR	0	0	0	0	0	0	0	0	0	0
Trichoptera	*Agrypnia*	SHR	0	0	0	0	0	0	0	0	0	0
Megaloptera	*Sialis*	PRED	0	0	0	0	0	0	0	0	0	0
Diptera	*Bezzia*	PRED	0	0	0	0	0	0	0	0	0	0
Diptera	*Probezzia*	PRED	0	0	0	0	0	0	0	0	0	0
Diptera	*Chaoborus*	PRED	0	0	0	0	0	0	0	14	29	14
Diptera	*Chironomus*	CG	257	1,729	57	0	86	426	243	1,514	1,129	962
Diptera	*Cladopelma*	CG	0	0	71	0	14	17	0	0	0	0
Diptera	*Cryptochironomus*	PRED	29	129	100	143	200	120	29	29	14	24
Diptera	*Cryptotendipes*	CG	0	0	0	0	0	0	0	0	0	0
Diptera	*Demicryptochironomus*	CG	0	0	0	0	0	0	0	0	0	0
Diptera	*Dicrotendipes*	CG	0	0	0	0	129	26	0	0	0	0
Diptera	*Endochironomus*	SHR	0	0	0	0	0	0	0	0	0	0
Diptera	*Microtendipes*	CF	0	0	0	0	0	0	0	0	0	0
Diptera	*Nilothauma*	CG	0	0	0	0	0	0	0	0	0	0
Diptera	*Parachironomus*	PRED	0	0	0	0	0	0	0	0	0	0
Diptera	*Paracladopelma*	CG	0	0	0	0	0	0	0	0	0	0
Diptera	*Polypedilum*	SHR	14	229	14	0	57	63	129	357	700	395
Diptera	*Stenochironomus*	CG	0	0	0	0	0	0	0	0	0	0
Diptera	*Stictochironomus*	CG	14	0	0	0	0	3	14	0	0	5
Diptera	*Tribelos*	CG	0	0	0	0	29	6	0	0	0	0
Diptera	*Pseudochironomus*	CG	0	0	0	0	0	0	0	0	0	0
Diptera	*Ablabesmyia*	PRED	0	0	0	0	0	0	0	0	0	0
Diptera	*Guttipelopia guttipennis*	PRED	0	57	0	0	0	11	0	0	0	0
Diptera	*Procladius*	PRED	86	200	157	43	271	151	0	243	143	129
Diptera	*Tanypus*	PRED	0	0	0	0	0	0	0	0	0	0
Diptera	*Thienemannimyia* gr.	PRED	0	0	0	0	0	0	86	0	0	29
Diptera	*Cladotanytarsus*	CF	71	57	471	929	357	377	0	0	14	5
Diptera	*Corynocera*	CF	0	0	0	0	0	0	0	0	0	0
Diptera	*Neostempellina*	CF	0	0	0	0	0	0	0	0	0	0
Diptera	*Paratanytarsus*	CF	0	0	0	0	0	0	0	0	0	0
Diptera	*Tanytarsus*	CF	200	429	114	700	14	291	0	0	0	0
Diptera	*Cricotopus/Orthocladius*	CG	0	0	0	0	0	0	0	0	0	0
Diptera	*Epoicocladius*	CG	0	0	29	0	0	6	0	0	0	0
Diptera	*Heterotanytarsus*	CG	0	0	0	0	0	0	0	0	0	0
Diptera	*Heterotrissocladius*	CG	0	0	0	0	0	0	0	0	0	0
Diptera	*Paracladius*	CG	0	0	0	0	0	0	29	0	0	10
Diptera	*Psectrocladius*	CG	0	0	0	0	0	0	0	0	0	0
Diptera	*Potthastia longimana* group	CG	0	0	0	0	0	0	0	0	0	0
Diptera	*Monodiamesa*	CG	0	0	0	0	0	0	0	0	0	0

Note:
Samples were collected between September 10 and 21, 2016

Table A-11
Baseline Benthic Invertebrate Community Collected in September 2016
Feeding Groups Summary

Metric	Feeding Group		LA-7A #1	LA-7A #2	LA-7A #3	LA-7A Average	LA-8 #1	LA-8 #2	LA-8 #3	LA-8 Average	LA-9 #1	LA-9 #2	LA-9 #3	LA-9 Average
Density (individuals/m^3)			543	1,171	686	800	543	843	614	667	1,986	1,386	1,529	1,633
Taxa Richness			6	8	8	7.3	10	12	7	9.7	21	6	5	11
Simpson's Evenness			0.53	0.32	0.43	0.43	0.35	0.25	0.54	0.38	0.23	0.45	0.41	0.36
Simpson's Diversity			0.68	0.61	0.71	0.67	0.74	0.69	0.73	0.72	0.79	0.63	0.66	0.69
Bray-Curtis Dissimilarity			0.20	0.58	0.31	0.36	0.34	0.50	0.40	0.41	0.63	0.53	0.56	0.57
	Feeding Group													
Number of Individuals	Collector-Filterer	CF	0	257	57	105	29	43	0	24	329	57	29	138
	Collector-Gatherer	CG	129	757	71	319	43	114	129	95	429	371	657	486
	Omnivore	OMN	0	0	0	0	0	0	0	0	0	0	0	0
	Predator	PRED	300	129	271	233	329	229	229	262	1157	957	843	986
	Scraper	SCR	0	0	0	0	0	0	0	0	0	0	0	0
	Shredder	SHR	114	29	286	143	143	457	257	286	71	0	0	24
	Total		543	1171	686	800	543	843	614	667	1986	1386	1529	1633
Relative Abundance	Collector-Filterer	CF	0%	22%	8%	10%	5%	5%	0%	3%	17%	4%	2%	8%
	Collector-Gatherer	CG	24%	65%	10%	33%	8%	14%	21%	14%	22%	27%	43%	30%
	Omnivore	OMN	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Predator	PRED	55%	11%	40%	35%	61%	27%	37%	42%	58%	69%	55%	61%
	Scraper	SCR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Shredder	SHR	21%	2%	42%	22%	26%	54%	42%	41%	4%	0%	0%	1%
	Total		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Major Taxon	**Genus/Species/Feeding Group**													
Nematoda		PRED	0	14	0	5	0	0	0	0	0	0	0	0
Microturbellaria		PRED	0	0	0	0	0	0	0	0	0	0	0	0
Hirudinea	*Erpobdella punctata*	PRED	0	0	0	0	0	0	0	0	0	0	0	0
Oligochaeta		CG	14	0	0	5	0	14	0	5	57	0	0	19
Oligochaeta		CG	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	(i/d)	SCR	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	*Gyraulus*	SCR	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	*Valvata sincera*	SCR	0	0	0	0	0	0	0	0	0	0	0	0
Pelecypoda	(i/d)	CG	0	0	0	0	0	14	0	5	0	0	14	5
Pelecypoda	*Pisidium*	CG	0	0	0	0	0	0	14	5	14	0	0	5
Acari - Hydrachnidia	(i/d)	PRED	0	0	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	*Arrenurus*	PRED	0	0	0	0	0	0	0	0	29	0	0	10
Acari - Hydrachnidia	*Hygrobates*	PRED	0	0	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	*Lebertia*	PRED	0	0	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	*Limnesia*	PRED	0	0	0	0	0	0	14	5	0	0	0	0
Acari - Hydrachnidia	*Oxus*	PRED	0	0	0	0	0	0	0	0	14	0	0	5
Acari - Hydrachnidia	*Piona*	PRED	0	0	0	0	0	0	0	0	57	0	0	19
Acari - Hydrachnidia	*Unionicola*	PRED	0	0	0	0	14	0	0	5	14	0	0	5
Ostracoda		CG	0	71	0	24	0	0	0	0	186	0	0	62
Copepoda-Cyclopoida		CF	0	200	29	76	0	0	0	0	57	57	14	43
Cladocera	*Holopedium gibberum*	CF	0	0	0	0	0	0	0	0	0	0	0	0
Cladocera	-	CF	0	0	0	0	0	0	0	0	0	0	0	0
Cladocera	*Eurycercus*	CF	0	0	0	0	0	14	0	5	0	0	0	0
Cladocera	*Ilyocryptus*	CF	0	0	0	0	0	0	0	0	0	0	0	0
Cladocera		CF	0	0	0	0	14	14	0	10	0	0	0	0
Cladocera	*Polyphemus pediculus*	CF	0	0	0	0	0	0	0	0	0	0	0	0
Cladocera	*Latona setifera*	CF	0	57	14	24	0	0	0	0	0	0	0	0
Amphipoda	*Gammarus lacustris*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Amphipoda	*Hyalella azteca*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Ephemeroptera	*Baetisca*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Ephemeroptera	*Caenis*	CG	0	0	0	0	14	0	0	5	43	0	0	14
Ephemeroptera	*Ephemera*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Ephemeroptera	*Hexagenia limbata*	CG	0	0	0	0	0	0	0	0	43	0	0	14
Trichoptera	*Oxyethira*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Trichoptera	*Lepidostoma*	SHR	0	0	0	0	0	0	0	0	0	0	0	0
Trichoptera	*Mystacides*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Trichoptera	*Oecetis*	PRED	0	0	0	0	0	0	0	0	0	0	0	0
Trichoptera	*Molannodes / Molanna*	SCR	0	0	0	0	0	0	0	0	0	0	0	0
Trichoptera	*Agrypnia*	SHR	0	0	0	0	0	0	0	0	0	0	0	0
Megaloptera	*Sialis*	PRED	0	0	0	0	0	0	0	0	14	0	0	5
Diptera	*Bezzia*	PRED	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Probezzia*	PRED	0	0	0	0	0	0	0	0	29	0	0	10
Diptera	*Chaoborus*	PRED	14	14	14	14	43	71	86	67	114	729	586	476
Diptera	*Chironomus*	CG	114	686	71	290	14	71	114	67	57	343	643	348
Diptera	*Cladopelma*	CG	0	0	0	0	0	14	0	5	0	14	0	5
Diptera	*Cryptochironomus*	PRED	29	0	43	24	29	29	14	24	43	0	0	14
Diptera	*Cryptotendipes*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Demicryptochironomus*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Dicrotendipes*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Endochironomus*	SHR	0	0	0	0	0	14	0	5	0	0	0	0
Diptera	*Microtendipes*	CF	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Nilothauma*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Parachironomus*	PRED	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Paracladopelma*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Polypedilum*	SHR	114	29	286	143	143	443	257	281	71	0	0	24
Diptera	*Stenochironomus*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Stictochironomus*	CG	0	0	0	0	0	0	0	0	0	14	0	5
Diptera	*Tribelos*	CG	0	0	0	0	0	0	0	0	14	0	0	5
Diptera	*Pseudochironomus*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Ablabesmyia*	PRED	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Guttipelopia guttipennis*	PRED	0	0	0	0	14	14	0	10	0	0	43	14
Diptera	*Procladius*	PRED	257	100	214	190	229	114	114	152	843	229	214	429
Diptera	*Tanypus*	PRED	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Thienemannimyia* gr.	PRED	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Cladotanytarsus*	CF	0	0	0	0	0	14	0	5	57	0	0	19
Diptera	*Corynocera*	CF	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Neostempellina*	CF	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Paratanytarsus*	CF	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Tanytarsus*	CF	0	0	14	5	14	0	0	5	214	0	14	76
Diptera	*Cricotopus/Orthocladius*	CG	0	0	0	0	14	0	0	5	0	0	0	0
Diptera	*Epoicocladius*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Heterotanytarsus*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Heterotrissocladius*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Paracladius*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Psectrocladius*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Potthastia longimana* group	CG	0	0	0	0	0	0	0	0	14	0	0	5
Diptera	*Monodiamesa*	CG	0	0	0	0	0	0	0	0	0	0	0	0

Note:
Samples were collected between September 10 and 21, 2016

Table A-11
Baseline Benthic Invertebrate Community Collected in September 2016
Feeding Groups Summary

Metric	Feeding Group		LB-3				LAB-1				LAB-2			
			#1	#2	#3	Average	#1	#2	#3	Average	#1	#2	#3	Average
Density (individuals/m^3)			3,029	25,114	3,229	10,457	5,286	2,471	2,757	3,505	2,729	2,600	10,557	5,295
Taxa Richness			14	18	13	15	24	19	15	19	27	20	25	24
Simpson's Evenness			0.31	0.09	0.35	0.25	0.28	0.33	0.40	0.34	0.29	0.31	0.14	0.25
Simpson's Diversity			0.79	0.45	0.79	0.68	0.86	0.85	0.84	0.85	0.88	0.85	0.75	0.82
Bray-Curtis Dissimilarity			0.64	0.95	0.69	0.76	0.85	0.63	0.64	0.71	0.77	0.91	0.93	0.87
	Feeding Group													
Number of Individuals	Collector-Filterer	CF	171	20714	171	7019	2514	371	500	1129	557	329	5843	2243
	Collector-Gatherer	CG	843	2043	2100	1662	1857	1643	1757	1752	1686	2029	3786	2500
	Omnivore	OMN	0	0	0	0	0	0	0	0	0	0	0	0
	Predator	PRED	1786	2100	914	1600	414	414	300	376	414	243	900	519
	Scraper	SCR	14	0	0	5	14	0	0	5	29	0	14	14
	Shredder	SHR	214	257	43	171	486	43	200	243	43	0	14	19
	Total		3029	25114	3229	10457	5286	2471	2757	3505	2729	2600	10557	5295
Relative Abundance	Collector-Filterer	CF	6%	82%	5%	31%	48%	15%	18%	27%	20%	13%	55%	29%
	Collector-Gatherer	CG	28%	8%	65%	34%	35%	66%	64%	55%	62%	78%	36%	59%
	Omnivore	OMN	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Predator	PRED	59%	8%	28%	32%	8%	17%	11%	12%	15%	9%	9%	11%
	Scraper	SCR	0.47%	0%	0%	0%	0.27%	0%	0%	0%	1.05%	0%	0.14%	0%
	Shredder	SHR	7%	1%	1%	3%	9%	2%	7%	6%	2%	0%	0%	1%
	Total		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Major Taxon	**Genus/Species/Feeding Group**													
Nematoda		PRED	0	0	0	0	129	43	0	57	100	29	129	86
Microturbellaria		PRED	0	0	0	0	0	0	14	5	0	0	0	0
Hirudinea	*Erpobdella punctata*	PRED	0	0	0	0	14	0	0	5	0	0	0	0
Oligochaeta		CG	357	129	1,100	529	200	643	586	476	71	71	14	52
Oligochaeta		CG	43	0	0	14	286	43	0	110	0	0	0	0
Gastropoda	(i/d)	SCR	0	0	0	0	0	0	0	0	0	0	14	5
Gastropoda	*Gyraulus*	SCR	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	*Valvata sincera*	SCR	14	0	0	5	0	0	0	0	0	0	0	0
Pelecypoda	(i/d)	CG	86	729	171	329	486	300	200	329	186	457	571	405
Pelecypoda	*Pisidium*	CG	29	243	171	148	186	86	57	110	71	86	200	119
Acari - Hydrachnidia	(i/d)	PRED	0	114	0	38	14	0	0	5	0	0	0	0
Acari - Hydrachnidia	*Arrenurus*	PRED	0	0	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	*Hygrobates*	PRED	0	0	0	0	0	0	0	0	29	57	0	29
Acari - Hydrachnidia	*Lebertia*	PRED	0	0	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	*Limnesia*	PRED	0	0	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	*Oxus*	PRED	0	0	0	0	0	0	0	0	0	0	0	0
Acari - Hydrachnidia	*Piona*	PRED	0	114	0	38	14	14	14	14	14	0	14	10
Acari - Hydrachnidia	*Unionicola*	PRED	0	0	14	5	14	29	14	19	0	14	0	5
Ostracoda		CG	14	114	0	43	57	14	14	29	14	0	0	5
Copepoda-Cyclopoida		CF	114	0	57	57	29	157	200	129	43	0	57	33
Cladocera	*Holopedium gibberum*	CF	0	0	0	0	0	0	0	0	0	0	0	0
Cladocera	-	CF	0	0	0	0	0	0	0	0	0	0	0	0
Cladocera	*Eurycercus*	CF	0	114	0	38	0	0	0	0	43	0	0	14
Cladocera	*Ilyocryptus*	CF	0	0	0	0	0	14	0	5	0	0	0	0
Cladocera		CF	0	114	0	38	29	0	0	10	57	0	0	19
Cladocera	*Polyphemus pediculus*	CF	0	0	0	0	0	0	0	0	0	0	0	0
Cladocera	*Latona setifera*	CF	29	0	0	10	0	14	0	5	29	0	0	10
Amphipoda	*Gammarus lacustris*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Amphipoda	*Hyalella azteca*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Ephemeroptera	*Baetisca*	CG	0	0	0	0	0	0	0	0	0	14	0	5
Ephemeroptera	*Caenis*	CG	0	14	0	5	0	0	0	0	0	0	14	5
Ephemeroptera	*Ephemera*	CG	0	0	0	0	0	0	0	0	0	100	414	171
Ephemeroptera	*Hexagenia limbata*	CG	0	0	0	0	0	0	0	0	0	0	14	5
Trichoptera	*Oxyethira*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Trichoptera	*Lepidostoma*	SHR	0	0	0	0	0	0	0	0	14	0	0	5
Trichoptera	*Mystacides*	CG	0	0	0	0	0	0	0	0	0	0	71	24
Trichoptera	*Oecetis*	PRED	0	0	0	0	0	0	0	0	29	29	0	19
Trichoptera	*Molannodes / Molanna*	SCR	0	0	0	0	14	0	0	5	29	0	0	10
Trichoptera	*Agrypnia*	SHR	0	0	0	0	0	0	0	0	14	0	0	5
Megaloptera	*Sialis*	PRED	0	0	14	5	0	0	0	0	0	0	0	0
Diptera	*Bezzia*	PRED	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Probezzia*	PRED	0	0	0	0	0	0	0	0	0	0	29	10
Diptera	*Chaoborus*	PRED	1,143	200	200	514	0	0	14	5	0	0	0	0
Diptera	*Chironomus*	CG	229	243	657	376	43	500	771	438	100	14	29	48
Diptera	*Cladopelma*	CG	86	129	0	71	457	43	129	210	0	0	0	0
Diptera	*Cryptochironomus*	PRED	0	43	29	24	29	14	71	38	86	71	100	86
Diptera	*Cryptotendipes*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Demicryptochironomus*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Dicrotendipes*	CG	0	429	0	143	114	0	0	38	700	757	1,800	1086
Diptera	*Endochironomus*	SHR	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Microtendipes*	CF	0	0	0	0	100	0	0	33	0	0	0	0
Diptera	*Nilothauma*	CG	0	0	0	0	0	0	0	0	0	0	14	5
Diptera	*Parachironomus*	PRED	0	0	0	0	29	0	0	10	0	0	0	0
Diptera	*Paracladopelma*	CG	0	0	0	0	0	0	0	0	0	0	14	5
Diptera	*Polypedilum*	SHR	214	257	43	171	486	43	200	243	14	0	14	10
Diptera	*Stenochironomus*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Stictochironomus*	CG	0	0	0	0	0	14	0	5	471	329	343	381
Diptera	*Tribelos*	CG	0	14	0	5	14	0	0	5	0	0	0	0
Diptera	*Pseudochironomus*	CG	0	0	0	0	0	0	0	0	14	71	157	81
Diptera	*Ablabesmyia*	PRED	0	0	0	0	0	0	0	0	14	0	0	5
Diptera	*Guttipelopia guttipennis*	PRED	29	0	0	10	0	14	0	5	0	0	0	0
Diptera	*Procladius*	PRED	614	1,629	629	957	171	300	171	214	143	43	629	271
Diptera	*Tanypus*	PRED	0	0	29	10	0	0	0	0	0	0	0	0
Diptera	*Thienemannimyia* gr.	PRED	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Cladotanytarsus*	CF	0	114	0	38	829	14	43	295	57	14	700	257
Diptera	*Corynocera*	CF	0	18,371	43	6,138	0	0	0	0	0	0	0	0
Diptera	*Neostempellina*	CF	0	0	0	0	0	0	0	0	0	14	57	24
Diptera	*Paratanytarsus*	CF	0	0	0	0	14	0	0	5	0	0	229	76
Diptera	*Tanytarsus*	CF	29	2,000	71	700	1,514	171	257	648	329	300	4,800	1810
Diptera	*Cricotopus/Orthocladius*	CG	0	0	0	0	0	0	0	0	0	0	57	19
Diptera	*Epoicocladius*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Heterotanytarsus*	CG	0	0	0	0	0	0	0	0	0	0	57	19
Diptera	*Heterotrissocladius*	CG	0	0	0	0	0	0	0	0	14	57	0	24
Diptera	*Paracladius*	CG	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	*Psectrocladius*	CG	0	0	0	0	14	0	0	5	29	29	0	19
Diptera	*Potthastia longimana* group	CG	0	0	0	0	0	0	0	0	14	43	14	24
Diptera	*Monodiamesa*	CG	0	0	0	0	0	0	0	0	0	0	0	0

Note:
Samples were collected between September 10 and 21, 2016

Table A-12
Baseline Benthic Invertebrate Chemistry Collected September 2016

Parameters			Moisture	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead
Unit			%	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Baseline Bentic Invertebrate Chemistry Characteristics		Count	9	9	9	9	9	9	9	9	9	9	9	9	9
		# Less than RDL	0	0	9	0	0	4	1	0	8	0	0	0	0
		Min	82	39	0.1	0.43	4.7	0.01	1	0.1	0.5	0.12	5.3	390	0.05
		Mean	87	128	0.1	1.2	90	0.013	3.1	0.17	0.51	0.97	8.5	1089	0.17
		Max	91	250	0.1	2.6	167	0.03	7	0.25	0.6	3.7	15	1800	0.34
		Geomean	87	110	0.1	1.0	53	0.012	2.4	0.17	0.51	0.54	8.0	939	0.14
		SD	2.8	71	1.5E-17	0.68	62	0.0071	2.2	0.048	0.033	1.2	3.5	556	0.11
Location	**Benthic Invertebrate**	**Sample Date**													
LA-1	Caddisfly	18-Sep-19	91	93	<0.1	1.8	142	0.01	4.0	0.19	<0.5	0.99	7.1	1300	0.17
LA-5	Caddisfly	19-Sep-16	87	120	<0.1	1.5	85	<0.01	1.0	0.18	0.6	0.48	6.3	1000	0.34
LA-6	Caddisfly	18-Sep-16	87	140	<0.1	2.6	167	0.02	3.0	0.25	<0.5	0.68	5.3	1800	0.33
LA-7	Caddisfly	20-Sep-16	87	78	<0.1	0.74	49	<0.01	2.0	0.13	<0.5	0.16	6.9	410	0.08
LA-7A	Caddisfly	20-Sep-16	89	150	<0.1	1.2	80	0.01	3.0	0.22	<0.5	0.44	8.5	1200	0.2
LA-8	Dragonfly	18-Sep-16	84	39	<0.1	0.43	4.7	<0.01	<1	0.13	<0.5	0.12	15	390	0.05
LA-9	Dragonfly	18-Sep-16	82	62	<0.1	0.68	4.8	<0.01	1.0	0.1	<0.5	0.18	14	500	0.06
LAB-1	Caddisfly	19-Sep-16	89	250	<0.1	0.9	111	0.03	6.0	0.16	<0.5	2.0	6.8	1800	0.16
LAB-2	Caddisfly	21-Sep-16	89	220	<0.1	0.81	164	0.01	7.0	0.2	<0.5	3.7	6.6	1400	0.13

Notes:
Results are for one sample per lake assessed
Samples were collected between September 18 and 21, 2016
Results are on a dry weight basis

Table A-12
Baseline Benthic Invertebrate Chemistry Collected September 2016

Parameters			Manganese	Molybdenum	Nickel	Selenium	Silver	Strontium	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc
Unit			µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Baseline Bentic Invertebrate Chemistry Characteristics		Count	9	9	9	9	9	9	9	9	9	9	9	9
		# Less than RDL	0	0	0	0	0	0	9	9	0	0	0	0
		Min	57	0.1	0.17	0.36	0.02	3.6	0.05	0.05	1	0.012	0.1	91
		Mean	884	0.53	1.24	0.60	0.054444	10	0.05	0.05	4.0	0.069	0.4	138
		Max	1900	1.2	2.7	1	0.12	20	0.05	0.05	9.1	0.16	0.7	190
		Geomean	481	0.44	0.77	0.56	0.044702	9.2	0.05	0.05	3.3	0.051	0.34	134
		SD	774	0.32	1.1	0.22	0.037118	4.8	7.35981E-18	7.36E-18	2.6	0.048	0.21	33
Location	**Benthic Invertebrate**	**Sample Date**												
LA-1	Caddisfly	18-Sep-19	1900	0.5	2.7	0.53	0.02	10	<0.05	<0.05	2.6	0.081	0.4	150
LA-5	Caddisfly	19-Sep-16	790	0.4	0.75	0.50	0.06	11	<0.05	<0.05	3.0	0.062	0.4	150
LA-6	Caddisfly	18-Sep-16	1030	0.6	1.3	0.52	0.03	10	<0.05	<0.05	4.1	0.087	0.4	110
LA-7	Caddisfly	20-Sep-16	146	0.5	0.19	0.50	0.05	7.5	<0.05	<0.05	3.0	0.023	0.2	150
LA-7A	Caddisfly	20-Sep-16	385	0.6	0.85	0.67	0.05	11	<0.05	<0.05	9.1	0.08	0.5	160
LA-8	Dragonfly	18-Sep-16	88	0.1	0.17	0.91	0.12	3.6	<0.05	<0.05	1.0	0.012	0.1	91
LA-9	Dragonfly	18-Sep-16	57	0.2	0.2	1.0	0.11	5.3	<0.05	<0.05	1.4	0.014	0.2	92
LAB-1	Caddisfly	19-Sep-16	1850	1.2	2.3	0.37	0.02	14	<0.05	<0.05	5.6	0.099	0.7	150
LAB-2	Caddisfly	21-Sep-16	1710	0.7	2.7	0.36	0.03	20	<0.05	<0.05	6.4	0.16	0.7	190

Notes:

Results are for one sample per lake assessed

Samples were collected between September 18 and 21, 2016

Results are on a dry weight basis

Table A-12
Baseline Benthic Invertebrate Chemistry Collected September 2016

Parameters			Lead-210	Polonium-210	Radium-226	Thorium-228	Thorium-230	Thorium-232
Unit			Bq/g	Bq/g	Bq/g	Bq/g	Bq/g	Bq/g
Baseline Bentic Invertebrate Chemistry Characteristics		Count	9	9	9	9	9	9
		# Less than RDL	8	0	3	9	9	9
		Min	0.02	0.03	0.005	0.009	0.009	0.009
		Mean	0.036	0.073	0.013	0.018	0.018	0.018
		Max	0.06	0.12	0.02	0.03	0.03	0.03
		Geomean	0.033	0.069	0.012	0.016	0.016	0.016
		SD	0.014	0.027	0.0058	0.0068	0.0068	0.0068
Location	**Benthic Invertebrate**	**Sample Date**						
LA-1	Caddisfly	18-Sep-19	<0.05	0.06	0.02	<0.02	<0.02	<0.02
LA-5	Caddisfly	19-Sep-16	<0.04	0.09	0.01	<0.02	<0.02	<0.02
LA-6	Caddisfly	18-Sep-16	<0.02	0.061	0.015	<0.009	<0.009	<0.009
LA-7	Caddisfly	20-Sep-16	<0.04	0.08	<0.01	<0.02	<0.02	<0.02
LA-7A	Caddisfly	20-Sep-16	<0.06	0.12	<0.01	<0.03	<0.03	<0.03
LA-8	Dragonfly	18-Sep-16	<0.02	0.06	<0.005	<0.01	<0.01	<0.01
LA-9	Dragonfly	18-Sep-16	<0.02	0.1	0.008	<0.01	<0.01	<0.01
LAB-1	Caddisfly	19-Sep-16	0.03	0.06	0.02	<0.02	<0.02	<0.02
LAB-2	Caddisfly	21-Sep-16	<0.04	0.03	0.02	<0.02	<0.02	<0.02

Notes:
Results are for one sample per lake assessed
Samples were collected between September 18 and 21, 2016
Results are on a dry weight basis

Table A-13
Baseline Fish Catch Summary

Watershed	Waterbody	Station	Date	Reported by	Method	Sets	Effort[1]	Lake Chub	Spottail Shiner	Longnose Sucker	White Sucker	Lake Whitefish	Lake Trout	Arctic Grayling	Northern Pike	Burbot	Ninespine Stickleback	Slimy Sculpin	Yellow Perch	Walleye
Lake Stations																				
Icelander River	LA-1	LA-1	12-Aug-12	Golder	Visual	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-
			14-Sep-16	EcoMetrix	Minnow Trap	8	48	-	-	-	-		-	-	-	-	-	-	-	-
			17-Sep-16	EcoMetrix	Gillnet	2	19	-	4	-	2	11	-	-	4	-	-	-	2	14
			18-Sep-16	EcoMetrix	Gillnet	2	44	-	11	2	5	17	1	-	5	-	-	-	2	21
			18-Sep-16	EcoMetrix	Seine	1	-	-	-	-	-	-	-	-	3	-	-	-	-	-
			19-Sep-16	EcoMetrix	Gillnet	4	18.5	-	-	-	4	6	-	-	4	-	-	-	-	13
			20-Sep-16	EcoMetrix	Gillnet	3	8	-	-	1	3	1	-	-	3	-	-	-	-	6
			27-May-17	EcoMetrix	Angling	-	4.5	-	-	-	-	-	-	-	5	-	-	-	-	-
			27-May-17	EcoMetrix	Gillnet	1	4	-	-	-	9	1	-	-	2	-	-	-	-	1
	LA-5	LA-5	13-Aug-12	Golder	Visual	-	-	-	-	-	x	-	-	-	x	-	-	-	-	-
			10-Sep-16	EcoMetrix	Gillnet	1	8	-	4	-	2	1	-	-	7	-	-	-	-	-
			11-Sep-16	EcoMetrix	Gillnet	1	9.5	-	-	-	9	1	-	-	4	-	-	-	-	-
			11-Sep-16	EcoMetrix	Minnow Trap	8	80	-	-	-	-	-	-	-	-	-	-	-	-	-
			13-Sep-16	EcoMetrix	Seine	1	-	-	13	-	1	-	-	-	-	-	2	-	-	-
			30-May-17	EcoMetrix	Angling	-	4.5	-	-	-	-	-	-	-	2	-	-	-	-	2
			30-May-17	EcoMetrix	Gillnet	1	3	-	-	-	6	1	-	-	3	-	-	-	-	9
	LA-6	LA-6	13-Aug-12	Golder	Visual	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-
			16-Sep-16	EcoMetrix	Gillnet	1	20	-	6	-	12	1	-	-	8	-	-	-	-	1
			16-Sep-16	EcoMetrix	Minnow Trap	8	416	-	-	-	-	-	-	-	-	-	-	-	-	-
			29-May-17	EcoMetrix	Gillnet	1	-	-	-	-	20	-	-	-	-	-	-	-	-	-
			29-May-17	EcoMetrix	Angling	-	1.75	-	-	-	-	-	-	-	9	-	-	-	-	-
			30-May-17	EcoMetrix	Angling	-	4	-	-	-	-	-	-	-	9	-	-	-	-	2
	Kratchkowsky Lake	LA-7/7A	12-Sep-16	EcoMetrix	Minnow Trap	3	24	-	-	-	-		-	-	-	-	-	-	-	-
			19-Sep-16	EcoMetrix	Gillnet	2	15.5	-	9	-	13	14	-	-	5	-	-	-	-	4
			20-Sep-16	EcoMetrix	Gillnet	1	23	-	9	-	22	18	-	-	8	-	x	-	-	4
			31-May-17	EcoMetrix	Angling	-	9	-	-	-	-		-	-	10	-	-	-	-	3
			31-May-17	EcoMetrix	Gillnet	4	11	-	-	-	25	2	-	-	19	-	-	-	-	6
	LA-8	LA-8	16-Sep-16	EcoMetrix	Gillnet	3	17	-	-	-	3	17	-	-	9	-	1	-	x	-
	LA-9	LA-9	17-Sep-16	EcoMetrix	Gillnet	1	3	-	9	-	4	10	-	-	2	-	-	-	4	3
			18-Sep-16	EcoMetrix	Dipnet	-	-	-	-	-	-		-	-	-	-	13	-	-	-
	Pond-2	PA-2	19-Sep-16	EcoMetrix	Gillnet	1	4	-	-	-	1	17		-	3	-	-	-	-	-
	Pond-3	PA-3	20-Sep-16	EcoMetrix	Gillnet	1	3	no fish collected												
Williams Lake	Williams Lake	LB-3	8-Aug-12	Golder	Visual	-	-	x	x	-	-	-	-	-	x	-	-	-	x	-
			30-May-17	EcoMetrix	Angling	-	-	-	-	-	-	-	-	-	x	-	-	-	-	x
	Russell Lake	LAB-1	8-Nov-12	Golder	Visual	-	-	-	-	-	-	-	-	-	x	-	x	-	-	-
			20-Sep-16	EcoMetrix	Gillnet	1	9	-	2	-	-	5	-	-	1	-	x	-	-	2
			21-Sep-16	EcoMetrix	Gillnet	1	2	-	-	-	4		1	-	2	-	-	-	-	2
			28-May-17	EcoMetrix	Gillnet	2	4	-	-	-	-	4	1	-	1	-	-	-	-	-
			1-Jun-17	EcoMetrix	Gillnet	2	3.5	-	-	-	-	10	-	-	9	-	-	-	-	-
		LAB-2	20-Sep-16	EcoMetrix	Gillnet	1	4	-	-	-	-	2	-	-	-	-	-	-	-	4
			21-Sep-16	EcoMetrix	Gillnet	1	29.5	-	-	-	7	8	2	-	2	x	x	-	-	28
Stream Stations																				
Watershed	**Waterbody**	**Station**	**Date**	**Reported by**	**Method**	**Sets**	**Effort[1]**	**Lake Chub**	**Spottail Shiner**	**Longnose Sucker**	**White Sucker**	**Lake Whitefish**	**Lake Trout**	**Arctic Grayling**	**Northern Pike**	**Burbot**	**Ninespine Stickleback**	**Slimy Sculpin**	**Yellow Perch**	**Walleye**
Icelander River	SA-1	SA-1	17-Sep-16	EcoMetrix	Electrofishing	-	1144	10	-	4	1			x	-	23	-	4	-	-
			28-May-17	EcoMetrix	Angling	-	2	-	-	-	-	1	-	-	10	-	-	-	-	-
			28-May-17	EcoMetrix	Gillnet	1	n/a	-	-	12	-	-	-	-	x	-	-	-	-	-
	SA-2	SA-2	16-Sep-16	EcoMetrix	Electrofishing		1271	13	-	-	2			2	3	7	-	70	-	-
			27-May-17	EcoMetrix	Gillnet	2	n/a	-	-	-	18	-	-	-	-	-	-	-	-	x
	SA-4	SA-4	10-Sep-16	EcoMetrix	Electrofishing	-	1749	5	-	1	21	-	-	2	1	9	23	19	-	-
			26-May-17	EcoMetrix	Electrofishing	-	758	x	x	-	16	-	-	-	x	-	-	x	-	-
			1-Jun-17	EcoMetrix	Visual	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-
	SA-5	SA-5	9-Sep-16	EcoMetrix	Electrofishing	-	2314	6	-	-	4	-	-	-	-	26	1	17	-	x
			29-May-17	EcoMetrix	Gillnet	1	n/a	-	-	1	18	-	-	-	-	-	-	-	-	x
			1-Jun-17	EcoMetrix	Visual	-	-	x	-	-	x	-	-	-	-	-	-	-	-	-
	SA-6	SA-6	12-Sep-16	EcoMetrix	Electrofishing	-	1531	-	15	1	-	-	-	-	-	6	2	-	-	-
			29-May-17	EcoMetrix	Gillnet	1	n/a	-	-	-	3	-	-	-	5	-	-	-	-	1
			30-May-17	EcoMetrix	Visual	-	-	-	-	-	2	-	-	-	6	-	-	-	-	-
	RC-1	RC-1	14-Sep-16	EcoMetrix	Electrofishing	-	1719	60	-	-	21	-	-	-	1	16	-	1	2	-
			29-May-17	EcoMetrix	Electrofishing	-	675	33	-	-	14	-	-	-	1	5	-	-	-	-
Williams Lake	SB-1	SB-1	17-Sep-16	EcoMetrix	Electrofishing	-	752	-	-	-	-			-	-	8	-	-	-	-

Notes
[1] - Electrofishing (seconds), Gillnetting (hours), Minnow Trapping (hours), Angling (angler/hrs),
n/a - not applicable (gillnet used like a seine to capture fish observed)
x - species observed but not collected

Table A-14
Key Baseline Lake Features

Site	**LA-1**		**LA-5**		**LA-6**		**LA-7A**	**LA-7**	**PA-2**	**PA-3**	**LA-8**	**LA-9**	**LB-3**	**LAB-1***		**LAB-2***
Key Features																
Survey Date(s)	12-Aug-12	14-Sep-16	13-Aug-12	11-Sep-16	13-Aug-12	13-Sep-16	11-Sep-16	9-Aug-12	19-Sep-16	20-Sep-16	15-Sep-16	17-Sep-16	8-Aug-12	12-Aug-12	15-Sep-16	20-Sep-16
Surface Area (m^2)	1,485,480	-	324,049	-	262,740	-	2,433,413	795,937	84,323	44,869	2,082,140	1,379,406	1,522,984	751,485	-	1,516,617
Volume (m^3)	8,189,320	-	332,502	-	413,505	-	12,712,684	-	122,617	38,845	7,467,381	6,410,916	6,933,788	-	-	6,079,370
Lake Elevation	494.37	494.39	500.04	500.06	500.06	500.07	520.53	520.48	510.46	517.36	520.86	514.25	518.52	488.17	488.26	488.26
Maximum Depth (m)	9.67	-	4.07	-	2.71	-	21.8	6.78	3.2	2.7	10.2	11.2	17.82	18.78	-	20.6
Mean Depth (m)	5.5	-	1.1	-	1.6	-	5.2	2.9	1.5	0.9	3.6	4.6	4.6	3.0	-	4.0
Secchi Depth (m)	1.5	2.1	2.2	1.8	2	1.75	2.2	1.75	bottom	1.6	1.6	1.5	3.5	3.5	3.1	2.9
Fish Species Observed																
Lake Chub													x			
Spottail Shiner		x		x		x	x					x	x		x	
Longnose Sucker		x														
White Sucker	x	x	x	x		x	x		x		x	x			x	x
Lake Whitefish		x		x		x	x		x		x	x			x	x
Lake Trout		x													x	x
Northern Pike		x	x	x	x	x	x		x		x	x	x	x	x	x
Burbot																x
Ninespine Stickleback				x			x				x	x		x	x	x
Yellow Perch		x									x	x	x			
Walleye		x		x		x	x					x				x
Aquatic Plants Observed																
Submergent		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Emergent	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x
Floating							x		x	x	x	x				x

Note
* indicates for the assessed portion of the lake

EcoMetrix INCORPORATED

Table A-15
Baseline Stream Spawning Habitat

Station Characteristics	Station Number		**SA-1**	**SA-2**	**SA-4**	**SA-5**	**SA-6**	**RC-1**	**SB-1**
	Location		u/s of Russel Lake; d/s of McArthur River Mine Road	u/s of Lake LA-1	u/s and d/s of Fox Lake Tote Road	u/s and d/s of Fox Lake Tote Road	d/s of Lake LA-6; u/s of Lake LA-5	d/s of Kratchkowsky Lake	u/s of Russel Lake
	Coordinates	Latitude	57 28.918	57 30.070	57 31.456	57 31.442	57 30.883	57 31.545	57 26.347
		Longitude	-105 19.647	-105 21.476	-105 23.084	-105 22.180	-105 22.171	-105 24.578	-105 23.923
Station Data	Flow Velocity (m/s)		1.25	1	0.5	0.4	0.2	0.75	0.2
	Length (m)		195	285	100	300	390	305	280
	Mean Width (m)		10	9	7	15	14	3.5	8
	Mean Depth (m)		0.35	0.35	0.25	0.4	0.7	0.3	0.5
Habitat Characteristics	Bank Stability (%)	Highly Unstable	0	0	0	0	0	0	0
		Moderately Unstable	0	0	0	0	0	0	0
		Stable	100	100	100	100	100	100	100
	Stream Morphology (% total surface area)	Pool	15	5	20	25	20	10	50
		Riffle	60	90	60	30	0	30	0
		Cascade	0	0	0	0	0	p	0
		Run	20	5	20	40	75	60	40
		Flat	5	p	p	5	5	p	10
	Stream Gradient (% reach)	High	60	60	50	0	0	70	0
		Modrate	25	35	35	70	0	25	25
		Low	15	5	15	30	100	5	75
	Stream Channel Type (% Reach)	Straight	0	0	30	70	0	0	0
		Meandering	95	75	25	0	100	100	35
		Braided	5	20	30	5	0	0	15
		Ponded	0	5	15	25	0	0	50
	Stream Canopy (% Stream Shaded)	Dense	0	50	50	0	0	90	0
		Partly Open	85	50	35	80	60	10	25
		Open	15	0	15	20	40	0	75
	Instream Cover (% Total surface area)	Undercut Banks	5	5	5	5	5	5	0
		Boulder	10	15	25	10	5	10	p
		Logs & Trees	p	p	5	p	5	5	p
		Log Jams	0	0	0	0	0	0	5
		Deep Pool	10	p	10	20	15	5	5
		Aquatic Macrophyte	5	p	15	20	5	5	75
	Substrate Types (%)	Bedrock	0	0	0	0	0	p	0
		Boulder	55	45	80	50	10	35	5
		Cobble	25	40	10	25	0	55	0
		Gravel	5	5	5	0	0	5	0
		Sand	15	p	5	25	85	5	10
		Silt	0	p	0	0	5	p	0
		Clay	0	0	0	0	0	0	0
		Marl	0	0	0	0	0	0	0
		Muck	0	0	0	0	0	0	85
		Detritus	p	0	p	0	0	0	0
	Terrain Characteristics (%)	Cultivated	0	0	0	0	0	0	0
		Meadow	0	0	0	0	0	0	0
		Lawn	0	0	0	0	0	0	0
		Urban	0	0	0	0	0	0	0
		Forested Lowland	25	10	30	30	50	0	100
		Marsh	0	0	0	0	0	0	0
		Beaver Pond	0	0	0	0	0	0	0
		Bog	0	0	0	0	0	0	0
		Swamp	0	0	0	0	0	0	0
		Forested Upland	75	90	70	70	50	100	0
	Dominant Terrestrial Vegetation		jack pine, black spruce, sweet gale, willow	sweet gale, Labrador tea, alder, black spruce, jack pine, willow	sweet gale, Labrador tea, alder, black spruce, jack pine, willow	sweet gale, Labrador tea, alder, jack pine, black spruce	sweet gale, Labrador tea, black spruce, jack pine	black spruce, jack pine, sweet gale, Labrador tea, moss, lichen, willow, alder	tamarack, black spruce, sweet gale
	Dominant Aquatic Vegetation		sedges	sedge, algae, horsetail	horsetail, pondweed, moss, sedge, burreed, spike rush	pondweeds, burred, cala, sedge	sponge, algae, pondweed, sedges, horsetail, sedge	sedge, algae, burreed	burreed, pond lily, pondweed, calla, sedges
	Adjacent Land Use		mining exploration, outfitters	mining exploration	mining exploration, access road	access road	mining exploration, drill site	mining exploration, drilling, access road	mining exploration, access road
	Sediment Overlaying Substrate		Slight	None	None	None	Slight	Slight	Heavy
	Algae Overlaying Substrate		Slight	Moderate	Slight	None	Moderate	Slight	None
	Barriers/Obstacles Observed		None	None	None	None	None	None	None

Table A-15
Baseline Stream Spawning Habitat

			SA-1	SA-2	SA-4	SA-5	SA-6	RC-1	SB-1
Station Characteristics	Station Number		**SA-1**	**SA-2**	**SA-4**	**SA-5**	**SA-6**	**RC-1**	**SB-1**
	Location		u/s of Russel Lake; d/s of McArthur River Mine Road	u/s of Lake LA-1	u/s and d/s of Fox Lake Tote Road	u/s and d/s of Fox Lake Tote Road	d/s of Lake LA-6; u/s of Lake LA-5	d/s of Kratchkowsky Lake	u/s of Russel Lake
	Coordinates	Latitude	57 28.918	57 30.070	57 31.456	57 31.442	57 30.883	57 31.545	57 26.347
		Longitude	-105 19.647	-105 21.476	-105 23.084	-105 22.180	-105 22.171	-105 24.578	-105 23.923
Weather	Cloud Cover (%)		100	95	100	100	100	100	100
	Air Temprature (°C)		13	13	8	5	6	11	12
	Precipitation		Light	None	Moderate	Moderate	None	None	Light
	Recent Precipitation		Light	Light	Light	Light	Light	Light	Light
Chemical Parameters	Time		16:30	14:50	11:45	15:30	10:50	10:50	10:30
	Water Temp (°C)		12.26	12.13	11.05	13.59	8.91	10.64	10.6
	DO (mg/L)		10.63	10.64	9.58	9.52	10.92	10.23	8.41
	DO (%)		99.4	98.9	87	91.6	93.6	92	75.2
	Conductivity (us/cm)		15	15	16	20	22	21	15
	Sp Cond (us/cm)		20	19	22	26	32	30	20
	pH		7.01	6.89	6.71	5.96	5.83	6.92	5.98
	Total Dissolved Solids (g/L)		13	13	14	17	-	-	-
	Water Colour		Yellow/Brown	Colourless	Colourless, Yellow/Brown	Colourless, Yellow/Brown	Yellow/Brown	Yellow/Brown	Yellow/Brown
	Water Clarity		Clear	Turbid (slight)	Clear	Clear	Clear	Clear	Clear
Biological Characteristics	Benthic Community	Sampling Method	Visual	Visual	Visual	Visual	Visual	Visual	N/A
		Methodology	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	N/A
		Notes	stonefly nymph	stonefly nymph, caddisfly larvae	stonefly nymph, dragonfly nymph, caddisfly larvae	dragonfly nymph, stonefly nymph	dragonfly nymph, snail, *Hexagenia* mayfly	stonefly nymph, snail, caddisfly larvae	N/A
	Fish Community	Sampling Method	Electrofisher; Dipnet	Electrofisher; Dipnet; Visual	Electrofisher; Dipnet	Electrofisher; Dipnet; Visual	Electrofisher	Electrofisher; Dipnet; Visual	Electrofisher
		Methodology	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative
		Notes	Arctic Grayling observed. Burbot, Slimy Sculpin, White Sucker, Longnose Sucker, Lake Chub collected.	Arctic Grayling, Northern Pike, Slimy Sculpin, Lake Chub, White Sucker, Burbot collected.	Arctic Grayling, White Sucker, Slimy Sculpin, Ninespine Stickleback, Lake Chub, Northern Pike, Burbot, Longnose Sucker collected.	Adult Walleye observed. Burbot, Slimy Sculpin, White Sucker, Lake Chub, Ninespine Stickleback collected.	Burbot, Spottail Shiner, Ninespine Stickleback, Longnose Sucker collected.	Lake Chub, Burbot, White Sucker, Northern Pike, Yellow Perch, Slimy Sculpin collected.	Burbot collected.

Notes:
u/s - upstream
d/s - downstream
p = present/observed

Table A-16
Baseline Detailed Fish Collection Data

Waterbody	Method	Date	Sample Number	Species	Total Length (mm)	Fork Length (mm)	Weight (g)	Age (y)	Age Class*	Sex	Spawning Condition**
LA-1	Gillnet	19-Sep-2016	-	Lake Trout	825	755	3610	-	Adult	Female	3
LA-1	Gillnet	17-Sep-2016	-	Lake Whitefish	202	177	80	-	Juvenile	-	-
LA-1	Gillnet	17-Sep-2016	-	Lake Whitefish	248	220	129.5	-	Juvenile	-	-
LA-1	Gillnet	17-Sep-2016	-	Lake Whitefish	308	370	240	-	Juvenile	-	-
LA-1	Gillnet	17-Sep-2016	-	Lake Whitefish	328	290	350	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	-	Lake Whitefish	350	305	400	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	-	Lake Whitefish	352	315	380	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	-	Lake Whitefish	377	329	490	-	Adult	Female	4
LA-1	Gillnet	17-Sep-2016	-	Lake Whitefish	381	334	460	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	-	Lake Whitefish	387	338	560	-	Adult	Male	3
LA-1	Gillnet	17-Sep-2016	-	Lake Whitefish	398	345	510	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	-	Lake Whitefish	406	355	600	-	Adult	Female	4
LA-1	Gillnet	18-Sep-2016	-	Lake Whitefish	228	203	100	-	Juvenile	-	-
LA-1	Gillnet	20-Sep-2016	-	Lake Whitefish	319	230	320	-	Adult	Female	4
LA-1	Gillnet	20-Sep-2016	-	Lake Whitefish	261	230	160	-	Juvenile	-	-
LA-1	Gillnet	20-Sep-2016	-	Lake Whitefish	325	236	310	-	Adult	Female	4
LA-1	Gillnet	20-Sep-2016	-	Lake Whitefish	301	262	210	-	Juvenile	-	-
LA-1	Gillnet	20-Sep-2016	-	Lake Whitefish	297	263	210	-	Juvenile	-	-
LA-1	Gillnet	20-Sep-2016	-	Lake Whitefish	315	278	260	-	Juvenile	-	-
LA-1	Gillnet	20-Sep-2016	-	Lake Whitefish	326	287	290	-	Adult	Female	4
LA-1	Gillnet	20-Sep-2016	-	Lake Whitefish	334	294	300	-	Juvenile	-	-
LA-1	Gillnet	20-Sep-2016	-	Lake Whitefish	345	305	360	-	Adult	Female	3
LA-1	Gillnet	20-Sep-2016	-	Lake Whitefish	384	340	480	-	Adult	Male	2
LA-1	Gillnet	20-Sep-2016	-	Lake Whitefish	406	353	620	-	Adult	Female	3
LA-1	Gillnet	20-Sep-2016	-	Lake Whitefish	420	371	660	-	Adult	Female	4
LA-1	Gillnet	27-May-2017	-	Lake Whitefish	306	268	220	-	Juvenile	-	-
LA-1	Gillnet	18-Sep-2016	-	Longnose Sucker	433	406	930	-	Adult	-	-
LA-1	Gillnet	18-Sep-2016	-	Longnose Sucker	492	463	1220	-	Adult	-	-
LA-1	Gillnet	20-Sep-2016	-	Longnose Sucker	468	437	1200	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	2016-NP2	Northern Pike	576	540	1180	4	Adult	Male	2
LA-1	Gillnet	17-Sep-2016	2016-NP5	Northern Pike	678	639	1910	6	Adult	Male	2
LA-1	Gillnet	17-Sep-2016	2016-NP4	Northern Pike	677	640	1650	8	Adult	Male	2
LA-1	Gillnet	17-Sep-2016	2016-NP1	Northern Pike	772	730	2510	3	Adult	Female	2
LA-1	Gillnet	17-Sep-2016	2016-NP3	Northern Pike	930	882	5180	11	Adult	Female	2
LA-1	Seine	18-Sep-2016	-	Northern Pike	172	161	-	-	Juvenile	-	-
LA-1	Seine	18-Sep-2016	-	Northern Pike	192	181	-	-	Juvenile	-	-
LA-1	Seine	18-Sep-2016	-	Northern Pike	196	182	-	-	Juvenile	-	-
LA-1	Gillnet	19-Sep-2016	-	Northern Pike	727	695	2420	-	Adult	-	-
LA-1	Gillnet	19-Sep-2016	-	Northern Pike	746	715	2440	-	Adult	-	-
LA-1	Gillnet	19-Sep-2016	-	Northern Pike	782	740	2750	-	Adult	-	-
LA-1	Gillnet	19-Sep-2016	-	Northern Pike	814	772	2700	-	Adult	-	-
LA-1	Gillnet	19-Sep-2016	-	Northern Pike	852	805	3560	-	Adult	-	-
LA-1	Gillnet	20-Sep-2016	-	Northern Pike	774	730	2740	-	Adult	-	-
LA-1	Gillnet	20-Sep-2016	-	Northern Pike	824	783	3130	-	Adult	-	-
LA-1	Gillnet	20-Sep-2016	-	Northern Pike	819	785	3160	-	Adult	-	-
LA-1	Angling	27-May-2017	-	Northern Pike	563	529	1060	-	Juvenile	-	-
LA-1	Angling	27-May-2017	LA1-NP3	Northern Pike	710	671	2100	7	Adult	Male	5
LA-1	Angling	27-May-2017	LA1-NP2	Northern Pike	728	690	2190	9	Adult	Male	5
LA-1	Angling	27-May-2017	LA1-NP1	Northern Pike	769	731	2470	6	Adult	Female	5
LA-1	Gillnet	27-May-2017	LA1-NP4	Northern Pike	668	629	1550	5	Adult	Female	5
LA-1	Gillnet	27-May-2017	-	Northern Pike	795	758	2730	-	Adult	Female	5
LA-1	Gillnet	17-Sep-2016	-	Spottail Shiner	87	79	6	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	-	Spottail Shiner	94	85	7.9	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	-	Spottail Shiner	105	93	11.2	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	-	Spottail Shiner	113	102	15.1	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	-	Walleye	429	404	690	-	Adult	Male	2
LA-1	Gillnet	17-Sep-2016	-	Walleye	458	430	830	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	-	Walleye	471	450	1010	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	-	Walleye	480	455	950	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	-	Walleye	493	458	1003	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	-	Walleye	497	467	950	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	-	Walleye	515	490	1009	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	-	Walleye	534	505	1360	-	Adult	Female	3
LA-1	Gillnet	17-Sep-2016	-	Walleye	537	509	1540	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	-	Walleye	536	511	1260	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	-	Walleye	555	527	1720	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	-	Walleye	558	528	1440	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	-	Walleye	598	561	2160	-	Adult	-	-
LA-1	Gillnet	17-Sep-2016	-	Walleye	598	570	1880	-	Adult	-	-
LA-1	Gillnet	18-Sep-2016	-	Walleye	377	357	470	-	Juvenile	-	-
LA-1	Gillnet	18-Sep-2016	-	Walleye	404	378	580	-	Juvenile	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	348	329	370	-	Juvenile	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	357	331	390	-	Juvenile	-	-

Table A-16
Baseline Detailed Fish Collection Data

Waterbody	Method	Date	Sample Number	Species	Total Length (mm)	Fork Length (mm)	Weight (g)	Age (y)	Age Class*	Sex	Spawning Condition**
LA-1	Gillnet	19-Sep-2016	-	Walleye	361	337	400	-	Juvenile	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	360	342	410	-	Juvenile	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	399	378	550	-	Juvenile	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	425	402	610	-	Juvenile	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	451	425	790	-	Juvenile	Female	1
LA-1	Gillnet	19-Sep-2016	-	Walleye	465	434	820	-	Juvenile	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	487	460	990	-	Adult	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	495	470	980	-	Adult	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	503	474	1000	-	Adult	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	515	487	1100	-	Adult	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	524	497	1170	-	Adult	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	535	505	1150	-	Adult	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	532	508	1370	-	Adult	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	539	510	1380	-	Adult	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	543	516	1430	-	Adult	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	569	535	1580	-	Adult	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	561	535	1500	-	Adult	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	581	552	1520	-	Adult	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	604	576	1610	-	Adult	Female	2
LA-1	Gillnet	19-Sep-2016	-	Walleye	612	580	1980	-	Adult	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	608	582	1930	-	Adult	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	611	582	1650	-	Adult	-	-
LA-1	Gillnet	19-Sep-2016	-	Walleye	648	618	2020	-	Adult	-	-
LA-1	Gillnet	20-Sep-2016	-	Walleye	392	370	510	-	Juvenile	-	-
LA-1	Gillnet	20-Sep-2016	-	Walleye	430	405	660	-	Juvenile	-	-
LA-1	Gillnet	20-Sep-2016	-	Walleye	466	440	920	-	Adult	-	-
LA-1	Gillnet	20-Sep-2016	-	Walleye	478	450	820	-	Juvenile	-	-
LA-1	Gillnet	20-Sep-2016	-	Walleye	508	479	1130	-	Adult	-	-
LA-1	Gillnet	20-Sep-2016	-	Walleye	586	551	1760	-	Adult	-	-
LA-1	Gillnet	27-May-2017	-	Walleye	513	485	1140	-	Adult	Female	5
LA-1	Gillnet	17-Sep-2016	-	White Sucker	162	153	58.7	-	Juvenile	Female	1
LA-1	Gillnet	17-Sep-2016	2016-WS1	White Sucker	428	390	780	8	Adult	Female	3
LA-1	Gillnet	18-Sep-2016	-	White Sucker	325	300	290	-	Juvenile	-	-
LA-1	Gillnet	20-Sep-2016	-	White Sucker	316	289	330	-	Juvenile	-	-
LA-1	Gillnet	20-Sep-2016	2016-WS4	White Sucker	329	297	320	5	Juvenile	-	-
LA-1	Gillnet	20-Sep-2016	-	White Sucker	327	300	370	-	Juvenile	-	-
LA-1	Gillnet	20-Sep-2016	2016-WS3	White Sucker	355	327	500	10	Adult	Female	2
LA-1	Gillnet	20-Sep-2016	2016-WS1	White Sucker	356	329	520	6	Adult	Female	2
LA-1	Gillnet	20-Sep-2016	2016-WS2	White Sucker	367	341	520	8	Adult	Female	2
LA-1	Gillnet	20-Sep-2016	2016-WS4	White Sucker	388	347	580	5	Adult	Female	3
LA-1	Gillnet	20-Sep-2016	2016-WS3	White Sucker	385	352	540	8	Adult	Female	3
LA-1	Gillnet	20-Sep-2016	2016-WS2	White Sucker	382	356	620	10	Adult	Female	3
LA-1	Gillnet	27-May-2017	-	White Sucker	214	197	70	-	Juvenile	-	-
LA-1	Gillnet	27-May-2017	-	White Sucker	275	254	190	-	Juvenile	-	-
LA-1	Gillnet	27-May-2017	-	White Sucker	298	278	210	-	Juvenile	-	-
LA-1	Gillnet	27-May-2017	-	White Sucker	305	280	290	-	Juvenile	-	-
LA-1	Gillnet	27-May-2017	-	White Sucker	321	297	300	-	Juvenile	Female	1
LA-1	Gillnet	27-May-2017	-	White Sucker	325	300	290	-	Juvenile	Female	1
LA-1	Gillnet	27-May-2017	-	White Sucker	350	320	390	-	Juvenile	Female	1
LA-1	Gillnet	27-May-2017	-	White Sucker	312	344	390	-	Juvenile	Female	1
LA-1	Gillnet	27-May-2017	-	White Sucker	395	360	590	-	Adult	Female	2
LA-1	Gillnet	17-Sep-2016	-	Yellow Perch	55	53	1.6	-	YOY	-	-
LA-1	Gillnet	17-Sep-2016	-	Yellow Perch	90	85	7.7	-	Juvenile	-	-
LA-5	Gillnet	10-Sep-2016	-	Lake Whitefish	361	320	495.4	-	Adult	Female	4.5
LA-5	Gillnet	11-Sep-2016	-	Lake Whitefish	394	349	760	-	Adult	Male	2
LA-5	Gillnet	30-May-2016	-	Lake Whitefish	275	245	180	-	Juvenile	-	-
LA-5	Seine	13-Sep-2016	-	Ninespine Stickleback	48	48	0.2	-	Adult	-	-
LA-5	Seine	13-Sep-2016	-	Ninespine Stickleback	63	62	0.8	-	Adult	-	-
LA-5	Gillnet	10-Sep-2016	-	Northern Pike	473	445	531.4	-	Adult	Male	2
LA-5	Gillnet	10-Sep-2016	-	Northern Pike	500	464	700	-	Adult	-	-
LA-5	Gillnet	10-Sep-2016	2016-NP1	Northern Pike	595	560	1200	3	Adult	Male	3
LA-5	Gillnet	10-Sep-2016	2016-NP4	Northern Pike	853	809	3720	12	Adult	Male	3
LA-5	Gillnet	10-Sep-2016	2016-NP2	Northern Pike	910	863	4150	10	Adult	Female	3
LA-5	Gillnet	10-Sep-2016	2016-NP5	Northern Pike	990	940	6000	13	Adult	Female	3
LA-5	Gillnet	10-Sep-2016	2016-NP3	Northern Pike	1006	968	4100	12	Adult	Female	3
LA-5	Gillnet	11-Sep-2016	-	Northern Pike	549	517	900	-	Adult	-	-
LA-5	Gillnet	11-Sep-2016	-	Northern Pike	788	757	-	-	Adult	-	-
LA-5	Gillnet	11-Sep-2016	-	Northern Pike	880	840	4200	-	Adult	-	-
LA-5	Gillnet	11-Sep-2016	-	Northern Pike	916	869	-	-	Adult	-	-
LA-5	Angling	30-May-2017	-	Northern Pike	-	-	3990	-	Adult	-	-
LA-5	Gillnet	30-May-2017	-	Northern Pike	447	418	560	-	Juvenile	-	-
LA-5	Gillnet	30-May-2017	-	Northern Pike	560	520	1060	-	Juvenile	-	-
LA-5	Gillnet	30-May-2017	-	Northern Pike	570	534	1060	-	Adult	Male	1

Table A-16
Baseline Detailed Fish Collection Data

Waterbody	Method	Date	Sample Number	Species	Total Length (mm)	Fork Length (mm)	Weight (g)	Age (y)	Age Class*	Sex	Spawning Condition**
LA-5	Gillnet	10-Sep-2016	-	Spottail Shiner	89	81	5.8	-	Adult	-	-
LA-5	Gillnet	10-Sep-2016	-	Spottail Shiner	90	81	6.1	-	Adult	Female	-
LA-5	Gillnet	10-Sep-2016	-	Spottail Shiner	93	84	8.6	-	Adult	Male	-
LA-5	Gillnet	10-Sep-2016	-	Spottail Shiner	96	86	7.3	-	Adult	Male	-
LA-5	Seine	13-Sep-2016	-	Spottail Shiner	39	37	0.2	-	Juvenile	-	-
LA-5	Seine	13-Sep-2016	-	Spottail Shiner	42	39	0.2	-	Juvenile	-	-
LA-5	Seine	13-Sep-2016	-	Spottail Shiner	42	39	0.2	-	Juvenile	-	-
LA-5	Seine	13-Sep-2016	-	Spottail Shiner	42	40	0.3	-	Juvenile	-	-
LA-5	Seine	13-Sep-2016	-	Spottail Shiner	45	42	0.3	-	Juvenile	-	-
LA-5	Seine	13-Sep-2016	-	Spottail Shiner	48	44	0.4	-	Juvenile	-	-
LA-5	Seine	13-Sep-2016	-	Spottail Shiner	48	44	0.2	-	Juvenile	-	-
LA-5	Seine	13-Sep-2016	-	Spottail Shiner	47	44	0.3	-	Juvenile	-	-
LA-5	Seine	13-Sep-2016	-	Spottail Shiner	49	45	0.4	-	Juvenile	-	-
LA-5	Seine	13-Sep-2016	-	Spottail Shiner	49	45	0.5	-	Juvenile	-	-
LA-5	Seine	13-Sep-2016	-	Spottail Shiner	48	45	0.3	-	Juvenile	-	-
LA-5	Seine	13-Sep-2016	-	Spottail Shiner	49	46	0.4	-	Juvenile	-	-
LA-5	Seine	13-Sep-2016	-	Spottail Shiner	52	47	0.6	-	Juvenile	-	-
LA-5	Angling	30-May-2017	-	Walleye	-	-	-	-	Adult	Male	4
LA-5	Gillnet	30-May-2017	-	Walleye	466	434	750	-	Adult	Male	5
LA-5	Gillnet	30-May-2017	-	Walleye	483	456	940	-	Juvenile	Male	2
LA-5	Gillnet	30-May-2017	-	Walleye	512	484	1010	-	Adult	Male	5
LA-5	Gillnet	30-May-2017	-	Walleye	529	495	1090	-	Adult	Male	5
LA-5	Gillnet	30-May-2017	-	Walleye	531	504	1050	-	Juvenile	Female	1
LA-5	Gillnet	30-May-2017	-	Walleye	488	522	1070	-	Adult	Male	4
LA-5	Gillnet	30-May-2017	-	Walleye	555	523	1350	-	Adult	Male	5
LA-5	Gillnet	30-May-2017	-	Walleye	566	528	1290	-	Adult	Male	5
LA-5	Gillnet	30-May-2017	-	Walleye	576	541	1540	-	Adult	Male	5
LA-5	Gillnet	10-Sep-2016	2016-WS1	White Sucker	376	340	587	4	Adult	Male	3
LA-5	Gillnet	10-Sep-2016	2016-WS1	White Sucker	373	343	534.1	9	Adult	Male	3
LA-5	Gillnet	11-Sep-2016	-	White Sucker	56	53	0.6	-	YOY	-	-
LA-5	Gillnet	11-Sep-2016	2016-WS3	White Sucker	369	341	561.7	10	Adult	Male	3
LA-5	Gillnet	11-Sep-2016	2016-WS5	White Sucker	375	347	559.2	9	Adult	Male	3
LA-5	Gillnet	11-Sep-2016	2016-WS2	White Sucker	372	349	591.5	10	Adult	Male	3
LA-5	Gillnet	11-Sep-2016	-	White Sucker	379	350	598.3	6	Adult	Female	2
LA-5	Gillnet	11-Sep-2016	2016-WS4	White Sucker	382	350	582.6	13	Adult	Male	3
LA-5	Gillnet	11-Sep-2016	2016-WS5	White Sucker	386	357	600	10	Adult	Male	3
LA-5	Gillnet	11-Sep-2016	2016-WS3	White Sucker	429	393	750	8	Adult	Male	3
LA-5	Gillnet	11-Sep-2016	2016-WS2	White Sucker	429	396	780	12	Adult	Male	3
LA-5	Gillnet	11-Sep-2016	2016-WS4	White Sucker	430	397	700	13	Adult	Male	3
LA-5	Gillnet	30-May-2017	-	White Sucker	308	284	280	-	Juvenile	-	-
LA-5	Gillnet	30-May-2017	-	White Sucker	345	321	380	-	Juvenile	Female	1
LA-5	Gillnet	30-May-2017	-	White Sucker	363	333	470	-	Adult	Male	4
LA-5	Gillnet	30-May-2017	LA1-WS2	White Sucker	403	366	620	7	Adult	Female	5
LA-5	Gillnet	30-May-2017	LA1-WS1	White Sucker	409	377	700	7	Adult	Female	5
LA-5	Gillnet	30-May-2017	-	White Sucker	430	393	760	-	Adult	Female	5
LA-6	Gillnet	16-Sep-2016	-	Lake Whitefish	402	355	680	-	Juvenile	Female	1
LA-6	Gillnet	16-Sep-2016	-	Northern Pike	192	182	33	-	YOY	-	-
LA-6	Gillnet	16-Sep-2016	-	Northern Pike	200	189	38.4	-	YOY	-	-
LA-6	Gillnet	16-Sep-2016	2016-NP1	Northern Pike	343	316	460	3	Adult	Male	2
LA-6	Gillnet	16-Sep-2016	2016-NP1	Northern Pike	543	508	860	3	Adult	Female	3
LA-6	Gillnet	16-Sep-2016	2016-NP4	Northern Pike	900	859	5330	9	Adult	Female	3
LA-6	Gillnet	16-Sep-2016	2016-NP2	Northern Pike	928	885	5630	10	Adult	Female	3
LA-6	Gillnet	16-Sep-2016	2016-NP5	Northern Pike	935	890	5340	11	Adult	Female	3
LA-6	Gillnet	16-Sep-2016	2016-NP3	Northern Pike	982	935	5610	10	Adult	Female	3
LA-6	Angling	29-May-2017	LA6-NP1	Northern Pike	650	618	1730	-	Adult	Male	5
LA-6	Gillnet	16-Sep-2016	-	Spottail Shiner	68	62	1.6	-	Juvenile	-	-
LA-6	Gillnet	16-Sep-2016	-	Spottail Shiner	69	63	1.8	-	Juvenile	Male	1
LA-6	Gillnet	16-Sep-2016	-	Spottail Shiner	72	66	1.8	-	Juvenile	Male	1
LA-6	Gillnet	16-Sep-2016	-	Spottail Shiner	91	83	5.3	-	Adult	-	-
LA-6	Gillnet	16-Sep-2016	-	Spottail Shiner	103	92	6.9	-	Adult	-	-
LA-6	Gillnet	16-Sep-2016	-	Walleye	536	510	1330	-	Adult	Female	3
LA-6	Angling	30-May-2017	-	Walleye	531	496	1050	-	Adult	Female	5
LA-6	Angling	30-May-2017	-	Walleye	521	496	1110	-	Adult	Female	5
LA-6	Gillnet	16-Sep-2016	2016-WS3	White Sucker	362	327	1040	12	Adult	Female	3
LA-6	Gillnet	16-Sep-2016	2016-WS5	White Sucker	369	338	570	6	Adult	Male	3
LA-6	Gillnet	16-Sep-2016	2016-WS1	White Sucker	367	339	530	8	Adult	Male	2
LA-6	Gillnet	16-Sep-2016	2016-WS3	White Sucker	387	350	660	6	Adult	Male	3
LA-6	Gillnet	16-Sep-2016	-	White Sucker	400	366	740	-	Adult	Female	2
LA-6	Gillnet	16-Sep-2016	-	White Sucker	403	372	690	-	Adult	Male	3
LA-6	Gillnet	16-Sep-2016	2016-WS4	White Sucker	418	382	820	10	Adult	Male	2
LA-6	Gillnet	16-Sep-2016	2016-WS1	White Sucker	430	390	850	8	Adult	Female	3
LA-6	Gillnet	16-Sep-2016	2016-WS2	White Sucker	424	390	810	8	Adult	Female	3
LA-6	Gillnet	16-Sep-2016	2016-WS4	White Sucker	431	395	910	10	Adult	Female	3

Table A-16
Baseline Detailed Fish Collection Data

Waterbody	Method	Date	Sample Number	Species	Total Length (mm)	Fork Length (mm)	Weight (g)	Age (y)	Age Class*	Sex	Spawning Condition**
LA-6	Gillnet	16-Sep-2016	2016-WS2	White Sucker	442	405	940	10	Adult	Female	3
LA-6	Gillnet	16-Sep-2016	2016-WS5	White Sucker	460	427	1110	9	Adult	Female	3
LA-6	Gillnet	29-May-2017	LA6-WS1	White Sucker	409	355	680	10	Adult	Male	3
LA-6	Gillnet	29-May-2017	LA6-WS1	White Sucker	425	386	790	9	Adult	Female	3
LA-7	Gillnet	19-Sep-2016	-	Lake Whitefish	100	90	-	-	YOY	-	-
LA-7	Gillnet	19-Sep-2016	-	Lake Whitefish	183	154	50	-	Juvenile	-	-
LA-7	Gillnet	19-Sep-2016	-	Lake Whitefish	203	175	70	-	Juvenile	-	-
LA-7	Gillnet	19-Sep-2016	-	Lake Whitefish	205	184	80	-	Juvenile	-	-
LA-7	Gillnet	19-Sep-2016	-	Lake Whitefish	287	251	190	-	Juvenile	-	-
LA-7	Gillnet	19-Sep-2016	-	Lake Whitefish	315	278	240	-	Juvenile	-	-
LA-7	Gillnet	19-Sep-2016	-	Lake Whitefish	336	300	330	-	Juvenile	-	-
LA-7	Gillnet	19-Sep-2016	-	Lake Whitefish	335	300	-	-	Juvenile	-	-
LA-7	Gillnet	19-Sep-2016	-	Lake Whitefish	379	333	480	-	Adult	-	-
LA-7	Gillnet	19-Sep-2016	-	Lake Whitefish	385	340	470	-	Adult	-	-
LA-7	Gillnet	19-Sep-2016	-	Lake Whitefish	390	350	430	-	Adult	-	-
LA-7	Gillnet	19-Sep-2016	-	Lake Whitefish	410	365	600	-	Adult	-	-
LA-7	Gillnet	19-Sep-2016	-	Lake Whitefish	430	382	670	-	Adult	-	-
LA-7	Gillnet	19-Sep-2016	-	Lake Whitefish	445	395	840	-	Adult	Female	3
LA-7	Gillnet	19-Sep-2016	-	Lake Whitefish	442	396	850	-	Adult	-	-
LA-7	Gillnet	20-Sep-2016	-	Lake Whitefish	204	180	63	-	Juvenile	-	-
LA-7	Gillnet	20-Sep-2016	-	Lake Whitefish	289	252	190	-	Juvenile	-	-
LA-7	Gillnet	20-Sep-2016	-	Lake Whitefish	420	365	590	-	Adult	-	-
LA-7	Gillnet	20-Sep-2016	-	Lake Whitefish	445	395	730	-	Adult	-	-
LA-7	Gillnet	31-May-2017	-	Lake Whitefish	322	285	310	-	Juvenile	-	-
LA-7	Gillnet	31-May-2017	-	Lake Whitefish	340	299	310	-	Juvenile	-	-
LA-7	Gillnet	19-Sep-2016	2016-NP2	Northern Pike	772	732	2620	-	Adult	Male	-
LA-7	Gillnet	19-Sep-2016	2016-NP5	Northern Pike	729	690	2430	8	Adult	Male	-
LA-7	Gillnet	19-Sep-2016	2016-NP3	Northern Pike	681	621	1650	7	Adult	Male	-
LA-7	Gillnet	19-Sep-2016	2016-NP4	Northern Pike	720	683	2050	8	Adult	Female	-
LA-7	Gillnet	19-Sep-2016	2016-NP1	Northern Pike	783	745	2840	10	Adult	Male	-
LA-7	Gillnet	20-Sep-2016	-	Northern Pike	596	560	1100	-	Juvenile	-	-
LA-7	Gillnet	20-Sep-2016	-	Northern Pike	653	635	1680	-	Adult	-	-
LA-7	Gillnet	20-Sep-2016	-	Northern Pike	794	745	1930	-	Adult	-	-
LA-7	Angling	31-May-2017	LA7-NP1	Northern Pike	760	713	2630	9	Adult	Female	5
LA-7	Gillnet	31-May-2017	-	Northern Pike	524	456	830	-	Juvenile	-	-
LA-7	Gillnet	31-May-2017	-	Northern Pike	548	516	950	-	Adult	-	-
LA-7	Gillnet	31-May-2017	-	Northern Pike	580	550	990	-	Juvenile	-	-
LA-7	Gillnet	31-May-2017	-	Northern Pike	596	558	1250	-	Adult	-	-
LA-7	Gillnet	31-May-2017	-	Northern Pike	608	570	1160	-	Adult	-	-
LA-7	Gillnet	31-May-2017	-	Northern Pike	635	600	1680	-	Adult	Female	5
LA-7	Gillnet	31-May-2017	-	Northern Pike	645	610	1620	-	Adult	-	-
LA-7	Gillnet	31-May-2017	-	Northern Pike	669	630	1540	-	Adult	-	-
LA-7	Gillnet	31-May-2017	LA7-NP2	Northern Pike	698	642	2130	9	Adult	Male	5
LA-7	Gillnet	31-May-2017	-	Northern Pike	691	648	1910	-	Adult	-	-
LA-7	Gillnet	31-May-2017	-	Northern Pike	701	660	1960	-	Adult	-	-
LA-7	Gillnet	31-May-2017	-	Northern Pike	726	678	1850	-	Adult	-	-
LA-7	Gillnet	31-May-2017	LA7-NP3	Northern Pike	735	693	2230	7	Adult	Female	5
LA-7	Gillnet	31-May-2017	-	Northern Pike	743	699	2030	-	Adult	-	-
LA-7	Gillnet	31-May-2017	-	Northern Pike	750	710	2490	-	Adult	-	-
LA-7	Gillnet	31-May-2017	-	Northern Pike	774	734	2660	-	Adult	-	-
LA-7	Gillnet	31-May-2017	-	Northern Pike	812	772	2780	-	Adult	-	-
LA-7	Gillnet	31-May-2017	-	Northern Pike	895	845	4710	-	Adult	-	-
LA-7	Gillnet	19-Sep-2016	-	Spottail Shiner	60	55	-	-	Juvenile	-	-
LA-7	Gillnet	19-Sep-2016	-	Spottail Shiner	66	58	-	-	Adult	-	-
LA-7	Gillnet	19-Sep-2016	-	Spottail Shiner	80	72	-	-	Adult	-	-
LA-7	Gillnet	19-Sep-2016	-	Spottail Shiner	92	83	-	-	Adult	-	-
LA-7	Gillnet	19-Sep-2016	-	Spottail Shiner	78	84	-	-	Adult	-	-
LA-7	Gillnet	19-Sep-2016	-	Spottail Shiner	95	85	-	-	Adult	-	-
LA-7	Gillnet	19-Sep-2016	-	Spottail Shiner	100	90	-	-	Adult	-	-
LA-7	Gillnet	19-Sep-2016	-	Spottail Shiner	102	94	-	-	Adult	-	-
LA-7	Gillnet	19-Sep-2016	-	Spottail Shiner	105	96	-	-	Adult	-	-
LA-7	Gillnet	19-Sep-2016	-	Walleye	125	117	-	-	YOY	-	-
LA-7	Gillnet	19-Sep-2016	-	Walleye	496	460	990	-	Adult	-	-
LA-7	Gillnet	19-Sep-2016	-	Walleye	568	532	1160	-	Adult	-	-
LA-7	Gillnet	19-Sep-2016	-	Walleye	551	518	1290	-	Adult	-	-
LA-7	Angling	31-May-2017	-	Walleye	-	-	-	-	Juvenile	-	-
LA-7	Angling	31-May-2017	-	Walleye	-	-	-	-	Adult	Male	4
LA-7	Angling	31-May-2017	-	Walleye	-	-	1800	-	Adult	-	-
LA-7	Gillnet	31-May-2017	-	Walleye	330	309	310	-	Juvenile	-	1
LA-7	Gillnet	31-May-2017	-	Walleye	358	335	360	-	Juvenile	-	-
LA-7	Gillnet	31-May-2017	-	Walleye	430	402	590	-	Juvenile	-	-
LA-7	Gillnet	31-May-2017	-	Walleye	482	448	880	-	Juvenile	-	-
LA-7	Gillnet	31-May-2017	-	Walleye	565	533	1370	-	Adult	Male	5

Table A-16
Baseline Detailed Fish Collection Data

Waterbody	Method	Date	Sample Number	Species	Total Length (mm)	Fork Length (mm)	Weight (g)	Age (y)	Age Class*	Sex	Spawning Condition**
LA-7	Gillnet	31-May-2017	-	Walleye	620	588	1920	-	Adult	Female	5
LA-7	Gillnet	19-Sep-2016	-	White Sucker	205	190	95	-	Juvenile	-	-
LA-7	Gillnet	19-Sep-2016	-	White Sucker	208	193	110	-	Juvenile	-	-
LA-7	Gillnet	19-Sep-2016	-	White Sucker	270	251	200	-	Juvenile	-	-
LA-7	Gillnet	19-Sep-2016	-	White Sucker	277	258	240	-	Juvenile	-	-
LA-7	Gillnet	19-Sep-2016	-	White Sucker	280	260	220	-	Juvenile	-	-
LA-7	Gillnet	19-Sep-2016	-	White Sucker	300	281	360	-	Juvenile	-	-
LA-7	Gillnet	19-Sep-2016	2016-WS5	White Sucker	336	311	350	5	Juvenile	-	-
LA-7	Gillnet	19-Sep-2016	2016-WS3	White Sucker	340	312	440	8	Adult	Female	-
LA-7	Gillnet	19-Sep-2016	2016-WS3	White Sucker	339	312	400	8	Adult	Male	-
LA-7	Gillnet	19-Sep-2016	2016-WS2	White Sucker	340	313	400	9	Adult	Male	-
LA-7	Gillnet	19-Sep-2016	2016-WS1	White Sucker	351	326	420	9	Adult	Female	-
LA-7	Gillnet	19-Sep-2016	2016-WS2	White Sucker	360	333	480	9	Adult	Female	-
LA-7	Gillnet	19-Sep-2016	2016-WS1	White Sucker	371	340	500	8	Adult	Female	-
LA-7	Gillnet	20-Sep-2016	-	White Sucker	234	217	130	-	Juvenile	-	-
LA-7	Gillnet	20-Sep-2016	-	White Sucker	257	236	200	-	Juvenile	-	-
LA-7	Gillnet	20-Sep-2016	-	White Sucker	270	250	200	-	Juvenile	-	-
LA-7	Gillnet	20-Sep-2016	-	White Sucker	277	260	230	-	Juvenile	-	-
LA-7	Gillnet	20-Sep-2016	-	White Sucker	285	263	230	-	Juvenile	-	-
LA-7	Gillnet	20-Sep-2016	-	White Sucker	333	305	350	-	Adult	-	-
LA-7	Gillnet	20-Sep-2016	2016-WS4	White Sucker	339	313	380	5	Juvenile	Female	1
LA-7	Gillnet	20-Sep-2016	2016-WS4	White Sucker	368	337	490	9	Adult	Female	3
LA-7	Gillnet	20-Sep-2016	2016-WS5	White Sucker	404	371	730	10	Adult	Female	3
LA-7	Gillnet	31-May-2017	-	White Sucker	278	260	210	-	Juvenile	Male	4
LA-7	Gillnet	31-May-2017	-	White Sucker	290	270	210	-	Juvenile	-	-
LA-7	Gillnet	31-May-2017	-	White Sucker	293	272	290	-	Juvenile	-	-
LA-7	Gillnet	31-May-2017	-	White Sucker	294	273	210	-	Juvenile	-	-
LA-7	Gillnet	31-May-2017	-	White Sucker	298	273	250	-	Juvenile	-	-
LA-7	Gillnet	31-May-2017	-	White Sucker	308	278	250	-	Juvenile	-	1
LA-7	Gillnet	31-May-2017	-	White Sucker	307	279	290	-	Juvenile	-	-
LA-7	Gillnet	31-May-2017	-	White Sucker	306	280	310	-	Adult	Male	4
LA-7	Gillnet	31-May-2017	-	White Sucker	320	298	360	-	Adult	-	-
LA-7	Gillnet	31-May-2017	-	White Sucker	324	298	360	-	Adult	Female	2
LA-7	Gillnet	31-May-2017	-	White Sucker	322	299	360	-	Adult	Male	4
LA-7	Gillnet	31-May-2017	-	White Sucker	324	300	360	-	Adult	Male	3.5
LA-7	Gillnet	31-May-2017	-	White Sucker	333	304	320	-	Adult	-	-
LA-7	Gillnet	31-May-2017	-	White Sucker	334	309	380	-	Adult	Female	1
LA-7	Gillnet	31-May-2017	LA7-WS1	White Sucker	339	309	430	8	Adult	Female	3.5
LA-7	Gillnet	31-May-2017	-	White Sucker	340	312	410	-	Adult	-	-
LA-7	Gillnet	31-May-2017	LA7-WS1	White Sucker	346	314	430	5	Adult	Female	3
LA-7	Gillnet	31-May-2017	LA7-WS1	White Sucker	351	320	430	9	Adult	Male	3.5
LA-7	Gillnet	31-May-2017	-	White Sucker	355	326	390	-	Adult	Male	5
LA-7	Gillnet	31-May-2017	-	White Sucker	359	327	510	-	Adult	Female	-
LA-7	Gillnet	31-May-2017	LA7-WS2	White Sucker	352	330	460	7	Adult	Female	3.5
LA-7	Gillnet	31-May-2017	LA7-WS2	White Sucker	359	334	480	8	Adult	Female	3.5
LA-7	Gillnet	31-May-2017	-	White Sucker	365	335	460	-	Adult	-	-
LA-7	Gillnet	31-May-2017	LA7-WS2	White Sucker	373	340	430	9	Adult	Female	3.5
LA-7	Gillnet	31-May-2017	-	White Sucker	388	348	350	-	Adult	Female	-
LA-8	Gillnet	16-Sep-2016	-	Lake Whitefish	304	263	220	-	Juvenile	-	-
LA-8	Gillnet	16-Sep-2016	-	Lake Whitefish	383	340	570	-	Adult	-	-
LA-8	Gillnet	16-Sep-2016	-	Lake Whitefish	397	349	550	-	Adult	-	-
LA-8	Gillnet	16-Sep-2016	-	Lake Whitefish	417	365	600	-	Adult	-	-
LA-8	Gillnet	16-Sep-2016	-	Lake Whitefish	432	385	770	-	Adult	-	-
LA-8	Gillnet	16-Sep-2016	-	Lake Whitefish	445	394	810	-	Adult	-	-
LA-8	Gillnet	16-Sep-2016	-	Lake Whitefish	451	401	950	-	Adult	-	-
LA-8	Gillnet	16-Sep-2016	-	Lake Whitefish	474	418	1000	-	Adult	-	-
LA-8	Gillnet	16-Sep-2016	-	Lake Whitefish	483	431	1170	-	Adult	-	-
LA-8	Gillnet	16-Sep-2016	-	Lake Whitefish	489	432	1200	-	Adult	Male	4
LA-8	Gillnet	16-Sep-2016	-	Lake Whitefish	501	449	1240	-	Adult	Female	2
LA-8	Gillnet	16-Sep-2016	-	Lake Whitefish	505	449	1410	-	Adult	-	-
LA-8	Gillnet	16-Sep-2016	-	Lake Whitefish	505	451	1330	-	Adult	Female	3
LA-8	Gillnet	16-Sep-2016	-	Lake Whitefish	518	459	1540	-	Adult	-	-
LA-8	Gillnet	16-Sep-2016	-	Lake Whitefish	521	459	1380	-	Adult	-	-
LA-8	Gillnet	16-Sep-2016	-	Lake Whitefish	521	465	1280	-	Adult	-	3
LA-8	Gillnet	16-Sep-2016	-	Lake Whitefish	565	510	1950	-	Adult	Female	4
LA-8	Gillnet	16-Sep-2016	-	Lake Whitefish	686	648	2040	-	Adult	-	-
LA-8	Gillnet	16-Sep-2016	-	Ninespine Stickleback	59	-	1.6	-	Adult	-	-
LA-8	Gillnet	16-Sep-2016	-	Northern Pike	612	574	1410	-	Juvenile	-	2
LA-8	Gillnet	16-Sep-2016	-	Northern Pike	621	585	1280	-	Adult	Female	2
LA-8	Gillnet	16-Sep-2016	-	Northern Pike	631	594	1590	-	Adult	Female	2
LA-8	Gillnet	16-Sep-2016	-	Northern Pike	660	626	1440	-	Adult	-	-
LA-8	Gillnet	16-Sep-2016	-	Northern Pike	681	640	1920	-	Juvenile	-	2
LA-8	Gillnet	16-Sep-2016	-	Northern Pike	727	681	2110	-	Juvenile	-	2

Table A-16
Baseline Detailed Fish Collection Data

Waterbody	Method	Date	Sample Number	Species	Total Length (mm)	Fork Length (mm)	Weight (g)	Age (y)	Age Class*	Sex	Spawning Condition**
LA-8	Gillnet	16-Sep-2016	-	Northern Pike	761	715	2520	-	Juvenile	-	2
LA-8	Gillnet	16-Sep-2016	-	Northern Pike	765	724	2280	-	Adult	-	-
LA-8	Gillnet	16-Sep-2016	-	White Sucker	179	161	49.9	-	Juvenile	-	-
LA-8	Gillnet	16-Sep-2016	-	White Sucker	229	206	110	-	Juvenile	-	-
LA-8	Gillnet	16-Sep-2016	-	White Sucker	254	235	146.9	-	Juvenile	-	-
LA-8	Gillnet	16-Sep-2016	-	Yellow Perch	-	42	1.1	-	YOY	-	-
LA-9	Gillnet	17-Sep-2016	-	Lake Whitefish	210	185	69.9	-	Juvenile	-	-
LA-9	Gillnet	17-Sep-2016	-	Lake Whitefish	212	186	69.9	-	Juvenile	-	-
LA-9	Gillnet	17-Sep-2016	-	Lake Whitefish	266	231	132	-	Juvenile	-	-
LA-9	Gillnet	17-Sep-2016	-	Lake Whitefish	265	232	140.7	-	Juvenile	-	-
LA-9	Gillnet	17-Sep-2016	-	Lake Whitefish	316	275	252.1	-	Juvenile	-	-
LA-9	Gillnet	17-Sep-2016	-	Lake Whitefish	317	278	252.3	-	Juvenile	-	-
LA-9	Gillnet	17-Sep-2016	-	Lake Whitefish	402	357	540	-	Adult	-	3
LA-9	Gillnet	17-Sep-2016	-	Lake Whitefish	415	364	570	-	Adult	-	3
LA-9	Gillnet	17-Sep-2016	-	Lake Whitefish	457	399	820	-	Adult	-	3
LA-9	Gillnet	17-Sep-2016	-	Lake Whitefish	496	439	1256	-	Adult	-	3
LA-9	Gillnet	17-Sep-2016	-	Northern Pike	224	211	62	-	Juvenile	-	-
LA-9	Gillnet	17-Sep-2016	-	Northern Pike	364	340	393.6	-	Juvenile	-	-
LA-9	Gillnet	17-Sep-2016	-	Spottail Shiner	65	52	2	-	Adult	-	-
LA-9	Gillnet	17-Sep-2016	-	Spottail Shiner	68	62	3	-	Adult	-	-
LA-9	Gillnet	17-Sep-2016	-	Spottail Shiner	90	80	6.4	-	Adult	-	-
LA-9	Gillnet	17-Sep-2016	-	Spottail Shiner	92	81	7.3	-	Adult	-	-
LA-9	Gillnet	17-Sep-2016	-	Spottail Shiner	91	81	6	-	Adult	-	-
LA-9	Gillnet	17-Sep-2016	-	Spottail Shiner	94	83	6.5	-	Adult	-	-
LA-9	Gillnet	17-Sep-2016	-	Spottail Shiner	97	86	7.9	-	Adult	-	-
LA-9	Gillnet	17-Sep-2016	-	Spottail Shiner	96	86	7.1	-	Adult	-	-
LA-9	Gillnet	17-Sep-2016	-	Spottail Shiner	98	90	10.1	-	Adult	-	-
LA-9	Gillnet	17-Sep-2016	-	Walleye	531	491	1280	-	Adult	-	2
LA-9	Gillnet	17-Sep-2016	-	Walleye	535	500	1340	-	Adult	-	-
LA-9	Gillnet	17-Sep-2016	-	Walleye	572	536	1450	-	Adult	-	2
LA-9	Gillnet	17-Sep-2016	-	White Sucker	130	120	18.9	-	Juvenile	-	-
LA-9	Gillnet	17-Sep-2016	-	White Sucker	265	242	184.1	-	Juvenile	-	-
LA-9	Gillnet	17-Sep-2016	-	White Sucker	346	312	387.5	-	Adult	Male	4
LA-9	Gillnet	17-Sep-2016	-	White Sucker	377	358	567	-	Adult	-	-
LA-9	Gillnet	17-Sep-2016	-	Yellow Perch	51	48	1.5	-	YOY	-	-
LA-9	Gillnet	17-Sep-2016	-	Yellow Perch	51	48	1.3	-	YOY	-	-
LA-9	Gillnet	17-Sep-2016	-	Yellow Perch	55	51	1.8	-	YOY	-	-
LA-9	Gillnet	17-Sep-2016	-	Yellow Perch	54	51	1.4	-	YOY	-	-
LAB-1	Gillnet	21-Sep-2016	-	Lake Trout	700	636	2850	-	Adult	-	-
LAB-1	Gillnet	28-May-2017	-	Lake Trout	720	658	3160	-	Adult	-	-
LAB-1	Gillnet	20-Sep-2016	-	Lake Whitefish	240	210	110.3	-	Juvenile	-	-
LAB-1	Gillnet	20-Sep-2016	-	Lake Whitefish	404	351	510	-	Adult	-	-
LAB-1	Gillnet	20-Sep-2016	-	Lake Whitefish	508	453	1200	-	Adult	-	-
LAB-1	Gillnet	20-Sep-2016	-	Lake Whitefish	534	469	1390	-	Adult	-	-
LAB-1	Gillnet	20-Sep-2016	-	Lake Whitefish	541	488	1550	-	Adult	-	-
LAB-1	Gillnet	28-May-2017	-	Lake Whitefish	329	286	290	-	Juvenile	-	-
LAB-1	Gillnet	28-May-2017	-	Lake Whitefish	496	428	1180	-	Adult	-	-
LAB-1	Gillnet	28-May-2017	-	Lake Whitefish	495	443	1230	-	Adult	-	-
LAB-1	Gillnet	28-May-2017	-	Lake Whitefish	524	469	1430	-	Adult	Female	-
LAB-1	Gillnet	01-Jun-2017	-	Lake Whitefish	362	320	360	-	Juvenile	-	-
LAB-1	Gillnet	01-Jun-2017	-	Lake Whitefish	387	342	470	-	Juvenile	-	-
LAB-1	Gillnet	01-Jun-2017	-	Lake Whitefish	439	386	670	-	Juvenile	-	-
LAB-1	Gillnet	01-Jun-2017	-	Lake Whitefish	472	418	1040	-	Adult	-	-
LAB-1	Gillnet	01-Jun-2017	-	Lake Whitefish	475	420	1020	-	Adult	-	-
LAB-1	Gillnet	01-Jun-2017	-	Lake Whitefish	598	430	2070	-	Adult	-	-
LAB-1	Gillnet	01-Jun-2017	-	Lake Whitefish	502	440	1190	-	Adult	-	-
LAB-1	Gillnet	01-Jun-2017	-	Lake Whitefish	511	452	1130	-	Adult	-	-
LAB-1	Gillnet	01-Jun-2017	-	Lake Whitefish	539	482	1300	-	Adult	-	-
LAB-1	Gillnet	01-Jun-2017	-	Lake Whitefish	536	482	1350	-	Adult	-	-
LAB-1	Gillnet	20-Sep-2016	2016-NP1	Northern Pike	796	756	3390	9	Adult	Female	2
LAB-1	Gillnet	28-May-2017	LAB-NP1	Northern Pike	661	628	1710	5	Adult	Male	5
LAB-1	Gillnet	01-Jun-2017	-	Northern Pike	631	588	1540	-	Adult	-	-
LAB-1	Gillnet	01-Jun-2017	-	Northern Pike	647	608	1580	-	Adult	-	-
LAB-1	Gillnet	01-Jun-2017	-	Northern Pike	662	627	1730	-	Adult	-	-
LAB-1	Gillnet	01-Jun-2017	-	Northern Pike	690	650	2150	-	Adult	Male	4.5
LAB-1	Gillnet	01-Jun-2017	-	Northern Pike	711	665	2090	-	Adult	Male	5
LAB-1	Gillnet	01-Jun-2017	-	Northern Pike	732	695	2410	-	Adult	-	-
LAB-1	Gillnet	01-Jun-2017	-	Northern Pike	750	707	2630	-	Adult	-	-
LAB-1	Gillnet	01-Jun-2017	-	Northern Pike	880	833	4000	-	Adult	-	-
LAB-1	Gillnet	01-Jun-2017	-	Northern Pike	1015	962	5760	-	Adult	Female	5
LAB-1	Gillnet	20-Sep-2016	-	Spottail Shiner	83	76	6.3	-	Juvenile	Male	1
LAB-1	Gillnet	20-Sep-2016	-	Spottail Shiner	94	86	9.6	-	Adult	Male	3
LAB-1	Gillnet	20-Sep-2016	-	Walleye	562	526	1610	-	Adult	-	-

Table A-16
Baseline Detailed Fish Collection Data

Waterbody	Method	Date	Sample Number	Species	Total Length (mm)	Fork Length (mm)	Weight (g)	Age (y)	Age Class*	Sex	Spawning Condition**
LAB-1	Gillnet	20-Sep-2016	-	Walleye	591	555	1830	-	Adult	-	-
LAB-1	Gillnet	21-Sep-2016	-	Walleye	453	430	830	-	Juvenile	-	-
LAB-1	Gillnet	21-Sep-2016	-	Walleye	506	477	1200	-	Adult	-	-
LAB-1	Gillnet	21-Sep-2016	-	Walleye	546	512	1520	-	Adult	Male	3
LAB-2	Gillnet	21-Sep-2016	-	Lake Trout	526	484	1160	-	Juvenile	-	-
LAB-2	Gillnet	22-Sep-2016	-	Lake Trout	643	579	2700	-	Adult	Male	3
LAB-2	Gillnet	20-Sep-2016	-	Lake Whitefish	262	231	125	-	Juvenile	-	-
LAB-2	Gillnet	20-Sep-2016	-	Lake Whitefish	511	452	1070	-	Adult	-	-
LAB-2	Gillnet	21-Sep-2016	-	Lake Whitefish	375	331	390	-	Juvenile	-	-
LAB-2	Gillnet	22-Sep-2016	-	Lake Whitefish	316	276	274.5	-	Juvenile	-	-
LAB-2	Gillnet	22-Sep-2016	-	Lake Whitefish	324	287	254.4	-	Juvenile	-	-
LAB-2	Gillnet	22-Sep-2016	-	Lake Whitefish	337	298	319.4	-	Juvenile	-	-
LAB-2	Gillnet	22-Sep-2016	-	Lake Whitefish	500	446	1210	-	Juvenile	Male	2
LAB-2	Gillnet	22-Sep-2016	-	Lake Whitefish	515	454	1290	-	Juvenile	Male	2
LAB-2	Gillnet	22-Sep-2016	2016-NP2	Northern Pike	723	684	1590	12	Adult	Female	2
LAB-2	Gillnet	22-Sep-2016	2016-NP3	Northern Pike	822	776	3900	8	Adult	Female	3
LAB-2	Gillnet	22-Sep-2016	2016-NP5	Northern Pike	840	794	3690	8	Adult	Female	3
LAB-2	Gillnet	22-Sep-2016	2016-NP4	Northern Pike	843	799	3850	11	Adult	Female	3
LAB-2	Gillnet	20-Sep-2016	-	Walleye	593	563	1940	-	Adult	-	-
LAB-2	Gillnet	20-Sep-2016	-	Walleye	611	572	2140	-	Adult	-	-
LAB-2	Gillnet	20-Sep-2016	-	Walleye	618	576	2190	-	Adult	-	-
LAB-2	Gillnet	20-Sep-2016	-	Walleye	637	600	2180	-	Adult	-	-
LAB-2	Gillnet	21-Sep-2016	-	Walleye	380	357	490	-	Juvenile	Male	1
LAB-2	Gillnet	21-Sep-2016	-	Walleye	397	375	570	-	Juvenile	-	-
LAB-2	Gillnet	21-Sep-2016	-	Walleye	409	384	620	-	Juvenile	-	-
LAB-2	Gillnet	21-Sep-2016	-	Walleye	473	445	970	-	Adult	-	-
LAB-2	Gillnet	21-Sep-2016	-	Walleye	499	475	1140	-	Adult	-	-
LAB-2	Gillnet	21-Sep-2016	-	Walleye	505	477	1310	-	Adult	-	-
LAB-2	Gillnet	21-Sep-2016	-	Walleye	552	511	1550	-	Adult	-	-
LAB-2	Gillnet	21-Sep-2016	-	Walleye	571	540	1660	-	Adult	-	-
LAB-2	Gillnet	21-Sep-2016	-	Walleye	611	574	1800	-	Adult	-	-
LAB-2	Gillnet	21-Sep-2016	-	Walleye	633	601	2330	-	Adult	-	-
LAB-2	Gillnet	22-Sep-2016	-	Walleye	340	321	333.1	-	Juvenile	-	-
LAB-2	Gillnet	22-Sep-2016	-	Walleye	377	353	460.9	-	Juvenile	-	-
LAB-2	Gillnet	22-Sep-2016	-	Walleye	426	399	650	-	Juvenile	-	-
LAB-2	Gillnet	22-Sep-2016	-	Walleye	531	500	1550	-	Adult	Female	2
LAB-2	Gillnet	22-Sep-2016	-	Walleye	533	502	1260	-	Adult	Female	2
LAB-2	Gillnet	22-Sep-2016	-	Walleye	623	583	2330	-	Adult	Female	3
LAB-2	Gillnet	22-Sep-2016	2016-WS4	White Sucker	299	276	289.6	7	Juvenile	-	-
LAB-2	Gillnet	22-Sep-2016	2016-WS1	White Sucker	302	279	289.5	5	Juvenile	Female	1
LAB-2	Gillnet	22-Sep-2016	2016-WS2	White Sucker	311	290	328.3	5	Adult	Female	2
LAB-2	Gillnet	22-Sep-2016	-	White Sucker	321	293	379.4	-	Adult	-	-
LAB-2	Gillnet	22-Sep-2016	2016-WS5	White Sucker	327	305	377.4	4	Adult	-	-
LAB-2	Gillnet	22-Sep-2016	2016-WS4	White Sucker	332	306	399.9	5	Adult	Male	2
LAB-2	Gillnet	22-Sep-2016	2016-WS3	White Sucker	333	306	379	6	Adult	Female	3
LAB-2	Gillnet	22-Sep-2016	2016-WS5	White Sucker	332	307	402.4	5	Adult	Male	2
LAB-2	Gillnet	22-Sep-2016	2016-WS2	White Sucker	346	319	444	5	Adult	Female	3
LAB-2	Gillnet	22-Sep-2016	2016-WS3	White Sucker	356	329	454.9	7	Adult	Male	2
LAB-2	Gillnet	22-Sep-2016	2016-WS1	White Sucker	380	349	555.8	10	Adult	Female	2
PA-2	Gillnet	19-Sep-2016	-	Lake Whitefish	252	219	134	-	Juvenile	-	-
PA-2	Gillnet	19-Sep-2016	-	Lake Whitefish	290	255	200	-	Juvenile	-	-
PA-2	Gillnet	19-Sep-2016	-	Lake Whitefish	304	263	228	-	Juvenile	-	-
PA-2	Gillnet	19-Sep-2016	-	Lake Whitefish	332	290	300	-	Juvenile	-	-
PA-2	Gillnet	19-Sep-2016	-	Lake Whitefish	335	291	340	-	Juvenile	-	-
PA-2	Gillnet	19-Sep-2016	-	Lake Whitefish	336	291	305	-	Juvenile	-	-
PA-2	Gillnet	19-Sep-2016	-	Lake Whitefish	342	296	330	-	Adult	Male	3
PA-2	Gillnet	19-Sep-2016	-	Lake Whitefish	379	330	460	-	Adult	Male	3
PA-2	Gillnet	19-Sep-2016	-	Lake Whitefish	387	340	470	-	Adult	-	-
PA-2	Gillnet	19-Sep-2016	-	Lake Whitefish	419	367	580	-	Adult	-	-
PA-2	Gillnet	19-Sep-2016	-	Lake Whitefish	440	390	655	-	Adult	Female	4
PA-2	Gillnet	19-Sep-2016	-	Lake Whitefish	443	390	780	-	Adult	-	-
PA-2	Gillnet	19-Sep-2016	-	Lake Whitefish	485	434	1140	-	Adult	Female	4
PA-2	Gillnet	19-Sep-2016	-	Lake Whitefish	491	436	1020	-	Adult	-	-
PA-2	Gillnet	19-Sep-2016	-	Northern Pike	556	522	810	-	Adult	-	-
PA-2	Gillnet	19-Sep-2016	-	Northern Pike	838	800	3600	-	Adult	-	-
PA-2	Gillnet	19-Sep-2016	-	White Sucker	445	403	930	-	Adult	-	-
RC1	Electrofishing	19-Sep-2016	-	Burbot	132	-	13.8	-	Juvenile	-	-
RC1	Electrofishing	19-Sep-2016	-	Burbot	103	-	7.1	-	YOY	-	-
RC1	Electrofishing	19-Sep-2016	-	Burbot	201	-	48.6	-	Juvenile	-	-
RC1	Electrofishing	19-Sep-2016	-	Lake Chub	45	42	1	-	YOY	-	-
RC1	Electrofishing	19-Sep-2016	-	Lake Chub	54	50	1.5	-	YOY	-	-
RC1	Electrofishing	19-Sep-2016	-	Lake Chub	78	72	4.8	-	Juvenile	-	-
RC1	Electrofishing	19-Sep-2016	-	Lake Chub	96	87	8.6	-	Juvenile	-	-

Table A-16
Baseline Detailed Fish Collection Data

Waterbody	Method	Date	Sample Number	Species	Total Length (mm)	Fork Length (mm)	Weight (g)	Age (y)	Age Class*	Sex	Spawning Condition**
RC1	Electrofishing	19-Sep-2016	-	Lake Chub	103	96	10.8	-	Adult	-	-
RC1	Electrofishing	19-Sep-2016	-	Lake Chub	142	131	27.8	-	Adult	-	-
RC1	Electrofishing	19-Sep-2016	-	Northern Pike	452	425	625	-	Juvenile	-	-
RC1	Electrofishing	19-Sep-2016	-	Slimy Sculpin	99	-	12.2	-	Adult	-	-
RC1	Electrofishing	19-Sep-2016	-	White Sucker	109	102	11.9	-	Juvenile	-	-
RC1	Electrofishing	19-Sep-2016	-	White Sucker	121	111	16.5	-	Juvenile	-	-
RC1	Electrofishing	19-Sep-2016	-	Yellow Perch	77	73	4.4	-	Juvenile	-	-
RC1	Electrofishing	19-Sep-2016	-	Yellow Perch	77	74	4.9	-	Juvenile	-	-
RC-1	Electrofishing	29-May-2017	-	Northern Pike	-	370	-	-	Juvenile	-	-
RC-1	Electrofishing	29-May-2017	-	White Sucker	280	260	180	-	Juvenile	-	-
RC-1	Electrofishing	29-May-2017	-	White Sucker	321	300	320	-	Juvenile	Male	1
RC-1	Electrofishing	29-May-2017	-	White Sucker	330	310	440	-	Juvenile	Female	1
SA-1	Electrofishing	17-Sep-2016	-	Burbot	92	-	4.5	-	YOY	-	-
SA-1	Electrofishing	17-Sep-2016	-	Burbot	212	-	49.2	-	Juvenile	-	-
SA-1	Electrofishing	17-Sep-2016	-	Burbot	111	-	8.2	-	YOY	-	-
SA-1	Electrofishing	17-Sep-2016	-	Burbot	123	-	12.3	-	Juvenile	-	-
SA-1	Electrofishing	17-Sep-2016	-	Lake Chub	77	71	3.9	-	Juvenile	-	-
SA-1	Electrofishing	17-Sep-2016	-	Lake Chub	102	95	10.2	-	Adult	-	-
SA-1	Electrofishing	17-Sep-2016	-	Lake Chub	127	117	20.7	-	Adult	-	-
SA-1	Electrofishing	17-Sep-2016	-	Longnose Sucker	138	129	23.5	-	Juvenile	-	-
SA-1	Electrofishing	17-Sep-2016	-	Longnose Sucker	159	150	40.8	-	Juvenile	-	-
SA-1	Gillnet	28-May-2017	-	Longnose Sucker	449	420	950	-	Adult	Male	4
SA-1	Gillnet	28-May-2017	-	Longnose Sucker	476	440	1205	-	Adult	Male	4
SA-1	Gillnet	28-May-2017	-	Longnose Sucker	473	445	1175	-	Adult	Male	4
SA-1	Gillnet	28-May-2017	-	Longnose Sucker	491	450	1260	-	Adult	Male	3.5
SA-1	Gillnet	28-May-2017	-	Longnose Sucker	495	450	1340	-	Adult	Male	4
SA-1	Gillnet	28-May-2017	-	Longnose Sucker	495	460	1450	-	Adult	Male	3.5
SA-1	Gillnet	28-May-2017	-	Longnose Sucker	516	480	1420	-	Adult	Male	4
SA-1	Gillnet	28-May-2017	-	Longnose Sucker	526	491	1860	-	Adult	Female	3.5
SA-1	Gillnet	28-May-2017	-	Longnose Sucker	534	495	1850	-	Adult	Female	3.5
SA-1	Gillnet	28-May-2017	-	Longnose Sucker	541	501	1620	-	Adult	Male	4
SA-1	Gillnet	28-May-2017	-	Longnose Sucker	549	507	1920	-	Adult	Male	4
SA-1	Gillnet	28-May-2017	-	Longnose Sucker	566	530	2110	-	Adult	Male	3.5
SA-1	Electrofishing	17-Sep-2016	-	Slimy Sculpin	103	-	12.5	-	Adult	-	-
SA-1	Electrofishing	17-Sep-2016	-	Slimy Sculpin	114	-	19.8	-	Adult	-	-
SA-1	Electrofishing	17-Sep-2016	-	White Sucker	121	113	16.9	-	Juvenile	-	-
SA-2	Electrofishing	16-Sep-2016	-	Arctic Grayling	213	232	110.1	-	Juvenile	-	-
SA-2	Electrofishing	16-Sep-2016	-	Arctic Grayling	295	272	275	-	Adult	-	-
SA-2	Electrofishing	16-Sep-2016	-	Burbot	112	-	9	-	YOY	-	-
SA-2	Electrofishing	16-Sep-2016	-	Burbot	156	-	20	-	Juvenile	-	-
SA-2	Electrofishing	16-Sep-2016	-	Burbot	112	-	7.3	-	YOY	-	-
SA-2	Electrofishing	16-Sep-2016	-	Burbot	270	-	101.6	-	Juvenile	-	-
SA-2	Electrofishing	16-Sep-2016	-	Lake Chub	50	44	1.1	-	YOY	-	-
SA-2	Electrofishing	16-Sep-2016	-	Lake Chub	70	64	2.7	-	Juvenile	-	-
SA-2	Electrofishing	16-Sep-2016	-	Lake Chub	90	81	6	-	Juvenile	-	-
SA-2	Electrofishing	16-Sep-2016	-	Lake Chub	120	111	18.6	-	Adult	-	-
SA-2	Electrofishing	16-Sep-2016	-	Lake Chub	128	120	24.9	-	Adult	-	-
SA-2	Electrofishing	16-Sep-2016	-	Northern Pike	153	145	15.8	-	YOY	-	-
SA-2	Electrofishing	16-Sep-2016	-	Northern Pike	165	156	30.8	-	YOY	-	-
SA-2	Electrofishing	16-Sep-2016	-	Northern Pike	198	209	62.4	-	Juvenile	-	-
SA-2	Electrofishing	16-Sep-2016	-	Slimy Sculpin	40	-	1	-	YOY	-	-
SA-2	Electrofishing	16-Sep-2016	-	Slimy Sculpin	58	-	2.3	-	Juvenile	-	-
SA-2	Electrofishing	16-Sep-2016	-	Slimy Sculpin	82	-	7.3	-	Adult	-	-
SA-2	Electrofishing	16-Sep-2016	-	Slimy Sculpin	39	-	0.6	-	YOY	-	-
SA-2	Electrofishing	16-Sep-2016	-	Slimy Sculpin	51	-	1.4	-	Juvenile	-	-
SA-2	Electrofishing	16-Sep-2016	-	Slimy Sculpin	103	-	15	-	Adult	-	-
SA-2	Electrofishing	16-Sep-2016	-	White Sucker	121	119	16.8	-	Juvenile	-	-
SA-2	Electrofishing	16-Sep-2016	-	White Sucker	126	119	19.5	-	Juvenile	-	-
SA-2	Gillnet	27-May-2017	-	White Sucker	338	316	350	-	Adult	Male	4
SA-2	Gillnet	27-May-2017	-	White Sucker	370	338	480	-	Adult	Male	4
SA-2	Gillnet	27-May-2017	-	White Sucker	368	338	440	-	Adult	Male	5
SA-2	Gillnet	27-May-2017	-	White Sucker	368	339	490	-	Adult	Male	4.5
SA-2	Gillnet	27-May-2017	-	White Sucker	370	340	490	-	Adult	Male	5
SA-2	Gillnet	27-May-2017	-	White Sucker	366	343	500	-	Adult	Male	4
SA-2	Gillnet	27-May-2017	-	White Sucker	377	346	450	-	Adult	Male	4
SA-2	Gillnet	27-May-2017	-	White Sucker	383	353	560	-	Adult	Male	4
SA-2	Gillnet	27-May-2017	-	White Sucker	385	357	550	-	Adult	Male	5
SA-2	Gillnet	27-May-2017	-	White Sucker	394	365	720	-	Adult	Female	4
SA-2	Gillnet	27-May-2017	-	White Sucker	401	367	640	-	Adult	Male	4.5
SA-2	Gillnet	27-May-2017	-	White Sucker	395	370	590	-	Adult	Male	4
SA-2	Gillnet	27-May-2017	-	White Sucker	408	370	680	8	Adult	Male	4.5
SA-2	Gillnet	27-May-2017	-	White Sucker	412	377	590	8	Adult	Male	4.5
SA-2	Gillnet	27-May-2017	-	White Sucker	415	383	640	-	Adult	Female	4.5

Table A-16
Baseline Detailed Fish Collection Data

Waterbody	Method	Date	Sample Number	Species	Total Length (mm)	Fork Length (mm)	Weight (g)	Age (y)	Age Class*	Sex	Spawning Condition**
SA-2	Gillnet	27-May-2017	-	White Sucker	439	398	680	-	Adult	Female	4
SA-2	Gillnet	27-May-2017	-	White Sucker	482	443	1430	9	Adult	Male	4
SA-2	Gillnet	27-May-2017	-	White Sucker	390	356	560	-	Adult	Male	4.5
SA-4	Electrofishing	10-Sep-2016	-	Arctic Grayling	142	130	24.2	-	Juvenile	-	-
SA-4	Electrofishing	10-Sep-2016	-	Arctic Grayling	262	239	164	-	Adult	-	-
SA-4	Electrofishing	10-Sep-2016	-	Burbot	182	-	38.9	-	Juvenile	-	-
SA-4	Electrofishing	10-Sep-2016	-	Burbot	117	-	8.6	-	YOY	-	-
SA-4	Electrofishing	10-Sep-2016	-	Burbot	135	-	13.6	-	Juvenile	-	-
SA-4	Electrofishing	10-Sep-2016	-	Burbot	101	-	5.5	-	YOY	-	-
SA-4	Electrofishing	10-Sep-2016	-	Lake Chub	47	44	1.0	-	YOY	-	-
SA-4	Electrofishing	10-Sep-2016	-	Lake Chub	52	48	1.2	-	YOY	-	-
SA-4	Electrofishing	10-Sep-2016	-	Lake Chub	105	95	9.6	-	Adult	-	-
SA-4	Electrofishing	10-Sep-2016	-	Lake Chub	113	104	12.3	-	Adult	-	-
SA-4	Electrofishing	10-Sep-2016	-	Longnose Sucker	138	128	22.3	-	Juvenile	-	-
SA-4	Electrofishing	10-Sep-2016	-	Ninespine Stickleback	47	46	0.6	-	Adult	-	-
SA-4	Electrofishing	10-Sep-2016	-	Ninespine Stickleback	55	54	0.8	-	Adult	-	-
SA-4	Electrofishing	10-Sep-2016	-	Northern Pike	141	132	14.5	-	YOY	-	-
SA-4	Electrofishing	10-Sep-2016	-	Slimy Sculpin	106	-	16.8	-	Adult	-	-
SA-4	Electrofishing	10-Sep-2016	-	Slimy Sculpin	83	-	6.1	-	Adult	-	-
SA-4	Electrofishing	10-Sep-2016	-	Slimy Sculpin	36	-	0.5	-	YOY	-	-
SA-4	Electrofishing	10-Sep-2016	-	Slimy Sculpin	35	-	0.4	-	YOY	-	-
SA-4	Electrofishing	10-Sep-2016	-	Slimy Sculpin	52	-	1.5	-	Juvenile	-	-
SA-4	Electrofishing	10-Sep-2016	-	Slimy Sculpin	59	-	5.6	-	Juvenile	-	-
SA-4	Electrofishing	10-Sep-2016	-	White Sucker	69	64	2.2	-	YOY	-	-
SA-4	Electrofishing	10-Sep-2016	-	White Sucker	78	73	3.8	-	YOY	-	-
SA-4	Electrofishing	10-Sep-2016	-	White Sucker	110	104	11.8	-	Juvenile	-	-
SA-4	Electrofishing	10-Sep-2016	-	White Sucker	142	132	27	-	Juvenile	-	-
SA-4	Gillnet	26-May-2017	-	White Sucker	329	301	290	-	Adult	Male	4
SA-4	Gillnet	26-May-2017	-	White Sucker	326	302	340	-	Adult	Male	4
SA-4	Gillnet	26-May-2017	-	White Sucker	335	310	380	-	Adult	Male	4
SA-4	Gillnet	26-May-2017	-	White Sucker	364	336	440	-	Adult	Male	4
SA-4	Gillnet	26-May-2017	-	White Sucker	365	342	500	-	Adult	Male	4.5
SA-4	Gillnet	26-May-2017	-	White Sucker	386	349	430	-	Adult	Male	4
SA-4	Gillnet	26-May-2017	-	White Sucker	391	354	610	-	Adult	Male	5
SA-4	Gillnet	26-May-2017	-	White Sucker	388	357	520	-	Adult	Male	4
SA-4	Gillnet	26-May-2017	-	White Sucker	393	361	600	-	Adult	Female	4.5
SA-4	Gillnet	26-May-2017	-	White Sucker	402	367	650	-	Adult	Male	4
SA-4	Gillnet	26-May-2017	-	White Sucker	407	376	690	-	Adult	Female	4
SA-4	Gillnet	26-May-2017	-	White Sucker	415	381	650	-	Adult	Male	4
SA-4	Gillnet	26-May-2017	-	White Sucker	412	383	570	-	Adult	Female	4.5
SA-4	Gillnet	26-May-2017	-	White Sucker	425	395	700	-	Adult	Female	4
SA-4	Gillnet	26-May-2017	-	White Sucker	437	398	970	-	Adult	Female	4
SA-4	Gillnet	28-May-2017	-	White Sucker	374	344	510	-	Adult	Male	5
SA-5	Electrofishing	09-Sep-2016	-	Slimy Sculpin	4.8	-	1.3	-	YOY	-	-
SA-5	Electrofishing	09-Sep-2016	-	Slimy Sculpin	4.8	-	1.3	-	YOY	-	-
SA-5	Electrofishing	09-Sep-2016	-	Slimy Sculpin	9.3	-	8.6	-	Adult	-	-
SA-5	Electrofishing	09-Sep-2016	-	Slimy Sculpin	9.7	-	10.0	-	Adult	-	-
SA-5	Electrofishing	09-Sep-2016	-	Slimy Sculpin	9.1	-	8.3	-	Adult	-	-
SA-5	Electrofishing	09-Sep-2016	-	Burbot	17.6	-	29.9	-	Juvenile	-	-
SA-5	Electrofishing	09-Sep-2016	-	Burbot	9.5	-	4.9	-	YOY	-	-
SA-5	Electrofishing	09-Sep-2016	-	Burbot	29	-	136	-	Juvenile	-	-
SA-5	Electrofishing	09-Sep-2016	-	White Sucker	7.2	6.8	3.1	-	YOY	-	-
SA-5	Electrofishing	09-Sep-2016	-	White Sucker	13.0	12.0	19.7	-	Juvenile	-	-
SA-5	Electrofishing	09-Sep-2016	-	White Sucker	11.6	10.7	14.6	-	Juvenile	-	-
SA-5	Electrofishing	09-Sep-2016	-	Ninespine Stickleback	5.4	5.3	1.0	-	Adult	-	-
SA-5	Electrofishing	09-Sep-2016	-	Lake Chub	10.4	9.5	8.8	-	Juvenile	-	-
SA-5	Electrofishing	09-Sep-2016	-	Lake Chub	11.8	11.0	16.8	-	Adult	-	-
SA-5	Electrofishing	09-Sep-2016	-	Lake Chub	11.5	10.5	14.2	-	Adult	-	-
SA-5	Gillnet	29 May 2017	-	Longnose Sucker	417	388	720	-	Adult	Male	4
SA-5	Gillnet	29 May 2017	-	White Sucker	333	298	350	-	Adult	Female	4
SA-5	Gillnet	29 May 2017	-	White Sucker	326	300	310	-	Adult	Male	4
SA-5	Gillnet	29 May 2017	-	White Sucker	334	304	370	-	Adult	Female	5
SA-5	Gillnet	29 May 2017	-	White Sucker	343	310	300	-	Adult	Male	5
SA-5	Gillnet	29 May 2017	-	White Sucker	344	315	370	-	Adult	Female	4
SA-5	Gillnet	29 May 2017	-	White Sucker	350	318	340	-	Adult	Male	4
SA-5	Gillnet	29 May 2017	-	White Sucker	354	325	370	-	Adult	Male	4
SA-5	Gillnet	29 May 2017	-	White Sucker	370	335	470	-	Adult	Female	5
SA-5	Gillnet	29 May 2017	-	White Sucker	374	341	520	-	Adult	Female	5
SA-5	Gillnet	29 May 2017	-	White Sucker	380	348	510	-	Adult	Male	4
SA-5	Gillnet	29 May 2017	-	White Sucker	386	348	570	-	Adult	Male	4
SA-5	Gillnet	29 May 2017	-	White Sucker	380	351	570	-	Adult	Female	4
SA-5	Gillnet	29 May 2017	-	White Sucker	379	351	530	-	Adult	Male	4
SA-5	Gillnet	29 May 2017	-	White Sucker	383	355	550	-	Adult	Male	4

Table A-16
Baseline Detailed Fish Collection Data

Waterbody	Method	Date	Sample Number	Species	Total Length (mm)	Fork Length (mm)	Weight (g)	Age (y)	Age Class*	Sex	Spawning Condition**
SA-5	Gillnet	29 May 2017	-	White Sucker	400	365	530	-	Adult	Male	4
SA-5	Gillnet	29 May 2017	-	White Sucker	401	370	660	-	Adult	Male	4
SA-5	Gillnet	29 May 2017	-	White Sucker	418	379	770	-	Adult	Female	4
SA-5	Gillnet	29 May 2017	-	White Sucker	413	380	720	-	Adult	Male	4
SA-6	Electrofishing	12-Sep-2016	-	Burbot	81	-	3.0	-	YOY	-	-
SA-6	Electrofishing	12-Sep-2016	-	Burbot	148	-	19.4	-	Juvenile	-	-
SA-6	Electrofishing	12-Sep-2016	-	Burbot	92	-	4.9	-	YOY	-	-
SA-6	Electrofishing	12-Sep-2016	-	Burbot	117	-	8.9	-	Juvenile	-	-
SA-6	Electrofishing	12-Sep-2016	-	Longnose Sucker	71	66	3.7	-	YOY	-	-
SA-6	Electrofishing	12-Sep-2016	-	Ninespine Stickleback	42	41	0.4	-	Adult	-	-
SA-6	Electrofishing	12-Sep-2016	-	Ninespine Stickleback	48	46	0.5	-	Adult	-	-
SA-6	Gillnet	29 May 2017	-	Northern Pike	491	461	700	-	Juvenile	-	-
SA-6	Gillnet	29 May 2017	-	Northern Pike	506	476	700	-	Juvenile	-	-
SA-6	Gillnet	29 May 2017	-	Northern Pike	545	509	930	-	Juvenile	-	-
SA-6	Gillnet	29 May 2017	-	Northern Pike	560	524	850	-	Juvenile	-	-
SA-6	Gillnet	29 May 2017	-	Northern Pike	566	528	1010	-	Juvenile	-	-
SA-6	Electrofishing	12-Sep-2016	-	Spottail Shiner	23	21	0.2	-	YOY	-	-
SA-6	Electrofishing	12-Sep-2016	-	Spottail Shiner	36	31	0.3	-	YOY	-	-
SA-6	Electrofishing	12-Sep-2016	-	Spottail Shiner	85	76	5.9	-	Adult	-	-
SA-6	Electrofishing	12-Sep-2016	-	Spottail Shiner	81	76	5.1	-	Adult	-	-
SA-6	Gillnet	29 May 2017	-	Walleye	542	515	1100	-	Adult	Male	5
SA-6	Gillnet	29 May 2017	-	White Sucker	360	332	420	-	Adult	Female	5
SA-6	Gillnet	29 May 2017	-	White Sucker	403	365	670	-	Adult	Male	4
SA-6	Gillnet	29 May 2017	-	White Sucker	420	391	700	-	Adult	Female	4
SB-1	Electrofishing	17-Sep-2016	-	Burbot	84	-	3.8	-	YOY	-	-
SB-1	Electrofishing	17-Sep-2016	-	Burbot	203	-	40.3	-	Juvenile	-	-
SB-1	Electrofishing	17-Sep-2016	-	Burbot	96	-	6.7	-	YOY	-	-
SB-1	Electrofishing	17-Sep-2016	-	Burbot	172	-	33.3	-	Juvenile	-	-

* - YOY = young-of-the-year
** - 1. Immature; 2. Early Development; 3. Late Development; 4. Ripe; 5. Spent

Table A-17
Baseline Fish Flesh Chemistry

Parameter			Moisture	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt
Unit			%	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g
Northern Pike												
		Count	34	34	34	34	34	34	34	34	34	34
		# Less than DL	0	18	34	27	6	34	34	34	33	23
		Min	75	<0.5	<0.02	<0.01	<0.01	<0.002	<0.2	<0.002	<0.1	<0.002
		Mean	78	0.64	<0.02	0.011	0.042	<0.002	<0.2	<0.002	0.10	0.0044
		75th	79	0.70	<0.02	0.010	0.063	<0.002	<0.2	<0.002	0.10	0.0043
		95th	81	1.2	<0.02	0.020	0.12	<0.002	<0.2	<0.002	0.13	0.019
		Max	82	1.3	<0.02	0.020	0.18	<0.002	<0.2	<0.002	0.20	0.034
		Geomean	78	0.62	<0.02	0.011	0.030	<0.002	<0.2	<0.002	0.10	0.0030
		SD	1.3	0.21	7.0E-18	0.0033	0.037	1.3E-18	8.5E-17	1.3E-18	0.017	0.0060
Location	**Sample No.**	**Sample Date**										
LA-1	2016-NP1-T	17-Sep-2016	78	1.0	<0.02	<0.01	0.02	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-NP2-T	17-Sep-2016	79	0.7	<0.02	<0.01	0.10	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-NP3-T	17-Sep-2016	76	0.8	<0.02	<0.01	0.04	<0.002	<0.2	<0.002	<0.1	0.002
	2016-NP4-T	17-Sep-2016	80	<0.5	<0.02	<0.01	0.03	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-NP5-T	17-Sep-2016	78	<0.5	<0.02	<0.01	<0.01	<0.002	<0.2	<0.002	<0.1	<0.002
	LA1-NP1	27-May-2017	78	<0.5	<0.02	<0.01	0.02	<0.002	<0.2	<0.002	0.2	0.005
	LA1-NP2	27-May-2017	80	<0.5	<0.02	<0.01	0.02	<0.002	<0.2	<0.002	<0.1	<0.002
	LA1-NP3	27-May-2017	78	<0.5	<0.02	<0.01	0.02	<0.002	<0.2	<0.002	<0.1	<0.002
	LA1-NP4	27-May-2017	79	<0.5	<0.02	<0.01	0.03	<0.002	<0.2	<0.002	<0.1	0.004
LA-5	2016-NP1-T	10-Sep-2016	78	1.3	<0.02	0.01	0.06	<0.002	<0.2	<0.002	<0.1	0.009
	2016-NP2-T	10-Sep-2016	79	0.7	<0.02	<0.01	<0.01	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-NP3-T	10-Sep-2016	78	0.6	<0.02	<0.01	<0.01	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-NP4-T	10-Sep-2016	78	0.6	<0.02	<0.01	<0.01	<0.002	<0.2	<0.002	<0.1	0.014
	2016-NP5-T	10-Sep-2016	81	<0.5	<0.02	<0.01	0.01	<0.002	<0.2	<0.002	<0.1	0.009
LA-6	2016-NP1-T	16-Sep-2016	79	0.7	<0.02	<0.01	0.07	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-NP2-T	16-Sep-2016	77	1.0	<0.02	<0.01	0.04	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-NP3-T	16-Sep-2016	78	0.7	<0.02	<0.01	0.02	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-NP4-T	16-Sep-2016	76	0.9	<0.02	<0.01	0.07	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-NP5-T	16-Sep-2016	75	1.1	<0.02	<0.01	0.01	<0.002	<0.2	<0.002	<0.1	<0.002
	LA6-NP1	29-May-2017	79	<0.5	<0.02	0.02	0.09	<0.002	<0.2	<0.002	<0.1	0.010
LA-7	2016-NP2-T	19-Sep-2016	77	<0.5	<0.02	<0.01	0.02	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-NP3-T	19-Sep-2016	78	1.0	<0.02	<0.01	0.10	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-NP4-T	19-Sep-2016	77	0.7	<0.02	<0.01	0.07	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-NP5-T	19-Sep-2016	77	0.6	<0.02	<0.01	0.06	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-NP1-T	19-Sep-2016	78	0.5	<0.02	<0.01	0.03	<0.002	<0.2	<0.002	<0.1	<0.002
	LA7-NP1	31-May-2017	77	<0.5	<0.02	<0.01	0.01	<0.002	<0.2	<0.002	<0.1	0.004
	LA7-NP2	31-May-2017	79	<0.5	<0.02	<0.01	0.02	<0.002	<0.2	<0.002	<0.1	0.005
	LA7-NP3	31-May-2017	79	<0.5	<0.02	<0.01	0.06	<0.002	<0.2	<0.002	<0.1	0.034
LAB	2016-NP1-T	20-Sep-2016	77	<0.5	<0.02	<0.01	0.18	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-NP2-T	21-Sep-2016	82	<0.5	<0.02	0.01	<0.01	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-NP3-T	21-Sep-2016	77	<0.5	<0.02	0.01	0.08	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-NP4-T	21-Sep-2016	77	<0.5	<0.02	0.02	<0.01	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-NP5-T	21-Sep-2016	78	<0.5	<0.02	0.02	0.06	<0.002	<0.2	<0.002	<0.1	<0.002
	LAB-NP1	28-May-2017	79	<0.5	<0.02	0.02	0.04	<0.002	<0.2	<0.002	<0.1	0.008
White Sucker												
		Count	31	31	31	31	31	31	31	31	31	31
		# Less than DL	0	16	31	2	1	31	31	31	29	15
		Min	76	<0.5	<0.02	<0.01	<0.01	<0.002	<0.2	<0.002	<0.1	<0.002
		Mean	79	0.57	<0.02	0.03	0.08	<0.002	<0.2	<0.002	0.10	0.007
		75th	80	0.60	<0.02	0.05	0.14	<0.002	<0.2	<0.002	0.10	0.007
		95th	81	0.90	<0.02	0.06	0.24	<0.002	<0.2	<0.002	0.14	0.039
		Max	82	0.90	<0.02	0.06	0.25	<0.002	<0.2	<0.002	0.20	0.056
		Geomean	79	0.56	<0.02	0.031	0.056	<0.002	<0.2	<0.002	0.10	0.0041
		SD	1.3	0.12	7.054E-18	0.015	0.068	1.3E-18	8.5E-17	1.3E-18	0.018	0.011
Location	**Sample No.**	**Sample Date**										
LA-1	2016-WS1-T	17-Sep-2016	79	0.8	<0.02	0.03	0.15	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-WS2-T	20-Sep-2016	79	0.5	<0.02	0.01	0.12	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-WS3-T	20-Sep-2016	80	0.5	<0.02	0.02	0.25	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-WS4-T	20-Sep-2016	80	<0.5	<0.02	0.05	0.20	<0.002	<0.2	<0.002	<0.1	<0.002
	LA1-WS1	27-May-2017	76	<0.5	<0.02	0.03	0.07	<0.002	<0.2	<0.002	0.2	0.005
	LA1-WS2	27-May-2017	78	<0.5	<0.02	<0.01	0.06	<0.002	<0.2	<0.002	<0.1	0.014
LA-5	2016-WS1-T	10-Sep-2016	80	0.7	<0.02	0.04	0.01	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-WS2-T	11-Sep-2016	80	0.6	<0.02	0.03	0.07	<0.002	<0.2	<0.002	<0.1	0.005
	2016-WS2-T	11-Sep-2016	77	0.8	<0.02	0.04	0.17	<0.002	<0.2	<0.002	<0.1	0.003
	2016-WS3-T	11-Sep-2016	79	0.5	<0.02	0.04	0.14	<0.002	<0.2	<0.002	<0.1	0.002
	2016-WS4-T	11-Sep-2016	78	0.9	<0.02	0.03	0.03	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-WS5-T	11-Sep-2016	77	<0.5	<0.02	0.04	0.04	<0.002	<0.2	<0.002	<0.1	0.007
	LA5-WS1	30-May-2017	79	<0.5	<0.02	0.02	<0.01	<0.002	<0.2	<0.002	<0.1	0.009
LA-6	2016-WS1-T	16-Sep-2016	79	0.9	<0.02	0.05	0.02	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-WS2-T	16-Sep-2016	78	0.6	<0.02	0.02	0.05	<0.002	<0.2	<0.002	<0.1	0.056
	2016-WS3-T	16-Sep-2016	78	0.6	<0.02	0.06	0.05	<0.002	<0.2	<0.002	<0.1	0.027
	2016-WS4-T	16-Sep-2016	77	0.7	<0.02	0.04	0.04	<0.002	<0.2	<0.002	<0.1	0.006
	2016-WS5-T	16-Sep-2016	76	0.6	<0.02	0.06	0.05	<0.002	<0.2	<0.002	<0.1	0.021
	LA6-WS1	29-May-2017	79	<0.5	<0.02	0.02	0.04	<0.002	<0.2	<0.002	<0.1	0.007
LA-7	2016-WS1-T	19-Sep-2016	80	0.5	<0.02	0.04	0.15	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-WS2-T	19-Sep-2016	78	0.5	<0.02	0.05	0.12	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-WS3-T	19-Sep-2016	79	<0.5	<0.02	0.05	0.24	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-WS4-T	20-Sep-2016	80	<0.5	<0.02	0.05	0.14	<0.002	<0.2	<0.002	<0.1	0.002
	2016-WS5-T	20-Sep-2016	79	<0.5	<0.02	0.04	0.05	<0.002	<0.2	<0.002	<0.1	<0.002
	LA7-WS1	31-May-2017	80	<0.5	<0.02	0.03	0.05	<0.002	<0.2	<0.002	<0.1	0.004
	LA7-WS2	31-May-2017	82	<0.5	<0.02	0.02	0.03	<0.002	<0.2	<0.002	<0.1	<0.002
LAB	2016-WS1-T	21-Sep-2016	81	<0.5	<0.02	<0.01	0.03	<0.002	<0.2	<0.002	<0.1	0.018
	2016-WS2-T	21-Sep-2016	80	<0.5	<0.02	0.04	0.02	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-WS3-T	21-Sep-2016	79	<0.5	<0.02	0.02	0.02	<0.002	<0.2	<0.002	<0.1	0.01
	2016-WS4-T	21-Sep-2016	78	<0.5	<0.02	0.02	0.04	<0.002	<0.2	<0.002	<0.1	<0.002
	2016-WS5-T	21-Sep-2016	78	<0.5	<0.02	0.05	0.03	<0.002	<0.2	<0.002	<0.1	<0.002

Results are reported on a "raw (wet) weight" basis

Table A-17
Baseline Fish Flesh Chemistry

Parameter			Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Strontium
Unit			ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g
Northern Pike												
		Count	34	34	34	34	34	34	34	34	34	34
		# Less than DL	0	0	21	0	0	33	27	0	33	0
		Min	0.08	0.80	<0.002	0.07	0.05	<0.02	<0.01	0.15	<0.002	0.04
		Mean	0.21	2.4	0.0028	0.12	0.19	<0.02	0.014	0.23	0.002	0.27
		75th	0.24	3.4	0.0020	0.12	0.23	<0.02	0.010	0.24	0.002	0.32
		95th	0.51	5.4	0.010	0.21	0.44	<0.02	0.040	0.42	0.002	1.1
		Max	0.55	6.4	0.011	0.23	0.48	<0.02	0.070	0.53	0.002	1.1
		Geomean	0.19	2.1	0.0024	0.11	0.16	<0.02	0.012	0.22	0.002	0.19
		SD	0.12	1.4	0.0021	0.036	0.10	7.0E-18	0.011	0.074	1.3E-18	0.26
Location	**Sample No.**	**Sample Date**										
LA-1	2016-NP1-T	17-Sep-2016	0.16	1.9	0.003	0.10	0.11	<0.02	<0.01	0.23	<0.002	0.10
	2016-NP2-T	17-Sep-2016	0.14	2.0	<0.002	0.11	0.082	<0.02	<0.01	0.20	<0.002	0.15
	2016-NP3-T	17-Sep-2016	0.17	3.0	<0.002	0.12	0.25	<0.02	<0.01	0.25	<0.002	0.28
	2016-NP4-T	17-Sep-2016	0.23	6.4	<0.002	0.08	0.43	<0.02	<0.01	0.20	<0.002	0.11
	2016-NP5-T	17-Sep-2016	0.18	2.7	<0.002	0.11	0.10	<0.02	<0.01	0.24	<0.002	0.07
	LA1-NP1	27-May-2017	0.30	3.5	<0.002	0.09	0.15	<0.02	0.02	0.19	<0.002	0.25
	LA1-NP2	27-May-2017	0.28	3.5	<0.002	0.09	0.23	<0.02	<0.01	0.20	<0.002	0.11
	LA1-NP3	27-May-2017	0.55	5.0	<0.002	0.13	0.081	<0.02	0.03	0.20	0.002	0.39
	LA1-NP4	27-May-2017	0.48	3.2	0.002	0.10	0.075	<0.02	<0.01	0.24	<0.002	0.58
LA-5	2016-NP1-T	10-Sep-2016	0.14	2.3	0.004	0.11	0.047	<0.02	0.01	0.17	<0.002	0.14
	2016-NP2-T	10-Sep-2016	0.11	1.1	<0.002	0.11	0.16	<0.02	<0.01	0.15	<0.002	0.37
	2016-NP3-T	10-Sep-2016	0.11	0.8	<0.002	0.08	0.23	<0.02	<0.01	0.19	<0.002	0.16
	2016-NP4-T	10-Sep-2016	0.09	1.0	<0.002	0.11	0.15	<0.02	0.02	0.17	<0.002	0.1
	2016-NP5-T	10-Sep-2016	0.09	0.9	<0.002	0.12	0.23	<0.02	<0.01	0.17	<0.002	0.29
LA-6	2016-NP1-T	16-Sep-2016	0.23	2.4	0.004	0.23	0.074	<0.02	<0.01	0.20	<0.002	0.75
	2016-NP2-T	16-Sep-2016	0.16	1.6	0.002	0.10	0.18	<0.02	<0.01	0.21	<0.002	0.13
	2016-NP3-T	16-Sep-2016	0.15	1.5	<0.002	0.08	0.30	<0.02	<0.01	0.23	<0.002	0.09
	2016-NP4-T	16-Sep-2016	0.18	1.4	0.002	0.10	0.14	<0.02	<0.01	0.20	<0.002	0.15
	2016-NP5-T	16-Sep-2016	0.15	1.5	0.002	0.11	0.30	<0.02	<0.01	0.22	<0.002	0.14
	LA6-NP1	29-May-2017	0.16	1.4	<0.002	0.18	0.17	<0.02	0.02	0.19	<0.002	1.1
LA-7	2016-NP2-T	19-Sep-2016	0.18	2.4	<0.002	0.09	0.31	<0.02	<0.01	0.23	<0.002	0.07
	2016-NP3-T	19-Sep-2016	0.31	4.2	0.011	0.12	0.14	<0.02	<0.01	0.20	<0.002	0.20
	2016-NP4-T	19-Sep-2016	0.20	2.2	0.01	0.12	0.11	<0.02	<0.01	0.21	<0.002	0.12
	2016-NP5-T	19-Sep-2016	0.21	2.5	0.004	0.11	0.16	<0.02	<0.01	0.21	<0.002	0.26
	2016-NP1-T	19-Sep-2016	0.29	3.5	0.004	0.13	0.18	<0.02	<0.01	0.23	<0.002	0.36
	LA7-NP1	31-May-2017	0.21	1.0	<0.002	0.07	0.067	<0.02	<0.01	0.17	<0.002	0.26
	LA7-NP2	31-May-2017	0.50	3.4	<0.002	0.07	0.11	<0.02	0.02	0.18	<0.002	0.31
	LA7-NP3	31-May-2017	0.23	2.2	<0.002	0.15	0.085	<0.02	0.07	0.17	<0.002	1.1
LAB	2016-NP1-T	20-Sep-2016	0.13	1.3	0.002	0.08	0.24	<0.02	<0.01	0.38	<0.002	0.04
	2016-NP2-T	21-Sep-2016	0.14	4.7	<0.002	0.10	0.48	<0.02	<0.01	0.25	<0.002	0.07
	2016-NP3-T	21-Sep-2016	0.17	1.4	0.002	0.18	0.37	<0.02	<0.01	0.53	<0.002	0.20
	2016-NP4-T	21-Sep-2016	0.09	0.8	<0.002	0.11	0.20	<0.02	<0.01	0.30	<0.002	0.04
	2016-NP5-T	21-Sep-2016	0.08	1.2	<0.002	0.12	0.21	<0.02	<0.01	0.36	<0.002	0.10
	LAB-NP1	28-May-2017	0.46	4.4	<0.002	0.20	0.14	<0.02	<0.01	0.30	<0.002	0.43
White Sucker												
		Count	31	31	31	31	31	31	31	31	31	31
		# Less than DL	0	0	14	0	0	31	19	0	30	0
		Min	0.16	1.3	<0.002	0.09	0.012	<0.02	<0.01	0.15	<0.002	0.05
		Mean	0.29	3.1	0.003	0.23	0.034	<0.02	0.019	0.26	0.0025	0.44
		75th	0.38	3.5	0.003	0.23	0.045	<0.02	0.020	0.30	0.0020	0.40
		95th	0.64	6.0	0.0072	0.86	0.072	<0.02	0.092	0.51	0.0084	2.5
		Max	0.66	6.2	0.0090	1.1	0.076	<0.02	0.11	0.56	0.018	2.5
		Geomean	0.27	2.9	0.0025	0.19	0.030	<0.02	0.014	0.25	0.0021	0.26
		SD	0.13	1.2	0.0015	0.20	0.017	7.1E-18	0.022	0.095	0.0029	0.60
Location	**Sample No.**	**Sample Date**										
LA-1	2016-WS1-T	17-Sep-2016	0.17	3.1	0.002	1.1	0.023	<0.02	<0.01	0.30	<0.002	2.5
	2016-WS2-T	20-Sep-2016	0.17	2.2	0.003	0.18	0.04	<0.02	<0.01	0.30	<0.002	0.28
	2016-WS3-T	20-Sep-2016	0.25	3.1	0.004	0.41	0.028	<0.02	<0.01	0.29	<0.002	1.0
	2016-WS4-T	20-Sep-2016	0.25	2.9	0.009	0.17	0.022	<0.02	<0.01	0.23	<0.002	0.84
	LA1-WS1	27-May-2017	0.62	4.6	0.003	0.12	0.068	<0.02	0.11	0.21	<0.002	0.24
	LA1-WS2	27-May-2017	0.24	3.0	<0.002	0.15	0.046	<0.02	0.02	0.30	0.018	0.22
LA-5	2016-WS1-T	10-Sep-2016	0.16	2.3	0.004	0.14	0.014	<0.02	0.01	0.17	<0.002	0.11
	2016-WS2-T	11-Sep-2016	0.27	2.8	0.006	0.21	0.055	<0.02	0.02	0.19	<0.002	0.06
	2016-WS2-T	11-Sep-2016	0.27	5.9	<0.002	0.16	0.076	<0.02	0.02	0.24	<0.002	0.63
	2016-WS3-T	11-Sep-2016	0.40	2.4	0.002	0.12	0.049	<0.02	0.03	0.20	<0.002	0.20
	2016-WS4-T	11-Sep-2016	0.28	2.6	0.002	0.16	0.045	<0.02	<0.01	0.28	<0.002	0.22
	2016-WS5-T	11-Sep-2016	0.42	6.2	0.002	0.15	0.028	<0.02	0.01	0.25	<0.002	0.28
	LA5-WS1	30-May-2017	0.42	5.6	0.002	0.70	0.051	<0.02	0.02	0.23	<0.002	2.5
LA-6	2016-WS1-T	16-Sep-2016	0.28	2.6	0.002	0.13	0.035	<0.02	<0.01	0.18	<0.002	0.22
	2016-WS2-T	16-Sep-2016	0.20	2.8	0.002	0.09	0.044	<0.02	0.08	0.22	<0.002	0.20
	2016-WS3-T	16-Sep-2016	0.24	1.7	<0.002	0.28	0.024	<0.02	0.04	0.24	<0.002	0.68
	2016-WS4-T	16-Sep-2016	0.38	3.1	<0.002	0.11	0.07	<0.02	<0.01	0.21	<0.002	0.12
	2016-WS5-T	16-Sep-2016	0.42	2.6	0.003	0.22	0.025	<0.02	0.03	0.20	<0.002	0.40
	LA6-WS1	29-May-2017	0.28	3.5	<0.002	0.10	0.044	<0.02	<0.01	0.24	<0.002	0.16
LA-7	2016-WS1-T	19-Sep-2016	0.20	3.2	<0.002	0.15	0.018	<0.02	<0.01	0.23	<0.002	0.35
	2016-WS2-T	19-Sep-2016	0.50	3.6	0.004	0.33	0.02	<0.02	<0.01	0.22	<0.002	0.61
	2016-WS3-T	19-Sep-2016	0.25	3.0	0.005	0.23	0.019	<0.02	<0.01	0.20	<0.002	0.14
	2016-WS4-T	20-Sep-2016	0.19	2.3	0.003	0.14	0.012	<0.02	<0.01	0.15	<0.002	0.16
	2016-WS5-T	20-Sep-2016	0.21	3.6	<0.002	0.14	0.021	<0.02	<0.01	0.22	<0.002	0.27
	LA7-WS1	31-May-2017	0.66	5.3	<0.002	0.09	0.027	<0.02	0.01	0.18	<0.002	0.15
	LA7-WS2	31-May-2017	0.17	2.2	<0.002	0.12	0.014	<0.02	<0.01	0.18	<0.002	0.32
LAB	2016-WS1-T	21-Sep-2016	0.16	1.3	<0.002	0.16	0.043	<0.02	<0.01	0.48	<0.002	0.07
	2016-WS2-T	21-Sep-2016	0.32	2.3	<0.002	0.42	0.025	<0.02	<0.01	0.33	<0.002	0.33
	2016-WS3-T	21-Sep-2016	0.18	1.8	<0.002	0.28	0.022	<0.02	<0.01	0.56	<0.002	0.14
	2016-WS4-T	21-Sep-2016	0.21	1.8	<0.002	0.17	0.021	<0.02	<0.01	0.46	<0.002	0.05
	2016-WS5-T	21-Sep-2016	0.26	2.1	<0.002	0.18	0.022	<0.02	<0.01	0.38	<0.002	0.12

Results are reported on a "raw (wet) weight" basis

Table A-17
Baseline Fish Flesh Chemistry

Parameter			Thallium	Tin	Titanium	Uranium	Vanadium	Zinc	Lead-210	Polonium-210	Radium-226
Unit			ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	Bq/g	Bq/g	Bq/g
Northern Pike											
		Count	34	34	34	34	34	34	34	34	25
		# Less than DL	34	33	8	32	34	0	33	1	22
		Min	<0.01	<0.01	<0.01	<0.001	<0.02	3.1	<0.001	<0.0002	<0.00003
		Mean	<0.01	0.010	0.019	0.0010	<0.02	5.3	0.001	0.0010	0.00013
		75th	<0.01	0.010	0.020	0.0010	<0.02	6.5	0.001	0.0012	0.00009
		95th	<0.01	0.013	0.040	0.0013	<0.02	9.7	0.001	0.0027	0.00076
		Max	<0.01	0.020	0.040	0.0020	<0.02	9.8	0.001	0.0030	0.0010
		Geomean	<0.01	0.010	0.017	0.0010	<0.02	5.0	0.001	0.00087	9.0E-05
		SD	3.5E-18	0.0017	0.0089	0.000171	7.0E-18	2.0	6.6E-19	0.00064	0.00019
Location	**Sample No.**	**Sample Date**									
LA-1	2016-NP1-T	17-Sep-2016	<0.01	<0.01	0.02	<0.001	<0.02	3.5	<0.001	0.0008	
	2016-NP2-T	17-Sep-2016	<0.01	<0.01	0.03	<0.001	<0.02	3.9	<0.001	0.0015	
	2016-NP3-T	17-Sep-2016	<0.01	<0.01	0.04	<0.001	<0.02	9.0	<0.001	0.0008	<0.00007
	2016-NP4-T	17-Sep-2016	<0.01	<0.01	0.01	<0.001	<0.02	4.1	<0.001	0.0009	
	2016-NP5-T	17-Sep-2016	<0.01	<0.01	0.01	<0.001	<0.02	6.2	<0.001	0.001	
	LA1-NP1	27-May-2017	<0.01	<0.01	0.02	<0.001	<0.02	5.3	<0.001	<0.0002	<0.00007
	LA1-NP2	27-May-2017	<0.01	<0.01	0.02	<0.001	<0.02	9.7	0.001	0.0002	<0.00006
	LA1-NP3	27-May-2017	<0.01	<0.01	0.02	<0.001	<0.02	8.6	<0.001	0.0007	<0.0002
	LA1-NP4	27-May-2017	<0.01	<0.01	0.02	<0.001	<0.02	8.0	<0.001	0.0008	<0.0002
LA-5	2016-NP1-T	10-Sep-2016	<0.01	<0.01	0.04	<0.001	<0.02	4.4	<0.001	0.0021	0.0002
	2016-NP2-T	10-Sep-2016	<0.01	<0.01	<0.01	<0.001	<0.02	3.1	<0.001	0.0004	<0.00007
	2016-NP3-T	10-Sep-2016	<0.01	<0.01	<0.01	<0.001	<0.02	3.8	<0.001	0.0005	<0.00009
	2016-NP4-T	10-Sep-2016	<0.01	<0.01	<0.01	<0.001	<0.02	3.5	<0.001	0.0002	<0.00006
	2016-NP5-T	10-Sep-2016	<0.01	<0.01	<0.01	<0.001	<0.02	3.3	<0.001	0.0005	<0.00006
LA-6	2016-NP1-T	16-Sep-2016	<0.01	<0.01	0.02	0.002	<0.02	4.1	<0.001	0.0026	
	2016-NP2-T	16-Sep-2016	<0.01	<0.01	0.01	<0.001	<0.02	4.0	<0.001	0.0006	<0.00009
	2016-NP3-T	16-Sep-2016	<0.01	<0.01	0.01	<0.001	<0.02	3.1	<0.001	0.0006	<0.00007
	2016-NP4-T	16-Sep-2016	<0.01	<0.01	0.02	<0.001	<0.02	3.9	<0.001	0.0009	<0.00007
	2016-NP5-T	16-Sep-2016	<0.01	<0.01	0.02	<0.001	<0.02	4.3	<0.001	0.0008	<0.00006
	LA6-NP1	29-May-2017	<0.01	<0.01	0.02	<0.001	<0.02	4.6	<0.001	0.001	<0.00008
LA-7	2016-NP2-T	19-Sep-2016	<0.01	<0.01	0.02	<0.001	<0.02	5.4	<0.001	0.0008	
	2016-NP3-T	19-Sep-2016	<0.01	<0.01	0.03	<0.001	<0.02	4.2	<0.001	0.0011	<0.00007
	2016-NP4-T	19-Sep-2016	<0.01	<0.01	0.04	<0.001	<0.02	4.7	<0.001	0.0012	
	2016-NP5-T	19-Sep-2016	<0.01	<0.01	0.02	<0.001	<0.02	5.2	<0.001	0.0015	<0.00007
	2016-NP1-T	19-Sep-2016	<0.01	<0.01	0.02	<0.001	<0.02	5.3	<0.001	0.0012	
	LA7-NP1	31-May-2017	<0.01	0.02	0.01	<0.001	<0.02	5.0	<0.001	0.0011	<0.00007
	LA7-NP2	31-May-2017	<0.01	<0.01	0.02	<0.001	<0.02	7.4	<0.001	0.0006	<0.0002
	LA7-NP3	31-May-2017	<0.01	<0.01	0.02	<0.001	<0.02	6.5	<0.001	0.0009	<0.00009
LAB	2016-NP1-T	20-Sep-2016	<0.01	<0.01	0.02	<0.001	<0.02	3.9	<0.001	0.002	<0.001
	2016-NP2-T	21-Sep-2016	<0.01	<0.01	<0.01	<0.001	<0.02	6.5	<0.001	0.0017	
	2016-NP3-T	21-Sep-2016	<0.01	<0.01	<0.01	<0.001	<0.02	3.7	<0.001	0.003	<0.00007
	2016-NP4-T	21-Sep-2016	<0.01	<0.01	<0.01	<0.001	<0.02	4.0	<0.001	0.001	0.00007
	2016-NP5-T	21-Sep-2016	<0.01	<0.01	<0.01	<0.001	<0.02	8.6	<0.001	0.001	<0.00003
	LAB-NP1	28-May-2017	<0.01	<0.01	0.02	<0.001	<0.02	9.8	<0.001	0.0012	<0.00007
White Sucker											
		Count	31	31	31	31	31	31	31	31	25
		# Less than DL	31	30	10	30	31	0	29	0	24
		Min	<0.01	<0.01	<0.01	<0.001	<0.02	2.7	<0.001	0.001	<0.00006
		Mean	<0.01	<0.01	0.016	0.0012	<0.02	4.0	0.0010	0.0013	0.00010
		75th	<0.01	<0.01	0.020	0.0010	<0.02	4.5	0.0010	0.0016	0.00009
		95th	<0.01	<0.01	0.046	0.0030	<0.02	6.1	0.0014	0.0023	0.00034
		Max	<0.01	<0.01	0.070	0.0060	<0.02	6.5	0.0020	0.0025	0.00040
		Geomean	<0.01	<0.01	0.014	0.0011	<0.02	3.9	0.0010	0.0012	8.5E-05
		SD	3.5E-18	3.53E-18	0.012	0.000898	7.1E-18	0.89	0.00018	0.00048	6.9E-05
Location	**Sample No.**	**Sample Date**									
LA-1	2016-WS1-T	17-Sep-2016	<0.01	<0.01	0.03	<0.001	<0.02	4.2	<0.001	0.001	<0.00008
	2016-WS2-T	20-Sep-2016	<0.01	<0.01	0.02	<0.001	<0.02	3.6	0.001	0.0012	<0.00008
	2016-WS3-T	20-Sep-2016	<0.01	<0.01	0.02	<0.001	<0.02	3.8	<0.001	0.0006	
	2016-WS4-T	20-Sep-2016	<0.01	<0.01	0.01	<0.001	<0.02	4.6	<0.001	0.0015	<0.00009
	LA1-WS1	27-May-2017	<0.01	<0.01	0.03	<0.001	<0.02	4.9	<0.001	0.0008	<0.0002
	LA1-WS2	27-May-2017	<0.01	<0.01	0.01	<0.001	<0.02	3.9	<0.001	0.0008	<0.00008
LA-5	2016-WS1-T	10-Sep-2016	<0.01	<0.01	0.02	<0.001	<0.02	2.8	<0.001	0.0006	<0.00009
	2016-WS2-T	11-Sep-2016	<0.01	<0.01	0.01	<0.001	<0.02	3.9	<0.001	0.0008	<0.00007
	2016-WS2-T	11-Sep-2016	<0.01	<0.01	0.07	<0.001	<0.02	5.4	<0.001	0.0006	<0.00009
	2016-WS3-T	11-Sep-2016	<0.01	<0.01	0.02	<0.001	<0.02	4.9	<0.001	0.001	
	2016-WS4-T	11-Sep-2016	<0.01	<0.01	<0.01	<0.001	<0.02	4.1	<0.001	0.0016	<0.00006
	2016-WS5-T	11-Sep-2016	<0.01	<0.01	<0.01	0.006	<0.02	3.9	<0.001	0.001	<0.00008
	LA5-WS1	30-May-2017	<0.01	<0.01	0.03	<0.001	<0.02	6.5	<0.001	0.0011	<0.00007
LA-6	2016-WS1-T	16-Sep-2016	<0.01	<0.01	<0.01	<0.001	<0.02	3.2	<0.001	0.0014	<0.00006
	2016-WS2-T	16-Sep-2016	<0.01	<0.01	0.01	<0.001	<0.02	4.3	<0.001	0.0018	<0.00006
	2016-WS3-T	16-Sep-2016	<0.01	<0.01	<0.01	<0.001	<0.02	3.0	<0.001	0.0008	
	2016-WS4-T	16-Sep-2016	<0.01	<0.01	0.01	<0.001	<0.02	3.9	<0.001	0.0011	<0.0001
	2016-WS5-T	16-Sep-2016	<0.01	<0.01	<0.01	<0.001	<0.02	3.9	<0.001	0.0015	<0.00008
	LA6-WS1	29-May-2017	<0.01	<0.01	0.02	<0.001	<0.02	3.2	<0.001	0.0012	<0.0001
LA-7	2016-WS1-T	19-Sep-2016	<0.01	<0.01	0.01	<0.001	<0.02	3.3	<0.001	0.0014	
	2016-WS2-T	19-Sep-2016	<0.01	<0.01	0.01	<0.001	<0.02	4.9	0.002	0.0017	<0.00008
	2016-WS3-T	19-Sep-2016	<0.01	<0.01	<0.01	<0.001	<0.02	4.5	<0.001	0.0025	
	2016-WS4-T	20-Sep-2016	<0.01	<0.01	0.02	<0.001	<0.02	3.2	<0.001	0.0018	<0.00008
	2016-WS5-T	20-Sep-2016	<0.01	<0.01	0.01	<0.001	<0.02	3.5	<0.001	0.0019	<0.00008
	LA7-WS1	31-May-2017	<0.01	<0.01	<0.01	<0.001	<0.02	5.8	<0.001	0.0008	<0.00007
	LA7-WS2	31-May-2017	<0.01	<0.01	0.02	<0.001	<0.02	2.7	<0.001	0.0011	<0.00007
LAB	2016-WS1-T	21-Sep-2016	<0.01	<0.01	0.01	<0.001	<0.02	3.0	<0.001	0.0008	<0.00007
	2016-WS2-T	21-Sep-2016	<0.01	<0.01	<0.01	<0.001	<0.02	3.9	<0.001	0.0012	<0.00008
	2016-WS3-T	21-Sep-2016	<0.01	<0.01	<0.01	<0.001	<0.02	3.2	<0.001	0.0019	<0.00007
	2016-WS4-T	21-Sep-2016	<0.01	<0.01	0.02	<0.001	<0.02	3.3	<0.001	0.0021	0.0004
	2016-WS5-T	21-Sep-2016	<0.01	<0.01	<0.01	<0.001	<0.02	3.8	<0.001	0.0013	

Results are reported on a "raw (wet) weight" basis

Table A-17
Baseline Fish Flesh Chemistry

Parameter			Thorium-228	Thorium-230	Thorium-232
Unit			Bq/g	Bq/g	Bq/g
Northern Pike					
		Count	14	25	14
		# Less than DL	14	24	14
		Min	<0.0001	<0.00006	<0.0001
		Mean	<0.00019	0.00016	<0.00019
		75th	<0.00023	0.0002	<0.00023
		95th	na	0.0004	na
		Max	<0.0004	0.0004	<0.0004
		Geomean	<0.00016	0.00014	<0.00016
		SD	0.00011	0.00009	0.00011
Location	**Sample No.**	**Sample Date**			
LA-1	2016-NP1-T	17-Sep-2016			
	2016-NP2-T	17-Sep-2016			
	2016-NP3-T	17-Sep-2016		<0.0001	
	2016-NP4-T	17-Sep-2016			
	2016-NP5-T	17-Sep-2016			
	LA1-NP1	27-May-2017	<0.0001	<0.0001	<0.0001
	LA1-NP2	27-May-2017	<0.0001	<0.0001	<0.0001
	LA1-NP3	27-May-2017	<0.0004	<0.0004	<0.0004
	LA1-NP4	27-May-2017	<0.0004	<0.0004	<0.0004
LA-5	2016-NP1-T	10-Sep-2016	<0.0002	<0.0002	<0.0002
	2016-NP2-T	10-Sep-2016	<0.0001	<0.0001	<0.0001
	2016-NP3-T	10-Sep-2016	<0.0002	<0.0002	<0.0002
	2016-NP4-T	10-Sep-2016	<0.0001	<0.0001	<0.0001
	2016-NP5-T	10-Sep-2016	<0.0001	<0.0001	<0.0001
LA-6	2016-NP1-T	16-Sep-2016			
	2016-NP2-T	16-Sep-2016		<0.0002	
	2016-NP3-T	16-Sep-2016		<0.0001	
	2016-NP4-T	16-Sep-2016		<0.0001	
	2016-NP5-T	16-Sep-2016		0.0002	
	LA6-NP1	29-May-2017	<0.0002	<0.0002	<0.0002
LA-7	2016-NP2-T	19-Sep-2016			
	2016-NP3-T	19-Sep-2016		<0.0001	
	2016-NP4-T	19-Sep-2016			
	2016-NP5-T	19-Sep-2016		<0.0001	
	2016-NP1-T	19-Sep-2016			
	LA7-NP1	31-May-2017	<0.0001	<0.0001	<0.0001
	LA7-NP2	31-May-2017	<0.0003	<0.0003	<0.0003
	LA7-NP3	31-May-2017	<0.0002	<0.0002	<0.0002
LAB	2016-NP1-T	20-Sep-2016		<0.0002	
	2016-NP2-T	21-Sep-2016			
	2016-NP3-T	21-Sep-2016		<0.0001	
	2016-NP4-T	21-Sep-2016		<0.0001	
	2016-NP5-T	21-Sep-2016		<0.00006	
	LAB-NP1	28-May-2017	<0.0001	<0.0001	<0.0001
White Sucker					
		Count	8	25	8
		# Less than DL	8	25	8
		Min	<0.0001	<0.0001	<0.0001
		Mean	<0.00016	<0.00017	<0.00016
		75th	<0.0002	<0.0002	<0.0002
		95th	na	<0.00027	na
		Max	<0.0003	<0.0003	<0.0003
		Geomean	<0.00015	<0.00015838	<0.00015
		SD	7.4E-05	5.6E-05	7.4E-05
Location	**Sample No.**	**Sample Date**			
LA-1	2016-WS1-T	17-Sep-2016		<0.0002	
	2016-WS2-T	20-Sep-2016		<0.0002	
	2016-WS3-T	20-Sep-2016			
	2016-WS4-T	20-Sep-2016		<0.0002	
	LA1-WS1	27-May-2017	<0.0003	<0.0003	<0.0003
	LA1-WS2	27-May-2017	<0.0002	<0.0002	<0.0002
LA-5	2016-WS1-T	10-Sep-2016	<0.0002	<0.0002	<0.0002
	2016-WS2-T	11-Sep-2016	<0.0001	<0.0001	<0.0001
	2016-WS2-T	11-Sep-2016		<0.0002	
	2016-WS3-T	11-Sep-2016			
	2016-WS4-T	11-Sep-2016		<0.0001	
	2016-WS5-T	11-Sep-2016		<0.0002	
	LA5-WS1	30-May-2017	<0.0001	<0.0001	<0.0001
LA-6	2016-WS1-T	16-Sep-2016		<0.0001	
	2016-WS2-T	16-Sep-2016		<0.0001	
	2016-WS3-T	16-Sep-2016			
	2016-WS4-T	16-Sep-2016		<0.0002	
	2016-WS5-T	16-Sep-2016		<0.0002	
	LA6-WS1	29-May-2017	<0.0002	<0.0002	<0.0002
LA-7	2016-WS1-T	19-Sep-2016			
	2016-WS2-T	19-Sep-2016		<0.0002	
	2016-WS3-T	19-Sep-2016			
	2016-WS4-T	20-Sep-2016		<0.0002	
	2016-WS5-T	20-Sep-2016		<0.0002	
	LA7-WS1	31-May-2017	<0.0001	<0.0001	<0.0001
	LA7-WS2	31-May-2017	<0.0001	<0.0001	<0.0001
LAB	2016-WS1-T	21-Sep-2016		<0.0001	
	2016-WS2-T	21-Sep-2016		<0.0002	
	2016-WS3-T	21-Sep-2016		<0.0001	
	2016-WS4-T	21-Sep-2016		<0.0002	
	2016-WS5-T	21-Sep-2016			

Results are reported on a "raw (wet) weight" basis

Table A-18
Baseline Fish Bone Chemistry

Parameter			Moisture	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium
Unit			%	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g
Northern Pike										
		Count	34	34	34	34	34	34	34	34
		# Less than DL	0	9	34	19	0	34	34	34
		Min	48	<0.5	<0.05	<0.02	1.9	<0.01	<0.5	<0.01
		Mean	57	0.83	<0.05	0.022	4.9	<0.01	<0.5	<0.01
		75th	61	1.1	<0.05	0.02	6.425	<0.01	<0.5	<0.01
		95th	65	1.425	<0.05	0.035	8.45	<0.01	<0.5	<0.01
		Max	67	1.5	<0.05	0.05	9.8	<0.01	<0.5	<0.01
		Geomean	57	0.77	<0.05	0.022	4.6	<0.01	<0.5	<0.01
		SD	4.9	0.31	2.1E-17	0.0061	1.8	3.5E-18	0.0	0.0
Location	**Sample No.**	**Sample Date**								
LA-1	2016-NP5-B	17-Sep-2016	58	<0.5	<0.05	<0.02	4.5	<0.01	<0.5	<0.01
	2016-NP4-B	17-Sep-2016	56	0.5	<0.05	<0.02	9.8	<0.01	<0.5	<0.01
	2016-NP1-B	17-Sep-2016	57	1.0	<0.05	0.03	4.4	<0.01	<0.5	<0.01
	2016-NP2-B	17-Sep-2016	65	1.3	<0.05	0.03	5.0	<0.01	<0.5	<0.01
	2016-NP3-B	17-Sep-2016	49	0.6	<0.05	<0.02	4.4	<0.01	<0.5	<0.01
	LA1-NP1	27-May-2017	60	<0.5	<0.05	<0.02	5.5	<0.01	<0.5	<0.01
	LA1-NP2	27-May-2017	61	<0.5	<0.05	<0.02	2.2	<0.01	<0.5	<0.01
	LA1-NP3	27-May-2017	63	<0.5	<0.05	<0.02	5.4	<0.01	<0.5	<0.01
	LA1-NP4	27-May-2017	62	<0.5	<0.05	<0.02	3.3	<0.01	<0.5	<0.01
LA-5	2016-NP1-B	10-Sep-2016	59	1.3	<0.05	0.03	7.2	<0.01	<0.5	<0.01
	2016-NP2-B	10-Sep-2016	61	0.8	<0.05	0.03	6.7	<0.01	<0.5	<0.01
	2016-NP3-B	10-Sep-2016	59	<0.5	<0.05	0.02	6.4	<0.01	<0.5	<0.01
	2016-NP4-B	10-Sep-2016	58	<0.5	<0.05	0.02	7.2	<0.01	<0.5	<0.01
	2016-NP5-B	10-Sep-2016	60	0.7	<0.05	0.02	7.2	<0.01	<0.5	<0.01
LA-6	2016-NP1-B	16-Sep-2016	61	1.5	<0.05	<0.02	6.8	<0.01	<0.5	<0.01
	2016-NP2-B	16-Sep-2016	51	0.8	<0.05	0.02	5.8	<0.01	<0.5	<0.01
	2016-NP3-B	16-Sep-2016	51	0.9	<0.05	0.02	2.9	<0.01	<0.5	<0.01
	2016-NP4-B	16-Sep-2016	54	0.9	<0.05	0.03	5.2	<0.01	<0.5	<0.01
	2016-NP5-B	16-Sep-2016	50	1.2	<0.05	0.02	6.2	<0.01	<0.5	<0.01
	LA6-NP1	29-May-2017	62	1.4	<0.05	<0.02	8.0	<0.01	<0.5	<0.01
LA-7	2016-NP1-B	19-Sep-2016	53	0.7	<0.05	<0.02	4.4	<0.01	<0.5	<0.01
	2016-NP2-B	19-Sep-2016	54	0.8	<0.05	<0.02	6.5	<0.01	<0.5	<0.01
	2016-NP3-B	19-Sep-2016	58	0.7	<0.05	<0.02	4.6	<0.01	<0.5	<0.01
	2016-NP4-B	19-Sep-2016	56	0.9	<0.05	<0.02	3.4	<0.01	<0.5	<0.01
	2016-NP5-B	19-Sep-2016	56	<0.5	<0.05	<0.02	4.2	<0.01	<0.5	<0.01
	LA7-NP1	31-May-2017	56	0.7	<0.05	<0.02	4.9	<0.01	<0.5	<0.01
	LA7-NP2	31-May-2017	51	<0.5	<0.05	0.02	4.1	<0.01	<0.5	<0.01
	LA7-NP3	31-May-2017	67	0.5	<0.05	<0.02	4.5	<0.01	<0.5	<0.01
LAB	2016-NP1-B	20-Sep-2016	53	1.2	<0.05	<0.02	2.7	<0.01	<0.5	<0.01
	2016-NP2-B	21-Sep-2016	58	1.2	<0.05	<0.02	3.7	<0.01	<0.5	<0.01
	2016-NP3-B	21-Sep-2016	48	1.0	<0.05	0.02	2.5	<0.01	<0.5	<0.01
	2016-NP4-B	21-Sep-2016	49	0.9	<0.05	0.02	2.6	<0.01	<0.5	<0.01
	2016-NP5-B	21-Sep-2016	56	1.3	<0.05	<0.02	3.3	<0.01	<0.5	<0.01
	LAB-NP1	28-May-2017	65	0.8	<0.05	0.05	1.9	<0.01	<0.5	<0.01
White Sucker										
		Count	30	30	30	30	30	30	30	30
		# Less than DL	0	6	30	12	0	30	30	30
		Min	50	<0.5	<0.05	<0.02	1.3	<0.01	<0.5	<0.01
		Mean	57	0.87	<0.05	0.033	4.3	<0.01	<0.5	<0.01
		75th	60	1.125	<0.05	0.05	5.425	<0.01	<0.5	<0.01
		95th	65	1.645	<0.05	0.0645	7.84	<0.01	<0.5	<0.01
		Max	65	1.7	<0.05	0.07	8.5	<0.01	<0.5	<0.01
		Geomean	56	0.81	<0.05	0.030	4.0	<0.01	<0.5	<0.01
		SD	4.2	0.34	2.1E-17	0.016	1.7	3.5E-18	0.0	3.5E-18
Location	**Sample No.**	**Sample Date**								
LA-1	2016-WS1-B	17-Sep-2016	58	0.6	<0.05	<0.02	5.5	<0.01	<0.5	<0.01
	2016-WS2-B	20-Sep-2016	56	1.2	<0.05	<0.02	3.2	<0.01	<0.5	<0.01
	2016-WS3-B	20-Sep-2016	60	1.4	<0.05	0.03	3.6	<0.01	<0.5	<0.01
	2016-WS4-B	20-Sep-2016	58	0.8	<0.05	<0.02	3.6	<0.01	<0.5	<0.01
	LA1-WS1	27-May-2017	53	<0.5	<0.05	<0.02	7.3	<0.01	<0.5	<0.01
	LA1-WS2	27-May-2017	53	<0.5	<0.05	<0.02	5.4	<0.01	<0.5	<0.01
LA-5	2016-WS1-B	10-Sep-2016	58	1.2	<0.05	0.05	4.4	<0.01	<0.5	<0.01
	2016-WS2-B	11-Sep-2016	53	1.7	<0.05	0.05	6.4	<0.01	<0.5	<0.01
	2016-WS3-B	11-Sep-2016	52	0.7	<0.05	0.05	8.5	<0.01	<0.5	<0.01
	2016-WS4-B	11-Sep-2016	50	0.7	<0.05	0.04	3.0	<0.01	<0.5	<0.01
	2016-WS5-B	11-Sep-2016	54	1.2	<0.05	0.06	6.9	<0.01	<0.5	<0.01
	LA5-WS1	30-May-2017	57	1.0	<0.05	0.02	4.4	<0.01	<0.5	<0.01
LA-6	2016-WS1-B	16-Sep-2016	53	1.0	<0.05	0.06	5.5	<0.01	<0.5	<0.01
	2016-WS2-B	16-Sep-2016	53	0.8	<0.05	0.04	3.8	<0.01	<0.5	<0.01
	2016-WS3-B	16-Sep-2016	52	0.9	<0.05	0.07	4.8	<0.01	<0.5	<0.01
	2016-WS4-B	16-Sep-2016	53	0.9	<0.05	0.05	3.8	<0.01	<0.5	<0.01
	2016-WS5-B	16-Sep-2016	51	0.8	<0.05	0.05	3.6	<0.01	<0.5	<0.01
	LA6-WS1	29-May-2017	62	<0.5	<0.05	<0.02	5.6	<0.01	<0.5	<0.01
LA-7	2016-WS1-B	19-Sep-2016	57	0.8	<0.05	0.02	3.4	<0.01	<0.5	<0.01
	2016-WS2-B	19-Sep-2016	52	0.8	<0.05	0.04	4.3	<0.01	<0.5	<0.01
	2016-WS3-B	19-Sep-2016	56	<0.5	<0.05	<0.02	5.1	<0.01	<0.5	<0.01
	2016-WS4-B	20-Sep-2016	58	1.1	<0.05	<0.02	3.7	<0.01	<0.5	<0.01
	2016-WS5-B	20-Sep-2016	56	0.6	<0.05	0.02	2.6	<0.01	<0.5	<0.01
	LA7-WS1	31-May-2017	60	<0.5	<0.05	0.03	5.2	<0.01	<0.5	<0.01
	LA7-WS2	31-May-2017	65	1.6	<0.05	0.02	4.7	<0.01	<0.5	<0.01
LAB	2016-WS1-B	21-Sep-2016	60	0.7	<0.05	<0.02	2.1	<0.01	<0.5	<0.01
	2016-WS2-B	21-Sep-2016	64	0.5	<0.05	0.03	1.3	<0.01	<0.5	<0.01
	2016-WS3-B	21-Sep-2016	61	<0.5	<0.05	<0.02	2.1	<0.01	<0.5	<0.01
	2016-WS4-B	21-Sep-2016	63	0.7	<0.05	<0.02	2.4	<0.01	<0.5	<0.01
	2016-WS5-B	21-Sep-2016	61	1.4	<0.05	0.03	2.4	<0.01	<0.5	<0.01

Results are reported on a "raw (wet) weight" basis

Table A-18
Baseline Fish Bone Chemistry

Parameter			Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium
Unit			ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g
Northern Pike												
		Count	34	34	34	34	34	34	34	34	34	34
		# Less than DL	33	0	0	0	13	0	0	34	14	0
		Min	<0.2	0.04	0.06	1.4	<0.01	5.4	0.01	<0.05	<0.02	0.09
		Mean	0.21	0.10	0.34	9.7	0.016	14	0.047	<0.05	0.036	0.16
		75th	0.2	0.1225	0.51	6.825	0.02	17.5	0.0525	<0.05	0.05	0.185
		95th	0.25	0.165	0.7	47.25	0.04	35	0.155	<0.05	0.1	0.2475
		Max	0.4	0.18	0.82	150	0.04	41	0.2	<0.05	0.13	0.27
		Geomean	0.20	0.099	0.28	5.5	0.014	13	0.038	<0.05	0.030	0.15
		SD	0.034	0.033	0.19	25	0.0089	7.6	0.039	2.1E-17	0.027	0.045
Location	**Sample No.**	**Sample Date**										
LA-1	2016-NP5-B	17-Sep-2016	<0.2	0.07	0.48	6.8	0.02	20	0.03	<0.05	<0.02	0.18
	2016-NP4-B	17-Sep-2016	<0.2	0.11	0.50	4.9	0.04	19	0.13	<0.05	<0.02	0.14
	2016-NP1-B	17-Sep-2016	<0.2	0.09	0.64	7.7	0.02	20	0.03	<0.05	0.05	0.16
	2016-NP2-B	17-Sep-2016	<0.2	0.07	0.82	4.8	0.02	15	0.02	<0.05	<0.02	0.16
	2016-NP3-B	17-Sep-2016	<0.2	0.1	0.66	6.0	0.03	12	0.06	<0.05	<0.02	0.16
	LA1-NP1	27-May-2017	<0.2	0.16	0.16	2.7	0.04	14	0.03	<0.05	0.06	0.12
	LA1-NP2	27-May-2017	<0.2	0.05	0.32	5.6	<0.01	5.7	0.2	<0.05	0.07	0.20
	LA1-NP3	27-May-2017	<0.2	0.12	0.28	4.4	<0.01	16	0.02	<0.05	0.09	0.16
	LA1-NP4	27-May-2017	<0.2	0.07	0.27	3.2	<0.01	9.4	0.04	<0.05	0.04	0.20
LA-5	2016-NP1-B	10-Sep-2016	<0.2	0.06	0.16	11	0.01	17	0.02	<0.05	0.03	0.17
	2016-NP2-B	10-Sep-2016	<0.2	0.1	0.09	4.2	<0.01	14	0.03	<0.05	<0.02	0.10
	2016-NP3-B	10-Sep-2016	<0.2	0.1	0.08	1.4	<0.01	12	0.04	<0.05	<0.02	0.09
	2016-NP4-B	10-Sep-2016	<0.2	0.09	0.09	3.7	0.01	13	0.04	<0.05	<0.02	0.10
	2016-NP5-B	10-Sep-2016	<0.2	0.1	0.08	3.6	0.01	12	0.06	<0.05	<0.02	0.11
LA-6	2016-NP1-B	16-Sep-2016	<0.2	0.13	0.63	6.8	0.03	13	0.03	<0.05	0.09	0.16
	2016-NP2-B	16-Sep-2016	<0.2	0.08	0.57	3.6	0.02	9.2	0.03	<0.05	<0.02	0.13
	2016-NP3-B	16-Sep-2016	<0.2	0.04	0.55	3.9	0.02	6.0	0.08	<0.05	<0.02	0.16
	2016-NP4-B	16-Sep-2016	<0.2	0.09	0.55	3.3	0.02	11	0.03	<0.05	<0.02	0.12
	2016-NP5-B	16-Sep-2016	<0.2	0.11	0.54	4.2	0.02	11	0.04	<0.05	<0.02	0.11
	LA6-NP1	29-May-2017	<0.2	0.12	0.26	8.6	<0.01	15	0.06	<0.05	0.07	0.15
LA-7	2016-NP1-B	19-Sep-2016	<0.2	0.07	0.43	13	0.02	7.8	0.04	<0.05	<0.02	0.13
	2016-NP2-B	19-Sep-2016	0.4	0.11	0.32	6.9	0.01	9.2	0.07	<0.05	<0.02	0.15
	2016-NP3-B	19-Sep-2016	<0.2	0.08	0.31	4.5	0.01	8.6	0.05	<0.05	<0.02	0.13
	2016-NP4-B	19-Sep-2016	<0.2	0.07	0.30	3.5	0.01	5.4	0.03	<0.05	<0.02	0.12
	2016-NP5-B	19-Sep-2016	<0.2	0.1	0.26	5.1	<0.01	11	0.02	<0.05	<0.02	0.12
	LA7-NP1	31-May-2017	<0.2	0.14	0.30	7.5	<0.01	6.8	0.01	<0.05	0.13	0.12
	LA7-NP2	31-May-2017	<0.2	0.13	0.25	7.6	<0.01	6.0	0.04	<0.05	0.05	0.13
	LA7-NP3	31-May-2017	<0.2	0.11	0.21	6.1	<0.01	7.8	0.03	<0.05	0.03	0.14
LAB	2016-NP1-B	20-Sep-2016	<0.2	0.14	0.06	3.3	<0.01	20	0.02	<0.05	<0.02	0.21
	2016-NP2-B	21-Sep-2016	<0.2	0.12	0.23	6.1	0.01	24	0.14	<0.05	<0.02	0.22
	2016-NP3-B	21-Sep-2016	<0.2	0.18	0.21	6.6	0.01	33	0.03	<0.05	0.03	0.27
	2016-NP4-B	21-Sep-2016	<0.2	0.14	0.29	5.1	0.03	19	0.02	<0.05	<0.02	0.20
	2016-NP5-B	21-Sep-2016	<0.2	0.16	0.31	4.4	<0.01	41	0.02	<0.05	<0.02	0.24
	LAB-NP1	28-May-2017	<0.2	0.12	0.44	150	<0.01	17	0.05	<0.05	0.06	0.24
White Sucker												
		Count	30	30	30	30	30	30	30	30	30	30
		# Less than DL	30	0	0	0	9	0	10	25	16	0
		Min	<0.2	0.05	0.2	4	0.01	6.4	<0.01	<0.05	<0.02	0.13
		Mean	<0.2	0.091	0.59	17	0.025	27	0.016	0.071	0.038	0.23
		75th	<0.2	0.1225	0.775	11.25	0.03	35.25	0.02	0.05	0.05	0.2225
		95th	<0.2	0.16	1.5	133.5	0.0945	67	0.03	0.21	0.1245	0.5185
		Max	<0.2	0.17	1.6	150	0.1	68	0.03	0.23	0.13	0.59
		Geomean	<0.2	0.085	0.52	10	0.018	23	0.015	0.061	0.031	0.21
		SD	8.5E-17	0.035	0.35	32	0.025	16	0.007	0.050	0.029	0.11
Location	**Sample No.**	**Sample Date**										
LA-1	2016-WS1-B	17-Sep-2016	<0.2	0.1	0.42	5.2	0.01	35	0.01	<0.05	<0.02	0.18
	2016-WS2-B	20-Sep-2016	<0.2	0.06	0.46	8.9	0.03	30	0.02	<0.05	<0.02	0.26
	2016-WS3-B	20-Sep-2016	<0.2	0.06	0.40	8.6	0.01	20	0.01	<0.05	<0.02	0.18
	2016-WS4-B	20-Sep-2016	<0.2	0.06	0.45	7.9	0.01	18	0.02	<0.05	0.12	0.20
	LA1-WS1	27-May-2017	<0.2	0.14	0.27	4.1	<0.01	10	<0.01	<0.05	0.03	0.13
	LA1-WS2	27-May-2017	<0.2	0.11	0.38	9.8	<0.01	27	0.02	<0.05	0.05	0.21
LA-5	2016-WS1-B	10-Sep-2016	<0.2	0.05	0.26	9.8	0.01	21	0.02	<0.05	<0.02	0.16
	2016-WS2-B	11-Sep-2016	<0.2	0.13	1.6	6.7	0.09	24	0.03	<0.05	0.04	0.20
	2016-WS3-B	11-Sep-2016	<0.2	0.17	1.4	18	0.07	38	<0.01	<0.05	0.07	0.14
	2016-WS4-B	11-Sep-2016	<0.2	0.06	1.2	9.3	0.06	18	0.03	<0.05	<0.02	0.22
	2016-WS5-B	11-Sep-2016	<0.2	0.14	1.1	7.4	0.05	35	0.02	<0.05	0.05	0.23
	LA5-WS1	30-May-2017	<0.2	0.10	0.37	9.4	0.01	22	0.01	<0.05	0.07	0.18
LA-6	2016-WS1-B	16-Sep-2016	<0.2	0.12	0.93	8.1	0.04	33	0.02	<0.05	0.04	0.17
	2016-WS2-B	16-Sep-2016	<0.2	0.08	0.79	4.0	0.03	17	0.03	<0.05	0.03	0.18
	2016-WS3-B	16-Sep-2016	<0.2	0.06	0.84	16	0.02	18	0.02	<0.05	<0.02	0.22
	2016-WS4-B	16-Sep-2016	<0.2	0.1	0.73	4.9	0.02	26	0.02	<0.05	0.03	0.15
	2016-WS5-B	16-Sep-2016	<0.2	0.1	0.77	9.7	0.03	27	0.03	<0.05	0.02	0.18
	LA6-WS1	29-May-2017	<0.2	0.13	0.42	13	<0.01	36	0.02	<0.05	0.08	0.20
LA-7	2016-WS1-B	19-Sep-2016	<0.2	0.05	0.40	6.4	0.01	11	0.01	<0.05	<0.02	0.20
	2016-WS2-B	19-Sep-2016	<0.2	0.07	0.36	7.4	0.02	13	0.01	<0.05	<0.02	0.19
	2016-WS3-B	19-Sep-2016	<0.2	0.07	0.28	7.1	<0.01	12	<0.01	<0.05	<0.02	0.15
	2016-WS4-B	20-Sep-2016	<0.2	0.07	0.20	8.0	<0.01	13	<0.01	<0.05	<0.02	0.18
	2016-WS5-B	20-Sep-2016	<0.2	0.05	0.40	15	<0.01	12	0.02	<0.05	<0.02	0.20
	LA7-WS1	31-May-2017	<0.2	0.15	0.33	150	<0.01	16	<0.01	<0.05	0.13	0.16
	LA7-WS2	31-May-2017	<0.2	0.06	0.50	120	<0.01	6.4	<0.01	<0.05	0.05	0.16
LAB	2016-WS1-B	21-Sep-2016	<0.2	0.13	0.50	12	0.02	41	0.02	0.15	<0.02	0.45
	2016-WS2-B	21-Sep-2016	<0.2	0.05	0.38	6.8	<0.01	45	<0.01	0.23	<0.02	0.46
	2016-WS3-B	21-Sep-2016	<0.2	0.1	0.45	8.2	0.01	67	<0.01	0.2	<0.02	0.59
	2016-WS4-B	21-Sep-2016	<0.2	0.07	0.66	8.7	0.1	68	<0.01	0.13	<0.02	0.39
	2016-WS5-B	21-Sep-2016	<0.2	0.09	0.55	11	0.01	49	<0.01	0.17	<0.02	0.32

Results are reported on a "raw (wet) weight" basis

Table A-18
Baseline Fish Bone Chemistry

Parameter			Silver	Strontium	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc	Lead-210	Polonium-210
Unit			ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	Bq/g	Bq/g
Northern Pike												
		Count	34	34	34	34	34	34	34	34	34	34
		# Less than DL	34	0	34	33	0	34	34	0	33	5
		Min	<0.01	39	<0.02	<0.02	0.02	<0.01	<0.05	30	<0.002	<0.0005
		Mean	<0.01	113	<0.02	0.021	0.11	<0.01	<0.05	48	0.002	0.00090
		75th	<0.01	136	<0.02	0.02	0.165	<0.01	<0.05	60.5	0.002	0.001
		95th	<0.01	165	<0.02	0.0275	0.3625	<0.01	<0.05	77.5	0.002	0.00225
		Max	<0.01	173	<0.02	0.05	0.46	<0.01	<0.05	85	0.002	0.003
		Geomean	<0.01	106	<0.02	0.021	0.072	<0.01	<0.05	46	0.002	0.00080
		SD	3.5E-18	35	7.0E-18	0.0051	0.11	3.5E-18	2.1E-17	14	1.3E-18	0.00055
Location	**Sample No.**	**Sample Date**										
LA-1	2016-NP5-B	17-Sep-2016	<0.01	97	<0.02	<0.02	0.03	<0.01	<0.05	62	<0.002	0.0008
	2016-NP4-B	17-Sep-2016	<0.01	173	<0.02	<0.02	0.02	<0.01	<0.05	60	<0.002	0.001
	2016-NP1-B	17-Sep-2016	<0.01	118	<0.02	<0.02	0.03	<0.01	<0.05	47	<0.002	<0.0005
	2016-NP2-B	17-Sep-2016	<0.01	118	<0.02	<0.02	0.06	<0.01	<0.05	49	<0.002	0.001
	2016-NP3-B	17-Sep-2016	<0.01	133	<0.02	<0.02	0.04	<0.01	<0.05	43	<0.002	<0.0005
	LA1-NP1	27-May-2017	<0.01	146	<0.02	<0.02	0.21	<0.01	<0.05	45	<0.002	0.0005
	LA1-NP2	27-May-2017	<0.01	41	<0.02	<0.02	0.31	<0.01	<0.05	32	<0.002	0.0005
	LA1-NP3	27-May-2017	<0.01	117	<0.02	<0.02	0.24	<0.01	<0.05	64	<0.002	0.0007
	LA1-NP4	27-May-2017	<0.01	67	<0.02	<0.02	0.33	<0.01	<0.05	34	<0.002	0.0008
LA-5	2016-NP1-B	10-Sep-2016	<0.01	121	<0.02	<0.02	0.06	<0.01	<0.05	54	<0.002	0.003
	2016-NP2-B	10-Sep-2016	<0.01	155	<0.02	<0.02	0.03	<0.01	<0.05	36	<0.002	<0.0005
	2016-NP3-B	10-Sep-2016	<0.01	162	<0.02	<0.02	0.05	<0.01	<0.05	32	<0.002	0.0008
	2016-NP4-B	10-Sep-2016	<0.01	156	<0.02	<0.02	0.04	<0.01	<0.05	41	<0.002	0.001
	2016-NP5-B	10-Sep-2016	<0.01	156	<0.02	<0.02	0.06	<0.01	<0.05	30	<0.002	0.0007
LA-6	2016-NP1-B	16-Sep-2016	<0.01	125	<0.02	<0.02	0.04	<0.01	<0.05	56	<0.002	0.002
	2016-NP2-B	16-Sep-2016	<0.01	111	<0.02	<0.02	0.04	<0.01	<0.05	38	<0.002	0.0006
	2016-NP3-B	16-Sep-2016	<0.01	50	<0.02	<0.02	0.06	<0.01	<0.05	36	<0.002	0.002
	2016-NP4-B	16-Sep-2016	<0.01	109	<0.02	<0.02	0.02	<0.01	<0.05	34	<0.002	0.0005
	2016-NP5-B	16-Sep-2016	<0.01	128	<0.02	<0.02	0.05	<0.01	<0.05	44	<0.002	<0.0005
	LA6-NP1	29-May-2017	<0.01	113	<0.02	<0.02	0.24	<0.01	<0.05	46	<0.002	0.0008
LA-7	2016-NP1-B	19-Sep-2016	<0.01	97	<0.02	<0.02	0.10	<0.01	<0.05	51	<0.002	0.0008
	2016-NP2-B	19-Sep-2016	<0.01	149	<0.02	<0.02	0.04	<0.01	<0.05	67	<0.002	0.0008
	2016-NP3-B	19-Sep-2016	<0.01	132	<0.02	<0.02	0.03	<0.01	<0.05	70	<0.002	0.001
	2016-NP4-B	19-Sep-2016	<0.01	114	<0.02	<0.02	0.08	<0.01	<0.05	31	<0.002	0.0006
	2016-NP5-B	19-Sep-2016	<0.01	145	<0.02	<0.02	0.05	<0.01	<0.05	85	<0.002	0.0006
	LA7-NP1	31-May-2017	<0.01	132	<0.02	0.05	0.14	<0.01	<0.05	43	<0.002	<0.0005
	LA7-NP2	31-May-2017	<0.01	105	<0.02	<0.02	0.15	<0.01	<0.05	44	0.002	0.0008
	LA7-NP3	31-May-2017	<0.01	127	<0.02	<0.02	0.33	<0.01	<0.05	39	<0.002	0.002
LAB	2016-NP1-B	20-Sep-2016	<0.01	67	<0.02	<0.02	0.04	<0.01	<0.05	46	<0.002	0.0005
	2016-NP2-B	21-Sep-2016	<0.01	60	<0.02	<0.02	0.21	<0.01	<0.05	62	<0.002	0.001
	2016-NP3-B	21-Sep-2016	<0.01	77	<0.02	<0.02	0.06	<0.01	<0.05	75	<0.002	0.0009
	2016-NP4-B	21-Sep-2016	<0.01	90	<0.02	<0.02	0.02	<0.01	<0.05	46	<0.002	0.0009
	2016-NP5-B	21-Sep-2016	<0.01	100	<0.02	<0.02	0.10	<0.01	<0.05	63	<0.002	0.0006
	LAB-NP1	28-May-2017	<0.01	39	<0.02	<0.02	0.46	<0.01	<0.05	31	<0.002	0.001
White Sucker												
		Count	30	30	30	30	30	30	30	30	30	30
		# Less than DL	29	0	30	29	1	29	30	0	28	1
		Min	<0.01	40	<0.02	<0.02	0.02	0.01	0.05	11	<0.002	<0.0005
		Mean	0.010	123	<0.02	0.02	0.157333	0.01	0.05	20	0.0023	0.0030
		75th	0.01	164.25	<0.02	0.02	0.095	0.01	0.05	22	0.002	0.004
		95th	0.0145	199	<0.02	0.02	1.05	0.01	0.05	30	0.0059	0.00645
		Max	0.02	211	<0.02	0.02	1.7	0.01	0.05	33	0.007	0.007
		Geomean	0.010	115	<0.02	0.02	0.069	0.01	0.05	19	0.0021	0.0025
		SD	0.001826	43	7.06E-18	7.06E-18	0.32	3.5E-18	2.1E-17	4.3	0.0010	0.0016
Location	**Sample No.**	**Sample Date**										
LA-1	2016-WS1-B	17-Sep-2016	<0.01	175	<0.02	<0.02	0.06	<0.01	<0.05	19	0.007	0.002
	2016-WS2-B	20-Sep-2016	<0.01	111	<0.02	<0.02	0.04	<0.01	<0.05	16	<0.002	0.004
	2016-WS3-B	20-Sep-2016	<0.01	120	<0.02	<0.02	0.09	<0.01	<0.05	18	<0.002	0.002
	2016-WS4-B	20-Sep-2016	<0.01	117	<0.02	<0.02	0.05	<0.01	<0.05	20	<0.002	0.004
	LA1-WS1	27-May-2017	<0.01	188	<0.02	<0.02	0.40	<0.01	<0.05	18	<0.002	0.001
	LA1-WS2	27-May-2017	0.02	119	<0.02	<0.02	0.52	<0.01	<0.05	21	<0.002	0.002
LA-5	2016-WS1-B	10-Sep-2016	<0.01	125	<0.02	<0.02	0.05	<0.01	<0.05	15	<0.002	0.002
	2016-WS2-B	11-Sep-2016	<0.01	175	<0.02	<0.02	0.04	<0.01	<0.05	23	<0.002	0.001
	2016-WS3-B	11-Sep-2016	<0.01	211	<0.02	<0.02	0.02	<0.01	<0.05	33	<0.002	0.003
	2016-WS4-B	11-Sep-2016	<0.01	87	<0.02	<0.02	0.03	<0.01	<0.05	17	<0.002	0.003
	2016-WS5-B	11-Sep-2016	<0.01	190	<0.02	<0.02	0.04	<0.01	<0.05	27	<0.002	0.002
	LA5-WS1	30-May-2017	<0.01	107	<0.02	<0.02	0.25	<0.01	<0.05	20	<0.002	0.001
LA-6	2016-WS1-B	16-Sep-2016	<0.01	145	<0.02	<0.02	0.03	<0.01	<0.05	21	<0.002	0.003
	2016-WS2-B	16-Sep-2016	<0.01	92	<0.02	<0.02	0.04	<0.01	<0.05	16	<0.002	0.002
	2016-WS3-B	16-Sep-2016	<0.01	132	<0.02	<0.02	0.03	<0.01	<0.05	21	<0.002	0.002
	2016-WS4-B	16-Sep-2016	<0.01	100	<0.02	<0.02	0.04	<0.01	<0.05	16	<0.002	0.004
	2016-WS5-B	16-Sep-2016	<0.01	126	<0.02	<0.02	0.05	<0.01	<0.05	16	<0.002	0.004
	LA6-WS1	29-May-2017	<0.01	165	<0.02	<0.02	0.23	<0.01	<0.05	22	<0.002	0.002
LA-7	2016-WS1-B	19-Sep-2016	<0.01	122	<0.02	<0.02	0.04	<0.01	<0.05	18	<0.002	0.004
	2016-WS2-B	19-Sep-2016	<0.01	164	<0.02	<0.02	0.04	<0.01	<0.05	22	<0.002	0.007
	2016-WS3-B	19-Sep-2016	<0.01	150	<0.02	<0.02	0.03	<0.01	<0.05	21	<0.002	0.006
	2016-WS4-B	20-Sep-2016	<0.01	120	<0.02	<0.02	0.09	<0.01	<0.05	18	<0.002	0.005
	2016-WS5-B	20-Sep-2016	<0.01	100	<0.02	<0.02	<0.02	<0.01	<0.05	16	0.005	0.004
	LA7-WS1	31-May-2017	<0.01	172	<0.02	<0.02	0.48	<0.01	<0.05	21	<0.002	0.002
	LA7-WS2	31-May-2017	<0.01	67	<0.02	0.02	1.7	<0.01	<0.05	11	<0.002	0.001
LAB	2016-WS1-B	21-Sep-2016	<0.01	75	<0.02	<0.02	0.09	0.01	<0.05	26	<0.002	0.005
	2016-WS2-B	21-Sep-2016	<0.01	40	<0.02	<0.02	0.03	<0.01	<0.05	16	<0.002	0.003
	2016-WS3-B	21-Sep-2016	<0.01	72	<0.02	<0.02	0.04	<0.01	<0.05	24	<0.002	<0.0005
	2016-WS4-B	21-Sep-2016	<0.01	69	<0.02	<0.02	0.04	<0.01	<0.05	24	<0.002	0.003
	2016-WS5-B	21-Sep-2016	<0.01	61	<0.02	<0.02	0.11	<0.01	<0.05	21	<0.002	0.004

Results are reported on a "raw (wet) weight" basis

Table A-18
Baseline Fish Bone Chemistry

Parameter			Radium-226	Thorium-228	Thorium-230	Thorium-232
Unit			Bq/g	Bq/g	Bq/g	Bq/g
Northern Pike						
		Count	34	14	34	14
		# Less than DL	31	14	34	14
		Min	<0.0006	<0.001	<0.001	<0.001
		Mean	0.0010	0.0019	<0.00205882	0.0019
		75th	0.001	0.002	<0.002	0.002
		95th	0.00225	na	<0.003	na
		Max	0.003	0.003	<0.003	0.003
		Geomean	0.00099	0.0018	<0.00199694	0.0018
		SD	0.00040	0.00053	0.00049	0.00053
Location	**Sample No.**	**Sample Date**				
LA-1	2016-NP5-B	17-Sep-2016	<0.001		<0.002	
	2016-NP4-B	17-Sep-2016	<0.001		<0.002	
	2016-NP1-B	17-Sep-2016	<0.001		<0.002	
	2016-NP2-B	17-Sep-2016	<0.0009		<0.002	
	2016-NP3-B	17-Sep-2016	<0.001		<0.003	
	LA1-NP1	27-May-2017	<0.001	<0.002	<0.002	<0.002
	LA1-NP2	27-May-2017	<0.0009	<0.002	<0.002	<0.002
	LA1-NP3	27-May-2017	<0.0007	<0.001	<0.001	<0.001
	LA1-NP4	27-May-2017	<0.0009	<0.002	<0.002	<0.002
LA-5	2016-NP1-B	10-Sep-2016	<0.001	<0.002	<0.002	<0.002
	2016-NP2-B	10-Sep-2016	<0.0008	<0.002	<0.002	<0.002
	2016-NP3-B	10-Sep-2016	<0.0009	<0.002	<0.002	<0.002
	2016-NP4-B	10-Sep-2016	<0.0009	<0.002	<0.002	<0.002
	2016-NP5-B	10-Sep-2016	0.002	<0.002	<0.002	<0.002
LA-6	2016-NP1-B	16-Sep-2016	<0.001		<0.002	
	2016-NP2-B	16-Sep-2016	<0.001		<0.002	
	2016-NP3-B	16-Sep-2016	<0.001		<0.003	
	2016-NP4-B	16-Sep-2016	<0.001		<0.002	
	2016-NP5-B	16-Sep-2016	<0.001		<0.002	
	LA6-NP1	29-May-2017	<0.0009	<0.002	<0.002	<0.002
LA-7	2016-NP1-B	19-Sep-2016	<0.001		<0.002	
	2016-NP2-B	19-Sep-2016	<0.001		<0.002	
	2016-NP3-B	19-Sep-2016	<0.001		<0.002	
	2016-NP4-B	19-Sep-2016	0.001		<0.002	
	2016-NP5-B	19-Sep-2016	0.003		<0.002	
	LA7-NP1	31-May-2017	<0.001	<0.002	<0.002	<0.002
	LA7-NP2	31-May-2017	<0.001	<0.003	<0.003	<0.003
	LA7-NP3	31-May-2017	<0.0006	<0.001	<0.001	<0.001
LAB	2016-NP1-B	20-Sep-2016	<0.001		<0.002	
	2016-NP2-B	21-Sep-2016	<0.001		<0.002	
	2016-NP3-B	21-Sep-2016	<0.001		<0.003	
	2016-NP4-B	21-Sep-2016	<0.001		<0.003	
	2016-NP5-B	21-Sep-2016	<0.001		<0.002	
	LAB-NP1	28-May-2017	<0.0007	<0.001	<0.001	<0.001
White Sucker						
		Count	30	7	30	7
		# Less than DL	28	7	29	7
		Min	<0.0008	<0.002	<0.002	<0.002
		Mean	0.0010	<0.002	0.0020	<0.002
		75th	0.001	<0.002	0.002	<0.002
		95th	0.001	na	0.00245	na
		Max	0.001	<0.002	0.003	<0.002
		Geomean	0.0010	<0.002	0.0020	<0.002
		SD	7.8E-05	0	0.00018	0
Location	**Sample No.**	**Sample Date**				
LA-1	2016-WS1-B	17-Sep-2016	<0.001		<0.002	
	2016-WS2-B	20-Sep-2016	<0.001		<0.002	
	2016-WS3-B	20-Sep-2016	<0.001		<0.002	
	2016-WS4-B	20-Sep-2016	<0.001		<0.002	
	LA1-WS1	27-May-2017	<0.0009	<0.002	<0.002	<0.002
	LA1-WS2	27-May-2017	<0.001	<0.002	<0.002	<0.002
LA-5	2016-WS1-B	10-Sep-2016	0.001	<0.002	<0.002	<0.002
	2016-WS2-B	11-Sep-2016	<0.001		<0.002	
	2016-WS3-B	11-Sep-2016	<0.001		<0.002	
	2016-WS4-B	11-Sep-2016	<0.001		<0.002	
	2016-WS5-B	11-Sep-2016	<0.001		<0.002	
	LA5-WS1	30-May-2017	<0.0008	<0.002	<0.002	<0.002
LA-6	2016-WS1-B	16-Sep-2016	<0.001		<0.002	
	2016-WS2-B	16-Sep-2016	<0.001		<0.002	
	2016-WS3-B	16-Sep-2016	<0.001		<0.002	
	2016-WS4-B	16-Sep-2016	<0.001		<0.002	
	2016-WS5-B	16-Sep-2016	<0.001		0.003	
	LA6-WS1	29-May-2017	<0.0008	<0.002	<0.002	<0.002
LA-7	2016-WS1-B	19-Sep-2016	<0.001		<0.002	
	2016-WS2-B	19-Sep-2016	<0.0009		<0.002	
	2016-WS3-B	19-Sep-2016	<0.001		<0.002	
	2016-WS4-B	20-Sep-2016	0.001		<0.002	
	2016-WS5-B	20-Sep-2016	<0.001		<0.002	
	LA7-WS1	31-May-2017	<0.001	<0.002	<0.002	<0.002
	LA7-WS2	31-May-2017	<0.0009	<0.002	<0.002	<0.002
LAB	2016-WS1-B	21-Sep-2016	<0.001		<0.002	
	2016-WS2-B	21-Sep-2016	<0.0008		<0.002	
	2016-WS3-B	21-Sep-2016	<0.0008		<0.002	
	2016-WS4-B	21-Sep-2016	<0.0008		<0.002	
	2016-WS5-B	21-Sep-2016	<0.0009		<0.002	

Results are reported on a "raw (wet) weight" basis

Appendix B 2016-2018 Analytical Laboratory Reports

B-1: Lake Surface Water Quality
B-2: Lake Sediment Grain Size Analysis
B-3: Lake Sediment Quality
B-4: Lake Plankton Community
B-5: Benthic Taxonomy Data
B-6: Benthic Invertebrate Chemistry
B-7: Fish Flesh and Bone Chemistry
B-8: Environmental DNA Laboratory Report

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SRC Group # 2016-10860

Sep 29, 2016

EcoMetrix Inc.
6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Karen Petersen

Date Samples Received: Sep-13-2016 Client P.O.: 16-2285

This is a final report.

Lab Section 1 results have been authorized by Keith Gipman, Supervisor

Lab Section 2 results have been authorized by Melissa Tackaberry-Syed, Supervisor

Lab Section 3 results have been authorized by Pat Moser, Supervisor

Lab Sections 4 and 5 results have been authorized by Vicky Snook, Supervisor

Lab Section 6 results have been authorized by Marion McConnell, Supervisor

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* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as

    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

SRC SASKATCHEWAN RESEARCH COUNCIL

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SRC Group # 2016-10860

Sep 29, 2016

EcoMetrix Inc.

6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Karen Petersen

Date Samples Received: Sep-13-2016

Client P.O.: 16-2285

28877 **09/10/2016 LB-3T *WATER***
28878 **09/10/2016 LB-3B *WATER***
28879 **09/10/2016 LA-5 *WATER***

Analyte	Units	28877	28878	28879
Lab Section 1 (Inorganics)				
Bicarbonate	mg/L	10	17	8
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	0.2	0.8	0.3
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
pH	pH units	7.11	6.42	6.95
Specific conductivity	uS/cm	18	32	19
Sum of ions	mg/L	14	24	12
Total alkalinity	mg/L	8	14	7
Total hardness	mg/L	5	6	5
Ammonia as nitrogen	mg/L	0.02	1.2	0.07
Nitrate	mg/L	<0.04	<0.04	<0.04
Total Kjeldahl nitrogen	mg/L	0.20	1.6	0.19
Mercury	ng/L	<1	10	<1
Organic carbon	mg/L	2.7	4.4	2.2
Organic carbon, dissolved	mg/L	2.6	4.2	2.1
Fluoride	mg/L	0.02	0.02	0.02
Total dissolved solids	mg/L	24	33	22
Total suspended solids	mg/L	2	23	4
Lab Section 2 (ICP)				
Calcium	mg/L	1.3	1.8	1.2
Magnesium	mg/L	0.4	0.5	0.4
Potassium	mg/L	0.2	0.3	0.2
Sodium	mg/L	1.4	1.6	1.4
Sulfate	mg/L	0.7	0.5	0.6
Aluminum	mg/L	0.0016	0.0086	0.0078
Antimony	mg/L	<0.0002	<0.0002	<0.0002
Arsenic	ug/L	0.1	0.3	0.1
Barium	mg/L	0.0028	0.0095	0.0027
Beryllium	mg/L	<0.0001	<0.0001	<0.0001
Boron	mg/L	<0.01	<0.01	<0.01

SRC Group # 2016-10860

Sep 29, 2016

EcoMetrix Inc.

28877 **09/10/2016 LB-3T *WATER***
28878 **09/10/2016 LB-3B *WATER***
28879 **09/10/2016 LA-5 *WATER***

Analyte	Units	28877	28878	28879
Lab Section 2 (ICP)				
Cadmium	mg/L	<0.00001	0.00002	0.00001
Chromium	mg/L	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	0.0002	<0.0001
Copper	mg/L	<0.0002	<0.0002	<0.0002
Iron	mg/L	0.062	9.5	0.19
Lead	mg/L	<0.0001	<0.0001	<0.0001
Manganese	mg/L	0.012	0.34	0.020
Molybdenum	mg/L	<0.0001	<0.0001	<0.0001
Nickel	mg/L	<0.0001	0.0003	<0.0001
Selenium	mg/L	<0.0001	0.0001	<0.0001
Silver	mg/L	<0.00005	<0.00005	<0.00005
Strontium	mg/L	0.011	0.016	0.012
Thallium	mg/L	<0.0002	<0.0002	<0.0002
Tin	mg/L	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.0002	<0.0002	<0.0002
Uranium	ug/L	<0.1	<0.1	<0.1
Vanadium	mg/L	<0.0001	0.0005	<0.0001
Zinc	mg/L	<0.0005	0.0029	<0.0005
Phosphorus	mg/L	<0.01	0.17	<0.01
Phosphorus, dissolved	mg/L	<0.01	0.15	<0.01
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/L	<0.02	<0.02	<0.02
Polonium-210	Bq/L	<0.005	0.02	0.005
Radium-226	Bq/L	<0.005	0.007	0.008
Thorium-228	Bq/L	<0.01	<0.01	<0.01
Thorium-230	Bq/L	<0.01	<0.01	0.02
Thorium-232	Bq/L	<0.01	<0.01	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

SRC SASKATCHEWAN RESEARCH COUNCIL

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E: analytical@src.sk.ca

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SRC Group # 2016-10860

Sep 29, 2016

EcoMetrix Inc.

28880 09/10/2016 LA-7 *WATER*

Analyte	Units	28880
Lab Section 1 (Inorganics)		
Bicarbonate	mg/L	10
Carbonate	mg/L	<1
Chloride	mg/L	0.5
Hydroxide	mg/L	<1
P. alkalinity	mg/L	<1
pH	pH units	7.14
Specific conductivity	uS/cm	21
Sum of ions	mg/L	14
Total alkalinity	mg/L	8
Total hardness	mg/L	5
Ammonia as nitrogen	mg/L	0.01
Nitrate	mg/L	<0.04
Total Kjeldahl nitrogen	mg/L	0.32
Mercury	ng/L	<1
Organic carbon	mg/L	2.4
Organic carbon, dissolved	mg/L	2.2
Fluoride	mg/L	0.02
Total dissolved solids	mg/L	22
Total suspended solids	mg/L	4
Lab Section 2 (ICP)		
Calcium	mg/L	1.4
Magnesium	mg/L	0.4
Potassium	mg/L	0.2
Sodium	mg/L	1.6
Sulfate	mg/L	0.4
Aluminum	mg/L	0.0036
Antimony	mg/L	<0.0002
Arsenic	ug/L	0.1
Barium	mg/L	0.0024
Beryllium	mg/L	<0.0001
Boron	mg/L	<0.01
Cadmium	mg/L	<0.00001
Chromium	mg/L	<0.0005
Cobalt	mg/L	<0.0001
Copper	mg/L	<0.0002
Iron	mg/L	0.13

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SRC Group # 2016-10860

Sep 29, 2016

EcoMetrix Inc.

28880 **09/10/2016 LA-7 *WATER***

Analyte	Units	28880
Lab Section 2 (ICP)		
Lead	mg/L	<0.0001
Manganese	mg/L	0.015
Molybdenum	mg/L	<0.0001
Nickel	mg/L	<0.0001
Selenium	mg/L	<0.0001
Silver	mg/L	<0.00005
Strontium	mg/L	0.014
Thallium	mg/L	<0.0002
Tin	mg/L	<0.0001
Titanium	mg/L	<0.0002
Uranium	ug/L	<0.1
Vanadium	mg/L	<0.0001
Zinc	mg/L	<0.0005
Phosphorus	mg/L	<0.01
Phosphorus, dissolved	mg/L	<0.01
Lab Section 4 (Radiochemistry)		
Lead-210	Bq/L	<0.02
Polonium-210	Bq/L	<0.005
Radium-226	Bq/L	<0.005
Thorium-228	Bq/L	<0.01
Thorium-230	Bq/L	0.01
Thorium-232	Bq/L	<0.01

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SRC Group # 2016-11057

Sep 27, 2016

EcoMetrix Inc.
6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Karen Petersen

Date Samples Received: Sep-15-2016 Client P.O.: 16-2285

This is a final report.

Lab Section 1 results have been authorized by Keith Gipman, Supervisor

Lab Section 2 results have been authorized by Melissa Tackaberry-Syed, Supervisor

Lab Section 3 results have been authorized by Pat Moser, Supervisor

Lab Sections 4 and 5 results have been authorized by Vicky Snook, Supervisor

Lab Section 6 results have been authorized by Marion McConnell, Supervisor

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* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as

  * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
  * Environment Canada
  * US EPA
  * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

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SRC Group # 2016-11057

Sep 27, 2016

EcoMetrix Inc.

6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Karen Petersen

Date Samples Received: Sep-15-2016 Client P.O.: 16-2285

29148 09/13/2016 LB-1 *WATER*
29149 09/13/2016 LB-2 *WATER*
29150 09/14/2016 LA-1 *WATER*

Analyte	Units	29148	29149	29150
Lab Section 1 (Inorganics)				
Bicarbonate	mg/L	5	8	10
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	0.1	0.2	0.4
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
pH	pH units	6.70	6.74	6.79
Specific conductivity	uS/cm	18	20	19
Sum of ions	mg/L	9	12	14
Total alkalinity	mg/L	4	7	8
Total hardness	mg/L	5	5	5
Ammonia as nitrogen	mg/L	<0.01	<0.01	<0.01
Nitrate	mg/L	<0.04	<0.04	<0.04
Total Kjeldahl nitrogen	mg/L	0.28	0.35	0.38
Mercury	ng/L	<1	<1	<1
Organic carbon	mg/L	3.4	3.6	2.3
Organic carbon, dissolved	mg/L	3.6	3.5	2.1
Fluoride	mg/L	0.02	<0.01	<0.01
Total dissolved solids	mg/L	19	19	18
Total suspended solids	mg/L	2	<1	4
Lab Section 2 (ICP)				
Calcium	mg/L	1.2	1.3	1.2
Magnesium	mg/L	0.4	0.4	0.4
Potassium	mg/L	0.2	0.2	0.2
Sodium	mg/L	1.4	1.4	1.5
Sulfate	mg/L	0.7	0.5	0.7
Aluminum	mg/L	0.011	0.0096	0.0039
Antimony	mg/L	<0.0002	<0.0002	<0.0002
Arsenic	ug/L	0.1	0.1	<0.1
Barium	mg/L	0.0033	0.0033	0.0030
Beryllium	mg/L	<0.0001	<0.0001	<0.0001
Boron	mg/L	<0.01	<0.01	<0.01

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SRC Group # 2016-11057

Sep 27, 2016

EcoMetrix Inc.

29148 09/13/2016 LB-1 *WATER*
29149 09/13/2016 LB-2 *WATER*
29150 09/14/2016 LA-1 *WATER*

Analyte	Units	29148	29149	29150
Lab Section 2 (ICP)				
Cadmium	mg/L	0.00002	0.00001	0.00003
Chromium	mg/L	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0002	<0.0002	<0.0002
Iron	mg/L	0.084	0.15	0.27
Lead	mg/L	<0.0001	<0.0001	<0.0001
Manganese	mg/L	0.0044	0.0094	0.023
Molybdenum	mg/L	<0.0001	<0.0001	<0.0001
Nickel	mg/L	0.0001	0.0001	<0.0001
Selenium	mg/L	<0.0001	<0.0001	<0.0001
Silver	mg/L	<0.00005	<0.00005	<0.00005
Strontium	mg/L	0.013	0.013	0.013
Thallium	mg/L	<0.0002	<0.0002	<0.0002
Tin	mg/L	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.0002	<0.0002	<0.0002
Uranium	ug/L	<0.1	<0.1	<0.1
Vanadium	mg/L	0.0001	<0.0001	<0.0001
Zinc	mg/L	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	<0.01	0.03	<0.01
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/L	<0.02	<0.02	<0.02
Polonium-210	Bq/L	<0.005	<0.005	<0.005
Radium-226	Bq/L	<0.005	<0.005	<0.005
Thorium-230	Bq/L	<0.01	<0.01	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

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SRC Group # 2016-11057

Sep 27, 2016

EcoMetrix Inc.

29151 **09/14/2016 LA-8 *WATER***
29152 **09/13/2016 DUP1 *WATER***
29153 **09/12/2016 LA-6 *WATER***

Analyte	Units	29151	29152	29153
Lab Section 1 (Inorganics)				
Bicarbonate	mg/L	2	11	4
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	0.3	0.2	0.4
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
pH	pH units	6.79	6.73	6.71
Specific conductivity	uS/cm	17	18	18
Sum of ions	mg/L	6	15	8
Total alkalinity	mg/L	2	9	3
Total hardness	mg/L	5	5	5
Ammonia as nitrogen	mg/L	<0.01	<0.01	0.04
Nitrate	mg/L	<0.04	<0.04	<0.04
Total Kjeldahl nitrogen	mg/L	0.61	0.33	0.43
Mercury	ng/L	<1	<1	<1
Organic carbon	mg/L	2.2	3.6	2.3
Organic carbon, dissolved	mg/L	2.0	3.6	2.2
Fluoride	mg/L	<0.01	<0.01	0.02
Total dissolved solids	mg/L	21	18	14
Total suspended solids	mg/L	4	<1	4
Lab Section 2 (ICP)				
Calcium	mg/L	1.2	1.4	1.2
Magnesium	mg/L	0.4	0.4	0.4
Potassium	mg/L	0.2	0.2	0.2
Sodium	mg/L	1.3	1.4	1.4
Sulfate	mg/L	0.6	0.7	0.5
Aluminum	mg/L	0.0046	0.0098	0.0093
Antimony	mg/L	<0.0002	<0.0002	<0.0002
Arsenic	ug/L	<0.1	<0.1	<0.1
Barium	mg/L	0.0029	0.0034	0.0027
Beryllium	mg/L	<0.0001	<0.0001	<0.0001
Boron	mg/L	<0.01	<0.01	<0.01
Cadmium	mg/L	0.00001	<0.00001	<0.00001
Chromium	mg/L	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0002	<0.0002	<0.0002
Iron	mg/L	0.14	0.15	0.21

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SRC Group # 2016-11057

Sep 27, 2016

EcoMetrix Inc.

29151 **09/14/2016 LA-8 *WATER***
29152 **09/13/2016 DUP1 *WATER***
29153 **09/12/2016 LA-6 *WATER***

Analyte	Units	29151	29152	29153
Lab Section 2 (ICP)				
Lead	mg/L	<0.0001	<0.0001	<0.0001
Manganese	mg/L	0.028	0.0092	0.017
Molybdenum	mg/L	<0.0001	<0.0001	<0.0001
Nickel	mg/L	<0.0001	0.0001	<0.0001
Selenium	mg/L	<0.0001	<0.0001	<0.0001
Silver	mg/L	<0.00005	<0.00005	<0.00005
Strontium	mg/L	0.012	0.013	0.012
Thallium	mg/L	<0.0002	<0.0002	<0.0002
Tin	mg/L	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.0002	<0.0002	<0.0002
Uranium	ug/L	<0.1	<0.1	<0.1
Vanadium	mg/L	<0.0001	<0.0001	<0.0001
Zinc	mg/L	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	<0.01	<0.01	<0.01
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/L	<0.02	<0.02	<0.02
Polonium-210	Bq/L	<0.005	<0.005	<0.005
Radium-226	Bq/L	0.01	0.008	<0.005
Thorium-230	Bq/L	<0.01	<0.01	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

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SRC Group # 2016-11057

Sep 27, 2016

EcoMetrix Inc.

29154 **09/12/2016 LA-7A-T *WATER***
29155 **09/12/2016 LA-7A-B *WATER***

Analyte	Units	29154	29155
Lab Section 1 (Inorganics)			
Bicarbonate	mg/L	7	16
Carbonate	mg/L	<1	<1
Chloride	mg/L	0.6	0.6
Hydroxide	mg/L	<1	<1
P. alkalinity	mg/L	<1	<1
pH	pH units	6.89	6.46
Specific conductivity	uS/cm	21	32
Sum of ions	mg/L	12	23
Total alkalinity	mg/L	6	13
Total hardness	mg/L	5	7
Ammonia as nitrogen	mg/L	<0.01	0.91
Nitrate	mg/L	<0.04	<0.04
Total Kjeldahl nitrogen	mg/L	0.34	1.2
Mercury	ng/L	<1	68
Organic carbon	mg/L	2.1	2.6
Organic carbon, dissolved	mg/L	2.1	2.6
Fluoride	mg/L	<0.01	<0.01
Total dissolved solids	mg/L	22	29
Total suspended solids	mg/L	3	13
Lab Section 2 (ICP)			
Calcium	mg/L	1.4	2.1
Magnesium	mg/L	0.4	0.5
Potassium	mg/L	0.2	0.2
Sodium	mg/L	1.7	1.7
Sulfate	mg/L	0.3	0.5
Aluminum	mg/L	0.0015	0.0033
Antimony	mg/L	<0.0002	<0.0002
Arsenic	ug/L	<0.1	0.2
Barium	mg/L	0.0025	0.0036
Beryllium	mg/L	<0.0001	<0.0001
Boron	mg/L	<0.01	<0.01
Cadmium	mg/L	<0.00001	<0.00001
Chromium	mg/L	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001
Copper	mg/L	<0.0002	<0.0002
Iron	mg/L	0.085	5.2

SRC Group # 2016-11057

Sep 27, 2016

EcoMetrix Inc.

29154 **09/12/2016 LA-7A-T *WATER***
29155 **09/12/2016 LA-7A-B *WATER***

Analyte	Units	29154	29155
Lab Section 2 (ICP)			
Lead	mg/L	<0.0001	<0.0001
Manganese	mg/L	0.013	0.25
Molybdenum	mg/L	<0.0001	<0.0001
Nickel	mg/L	<0.0001	<0.0001
Selenium	mg/L	<0.0001	0.0002
Silver	mg/L	<0.00005	<0.00005
Strontium	mg/L	0.014	0.018
Thallium	mg/L	<0.0002	<0.0002
Tin	mg/L	<0.0001	<0.0001
Titanium	mg/L	<0.0002	<0.0002
Uranium	ug/L	<0.1	<0.1
Vanadium	mg/L	<0.0001	0.0003
Zinc	mg/L	<0.0005	0.0014
Phosphorus	mg/L	<0.01	0.11
Phosphorus, dissolved	mg/L	<0.01	0.10
Lab Section 4 (Radiochemistry)			
Lead-210	Bq/L	<0.02	<0.02
Polonium-210	Bq/L	<0.005	0.008
Radium-226	Bq/L	<0.005	0.01
Thorium-230	Bq/L	<0.01	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Note for Sample # 29155
This sample was reanalyzed for Mercury. Reanalysis confirmed original results within the expected measurement uncertainty.

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SRC Group # 2016-11119

Oct 05, 2016

EcoMetrix Inc.
6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Karen Petersen

Date Samples Received: Sep-19-2016 Client P.O.: 16-2285

This is a final report.

Lab Section 1 results have been authorized by Keith Gipman, Supervisor

Lab Section 2 results have been authorized by Melissa Tackaberry-Syed, Supervisor

Lab Section 3 results have been authorized by Pat Moser, Supervisor

Lab Sections 4 and 5 results have been authorized by Vicky Snook, Supervisor

Lab Section 6 results have been authorized by Marion McConnell, Supervisor

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as

  * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
  * Environment Canada
  * US EPA
  * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

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SRC Group # 2016-11119

Oct 05, 2016

EcoMetrix Inc.

6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Karen Petersen

Date Samples Received: Sep-19-2016

Client P.O.: 16-2285

29655 09/15/2016 LAB-1 *WATER*
29656 09/16/2016 LA-9 *WATER*

Analyte	Units	29655	29656
Lab Section 1 (Inorganics)			
Bicarbonate	mg/L	8	5
Carbonate	mg/L	<1	<1
Chloride	mg/L	<0.1	0.2
Hydroxide	mg/L	<1	<1
P. alkalinity	mg/L	<1	<1
pH	pH units	6.96	6.88
Specific conductivity	uS/cm	47	17
Sum of ions	mg/L	23	9
Total alkalinity	mg/L	7	4
Total hardness	mg/L	12	4
Ammonia as nitrogen	mg/L	<0.01	<0.01
Nitrate	mg/L	0.05	0.04
Total Kjeldahl nitrogen	mg/L	0.15	0.28
Mercury	ng/L	<1	<1
Organic carbon	mg/L	2.4	2.2
Organic carbon, dissolved	mg/L	2.4	2.1
Fluoride	mg/L	0.02	0.01
Total dissolved solids	mg/L	30	11
Total suspended solids	mg/L	1	3
Lab Section 2 (ICP)			
Calcium	mg/L	3.8	1.1
Magnesium	mg/L	0.6	0.3
Potassium	mg/L	0.3	0.1
Sodium	mg/L	1.8	1.4
Sulfate	mg/L	8.1	0.6
Aluminum	mg/L	0.0025	0.0016
Antimony	mg/L	<0.0002	<0.0002
Arsenic	ug/L	<0.1	0.1
Barium	mg/L	0.0035	0.0024
Beryllium	mg/L	<0.0001	<0.0001
Boron	mg/L	<0.01	<0.01

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SRC Group # 2016-11119

Oct 05, 2016

EcoMetrix Inc.

29655 **09/15/2016 LAB-1 *WATER***
29656 **09/16/2016 LA-9 *WATER***

Analyte	Units	29655	29656
Lab Section 2 (ICP)			
Cadmium	mg/L	0.00001	0.00001
Chromium	mg/L	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001
Copper	mg/L	<0.0002	<0.0002
Iron	mg/L	0.076	0.071
Lead	mg/L	<0.0001	<0.0001
Manganese	mg/L	0.041	0.011
Molybdenum	mg/L	0.0013	0.0002
Nickel	mg/L	0.0001	0.0001
Selenium	mg/L	<0.0001	<0.0001
Silver	mg/L	<0.00005	<0.00005
Strontium	mg/L	0.017	0.011
Thallium	mg/L	<0.0002	<0.0002
Tin	mg/L	<0.0001	<0.0001
Titanium	mg/L	<0.0002	<0.0002
Uranium	ug/L	<0.1	<0.1
Vanadium	mg/L	<0.0001	<0.0001
Zinc	mg/L	<0.0005	<0.0005
Phosphorus	mg/L	<0.01	<0.01
Phosphorus, dissolved	mg/L	<0.01	<0.01
Lab Section 4 (Radiochemistry)			
Lead-210	Bq/L	<0.02	<0.02
Polonium-210	Bq/L	<0.005	<0.005
Radium-226	Bq/L	0.006	<0.005
Thorium-228	Bq/L	<0.01	<0.01
Thorium-230	Bq/L	<0.01	<0.01
Thorium-232	Bq/L	<0.01	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

SRC SASKATCHEWAN RESEARCH COUNCIL

Environmental Analytical Laboratories
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Revised

SRC Group # 2016-11423

Oct 26, 2016

EcoMetrix Inc.
6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Karen Petersen

Date Samples Received: Sep-23-2016 Client P.O.: 16-2285

This is a final report.

Lab Section 1 results have been authorized by Keith Gipman, Supervisor

Lab Section 2 results have been authorized by Melissa Tackaberry-Syed, Supervisor

Lab Section 3 results have been authorized by Pat Moser, Supervisor

Lab Sections 4 and 5 results have been authorized by Vicky Snook, Supervisor

Lab Section 6 results have been authorized by Marion McConnell, Supervisor

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as

  * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
  * Environment Canada
  * US EPA
  * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

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Oct 26, 2016

EcoMetrix Inc.

6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Karen Petersen

Date Samples Received: Sep-23-2016

Client P.O.: 16-2285

30215 **09/19/2016 PA-3 *WATER***
30216 **09/20/2016 PA-2 *WATER***
30217 **09/21/2016 LA-2 *WATER***

Analyte	Units	30215	30216	30217
Lab Section 1 (Inorganics)				
Bicarbonate	mg/L	5	7	11
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	0.4	0.3	0.7
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
pH	pH units	6.74	7.03	7.19
Specific conductivity	uS/cm	18	20	22
Sum of ions	mg/L	10	12	16
Total alkalinity	mg/L	4	6	9
Total hardness	mg/L	4	5	5
Ammonia as nitrogen	mg/L	<0.01	<0.01	<0.01
Nitrate	mg/L	<0.04	0.04	0.05
Total Kjeldahl nitrogen	mg/L	0.33	0.22	0.22
Mercury	ng/L	1	<1	<1
Organic carbon	mg/L	8.4	3.4	2.2
Organic carbon, dissolved	mg/L	8.4	3.4	2.2
Fluoride	mg/L	0.02	0.06	<0.01
Total dissolved solids	mg/L	29	22	22
Total suspended solids	mg/L	2	2	2
Lab Section 2 (ICP)				
Calcium	mg/L	1.0	1.2	1.3
Magnesium	mg/L	0.3	0.4	0.4
Potassium	mg/L	0.5	0.2	0.4
Sodium	mg/L	1.3	1.4	1.6
Sulfate	mg/L	1.1	1.1	0.6
Aluminum	mg/L	0.027	0.0096	0.0022
Antimony	mg/L	<0.0002	<0.0002	<0.0002
Arsenic	ug/L	<0.1	<0.1	<0.1
Barium	mg/L	0.0026	0.0026	0.0029
Beryllium	mg/L	<0.0001	<0.0001	<0.0001
Boron	mg/L	<0.01	<0.01	<0.01

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Oct 26, 2016

EcoMetrix Inc.

30215 09/19/2016 PA-3 *WATER*
30216 09/20/2016 PA-2 *WATER*
30217 09/21/2016 LA-2 *WATER*

Analyte	Units	30215	30216	30217
Lab Section 2 (ICP)				
Cadmium	mg/L	<0.00001	<0.00001	<0.00001
Chromium	mg/L	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0002	<0.0002	<0.0002
Iron	mg/L	0.098	0.044	0.064
Lead	mg/L	<0.0001	<0.0001	<0.0001
Manganese	mg/L	0.0025	0.0026	0.0078
Molybdenum	mg/L	<0.0001	<0.0001	<0.0001
Nickel	mg/L	0.0002	0.0002	0.0003
Selenium	mg/L	<0.0001	<0.0001	<0.0001
Silver	mg/L	<0.00005	<0.00005	<0.00005
Strontium	mg/L	0.010	0.012	0.015
Thallium	mg/L	<0.0002	<0.0002	<0.0002
Tin	mg/L	<0.0001	<0.0001	<0.0001
Titanium	mg/L	0.0003	<0.0002	<0.0002
Uranium	ug/L	<0.1	<0.1	<0.1
Vanadium	mg/L	<0.0001	0.0001	<0.0001
Zinc	mg/L	0.0006	<0.0005	0.0011
Phosphorus	mg/L	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	<0.01	<0.01	<0.01
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/L	<0.02	<0.02	<0.02
Polonium-210	Bq/L	<0.005	0.007	<0.005
Radium-226	Bq/L	0.006	<0.005	0.006
Thorium-228	Bq/L	<0.01	<0.01	<0.01
Thorium-230	Bq/L	<0.01	<0.01	<0.01
Thorium-232	Bq/L	<0.01	<0.01	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

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Oct 26, 2016

EcoMetrix Inc.

30218 **09/21/2016 LA-3 *WATER***
30219 **09/21/2016 LA-4 *WATER***
30220 **09/21/2016 LAB-2 *WATER***

Analyte	Units	30218	30219	30220
Lab Section 1 (Inorganics)				
Bicarbonate	mg/L	8	15	10
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	0.8	0.6	0.4
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
pH	pH units	7.15	7.19	7.17
Specific conductivity	uS/cm	22	24	42
Sum of ions	mg/L	14	21	25
Total alkalinity	mg/L	7	12	8
Total hardness	mg/L	5	5	12
Ammonia as nitrogen	mg/L	<0.01	<0.01	<0.01
Nitrate	mg/L	0.05	0.05	0.05
Total Kjeldahl nitrogen	mg/L	0.25	0.24	0.29
Mercury	ng/L	<1	<1	<1
Organic carbon	mg/L	2.3	1.4	2.2
Organic carbon, dissolved	mg/L	2.2	1.4	2.2
Fluoride	mg/L	<0.01	0.02	0.03
Total dissolved solids	mg/L	22	26	35
Total suspended solids	mg/L	4	3	4
Lab Section 2 (ICP)				
Calcium	mg/L	1.2	1.4	3.5
Magnesium	mg/L	0.4	0.4	0.7
Potassium	mg/L	0.8	0.6	0.8
Sodium	mg/L	1.5	1.7	1.7
Sulfate	mg/L	0.9	1.3	8.3
Aluminum	mg/L	0.0021	0.0017	0.0029
Antimony	mg/L	<0.0002	<0.0002	<0.0002
Arsenic	ug/L	<0.1	0.1	0.1
Barium	mg/L	0.0030	0.0030	0.0034
Beryllium	mg/L	<0.0001	<0.0001	<0.0001
Boron	mg/L	<0.01	<0.01	<0.01
Cadmium	mg/L	<0.00001	<0.00001	<0.00001
Chromium	mg/L	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0002	<0.0002	<0.0002
Iron	mg/L	0.072	0.020	0.039

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SRC Group # 2016-11423

Oct 26, 2016

EcoMetrix Inc.

30218 **09/21/2016 LA-3 *WATER***
30219 **09/21/2016 LA-4 *WATER***
30220 **09/21/2016 LAB-2 *WATER***

Analyte	Units	30218	30219	30220
Lab Section 2 (ICP)				
Lead	mg/L	<0.0001	<0.0001	<0.0001
Manganese	mg/L	0.0086	0.025	0.019
Molybdenum	mg/L	<0.0001	<0.0001	0.0011
Nickel	mg/L	0.0002	0.0001	0.0003
Selenium	mg/L	<0.0001	<0.0001	<0.0001
Silver	mg/L	<0.00005	<0.00005	<0.00005
Strontium	mg/L	0.014	0.015	0.016
Thallium	mg/L	<0.0002	<0.0002	<0.0002
Tin	mg/L	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.0002	<0.0002	<0.0002
Uranium	ug/L	<0.1	<0.1	<0.1
Vanadium	mg/L	<0.0001	<0.0001	<0.0001
Zinc	mg/L	0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	<0.01	<0.01	<0.01
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/L	<0.02	<0.02	<0.02
Polonium-210	Bq/L	<0.005	<0.005	<0.005
Radium-226	Bq/L	<0.005	<0.005	0.007
Thorium-228	Bq/L	<0.01	<0.01	<0.01
Thorium-230	Bq/L	<0.01	<0.01	<0.01
Thorium-232	Bq/L	<0.01	<0.01	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Revised

SRC Group # 2016-11423

Oct 26, 2016

EcoMetrix Inc.

30221 **09/21/2016 DUP-2 *WATER***
30222 **09/21/2016 FIELD BLANK *WATER***

Analyte	Units	30221	30222
Lab Section 1 (Inorganics)			
Bicarbonate	mg/L	10	<1
Carbonate	mg/L	<1	<1
Chloride	mg/L	0.4	<0.1
Hydroxide	mg/L	<1	<1
P. alkalinity	mg/L	<1	<1
pH	pH units	7.17	5.48
Specific conductivity	uS/cm	42	<1
Sum of ions	mg/L	26	<1
Total alkalinity	mg/L	8	<1
Total hardness	mg/L	12	<1
Ammonia as nitrogen	mg/L	<0.01	<0.01
Nitrate	mg/L	0.05	0.06
Total Kjeldahl nitrogen	mg/L	0.30	<0.05
Mercury	ng/L	<1	<1
Organic carbon	mg/L	2.2	<0.2
Organic carbon, dissolved	mg/L	2.2	<0.2
Fluoride	mg/L	0.03	<0.01
Total dissolved solids	mg/L	35	1
Total suspended solids	mg/L	4	2
Lab Section 2 (ICP)			
Calcium	mg/L	3.7	<0.1
Magnesium	mg/L	0.6	<0.1
Potassium	mg/L	0.9	<0.1
Sodium	mg/L	1.8	<0.1
Sulfate	mg/L	8.2	<0.2
Aluminum	mg/L	0.0027	0.0025
Antimony	mg/L	<0.0002	<0.0002
Arsenic	ug/L	0.1	<0.1
Barium	mg/L	0.0031	<0.0005
Beryllium	mg/L	<0.0001	<0.0001
Boron	mg/L	<0.01	<0.01
Cadmium	mg/L	<0.00001	0.00001
Chromium	mg/L	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001
Copper	mg/L	<0.0002	0.0009
Iron	mg/L	0.042	0.0038

Revised

SRC Group # 2016-11423

Oct 26, 2016

EcoMetrix Inc.

30221 **09/21/2016 DUP-2 *WATER***
30222 **09/21/2016 FIELD BLANK *WATER***

Analyte	Units	30221	30222
Lab Section 2 (ICP)			
Lead	mg/L	<0.0001	0.0004
Manganese	mg/L	0.023	<0.0005
Molybdenum	mg/L	0.0010	<0.0001
Nickel	mg/L	0.0002	0.0001
Selenium	mg/L	<0.0001	<0.0001
Silver	mg/L	<0.00005	<0.00005
Strontium	mg/L	0.015	<0.0005
Thallium	mg/L	<0.0002	<0.0002
Tin	mg/L	<0.0001	<0.0001
Titanium	mg/L	<0.0002	<0.0002
Uranium	ug/L	<0.1	<0.1
Vanadium	mg/L	<0.0001	<0.0001
Zinc	mg/L	<0.0005	<0.0005
Phosphorus	mg/L	<0.01	<0.01
Phosphorus, dissolved	mg/L	<0.01	<0.01
Lab Section 4 (Radiochemistry)			
Lead-210	Bq/L	<0.02	<0.02
Polonium-210	Bq/L	<0.005	<0.005
Radium-226	Bq/L	0.006	<0.005
Thorium-228	Bq/L	<0.01	<0.01
Thorium-230	Bq/L	<0.01	<0.01
Thorium-232	Bq/L	<0.01	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Note for Sample # 30222
This sample was reanalyzed for Aluminum, Copper, Iron and Lead.
Reanalysis confirmed original results within the expected measurement uncertainty.

Added reanalysis note, as per client request. 10/26/2016 MTS.

Revised

SRC Group # 2016-11423

Oct 26, 2016

EcoMetrix Inc.

30223 TRAVEL BLANK *WATER*

Analyte	Units	30223
Lab Section 1 (Inorganics)		
Bicarbonate	mg/L	<1
Carbonate	mg/L	<1
Chloride	mg/L	<0.1
Hydroxide	mg/L	<1
P. alkalinity	mg/L	<1
pH	pH units	5.39
Specific conductivity	uS/cm	<1
Sum of ions	mg/L	<1
Total alkalinity	mg/L	<1
Total hardness	mg/L	<1
Ammonia as nitrogen	mg/L	<0.01
Nitrate	mg/L	0.06
Total Kjeldahl nitrogen	mg/L	<0.05
Mercury	ng/L	<1
Organic carbon	mg/L	<0.2
Fluoride	mg/L	<0.01
Total dissolved solids	mg/L	<1
Total suspended solids	mg/L	2
Lab Section 2 (ICP)		
Calcium	mg/L	<0.1
Magnesium	mg/L	<0.1
Potassium	mg/L	<0.1
Sodium	mg/L	<0.1
Sulfate	mg/L	<0.2
Aluminum	mg/L	0.0013
Antimony	mg/L	<0.0002
Arsenic	ug/L	<0.1
Barium	mg/L	<0.0005
Beryllium	mg/L	<0.0001
Boron	mg/L	<0.01
Cadmium	mg/L	<0.00001
Chromium	mg/L	<0.0005
Cobalt	mg/L	<0.0001
Copper	mg/L	<0.0002
Iron	mg/L	<0.0005
Lead	mg/L	<0.0001

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Oct 26, 2016

EcoMetrix Inc.

30223 TRAVEL BLANK *WATER*

Analyte	Units	30223
Lab Section 2 (ICP)		
Manganese	mg/L	<0.0005
Molybdenum	mg/L	<0.0001
Nickel	mg/L	0.0001
Selenium	mg/L	<0.0001
Silver	mg/L	<0.00005
Strontium	mg/L	<0.0005
Thallium	mg/L	<0.0002
Tin	mg/L	<0.0001
Titanium	mg/L	<0.0002
Uranium	ug/L	<0.1
Vanadium	mg/L	<0.0001
Zinc	mg/L	<0.0005
Phosphorus	mg/L	<0.01
Lab Section 4 (Radiochemistry)		
Lead-210	Bq/L	<0.02
Polonium-210	Bq/L	<0.005
Radium-226	Bq/L	0.006
Thorium-228	Bq/L	<0.01
Thorium-230	Bq/L	<0.01
Thorium-232	Bq/L	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

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SRC Group # 2018-2955

Apr 03, 2018

EcoMetrix Inc.
6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Gordan Ivanis

Date Samples Received: Mar-19-2018 Client P.O.:

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Sections 1 and 2 have been authorized by Keith Gipman, Supervisor
Results from Lab Section 3 have been authorized by Pat Moser, Supervisor
Results from Lab Sections 4 and 5 have been authorized by Vicky Snook, Supervisor
Results from Lab Section 6 have been authorized by Marion McConnell, Supervisor

---

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

This is a final report.

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SRC Group # 2018-2955

Apr 03, 2018

EcoMetrix Inc.

6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Gordan Ivanis

Date Samples Received: Mar-19-2018 Client P.O.:

9451 **03/17/2018 LA6 *WATER***
9452 **03/17/2018 LA6A *WATER***
9453 **03/16/2018 LA1T *WATER***

Analyte	Units	9451	9452	9453
Lab Section 1 (Inorganics)				
Bicarbonate	mg/L	4	4	10
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	0.3	0.3	0.5
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
pH	pH units	6.79	6.77	6.82
Specific conductivity	uS/cm	12	12	15
Sum of ions	mg/L	9	9	15
Total alkalinity	mg/L	3	3	8
Total hardness	mg/L	4	5	5
Ammonia as nitrogen	mg/L	0.02	0.02	0.03
Nitrate	mg/L	0.30	0.30	0.29
Total Kjeldahl nitrogen	mg/L	0.29	0.20	0.20
Mercury	ng/L	7	9	4
Organic carbon	mg/L	2.2	2.3	2.3
Organic carbon, dissolved	mg/L	2.2	2.2	2.2
Fluoride	mg/L	0.02	0.02	0.03
Total dissolved solids	mg/L	21	22	22
Total suspended solids	mg/L	<1	<1	<1
Lab Section 2 (ICP)				
Calcium	mg/L	1.1	1.2	1.4
Magnesium	mg/L	0.4	0.4	0.4
Potassium	mg/L	0.4	0.4	0.4
Sodium	mg/L	1.5	1.5	1.6
Sulfate	mg/L	0.7	0.8	0.8
Aluminum	mg/L	0.0058	0.0061	0.0046
Antimony	mg/L	<0.0002	<0.0002	<0.0002
Arsenic	ug/L	0.1	<0.1	<0.1
Barium	mg/L	0.0030	0.0030	0.0032
Beryllium	mg/L	<0.0001	<0.0001	<0.0001
Boron	mg/L	<0.01	<0.01	<0.01

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SRC Group # 2018-2955

Apr 03, 2018

EcoMetrix Inc.

9451 **03/17/2018 LA6 *WATER***
9452 **03/17/2018 LA6A *WATER***
9453 **03/16/2018 LA1T *WATER***

Analyte	Units	9451	9452	9453
Lab Section 2 (ICP)				
Cadmium	mg/L	<0.00001	<0.00001	<0.00001
Chromium	mg/L	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0002	<0.0002	<0.0002
Iron	mg/L	0.031	0.032	0.037
Lead	mg/L	<0.0001	<0.0001	<0.0001
Manganese	mg/L	0.0024	0.0024	0.0039
Molybdenum	mg/L	<0.0001	<0.0001	<0.0001
Nickel	mg/L	<0.0001	<0.0001	<0.0001
Selenium	mg/L	<0.0001	<0.0001	<0.0001
Silver	mg/L	<0.00005	<0.00005	<0.00005
Strontium	mg/L	0.012	0.012	0.014
Thallium	mg/L	<0.0002	<0.0002	<0.0002
Tin	mg/L	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.0002	<0.0002	<0.0002
Uranium	ug/L	<0.1	<0.1	<0.1
Vanadium	mg/L	<0.0001	<0.0001	<0.0001
Zinc	mg/L	0.0022	0.0016	0.0010
Phosphorus	mg/L	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	<0.01	<0.01	<0.01
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/L	<0.02	<0.02	<0.02
Polonium-210	Bq/L	<0.005	<0.005	<0.005
Radium-226	Bq/L	<0.005	<0.005	<0.005
Thorium-228	Bq/L	<0.01	<0.01	<0.01
Thorium-230	Bq/L	<0.01	<0.01	<0.01
Thorium-232	Bq/L	<0.01	<0.01	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

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SRC Group # 2018-2955

Apr 03, 2018

EcoMetrix Inc.

9454 **03/16/2018 LA1B *WATER***
9455 **03/17/2018 FIELD BLANK *WATER***

Analyte	Units	9454	9455
Lab Section 1 (Inorganics)			
Bicarbonate	mg/L	6	1
Carbonate	mg/L	<1	<1
Chloride	mg/L	0.5	<0.1
Hydroxide	mg/L	<1	<1
P. alkalinity	mg/L	<1	<1
pH	pH units	6.80	5.54
Specific conductivity	uS/cm	14	<1
Sum of ions	mg/L	12	1
Total alkalinity	mg/L	5	1
Total hardness	mg/L	5	<1
Ammonia as nitrogen	mg/L	0.02	<0.01
Nitrate	mg/L	0.60	<0.04
Total Kjeldahl nitrogen	mg/L	0.14	<0.05
Mercury	ng/L	7	10
Organic carbon	mg/L	2.2	<0.2
Organic carbon, dissolved	mg/L	2.2	<0.2
Fluoride	mg/L	0.02	<0.01
Total dissolved solids	mg/L	22	<5
Total suspended solids	mg/L	<1	<1
Lab Section 2 (ICP)			
Calcium	mg/L	1.4	<0.1
Magnesium	mg/L	0.4	<0.1
Potassium	mg/L	0.4	<0.1
Sodium	mg/L	1.6	<0.1
Sulfate	mg/L	0.8	<0.2
Aluminum	mg/L	0.0034	0.0013
Antimony	mg/L	<0.0002	<0.0002
Arsenic	ug/L	0.1	<0.1
Barium	mg/L	0.0031	<0.0005
Beryllium	mg/L	<0.0001	<0.0001
Boron	mg/L	<0.01	<0.01
Cadmium	mg/L	<0.00001	<0.00001
Chromium	mg/L	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001
Copper	mg/L	<0.0002	<0.0002
Iron	mg/L	0.036	<0.0005

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SRC Group # 2018-2955

Apr 03, 2018

EcoMetrix Inc.

9454 **03/16/2018 LA1B *WATER***
9455 **03/17/2018 FIELD BLANK *WATER***

Analyte	Units	9454	9455
Lab Section 2 (ICP)			
Lead	mg/L	<0.0001	<0.0001
Manganese	mg/L	0.0053	<0.0005
Molybdenum	mg/L	<0.0001	<0.0001
Nickel	mg/L	<0.0001	<0.0001
Selenium	mg/L	<0.0001	<0.0001
Silver	mg/L	<0.00005	<0.00005
Strontium	mg/L	0.014	<0.0005
Thallium	mg/L	<0.0002	<0.0002
Tin	mg/L	<0.0001	<0.0001
Titanium	mg/L	<0.0002	<0.0002
Uranium	ug/L	<0.1	<0.1
Vanadium	mg/L	<0.0001	<0.0001
Zinc	mg/L	0.0016	0.0007
Phosphorus	mg/L	<0.01	<0.01
Phosphorus, dissolved	mg/L	<0.01	<0.01
Lab Section 4 (Radiochemistry)			
Lead-210	Bq/L	0.03	<0.02
Polonium-210	Bq/L	<0.005	<0.005
Radium-226	Bq/L	<0.005	<0.005
Thorium-228	Bq/L	<0.01	<0.01
Thorium-230	Bq/L	0.01	<0.01
Thorium-232	Bq/L	<0.01	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Note for Sample # 9455
This sample was reanalyzed for Mercury. Reanalysis confirms original results are within the expected measurement uncertainty.
***Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.

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SRC Group # 2018-8051

Jul 20, 2018

EcoMetrix Inc.
6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Goran Ivanis

Date Samples Received: Jul-04-2018 Client P.O.:

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Sections 1 and 2 have been authorized by Keith Gipman, Supervisor
Results from Lab Section 3 have been authorized by Pat Moser, Supervisor
Results from Lab Sections 4 and 5 have been authorized by Vicky Snook, Supervisor
Results from Lab Section 6 have been authorized by Marion McConnell, Supervisor

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* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

This is a final report.

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SRC Group # 2018-8051

Jul 20, 2018

EcoMetrix Inc.

6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Goran Ivanis

Date Samples Received: Jul-04-2018 Client P.O.:

25959 07/02/2018 LA6T *WATER*
25960 07/02/2018 LA6TDUP *WATER*
25961 07/02/2018 LA1T *WATER*

Analyte	Units	25959	25960	25961
Lab Section 1 (Inorganics)				
Bicarbonate	mg/L	8	7	8
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	0.3	0.3	0.4
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
pH	pH units	6.75	6.68	6.71
Specific conductivity	uS/cm	9	9	9
Sum of ions	mg/L	12	11	12
Total alkalinity	mg/L	7	6	7
Total hardness	mg/L	4	4	4
Ammonia as nitrogen	mg/L	<0.01	<0.01	<0.01
Nitrate	mg/L	<0.04	<0.04	<0.04
Total Kjeldahl nitrogen	mg/L	0.28	0.32	0.33
Mercury	ng/L	<1	<1	<1
Organic carbon	mg/L	2.2	2.2	2.2
Organic carbon, dissolved	mg/L	2.2	2.1	2.0
Fluoride	mg/L	0.08	0.08	0.08
Total dissolved solids	mg/L	23	22	26
Total suspended solids	mg/L	2	2	2
Lab Section 2 (ICP)				
Calcium	mg/L	1.1	1.0	1.1
Magnesium	mg/L	0.2	0.3	0.3
Potassium	mg/L	0.3	0.3	0.4
Sodium	mg/L	1.4	1.4	1.4
Sulfate	mg/L	0.6	0.7	0.7
Aluminum	mg/L	0.0074	0.0063	0.0051
Antimony	mg/L	<0.0002	<0.0002	<0.0002
Arsenic	ug/L	0.1	<0.1	0.1
Barium	mg/L	0.0024	0.0023	0.0023
Beryllium	mg/L	<0.0001	<0.0001	<0.0001
Boron	mg/L	<0.01	<0.01	<0.01

SRC Group # 2018-8051

Jul 20, 2018

EcoMetrix Inc.

25959 **07/02/2018 LA6T *WATER***
25960 **07/02/2018 LA6TDUP *WATER***
25961 **07/02/2018 LA1T *WATER***

Analyte	Units	25959	25960	25961
Lab Section 2 (ICP)				
Cadmium	mg/L	<0.00001	<0.00001	<0.00001
Chromium	mg/L	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0002	<0.0002	<0.0002
Iron	mg/L	0.096	0.078	0.052
Lead	mg/L	<0.0001	<0.0001	<0.0001
Manganese	mg/L	0.019	0.016	0.010
Molybdenum	mg/L	<0.0001	<0.0001	<0.0001
Nickel	mg/L	<0.0001	<0.0001	<0.0001
Selenium	mg/L	<0.0001	<0.0001	<0.0001
Silver	mg/L	<0.00005	<0.00005	<0.00005
Strontium	mg/L	0.011	0.011	0.012
Thallium	mg/L	<0.0002	<0.0002	<0.0002
Tin	mg/L	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.0002	<0.0002	<0.0002
Uranium	ug/L	<0.1	<0.1	<0.1
Vanadium	mg/L	<0.0001	<0.0001	<0.0001
Zinc	mg/L	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	<0.01	<0.01	<0.01
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/L	<0.02	<0.02	<0.02
Polonium-210	Bq/L	<0.005	<0.005	<0.005
Radium-226	Bq/L	0.005	<0.005	<0.005
Thorium-230	Bq/L	<0.01	<0.01	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Note for Sample # 25959
Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.

Note for Sample # 25960
Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.

Note for Sample # 25961
Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.

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SRC Group # 2018-8051

Jul 20, 2018

EcoMetrix Inc.

25962 07/02/2018 LA1B *WATER*

Analyte	Units	25962
Lab Section 1 (Inorganics)		
Bicarbonate	mg/L	5
Carbonate	mg/L	<1
Chloride	mg/L	0.4
Hydroxide	mg/L	<1
P. alkalinity	mg/L	<1
pH	pH units	6.62
Specific conductivity	uS/cm	10
Sum of ions	mg/L	9
Total alkalinity	mg/L	4
Total hardness	mg/L	4
Ammonia as nitrogen	mg/L	<0.01
Nitrate	mg/L	<0.04
Total Kjeldahl nitrogen	mg/L	0.23
Mercury	ng/L	9
Organic carbon	mg/L	2.0
Organic carbon, dissolved	mg/L	1.9
Fluoride	mg/L	0.08
Total dissolved solids	mg/L	24
Total suspended solids	mg/L	2
Lab Section 2 (ICP)		
Calcium	mg/L	1.1
Magnesium	mg/L	0.3
Potassium	mg/L	0.3
Sodium	mg/L	1.4
Sulfate	mg/L	0.7
Aluminum	mg/L	0.0040
Antimony	mg/L	<0.0002
Arsenic	ug/L	0.1
Barium	mg/L	0.0026
Beryllium	mg/L	<0.0001
Boron	mg/L	<0.01
Cadmium	mg/L	<0.00001
Chromium	mg/L	<0.0005
Cobalt	mg/L	<0.0001
Copper	mg/L	<0.0002
Iron	mg/L	0.13

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SRC Group # 2018-8051

Jul 20, 2018

EcoMetrix Inc.

25962 07/02/2018 LA1B *WATER*

Analyte	Units	25962
Lab Section 2 (ICP)		
Lead	mg/L	<0.0001
Manganese	mg/L	0.013
Molybdenum	mg/L	<0.0001
Nickel	mg/L	<0.0001
Selenium	mg/L	<0.0001
Silver	mg/L	<0.00005
Strontium	mg/L	0.013
Thallium	mg/L	<0.0002
Tin	mg/L	<0.0001
Titanium	mg/L	<0.0002
Uranium	ug/L	<0.1
Vanadium	mg/L	<0.0001
Zinc	mg/L	0.0013
Phosphorus	mg/L	<0.01
Phosphorus, dissolved	mg/L	<0.01
Lab Section 4 (Radiochemistry)		
Lead-210	Bq/L	<0.02
Polonium-210	Bq/L	<0.005
Radium-226	Bq/L	<0.005
Thorium-230	Bq/L	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Note for Sample # 25962
Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.

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SRC Group # 2018-8051

Jul 20, 2018

EcoMetrix Inc.

25963 TRIP *WATER*

Analyte	Units	25963
Lab Section 1 (Inorganics)		
Bicarbonate	mg/L	1
Carbonate	mg/L	<1
Chloride	mg/L	<0.1
Hydroxide	mg/L	<1
P. alkalinity	mg/L	<1
pH	pH units	5.07
Specific conductivity	uS/cm	<1
Sum of ions	mg/L	1
Total alkalinity	mg/L	1
Total hardness	mg/L	<1
Ammonia as nitrogen	mg/L	<0.01
Nitrate	mg/L	<0.04
Total Kjeldahl nitrogen	mg/L	<0.05
Mercury	ng/L	<1
Organic carbon	mg/L	<0.2
Fluoride	mg/L	0.02
Total dissolved solids	mg/L	<5
Total suspended solids	mg/L	<1
Lab Section 2 (ICP)		
Calcium	mg/L	<0.1
Magnesium	mg/L	<0.1
Potassium	mg/L	<0.1
Sodium	mg/L	<0.1
Sulfate	mg/L	<0.2
Aluminum	mg/L	0.0013
Antimony	mg/L	<0.0002
Arsenic	ug/L	<0.1
Barium	mg/L	<0.0005
Beryllium	mg/L	<0.0001
Boron	mg/L	<0.01
Cadmium	mg/L	<0.00001
Chromium	mg/L	<0.0005
Cobalt	mg/L	<0.0001
Copper	mg/L	<0.0002
Iron	mg/L	<0.0005
Lead	mg/L	<0.0001

SRC Group # 2018-8051

Jul 20, 2018

EcoMetrix Inc.

25963 **TRIP *WATER***

Analyte	Units	25963
Lab Section 2 (ICP)		
Manganese	mg/L	<0.0005
Molybdenum	mg/L	<0.0001
Nickel	mg/L	<0.0001
Selenium	mg/L	<0.0001
Silver	mg/L	<0.00005
Strontium	mg/L	<0.0005
Thallium	mg/L	<0.0002
Tin	mg/L	<0.0001
Titanium	mg/L	<0.0002
Uranium	ug/L	<0.1
Vanadium	mg/L	<0.0001
Zinc	mg/L	<0.0005
Phosphorus	mg/L	<0.01
Lab Section 4 (Radiochemistry)		
Lead-210	Bq/L	<0.02
Polonium-210	Bq/L	<0.005
Radium-226	Bq/L	<0.005
Thorium-230	Bq/L	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

File name:	G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30600_03.$av
	2016-11577_30600_03.$av
File ID:	2016-11577
Sample ID:	30600
Operator:	MKM
Comment 1:	sonicated
Optical model:	Fraunhofer.rf780d PIDS included
LS 13 320	Aqueous Liquid Module
Pump speed:	60
Fluid:	Water

Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30600_01.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30600_02.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30600_03.$ls

Volume Statistics (Arithmetic)   2016-11577_30600_03.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	28.42 µm	S.D.:	31.34 µm
Median:	17.82 µm	C.V.:	110%
D(3,2):	7.350 µm	Skewness:	2.558 Right skewed
Mode:	16.40 µm	Kurtosis:	8.598 Leptokurtic

d_{10}:   4.198 µm d_{50}:   17.82 µm d_{90}:   64.34 µm

Folk and Ward Statistics (Phi)

Mean:	5.84	Median:	5.81	Deviation:	1.56
Skewness:	0.07	Kurtosis:	1.07		

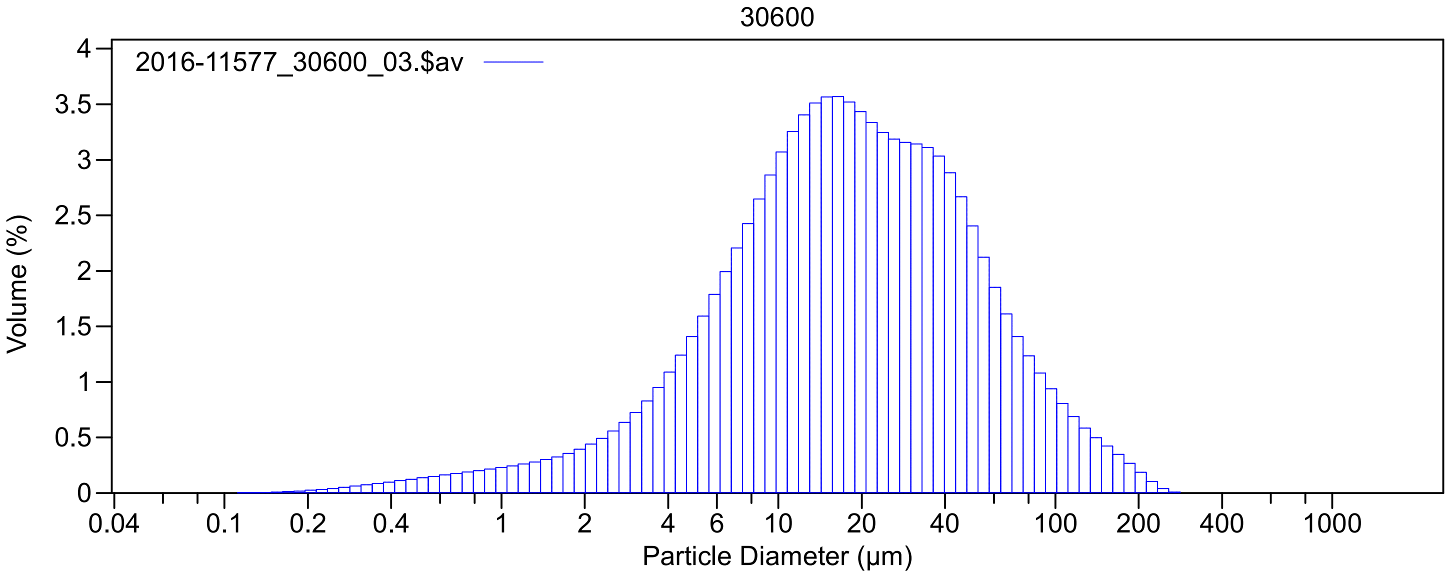
<80%
42.71 µm

2016-11577_30600_03.$av

Particle Diameter µm	Volume %
0.04	9.43
4	80.2
63	10.1
200	0.28
2000	

2016-11577_30600_03.$av

Size µm	Diff. Volume %
0	9.43
4	80.2
63	10.1
200	0.28
2000	0


30600
2016-11577_30600_03.$av
Volume (%)
4
3.5
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30601_06.$av
2016-11577_30601_06.$av
File ID: 2016-11577
Sample ID: 30601
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d PIDS included
LS 13 320 Aqueous Liquid Module
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30601_04.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30601_05.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30601_06.$ls

Volume Statistics (Arithmetic) 2016-11577_30601_06.$av

Calculations from 0.040 µm to 2000 µm

Volume: 100%

Mean:	35.29 µm	S.D.:	72.21 µm
Median:	15.55 µm	C.V.:	205%
D(3,2):	6.470 µm	Skewness:	6.951 Right skewed
Mode:	13.61 µm	Kurtosis:	67.72 Leptokurtic

d_{10}: 3.840 µm d_{50}: 15.55 µm d_{90}: 75.35 µm

Folk and Ward Statistics (Phi)

Mean:	5.95	Median:	6.01	Deviation:	1.69
Skewness:	-0.04	Kurtosis:	1.16		

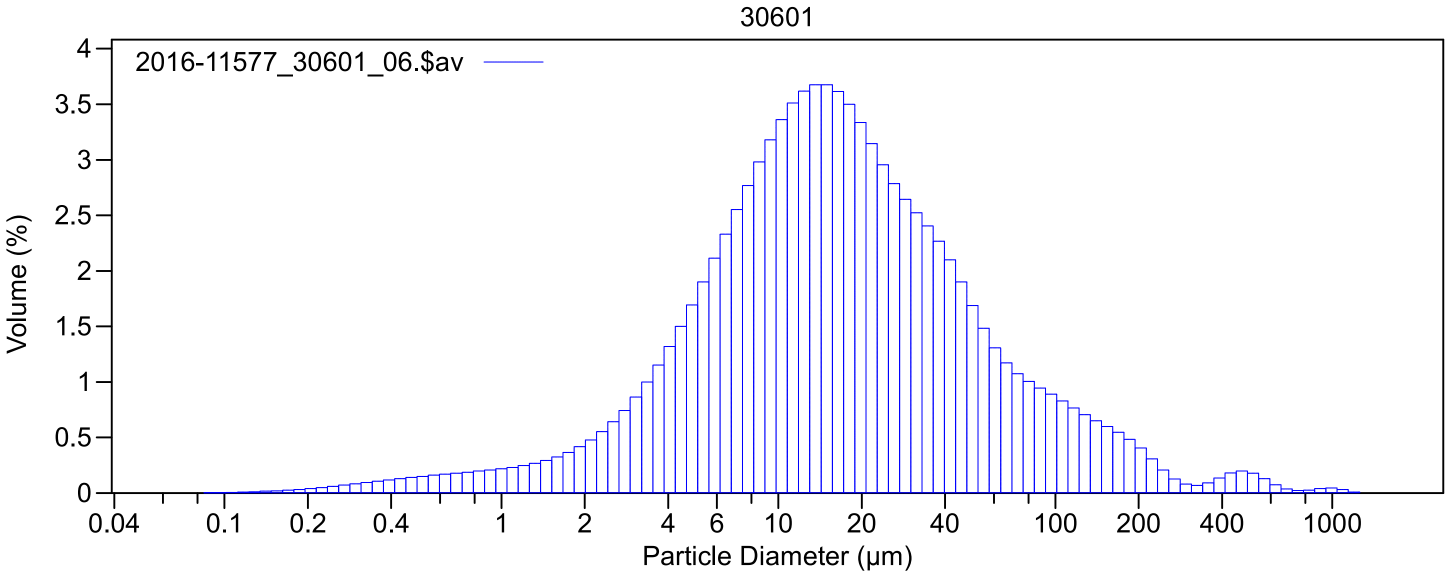
<80%
40.81 µm

2016-11577_30601_06.$av

Particle Diameter µm	Volume %
0.04	10.6
4	77.3
63	9.89
200	2.28
2000	

2016-11577_30601_06.$av

Size µm	Diff. Volume %
0	10.6
4	77.3
63	9.89
200	2.28
2000	0


30601
2016-11577_30601_06.$av
Volume (%)
4
3.5
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (μm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30602_09.$av
2016-11577_30602_09.$av
File ID: 2016-11577
Sample ID: 30602
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d PIDS included
LS 13 320 Aqueous Liquid Module
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30602_07.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30602_08.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30602_09.$ls

Volume Statistics (Arithmetic) 2016-11577_30602_09.$av

Calculations from 0.040 µm to 2000 µm

Volume: 100%
Mean: 135.8 µm S.D.: 152.4 µm
Median: 89.13 µm C.V.: 112%
D(3,2): 14.55 µm Skewness: 2.373 Right skewed
Mode: 185.4 µm Kurtosis: 9.288 Leptokurtic

d_{10}: 8.031 µm d_{50}: 89.13 µm d_{90}: 323.3 µm

Folk and Ward Statistics (Phi)
Mean: 3.90 Median: 3.49 Deviation: 2.08
Skewness: 0.31 Kurtosis: 0.92

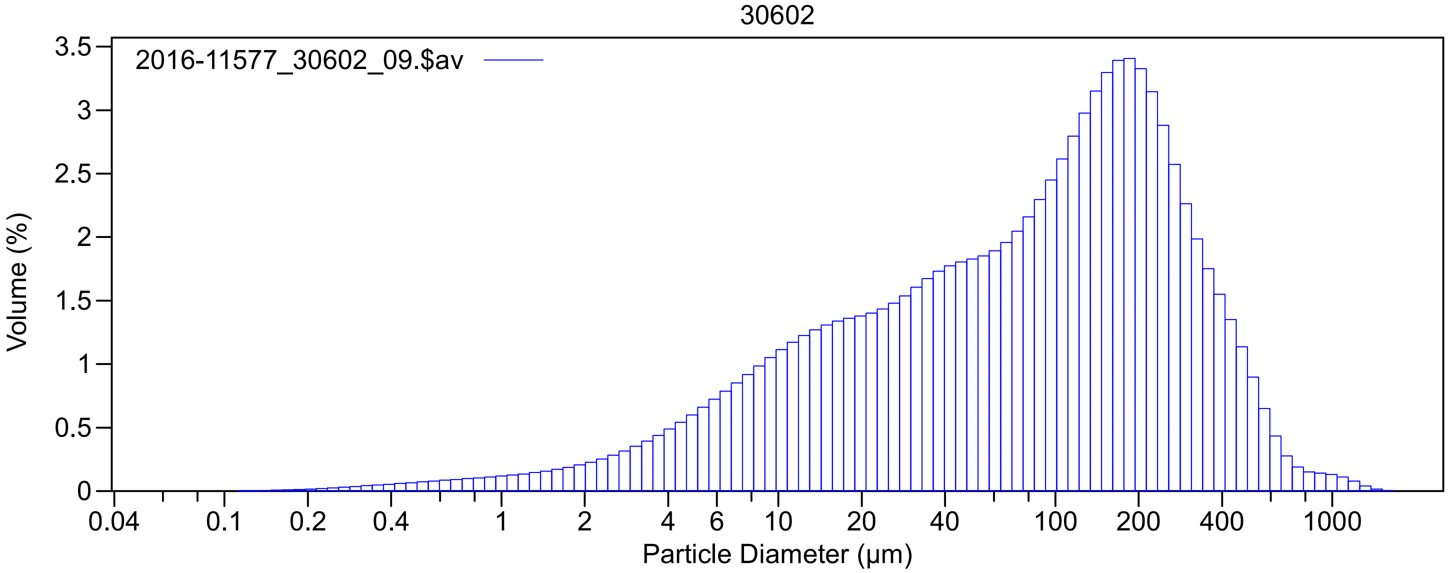
<80%
224.9 µm

2016-11577_30602_09.$av

Particle Diameter µm	Volume %
0.04	4.75
4	37.5
63	33.7
200	24.1
2000	

2016-11577_30602_09.$av

Size µm	Diff. Volume %
0	4.75
4	37.5
63	33.7
200	24.1
2000	0


30602
2016-11577_30602_09.$av
Volume (%)
3.5
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name:	G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30603_12.$av
	2016-11577_30603_12.$av
File ID:	2016-11577
Sample ID:	30603
Operator:	MKM
Comment 1:	sonicated
Optical model:	Fraunhofer.rf780d PIDS included
LS 13 320	Aqueous Liquid Module
Pump speed:	60
Fluid:	Water

Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30603_10.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30603_11.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30603_12.$ls

Volume Statistics (Arithmetic) 2016-11577_30603_12.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	121.7 µm	S.D.:	120.8 µm
Median:	96.72 µm	C.V.:	99.2%
D(3,2):	14.96 µm	Skewness:	2.755 Right skewed
Mode:	140.1 µm	Kurtosis:	11.91 Leptokurtic

d_{10}: 13.95 µm d_{50}: 96.72 µm d_{90}: 238.1 µm

Folk and Ward Statistics (Phi)

Mean:	3.71	Median:	3.37	Deviation:	1.60
Skewness:	0.35	Kurtosis:	1.13		

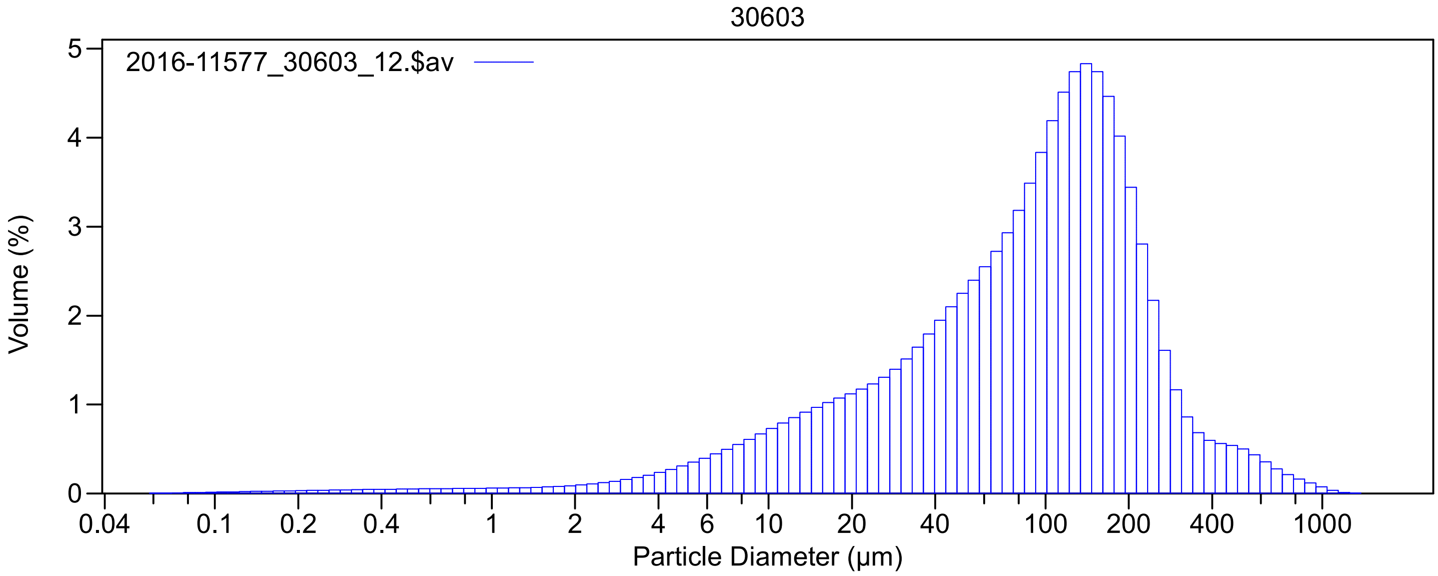
<80%
179.7 µm

2016-11577_30603_12.$av

Particle Diameter µm	Volume %
0.04	2.67
4	32.8
63	48.9
200	15.6
2000	

2016-11577_30603_12.$av

Size µm	Diff. Volume %
0	2.67
4	32.8
63	48.9
200	15.6
2000	0


30603
2016-11577_30603_12.$av
Volume (%)
5
4
3
2
1
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name:	G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30604_15.$av 2016-11577_30604_15.$av
File ID:	2016-11577
Sample ID:	30604
Operator:	MKM
Comment 1:	sonicated
Optical model:	Fraunhofer.rf780d PIDS included
LS 13 320	Aqueous Liquid Module
Pump speed:	60
Fluid:	Water

Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30604_13.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30604_14.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30604_15.$ls

Volume Statistics (Arithmetic) 2016-11577_30604_15.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	20.33 µm	S.D.:	26.25 µm
Median:	12.17 µm	C.V.:	129%
D(3,2):	5.597 µm	Skewness:	3.484 Right skewed
Mode:	12.40 µm	Kurtosis:	15.60 Leptokurtic

d_{10}: 3.205 µm d_{50}: 12.17 µm d_{90}: 43.81 µm

Folk and Ward Statistics (Phi)

Mean:	6.37	Median:	6.36	Deviation:	1.50
Skewness:	0.03	Kurtosis:	1.19		

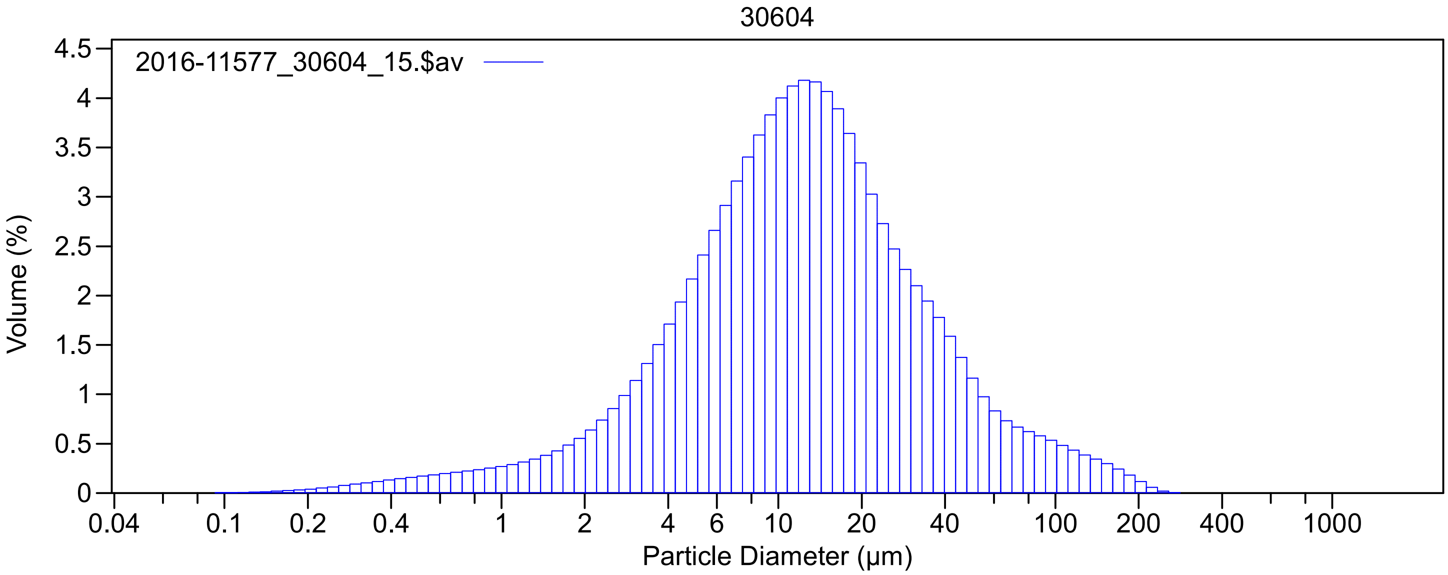
<80%
27.12 µm

2016-11577_30604_15.$av

Particle Diameter µm	Volume %
0.04	13.4
4	80.8
63	5.60
200	0.16
2000	

2016-11577_30604_15.$av

Size µm	Diff. Volume %
0	13.4
4	80.8
63	5.60
200	0.16
2000	0


30604
2016-11577_30604_15.$av
Volume (%)
Particle Diameter (µm)
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5

File name:	G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30605_18.$av
	2016-11577_30605_18.$av
File ID:	2016-11577
Sample ID:	30605
Operator:	MKM
Comment 1:	sonicated
Optical model:	Fraunhofer.rf780d PIDS included
LS 13 320	Aqueous Liquid Module
Pump speed:	60
Fluid:	Water

Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30605_16.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30605_17.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30605_18.$ls

Volume Statistics (Arithmetic) 2016-11577_30605_18.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	426.9 µm	S.D.:	246.7 µm
Median:	414.2 µm	C.V.:	57.8%
D(3,2):	30.38 µm	Skewness:	0.388 Right skewed
Mode:	471.1 µm	Kurtosis:	0.313 Leptokurtic

d_{10}: 33.74 µm d_{50}: 414.2 µm d_{90}: 748.2 µm

Folk and Ward Statistics (Phi)

Mean:	1.38	Median:	1.27	Deviation:	1.44
Skewness:	0.44	Kurtosis:	2.74		

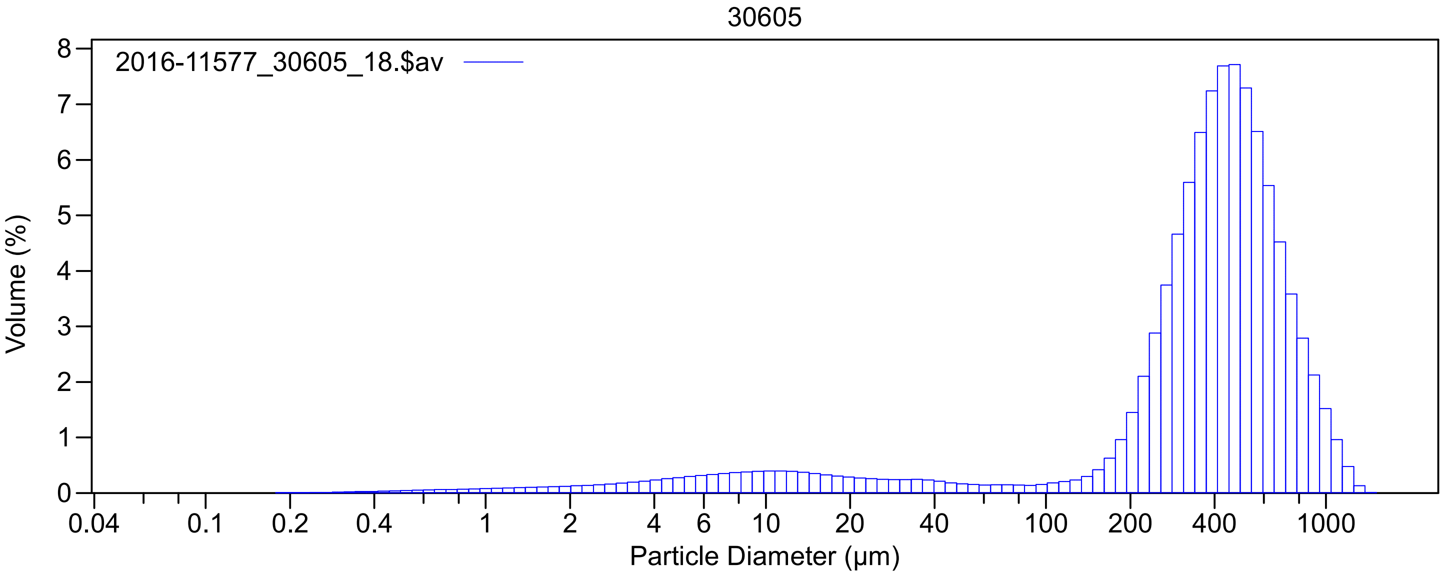
<80%
612.4 µm

2016-11577_30605_18.$av

Particle Diameter µm	Volume %
0.04	2.71
4	8.57
63	4.12
200	84.6
2000	

2016-11577_30605_18.$av

Size µm	Diff. Volume %
0	2.71
4	8.57
63	4.12
200	84.6
2000	0


30605
2016-11577_30605_18.$av
Volume (%)
0
1
2
3
4
5
6
7
8
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name:	G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30606_21.$av
	2016-11577_30606_21.$av
File ID:	2016-11577
Sample ID:	30606
Operator:	MKM
Comment 1:	sonicated
Optical model:	Fraunhofer.rf780d PIDS included
LS 13 320	Aqueous Liquid Module

Run length: 81 seconds

Pump speed:	60
Fluid:	Water

Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30606_19.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30606_20.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30606_21.$ls

Volume Statistics (Arithmetic)   2016-11577_30606_21.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	426.6 µm	S.D.:	269.2 µm
Median:	416.9 µm	C.V.:	63.1%
D(3,2):	26.21 µm	Skewness:	0.388 Right skewed
Mode:	471.1 µm	Kurtosis:	-0.034 Platykurtic

d_{10}: 30.38 µm d_{50}: 416.9 µm d_{90}: 780.9 µm

Folk and Ward Statistics (Phi)

Mean:	1.70	Median:	1.26	Deviation:	1.64
Skewness:	0.56	Kurtosis:	2.11		

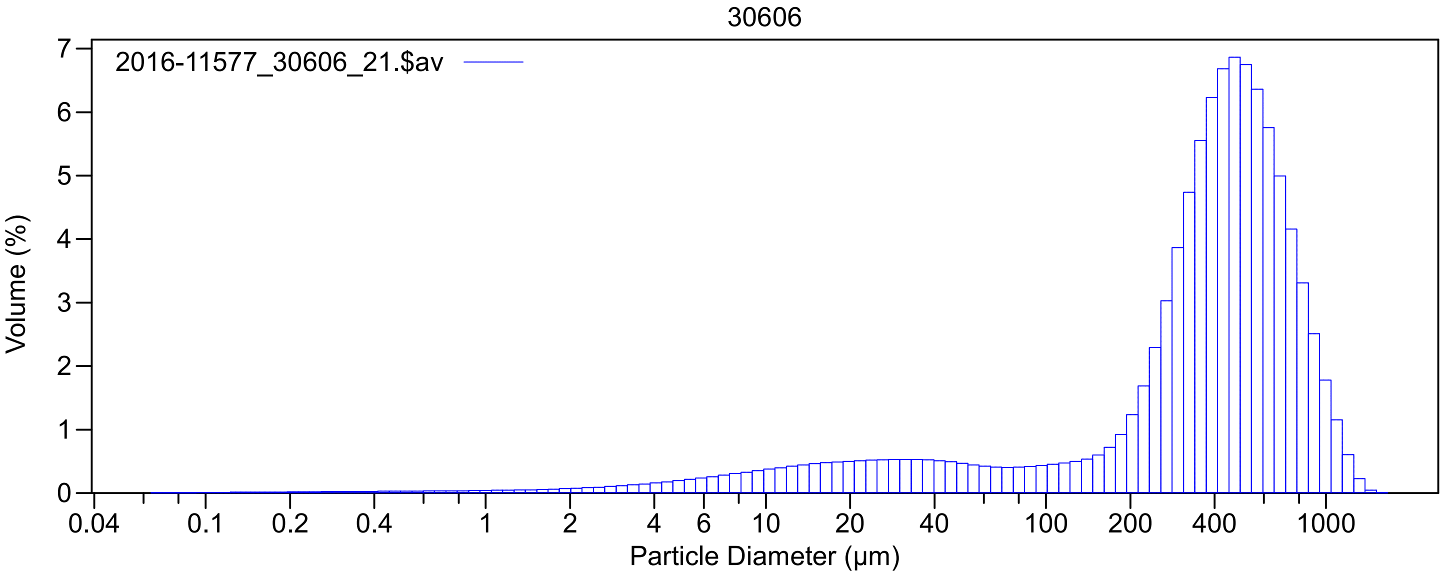
<80%
640.8 µm

2016-11577_30606_21.$av

Particle Diameter µm	Volume %
0.04	1.83
4	12.0
63	6.68
200	79.5
2000	

2016-11577_30606_21.$av

Size µm	Diff. Volume %
0	1.83
4	12.0
63	6.68
200	79.5
2000	0


30606
2016-11577_30606_21.$av
Volume (%)
0
1
2
3
4
5
6
7
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30607_24.$av
2016-11577_30607_24.$av
File ID: 2016-11577
Sample ID: 30607
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d PIDS included
LS 13 320 Aqueous Liquid Module
Run length: 82 seconds
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30607_22.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30607_23.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30607_24.$ls

Volume Statistics (Arithmetic) 2016-11577_30607_24.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	31.45 µm	S.D.:	54.97 µm
Median:	14.07 µm	C.V.:	175%
D(3,2):	5.788 µm	Skewness:	4.730 Right skewed
Mode:	12.40 µm	Kurtosis:	29.33 Leptokurtic

d_{10}: 3.322 µm d_{50}: 14.07 µm d_{90}: 71.09 µm

Folk and Ward Statistics (Phi)

Mean:	6.09	Median:	6.15	Deviation:	1.75
Skewness:	-0.04	Kurtosis:	1.16		

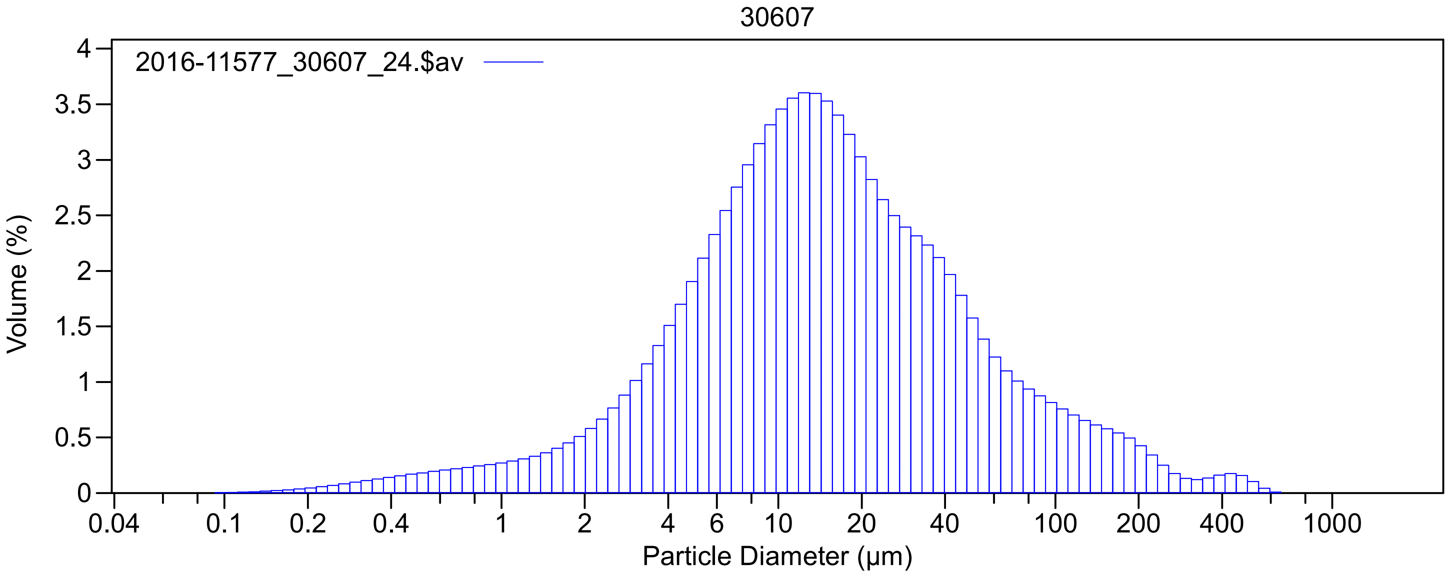
<80%
38.52 µm

2016-11577_30607_24.$av

Particle Diameter µm	Volume %
0.04	12.6
4	76.0
63	9.30
200	2.11
2000	

2016-11577_30607_24.$av

Size µm	Diff. Volume %
0	12.6
4	76.0
63	9.30
200	2.11
2000	0


30607
2016-11577_30607_24.$av
Volume (%)
4
3.5
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name:	G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30608_27.$av 2016-11577_30608_27.$av
File ID:	2016-11577
Sample ID:	30608
Operator:	MKM
Comment 1:	sonicated
Optical model:	Fraunhofer.rf780d PIDS included
LS 13 320	Aqueous Liquid Module
Pump speed:	60
Fluid:	Water

Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30608_25.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30608_26.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30608_27.$ls

Volume Statistics (Arithmetic) 2016-11577_30608_27.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	454.8 µm	S.D.:	260.2 µm
Median:	439.0 µm	C.V.:	57.2%
D(3,2):	33.14 µm	Skewness:	0.345 Right skewed
Mode:	471.1 µm	Kurtosis:	0.031 Leptokurtic

d_{10}: 71.38 µm d_{50}: 439.0 µm d_{90}: 802.7 µm

Folk and Ward Statistics (Phi)

Mean:	1.31	Median:	1.19	Deviation:	1.42
Skewness:	0.44	Kurtosis:	2.48		

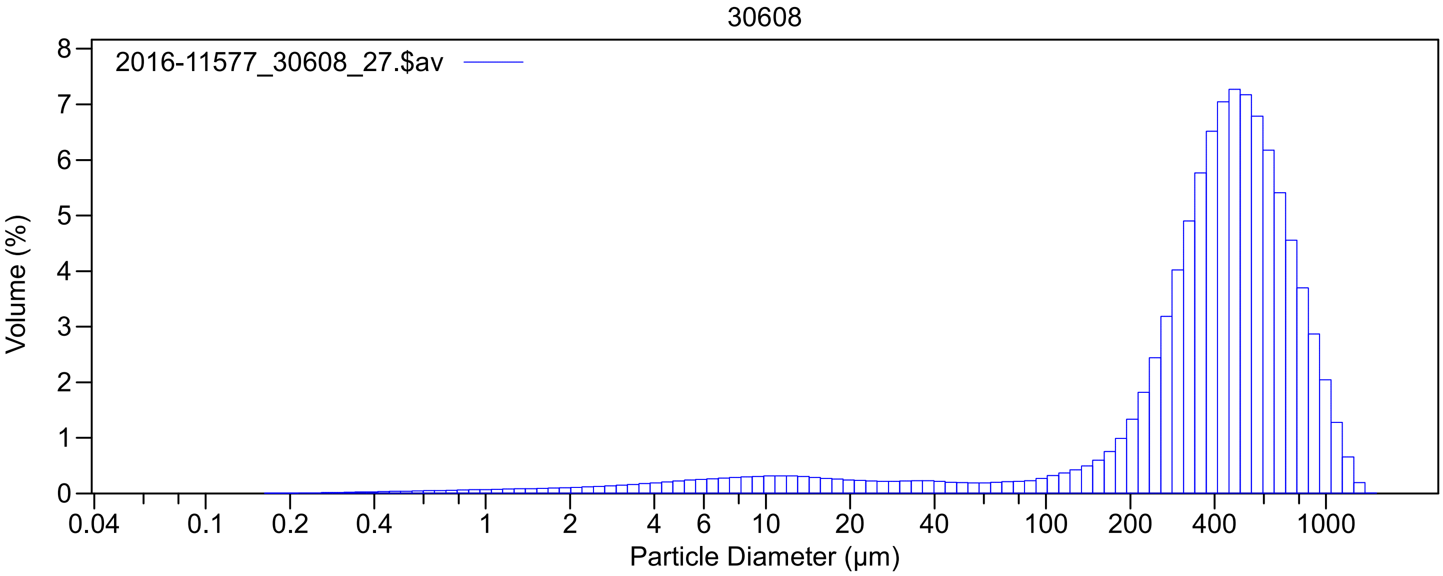
<80%
661.5 µm

2016-11577_30608_27.$av

Particle Diameter µm	Volume %
0.04	2.36
4	7.37
63	5.51
200	84.8
2000	

2016-11577_30608_27.$av

Size µm	Diff. Volume %
0	2.36
4	7.37
63	5.51
200	84.8
2000	0


30608
2016-11577_30608_27.$av
Volume (%)
8
7
6
5
4
3
2
1
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30609a_30.$av
2016-11577_30609a_30.$av
File ID: 2016-11577
Sample ID: 30609a
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d PIDS included
LS 13 320 Aqueous Liquid Module
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30609a_28.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30609a_29.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30609a_30.$ls

Volume Statistics (Arithmetic) 2016-11577_30609a_30.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	434.8 µm	S.D.:	253.8 µm
Median:	420.8 µm	C.V.:	58.4%
D(3,2):	33.49 µm	Skewness:	0.403 Right skewed
Mode:	471.1 µm	Kurtosis:	0.192 Leptokurtic

d_{10}: 54.43 µm d_{50}: 420.8 µm d_{90}: 768.2 µm

Folk and Ward Statistics (Phi)

Mean:	1.40	Median:	1.25	Deviation:	1.31
Skewness:	0.43	Kurtosis:	2.16		

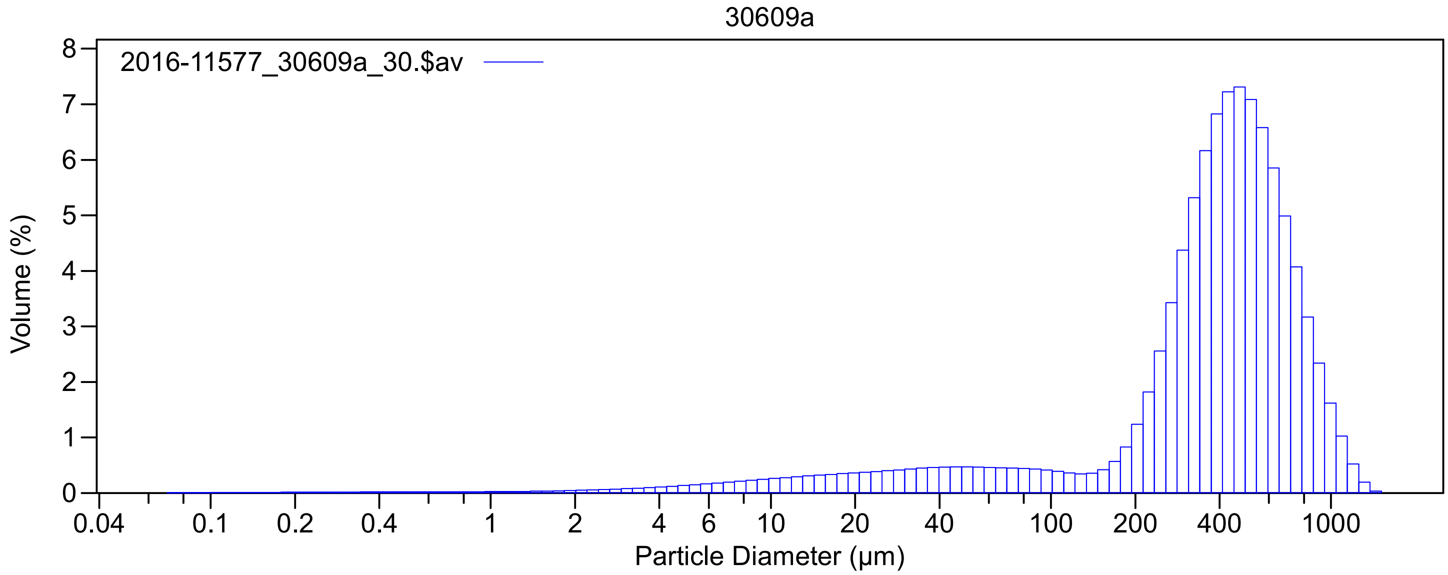
<80%
632.9 µm

2016-11577_30609a_30.$av

Particle Diameter µm	Volume %
0.04	1.27
4	9.46
63	5.90
200	83.4
2000	

2016-11577_30609a_30.$av

Size µm	Diff. Volume %
0	1.27
4	9.46
63	5.90
200	83.4
2000	0


30609a
2016-11577_30609a_30.$av
Volume (%)
0
1
2
3
4
5
6
7
8
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30610_36.$av
2016-11577_30610_36.$av
File ID: 2016-11577
Sample ID: 30610
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d PIDS included
LS 13 320 Aqueous Liquid Module
Run length: 81 seconds
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30610_34.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30610_35.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30610_36.$ls

Volume Statistics (Arithmetic) 2016-11577_30610_36.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	25.38 µm	S.D.:	32.57 µm
Median:	14.15 µm	C.V.:	128%
D(3,2):	5.937 µm	Skewness:	3.027 Right skewed
Mode:	13.61 µm	Kurtosis:	11.71 Leptokurtic

d_{10}: 3.381 µm d_{50}: 14.15 µm d_{90}: 60.29 µm

Folk and Ward Statistics (Phi)

Mean:	6.12	Median:	6.14	Deviation:	1.64
Skewness:	0.01	Kurtosis:	1.16		

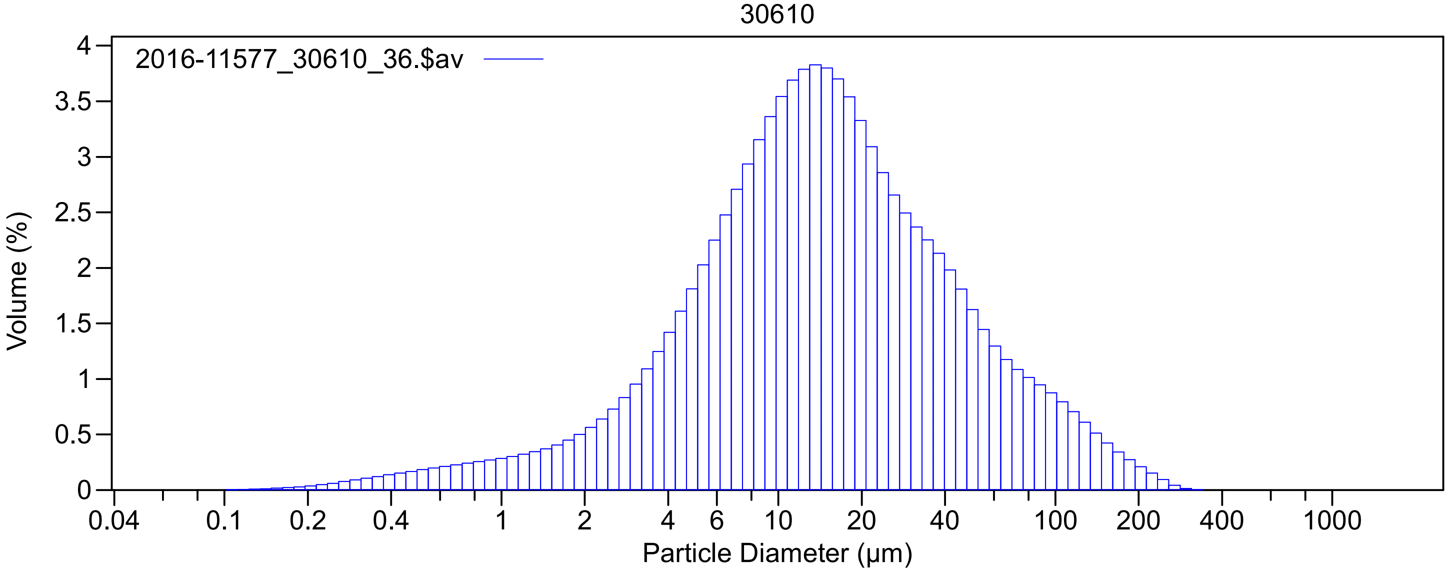
<80%
35.62 µm

2016-11577_30610_36.$av

Particle Diameter µm	Volume %
0.04	12.2
4	78.4
63	8.93
200	0.45
2000	

2016-11577_30610_36.$av

Size µm	Diff. Volume %
0	12.2
4	78.4
63	8.93
200	0.45
2000	0


30610
2016-11577_30610_36.$av
Volume (%)
4
3.5
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30611_39.$av
2016-11577_30611_39.$av
File ID: 2016-11577
Sample ID: 30611
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d PIDS included
LS 13 320 Aqueous Liquid Module
Run length: 82 seconds
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30611_37.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30611_38.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30611_39.$ls

Volume Statistics (Arithmetic) 2016-11577_30611_39.$av

Calculations from 0.040 µm to 2000 µm

Volume: 100%
Mean: 103.6 µm S.D.: 144.1 µm
Median: 55.28 µm C.V.: 139%
D(3,2): 11.53 µm Skewness: 3.307 Right skewed
Mode: 140.1 µm Kurtosis: 14.82 Leptokurtic

d_{10}: 6.132 µm d_{50}: 55.28 µm d_{90}: 230.0 µm

Folk and Ward Statistics (Phi)
Mean: 4.45 Median: 4.18 Deviation: 2.09
Skewness: 0.19 Kurtosis: 0.91

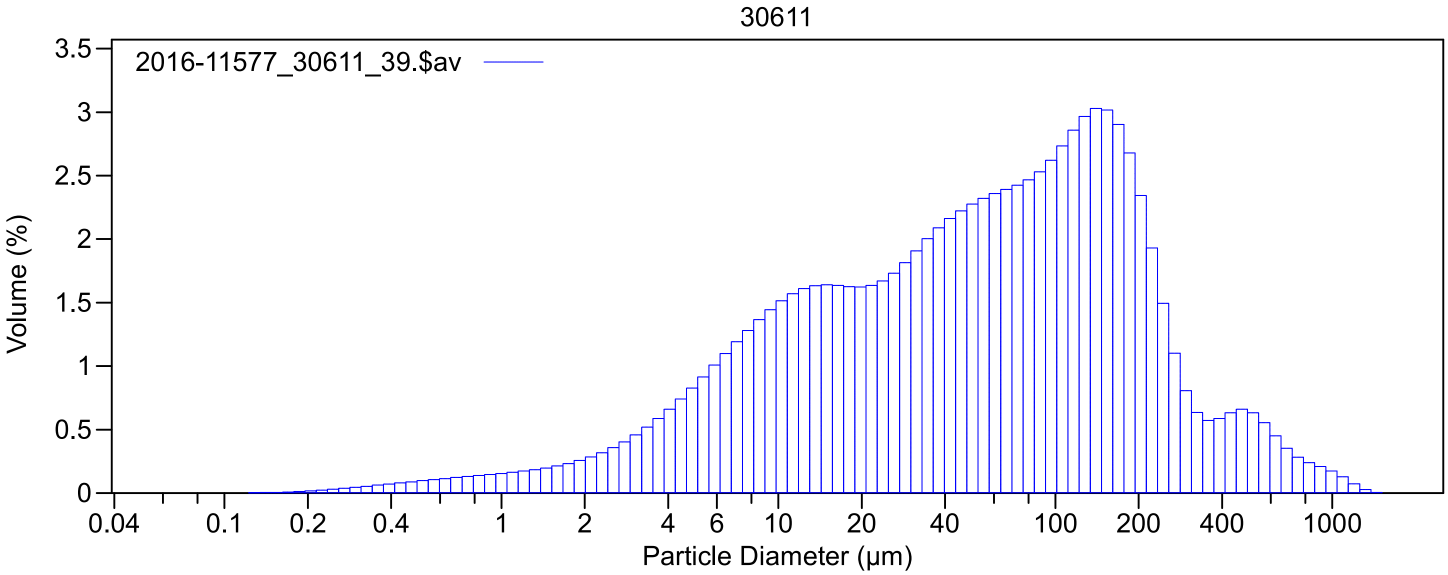
<80%
158.7 µm

2016-11577_30611_39.$av

Particle Diameter µm	Volume %
0.04	6.14
4	47.2
63	33.5
200	13.2
2000	

2016-11577_30611_39.$av

Size µm	Diff. Volume %
0	6.14
4	47.2
63	33.5
200	13.2
2000	0


30611
2016-11577_30611_39.$av
Volume (%)
3.5
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name:	G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30612_42.$av
	2016-11577_30612_42.$av
File ID:	2016-11577
Sample ID:	30612
Operator:	MKM
Comment 1:	sonicated
Optical model:	Fraunhofer.rf780d PIDS included
LS 13 320	Aqueous Liquid Module
Pump speed:	60
Fluid:	Water

Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30612_40.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30612_41.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30612_42.$ls

Volume Statistics (Arithmetic) 2016-11577_30612_42.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	21.38 µm	S.D.:	25.03 µm
Median:	13.82 µm	C.V.:	117%
D(3,2):	5.873 µm	Skewness:	3.223 Right skewed
Mode:	14.94 µm	Kurtosis:	14.29 Leptokurtic

d_{10}: 2.962 µm d_{50}: 13.82 µm d_{90}: 46.89 µm

Folk and Ward Statistics (Phi)

Mean:	6.22	Median:	6.18	Deviation:	1.55
Skewness:	0.11	Kurtosis:	1.28		

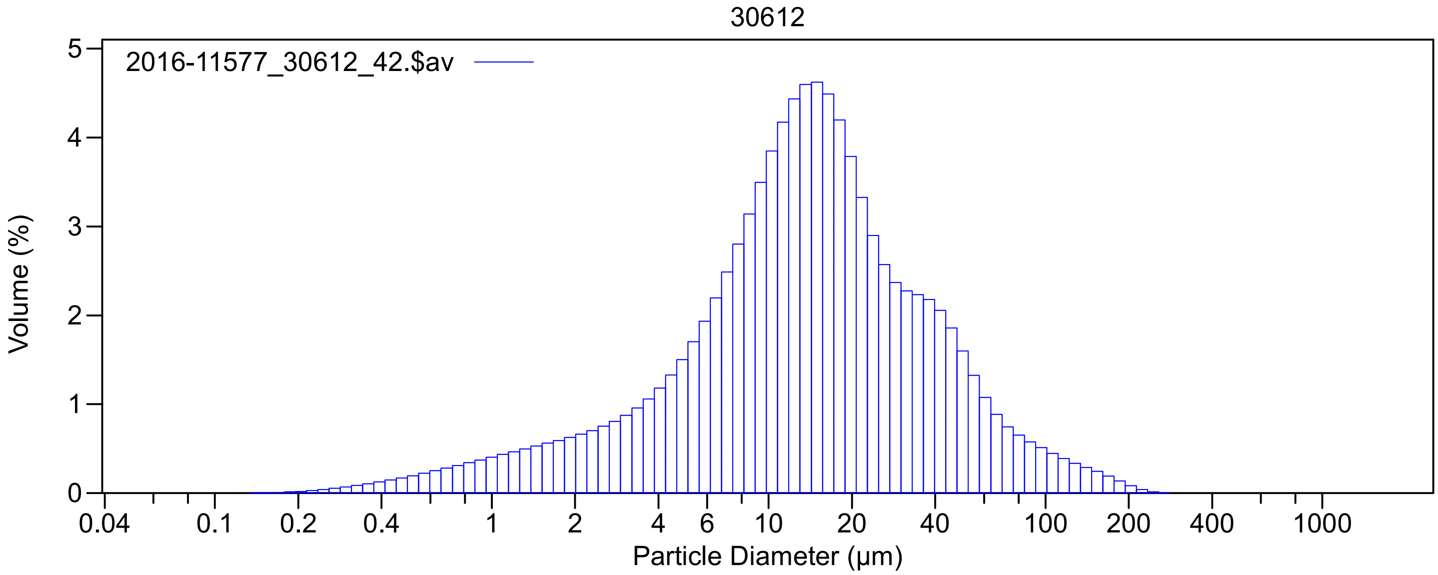
<80%
30.26 µm

2016-11577_30612_42.$av

Particle Diameter µm	Volume %
0.04	13.2
4	81.2
63	5.51
200	0.12
2000	

2016-11577_30612_42.$av

Size µm	Diff. Volume %
0	13.2
4	81.2
63	5.51
200	0.12
2000	0


30612
2016-11577_30612_42.$av
Volume (%)
0
1
2
3
4
5
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30613_03.$av
2016-11577_30613_03.$av
File ID: 2016-11577
Sample ID: 30613
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d PIDS included
LS 13 320 Aqueous Liquid Module
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30613_01.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30613_02.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30613_03.$ls

Volume Statistics (Arithmetic) 2016-11577_30613_03.$av

Calculations from 0.040 µm to 2000 µm

Volume: 100%
Mean: 25.41 µm
Median: 14.91 µm
D(3,2): 6.055 µm
Mode: 14.94 µm

S.D.: 31.22 µm
C.V.: 123%
Skewness: 2.915 Right skewed
Kurtosis: 10.61 Leptokurtic

d_{10}: 3.460 µm d_{50}: 14.91 µm d_{90}: 58.48 µm

Folk and Ward Statistics (Phi)
Mean: 6.06 Median: 6.07 Deviation: 1.62
Skewness: 0.04 Kurtosis: 1.20

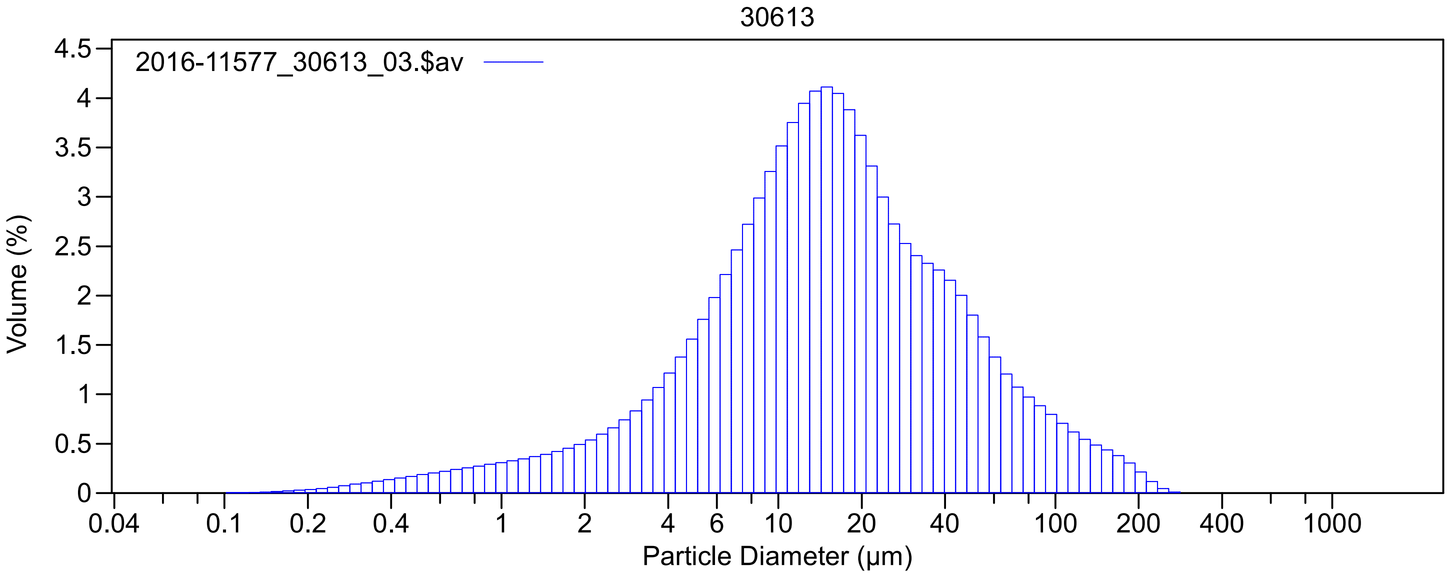
<80%
36.20 µm

2016-11577_30613_03.$av

Particle Diameter µm	Volume %
0.04	11.7
4	79.4
63	8.58
200	0.32
2000	

2016-11577_30613_03.$av

Size µm	Diff. Volume %
0	11.7
4	79.4
63	8.58
200	0.32
2000	0


30613
2016-11577_30613_03.$av
Volume (%)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30614_06.$av
2016-11577_30614_06.$av
File ID: 2016-11577
Sample ID: 30614
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d PIDS included
LS 13 320 Aqueous Liquid Module
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30614_04.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30614_05.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30614_06.$ls

Volume Statistics (Arithmetic) 2016-11577_30614_06.$av

Calculations from 0.040 µm to 2000 µm

Volume: 100%

Mean:	122.7 µm	S.D.:	317.2 µm
Median:	21.29 µm	C.V.:	258%
D(3,2):	7.888 µm	Skewness:	3.736 Right skewed
Mode:	14.94 µm	Kurtosis:	14.01 Leptokurtic

d_{10}: 5.231 µm d_{50}: 21.29 µm d_{90}: 220.9 µm

Folk and Ward Statistics (Phi)

Mean:	5.37	Median:	5.55	Deviation:	2.14
Skewness:	-0.23	Kurtosis:	1.40		

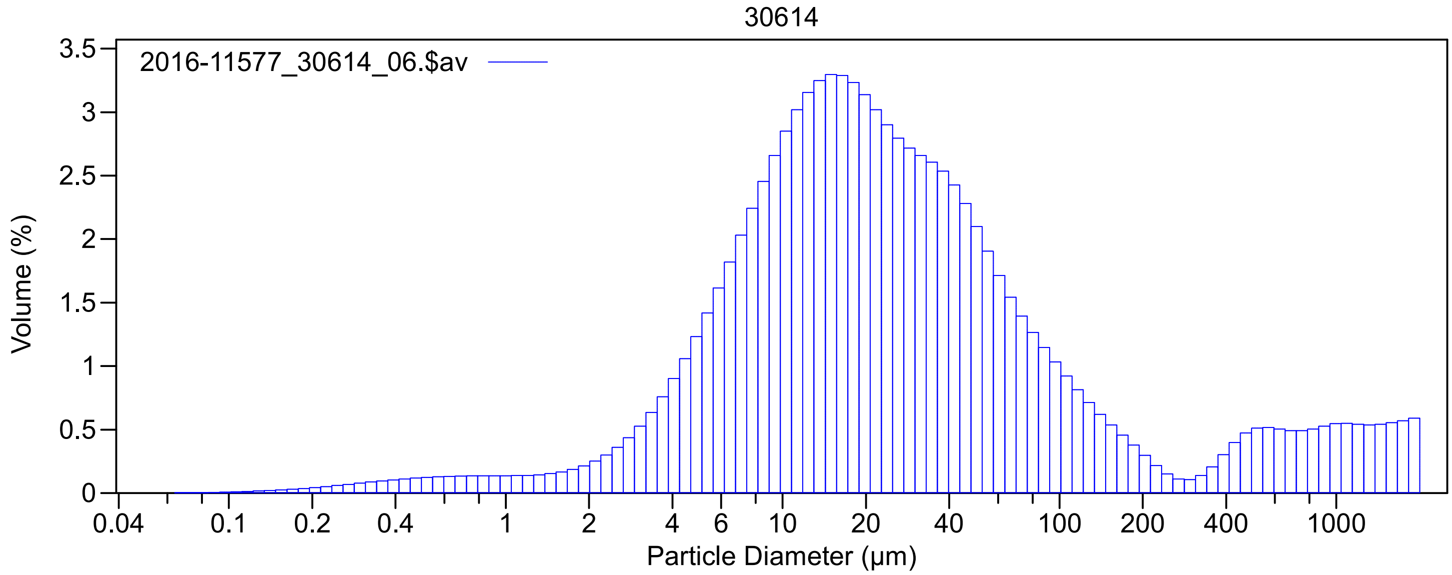
<80%
68.25 µm

2016-11577_30614_06.$av

Particle Diameter µm	Volume %
0.04	6.79
4	71.9
63	11.0
200	10.3
2000	

2016-11577_30614_06.$av

Size µm	Diff. Volume %
0	6.79
4	71.9
63	11.0
200	10.3
2000	0


30614
2016-11577_30614_06.$av
Volume (%)
0
0.5
1
1.5
2
2.5
3
3.5
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (μm)

File name:	G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30615_09.$av
	2016-11577_30615_09.$av
File ID:	2016-11577
Sample ID:	30615
Operator:	MKM
Comment 1:	sonicated
Optical model:	Fraunhofer.rf780d PIDS included
LS 13 320	Aqueous Liquid Module

Run length: 81 seconds

Pump speed:	60
Fluid:	Water

Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30615_07.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30615_08.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30615_09.$ls

Volume Statistics (Arithmetic) 2016-11577_30615_09.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	89.83 µm	S.D.:	204.8 µm
Median:	33.96 µm	C.V.:	228%
D(3,2):	10.44 µm	Skewness:	5.984 Right skewed
Mode:	18.00 µm	Kurtosis:	41.21 Leptokurtic

d_{10}: 6.678 µm d_{50}: 33.96 µm d_{90}: 174.4 µm

Folk and Ward Statistics (Phi)

Mean:	4.85	Median:	4.88	Deviation:	1.85
Skewness:	-0.00	Kurtosis:	0.91		

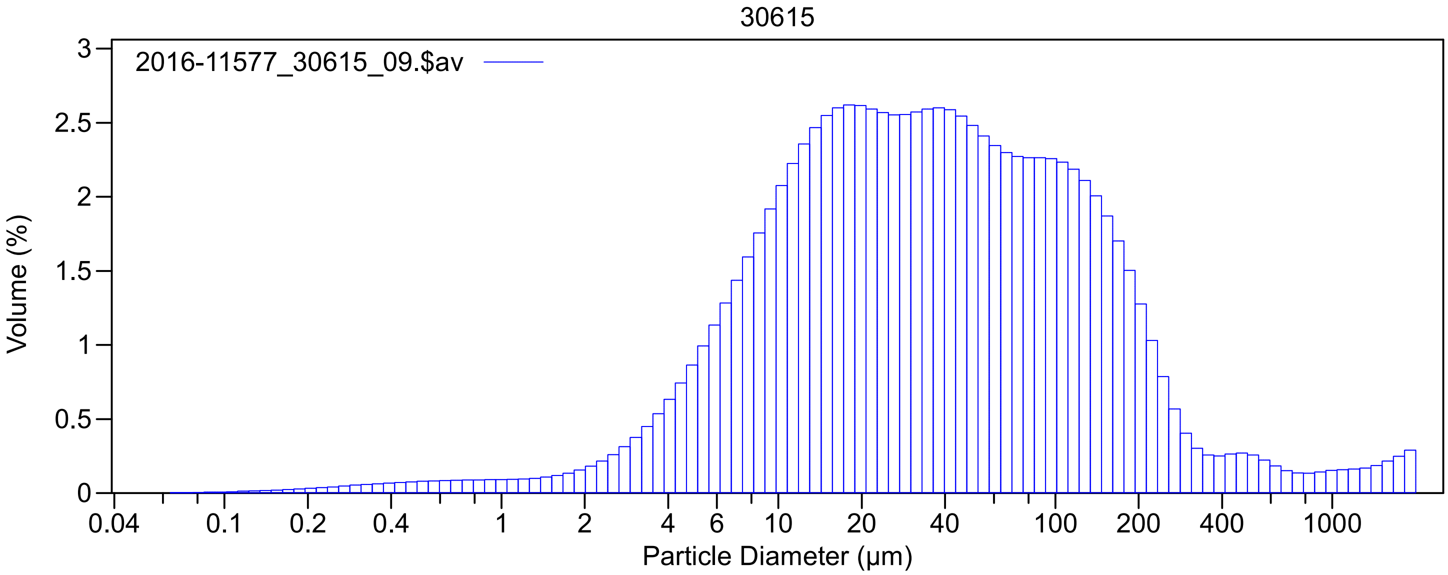
<80%
109.2 µm

2016-11577_30615_09.$av

Particle Diameter µm	Volume %
0.04	4.75
4	61.9
63	25.5
200	7.83
2000	

2016-11577_30615_09.$av

Size µm	Diff. Volume %
0	4.75
4	61.9
63	25.5
200	7.83
2000	0


30615
2016-11577_30615_09.$av
Volume (%)
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name:	G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30616_12.$av
	2016-11577_30616_12.$av
File ID:	2016-11577
Sample ID:	30616
Operator:	MKM
Comment 1:	sonicated
Optical model:	Fraunhofer.rf780d PIDS included
LS 13 320	Aqueous Liquid Module
Pump speed:	60
Fluid:	Water

Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30616_10.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30616_11.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30616_12.$ls

Volume Statistics (Arithmetic) 2016-11577_30616_12.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	260.3 µm	S.D.:	227.5 µm
Median:	220.3 µm	C.V.:	87.4%
D(3,2):	22.77 µm	Skewness:	1.082 Right skewed
Mode:	356.1 µm	Kurtosis:	1.254 Leptokurtic

d_{10}: 13.53 µm d_{50}: 220.3 µm d_{90}: 568.5 µm

Folk and Ward Statistics (Phi)

Mean:	2.85	Median:	2.18	Deviation:	2.06
Skewness:	0.48	Kurtosis:	1.00		

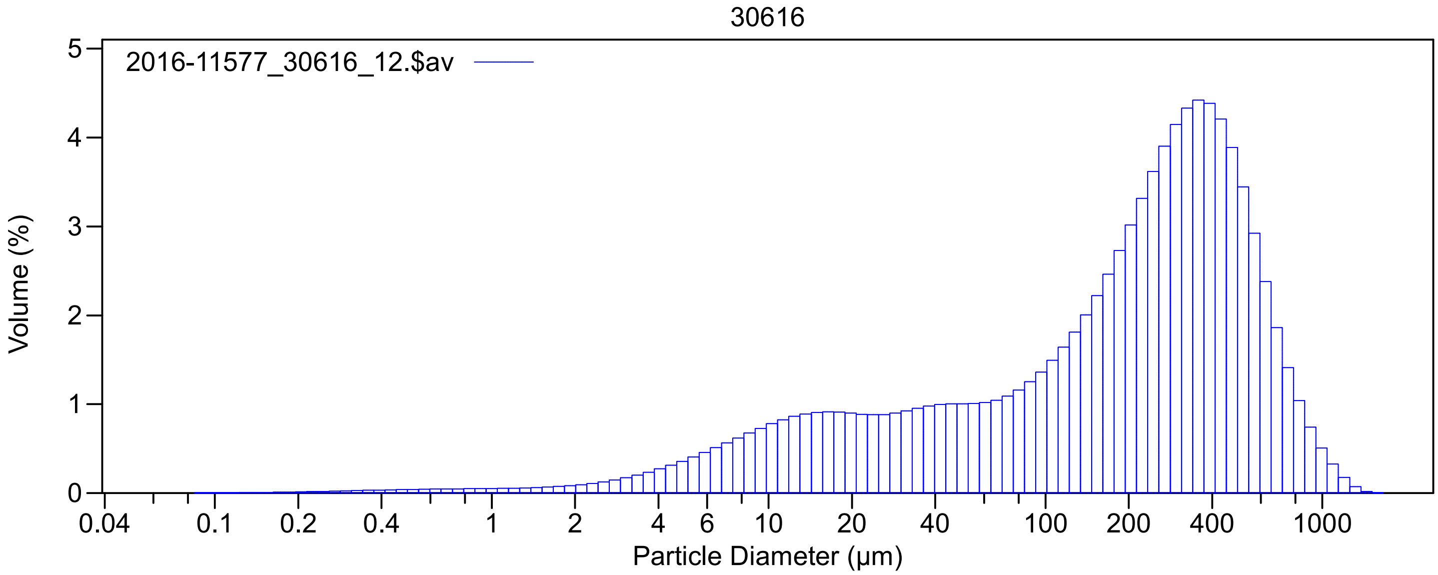
<80%
438.2 µm

2016-11577_30616_12.$av

Particle Diameter µm	Volume %
0.04	2.34
4	23.2
63	21.3
200	53.2
2000	

2016-11577_30616_12.$av

Size µm	Diff. Volume %
0	2.34
4	23.2
63	21.3
200	53.2
2000	0


30616
2016-11577_30616_12.$av
Volume (%)
0
1
2
3
4
5
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30617_15.$av
2016-11577_30617_15.$av
File ID: 2016-11577
Sample ID: 30617
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d PIDS included
LS 13 320 Aqueous Liquid Module
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30617_13.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30617_14.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30617_15.$ls

Volume Statistics (Arithmetic) 2016-11577_30617_15.$av

Calculations from 0.040 µm to 2000 µm

Volume: 100%
Mean: 112.1 µm S.D.: 164.5 µm
Median: 64.78 µm C.V.: 147%
D(3,2): 14.82 µm Skewness: 5.223 Right skewed
Mode: 153.8 µm Kurtosis: 40.18 Leptokurtic

d_{10}: 8.534 µm d_{50}: 64.78 µm d_{90}: 239.9 µm

Folk and Ward Statistics (Phi)
Mean: 4.19 Median: 3.95 Deviation: 1.89
Skewness: 0.21 Kurtosis: 0.87

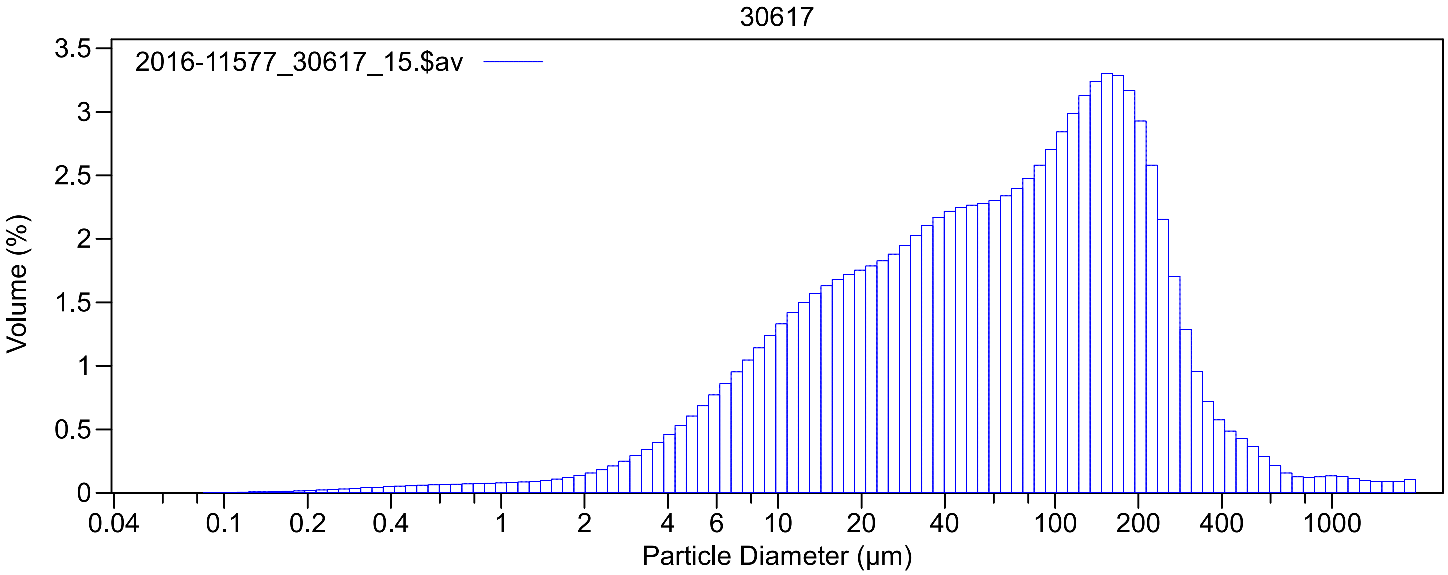
<80%
173.2 µm

2016-11577_30617_15.$av

Particle Diameter µm	Volume %
0.04	3.71
4	45.6
63	35.5
200	15.2
2000	

2016-11577_30617_15.$av

Size µm	Diff. Volume %
0	3.71
4	45.6
63	35.5
200	15.2
2000	0


30617
2016-11577_30617_15.$av
Volume (%)
3.5
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30618_18.$av
2016-11577_30618_18.$av
File ID: 2016-11577
Sample ID: 30618
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d PIDS included
LS 13 320 Aqueous Liquid Module
Run length: 82 seconds
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30618_16.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30618_17.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30618_18.$ls

Volume Statistics (Arithmetic) 2016-11577_30618_18.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	100.5 µm	S.D.:	105.6 µm
Median:	72.27 µm	C.V.:	105%
D(3,2):	14.11 µm	Skewness:	2.558 Right skewed
Mode:	153.8 µm	Kurtosis:	12.77 Leptokurtic

Folk and Ward Statistics (Phi)

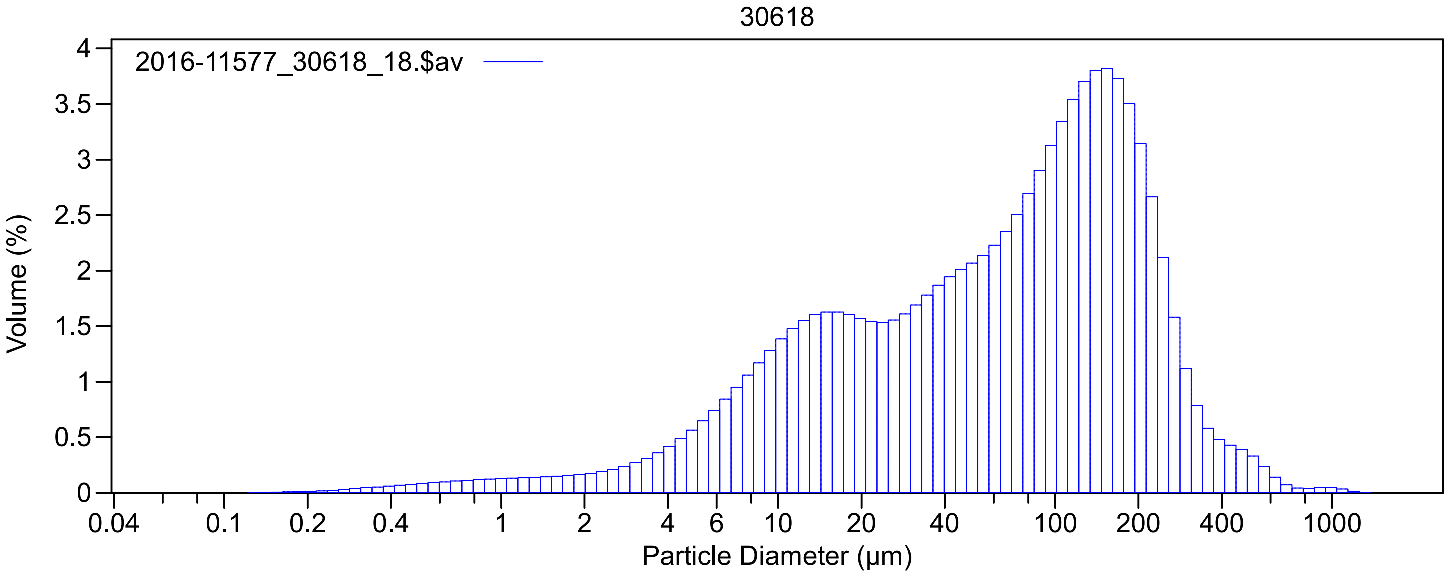
Mean:	4.18	Median:	3.79	Deviation:	1.87
Skewness:	0.32	Kurtosis:	0.86		

2016-11577_30618_18.$av

Particle Diameter µm	Volume %
0.04	4.24
4	42.3
63	40.1
200	13.4
2000	

2016-11577_30618_18.$av

Size µm	Diff. Volume %
0	4.24
4	42.3
63	40.1
200	13.4
2000	0


30618
2016-11577_30618_18.$av
Volume (%)
4
3.5
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (μm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30619_03.$av
2016-11577_30619_03.$av
File ID: 2016-11577
Sample ID: 30619
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d PIDS included
LS 13 320 Aqueous Liquid Module
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30619_01.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30619_02.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30619_03.$ls

Volume Statistics (Arithmetic) 2016-11577_30619_03.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	137.6 µm	S.D.:	199.6 µm
Median:	83.25 µm	C.V.:	145%
D(3,2):	15.73 µm	Skewness:	4.482 Right skewed
Mode:	168.9 µm	Kurtosis:	27.62 Leptokurtic

d_{10}: 9.751 µm d_{50}: 83.25 µm d_{90}: 284.8 µm

Folk and Ward Statistics (Phi)

Mean:	3.93	Median:	3.59	Deviation:	1.92
Skewness:	0.26	Kurtosis:	0.93		

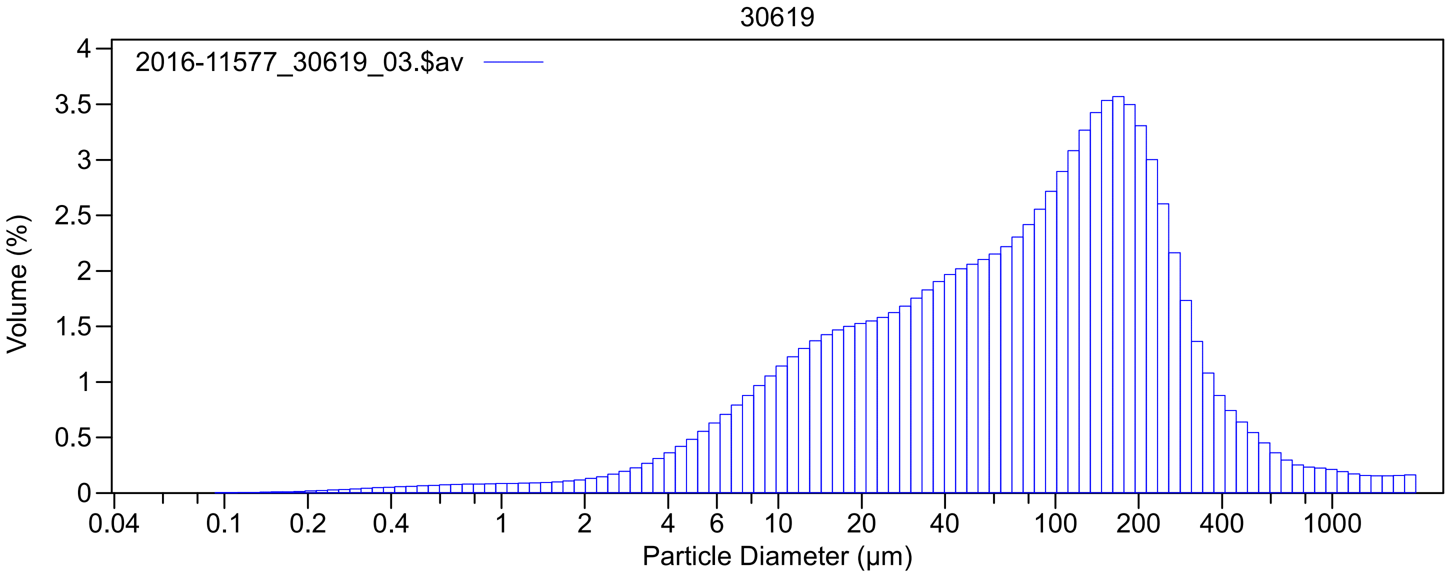
<80%
201.4 µm

2016-11577_30619_03.$av

Particle Diameter µm	Volume %
0.04	3.36
4	39.8
63	36.6
200	20.2
2000	

2016-11577_30619_03.$av

Size µm	Diff. Volume %
0	3.36
4	39.8
63	36.6
200	20.2
2000	0


30619
2016-11577_30619_03.$av
Volume (%)
4
3.5
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30620a_06.$av
2016-11577_30620a_06.$av
File ID: 2016-11577
Sample ID: 30620a
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d PIDS included
LS 13 320 Aqueous Liquid Module
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30620a_04.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30620a_05.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30620a_06.$ls

Volume Statistics (Arithmetic) 2016-11577_30620a_06.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	196.1 µm	S.D.:	171.1 µm
Median:	180.5 µm	C.V.:	87.3%
D(3,2):	19.98 µm	Skewness:	3.135 Right skewed
Mode:	245.2 µm	Kurtosis:	21.01 Leptokurtic

d_{10}: 19.00 µm d_{50}: 180.5 µm d_{90}: 368.4 µm

Folk and Ward Statistics (Phi)

Mean:	2.96	Median:	2.47	Deviation:	1.64
Skewness:	0.51	Kurtosis:	1.20		

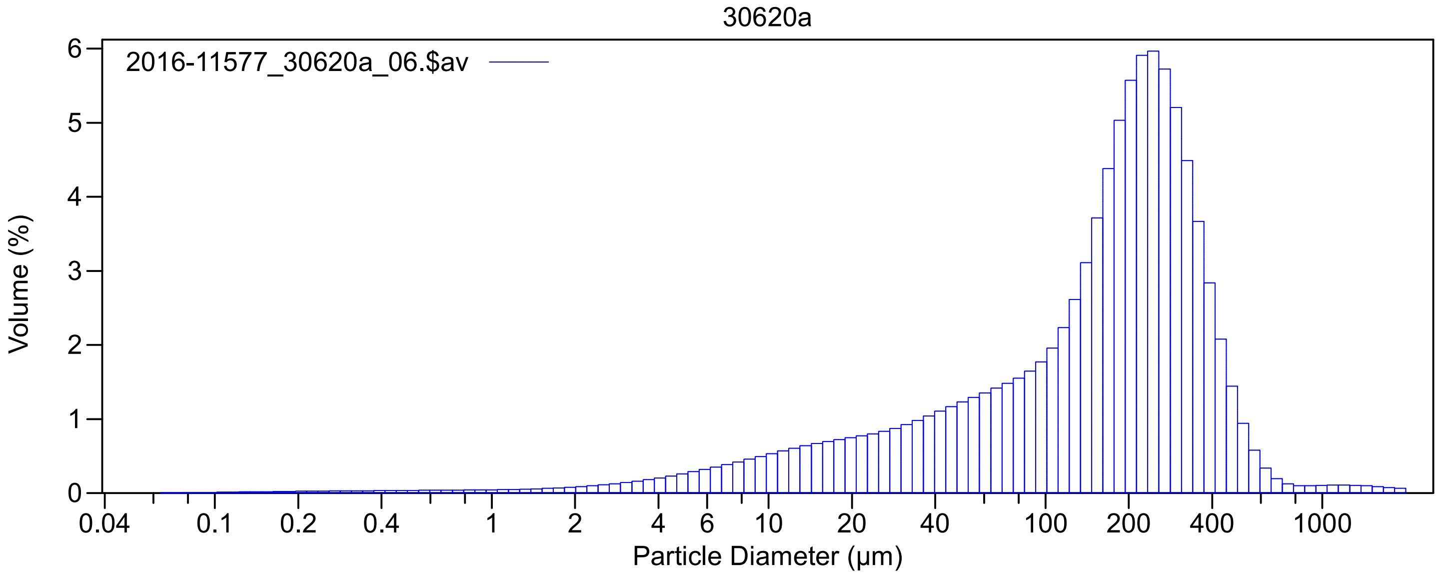
<80%
297.1 µm

2016-11577_30620a_06.$av

Particle Diameter µm	Volume %
0.04	2.18
4	20.8
63	32.7
200	44.3
2000	

2016-11577_30620a_06.$av

Size µm	Diff. Volume %
0	2.18
4	20.8
63	32.7
200	44.3
2000	0


30620a
2016-11577_30620a_06.$av
Volume (%)
0
1
2
3
4
5
6
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (μm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30621_12.$av
2016-11577_30621_12.$av
File ID: 2016-11577
Sample ID: 30621
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d PIDS included
LS 13 320 Aqueous Liquid Module
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30621_10.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30621_11.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30621_12.$ls

Volume Statistics (Arithmetic) 2016-11577_30621_12.$av

Calculations from 0.040 µm to 2000 µm

Volume: 100%
Mean: 216.1 µm S.D.: 288.5 µm
Median: 136.7 µm C.V.: 134%
D(3,2): 18.29 µm Skewness: 3.021 Right skewed
Mode: 223.4 µm Kurtosis: 10.91 Leptokurtic

d_{10}: 11.41 µm d_{50}: 136.7 µm d_{90}: 454.4 µm

Folk and Ward Statistics (Phi)
Mean: 3.37 Median: 2.87 Deviation: 2.10
Skewness: 0.32 Kurtosis: 1.04

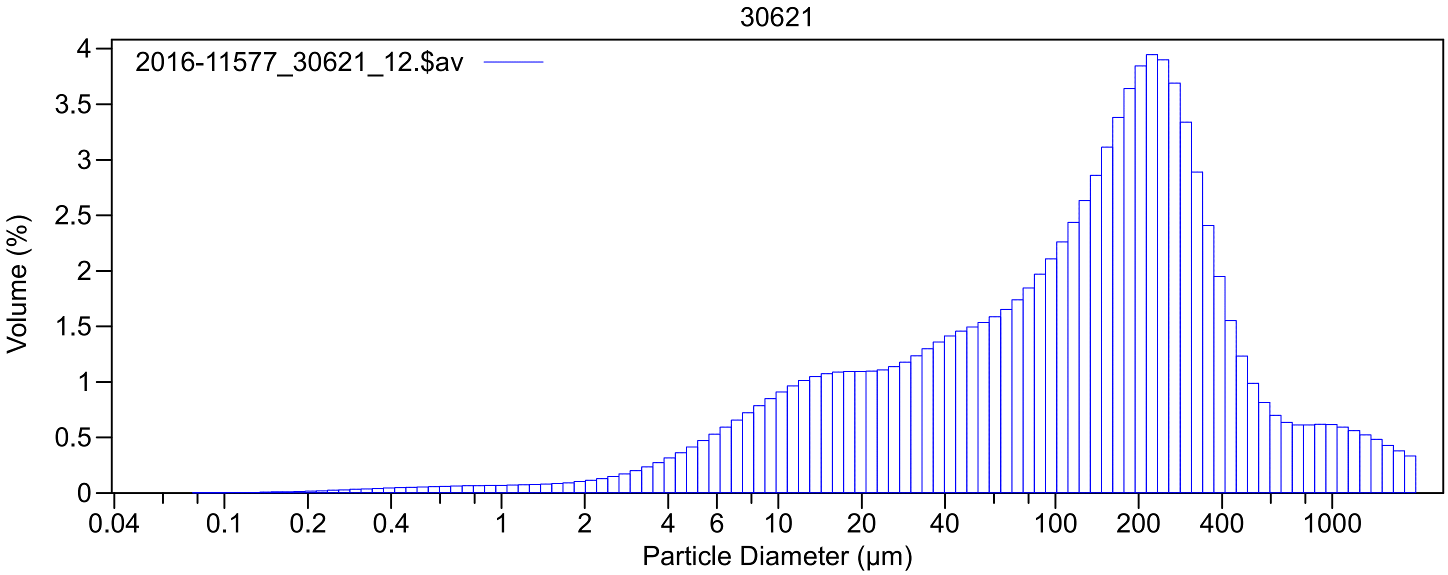
<80%
300.8 µm

2016-11577_30621_12.$av

Particle Diameter µm	Volume %
0.04	2.92
4	29.7
63	30.9
200	36.5
2000	

2016-11577_30621_12.$av

Size µm	Diff. Volume %
0	2.92
4	29.7
63	30.9
200	36.5
2000	0


30621
2016-11577_30621_12.$av
Volume (%)
4
3.5
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30622_15.$av
2016-11577_30622_15.$av
File ID: 2016-11577
Sample ID: 30622
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d PIDS included
LS 13 320 Aqueous Liquid Module
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30622_13.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30622_14.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30622_15.$ls

Volume Statistics (Arithmetic) 2016-11577_30622_15.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	43.56 µm	S.D.:	71.65 µm
Median:	18.61 µm	C.V.:	164%
D(3,2):	6.681 µm	Skewness:	4.249 Right skewed
Mode:	13.61 µm	Kurtosis:	23.43 Leptokurtic

d_{10}: 3.372 µm d_{50}: 18.61 µm d_{90}: 105.0 µm

Folk and Ward Statistics (Phi)

Mean:	5.69	Median:	5.75	Deviation:	1.95
Skewness:	0.00	Kurtosis:	1.02		

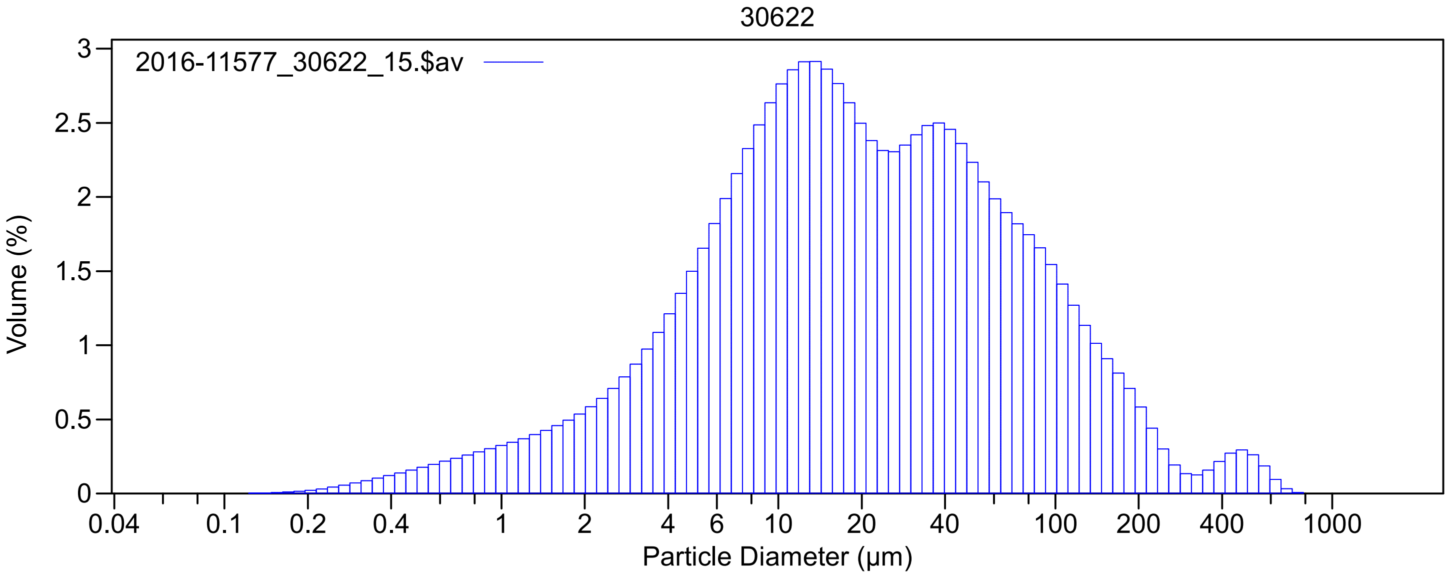
<80%
61.20 µm

2016-11577_30622_15.$av

Particle Diameter µm	Volume %
0.04	12.0
4	68.7
63	16.2
200	3.12
2000	

2016-11577_30622_15.$av

Size µm	Diff. Volume %
0	12.0
4	68.7
63	16.2
200	3.12
2000	0


30622
2016-11577_30622_15.$av
Volume (%)
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (μm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30623_18.$av
2016-11577_30623_18.$av
File ID: 2016-11577
Sample ID: 30623
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d PIDS included
LS 13 320 Aqueous Liquid Module
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30623_16.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30623_17.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30623_18.$ls

Volume Statistics (Arithmetic) 2016-11577_30623_18.$av

Calculations from 0.040 µm to 2000 µm

Volume: 100%

Mean:	33.29 µm	S.D.:	37.28 µm
Median:	19.65 µm	C.V.:	112%
D(3,2):	7.025 µm	Skewness:	2.158 Right skewed
Mode:	14.94 µm	Kurtosis:	5.551 Leptokurtic

d_{10}: 3.715 µm d_{50}: 19.65 µm d_{90}: 81.65 µm

Folk and Ward Statistics (Phi)

Mean:	5.72	Median:	5.67	Deviation:	1.75
Skewness:	0.09	Kurtosis:	1.02		

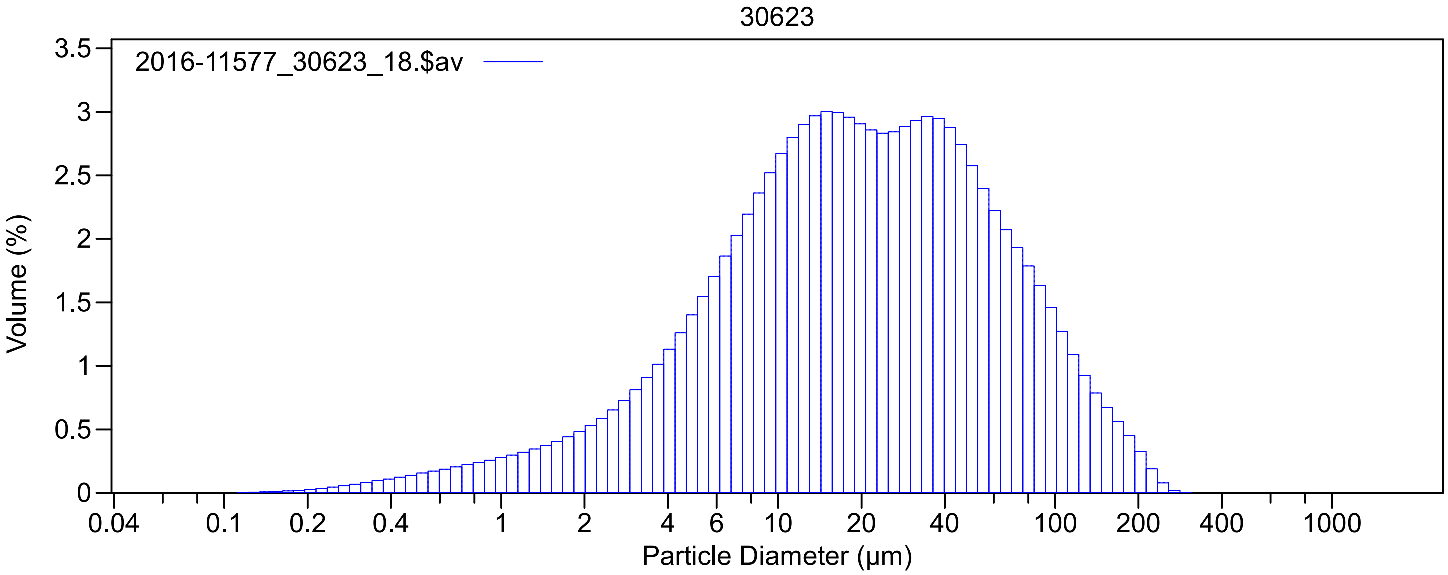
<80%
52.40 µm

2016-11577_30623_18.$av

Particle Diameter µm	Volume %
0.04	10.8
4	73.7
63	14.9
200	0.51
2000	

2016-11577_30623_18.$av

Size µm	Diff. Volume %
0	10.8
4	73.7
63	14.9
200	0.51
2000	0


30623
2016-11577_30623_18.$av
Volume (%)
3.5
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (μm)

File name:	G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30624_21.$av 2016-11577_30624_21.$av
File ID:	2016-11577
Sample ID:	30624
Operator:	MKM
Comment 1:	sonicated
Optical model:	Fraunhofer.rf780d PIDS included
LS 13 320	Aqueous Liquid Module

Run length: 81 seconds

Pump speed:	60
Fluid:	Water

Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30624_19.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30624_20.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30624_21.$ls

Volume Statistics (Arithmetic) 2016-11577_30624_21.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	33.76 µm	S.D.:	37.93 µm
Median:	19.90 µm	C.V.:	112%
D(3,2):	7.482 µm	Skewness:	2.331 Right skewed
Mode:	14.94 µm	Kurtosis:	6.496 Leptokurtic

d_{10}: 5.048 µm d_{50}: 19.90 µm d_{90}: 81.23 µm

Folk and Ward Statistics (Phi)

Mean:	5.62	Median:	5.65	Deviation:	1.57
Skewness:	0.00	Kurtosis:	1.01		

<80%
51.00 µm

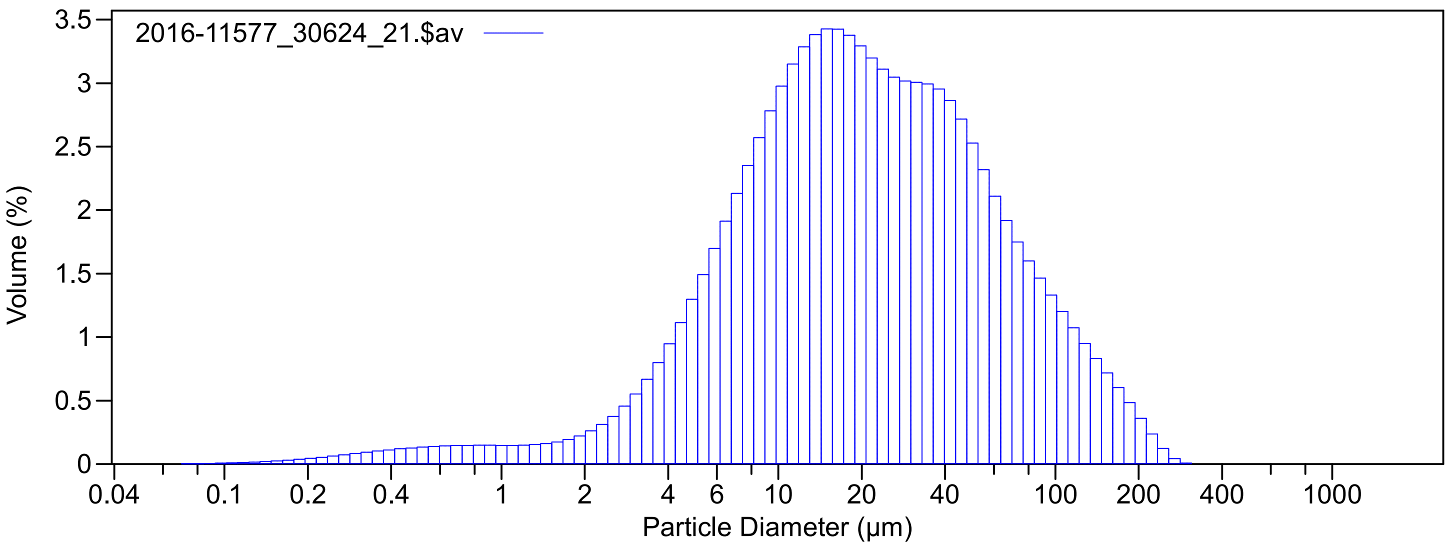
2016-11577_30624_21.$av

Particle Diameter µm	Volume %
0.04	7.16
4	78.0
63	14.2
200	0.66
2000	

2016-11577_30624_21.$av

Size µm	Diff. Volume %
0	7.16
4	78.0
63	14.2
200	0.66
2000	0

30624


2016-11577_30624_21.$av
Volume (%)
3.5
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30625_24.$av
2016-11577_30625_24.$av
File ID: 2016-11577
Sample ID: 30625
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d PIDS included
LS 13 320 Aqueous Liquid Module
Run length: 82 seconds
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30625_22.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30625_23.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30625_24.$ls

Volume Statistics (Arithmetic) 2016-11577_30625_24.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	35.01 µm	S.D.:	56.93 µm
Median:	14.51 µm	C.V.:	163%
D(3,2):	5.636 µm	Skewness:	4.348 Right skewed
Mode:	11.29 µm	Kurtosis:	27.01 Leptokurtic

d_{10}: 2.996 µm d_{50}: 14.51 µm d_{90}: 89.97 µm

Folk and Ward Statistics (Phi)

Mean:	5.98	Median:	6.11	Deviation:	1.92
Skewness:	-0.05	Kurtosis:	1.04		

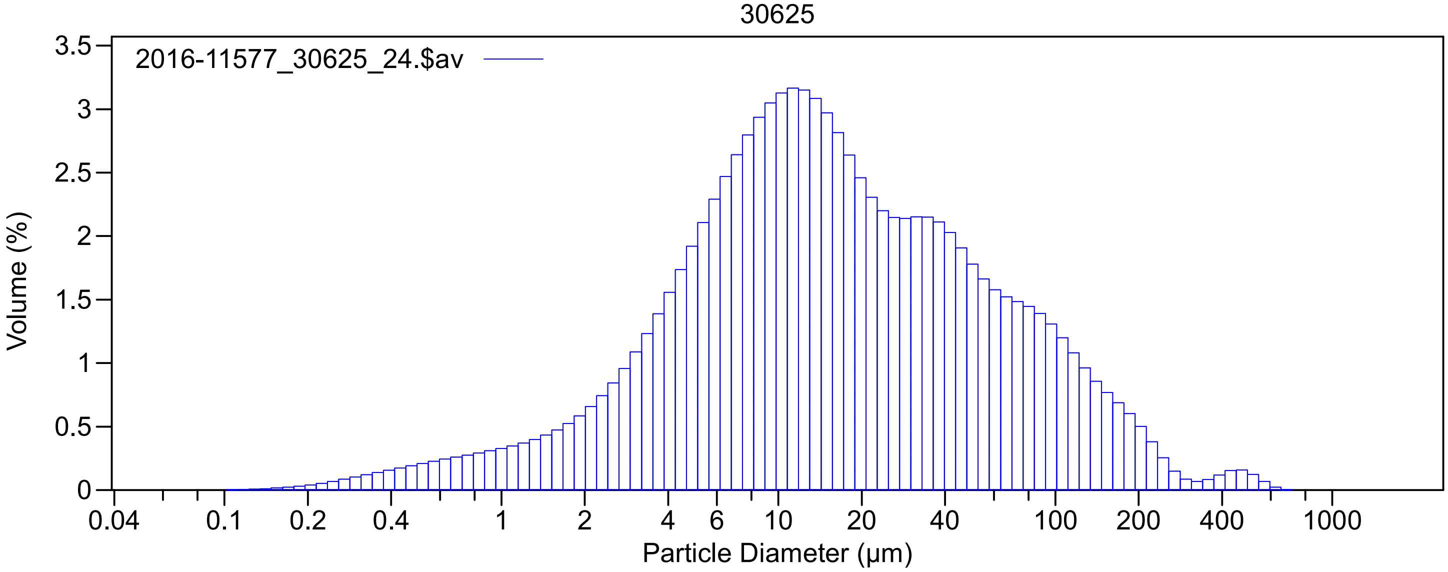
<80%
49.28 µm

2016-11577_30625_24.$av

Particle Diameter µm	Volume %
0.04	14.0
4	70.4
63	13.6
200	2.02
2000	

2016-11577_30625_24.$av

Size µm	Diff. Volume %
0	14.0
4	70.4
63	13.6
200	2.02
2000	0


30625
2016-11577_30625_24.$av
Volume (%)
3.5
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30626_27.$av
2016-11577_30626_27.$av
File ID: 2016-11577
Sample ID: 30626
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d PIDS included
LS 13 320 Aqueous Liquid Module
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30626_25.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30626_26.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30626_27.$ls

Volume Statistics (Arithmetic) 2016-11577_30626_27.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	27.05 µm	S.D.:	37.01 µm
Median:	13.45 µm	C.V.:	137%
D(3,2):	5.430 µm	Skewness:	2.878 Right skewed
Mode:	12.40 µm	Kurtosis:	9.697 Leptokurtic

d_{10}: 3.019 µm d_{50}: 13.45 µm d_{90}: 67.54 µm

Folk and Ward Statistics (Phi)

Mean:	6.15	Median:	6.22	Deviation:	1.77
Skewness:	-0.02	Kurtosis:	1.14		

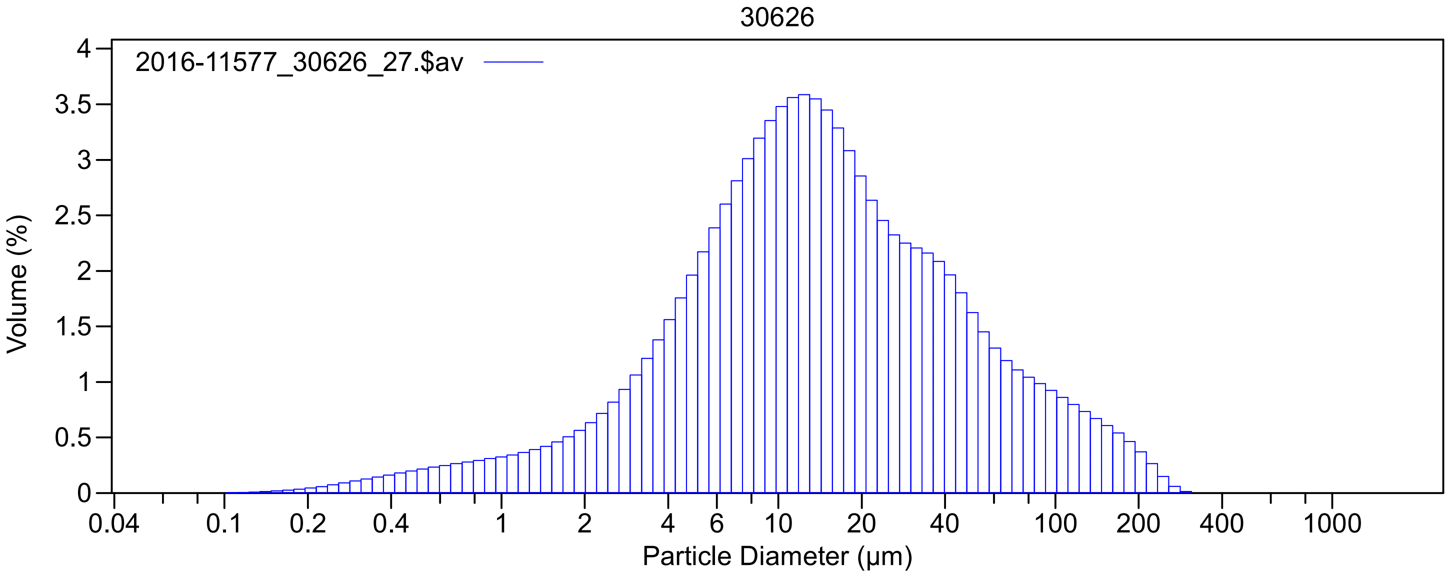
<80%
37.98 µm

2016-11577_30626_27.$av

Particle Diameter µm	Volume %
0.04	13.9
4	75.3
63	10.1
200	0.75
2000	

2016-11577_30626_27.$av

Size µm	Diff. Volume %
0	13.9
4	75.3
63	10.1
200	0.75
2000	0


30626
2016-11577_30626_27.$av
Volume (%)
4
3.5
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name:	G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30627_30.$av
	2016-11577_30627_30.$av
File ID:	2016-11577
Sample ID:	30627
Operator:	MKM
Comment 1:	sonicated
Optical model:	Fraunhofer.rf780d PIDS included
LS 13 320	Aqueous Liquid Module
Pump speed:	60
Fluid:	Water

Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30627_28.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30627_29.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30627_30.$ls

Volume Statistics (Arithmetic) 2016-11577_30627_30.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	25.92 µm	S.D.:	32.25 µm
Median:	14.45 µm	C.V.:	124%
D(3,2):	5.902 µm	Skewness:	2.576 Right skewed
Mode:	14.94 µm	Kurtosis:	7.602 Leptokurtic

d_{10}: 2.830 µm d_{50}: 14.45 µm d_{90}: 64.34 µm

Folk and Ward Statistics (Phi)

Mean:	6.10	Median:	6.11	Deviation:	1.73
Skewness:	0.04	Kurtosis:	1.27		

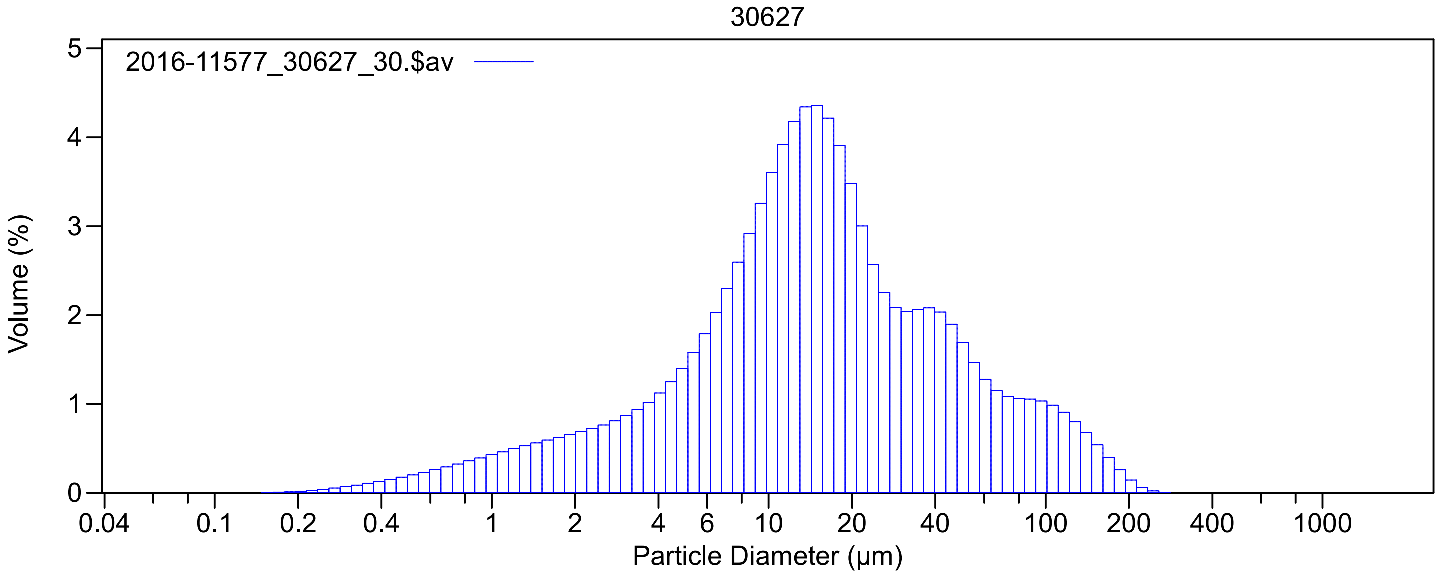
<80%
37.29 µm

2016-11577_30627_30.$av

Particle Diameter µm	Volume %
0.04	13.5
4	76.2
63	10.1
200	0.19
2000	

2016-11577_30627_30.$av

Size µm	Diff. Volume %
0	13.5
4	76.2
63	10.1
200	0.19
2000	0


30627
2016-11577_30627_30.$av
Volume (%)
0
1
2
3
4
5
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name:	G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30628_33.$av
	2016-11577_30628_33.$av
File ID:	2016-11577
Sample ID:	30628
Operator:	MKM
Comment 1:	sonicated
Optical model:	Fraunhofer.rf780d PIDS included
LS 13 320	Aqueous Liquid Module
Pump speed:	60
Fluid:	Water

Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30628_31.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30628_32.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30628_33.$ls

Volume Statistics (Arithmetic) 2016-11577_30628_33.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	154.8 µm	S.D.:	136.5 µm
Median:	130.2 µm	C.V.:	88.2%
D(3,2):	16.87 µm	Skewness:	2.250 Right skewed
Mode:	168.9 µm	Kurtosis:	8.760 Leptokurtic

d_{10}: 19.58 µm d_{50}: 130.2 µm d_{90}: 304.4 µm

Folk and Ward Statistics (Phi)

Mean:	3.28	Median:	2.94	Deviation:	1.53
Skewness:	0.37	Kurtosis:	1.20		

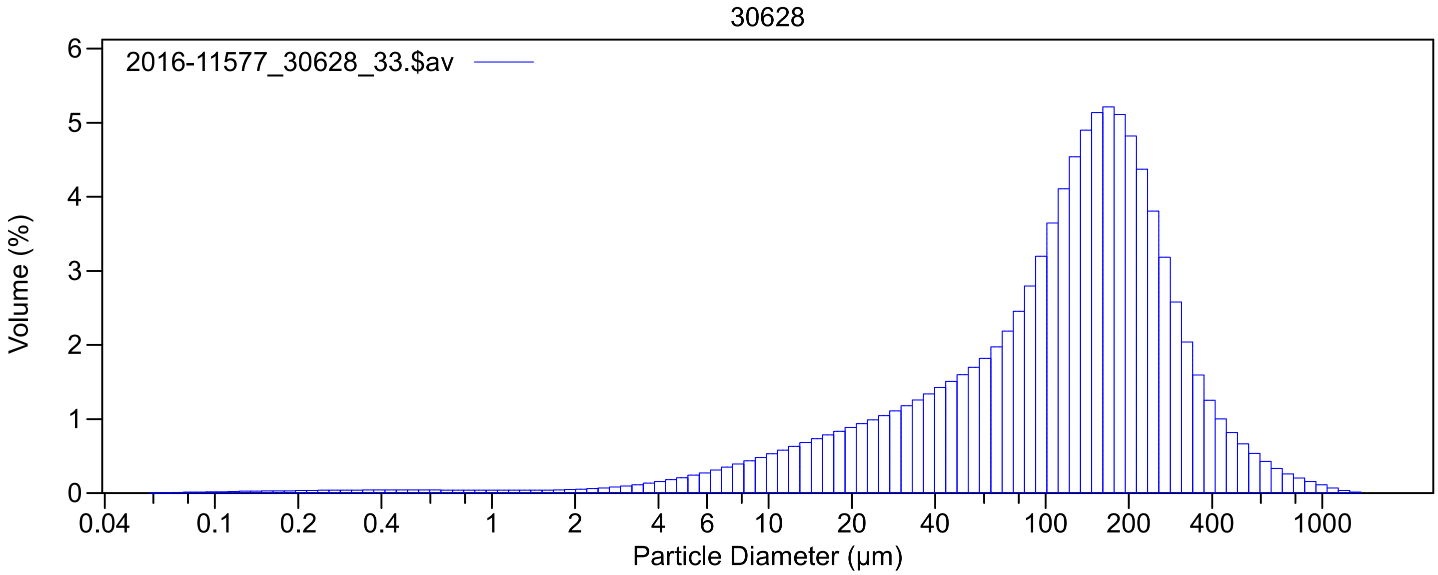
<80%
229.7 µm

2016-11577_30628_33.$av

Particle Diameter µm	Volume %
0.04	1.91
4	24.4
63	46.9
200	26.8
2000	

2016-11577_30628_33.$av

Size µm	Diff. Volume %
0	1.91
4	24.4
63	46.9
200	26.8
2000	0


30628
2016-11577_30628_33.$av
Volume (%)
6
5
4
3
2
1
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30629_36.$av
2016-11577_30629_36.$av
File ID: 2016-11577
Sample ID: 30629
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d PIDS included
LS 13 320 Aqueous Liquid Module
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30629_34.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30629_35.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30629_36.$ls

Volume Statistics (Arithmetic) 2016-11577_30629_36.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	138.6 µm	S.D.:	114.3 µm
Median:	119.8 µm	C.V.:	82.4%
D(3,2):	18.06 µm	Skewness:	0.974 Right skewed
Mode:	185.4 µm	Kurtosis:	0.795 Leptokurtic

d_{10}: 12.00 µm d_{50}: 119.8 µm d_{90}: 296.0 µm

Folk and Ward Statistics (Phi)

Mean:	3.58	Median:	3.06	Deviation:	1.79
Skewness:	0.43	Kurtosis:	0.98		

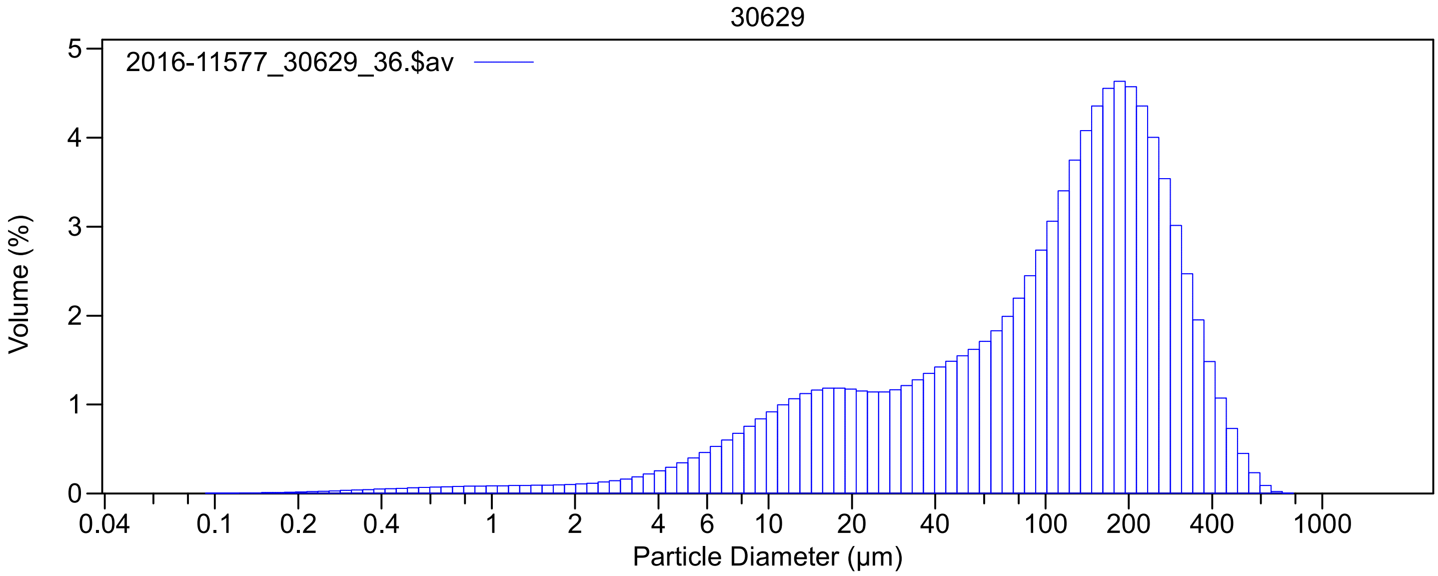
<80%
229.6 µm

2016-11577_30629_36.$av

Particle Diameter µm	Volume %
0.04	2.86
4	30.0
63	40.6
200	26.6
2000	

2016-11577_30629_36.$av

Size µm	Diff. Volume %
0	2.86
4	30.0
63	40.6
200	26.6
2000	0


30629
2016-11577_30629_36.$av
Volume (%)
0
1
2
3
4
5
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (μm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30630a_39.$av
2016-11577_30630a_39.$av
File ID: 2016-11577
Sample ID: 30630a
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d   PIDS included
LS 13 320 Aqueous Liquid Module
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30630a_37.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30630a_38.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30630a_39.$ls

Volume Statistics (Arithmetic)   2016-11577_30630a_39.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	30.96 µm	S.D.:	51.17 µm
Median:	15.58 µm	C.V.:	165%
D(3,2):	6.280 µm	Skewness:	5.493 Right skewed
Mode:	13.61 µm	Kurtosis:	42.68 Leptokurtic

d_{10}: 3.746 µm d_{50}: 15.58 µm d_{90}: 67.34 µm

Folk and Ward Statistics (Phi)

Mean:	5.96	Median:	6.00	Deviation:	1.67
Skewness:	0.00	Kurtosis:	1.20		

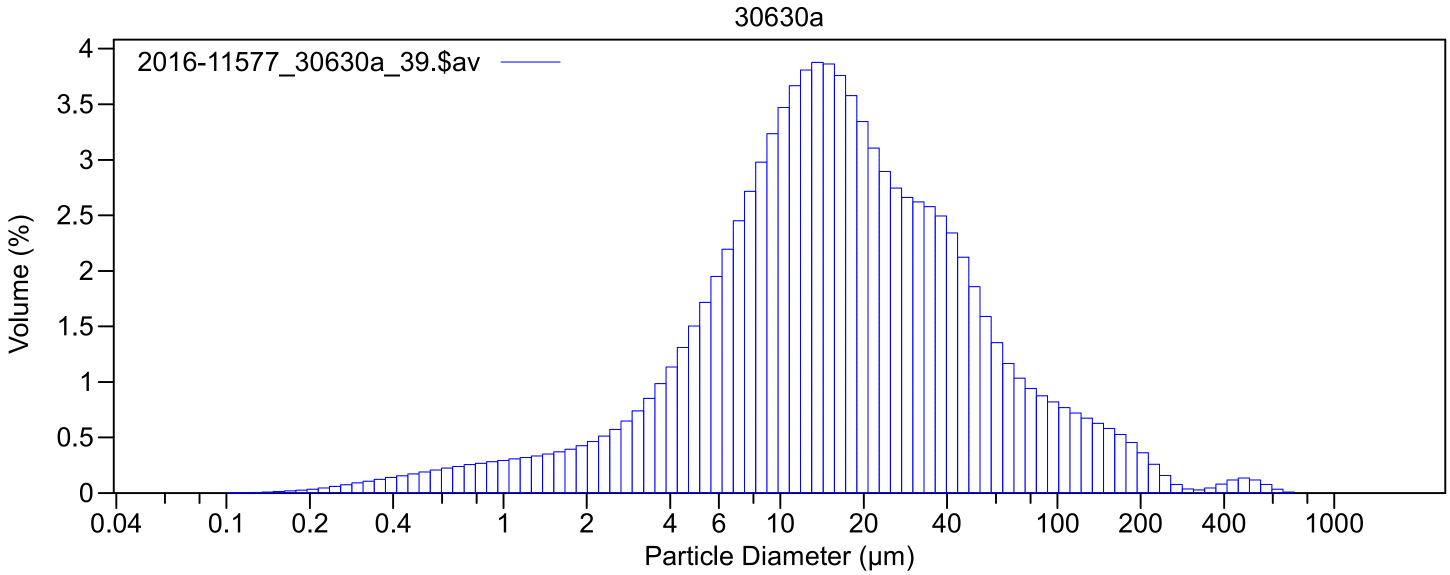
<80%
39.79 µm

2016-11577_30630a_39.$av

Particle Diameter µm	Volume %
0.04	10.7
4	78.4
63	9.40
200	1.43
2000	

2016-11577_30630a_39.$av

Size µm	Diff. Volume %
0	10.7
4	78.4
63	9.40
200	1.43
2000	0


30630a
2016-11577_30630a_39.$av
Volume (%)
4
3.5
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name:	G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30631_45.$av
	2016-11577_30631_45.$av
File ID:	2016-11577
Sample ID:	30631
Operator:	MKM
Comment 1:	sonicated
Optical model:	Fraunhofer.rf780d PIDS included
LS 13 320	Aqueous Liquid Module
Pump speed:	60
Fluid:	Water

Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30631_43.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30631_44.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30631_45.$ls

Volume Statistics (Arithmetic) 2016-11577_30631_45.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	58.48 µm	S.D.:	83.28 µm
Median:	36.24 µm	C.V.:	142%
D(3,2):	9.412 µm	Skewness:	4.935 Right skewed
Mode:	72.94 µm	Kurtosis:	36.86 Leptokurtic

d_{10}: 4.418 µm d_{50}: 36.24 µm d_{90}: 123.3 µm

Folk and Ward Statistics (Phi)

Mean:	5.09	Median:	4.79	Deviation:	1.88
Skewness:	0.26	Kurtosis:	0.92		

<80%
88.28 µm

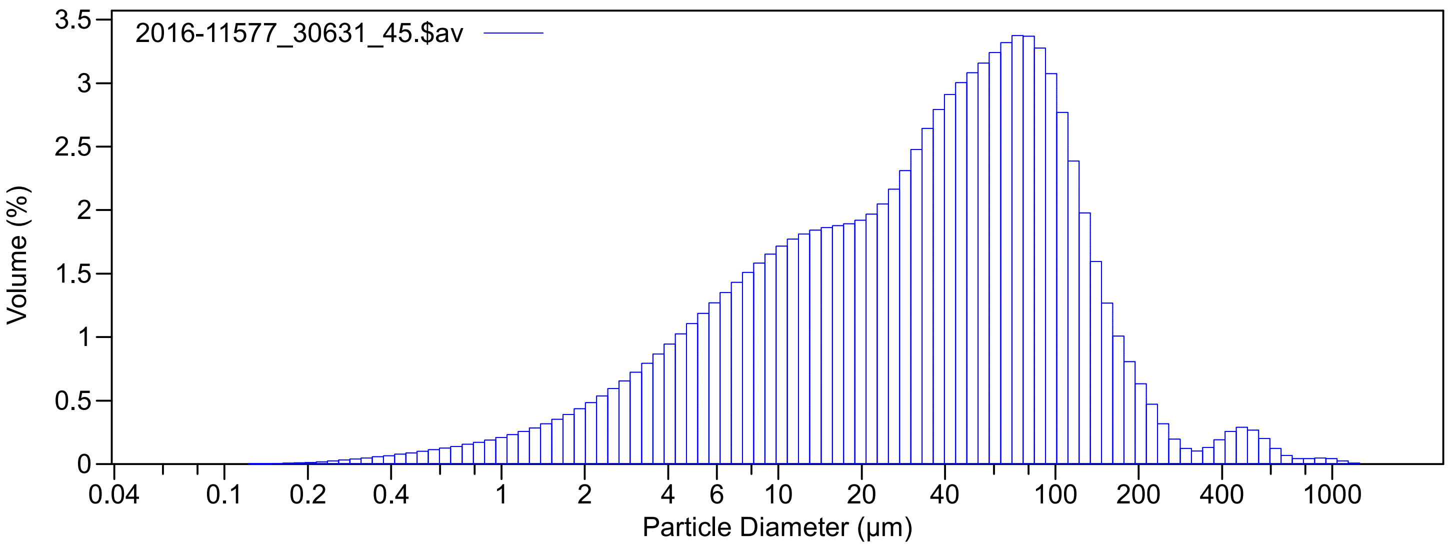
2016-11577_30631_45.$av

Particle Diameter µm	Volume %
0.04	8.96
4	59.0
63	28.7
200	3.39
2000	

2016-11577_30631_45.$av

Size µm	Diff. Volume %
0	8.96
4	59.0
63	28.7
200	3.39
2000	0

30631


2016-11577_30631_45.$av
Volume (%)
3.5
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name:	G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30632_48.$av
	2016-11577_30632_48.$av
File ID:	2016-11577
Sample ID:	30632
Operator:	MKM
Comment 1:	sonicated
Optical model:	Fraunhofer.rf780d PIDS included
LS 13 320	Aqueous Liquid Module
Pump speed:	60
Fluid:	Water

Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30632_46.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30632_47.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30632_48.$ls

Volume Statistics (Arithmetic) 2016-11577_30632_48.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	267.8 µm	S.D.:	152.7 µm
Median:	272.1 µm	C.V.:	57.0%
D(3,2):	25.32 µm	Skewness:	0.519 Right skewed
Mode:	295.5 µm	Kurtosis:	2.280 Leptokurtic

d_{10}: 20.08 µm d_{50}: 272.1 µm d_{90}: 440.8 µm

Folk and Ward Statistics (Phi)

Mean:	2.11	Median:	1.88	Deviation:	1.39
Skewness:	0.55	Kurtosis:	2.83		

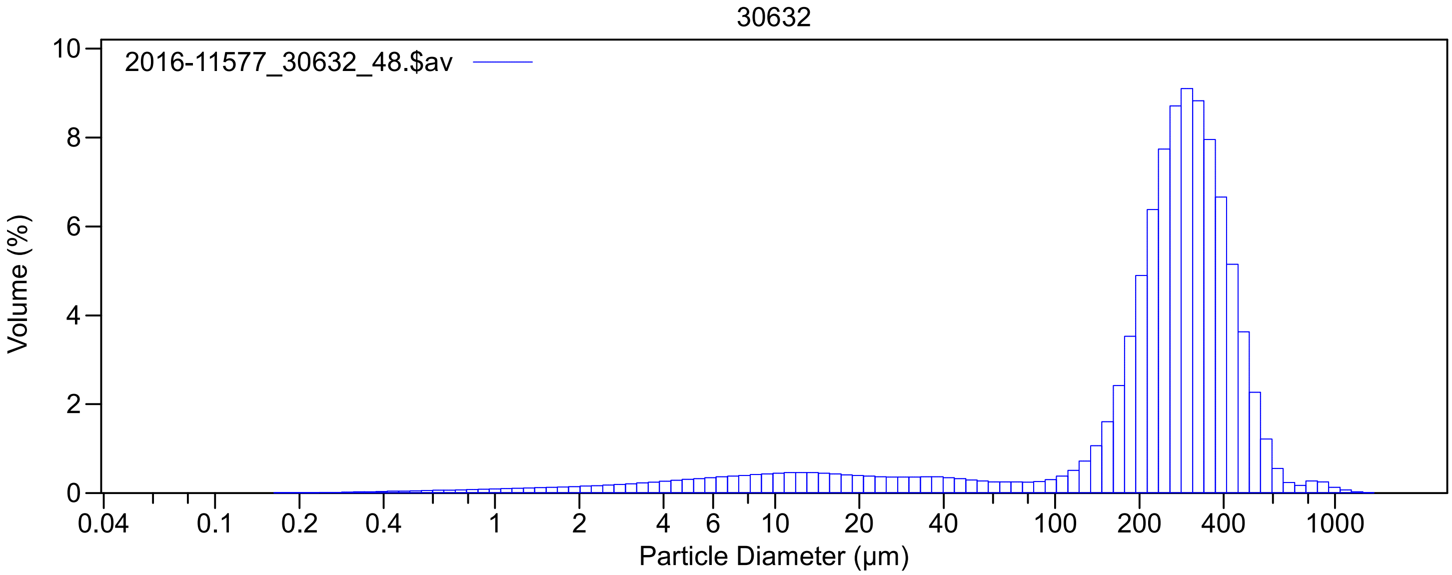
<80%
376.8 µm

2016-11577_30632_48.$av

Particle Diameter µm	Volume %
0.04	3.18
4	11.0
63	13.0
200	72.8
2000	

2016-11577_30632_48.$av

Size µm	Diff. Volume %
0	3.18
4	11.0
63	13.0
200	72.8
2000	0


30632
2016-11577_30632_48.$av
Volume (%)
0
2
4
6
8
10
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name:	G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30633_51.$av
	2016-11577_30633_51.$av
File ID:	2016-11577
Sample ID:	30633
Operator:	MKM
Comment 1:	sonicated
Optical model:	Fraunhofer.rf780d PIDS included
LS 13 320	Aqueous Liquid Module
Pump speed:	60
Fluid:	Water

Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30633_49.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30633_50.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30633_51.$ls

Volume Statistics (Arithmetic) 2016-11577_30633_51.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	417.2 µm	S.D.:	223.2 µm
Median:	418.0 µm	C.V.:	53.5%
D(3,2):	23.29 µm	Skewness:	0.106 Right skewed
Mode:	471.1 µm	Kurtosis:	0.089 Leptokurtic

d_{10}: 42.99 µm d_{50}: 418.0 µm d_{90}: 698.5 µm

Folk and Ward Statistics (Phi)

Mean:	1.38	Median:	1.26	Deviation:	1.47
Skewness:	0.49	Kurtosis:	3.19		

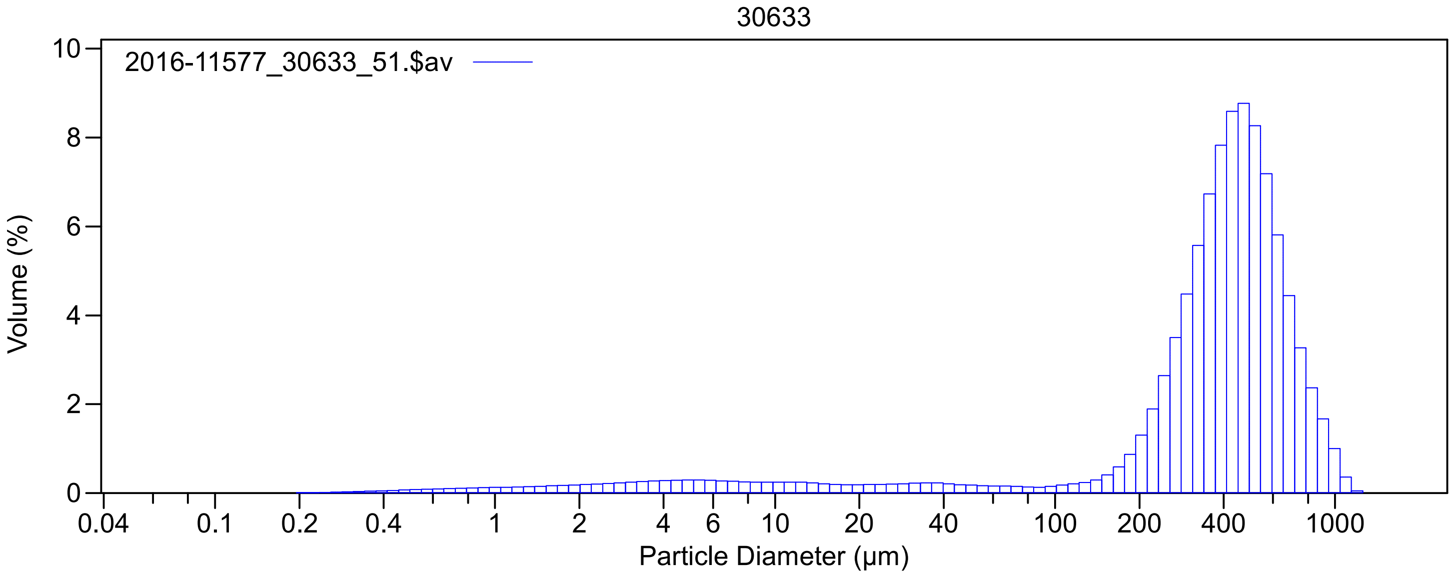
<80%
587.3 µm

2016-11577_30633_51.$av

Particle Diameter µm	Volume %
0.04	3.96
4	6.76
63	3.93
200	85.4
2000	

2016-11577_30633_51.$av

Size µm	Diff. Volume %
0	3.96
4	6.76
63	3.93
200	85.4
2000	0


30633
2016-11577_30633_51.$av
Volume (%)
0
2
4
6
8
10
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30634_54.$av
2016-11577_30634_54.$av
File ID: 2016-11577
Sample ID: 30634
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d PIDS included
LS 13 320 Aqueous Liquid Module
Run length: 81 seconds
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30634_52.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30634_53.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30634_54.$ls

Volume Statistics (Arithmetic) 2016-11577_30634_54.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	340.3 µm	S.D.:	213.2 µm
Median:	326.9 µm	C.V.:	62.6%
D(3,2):	27.88 µm	Skewness:	0.759 Right skewed
Mode:	356.1 µm	Kurtosis:	1.241 Leptokurtic

d_{10}: 30.60 µm d_{50}: 326.9 µm d_{90}: 597.0 µm

Folk and Ward Statistics (Phi)

Mean:	1.81	Median:	1.61	Deviation:	1.49
Skewness:	0.48	Kurtosis:	2.58		

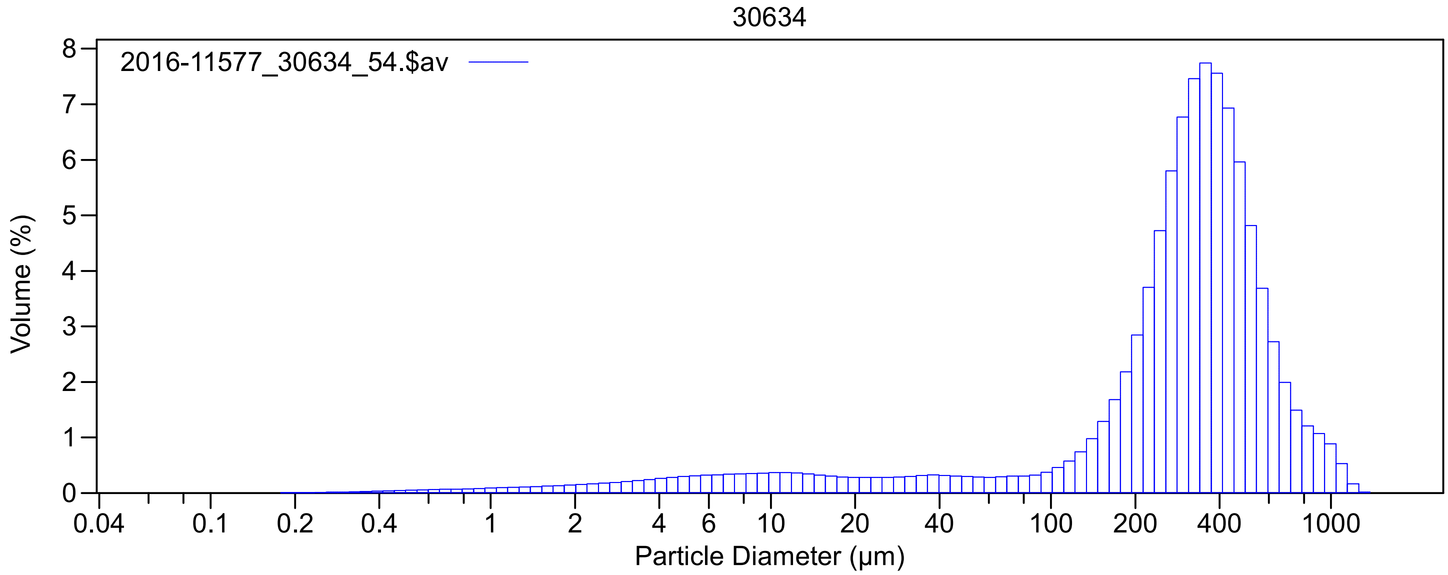
<80%
483.3 µm

2016-11577_30634_54.$av

Particle Diameter µm	Volume %
0.04	3.07
4	9.29
63	10.4
200	77.2
2000	

2016-11577_30634_54.$av

Size µm	Diff. Volume %
0	3.07
4	9.29
63	10.4
200	77.2
2000	0


30634
2016-11577_30634_54.$av
Volume (%)
0
1
2
3
4
5
6
7
8
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name:	G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30635_57.$av 2016-11577_30635_57.$av
File ID:	2016-11577
Sample ID:	30635
Operator:	MKM
Comment 1:	sonicated
Optical model:	Fraunhofer.rf780d PIDS included
LS 13 320	Aqueous Liquid Module
Pump speed:	60
Fluid:	Water

Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30635_55.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30635_56.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30635_57.$ls

Volume Statistics (Arithmetic) 2016-11577_30635_57.$av

Calculations from 0.040 µm to 2000 µm

Volume:	100%		
Mean:	28.58 µm	S.D.:	32.42 µm
Median:	17.76 µm	C.V.:	113%
D(3,2):	7.010 µm	Skewness:	3.061 Right skewed
Mode:	14.94 µm	Kurtosis:	17.22 Leptokurtic

d_{10}: 3.726 µm d_{50}: 17.76 µm d_{90}: 64.58 µm

Folk and Ward Statistics (Phi)

Mean:	5.87	Median:	5.82	Deviation:	1.62
Skewness:	0.10	Kurtosis:	1.03		

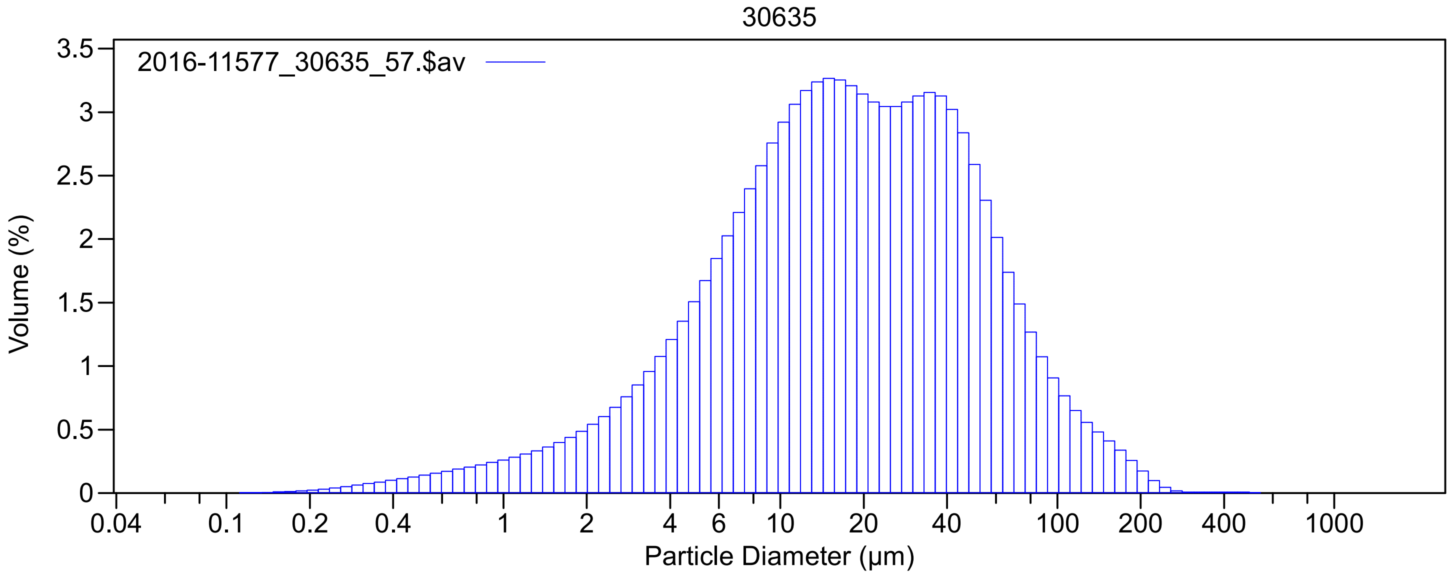
<80%
43.78 µm

2016-11577_30635_57.$av

Particle Diameter µm	Volume %
0.04	10.9
4	78.7
63	10.1
200	0.33
2000	

2016-11577_30635_57.$av

Size µm	Diff. Volume %
0	10.9
4	78.7
63	10.1
200	0.33
2000	0


30635
2016-11577_30635_57.$av
Volume (%)
3.5
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (µm)

File name: G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30636a_60.$av
2016-11577_30636a_60.$av
File ID: 2016-11577
Sample ID: 30636a
Operator: MKM
Comment 1: sonicated
Optical model: Fraunhofer.rf780d PIDS included
LS 13 320 Aqueous Liquid Module
Pump speed: 60
Fluid: Water
Average of 3 files
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30636a_58.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30636a_59.$ls
G:\LabDocs\RADIO\Particle Size\LS13320\Data Files\2016-11577\2016-11577_30636a_60.$ls

Volume Statistics (Arithmetic) 2016-11577_30636a_60.$av

Calculations from 0.040 µm to 2000 µm

Volume: 100%
Mean: 58.39 µm S.D.: 100.4 µm
Median: 21.56 µm C.V.: 172%
D(3,2): 7.406 µm Skewness: 4.554 Right skewed
Mode: 13.61 µm Kurtosis: 30.56 Leptokurtic

d_{10}: 3.837 µm d_{50}: 21.56 µm d_{90}: 145.3 µm

Folk and Ward Statistics (Phi)
Mean: 5.41 Median: 5.54 Deviation: 2.07
Skewness: -0.04 Kurtosis: 0.93

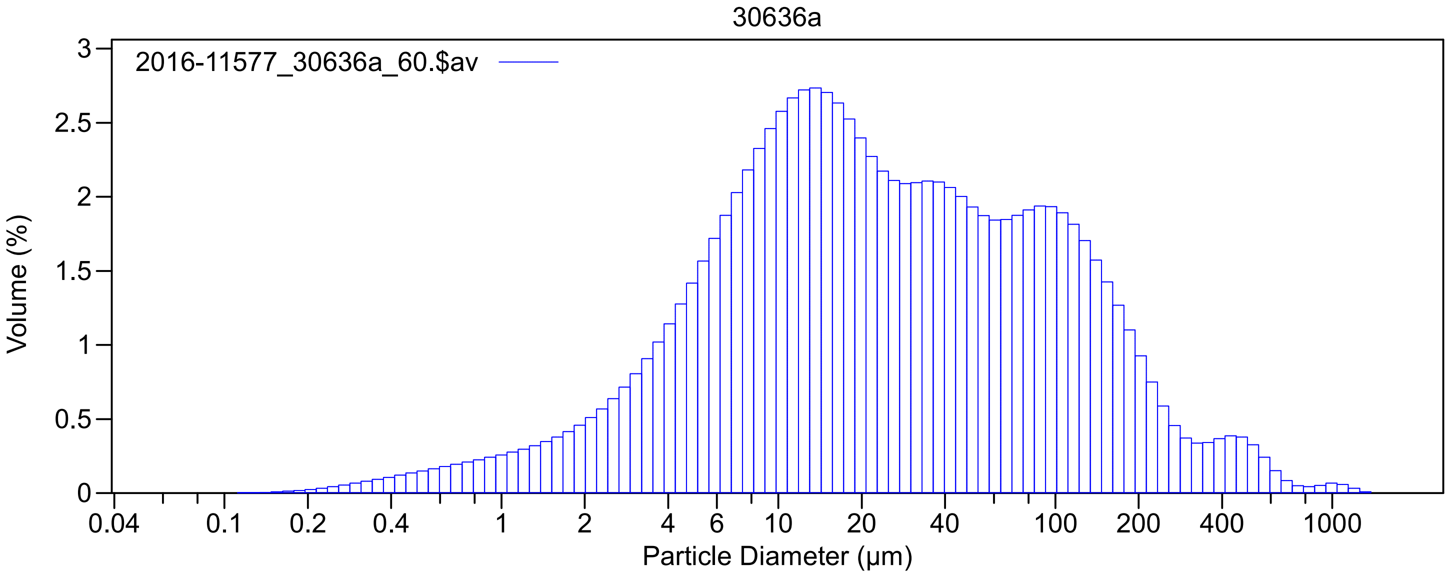
<80%
86.72 µm

2016-11577_30636a_60.$av

Particle Diameter µm	Volume %
0.04	10.5
4	63.1
63	20.7
200	5.74
2000	

2016-11577_30636a_60.$av

Size µm	Diff. Volume %
0	10.5
4	63.1
63	20.7
200	5.74
2000	0


30636a
2016-11577_30636a_60.$av
Volume (%)
3
2.5
2
1.5
1
0.5
0
0.04
0.1
0.2
0.4
1
2
4
6
10
20
40
100
200
400
1000
Particle Diameter (μm)

SRC SASKATCHEWAN RESEARCH COUNCIL

Environmental Analytical Laboratories
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E: analytical@src.sk.ca

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SRC Group # 2016-11577

Nov 07, 2016

EcoMetrix Inc.
6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Karen Petersen

Date Samples Received: Sep-23-2016 Client P.O.: 16-2285

This is a final report.

Lab Section 1 results have been authorized by Keith Gipman QP, Supervisor
Lab Section 2 results have been authorized by Melissa Tackaberry-Syed QP, Supervisor
Lab Section 3 results have been authorized by Pat Moser QP, Supervisor
Lab Sections 4 and 5 results have been authorized by Vicky Snook QP, Supervisor
Lab Section 6 results have been authorized by Marion McConnell QP, Supervisor

QP: Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

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Nov 07, 2016

EcoMetrix Inc.

6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Karen Petersen

Date Samples Received: Sep-23-2016

Client P.O.: 16-2285

30600 **09/09/2016 LB-3-1 (0-2) *SEDIMENT***
30601 **09/09/2016 LA-5-1 (0-2) *SEDIMENT***
30602 **09/10/2016 LB-3-2 (0-2) *SEDIMENT***

Analyte	Units	30600	30601	30602
Lab Section 2 (ICP)				
Aluminum	ug/g	7800	5300	6300
Antimony	ug/g	0.4	<0.2	0.3
Arsenic	ug/g	6.5	4.4	5.0
Barium	ug/g	57	49	46
Beryllium	ug/g	0.5	0.3	0.4
Boron	ug/g	9	6	6
Cadmium	ug/g	0.6	0.4	0.5
Calcium	ug/g	2000	1600	1900
Chromium	ug/g	17	11	12
Cobalt	ug/g	3.3	2.3	3.8
Copper	ug/g	8.4	2.0	6.4
Iron	ug/g	24800	23500	17400
Lead	ug/g	12	7.5	8.6
Magnesium	ug/g	870	780	720
Manganese	ug/g	160	320	140
Molybdenum	ug/g	1.2	0.7	1.2
Nickel	ug/g	13	6.3	12
Phosphorus	ug/g	1300	1600	1000
Potassium	ug/g	1100	1000	910
Selenium	ug/g	1.8	0.9	1.3
Silver	ug/g	<0.1	<0.1	<0.1
Sodium	ug/g	340	210	190
Strontium	ug/g	32	26	29
Thallium	ug/g	<0.2	<0.2	<0.2
Tin	ug/g	0.3	0.2	0.2
Titanium	ug/g	270	200	230
Uranium	ug/g	1.0	0.7	0.9
Vanadium	ug/g	33	20	25
Zinc	ug/g	43	28	39
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	0.61	0.43	0.36

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SRC Group # 2016-11577

Nov 07, 2016

EcoMetrix Inc.

30600	**09/09/2016 LB-3-1 (0-2) *SEDIMENT***
30601	**09/09/2016 LA-5-1 (0-2) *SEDIMENT***
30602	**09/10/2016 LB-3-2 (0-2) *SEDIMENT***

Analyte	Units	30600	30601	30602
Lab Section 4 (Radiochemistry)				
Polonium-210	Bq/g	0.50	0.52	0.36
Radium-226	Bq/g	0.02	0.03	0.01
Thorium-228	Bq/g	0.02	0.02	<0.02
Thorium-230	Bq/g	<0.02	<0.02	<0.02
Thorium-232	Bq/g	<0.02	<0.02	<0.02
Lab Section 6 (Misc.)				
Organic carbon	%	19.9	18.8	17.5
Moisture	%	93.77	96.10	91.95
Particle Size Custom Ranges	vol %	See Attached	See Attached	See Attached

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Organic carbon was subcontracted to SRC Geoanalytical Laboratories

Results are reported on a dry basis.

SRC Group # 2016-11577

Nov 07, 2016

EcoMetrix Inc.

30603 **09/10/2016 LB-3-3 (0-2) *SEDIMENT***
30604 **09/10/2016 LA-5-4 (0-2) *SEDIMENT***
30605 **09/10/2016 LA-5-5 (0-2) *SEDIMENT***

Analyte	Units	30603	30604	30605
Lab Section 2 (ICP)				
Aluminum	ug/g	2790	5800	2450
Antimony	ug/g	<0.2	<0.2	<0.2
Arsenic	ug/g	1.5	3.1	1.2
Barium	ug/g	27	45	45
Beryllium	ug/g	0.1	0.3	<0.1
Boron	ug/g	<1	4	<1
Cadmium	ug/g	0.3	0.3	0.4
Calcium	ug/g	680	2100	360
Chromium	ug/g	8.4	11	1.0
Cobalt	ug/g	1.2	1.8	<0.2
Copper	ug/g	<0.5	1.4	<0.5
Iron	ug/g	5700	18500	1980
Lead	ug/g	2.4	7.0	1.6
Magnesium	ug/g	350	910	110
Manganese	ug/g	58	210	46
Molybdenum	ug/g	0.3	0.5	<0.1
Nickel	ug/g	4.2	6.0	0.9
Phosphorus	ug/g	150	1400	70
Potassium	ug/g	720	1100	1400
Selenium	ug/g	0.3	0.7	<0.1
Silver	ug/g	0.2	<0.1	0.7
Sodium	ug/g	340	210	610
Strontium	ug/g	16	33	24
Thallium	ug/g	<0.2	<0.2	<0.2
Tin	ug/g	0.1	0.1	<0.1
Titanium	ug/g	130	170	47
Uranium	ug/g	0.3	0.6	0.8
Vanadium	ug/g	7.9	17	1.3
Zinc	ug/g	12	24	<0.5
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.04	0.40	<0.04
Polonium-210	Bq/g	0.05	0.40	0.02
Radium-226	Bq/g	0.04	0.03	0.02
Thorium-228	Bq/g	<0.02	<0.02	<0.02
Thorium-230	Bq/g	<0.02	<0.02	<0.02
Thorium-232	Bq/g	<0.02	<0.02	<0.02

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Nov 07, 2016

EcoMetrix Inc.

30603 **09/10/2016 LB-3-3 (0-2) *SEDIMENT***
30604 **09/10/2016 LA-5-4 (0-2) *SEDIMENT***
30605 **09/10/2016 LA-5-5 (0-2) *SEDIMENT***

Analyte	Units	30603	30604	30605
Lab Section 6 (Misc.)				
Organic carbon	%	2.59	17.8	0.58
Moisture	%	68.39	96.81	34.29
Particle Size Custom Ranges	vol %	See Attached	See Attached	See Attached

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Organic carbon was subcontracted to SRC Geoanalytical Laboratories

Results are reported on a dry basis.

EcoMetrix Inc.

30606 **09/11/2016 LA-5-2 (0-2) *SEDIMENT***
30607 **09/11/2016 LA-5-3 (0-2) *SEDIMENT***
30608 **09/10/2016 LA-5-2 PONAR *SEDIMENT***

Analyte	Units	30606	30607	30608
Lab Section 2 (ICP)				
Aluminum	ug/g	1990	4860	1650
Antimony	ug/g	<0.2	<0.2	<0.2
Arsenic	ug/g	0.6	3.9	0.5
Barium	ug/g	33	42	26
Beryllium	ug/g	<0.1	0.3	<0.1
Boron	ug/g	<1	3	<1
Cadmium	ug/g	<0.1	0.3	0.1
Calcium	ug/g	270	1600	240
Chromium	ug/g	4.1	9.8	1.9
Cobalt	ug/g	0.2	2.1	0.3
Copper	ug/g	<0.5	1.2	<0.5
Iron	ug/g	2050	16400	1570
Lead	ug/g	1.3	7.1	1.0
Magnesium	ug/g	120	700	100
Manganese	ug/g	33	240	22
Molybdenum	ug/g	0.1	0.6	<0.1
Nickel	ug/g	1.8	5.7	0.9
Phosphorus	ug/g	60	870	50
Potassium	ug/g	1000	840	740
Selenium	ug/g	<0.1	0.7	<0.1
Silver	ug/g	0.2	<0.1	0.2
Sodium	ug/g	400	170	370
Strontium	ug/g	19	27	17
Thallium	ug/g	<0.2	<0.2	<0.2
Tin	ug/g	<0.1	0.1	<0.1
Titanium	ug/g	45	180	44
Uranium	ug/g	0.2	0.6	0.2
Vanadium	ug/g	1.5	18	1.3
Zinc	ug/g	0.8	26	<0.5
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.04	0.25	<0.04
Polonium-210	Bq/g	0.02	0.32	0.02
Radium-226	Bq/g	<0.01	0.03	<0.01
Thorium-228	Bq/g	<0.02	<0.02	<0.02
Thorium-230	Bq/g	<0.02	<0.02	<0.02
Thorium-232	Bq/g	<0.02	<0.02	<0.02

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SRC Group # 2016-11577

Nov 07, 2016

EcoMetrix Inc.

30606 **09/11/2016 LA-5-2 (0-2) *SEDIMENT***
30607 **09/11/2016 LA-5-3 (0-2) *SEDIMENT***
30608 **09/10/2016 LA-5-2 PONAR *SEDIMENT***

Analyte	Units	30606	30607	30608
Lab Section 6 (Misc.)				
Organic carbon	%	0.44	15.6	0.37
Moisture	%	28.92	94.24	29.58
Particle Size Custom Ranges	vol %	See Attached	See Attached	See Attached

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Organic carbon was subcontracted to SRC Geoanalytical Laboratories

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SRC Group # 2016-11577

Nov 07, 2016

EcoMetrix Inc.

30609 **09/10/2016 LA-5-5 PONAR *SEDIMENT***
30610 **09/12/2016 LA-6-1 (0-2) *SEDIMENT***
30611 **09/12/2016 LA-6-2 (0-2) *SEDIMENT***

Analyte	Units	30609	30610	30611
Lab Section 2 (ICP)				
Aluminum	ug/g	1600	5200	4670
Antimony	ug/g	<0.2	<0.2	<0.2
Arsenic	ug/g	0.4	3.3	3.1
Barium	ug/g	27	45	43
Beryllium	ug/g	<0.1	0.3	0.3
Boron	ug/g	<1	6	6
Cadmium	ug/g	0.2	0.4	0.4
Calcium	ug/g	250	1800	2500
Chromium	ug/g	2.9	10	8.3
Cobalt	ug/g	<0.2	2.1	1.7
Copper	ug/g	<0.5	2.1	3.0
Iron	ug/g	1410	15100	13200
Lead	ug/g	1.2	8.5	7.6
Magnesium	ug/g	90	750	880
Manganese	ug/g	22	140	190
Molybdenum	ug/g	0.3	0.7	0.4
Nickel	ug/g	1.5	6.4	4.7
Phosphorus	ug/g	60	1500	1400
Potassium	ug/g	750	940	960
Selenium	ug/g	<0.1	0.9	0.9
Silver	ug/g	0.2	<0.1	<0.1
Sodium	ug/g	370	190	180
Strontium	ug/g	19	28	34
Thallium	ug/g	<0.2	<0.2	<0.2
Tin	ug/g	<0.1	0.2	0.2
Titanium	ug/g	36	180	230
Uranium	ug/g	0.2	0.7	0.7
Vanadium	ug/g	1.2	18	18
Zinc	ug/g	<0.5	28	27
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.04	0.45	0.52
Polonium-210	Bq/g	<0.01	0.48	0.53
Radium-226	Bq/g	<0.01	0.04	0.03
Thorium-228	Bq/g	<0.02	<0.02	<0.02
Thorium-230	Bq/g	<0.02	<0.02	<0.02
Thorium-232	Bq/g	<0.02	<0.02	<0.02

SRC Group # 2016-11577

Nov 07, 2016

EcoMetrix Inc.

30609 **09/10/2016 LA-5-5 PONAR *SEDIMENT***
30610 **09/12/2016 LA-6-1 (0-2) *SEDIMENT***
30611 **09/12/2016 LA-6-2 (0-2) *SEDIMENT***

Analyte	Units	30609	30610	30611
Lab Section 6 (Misc.)				
Organic carbon	%	0.42	18.7	18.5
Moisture	%	24.59	96.72	95.56
Particle Size Custom Ranges	vol %	See Attached	See Attached	See Attached

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Organic carbon was subcontracted to SRC Geoanalytical Laboratories

Results are reported on a dry basis.

SRC Group # 2016-11577

Nov 07, 2016

EcoMetrix Inc.

30612 09/14/2016 LA-1-1 (0-2) *SEDIMENT*
30613 09/14/2016 LA-1-2 (0-2) *SEDIMENT*
30614 09/13/2016 LA-7-1 (0-2) *SEDIMENT*

Analyte	Units	30612	30613	30614
Lab Section 2 (ICP)				
Aluminum	ug/g	4740	4440	3340
Antimony	ug/g	0.3	0.2	0.2
Arsenic	ug/g	5.7	5.0	3.6
Barium	ug/g	42	34	43
Beryllium	ug/g	0.3	0.3	0.2
Boron	ug/g	8	8	7
Cadmium	ug/g	0.5	0.4	0.3
Calcium	ug/g	1600	1600	2900
Chromium	ug/g	16	8.8	21
Cobalt	ug/g	2.3	2.2	1.9
Copper	ug/g	4.6	3.5	3.6
Iron	ug/g	9900	12100	8500
Lead	ug/g	10	8.6	7.2
Magnesium	ug/g	780	830	1000
Manganese	ug/g	170	150	130
Molybdenum	ug/g	2.0	0.9	2.8
Nickel	ug/g	12	8.8	12
Phosphorus	ug/g	1400	1300	2500
Potassium	ug/g	1000	980	1300
Selenium	ug/g	1.3	1.5	1.0
Silver	ug/g	0.2	<0.1	0.1
Sodium	ug/g	210	170	210
Strontium	ug/g	25	24	31
Thallium	ug/g	<0.2	<0.2	<0.2
Tin	ug/g	0.2	0.2	0.2
Titanium	ug/g	200	250	170
Uranium	ug/g	0.8	0.8	0.7
Vanadium	ug/g	22	21	15
Zinc	ug/g	27	26	22
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	0.73	0.75	0.55
Polonium-210	Bq/g	0.64	0.76	0.56
Radium-226	Bq/g	0.04	0.02	<0.01
Thorium-228	Bq/g	<0.02	<0.02	<0.02
Thorium-230	Bq/g	<0.02	<0.02	<0.02
Thorium-232	Bq/g	<0.02	<0.02	<0.02

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SRC Group # 2016-11577

Nov 07, 2016

EcoMetrix Inc.

30612 **09/14/2016 LA-1-1 (0-2) *SEDIMENT***
30613 **09/14/2016 LA-1-2 (0-2) *SEDIMENT***
30614 **09/13/2016 LA-7-1 (0-2) *SEDIMENT***

Analyte	Units	30612	30613	30614
Lab Section 6 (Misc.)				
Organic carbon	%	17.4	17.2	25.5
Moisture	%	97.24	96.86	97.14
Particle Size Custom Ranges	vol %	See Attached	See Attached	See Attached

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Nov 07, 2016

EcoMetrix Inc.

30615 **09/13/2016 LA-7-2 (0-2) *SEDIMENT***
30616 **09/13/2016 LA-7-3 (0-2) *SEDIMENT***
30617 **09/13/2016 LA-7A-1 (0-2) *SEDIMENT***

Analyte	Units	30615	30616	30617
Lab Section 2 (ICP)				
Aluminum	ug/g	3830	3860	4190
Antimony	ug/g	0.2	0.3	0.2
Arsenic	ug/g	3.5	3.6	3.3
Barium	ug/g	36	36	38
Beryllium	ug/g	0.2	0.2	0.2
Boron	ug/g	6	6	6
Cadmium	ug/g	0.4	0.4	0.4
Calcium	ug/g	3200	3100	3300
Chromium	ug/g	7.4	7.3	9.7
Cobalt	ug/g	1.4	1.4	1.2
Copper	ug/g	4.0	3.9	3.5
Iron	ug/g	6900	8000	7400
Lead	ug/g	7.8	8.3	10
Magnesium	ug/g	890	920	970
Manganese	ug/g	120	120	160
Molybdenum	ug/g	1.3	1.2	0.8
Nickel	ug/g	3.9	4.6	4.0
Phosphorus	ug/g	1200	1400	1200
Potassium	ug/g	870	1000	1000
Selenium	ug/g	1.2	1.2	1.0
Silver	ug/g	<0.1	<0.1	<0.1
Sodium	ug/g	180	200	190
Strontium	ug/g	38	38	36
Thallium	ug/g	<0.2	<0.2	<0.2
Tin	ug/g	0.2	0.2	0.2
Titanium	ug/g	200	200	230
Uranium	ug/g	0.6	0.6	0.6
Vanadium	ug/g	16	16	17
Zinc	ug/g	29	29	23
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	0.29	0.29	0.41
Polonium-210	Bq/g	0.30	0.35	0.51
Radium-226	Bq/g	0.02	0.02	<0.01
Thorium-228	Bq/g	<0.02	<0.02	<0.02
Thorium-230	Bq/g	<0.02	<0.02	<0.02
Thorium-232	Bq/g	<0.02	<0.02	<0.02

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EcoMetrix Inc.

30615 **09/13/2016 LA-7-2 (0-2) *SEDIMENT***
30616 **09/13/2016 LA-7-3 (0-2) *SEDIMENT***
30617 **09/13/2016 LA-7A-1 (0-2) *SEDIMENT***

Analyte	Units	30615	30616	30617
Lab Section 6 (Misc.)				
Organic carbon	%	25.9	25.5	23.6
Moisture	%	95.15	96.46	94.64
Particle Size Custom Ranges	vol %	See Attached	See Attached	See Attached

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Nov 07, 2016

EcoMetrix Inc.

30618 **09/13/2016 LA-7A-2 (0-2) *SEDIMENT***
30619 **09/13/2016 LA-7A-3 (0-2) *SEDIMENT***
30620 **09/15/2016 LA-8-2 (0-2) *SEDIMENT***

Analyte	Units	30618	30619	30620
Lab Section 2 (ICP)				
Aluminum	ug/g	4530	3660	1950
Antimony	ug/g	0.3	0.2	<0.2
Arsenic	ug/g	5.0	3.4	1.5
Barium	ug/g	33	33	20
Beryllium	ug/g	0.2	0.2	0.1
Boron	ug/g	6	5	3
Cadmium	ug/g	0.4	0.4	0.3
Calcium	ug/g	2100	2700	900
Chromium	ug/g	9.7	6.9	1.6
Cobalt	ug/g	2.2	1.4	<0.2
Copper	ug/g	4.6	3.4	<0.5
Iron	ug/g	10000	6800	9700
Lead	ug/g	8.7	7.8	3.7
Magnesium	ug/g	760	800	330
Manganese	ug/g	120	140	100
Molybdenum	ug/g	1.3	1.0	0.2
Nickel	ug/g	6.2	3.6	1.2
Phosphorus	ug/g	1300	1500	480
Potassium	ug/g	920	940	530
Selenium	ug/g	1.3	1.0	0.4
Silver	ug/g	<0.1	<0.1	<0.1
Sodium	ug/g	170	160	80
Strontium	ug/g	30	32	20
Thallium	ug/g	<0.2	<0.2	<0.2
Tin	ug/g	0.2	0.2	<0.1
Titanium	ug/g	220	190	80
Uranium	ug/g	0.8	0.6	0.3
Vanadium	ug/g	24	16	7.3
Zinc	ug/g	23	22	9.6
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	0.35	0.44	0.17
Polonium-210	Bq/g	0.38	0.38	0.21
Radium-226	Bq/g	0.03	<0.01	0.01
Thorium-228	Bq/g	<0.02	<0.02	0.02
Thorium-230	Bq/g	0.02	<0.02	<0.02
Thorium-232	Bq/g	<0.02	<0.02	<0.02

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Nov 07, 2016

EcoMetrix Inc.

30618 **09/13/2016 LA-7A-2 (0-2) *SEDIMENT***
30619 **09/13/2016 LA-7A-3 (0-2) *SEDIMENT***
30620 **09/15/2016 LA-8-2 (0-2) *SEDIMENT***

Analyte	Units	30618	30619	30620
Lab Section 6 (Misc.)				
Organic carbon	%	19.0	22.7	7.83
Moisture	%	94.03	94.65	88.17
Particle Size Custom Ranges	vol %	See Attached	See Attached	See Attached

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EcoMetrix Inc.

30621 **09/15/2016 LA-8-3 (0-2) *SEDIMENT***
30622 **09/19/2016 LAB-1-1 (0-2) *SEDIMENT***
30623 **09/15/2016 LAB-1-2 (0-2) *SEDIMENT***

Analyte	Units	30621	30622	30623
Lab Section 2 (ICP)				
Aluminum	ug/g	4310	4810	7400
Antimony	ug/g	0.2	<0.2	0.2
Arsenic	ug/g	3.5	2.6	4.6
Barium	ug/g	30	45	60
Beryllium	ug/g	0.3	0.3	0.3
Boron	ug/g	4	7	11
Cadmium	ug/g	0.4	0.3	0.5
Calcium	ug/g	1800	2800	3000
Chromium	ug/g	7.2	8.0	12
Cobalt	ug/g	1.7	1.4	2.0
Copper	ug/g	3.2	1.7	2.8
Iron	ug/g	10200	11900	27000
Lead	ug/g	6.0	5.4	9.0
Magnesium	ug/g	620	960	1100
Manganese	ug/g	200	290	300
Molybdenum	ug/g	0.9	6.3	11
Nickel	ug/g	7.2	6.5	8.1
Phosphorus	ug/g	780	960	820
Potassium	ug/g	760	960	1100
Selenium	ug/g	1.2	1.0	1.2
Silver	ug/g	<0.1	<0.1	0.3
Sodium	ug/g	120	150	210
Strontium	ug/g	26	28	35
Thallium	ug/g	<0.2	<0.2	<0.2
Tin	ug/g	0.2	0.3	0.4
Titanium	ug/g	250	380	450
Uranium	ug/g	0.8	1.1	1.3
Vanadium	ug/g	20	16	22
Zinc	ug/g	26	18	30
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	0.22	0.63	0.56
Polonium-210	Bq/g	0.26	0.55	0.55
Radium-226	Bq/g	0.02	0.03	0.04
Thorium-228	Bq/g	<0.02	<0.02	0.02
Thorium-230	Bq/g	<0.02	0.03	<0.02
Thorium-232	Bq/g	<0.02	<0.02	<0.02

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30621 **09/15/2016 LA-8-3 (0-2) *SEDIMENT***
30622 **09/19/2016 LAB-1-1 (0-2) *SEDIMENT***
30623 **09/15/2016 LAB-1-2 (0-2) *SEDIMENT***

Analyte	Units	30621	30622	30623
Lab Section 6 (Misc.)				
Organic carbon	%	15.6	13.0	12.9
Moisture	%	95.26	93.90	92.80
Particle Size Custom Ranges	vol %	See Attached	See Attached	See Attached

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EcoMetrix Inc.

30624 **09/16/2016 LA-8-1 (0-2) *SEDIMENT***
30625 **09/16/2016 LA-6-3 (0-2) *SEDIMENT***
30626 **09/16/2016 LA-6-4 (0-2) *SEDIMENT***

Analyte	Units	30624	30625	30626
Lab Section 2 (ICP)				
Aluminum	ug/g	4470	5900	4620
Antimony	ug/g	0.3	<0.2	<0.2
Arsenic	ug/g	3.6	4.2	3.8
Barium	ug/g	39	42	37
Beryllium	ug/g	0.3	0.3	0.3
Boron	ug/g	8	7	6
Cadmium	ug/g	0.4	0.5	0.4
Calcium	ug/g	2500	1900	1700
Chromium	ug/g	8.0	10	7.5
Cobalt	ug/g	1.0	1.7	1.4
Copper	ug/g	4.1	1.6	1.7
Iron	ug/g	14500	14600	14000
Lead	ug/g	9.6	7.9	7.8
Magnesium	ug/g	890	800	650
Manganese	ug/g	230	230	180
Molybdenum	ug/g	1.2	0.6	0.4
Nickel	ug/g	6.7	5.5	4.2
Phosphorus	ug/g	1700	960	1000
Potassium	ug/g	1000	970	860
Selenium	ug/g	1.2	0.8	0.8
Silver	ug/g	0.2	0.2	<0.1
Sodium	ug/g	120	190	140
Strontium	ug/g	29	28	26
Thallium	ug/g	<0.2	<0.2	<0.2
Tin	ug/g	0.2	0.2	0.2
Titanium	ug/g	250	310	250
Uranium	ug/g	0.7	0.7	0.6
Vanadium	ug/g	20	19	18
Zinc	ug/g	30	26	24
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	0.58	0.32	0.31
Polonium-210	Bq/g	0.44	0.34	0.31
Radium-226	Bq/g	<0.01	<0.01	0.03
Thorium-228	Bq/g	<0.02	<0.02	<0.02
Thorium-230	Bq/g	<0.02	<0.02	<0.02
Thorium-232	Bq/g	<0.02	<0.02	<0.02

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EcoMetrix Inc.

30624 **09/16/2016 LA-8-1 (0-2) *SEDIMENT***
30625 **09/16/2016 LA-6-3 (0-2) *SEDIMENT***
30626 **09/16/2016 LA-6-4 (0-2) *SEDIMENT***

Analyte	Units	30624	30625	30626
Lab Section 6 (Misc.)				
Organic carbon	%	24.1	16.6	15.9
Moisture	%	96.55	95.64	95.98
Particle Size Custom Ranges	vol %	See Attached	See Attached	See Attached

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30627 **09/17/2016 LA-1-3 (0-2) *SEDIMENT***
30628 **09/18/2016 LA-9-1 (0-2) *SEDIMENT***
30629 **09/18/2016 LA-9-2 (0-2) *SEDIMENT***

Analyte	Units	30627	30628	30629
Lab Section 2 (ICP)				
Aluminum	ug/g	4010	1860	4410
Antimony	ug/g	0.2	<0.2	0.3
Arsenic	ug/g	5.3	0.9	3.6
Barium	ug/g	30	20	36
Beryllium	ug/g	0.2	<0.1	0.2
Boron	ug/g	5	<1	6
Cadmium	ug/g	0.3	0.2	0.5
Calcium	ug/g	1400	600	2000
Chromium	ug/g	6.7	1.1	8.5
Cobalt	ug/g	1.6	<0.2	1.4
Copper	ug/g	2.7	<0.5	3.5
Iron	ug/g	7800	2670	4800
Lead	ug/g	8.2	1.5	10
Magnesium	ug/g	690	260	780
Manganese	ug/g	140	51	140
Molybdenum	ug/g	0.8	<0.1	1.1
Nickel	ug/g	6.0	<0.1	6.8
Phosphorus	ug/g	1000	120	1100
Potassium	ug/g	820	610	940
Selenium	ug/g	1.0	0.2	1.3
Silver	ug/g	<0.1	0.2	0.4
Sodium	ug/g	160	240	200
Strontium	ug/g	21	16	26
Thallium	ug/g	<0.2	<0.2	<0.2
Tin	ug/g	0.2	<0.1	0.2
Titanium	ug/g	280	230	290
Uranium	ug/g	0.7	0.3	0.7
Vanadium	ug/g	18	5.5	20
Zinc	ug/g	20	4.3	27
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	0.54	<0.04	0.45
Polonium-210	Bq/g	0.52	0.04	0.45
Radium-226	Bq/g	0.02	0.05	0.03
Thorium-228	Bq/g	<0.02	<0.02	<0.02
Thorium-230	Bq/g	<0.02	<0.02	<0.02
Thorium-232	Bq/g	<0.02	<0.02	<0.02

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EcoMetrix Inc.

30627 **09/17/2016 LA-1-3 (0-2) *SEDIMENT***
30628 **09/18/2016 LA-9-1 (0-2) *SEDIMENT***
30629 **09/18/2016 LA-9-2 (0-2) *SEDIMENT***

Analyte	Units	30627	30628	30629
Lab Section 6 (Misc.)				
Organic carbon	%	13.3	2.61	16.7
Moisture	%	96.80	65.71	94.04
Particle Size Custom Ranges	vol %	See Attached	See Attached	See Attached

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EcoMetrix Inc.

30630 **09/18/2016 LA-9-3 (0-2) *SEDIMENT***
30631 **09/21/2016 LAB-2-CONE (0-2) *SEDIMENT***
30632 **09/21/2016 LAB-2-1 PONAR *SEDIMENT***

Analyte	Units	30630	30631	30632
Lab Section 2 (ICP)				
Aluminum	ug/g	4250	9300	920
Antimony	ug/g	0.3	<0.2	<0.2
Arsenic	ug/g	3.8	7.2	0.6
Barium	ug/g	33	100	19
Beryllium	ug/g	0.3	0.5	<0.1
Boron	ug/g	6	12	<1
Cadmium	ug/g	0.4	0.6	0.1
Calcium	ug/g	1900	2800	190
Chromium	ug/g	8.5	13	<0.5
Cobalt	ug/g	1.2	3.8	<0.2
Copper	ug/g	3.0	3.9	<0.5
Iron	ug/g	6100	91300	3170
Lead	ug/g	10	10	1.0
Magnesium	ug/g	710	1000	80
Manganese	ug/g	160	1270	230
Molybdenum	ug/g	1.0	12	1.1
Nickel	ug/g	6.1	9.9	<0.1
Phosphorus	ug/g	1100	1400	80
Potassium	ug/g	850	1200	350
Selenium	ug/g	1.3	1.3	<0.1
Silver	ug/g	0.1	0.1	0.2
Sodium	ug/g	170	150	100
Strontium	ug/g	27	40	16
Thallium	ug/g	<0.2	<0.2	<0.2
Tin	ug/g	0.2	0.4	<0.1
Titanium	ug/g	260	360	31
Uranium	ug/g	0.7	1.4	0.2
Vanadium	ug/g	23	30	1.7
Zinc	ug/g	28	62	<0.5
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	0.58	0.45	<0.04
Polonium-210	Bq/g	0.54	0.42	0.03
Radium-226	Bq/g	0.03	0.05	<0.01
Thorium-228	Bq/g	<0.02	<0.02	<0.02
Thorium-230	Bq/g	<0.02	0.02	<0.02
Thorium-232	Bq/g	<0.02	<0.02	<0.02

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EcoMetrix Inc.

30630 **09/18/2016 LA-9-3 (0-2) *SEDIMENT***
30631 **09/21/2016 LAB-2-CONE (0-2) *SEDIMENT***
30632 **09/21/2016 LAB-2-1 PONAR *SEDIMENT***

Analyte	Units	30630	30631	30632
Lab Section 6 (Misc.)				
Organic carbon	%	16.9	11.8	0.48
Moisture	%	95.04	93.08	34.51
Particle Size Custom Ranges	vol %	See Attached	See Attached	See Attached

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Organic carbon was subcontracted to SRC Geoanalytical Laboratories

Results are reported on a dry basis.

30633 **09/21/2016 LAB-2-2 PONAR *SEDIMENT***
30634 **09/21/2016 LAB-2-3 PONAR *SEDIMENT***
30635 **09/15/2016 LAB-1-3 (0-2) *SEDIMENT***

Analyte	Units	30633	30634	30635
Lab Section 2 (ICP)				
Aluminum	ug/g	1120	2820	9200
Antimony	ug/g	<0.2	<0.2	0.3
Arsenic	ug/g	1.0	0.7	5.6
Barium	ug/g	21	50	71
Beryllium	ug/g	<0.1	<0.1	0.4
Boron	ug/g	<1	<1	11
Cadmium	ug/g	<0.1	0.7	0.5
Calcium	ug/g	190	370	3500
Chromium	ug/g	<0.5	<0.5	15
Cobalt	ug/g	<0.2	<0.2	2.7
Copper	ug/g	<0.5	<0.5	5.0
Iron	ug/g	9000	2360	33000
Lead	ug/g	1.0	1.5	13
Magnesium	ug/g	90	160	1200
Manganese	ug/g	200	90	360
Molybdenum	ug/g	1.2	0.6	13
Nickel	ug/g	<0.1	<0.1	12
Phosphorus	ug/g	170	50	1200
Potassium	ug/g	460	1400	1400
Selenium	ug/g	<0.1	<0.1	1.6
Silver	ug/g	0.2	2.0	<0.1
Sodium	ug/g	140	730	180
Strontium	ug/g	17	28	42
Thallium	ug/g	<0.2	<0.2	<0.2
Tin	ug/g	<0.1	<0.1	0.4
Titanium	ug/g	31	64	480
Uranium	ug/g	0.2	0.3	1.5
Vanadium	ug/g	2.1	1.8	27
Zinc	ug/g	1.4	<0.5	44
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.04	<0.04	0.55
Polonium-210	Bq/g	0.02	0.02	0.68
Radium-226	Bq/g	<0.01	0.02	0.05
Thorium-228	Bq/g	<0.02	<0.02	<0.02
Thorium-230	Bq/g	<0.02	<0.02	<0.02
Thorium-232	Bq/g	<0.02	<0.02	<0.02

SRC Group # 2016-11577

Nov 07, 2016

EcoMetrix Inc.

30633 **09/21/2016 LAB-2-2 PONAR *SEDIMENT***
30634 **09/21/2016 LAB-2-3 PONAR *SEDIMENT***
30635 **09/15/2016 LAB-1-3 (0-2) *SEDIMENT***

Analyte	Units	30633	30634	30635
Lab Section 6 (Misc.)				
Organic carbon	%	0.30	0.37	14.9
Moisture	%	29.75	29.20	95.38
Particle Size Custom Ranges	vol %	See Attached	See Attached	See Attached

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Organic carbon was subcontracted to SRC Geoanalytical Laboratories

Results are reported on a dry basis.

SRC Group # 2016-11577

Nov 07, 2016

EcoMetrix Inc.

30636 **09/18/2016 LA-6-5 (0-2) *SEDIMENT***

Analyte	Units	30636
Lab Section 2 (ICP)		
Aluminum	ug/g	3820
Antimony	ug/g	<0.2
Arsenic	ug/g	3.4
Barium	ug/g	56
Beryllium	ug/g	0.3
Boron	ug/g	4
Cadmium	ug/g	0.4
Calcium	ug/g	1900
Chromium	ug/g	7.6
Cobalt	ug/g	1.5
Copper	ug/g	1.4
Iron	ug/g	22600
Lead	ug/g	7.0
Magnesium	ug/g	710
Manganese	ug/g	390
Molybdenum	ug/g	0.4
Nickel	ug/g	4.7
Phosphorus	ug/g	1300
Potassium	ug/g	800
Selenium	ug/g	0.8
Silver	ug/g	<0.1
Sodium	ug/g	120
Strontium	ug/g	27
Thallium	ug/g	<0.2
Tin	ug/g	0.2
Titanium	ug/g	300
Uranium	ug/g	0.6
Vanadium	ug/g	18
Zinc	ug/g	22
Lab Section 4 (Radiochemistry)		
Lead-210	Bq/g	0.59
Polonium-210	Bq/g	0.57
Radium-226	Bq/g	0.03
Thorium-228	Bq/g	<0.02
Thorium-230	Bq/g	<0.02
Thorium-232	Bq/g	<0.02

SRC Group # 2016-11577

Nov 07, 2016

EcoMetrix Inc.

30636 **09/18/2016 LA-6-5 (0-2) *SEDIMENT***

Analyte	Units	30636
Lab Section 6 (Misc.)		
Organic carbon	%	17.1
Moisture	%	95.78
Particle Size Custom Ranges	vol %	See Attached

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Organic carbon was subcontracted to SRC Geoanalytical Laboratories

Results are reported on a dry basis.

ECOMETRIX INC
ATTN: JANEEN TANG/KAREN PETERSON
6800 CAMPOBELLO ROAD
MISSISSAUGA ON L5N 2L8

Date Received: 28-SEP-16
Report Date: 10-FEB-17 08:42 (MT)
Version: FINAL

Client Phone: 905-794-2325

Certificate of Analysis

Lab Work Order #: L1835656
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers: 14-427473
Legal Site Desc:

Brian Morgan, B.Sc. Hons.
Client Services Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1835656-1	L1835656-2	L1835656-3	L1835656-4	L1835656-5
	Description	PLANKTON	PLANKTON	PLANKTON	PLANKTON	PLANKTON
	Sampled Date	14-SEP-16	10-SEP-16	13-SEP-16	12-SEP-16	15-SEP-16
	Sampled Time	12:00	12:00	12:00	12:00	12:00
	Client ID	LA-1	LA-5	LA-6	LA-7	LAB-1
Grouping	**Analyte**					
WATER						
Taxonomy	Phytoplankton Biovolumes	See attached.	See attached.	See attached.	See attached.	See attached.
	Zooplankton Biovolumes	See attached.	See attached.	See attached.	See attached.	See attached.
Plant Pigments	Chlorophyll a (ug/L)	<0.60	<0.60	<0.60	<0.60	<0.60
	ODb/ODa (ABS Ratio)	1.0	1.0	1.0	1.0	1.0
	Pheophytin a (ug/L)	10.9	8.94	6.68	7.24	6.40

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1835656-6				
	Description	PLANKTON				
	Sampled Date	21-SEP-16				
	Sampled Time	12:00				
	Client ID	LAB-2				
Grouping	**Analyte**					
WATER						
Taxonomy	Phytoplankton Biovolumes	See attached.				
	Zooplankton Biovolumes	See attached.				
Plant Pigments	Chlorophyll a (ug/L)	<0.60				
	ODb/ODa (ABS Ratio)	1.0				
	Pheophytin a (ug/L)	13.9				

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CHL,PHEO-ACET-LOW-WP	Water	Chlorophyll-a & Pheophytin-a	APHA 10200H

Phytoplankton in aqueous matrices are concentrated by filtration. Chlorophyll is extracted from the cells collected on the filter using acetone. Chlorophyll a and its degradation product Pheophytin a, are determined spectrophotometrically using the acidification method.

ALS Test Code	Matrix	Test Description	Method Reference**
PHYTO-BIO-WP	Water	Phytoplankton Biovolumes	APHA 10200 C, F & I

Samples are prepared by sedimentation/settling and examined using a compound phase contrast inverted microscope. Phytoplankters are identified to species where possible and enumerated. The average biovolume and total biovolume for every genus/species is also reported.

ALS Test Code	Matrix	Test Description	Method Reference**
ZOOP-BIO-WP	Water	Zooplankton Biovolumes	APHA 10200 C, G & I

Samples are concentrated by sedimentation/settling and examined using a compound phase contrast inverted microscope or stereoscopic microscope (to aid in identification of larger crustaceans). Zooplankters are identified to species where possible and enumerated. The average biovolume and total biovolume for every genus/species is also reported.

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

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

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

Chain of Custody Numbers:

14-427473

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

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

ALS Environmental

Quality Control Report

Client: ECOMETRIX INC
6800 CAMPOBELLO ROAD
MISSISSAUGA ON L5N 2L8
Contact: JANEEN TANG/KAREN PETERSON

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CHL,PHEO-ACET-LOW-WP	**Water**							
Batch R3563211								
WG2403007-1 LCS								
Chlorophyll a			100.4		%		80-120	04-OCT-16
WG2402998-1 MB								
Chlorophyll a			<0.60		ug/L		0.6	04-OCT-16
Pheophytin a			<0.60		ug/L		0.6	04-OCT-16
WG2402998-2 MB								
Chlorophyll a			<0.60		ug/L		0.6	04-OCT-16
Pheophytin a			<0.60		ug/L		0.6	04-OCT-16

Legend:

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

Hold Time Exceedances:

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

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

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

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

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

Phytoplankton Sample Results

Lab Number: L1835656-1 **Work Order** L1835656 **Sample Type** PLANKTON

Date Sampled: September 14, 2016 **Submitter:** CLIENT

Sample ID: LA-1

Class	Genus	Species	Unit:	Units/L	Biovolume Unit µm3	Biovolume Total µm3
Bacillariophyceae	*Asterionella*	*formosa*	Single Cell	94000	810	76140000
Bacillariophyceae	*Fragilaria*	*sp.*	Single Cell	18000	640	11520000
Bacillariophyceae	*Melosira*	*sp.*	Filament	105000	115200	12096000000
Bacillariophyceae	*Navicula*	*sp.*	Single Cell	6000	4000	24000000
Bacillariophyceae	*Stephanodiscus*	*sp.*	Single Cell	5000	62500	312500000
Bacillariophyceae	*Synedra*	*sp.*	Single Cell	12000	810	9720000
Bacillariophyceae	*Tabellaria*	*sp.*	Single Cell	13000	1920	24960000
Chlorophyceae	*Cosmarium*	*sp.*	Single Cell	3000	11250	33750000
Chlorophyceae	*Crucigenia*	*quadrata*	Single Cell	56000	12	672000
Chlorophyceae	*Crucigenia*	*sp.*	Single Cell	25000	12	300000
Chlorophyceae	*Crucigenia*	*tetrapedia*	Single Cell	25000	36	900000
Chlorophyceae	*Dictyosphaerium*	*sp.*	Colony	2000	27000	54000000
Chlorophyceae	*Elakatothrix*	*sp.*	Single Cell	4000	180	720000
Chlorophyceae	*Monoraphidium*	*sp.*	Single Cell	12000	120	1440000
Chlorophyceae	*Oocystis*	*sp.*	Colony	2000	4500	9000000
Chlorophyceae	*Pediastrum*	*privum*	Colony	12000	450	5400000
Chlorophyceae	*Pediastrum*	*tetras*	Colony	6000	200	1200000

Date Printed: February 09, 2017

Lab Number: L1835656-1 **Work Order** L1835656 **Sample Type** PLANKTON

Date Sampled: September 14, 2016 **Submitter:** CLIENT

Sample ID: LA-1

Class	Genus	Species	Unit:	Units/L	Biovolume Unit µm3	Biovolume Total µm3
Chlorophyceae	*Planktosphaeria*	*sp.*	Colony	12000	27000	324000000
Chlorophyceae	*Quadrigula*	*sp.*	Single Cell	24000	180	4320000
Chlorophyceae	*Scenedesmus*	*acuminatus*	Single Cell	4000	160	640000
Chlorophyceae	*Scenedesmus*	*quadricauda*	Single Cell	25000	160	4000000
Chlorophyceae	*Scenedesmus*	*sp.*	Single Cell	37000	160	5920000
Chlorophyceae	*Tetraedron*	*trigonum*	Single Cell	1000	1200	1200000
Chlorophyceae	*Unidentified*		Filament	1000	2500	2500000
Chlorophyceae	*Unidentified*		Single Cell	297000	64	19008000
Chrysophyceae	*Dinobryon*	*bavaricum*	Single Cell	6000	540	3240000
Chrysophyceae	*Dinobryon*	*sp.*	Single Cell	6000	540	3240000
Chrysophyceae	*small chrysophytes*		Single Cell	68000	64	4352000
Cryptophyceae	*Cryptomonas*	*sp.*	Single Cell	19000	6750	128250000
Cryptophyceae	*Unidentified*		Single Cell	74000	324	23976000
Cyanophyceae	*Anabaena*	*sp.*	Filament	16000	4320	69120000
Cyanophyceae	*Aphanocapsa*	*sp.*	Colony	6000	64000	384000000
Cyanophyceae	*Aphanothece*	*sp.*	Colony	1000	216000	216000000
Cyanophyceae	*Gomphosphaeria*	*sp.*	Colony	3000	27000	81000000
Cyanophyceae	*Planktolyngbya*	*sp.*	Filament	4000	720	2880000
Dinophyceae	*Gymnodinium*	*sp.*	Single Cell	3000	15625	46875000
Euglenophyceae	*Trachelomonas*	*sp.*	Single Cell	2000	4500	9000000

Date Printed: February 09, 2017

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(204) 255-9720

Zooplankton Sample Results

Lab Number: L1835656-1 **Work Order** L1835656

Date Sampled: September 14, 2016 **Submitter:** CLIENT *Volume Decanted (mL):* 500
Sample ID: LA-1 *Volume Analyzed (mL):* 10

Phylum	Class	Order	Family	*Genus*	*Species*	Total No. per Sample	Average µm3 Biovolume	Biovolume µm3 per Sample
Rotifera				*Unidentified*		800	9.72E+05	7.78E+08
Crustacea	Branchiopoda	Cladocera	Bosminidae	*Bosmina*	*sp.*	800	1.62E+07	1.30E+10
Crustacea	Branchiopoda	Cladocera	Chydoridae	*Chydorus*	*sp.*	50	1.08E+07	5.40E+08
Crustacea	Branchiopoda	Cladocera	Daphniidae	*Daphnia*	*sp.*	50	4.32E+06	2.16E+08
Crustacea	Branchiopoda	Cladocera	Sididae	*Diaphanosoma*	*sp.*	300	7.26E+07	2.18E+10
Crustacea	Branchiopoda	Cladocera	Holopediidae	*Holopedium*	*sp.*	4600	2.18E+08	1.00E+12
Protozoa	Ciliata	Peritrichida	Epistylidae	*Epistylis*	*sp.*	3800	9.60E+04	3.65E+08
Protozoa	Ciliata			*Unidentified*		600	1.73E+06	1.04E+09
Protozoa	Ciliata	Peritrichida	Vorticellidae	*Vorticella*	*sp.*	10100	2.16E+05	2.18E+09
Crustacea	Copepoda	Cyclopoida	Cyclopidae	*Acanthocyclops*	*sp.*	850	4.86E+07	4.13E+10
Crustacea	Copepoda			*Nauplii*		1800	9.72E+05	1.75E+09
Crustacea	Copepoda	Cyclopoida		*To young to ID*		2600	6.75E+06	1.76E+10
Crustacea	Copepoda	Calanoida		*To young to ID*		100	3.80E+07	3.80E+09
Protozoa	Filosia	Aconchulinida	Euglyphidae	*Euglypha*	*sp.*	200	2.25E+05	4.50E+07

Date Printed: February 09, 2017

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

Zooplankton Sample Results

Lab Number: L1835656-1 **Work Order** L1835656

Date Sampled: September 14, 2016 **Submitter:** CLIENT *Volume Decanted (mL):* 500

Sample ID: LA-1 *Volume Analyzed (mL):* 10

Phylum	Class	Order	Family	*Genus*	*Species*	Total No. per Sample	Average µm3 Biovolume	Biovolume µm3 per Sample
Protozoa	Lobosa	Arcellinida	Arcellidae	*Arcella*	*sp.*	150	5.00E+05	7.50E+07
Protozoa	Lobosa	Arcellinida	Difflugiidae	*Difflugia*	*sp.*	100	8.10E+05	8.10E+07
Rotifera	Monogononta	Flosculariaceae	Conochilidae	*Conochilus*	*sp.*	1000	3.24E+05	3.24E+08
Rotifera	Monogononta	Ploima	Gastropodidae	*Gastropus*	*sp.*	200	4.86E+05	9.72E+07
Rotifera	Monogononta	Ploima	Brachionidae	*Kellicottia*	*longispina*	50	5.40E+05	2.70E+07
Rotifera	Monogononta	Ploima	Brachionidae	*Keratella*	*sp.*	2000	3.24E+05	6.48E+08

Date Printed: February 09, 2017

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

Phytoplankton Sample Results

Lab Number: L1835656-2 **Work Order** L1835656 **Sample Type** PLANKTON

Date Sampled: September 10, 2016 **Submitter:** CLIENT

Sample ID: LA-5

Class	Genus	Species	Unit:	Units/L	Biovolume Unit µ m3	Biovolume Total µ m3
Bacillariophyceae	*Achnanthes*	*sp.*	Single Cell	12000	180	2160000
Bacillariophyceae	*Asterionella*	*formosa*	Single Cell	7000	810	5670000
Bacillariophyceae	*Cyclotella*	*sp.*	Single Cell	6000	500	3000000
Bacillariophyceae	*Fragilaria*	*sp.*	Single Cell	170000	320	54400000
Bacillariophyceae	*Melosira*	*sp.*	Filament	17000	24000	408000000
Bacillariophyceae	*Nitzschia*	*sp.*	Single Cell	2000	640	1280000
Bacillariophyceae	*Rhizosolenia*	*sp.*	Single Cell	37000	540	19980000
Bacillariophyceae	*Synedra*	*sp.*	Single Cell	6000	810	4860000
Bacillariophyceae	*Tabellaria*	*sp.*	Single Cell	7000	1920	13440000
Chlorophyceae	*Crucigenia*	*sp.*	Single Cell	16000	12	192000
Chlorophyceae	*Elakatothrix*	*sp.*	Single Cell	12000	180	2160000
Chlorophyceae	*Monoraphidium*	*sp.*	Single Cell	12000	120	1440000
Chlorophyceae	*Pediastrum*	*Boryanum*	Colony	1000	5000	5000000
Chlorophyceae	*Pediastrum*	*privum*	Colony	6000	450	2700000
Chlorophyceae	*Quadrigula*	*sp.*	Single Cell	8000	180	1440000
Chlorophyceae	*Scenedesmus*	*sp.*	Single Cell	14000	160	2240000
Chlorophyceae	*Spondylosium*	*sp.*	Filament	1000	1000	1000000

Date Printed: February 09, 2017

Lab Number: L1835656-2 **Work Order** L1835656 **Sample Type** PLANKTON

Date Sampled: September 10, 2016 **Submitter:** CLIENT

Sample ID: LA-5

Class	Genus	Species	Unit:	Units/L	Biovolume Unit µm3	Biovolume Total µm3
Chlorophyceae	*Staurastrum*	*sp.*	Single Cell	2000	6750	13500000
Chlorophyceae	*Tetraedron*	*minimum*	Single Cell	1000	256	256000
Chlorophyceae	*Unidentified*		Single Cell	99000	64	6336000
Chrysophyceae	*Bitrichia*	*sp.*	Single Cell	6000	432	2592000
Chrysophyceae	*Dinobryon*	*bavaricum*	Single Cell	43000	540	23220000
Chrysophyceae	*Dinobryon*	*sp.*	Single Cell	31000	540	16740000
Chrysophyceae	*small chrysophytes*		Single Cell	248000	64	15872000
Cryptophyceae	*Cryptomonas*	*sp.*	Single Cell	6000	6750	40500000
Cryptophyceae	*Unidentified*		Single Cell	6000	324	1944000
Cyanophyceae	*Anabaena*	*sp.*	Filament	3000	4320	12960000
Cyanophyceae	*Aphanizomenon*	*sp.*	Filament	5000	2880	14400000
Cyanophyceae	*Aphanothece*	*sp.*	Colony	1000	216000	216000000
Cyanophyceae	*Gomphosphaeria*	*sp.*	Colony	2000	27000	54000000
Cyanophyceae	*Planktolyngbya*	*sp.*	Filament	3000	720	2160000
Cyanophyceae	*Pseudanabaena*	*sp.*	Filament	6000	720	4320000
Dinophyceae	*Gymnodinium*	*sp.*	Single Cell	6000	4500	27000000
Dinophyceae	*Peridinium*	*sp.*	Single Cell	6000	10000	60000000

Date Printed: February 09, 2017

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

Zooplankton Sample Results

Lab Number: L1835656-2 **Work Order** L1835656

Date Sampled: September 10, 2016 **Submitter:** CLIENT *Volume Decanted (mL):* 500
Sample ID: LA-5 *Volume Analyzed (mL):* 20

Phylum	Class	Order	Family	*Genus*	*Species*	Total No. per Sample	Average µm3 Biovolume	Biovolume µm3 per Sample
Rotifera				*Unidentified*		1900	9.72E+05	1.85E+09
Crustacea	Branchiopoda	Cladocera	Bosminidae	*Bosmina*	*sp.*	150	2.27E+07	3.40E+09
Crustacea	Branchiopoda	Cladocera	Chydoridae	*Chydorus*	*sp.*	25	8.06E+06	2.02E+08
Protozoa	Ciliata			*Unidentified*		750	3.24E+05	2.43E+08
Protozoa	Ciliata	Peritrichida	Vorticellidae	*Vorticella*	*sp.*	100	2.16E+05	2.16E+07
Crustacea	Copepoda			*Nauplii*		350	9.72E+05	3.40E+08
Protozoa	Filosia	Aconchulinida	Euglyphidae	*Euglypha*	*sp.*	25	2.25E+05	5.63E+06
Protozoa	Heliozoa	Actinophryida	Actinosphaeridae	*Actinosphaerium*	*sp.*	25	7.29E+05	1.82E+07
Arthropoda	Insecta	Diptera	Chironomidae	*Unidentified*		50	2.59E+06	1.30E+08
Protozoa	Lobosa	Arcellinida	Arcellidae	*Arcella*	*sp.*	25	5.00E+05	1.25E+07
Protozoa	Lobosa	Arcellinida	Difflugiidae	*Difflugia*	*sp.*	100	8.10E+05	8.10E+07
Rotifera	Monogononta	Collothecaceae	Collothecidae	*Collotheca*	*sp.*	25	3.00E+05	7.50E+06
Rotifera	Monogononta	Ploima	Euchlanidae	*Euchlanis*	*sp.*	25	1.20E+07	3.00E+08
Rotifera	Monogononta	Ploima	Gastropodidae	*Gastropus*	*sp.*	275	4.86E+05	1.34E+08

Date Printed: February 09, 2017

ALS Environmental
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Winnipeg, Manitoba R2J 3T4
(204) 255-9720

Zooplankton Sample Results

Lab Number: L1835656-2 **Work Order** L1835656

Date Sampled: September 10, 2016 **Submitter:** CLIENT *Volume Decanted (mL):* 500

Sample ID: LA-5 *Volume Analyzed (mL):* 20

Phylum	Class	Order	Family	*Genus*	*Species*	Total No. per Sample	Average µm3 Biovolume	Biovolume µm3 per Sample
Rotifera	Monogononta	Ploima	Brachionidae	*Kellicottia*	*longispina*	25	5.40E+05	1.35E+07
Rotifera	Monogononta	Ploima	Brachionidae	*Keratella*	*sp.*	2200	3.24E+05	7.13E+08
Rotifera	Monogononta	Ploima	Synchaetidae	*Ploesoma*	*sp.*	25	1.22E+06	3.04E+07
Rotifera	Monogononta	Ploima	Synchaetidae	*Polyarthra*	*sp.*	750	3.24E+05	2.43E+08
Rotifera	Monogononta	Ploima	Trichocercidae	*Trichocerca*	*sp.*	25	2.27E+06	5.67E+07

Date Printed: February 09, 2017

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

Phytoplankton Sample Results

Lab Number: L1835656-3 **Work Order** L1835656 **Sample Type** PLANKTON

Date Sampled: September 13, 2016 **Submitter:** CLIENT

Sample ID: LA-6

Class	Genus	Species	Unit:	Units/L	Biovolume Unit µm3	Biovolume Total µm3
Bacillariophyceae	*Asterionella*	*formosa*	Single Cell	8000	810	6480000
Bacillariophyceae	*Cyclotella*	*sp.*	Single Cell	14000	500	7000000
Bacillariophyceae	*Fragilaria*	*sp.*	Single Cell	90000	320	28800000
Bacillariophyceae	*Melosira*	*sp.*	Filament	25000	16960	424000000
Bacillariophyceae	*Nitzschia*	*sp.*	Single Cell	1000	640	640000
Bacillariophyceae	*Rhizosolenia*	*sp.*	Single Cell	19000	540	10260000
Bacillariophyceae	*Synedra*	*sp.*	Single Cell	7000	810	5670000
Bacillariophyceae	*Tabellaria*	*sp.*	Single Cell	2000	1920	3840000
Chlorophyceae	*Elakatothrix*	*sp.*	Single Cell	6000	180	1080000
Chlorophyceae	*Monoraphidium*	*sp.*	Single Cell	6000	120	720000
Chlorophyceae	*Oocystis*	*sp.*	Colony	4000	2000	8000000
Chlorophyceae	*Quadrigula*	*sp.*	Single Cell	4000	180	720000
Chlorophyceae	*Scenedesmus*	*quadricauda*	Single Cell	25000	160	4000000
Chlorophyceae	*Staurastrum*	*sp.*	Single Cell	1000	6750	6750000
Chlorophyceae	*Staurodesmus*	*sp.*	Single Cell	6000	900	5400000
Chlorophyceae	*Unidentified*		Filament	1000	3000	3000000
Chlorophyceae	*Unidentified*		Single Cell	19000	64	1216000

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Lab Number:	L1835656-3	**Work Order**	L1835656	**Sample Type**	PLANKTON
Date Sampled:	September 13, 2016	**Submitter:**	CLIENT		
Sample ID:	LA-6				

Class	**Genus**	**Species**	**Unit:**	**Units/L**	**Biovolume Unit µm3**	**Biovolume Total µm3**
Chrysophyceae	*Dinobryon*	*bavaricum*	Single Cell	6000	540	3240000
Chrysophyceae	*Dinobryon*	*sp.*	Single Cell	19000	540	10260000
Chrysophyceae	*small chrysophytes*		Single Cell	161000	64	10304000
Cryptophyceae	*Cryptomonas*	*sp.*	Single Cell	2000	6750	13500000
Cryptophyceae	*Unidentified*		Single Cell	12000	324	3888000
Cyanophyceae	*Anabaena*	*sp.*	Filament	10000	4320	43200000
Cyanophyceae	*Aphanizomenon*	*sp.*	Filament	6000	2880	17280000
Cyanophyceae	*Planktolyngbya*	*sp.*	Filament	12000	720	8640000
Cyanophyceae	*Pseudanabaena*	*sp.*	Filament	9000	720	6480000
Dinophyceae	*Peridinium*	*sp.*	Single Cell	6000	10000	60000000

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Zooplankton Sample Results

Lab Number: L1835656-3 **Work Order** L1835656

Date Sampled: September 13, 2016 **Submitter:** CLIENT *Volume Decanted (mL):* 500
Sample ID: LA-6 *Volume Analyzed (mL):* 30

Phylum	Class	Order	Family	Genus	Species	Total No. per Sample	Average µm3 Biovolume	Biovolume µm3 per Sample
Rotifera				*Unidentified*		616.667	1.73E+06	1.07E+09
Crustacea	Branchiopoda	Cladocera	Bosminidae	*Bosmina*	*sp.*	100	9.72E+06	9.72E+08
Crustacea	Branchiopoda	Cladocera	Sididae	*Diaphanosoma*	*sp.*	50	1.73E+07	8.64E+08
Crustacea	Branchiopoda	Cladocera	Holopediidae	*Holopedium*	*sp.*	16.6667	5.53E+07	9.22E+08
Protozoa	Ciliata			*Unidentified*		400	3.24E+05	1.30E+08
Crustacea	Copepoda			*Nauplii*		83.3333	9.72E+05	8.10E+07
Protozoa	Filosia	Aconchulinida	Cyphoderiidae	*Cyphoderia*	*sp.*	33.3333	1.30E+06	4.32E+07
Protozoa	Filosia	Aconchulinida	Euglyphidae	*Euglypha*	*sp.*	33.3333	2.25E+05	7.50E+06
Protozoa	Lobosa	Arcellinida	Arcellidae	*Arcella*	*sp.*	33.3333	5.00E+05	1.67E+07
Protozoa	Lobosa	Arcellinida	Difflugiidae	*Difflugia*	*sp.*	150	8.10E+05	1.22E+08
Rotifera	Monogononta	Collothecaceae	Collothecidae	*Collotheca*	*sp.*	83.3333	3.00E+05	2.50E+07
Rotifera	Monogononta	Flosculariaceae	Conochilidae	*Conochilus*	*sp.*	33.3333	3.24E+05	1.08E+07
Rotifera	Monogononta	Ploima	Gastropodidae	*Gastropus*	*sp.*	516.667	4.86E+05	2.51E+08
Rotifera	Monogononta	Ploima	Brachionidae	*Keratella*	*sp.*	1166.67	3.24E+05	3.78E+08

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Zooplankton Sample Results

Lab Number: L1835656-3 **Work Order** L1835656

Date Sampled: September 13, 2016 **Submitter:** CLIENT *Volume Decanted (mL):* 500
Sample ID: LA-6 *Volume Analyzed (mL):* 30

Phylum	Class	Order	Family	*Genus*	*Species*	Total No. per Sample	Average µm3 Biovolume	Biovolume µm3 per Sample
Rotifera	Monogononta	Ploima	Synchaetidae	*Polyarthra*	*sp.*	300	3.24E+05	9.72E+07

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Phytoplankton Sample Results

Lab Number: L1835656-4 **Work Order** L1835656 **Sample Type** PLANKTON

Date Sampled: September 12, 2016 **Submitter:** CLIENT

Sample ID: LA-7

Class	Genus	Species	Unit:	Units/L	Biovolume Unit µm3	Biovolume Total µm3
Bacillariophyceae	*Cyclotella*	*sp.*	Single Cell	81000	500	40500000
Bacillariophyceae	*Fragilaria*	*sp.*	Single Cell	90000	320	28800000
Bacillariophyceae	*Melosira*	*sp.*	Filament	22000	15680	344960000
Bacillariophyceae	*Nitzschia*	*sigmoidea*	Single Cell	2000	3420	6840000
Bacillariophyceae	*Nitzschia*	*sp.*	Single Cell	2000	640	1280000
Bacillariophyceae	*Rhizosolenia*	*sp.*	Single Cell	6000	540	3240000
Bacillariophyceae	*Synedra*	*sp.*	Single Cell	6000	810	4860000
Bacillariophyceae	*Tabellaria*	*sp.*	Single Cell	13000	1920	24960000
Chlorophyceae	*Botryococcus*	*sp.*	Colony	1000	64000	64000000
Chlorophyceae	*Cosmarium*	*sp.*	Single Cell	6000	500	3000000
Chlorophyceae	*Monoraphidium*	*sp.*	Single Cell	19000	120	2280000
Chlorophyceae	*Pediastrum*	*privum*	Colony	2000	800	1600000
Chlorophyceae	*Spondylosium*	*sp.*	Filament	2000	1000	2000000
Chlorophyceae	*Unidentified*		Single Cell	62000	64	3968000
Chlorophyceae	*Unidentified*		Filament	2000	1500	3000000
Chrysophyceae	*Dinobryon*	*bavaricum*	Single Cell	19000	540	10260000
Chrysophyceae	*Dinobryon*	*sp.*	Single Cell	12000	540	6480000

Date Printed: February 09, 2017

Lab Number: L1835656-4 **Work Order** L1835656 **Sample Type** PLANKTON

Date Sampled: September 12, 2016 **Submitter:** CLIENT

Sample ID: LA-7

Class	Genus	Species	Unit:	Units/L	Biovolume Unit µm3	Biovolume Total µm3
Chrysophyceae	*small chrysophytes*		Single Cell	81000	64	5184000
Cryptophyceae	*Cryptomonas*	*sp.*	Single Cell	37000	6750	249750000
Cyanophyceae	*Anabaena*	*sp.*	Filament	9000	4320	38880000
Cyanophyceae	*Aphanizomenon*	*sp.*	Filament	6000	2880	17280000
Cyanophyceae	*Aphanothece*	*sp.*	Colony	12000	8000	96000000
Cyanophyceae	*Eucapsis*	*sp.*	Single Cell	32000	8	256000
Cyanophyceae	*Oscillatoria*	*sp.*	Filament	1000	5250	5250000
Cyanophyceae	*Planktolyngbya*	*sp.*	Filament	19000	720	13680000
Cyanophyceae	*Pseudanabaena*	*sp.*	Filament	25000	480	12000000
Dinophyceae	*Gymnodinium*	*sp.*	Single Cell	12000	10000	120000000
Dinophyceae	*Peridinium*	*sp.*	Single Cell	1000	10000	10000000
Euglenophyceae	*Trachelomonas*	*sp.*	Single Cell	1000	4500	4500000

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Zooplankton Sample Results

Lab Number: L1835656-4 **Work Order** L1835656

Date Sampled: September 12, 2016 **Submitter:** CLIENT
Sample ID: LA-7

Volume Decanted (mL): 500
Volume Analyzed (mL): 10

Phylum	Class	Order	Family	*Genus*	*Species*	Total No. per Sample	Average µm3 Biovolume	Biovolume µm3 per Sample
Rotifera				*Unidentified*		900	3.24E+05	2.92E+08
Crustacea	Branchiopoda	Cladocera	Chydoridae	*Chydorus*	*sp.*	150	1.35E+07	2.03E+09
Crustacea	Branchiopoda	Cladocera	Sididae	*Diaphanosoma*	*sp.*	50	7.26E+07	3.63E+09
Crustacea	Branchiopoda	Cladocera	Holopediidae	*Holopedium*	*sp.*	800	2.36E+08	1.89E+11
Protozoa	Ciliata	Peritrichida	Epistylidae	*Epistylis*	*sp.*	700	9.60E+04	6.72E+07
Protozoa	Ciliata			*Unidentified*		200	1.73E+06	3.46E+08
Protozoa	Ciliata	Peritrichida	Vorticellidae	*Vorticella*	*sp.*	700	2.16E+05	1.51E+08
Crustacea	Copepoda			*Nauplii*		6300	9.72E+05	6.12E+09
Crustacea	Copepoda	Calanoida	Diaptomidae	*Skistodiaptomus*	*sp.*	650	7.56E+07	4.91E+10
Crustacea	Copepoda	Calanoida		*To young to ID*		1000	1.94E+07	1.94E+10
Crustacea	Copepoda	Cyclopoida		*To young to ID*		2600	6.75E+06	1.76E+10
Euglenozoa	Euglenoidea	Euglenales	Euglenaceae	*Euglena*	*sp.*	100	1.08E+05	1.08E+07
Protozoa	Lobosa	Arcellinida	Arcellidae	*Arcella*	*sp.*	50	5.00E+05	2.50E+07
Protozoa	Lobosa	Arcellinida	Difflugiidae	*Difflugia*	*sp.*	100	8.10E+05	8.10E+07

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Zooplankton Sample Results

Lab Number: L1835656-4 **Work Order** L1835656

Date Sampled: September 12, 2016 **Submitter:** CLIENT
Sample ID: LA-7

Volume Decanted (mL): 500
Volume Analyzed (mL): 10

Phylum	Class	Order	Family	*Genus*	*Species*	Total No. per Sample	Average µm3 Biovolume	Biovolume µm3 per Sample
Rotifera	Monogononta	Flosculariaceae	Conochilidae	*Conochilus*	*sp.*	38800	3.24E+05	1.26E+10
Rotifera	Monogononta	Ploima	Gastropodidae	*Gastropus*	*sp.*	800	4.86E+05	3.89E+08
Rotifera	Monogononta	Ploima	Brachionidae	*Kellicottia*	*longispina*	3800	5.40E+05	2.05E+09
Rotifera	Monogononta	Ploima	Brachionidae	*Keratella*	*sp.*	23900	3.24E+05	7.74E+09
Rotifera	Monogononta	Ploima	Synchaetidae	*Polyarthra*	*sp.*	3700	3.24E+05	1.20E+09
Rotifera	Monogononta	Ploima	Trichocercidae	*Trichocerca*	*sp.*	800	2.92E+06	2.33E+09
Rotifera	Monogononta	Ploima	Trichotriidae	*Trichotria*	*sp.*	100	1.22E+06	1.22E+08

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Phytoplankton Sample Results

Lab Number: L1835656-5 **Work Order** L1835656 **Sample Type** PLANKTON

Date Sampled: September 15, 2016 **Submitter:** CLIENT

Sample ID: LAB-1

Class	Genus	Species	Unit:	Units/L	Biovolume Unit µm3	Biovolume Total µm3
Bacillariophyceae	*Asterionella*	*formosa*	Single Cell	36000	810	29160000
Bacillariophyceae	*Cyclotella*	*sp.*	Single Cell	4000	1800	7200000
Bacillariophyceae	*Melosira*	*sp.*	Filament	23000	24000	552000000
Bacillariophyceae	*Nitzschia*	*sp.*	Single Cell	6000	640	3840000
Bacillariophyceae	*Rhizosolenia*	*sp.*	Single Cell	25000	540	13500000
Bacillariophyceae	*Synedra*	*sp.*	Single Cell	19000	810	15390000
Chlorophyceae	*Crucigenia*	*quadrata*	Single Cell	32000	12	384000
Chlorophyceae	*Crucigenia*	*sp.*	Single Cell	16000	54	864000
Chlorophyceae	*Elakatothrix*	*sp.*	Single Cell	2000	180	360000
Chlorophyceae	*Monoraphidium*	*sp.*	Single Cell	4000	120	480000
Chlorophyceae	*Pediastrum*	*tetras*	Colony	6000	450	2700000
Chlorophyceae	*Quadrigula*	*sp.*	Single Cell	4000	180	720000
Chlorophyceae	*Staurastrum*	*sp.*	Single Cell	2000	6750	13500000
Chlorophyceae	*Tetraedron*	*sp.*	Single Cell	6000	32	192000
Chlorophyceae	*Unidentified*		Single Cell	74000	64	4736000
Chrysophyceae	*Dinobryon*	*bavaricum*	Single Cell	6000	540	3240000
Chrysophyceae	*Dinobryon*	*sp.*	Single Cell	42000	540	22680000

Date Printed: February 09, 2017

Lab Number: L1835656-5 **Work Order** L1835656 **Sample Type** PLANKTON

Date Sampled: September 15, 2016 **Submitter:** CLIENT

Sample ID: LAB-1

Class	Genus	Species	Unit:	Units/L	Biovolume Unit µm3	Biovolume Total µm3
Chrysophyceae	*small chrysophytes*		Single Cell	62000	64	3968000
Cryptophyceae	*Cryptomonas*	*sp.*	Single Cell	56000	12000	672000000
Cryptophyceae	*Unidentified*		Single Cell	50000	324	16200000
Cyanophyceae	*Anabaena*	*sp.*	Filament	8000	6480	51840000
Cyanophyceae	*Aphanizomenon*	*sp.*	Filament	2000	2880	5760000
Cyanophyceae	*Aphanothece*	*sp.*	Colony	2000	27000	54000000
Cyanophyceae	*Gomphosphaeria*	*sp.*	Colony	4000	27000	108000000
Cyanophyceae	*Planktolyngbya*	*sp.*	Filament	17000	960	16320000
Cyanophyceae	*Pseudanabaena*	*sp.*	Filament	2000	480	960000
Dinophyceae	*Gymnodinium*	*sp.*	Single Cell	19000	10000	190000000
Dinophyceae	*Peridinium*	*sp.*	Single Cell	6000	10000	60000000
Euglenophyceae	*Trachelomonas*	*sp.*	Single Cell	7000	4500	31500000

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Zooplankton Sample Results

Lab Number: L1835656-5 **Work Order** L1835656

Date Sampled: September 15, 2016 **Submitter:** CLIENT *Volume Decanted (mL):* 500
Sample ID: LAB-1 *Volume Analyzed (mL):* 10

Phylum	Class	Order	Family	Genus	Species	Total No. per Sample	Average µm3 Biovolume	Biovolume µm3 per Sample
Rotifera				*Unidentified*		6300	9.72E+05	6.12E+09
Crustacea	Branchiopoda	Cladocera	Bosminidae	*Bosmina*	*sp.*	900	1.62E+07	1.46E+10
Crustacea	Branchiopoda	Cladocera	Chydoridae	*Chydorus*	*sp.*	1400	1.08E+07	1.51E+10
Crustacea	Branchiopoda	Cladocera	Daphniidae	*Daphnia*	*sp.*	200	9.60E+06	1.92E+09
Crustacea	Branchiopoda	Cladocera	Holopediidae	*Holopedium*	*sp.*	50	5.53E+07	2.76E+09
Protozoa	Ciliata	Peritrichida	Epistylidae	*Epistylis*	*sp.*	1600	9.60E+04	1.54E+08
Protozoa	Ciliata			*Unidentified*		200	1.73E+06	3.46E+08
Protozoa	Ciliata	Peritrichida	Vorticellidae	*Vorticella*	*sp.*	4600	2.16E+05	9.94E+08
Crustacea	Copepoda			*Nauplii*		4100	9.72E+05	3.99E+09
Crustacea	Copepoda	Calanoida		*To young to ID*		500	1.62E+07	8.10E+09
Crustacea	Copepoda	Cyclopoida		*To young to ID*		1700	6.75E+06	1.15E+10
Arthropoda	Insecta	Diptera	Chironomidae	*Unidentified*		50	2.59E+06	1.30E+08
Protozoa	Lobosa	Arcellinida	Difflugiidae	*Difflugia*	*sp.*	50	8.10E+05	4.05E+07
Rotifera	Monogononta	Ploima	Asplanchnidae	*Asplanchna*	*sp.*	300	9.45E+06	2.84E+09

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Zooplankton Sample Results

Lab Number: L1835656-5 **Work Order** L1835656

Date Sampled: September 15, 2016 **Submitter:** CLIENT *Volume Decanted (mL):* 500
Sample ID: LAB-1 *Volume Analyzed (mL):* 10

Phylum	Class	Order	Family	*Genus*	*Species*	Total No. per Sample	Average µm3 Biovolume	Biovolume µm3 per Sample
Rotifera	Monogononta	Collothecaceae	Collothecidae	*Collotheca*	*sp.*	100	3.00E+05	3.00E+07
Rotifera	Monogononta	Flosculariaceae	Conochilidae	*Conochilus*	*sp.*	1400	3.24E+05	4.54E+08
Rotifera	Monogononta	Ploima	Gastropodidae	*Gastropus*	*sp.*	2100	4.86E+05	1.02E+09
Rotifera	Monogononta	Ploima	Brachionidae	*Kellicottia*	*longispina*	500	5.40E+05	2.70E+08
Rotifera	Monogononta	Ploima	Brachionidae	*Keratella*	*sp.*	5500	3.24E+05	1.78E+09
Rotifera	Monogononta	Ploima	Synchaetidae	*Polyarthra*	*sp.*	1200	6.48E+05	7.78E+08
Rotifera	Monogononta	Ploima	Trichocercidae	*Trichocerca*	*sp.*	1100	9.60E+05	1.06E+09

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Phytoplankton Sample Results

Lab Number: L1835656-6 **Work Order** L1835656 **Sample Type** PLANKTON

Date Sampled: September 21, 2016 **Submitter:** CLIENT

Sample ID: LAB-2

Class	Genus	Species	Unit:	Units/L	Biovolume Unit µm3	Biovolume Total µm3
Bacillariophyceae	*Asterionella*	*formosa*	Single Cell	4000	630	2520000
Bacillariophyceae	*Cyclotella*	*sp.*	Single Cell	12000	500	6000000
Bacillariophyceae	*Melosira*	*sp.*	Filament	16000	21120	337920000
Bacillariophyceae	*Nitzschia*	*sp.*	Single Cell	6000	640	3840000
Bacillariophyceae	*Rhizosolenia*	*sp.*	Single Cell	161000	450	72450000
Bacillariophyceae	*Synedra*	*sp.*	Single Cell	12000	540	6480000
Chlorophyceae	*Elakatothrix*	*sp.*	Single Cell	1000	180	180000
Chlorophyceae	*Monoraphidium*	*sp.*	Single Cell	6000	120	720000
Chlorophyceae	*Pediastrum*	*privum*	Colony	6000	450	2700000
Chlorophyceae	*Unidentified*		Single Cell	31000	64	1984000
Chrysophyceae	*Dinobryon*	*bavaricum*	Single Cell	1000	540	540000
Chrysophyceae	*small chrysophytes*		Single Cell	167000	64	10688000
Cryptophyceae	*Cryptomonas*	*sp.*	Single Cell	68000	12000	816000000
Cryptophyceae	*Unidentified*		Single Cell	56000	324	18144000
Cyanophyceae	*Anabaena*	*sp.*	Filament	1000	1440	1440000
Cyanophyceae	*Aphanizomenon*	*sp.*	Filament	1000	3840	3840000
Cyanophyceae	*Gomphosphaeria*	*sp.*	Colony	2000	27000	54000000

Date Printed: February 09, 2017

Lab Number: L1835656-6 **Work Order** L1835656 **Sample Type** PLANKTON

Date Sampled: September 21, 2016 **Submitter:** CLIENT

Sample ID: LAB-2

Class	Genus	Species	Unit:	Units/L	Biovolume Unit µm3	Biovolume Total µm3
Cyanophyceae	*Planktolyngbya*	*sp.*	Filament	2000	960	1920000
Dinophyceae	*Gymnodinium*	*sp.*	Single Cell	5000	27000	135000000
Dinophyceae	*Peridinium*	*sp.*	Single Cell	2000	18750	37500000
Euglenophyceae	*Trachelomonas*	*sp.*	Single Cell	6000	4500	27000000

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Zooplankton Sample Results

Lab Number: L1835656-6 **Work Order** L1835656

Date Sampled: September 21, 2016 **Submitter:** CLIENT *Volume Decanted (mL):* 500

Sample ID: LAB-2 *Volume Analyzed (mL):* 10

Phylum	Class	Order	Family	Genus	Species	Total No. per Sample	Average µm3 Biovolume	Biovolume µm3 per Sample
Rotifera				*Unidentified*		7300	9.72E+05	7.10E+09
Crustacea	Branchiopoda	Cladocera	Bosminidae	*Bosmina*	*sp.*	1000	1.62E+07	1.62E+10
Crustacea	Branchiopoda	Cladocera	Chydoridae	*Chydorus*	*sp.*	2400	1.08E+07	2.59E+10
Crustacea	Branchiopoda	Cladocera	Daphniidae	*Daphnia*	*sp.*	150	2.59E+07	3.89E+09
Crustacea	Branchiopoda	Cladocera	Holopediidae	*Holopedium*	*sp.*	50	6.91E+07	3.46E+09
Protozoa	Ciliata	Peritrichida	Epistylidae	*Epistylis*	*sp.*	300	9.60E+04	2.88E+07
Protozoa	Ciliata			*Unidentified*		3800	1.73E+06	6.57E+09
Protozoa	Ciliata	Peritrichida	Vorticellidae	*Vorticella*	*sp.*	1900	2.16E+05	4.10E+08
Crustacea	Copepoda			*Nauplii*		5000	9.72E+05	4.86E+09
Crustacea	Copepoda	Cyclopoida		*To young to ID*		3500	6.75E+06	2.36E+10
Crustacea	Copepoda	Calanoida		*To young to ID*		100	1.62E+07	1.62E+09
Protozoa	Filosia	Aconchulinida	Cyphoderiidae	*Cyphoderia*	*sp.*	200	4.32E+05	8.64E+07
Protozoa	Heliozoa	Actinophryida	Actinosphaeridae	*Actinosphaerium*	*sp.*	800	2.16E+05	1.73E+08
Arthropoda	Insecta	Diptera	Chironomidae	*Unidentified*		50	8.55E+07	4.28E+09

Date Printed: February 09, 2017

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

Zooplankton Sample Results

Lab Number: L1835656-6 **Work Order** L1835656

Date Sampled: September 21, 2016 **Submitter:** CLIENT *Volume Decanted (mL):* 500

Sample ID: LAB-2 *Volume Analyzed (mL):* 10

Phylum	Class	Order	Family	*Genus*	*Species*	Total No. per Sample	Average µm3 Biovolume	Biovolume µm3 per Sample
Rotifera	Monogononta	Ploima	Asplanchnidae	*Asplanchna*	*sp.*	800	6.53E+07	5.23E+10
Rotifera	Monogononta	Collothecaceae	Collothecidae	*Collotheca*	*sp.*	500	3.00E+05	1.50E+08
Rotifera	Monogononta	Flosculariaceae	Conochilidae	*Conochilus*	*sp.*	1800	3.24E+05	5.83E+08
Rotifera	Monogononta	Ploima	Gastropodidae	*Gastropus*	*sp.*	6400	4.86E+05	3.11E+09
Rotifera	Monogononta	Ploima	Brachionidae	*Kellicottia*	*longispina*	1100	5.40E+05	5.94E+08
Rotifera	Monogononta	Ploima	Brachionidae	*Keratella*	*sp.*	9900	3.24E+05	3.21E+09
Rotifera	Monogononta	Ploima	Synchaetidae	*Polyarthra*	*sp.*	2700	3.24E+05	8.75E+08
Rotifera	Monogononta	Ploima	Trichocercidae	*Trichocerca*	*sp.*	900	9.60E+05	8.64E+08

Date Printed: February 09, 2017

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L1835656-COFC

COC Number: 14 - 427473

Page 1 of 1

Report To	
Company:	[illegible]
Contact:	[illegible]
Address:	[illegible]
Phone:	[illegible]

Report Format / Distribution	
Select Report Format:	☐ PDF ☐ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☐ Yes ☐ No
☐ Criteria on Report - provide details below if box checked	
Select Distribution:	☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	
Email 2	

Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)		
R	☑	Regular (Standard TAT if received by 3pm)
P	☐	Priority (2-4 business days if received by 3pm)
E	☐	Emergency (1-2 business days if received by 3pm)
E2	☐	Same day or weekend emergency if received by 10am – contact ALS for surcharge.
Specify Date Required for E2,E or P:		

Invoice To		
Same as Report To	☒ Yes	☐ No
Copy of Invoice with Report	☒ Yes	☐ No
Company:		
Contact:		

Invoice Distribution	
Select Invoice Distribution:	☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	
Email 2	

Project Information	
ALS Quote #:	
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
Approver ID:	Cost Center:
GL Account:	Routing Code:
Activity Code:	
Location:	

ALS Lab Work Order # (lab use only)

ALS Contact: | Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Chlorophyll (F)	Zooplankton Community (P)	Phytoplankton Community (P)	Number of Containers
	LA-1	14Sept16		Plankton	X	X	X	3
	[illegible]	10Sept16		↓	↓	↓	↓	3
	[illegible]	13Sept16		↓	↓	↓	↓	3
	[illegible]	12Sept16		↓	↓	↓	↓	3
	LAB-1	15Sept16		↓	↓	↓	↓	5
	LAB-2	21Sept16		↓	↓	↓	↓	3

Drinking Water (DW) Samples[1] (client use)	
Are samples taken from a Regulated DW System?	☐ Yes ☐ No
Are samples for human drinking water use?	☐ Yes ☐ No

Special Instructions / Specify Criteria to add on report (client Use)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice packs Yes ☐ No ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐
INITIAL COOLER TEMPERATURES °C: 4°C
FINAL COOLER TEMPERATURES °C:

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: [signature]	Date: Sept 23/16	Time: 15:30	Received by: [signature]	Date: 9/3/9	Time: 3:30	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION | WHITE - LABORATORY COPY | YELLOW - CLIENT COPY

NA FM 0326e v09 Front/03 October 2013

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

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

EcoMetrix - Denison Mine 2016

Major Taxon	Family	Subfamily/Tribe	Genus/Species	LA-1 #1	LA-1 #2	LA-1 #3
Nematoda						
Microturbellaria						
Hirudinea	Erpobdellidae		*Erpobdella punctata*			
Oligochaeta	Naididae	Tubificinae				3
Oligochaeta	Naididae	Naidinae				
Gastropoda	Lymnaeidae		(i/d)			
Gastropoda	Planorbidae		*Gyraulus*			
Gastropoda	Valvatidae		*Valvata sincera*			
Pelecypoda	Pisidiidae		(i/d)		2	
Pelecypoda	Pisidiidae		*Pisidium*			
Acari - Hydrachnidia			(i/d)			
Acari - Hydrachnidia	Arenuridae		*Arrenurus*			
Acari - Hydrachnidia	Hygrobaetidae		*Hygrobates*			
Acari - Hydrachnidia	Lebertiidae		*Lebertia*			
Acari - Hydrachnidia	Limnesiidae		*Limnesia*			
Acari - Hydrachnidia	Oxidae		*Oxus*			
Acari - Hydrachnidia	Pionidae		*Piona*			
Acari - Hydrachnidia	Unionicolidae		*Unionicola*			
Ostracoda				2	2	
Copepoda-Cyclopoida				1	4	5
Cladocera	Holopedidae		*Holopedium gibberum*	18	1	4
Cladocera	Chydoridae		-			
Cladocera	Chydoridae		*Eurycercus*	1		
Cladocera	Ilyocryptidae		*Ilyocryptus*			
Cladocera	Macrothricidae					
Cladocera	Polyphemidae		*Polyphemus pediculus*	1		
Cladocera	Sididae		*Latona setifera*	1		
Amphipoda	Gammaridae		*Gammarus lacustris*			
Amphipoda	Hyalellidae		*Hyalella azteca*			
Ephemeroptera	Baetiscidae		*Baetisca*			
Ephemeroptera	Caenidae		*Caenis*			
Ephemeroptera	Ephemeridae		*Ephemera*		1	
Ephemeroptera	Ephemeridae		*Hexagenia limbata*			
Trichoptera	Hydroptilidae		*Oxyethira*		1	
Trichoptera	Lepidosomatidae		*Lepidostoma*			
Trichoptera	Leptoceridae		*Mystacides*			
Trichoptera	Leptoceridae		*Oecetis*			
Trichoptera	Molannidae		*Molannodes / Molanna*			
Trichoptera	Phryganeidae		*Agrypnia*			
Megaloptera	Sialidae		*Sialis*			
Diptera	Ceratopogonidae	Ceratopogoninae	*Bezzia*			
Diptera	Ceratopogonidae	Ceratopogoninae	*Probezzia*			
Diptera	Chaoboridae		*Chaoborus*	26	24	18
Diptera	Chironomidae - pupa					
Diptera	Chironomidae	Chironomini	*Chironomus*	12	7	26
Diptera	Chironomidae	Chironomini	*Cladopelma*			
Diptera	Chironomidae	Chironomini	*Cryptochironomus*	1		
Diptera	Chironomidae	Chironomini	*Cryptotendipes*			
Diptera	Chironomidae	Chironomini	*Demicryptochironomus*			
Diptera	Chironomidae	Chironomini	*Dicrotendipes*			
Diptera	Chironomidae	Chironomini	*Endochironomus*			
Diptera	Chironomidae	Chironomini	*Microtendipes*			
Diptera	Chironomidae	Chironomini	*Nilothauma*			
Diptera	Chironomidae	Chironomini	*Parachironomus*			
Diptera	Chironomidae	Chironomini	*Paracladopelma*			
Diptera	Chironomidae	Chironomini	*Polypedilum*		7	
Diptera	Chironomidae	Chironomini	*Stenochironomus*			
Diptera	Chironomidae	Chironomini	*Stictochironomus*			
Diptera	Chironomidae	Chironomini	*Tribelos*			
Diptera	Chironomidae	Pseudochironomini	*Pseudochironomus*			
Diptera	Chironomidae	Tanypodinae	*Ablabesmyia*			
Diptera	Chironomidae	Tanypodinae	*Guttipelopia guttipennis*			
Diptera	Chironomidae	Tanypodinae	*Procladius*	6	20	5
Diptera	Chironomidae	Tanypodinae	*Tanypus*			
Diptera	Chironomidae	Tanypodinae	*Thienemannimyia* gr.			
Diptera	Chironomidae	Tanytarsini	*Cladotanytarsus*			
Diptera	Chironomidae	Tanytarsini	*Corynocera*			
Diptera	Chironomidae	Tanytarsini	*Neostempellina*			
Diptera	Chironomidae	Tanytarsini	*Paratanytarsus*			
Diptera	Chironomidae	Tanytarsini	*Tanytarsus*	2	4	1
Diptera	Chironomidae	Orthocladiinae	*Cricotopus/Orthocladius*			
Diptera	Chironomidae	Orthocladiinae	*Epoicocladius*			
Diptera	Chironomidae	Orthocladiinae	*Heterotanytarsus*			
Diptera	Chironomidae	Orthocladiinae	*Heterotrissocladius*			
Diptera	Chironomidae	Orthocladiinae	*Paracladius*			
Diptera	Chironomidae	Orthocladiinae	*Psectrocladius*			
Diptera	Chironomidae	Diamesinae	*Potthastia longimana* group			
Diptera	Chironomidae	Prodiamesinae	*Monodiamesa*			
Terrestrial						
			Total	***71***	***73***	***62***

EcoMetrix - Denison Mine 2016

Major Taxon	Family	Subfamily/Tribe	Genus/Species	LA-5				
				#1	#2	#3	#4	#5
Nematoda				1		5		
Microturbellaria				1				1
Hirudinea	Erpobdellidae		*Erpobdella punctata*					
Oligochaeta	Naididae	Tubificinae			2			4
Oligochaeta	Naididae	Naidinae		8				
Gastropoda	Lymnaeidae		(i/d)					
Gastropoda	Planorbidae		*Gyraulus*					4
Gastropoda	Valvatidae		*Valvata sincera*					
Pelecypoda	Pisidiidae		(i/d)	8	28	6	3	72
Pelecypoda	Pisidiidae		*Pisidium*	7	10			3
Acari - Hydrachnidia			(i/d)					
Acari - Hydrachnidia	Arenuridae		*Arrenurus*	1				1
Acari - Hydrachnidia	Hygrobaetidae		*Hygrobates*		1			12
Acari - Hydrachnidia	Lebertiidae		*Lebertia*					4
Acari - Hydrachnidia	Limnesiidae		*Limnesia*					
Acari - Hydrachnidia	Oxidae		*Oxus*					
Acari - Hydrachnidia	Pionidae		*Piona*		5	1		
Acari - Hydrachnidia	Unionicolidae		*Unionicola*		2	1	8	
Ostracoda				18	16	20	40	4
Copepoda-Cyclopoida				16	41	32	8	12
Cladocera	Holopedidae		*Holopedium gibberum*					
Cladocera	Chydoridae		-					
Cladocera	Chydoridae		*Eurycercus*	293	54	377	691	82
Cladocera	Ilyocryptidae		*Ilyocryptus*	8			8	
Cladocera	Macrothricidae			225	40	164	152	76
Cladocera	Polyphemidae		*Polyphemus pediculus*					
Cladocera	Sididae		*Latona setifera*			4		8
Amphipoda	Gammaridae		*Gammarus lacustris*					
Amphipoda	Hyalellidae		*Hyalella azteca*					1
Ephemeroptera	Baetiscidae		*Baetisca*					
Ephemeroptera	Caenidae		*Caenis*	39	48	10		28
Ephemeroptera	Ephemeridae		*Ephemera*					19
Ephemeroptera	Ephemeridae		*Hexagenia limbata*		19			
Trichoptera	Hydroptilidae		*Oxyethira*					
Trichoptera	Lepidosomatidae		*Lepidostoma*					
Trichoptera	Leptoceridae		*Mystacides*					4
Trichoptera	Leptoceridae		*Oecetis*					
Trichoptera	Molannidae		*Molannodes / Molanna*					
Trichoptera	Phryganeidae		*Agrypnia*					
Megaloptera	Sialidae		*Sialis*					
Diptera	Ceratopogonidae	Ceratopogoninae	*Bezzia*		1			
Diptera	Ceratopogonidae	Ceratopogoninae	*Probezzia*	2	2	1		3
Diptera	Chaoboridae		*Chaoborus*					
Diptera	Chironomidae - pupa							
Diptera	Chironomidae	Chironomini	*Chironomus*	3		19	51	
Diptera	Chironomidae	Chironomini	*Cladopelma*			2		4
Diptera	Chironomidae	Chironomini	*Cryptochironomus*	8	3	10	21	20
Diptera	Chironomidae	Chironomini	*Cryptotendipes*	1				
Diptera	Chironomidae	Chironomini	*Demicryptochironomus*		3			1
Diptera	Chironomidae	Chironomini	*Dicrotendipes*	1				
Diptera	Chironomidae	Chironomini	*Endochironomus*	2	4			19
Diptera	Chironomidae	Chironomini	*Microtendipes*					
Diptera	Chironomidae	Chironomini	*Nilothauma*		6			
Diptera	Chironomidae	Chironomini	*Parachironomus*	1	2			4
Diptera	Chironomidae	Chironomini	*Paracladopelma*					4
Diptera	Chironomidae	Chironomini	*Polypedilum*	17			1	
Diptera	Chironomidae	Chironomini	*Stenochironomus*			1		
Diptera	Chironomidae	Chironomini	*Stictochironomus*		37	4		141
Diptera	Chironomidae	Chironomini	*Tribelos*					
Diptera	Chironomidae	Pseudochironomini	*Pseudochironomus*					
Diptera	Chironomidae	Tanypodinae	*Ablabesmyia*					4
Diptera	Chironomidae	Tanypodinae	*Guttipelopia guttipennis*					
Diptera	Chironomidae	Tanypodinae	*Procladius*	29	8	15	3	8
Diptera	Chironomidae	Tanypodinae	*Tanypus*					
Diptera	Chironomidae	Tanypodinae	*Thienemannimyia* gr.					
Diptera	Chironomidae	Tanytarsini	*Cladotanytarsus*	2	1	13		1
Diptera	Chironomidae	Tanytarsini	*Corynocera*					
Diptera	Chironomidae	Tanytarsini	*Neostempellina*					
Diptera	Chironomidae	Tanytarsini	*Paratanytarsus*					
Diptera	Chironomidae	Tanytarsini	*Tanytarsus*	41	24	10		27
Diptera	Chironomidae	Orthocladiinae	*Cricotopus/Orthocladius*					
Diptera	Chironomidae	Orthocladiinae	*Epoicocladius*		3			
Diptera	Chironomidae	Orthocladiinae	*Heterotanytarsus*		2			
Diptera	Chironomidae	Orthocladiinae	*Heterotrissocladius*					
Diptera	Chironomidae	Orthocladiinae	*Paracladius*					
Diptera	Chironomidae	Orthocladiinae	*Psectrocladius*		1			
Diptera	Chironomidae	Diamesinae	*Potthastia longimana* group		4			6
Diptera	Chironomidae	Prodiamesinae	*Monodiamesa*		2			
Terrestrial								
			Total	***732***	***369***	***695***	***986***	***577***

EcoMetrix - Denison Mine 2016				LA-6				
Major Taxon	Family	Subfamily/Tribe	Genus/Species	#1	#2	#3	#4	#5
Nematoda				3		4	8	
Microturbellaria								
Hirudinea	Erpobdellidae		*Erpobdella punctata*					
Oligochaeta	Naididae	Tubificinae				1		
Oligochaeta	Naididae	Naidinae				12	24	
Gastropoda	Lymnaeidae		(i/d)					
Gastropoda	Planorbidae		*Gyraulus*					
Gastropoda	Valvatidae		*Valvata sincera*					
Pelecypoda	Pisidiidae		(i/d)	2	22	2	4	10
Pelecypoda	Pisidiidae		*Pisidium*		3	6	6	6
Acari - Hydrachnidia			(i/d)					
Acari - Hydrachnidia	Arenuridae		*Arrenurus*					
Acari - Hydrachnidia	Hygrobaetidae		*Hygrobates*		1	5		2
Acari - Hydrachnidia	Lebertiidae		*Lebertia*					
Acari - Hydrachnidia	Limnesiidae		*Limnesia*					
Acari - Hydrachnidia	Oxidae		*Oxus*					
Acari - Hydrachnidia	Pionidae		*Piona*				6	
Acari - Hydrachnidia	Unionicolidae		*Unionicola*					
Ostracoda				4	8	33	176	26
Copepoda-Cyclopoida				5		8	24	24
Cladocera	Holopedidae		*Holopedium gibberum*					
Cladocera	Chydoridae		-		8	8		32
Cladocera	Chydoridae		*Eurycercus*	155	491	297	761	150
Cladocera	Ilyocryptidae		*Ilyocryptus*	1			16	24
Cladocera	Macrothricidae			4	60	128	136	72
Cladocera	Polyphemidae		*Polyphemus pediculus*					
Cladocera	Sididae		*Latona setifera*	1		8		
Amphipoda	Gammaridae		*Gammarus lacustris*				40	
Amphipoda	Hyalellidae		*Hyalella azteca*					1
Ephemeroptera	Baetiscidae		*Baetisca*					
Ephemeroptera	Caenidae		*Caenis*		7	10	11	171
Ephemeroptera	Ephemeridae		*Ephemera*		1	3	1	
Ephemeroptera	Ephemeridae		*Hexagenia limbata*					
Trichoptera	Hydroptilidae		*Oxyethira*					
Trichoptera	Lepidosomatidae		*Lepidostoma*					
Trichoptera	Leptoceridae		*Mystacides*					
Trichoptera	Leptoceridae		*Oecetis*					1
Trichoptera	Molannidae		*Molannodes / Molanna*					
Trichoptera	Phryganeidae		*Agrypnia*					
Megaloptera	Sialidae		*Sialis*					
Diptera	Ceratopogonidae	Ceratopogoninae	*Bezzia*					
Diptera	Ceratopogonidae	Ceratopogoninae	*Probezzia*					
Diptera	Chaoboridae		*Chaoborus*					
Diptera	Chironomidae - pupa							
Diptera	Chironomidae	Chironomini	*Chironomus*	18	121	4		6
Diptera	Chironomidae	Chironomini	*Cladopelma*			5		1
Diptera	Chironomidae	Chironomini	*Cryptochironomus*	2	9	7	10	14
Diptera	Chironomidae	Chironomini	*Cryptotendipes*					
Diptera	Chironomidae	Chironomini	*Demicryptochironomus*					
Diptera	Chironomidae	Chironomini	*Dicrotendipes*					9
Diptera	Chironomidae	Chironomini	*Endochironomus*					
Diptera	Chironomidae	Chironomini	*Microtendipes*					
Diptera	Chironomidae	Chironomini	*Nilothauma*					
Diptera	Chironomidae	Chironomini	*Parachironomus*					
Diptera	Chironomidae	Chironomini	*Paracladopelma*					
Diptera	Chironomidae	Chironomini	*Polypedilum*	1	16	1		4
Diptera	Chironomidae	Chironomini	*Stenochironomus*					
Diptera	Chironomidae	Chironomini	*Stictochironomus*	1				
Diptera	Chironomidae	Chironomini	*Tribelos*					2
Diptera	Chironomidae	Pseudochironomini	*Pseudochironomus*					
Diptera	Chironomidae	Tanypodinae	*Ablabesmyia*					
Diptera	Chironomidae	Tanypodinae	*Guttipelopia guttipennis*		4			
Diptera	Chironomidae	Tanypodinae	*Procladius*	6	14	11	3	19
Diptera	Chironomidae	Tanypodinae	*Tanypus*					
Diptera	Chironomidae	Tanypodinae	*Thienemannimyia* gr.					
Diptera	Chironomidae	Tanytarsini	*Cladotanytarsus*	5	4	33	65	25
Diptera	Chironomidae	Tanytarsini	*Corynocera*					
Diptera	Chironomidae	Tanytarsini	*Neostempellina*					
Diptera	Chironomidae	Tanytarsini	*Paratanytarsus*					
Diptera	Chironomidae	Tanytarsini	*Tanytarsus*	14	30	8	49	1
Diptera	Chironomidae	Orthocladiinae	*Cricotopus/Orthocladius*					
Diptera	Chironomidae	Orthocladiinae	*Epoicocladius*			2		
Diptera	Chironomidae	Orthocladiinae	*Heterotanytarsus*					
Diptera	Chironomidae	Orthocladiinae	*Heterotrissocladius*					
Diptera	Chironomidae	Orthocladiinae	*Paracladius*					
Diptera	Chironomidae	Orthocladiinae	*Psectrocladius*					
Diptera	Chironomidae	Diamesinae	*Potthastia longimana* group					
Diptera	Chironomidae	Prodiamesinae	*Monodiamesa*					
Terrestrial								
			Total	***222***	***799***	***596***	***1340***	***600***

EcoMetrix - Denison Mine 2016

Major Taxon	Family	Subfamily/Tribe	Genus/Species	LA-7			LA-7A		
				#1	#2	#3	#1	#2	#3
Nematoda								1	
Microturbellaria									
Hirudinea	Erpobdellidae		*Erpobdella punctata*						
Oligochaeta	Naididae	Tubificinae					1		
Oligochaeta	Naididae	Naidinae							
Gastropoda	Lymnaeidae		(i/d)						
Gastropoda	Planorbidae		*Gyraulus*						
Gastropoda	Valvatidae		*Valvata sincera*						
Pelecypoda	Pisidiidae		(i/d)	3	1	1			
Pelecypoda	Pisidiidae		*Pisidium*		1				
Acari - Hydrachnidia			(i/d)						
Acari - Hydrachnidia	Arenuridae		*Arrenurus*						
Acari - Hydrachnidia	Hygrobaetidae		*Hygrobates*						
Acari - Hydrachnidia	Lebertiidae		*Lebertia*						
Acari - Hydrachnidia	Limnesiidae		*Limnesia*		1				
Acari - Hydrachnidia	Oxidae		*Oxus*						
Acari - Hydrachnidia	Pionidae		*Piona*						
Acari - Hydrachnidia	Unionicolidae		*Unionicola*	1		1			
Ostracoda				7	17	3		5	
Copepoda-Cyclopoida				4	1	1		14	2
Cladocera	Holopedidae		*Holopedium gibberum*						
Cladocera	Chydoridae		-						
Cladocera	Chydoridae		*Eurycercus*	1	3	6			
Cladocera	Ilyocryptidae		*Ilyocryptus*						
Cladocera	Macrothricidae				2				
Cladocera	Polyphemidae		*Polyphemus pediculus*						
Cladocera	Sididae		*Latona setifera*	2				4	1
Amphipoda	Gammaridae		*Gammarus lacustris*						
Amphipoda	Hyalellidae		*Hyalella azteca*						
Ephemeroptera	Baetiscidae		*Baetisca*						
Ephemeroptera	Caenidae		*Caenis*			1			
Ephemeroptera	Ephemeridae		*Ephemera*						
Ephemeroptera	Ephemeridae		*Hexagenia limbata*						
Trichoptera	Hydroptilidae		*Oxyethira*						
Trichoptera	Lepidosomatidae		*Lepidostoma*						
Trichoptera	Leptoceridae		*Mystacides*						
Trichoptera	Leptoceridae		*Oecetis*						
Trichoptera	Molannidae		*Molannodes / Molanna*						
Trichoptera	Phryganeidae		*Agrypnia*						
Megaloptera	Sialidae		*Sialis*						
Diptera	Ceratopogonidae	Ceratopogoninae	*Bezzia*						
Diptera	Ceratopogonidae	Ceratopogoninae	*Probezzia*						
Diptera	Chaoboridae		*Chaoborus*		1	2	1	1	1
Diptera	Chironomidae - pupa			1					
Diptera	Chironomidae	Chironomini	*Chironomus*	17	106	79	8	48	5
Diptera	Chironomidae	Chironomini	*Cladopelma*						
Diptera	Chironomidae	Chironomini	*Cryptochironomus*	2	2	1	2		3
Diptera	Chironomidae	Chironomini	*Cryptotendipes*						
Diptera	Chironomidae	Chironomini	*Demicryptochironomus*						
Diptera	Chironomidae	Chironomini	*Dicrotendipes*						
Diptera	Chironomidae	Chironomini	*Endochironomus*						
Diptera	Chironomidae	Chironomini	*Microtendipes*						
Diptera	Chironomidae	Chironomini	*Nilothauma*						
Diptera	Chironomidae	Chironomini	*Parachironomus*						
Diptera	Chironomidae	Chironomini	*Paracladopelma*						
Diptera	Chironomidae	Chironomini	*Polypedilum*	9	25	49	8	2	20
Diptera	Chironomidae	Chironomini	*Stenochironomus*						
Diptera	Chironomidae	Chironomini	*Stictochironomus*	1					
Diptera	Chironomidae	Chironomini	*Tribelos*						
Diptera	Chironomidae	Pseudochironomini	*Pseudochironomus*						
Diptera	Chironomidae	Tanypodinae	*Ablabesmyia*						
Diptera	Chironomidae	Tanypodinae	*Guttipelopia guttipennis*						
Diptera	Chironomidae	Tanypodinae	*Procladius*		17	10	18	7	15
Diptera	Chironomidae	Tanypodinae	*Tanypus*						
Diptera	Chironomidae	Tanypodinae	*Thienemannimyia* gr.	6					
Diptera	Chironomidae	Tanytarsini	*Cladotanytarsus*			1			
Diptera	Chironomidae	Tanytarsini	*Corynocera*						
Diptera	Chironomidae	Tanytarsini	*Neostempellina*						
Diptera	Chironomidae	Tanytarsini	*Paratanytarsus*						
Diptera	Chironomidae	Tanytarsini	*Tanytarsus*						1
Diptera	Chironomidae	Orthocladiinae	*Cricotopus/Orthocladius*						
Diptera	Chironomidae	Orthocladiinae	*Epoicocladius*						
Diptera	Chironomidae	Orthocladiinae	*Heterotanytarsus*						
Diptera	Chironomidae	Orthocladiinae	*Heterotrissocladius*						
Diptera	Chironomidae	Orthocladiinae	*Paracladius*	2					
Diptera	Chironomidae	Orthocladiinae	*Psectrocladius*						
Diptera	Chironomidae	Diamesinae	*Potthastia longimana* group						
Diptera	Chironomidae	Prodiamesinae	*Monodiamesa*						
Terrestrial									
			Total	***56***	***177***	***155***	***38***	***82***	***48***

EcoMetrix - Denison Mine 2016									
				LA-8			LA-9		
Major Taxon	Family	Subfamily/Tribe	Genus/Species	#1	#2	#3	#1	#2	#3
Nematoda									
Microturbellaria									
Hirudinea	Erpobdellidae		*Erpobdella punctata*						
Oligochaeta	Naididae	Tubificinae			1		4		
Oligochaeta	Naididae	Naidinae							
Gastropoda	Lymnaeidae		(i/d)						
Gastropoda	Planorbidae		*Gyraulus*						
Gastropoda	Valvatidae		*Valvata sincera*						
Pelecypoda	Pisidiidae		(i/d)		1				1
Pelecypoda	Pisidiidae		*Pisidium*			1	1		
Acari - Hydrachnidia			(i/d)						
Acari - Hydrachnidia	Arenuridae		*Arrenurus*				2		
Acari - Hydrachnidia	Hygrobaetidae		*Hygrobates*						
Acari - Hydrachnidia	Lebertiidae		*Lebertia*						
Acari - Hydrachnidia	Limnesiidae		*Limnesia*			1			
Acari - Hydrachnidia	Oxidae		*Oxus*				1		
Acari - Hydrachnidia	Pionidae		*Piona*				4		
Acari - Hydrachnidia	Unionicolidae		*Unionicola*	1			1		
Ostracoda							13		
Copepoda-Cyclopoida							4	4	1
Cladocera	Holopedidae		*Holopedium gibberum*						
Cladocera	Chydoridae		-						
Cladocera	Chydoridae		*Eurycercus*		1				
Cladocera	Ilyocryptidae		*Ilyocryptus*						
Cladocera	Macrothricidae			1	1				
Cladocera	Polyphemidae		*Polyphemus pediculus*						
Cladocera	Sididae		*Latona setifera*						
Amphipoda	Gammaridae		*Gammarus lacustris*						
Amphipoda	Hyalellidae		*Hyalella azteca*						
Ephemeroptera	Baetiscidae		*Baetisca*						
Ephemeroptera	Caenidae		*Caenis*	1			3		
Ephemeroptera	Ephemeridae		*Ephemera*						
Ephemeroptera	Ephemeridae		*Hexagenia limbata*				3		
Trichoptera	Hydroptilidae		*Oxyethira*						
Trichoptera	Lepidosomatidae		*Lepidostoma*						
Trichoptera	Leptoceridae		*Mystacides*						
Trichoptera	Leptoceridae		*Oecetis*						
Trichoptera	Molannidae		*Molannodes / Molanna*						
Trichoptera	Phryganeidae		*Agrypnia*						
Megaloptera	Sialidae		*Sialis*				1		
Diptera	Ceratopogonidae	Ceratopogoninae	*Bezzia*						
Diptera	Ceratopogonidae	Ceratopogoninae	*Probezzia*				2		
Diptera	Chaoboridae		*Chaoborus*	3	5	6	8	51	41
Diptera	Chironomidae - pupa			1					
Diptera	Chironomidae	Chironomini	*Chironomus*	1	5	8	4	24	45
Diptera	Chironomidae	Chironomini	*Cladopelma*		1			1	
Diptera	Chironomidae	Chironomini	*Cryptochironomus*	2	2	1	3		
Diptera	Chironomidae	Chironomini	*Cryptotendipes*						
Diptera	Chironomidae	Chironomini	*Demicryptochironomus*						
Diptera	Chironomidae	Chironomini	*Dicrotendipes*						
Diptera	Chironomidae	Chironomini	*Endochironomus*		1				
Diptera	Chironomidae	Chironomini	*Microtendipes*						
Diptera	Chironomidae	Chironomini	*Nilothauma*						
Diptera	Chironomidae	Chironomini	*Parachironomus*						
Diptera	Chironomidae	Chironomini	*Paracladopelma*						
Diptera	Chironomidae	Chironomini	*Polypedilum*	10	31	18	5		
Diptera	Chironomidae	Chironomini	*Stenochironomus*						
Diptera	Chironomidae	Chironomini	*Stictochironomus*					1	
Diptera	Chironomidae	Chironomini	*Tribelos*				1		
Diptera	Chironomidae	Pseudochironomini	*Pseudochironomus*						
Diptera	Chironomidae	Tanypodinae	*Ablabesmyia*						
Diptera	Chironomidae	Tanypodinae	*Guttipelopia guttipennis*	1	1				3
Diptera	Chironomidae	Tanypodinae	*Procladius*	16	8	8	59	16	15
Diptera	Chironomidae	Tanypodinae	*Tanypus*						
Diptera	Chironomidae	Tanypodinae	*Thienemannimyia* gr.						
Diptera	Chironomidae	Tanytarsini	*Cladotanytarsus*		1		4		
Diptera	Chironomidae	Tanytarsini	*Corynocera*						
Diptera	Chironomidae	Tanytarsini	*Neostempellina*						
Diptera	Chironomidae	Tanytarsini	*Paratanytarsus*						
Diptera	Chironomidae	Tanytarsini	*Tanytarsus*	1			15		1
Diptera	Chironomidae	Orthocladiinae	*Cricotopus/Orthocladius*	1					
Diptera	Chironomidae	Orthocladiinae	*Epoicocladius*						
Diptera	Chironomidae	Orthocladiinae	*Heterotanytarsus*						
Diptera	Chironomidae	Orthocladiinae	*Heterotrissocladius*						
Diptera	Chironomidae	Orthocladiinae	*Paracladius*						
Diptera	Chironomidae	Orthocladiinae	*Psectrocladius*						
Diptera	Chironomidae	Diamesinae	*Potthastia longimana* group				1		
Diptera	Chironomidae	Prodiamesinae	*Monodiamesa*						
Terrestrial									1
			Total	***39***	***59***	***43***	***139***	***97***	***108***

EcoMetrix - Denison Mine 2016

Major Taxon	Family	Subfamily/Tribe	Genus/Species	LB-3			LAB-1		
				#1	#2	#3	#1	#2	#3
Nematoda							9	3	
Microturbellaria									1
Hirudinea	Erpobdellidae		*Erpobdella punctata*				1		
Oligochaeta	Naididae	Tubificinae		25	9	77	14	45	41
Oligochaeta	Naididae	Naidinae		3			20	3	
Gastropoda	Lymnaeidae		(i/d)						
Gastropoda	Planorbidae		*Gyraulus*						
Gastropoda	Valvatidae		*Valvata sincera*	1					
Pelecypoda	Pisidiidae		(i/d)	6	51	12	34	21	14
Pelecypoda	Pisidiidae		*Pisidium*	2	17	12	13	6	4
Acari - Hydrachnidia			(i/d)		8		1		
Acari - Hydrachnidia	Arenuridae		*Arrenurus*						
Acari - Hydrachnidia	Hygrobaetidae		*Hygrobates*						
Acari - Hydrachnidia	Lebertiidae		*Lebertia*						
Acari - Hydrachnidia	Limnesiidae		*Limnesia*						
Acari - Hydrachnidia	Oxidae		*Oxus*						
Acari - Hydrachnidia	Pionidae		*Piona*		8		1	1	1
Acari - Hydrachnidia	Unionicolidae		*Unionicola*			1	1	2	1
Ostracoda				1	8		4	1	1
Copepoda-Cyclopoida				8		4	2	11	14
Cladocera	Holopedidae		*Holopedium gibberum*						
Cladocera	Chydoridae		-						
Cladocera	Chydoridae		*Eurycercus*		8				
Cladocera	Ilyocryptidae		*Ilyocryptus*					1	
Cladocera	Macrothricidae				8		2		
Cladocera	Polyphemidae		*Polyphemus pediculus*						
Cladocera	Sididae		*Latona setifera*	2				1	
Amphipoda	Gammaridae		*Gammarus lacustris*						
Amphipoda	Hyalellidae		*Hyalella azteca*						
Ephemeroptera	Baetiscidae		*Baetisca*						
Ephemeroptera	Caenidae		*Caenis*		1				
Ephemeroptera	Ephemeridae		*Ephemera*						
Ephemeroptera	Ephemeridae		*Hexagenia limbata*						
Trichoptera	Hydroptilidae		*Oxyethira*						
Trichoptera	Lepidosomatidae		*Lepidostoma*						
Trichoptera	Leptoceridae		*Mystacides*						
Trichoptera	Leptoceridae		*Oecetis*						
Trichoptera	Molannidae		*Molannodes / Molanna*				1		
Trichoptera	Phryganeidae		*Agrypnia*						
Megaloptera	Sialidae		*Sialis*			1			
Diptera	Ceratopogonidae	Ceratopogoninae	*Bezzia*						
Diptera	Ceratopogonidae	Ceratopogoninae	*Probezzia*						
Diptera	Chaoboridae		*Chaoborus*	80	14	14			1
Diptera	Chironomidae - pupa								
Diptera	Chironomidae	Chironomini	*Chironomus*	16	17	46	3	35	54
Diptera	Chironomidae	Chironomini	*Cladopelma*	6	9		32	3	9
Diptera	Chironomidae	Chironomini	*Cryptochironomus*		3	2	2	1	5
Diptera	Chironomidae	Chironomini	*Cryptotendipes*						
Diptera	Chironomidae	Chironomini	*Demicryptochironomus*						
Diptera	Chironomidae	Chironomini	*Dicrotendipes*		30		8		
Diptera	Chironomidae	Chironomini	*Endochironomus*						
Diptera	Chironomidae	Chironomini	*Microtendipes*				7		
Diptera	Chironomidae	Chironomini	*Nilothauma*						
Diptera	Chironomidae	Chironomini	*Parachironomus*				2		
Diptera	Chironomidae	Chironomini	*Paracladopelma*						
Diptera	Chironomidae	Chironomini	*Polypedilum*	15	18	3	34	3	14
Diptera	Chironomidae	Chironomini	*Stenochironomus*						
Diptera	Chironomidae	Chironomini	*Stictochironomus*					1	
Diptera	Chironomidae	Chironomini	*Tribelos*		1		1		
Diptera	Chironomidae	Pseudochironomini	*Pseudochironomus*						
Diptera	Chironomidae	Tanypodinae	*Ablabesmyia*						
Diptera	Chironomidae	Tanypodinae	*Guttipelopia guttipennis*	2				1	
Diptera	Chironomidae	Tanypodinae	*Procladius*	43	114	44	12	21	12
Diptera	Chironomidae	Tanypodinae	*Tanypus*			2			
Diptera	Chironomidae	Tanypodinae	*Thienemannimyia* gr.						
Diptera	Chironomidae	Tanytarsini	*Cladotanytarsus*		8		58	1	3
Diptera	Chironomidae	Tanytarsini	*Corynocera*		1286	3			
Diptera	Chironomidae	Tanytarsini	*Neostempellina*						
Diptera	Chironomidae	Tanytarsini	*Paratanytarsus*				1		
Diptera	Chironomidae	Tanytarsini	*Tanytarsus*	2	140	5	106	12	18
Diptera	Chironomidae	Orthocladiinae	*Cricotopus/Orthocladius*						
Diptera	Chironomidae	Orthocladiinae	*Epoicocladius*						
Diptera	Chironomidae	Orthocladiinae	*Heterotanytarsus*						
Diptera	Chironomidae	Orthocladiinae	*Heterotrissocladius*						
Diptera	Chironomidae	Orthocladiinae	*Paracladius*						
Diptera	Chironomidae	Orthocladiinae	*Psectrocladius*				1		
Diptera	Chironomidae	Diamesinae	*Potthastia longimana* group						
Diptera	Chironomidae	Prodiamesinae	*Monodiamesa*						
Terrestrial									
			Total	***212***	***1758***	***226***	***370***	***173***	***193***

EcoMetrix - Denison Mine 2016						
				LAB-2		
Major Taxon	Family	Subfamily/Tribe	Genus/Species	#1	#2	#3
Nematoda				7	2	9
Microturbellaria						
Hirudinea	Erpobdellidae		*Erpobdella punctata*			
Oligochaeta	Naididae	Tubificinae		5	5	1
Oligochaeta	Naididae	Naidinae				
Gastropoda	Lymnaeidae		(i/d)			1
Gastropoda	Planorbidae		*Gyraulus*			
Gastropoda	Valvatidae		*Valvata sincera*			
Pelecypoda	Pisidiidae		(i/d)	13	32	40
Pelecypoda	Pisidiidae		*Pisidium*	5	6	14
Acari - Hydrachnidia			(i/d)			
Acari - Hydrachnidia	Arenuridae		*Arrenurus*			
Acari - Hydrachnidia	Hygrobaetidae		*Hygrobates*	2	4	
Acari - Hydrachnidia	Lebertiidae		*Lebertia*			
Acari - Hydrachnidia	Limnesiidae		*Limnesia*			
Acari - Hydrachnidia	Oxidae		*Oxus*			
Acari - Hydrachnidia	Pionidae		*Piona*	1		1
Acari - Hydrachnidia	Unionicolidae		*Unionicola*		1	
Ostracoda				1		
Copepoda-Cyclopoida				3		4
Cladocera	Holopedidae		*Holopedium gibberum*			
Cladocera	Chydoridae		-			
Cladocera	Chydoridae		*Eurycercus*	3		
Cladocera	Ilyocryptidae		*Ilyocryptus*			
Cladocera	Macrothricidae			4		
Cladocera	Polyphemidae		*Polyphemus pediculus*			
Cladocera	Sididae		*Latona setifera*	2		
Amphipoda	Gammaridae		*Gammarus lacustris*			
Amphipoda	Hyalellidae		*Hyalella azteca*			
Ephemeroptera	Baetiscidae		*Baetisca*		1	
Ephemeroptera	Caenidae		*Caenis*			1
Ephemeroptera	Ephemeridae		*Ephemera*		7	29
Ephemeroptera	Ephemeridae		*Hexagenia limbata*			1
Trichoptera	Hydroptilidae		*Oxyethira*			
Trichoptera	Lepidosomatidae		*Lepidostoma*	1		
Trichoptera	Leptoceridae		*Mystacides*			5
Trichoptera	Leptoceridae		*Oecetis*	2	2	
Trichoptera	Molannidae		*Molannodes / Molanna*	2		
Trichoptera	Phryganeidae		*Agrypnia*	1		
Megaloptera	Sialidae		*Sialis*			
Diptera	Ceratopogonidae	Ceratopogoninae	*Bezzia*			
Diptera	Ceratopogonidae	Ceratopogoninae	*Probezzia*			2
Diptera	Chaoboridae		*Chaoborus*			
Diptera	Chironomidae - pupa					
Diptera	Chironomidae	Chironomini	*Chironomus*	7	1	2
Diptera	Chironomidae	Chironomini	*Cladopelma*			
Diptera	Chironomidae	Chironomini	*Cryptochironomus*	6	5	7
Diptera	Chironomidae	Chironomini	*Cryptotendipes*			
Diptera	Chironomidae	Chironomini	*Demicryptochironomus*			
Diptera	Chironomidae	Chironomini	*Dicrotendipes*	49	53	126
Diptera	Chironomidae	Chironomini	*Endochironomus*			
Diptera	Chironomidae	Chironomini	*Microtendipes*			
Diptera	Chironomidae	Chironomini	*Nilothauma*			1
Diptera	Chironomidae	Chironomini	*Parachironomus*			
Diptera	Chironomidae	Chironomini	*Paracladopelma*			1
Diptera	Chironomidae	Chironomini	*Polypedilum*	1		1
Diptera	Chironomidae	Chironomini	*Stenochironomus*			
Diptera	Chironomidae	Chironomini	*Stictochironomus*	33	23	24
Diptera	Chironomidae	Chironomini	*Tribelos*			
Diptera	Chironomidae	Pseudochironomini	*Pseudochironomus*	1	5	11
Diptera	Chironomidae	Tanypodinae	*Ablabesmyia*	1		
Diptera	Chironomidae	Tanypodinae	*Guttipelopia guttipennis*			
Diptera	Chironomidae	Tanypodinae	*Procladius*	10	3	44
Diptera	Chironomidae	Tanypodinae	*Tanypus*			
Diptera	Chironomidae	Tanypodinae	*Thienemannimyia* gr.			
Diptera	Chironomidae	Tanytarsini	*Cladotanytarsus*	4	1	49
Diptera	Chironomidae	Tanytarsini	*Corynocera*			
Diptera	Chironomidae	Tanytarsini	*Neostempellina*		1	4
Diptera	Chironomidae	Tanytarsini	*Paratanytarsus*			16
Diptera	Chironomidae	Tanytarsini	*Tanytarsus*	23	21	336
Diptera	Chironomidae	Orthocladiinae	*Cricotopus/Orthocladius*			4
Diptera	Chironomidae	Orthocladiinae	*Epoicocladius*			
Diptera	Chironomidae	Orthocladiinae	*Heterotanytarsus*			4
Diptera	Chironomidae	Orthocladiinae	*Heterotrissocladius*	1	4	
Diptera	Chironomidae	Orthocladiinae	*Paracladius*			
Diptera	Chironomidae	Orthocladiinae	*Psectrocladius*	2	2	
Diptera	Chironomidae	Diamesinae	*Potthastia longimana* group	1	3	1
Diptera	Chironomidae	Prodiamesinae	*Monodiamesa*			
Terrestrial						1
			Total	***191***	***182***	***740***

QA/QC – SORTING EFFICIENCY

Site	% sorting efficiency
LA-1 #1	[1-(0/(71+0))]*100 = 100
LA-5 #2	[1-(3/(369+3))]*100 = 99.2
LA-7 #3	[1-(1/(155+1))]*100 = 99.4

Average efficiency – 99.5%

% sorting efficiency = [1-((# in QA/AC re-sort / (# sorted originally + # QA/QC resort))]* 100

Benthic Invertebrate Sample Processing Methods

The field samples (usually three or five for each site) are processed separately. Each sample is divided into the coarse and the fine fractions. The coarse fractions are sorted completely and the fine fractions, if required, are subsampled independently using a modification of the subsampling method (Wrona et al. 1982).

1. Pour sample into sieves (2 mm, 1 mm, 500/250 µm) and wash through well with running water to remove preservative and silt); if there is only small amounts of larger organic material, the 2 mm sieve can be omitted.
2. Transfer the coarse fraction (contents of the 2-mm and 1 mm sieves) into individual container and add 70 % alcohol. Label container with site number and fraction size. Now this fraction is ready for sorting.
3. Transfer the fine fraction (contents of 500/250 µm sieve) into 2-L container for decanting. Add warm water to the 2 L container, swirl and decant water and organic material into the 0.250 mm sieve, repeating until all organic material is washed out of the sand; then scan container under magnifying glass for heavy-shelled or stone-cased animals and pick them out; then discard sand and gravel. Transfer this fine fraction into individual container and add 70 % alcohol. Label container with site number and fraction size. Now this fraction is ready for sorting.

Coarse Fraction

4. Sort out all organisms from the coarse fraction by the "grid method" and place them into properly labeled vials (if there are large numbers of Ephemeroptera, Plecoptera, Trichoptera or any other group place them in a separate vial). The grid method consists of a petri dish with a gridded bottom (1 x 1-cm). Add small amounts of organic material into the petri dish and pick out all benthic invertebrates with fine (#5) forceps under ~ 6 X magnification, proceeding row by row. Once done with a dish, re-mix material and quickly re-scan to catch any animals that were missed.
5. In some situations there is very little organic material in the fine fractions and usually very few organisms, in which case subsampling as described below, is not required for the fine fractions.

Fine Fraction

6. When there is a lot of organic material in the fine fractions and/or large numbers of organisms, a subsampling of the fine fractions is to be done.
7. Pour contents of 0.250-mm fraction container into the Imhoff cone and ensure that all material is transferred from the container. Fill the cone to the 1-L mark with diluted alcohol and allow bubbling for about 5 minutes to ensure thorough mixing. Remove ten 25-ml subsamples from the Imhoff cone with the 25-ml subsampler container and pour into gridded petri dishes (total volume of 250 ml removed). Examine each 25 ml subsample under the microscope (~12 X magnification) and go through each petri dish twice.

8. Generally, the recommended portion to subsample is a minimum of one-quarter (250-ml). However, if very large numbers of organisms are present the following guidelines are provided:
   - if each 25 ml subsample contains 35-50 organisms, then do all ten 25 ml subsamples (total volume of 250 ml),
   - if each 25 ml subsample contains 50-75 organisms, then do eight 25 ml subsamples (total volume of 200 ml),
   - if each 25 ml subsample contains 75-100 organisms, then do five 25 ml subsamples (total volume of 125 ml),
   - if each 25 ml subsample contains 100-150 organisms, then do four 25 ml subsamples (total volume of 100 ml),
   - for samples with very large number of organisms – if each 25 ml subsample contains >150 organisms, contact the project manager for confirmation, prior to doing two 25 ml subsamples (total volume of 50 ml),
   - for samples with very few organisms – if each 25 ml subsample contains less than 35 organisms, then do twenty 25 ml subsamples (total volume 500ml) or whole fine fraction'
9. Place the sorted and the unsorted material from the subsamples into a container for archiving and label them properly.
10. Return all sorted organisms, and archived sorted and unsorted samples to the Project Manager.

Hints on subsampling

Coarse fraction:

If there is a lot of material (takes more than 3-4 h to pick through), add the entire coarse fraction to a petri dish, distribute it evenly, and use an L-shaped piece of plastic to delineate a quarter of the dish and remove a quarter of the coarse fraction for sorting. The sorted and unsorted detritus should be dried and weighed to determine the exact amount sorted.
Other methods, such as evenly distributing the coarse fraction (after removing the water with a sieve) on a gridded surface (e.g. 4x4 grid) and randomly picking a sufficient number of cells on the grid to add up to ¼ of the sample (4 for this example) are also acceptable. At least 1/4 of the coarse fraction should be sorted.

Fine fraction:

If the amount of material is low, sort the entire fine fraction. If there is a lot of material, subsample it using cone with bubbler (Wrona et al. 1982), method described above. Aim for sorting a minimum of a quarter of the fine fraction, or for removing at least 100 individuals of the dominant animals (at the level of genus or Chironomidae subfamily/tribe). Staining of the fine fraction (with haematoxalin or rose bengal) will improve sorting quality.

Identification

Once the field subsamples have been sorted, they are ready for the identification. All organisms should be identified to the lowest practical taxonomic level (genus or species wherever feasible) using current literature and nomenclature.

Level of taxonomic identification

Group	**Level**
Nematoda	phylum
Oligochaeta	family
Gastropoda	genus/species
Turbellaria	family
Hirudinea	species
Mollusca	genus/species
Hydracarina	leave at this level
Cladocera	leave at this level
Copepoda	order
Ostracoda	leave at this level
Amphipoda	genus
Insecta	genus/species
Terrestrial	leave at this level

The level of taxonomy should be consistent in each major group for all samples from a survey and from survey to survey. Organisms that cannot be identified to the desired level of taxonomic precision should be reported as a separate category (at the finest level of taxonomic resolution possible).

Organisms which require detailed microscopic examination for identification (e.g., Chironomidae) will be mounted onto microscope slides using an appropriate mounting medium (e.g. CMC 10, Canada balsam, Permount, Hohers's). The commonest species may be distinguishable on the basis of gross morphology and may require only a few mounts (5-10) as checks. All rare or less commonly occurring species are mounted for identification.

A reference collection (if required) is prepared of all taxa identified from the samples. These collections are retained for taxonomic verification, ensuring consistent taxonomy and for quality control checks.

Weighing samples (wet biomass)

The coarse and fine fractions of each sample are analyzed separately, and are further subdivided into taxonomic groups (e.g. Ephemeroptera, Plecoptera, Trichoptera, Chironomidae, other Diptera, and other Invertebrates). Excess preservative (70% alcohol) is removed with filter paper. Biomass is then measured on an electronic analytical balance (Mettler ER-182A) with a resolution of 0.01 mg.

Deformities in Chironomidae

Head capsules are removed with a sharpened probe from 125 randomly selected larvae. Heavily sclerotized individuals are cleared in warm 10% KOH, followed by rinsing in distilled water and then 70% ethanol. Head capsules are mounted individually in a mounting medium with the ventral side upwards on a slide. A small paintbrush is used to apply pressure without breaking the cover slip to fully flatten the head capsule. Mentum, mandible teeth and antennae of each individual are examined for abnormal appearance using compound microscope (magnification up to 400X).

Commonly used literature for ID

The taxa were identified using the following references, as appropriate:

Alder, P.H., D.C. Currie, and D. M. Wood. 2004. The Black Flies (Simulidae) of North America. Cornell University Press. 941pp.

Anderson, T., P. S. Cranston, and J. H. Epler (eds). 2013. Chironomidae of the Holarctic Region. Keys and diagnosis – Larvae. Insect Systematics and Evolution. Suppl. 66: 1-573.

Blahnik, R.J., and R. W. Holzenthal. 2006. Revision of the genus *Culoptila*. (Trichoptera: Glossosomatidae). Zootaxa 1233:1-52 (online edition).

Brinkhurst, R.O. 1986. Guide to the freshwater aquatic microdrile oligochaetes of North America. Can. Spec. Publ. Fish. Aquatic Sci. 98: 1-259.

Brooks, A.R., and L.A. Kelton. 1967. Aquatic and semiaquatic Heteroptera of Alberta, Saskatchewen, and Manitoba (Hemiptera). Memoirs of The Entomological Society of Canada, No. 51. 92 pp.

Clifford, H.F. 1991. Aquatic Invertebrates of Alberta. University of Alberta Press, Edmonton, Alberta. 538 pp.

Coffman, W.P., and L.C. Ferrington, Jr. 1996. pp. 635-754, In R.W. Merritt, and K.W.

Cummins (eds). An introduction to the aquatic insects of North America. (3rd ed.). Kendall/Hunt Publishing Company, Dubuque, Iowa. 862 pp.

Edmunds, G.F., Jr., S.L. Jensen, and L. Berner. 1976. The mayflies of North and Central America. University of Minnesota Press, Minneapolis. 330 pp.

Epler J. H. 2001. Identification manual for the larval Chironomidae (Diptera) of North and South Carolina. Special publication SJ2001-SP13. North Carolina Department of Environment and Natural Resources. 176 pp.

Kathman, R.D., and R.O. Brinkhurst. 1998. (Revised May 1999). Guide to the freshwater oligochaetes of North America. Aquatic Resources Center, Thompsons Station, Tennessee. 264pp.

Larson, D.J., Y. Alarie, and R.F. Roughley. 2000. Predaceous diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region with emphasis on the fauna of Canada and Alaska. NRC Res. Press, Ottawa, Ontario. 982pp.

Maschwitz, D.E., and E.F. Cook. 2000. Revision of the Nearctic species of the genus Polypedilum Kieffer (Diptera: Chironomidae) in the Subgenus P. (Polypedilum) Kieffer and P. (Urespedilum) Oyewo and Saether. Ohio Biological Survey Buletin (New Series) Vol. 12. N. 3. 135pp.

Maw, H.E.L., R.G. Foottit, K.G.A. Hamilton, and G.G.E. Scudder. 2000. Checklist of the Hemiptera of Canada and Alaska. NRC Research Press of Canada. 220 pp.

Merritt, R.W., K.W. Cummins, and M.B. Berg (eds). 2008. An introduction to the aquatic insects of North America. (4th ed.). Kendall/Hunt Publishing Company, Dubuque, Iowa. 1158 pp.

McAlpine, J.F., B.V. Peterson, G.E. Shewell, H.J. Teskey, J.R. Vockeroth, and D.M. Wood (cords). 1981. Manual of Nearctic Diptera, Vol. 1. Res. Branch, Agric. Can. Monogr. 28. 674 pp.

McCafferty, W.P., and R.P. Randolph. 1998. Canadian mayflies: A faunistic compendium. Proc. Ent. Soc. Ont. 129: 47-97.

Needham J. G., M.J. Westfall, Jr., and M.J. May. 2000. Dragonflies of North America, revised edition. Scientific Publ., Gainesville, Fl. 939pp.

Oliver, D.R., and M.E. Roussel. 1983. The genera of larval midges of Canada (Diptera: Chironomidae). Part 11. The insects and arachnids of Canada. Biosys. Res. Inst., Ottawa. 263 pp.

Pennak, R.W. 1989. Fresh-water invertebrates of the United States. (3rd ed.). John Wiley & Sons, New York. 628 pp.

Soponis, A.R. 1977. A revision of the Nearctic species of Orthocladius (Orthocladius) Van Der Wulp (Diptera: Chironomidae). Mem. Ent. Soc. Can. 102: 1-187.

Stewart, K.W., and M.W. Oswood. 2006. The Stoneflies (Plecoptera) of Alaska and Western Canada. The Caddis Press, Columbus, Ohia. 325pp.

Stewart, K.W., and B.P. Stark. 2002. Nymphs of North American stonefly genera (Plecoptera), 2nd ed.. The Caddis Press, Columbus, OH. 510 pp.
Tennessen, K. 2007. Odonata larvae of the Pacific Northwest. The Xerces Society for Invertebrate Conservation. 42pp.

Thorp J.H., and A.P. Covich (eds). 2001. Ecology and classification of Noth American freshwater invertaebrates, 2nd ed. Academic Press, San Diego, Ca. 1056 pp.
Wiederholm, T. (ed.). 1983. Chironomidae of the holarctic region. Keys and diagnoses. Part 1. Larvae. Ent. Scand. Suppl. 19: 1-457.

Wiggins, G.B. 1996. Larvae of the North American caddisfly genera (Trichoptera). (2nd ed.). University of Toronto Press, Toronto, Ontario. 457 pp.

Westfall, M.J., Jr., and M.L. May. 1996. Damselflies of North America. Scientific Publishers, Gainesville. 649 pp.

Wrona, F . J. , J. M. Culp, and R. W. Davies.1982. Macroinvertebrate subsampling: a simplified apparatus and approach. *Can. J. Fish. Aquat. Sci.* 39: 1051 - 1054.

Zloty, J. and G. Pritchard. 1997. Larvae and adults of *Ameletus* mayflies (Ephemeroptera: Ameletidae) from Alberta. Can. Ent. 129: 251-289.

Zloty, J., B.J. Sinclair, and G. Pritchard. 2005. Discovered in our backyard: a new genus and species of a new family from the Rocky Mountains of North America (Diptera, Tabanomorpha). Syst. Ent. 30: 248-266.

Sample Sorting and Taxonomic Identification

Benthic invertebrate samples were processed according to standard protocols based on recommendations in Environment Canada (2002) and Gibbons et al. (1993). Benthic invertebrate samples were first washed through a 500-µm sieve to remove the preservative and fine sediments remaining after field sieving. Organic material was separated from inorganic material using elutriation, and the inorganic material was checked for any remaining shelled or cased invertebrates, which were removed and added to the organic material. The entire coarse fractions were sorted. Fine fractions of samples containing large amounts of detritus or large numbers of organisms were subsampled using the device described by Wrona et al. (1982). All remaining material was preserved for random checks of sorting efficiency.

Invertebrates were identified to the levels recommended by Alberta Environment (1990) and Environment Canada (2010, 2012), typically genus for most invertebrates. Damaged organisms and early instar insects were identified to the lowest level possible, generally to family. The most common taxa should be distinguishable based on gross morphology and should require only a few slide mounts (five to ten) for verification. Organisms that required detailed microscopic examination for identification (i.e., Chironomidae and Oligocheata) were mounted on microscope slides using appropriate medium. All rare or less commonly occurring taxa were mounted on microscope slides for identification. Identifications were made using recognized taxonomic keys.

Data were presented as the number of organisms per sample (organisms/sample) for individual taxa. The biomass (if required), in units of milligrams wet weight (mg, ww), for major taxonomic groups was also estimated for each sample and presented in the raw dataset.

As part of the QC program, the re-sorting of benthic sample residues was conducted on 10% of the samples to determine the level of sorting efficiency.

References

AENV (Alberta Environment). 1990. Selected Methods for the Monitoring of Benthic Invertebrates in Alberta Rivers. Environmental Quality Monitoring Branch, Environmental Assessment Division. Edmonton, AB.

Environment Canada. 2002. Revised Guidance for Sample Sorting and Subsampling Protocols for EEM Benthic Invertebrate Community Surveys. National EEM Office, Ottawa, ON, Canada.

Environment Canada. 2010. Pulp and Paper Environmental Effects Monitoring (EEM) Technical Guidance Document. National EEM Office, Ottawa, ON, Canada

Environment Canada. 2012. Metal Mining Technical Guidance for Environmental Effects Monitoring. National EEM Office, Ottawa, ON, Canada.

Gibbons, W.N., M.D. Munn, M.D. Paine and EVS Environmental Consultants. 1993. Guidelines for Monitoring Benthos in Freshwater Environments. Environment Canada. North Vancouver, BC.

Wrona, F.J., J.M. Culp and R.W. Davies. 1982. Macroinvertebrate Subsampling: a Simplified Apparatus and Approach. Canadian Journal of Fisheries and Aquatic Science. 39:1051-1054

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SRC Group # 2016-11425

Nov 24, 2016

EcoMetrix Inc.
6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Karen Petersen

Date Samples Received: Sep-23-2016 Client P.O.: 16-2285

This is a final report.

Lab Section 1 results have been authorized by Keith Gipman QP, Supervisor
Lab Section 2 results have been authorized by Melissa Tackaberry-Syed QP, Supervisor
Lab Section 3 results have been authorized by Pat Moser QP, Supervisor
Lab Sections 4 and 5 results have been authorized by Vicky Snook QP, Supervisor
Lab Section 6 results have been authorized by Marion McConnell QP, Supervisor

QP: Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

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* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

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Attn: Karen Petersen

Date Samples Received: Sep-23-2016

Client P.O.: 16-2285

30554 **09/18/2016 LA-1 (CADDISFLY) *INSECTS***
30555 **09/18/2016 LA-6 (CADDISFLY) *INSECTS***
30556 **09/18/2016 LA-8 (DRAGONFLY) *INSECTS***

Analyte	Units	30554	30555	30556
Lab Section 2 (ICP)				
Aluminum	ug/g	93	140	39
Antimony	ug/g	<0.1	<0.1	<0.1
Arsenic	ug/g	1.8	2.6	0.43
Barium	ug/g	142	167	4.7
Beryllium	ug/g	0.01	0.02	<0.01
Boron	ug/g	4	3	<1
Cadmium	ug/g	0.19	0.25	0.13
Chromium	ug/g	<0.5	<0.5	<0.5
Cobalt	ug/g	0.99	0.68	0.12
Copper	ug/g	7.1	5.3	15
Iron	ug/g	1300	1800	390
Lead	ug/g	0.17	0.33	0.05
Manganese	ug/g	1900	1030	88
Molybdenum	ug/g	0.5	0.6	0.1
Nickel	ug/g	2.7	1.3	0.17
Selenium	ug/g	0.53	0.52	0.91
Silver	ug/g	0.02	0.03	0.12
Strontium	ug/g	10	10	3.6
Thallium	ug/g	<0.05	<0.05	<0.05
Tin	ug/g	<0.05	<0.05	<0.05
Titanium	ug/g	2.6	4.1	1.0
Uranium	ug/g	0.081	0.087	0.012
Vanadium	ug/g	0.4	0.4	0.1
Zinc	ug/g	150	110	91
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.05	<0.02	<0.02
Polonium-210	Bq/g	0.06	0.061	0.06
Radium-226	Bq/g	0.02	0.015	<0.005
Thorium-228	Bq/g	<0.02	<0.009	<0.01
Thorium-230	Bq/g	<0.02	<0.009	<0.01
Thorium-232	Bq/g	<0.02	<0.009	<0.01

SRC Group # 2016-11425

Nov 24, 2016

EcoMetrix Inc.

30554 09/18/2016 LA-1 (CADDISFLY) *INSECTS*
30555 09/18/2016 LA-6 (CADDISFLY) *INSECTS*
30556 09/18/2016 LA-8 (DRAGONFLY) *INSECTS*

Analyte	Units	30554	30555	30556
Lab Section 6 (Misc.)				
Moisture	%	91.29	86.90	84.28

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Results are reported on a dry basis.

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30557 **09/18/2016 LA-9 (DRAGONFLY) *INSECTS***
30558 **09/19/2016 LA-5 (CADDISFLY) *INSECTS***
30559 **09/19/2016 LAB-1 (CADDISFLY) *INSECTS***

Analyte	Units	30557	30558	30559
Lab Section 2 (ICP)				
Aluminum	ug/g	62	120	250
Antimony	ug/g	<0.1	<0.1	<0.1
Arsenic	ug/g	0.68	1.5	0.90
Barium	ug/g	4.8	85	111
Beryllium	ug/g	<0.01	<0.01	0.03
Boron	ug/g	1	1	6
Cadmium	ug/g	0.10	0.18	0.16
Chromium	ug/g	<0.5	0.6	<0.5
Cobalt	ug/g	0.18	0.48	2.0
Copper	ug/g	14	6.3	6.8
Iron	ug/g	500	1000	1800
Lead	ug/g	0.06	0.34	0.16
Manganese	ug/g	57	790	1850
Molybdenum	ug/g	0.2	0.4	1.2
Nickel	ug/g	0.20	0.75	2.3
Selenium	ug/g	1.0	0.50	0.37
Silver	ug/g	0.11	0.06	0.02
Strontium	ug/g	5.3	11	14
Thallium	ug/g	<0.05	<0.05	<0.05
Tin	ug/g	<0.05	<0.05	<0.05
Titanium	ug/g	1.4	3.0	5.6
Uranium	ug/g	0.014	0.062	0.099
Vanadium	ug/g	0.2	0.4	0.7
Zinc	ug/g	92	150	150
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.02	<0.04	0.03
Polonium-210	Bq/g	0.10	0.09	0.06
Radium-226	Bq/g	0.008	0.01	0.02
Thorium-228	Bq/g	<0.01	<0.02	<0.02
Thorium-230	Bq/g	<0.01	<0.02	<0.02
Thorium-232	Bq/g	<0.01	<0.02	<0.02
Lab Section 6 (Misc.)				
Moisture	%	81.94	86.65	89.18

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Nov 24, 2016

EcoMetrix Inc.

30560 **09/20/2016 LA-7 (CADDISFLY) *INSECTS***
30561 **09/20/2016 LA-7A (CADDISFLY) *INSECTS***
30562 **09/21/2016 LAB-2 (CADDISFLY) *INSECTS***

Analyte	Units	30560	30561	30562
Lab Section 2 (ICP)				
Aluminum	ug/g	78	150	220
Antimony	ug/g	<0.1	<0.1	<0.1
Arsenic	ug/g	0.74	1.2	0.81
Barium	ug/g	49	80	164
Beryllium	ug/g	<0.01	0.01	0.01
Boron	ug/g	2	3	7
Cadmium	ug/g	0.13	0.22	0.20
Chromium	ug/g	<0.5	<0.5	<0.5
Cobalt	ug/g	0.16	0.44	3.7
Copper	ug/g	6.9	8.5	6.6
Iron	ug/g	410	1200	1400
Lead	ug/g	0.08	0.20	0.13
Manganese	ug/g	146	385	1710
Molybdenum	ug/g	0.5	0.6	0.7
Nickel	ug/g	0.19	0.85	2.7
Selenium	ug/g	0.50	0.67	0.36
Silver	ug/g	0.05	0.05	0.03
Strontium	ug/g	7.5	11	20
Thallium	ug/g	<0.05	<0.05	<0.05
Tin	ug/g	<0.05	<0.05	<0.05
Titanium	ug/g	3.0	9.1	6.4
Uranium	ug/g	0.023	0.080	0.16
Vanadium	ug/g	0.2	0.5	0.7
Zinc	ug/g	150	160	190
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.04	<0.06	<0.04
Polonium-210	Bq/g	0.08	0.12	0.03
Radium-226	Bq/g	<0.01	<0.01	0.02
Thorium-228	Bq/g	<0.02	<0.03	<0.02
Thorium-230	Bq/g	<0.02	<0.03	<0.02
Thorium-232	Bq/g	<0.02	<0.03	<0.02
Lab Section 6 (Misc.)				
Moisture	%	86.87	89.24	88.94

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SRC Group # 2016-11422

Dec 15, 2016

EcoMetrix Inc.
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Mississauga, ON L5N 2L8
Attn: Karen Petersen

Date Samples Received: Sep-23-2016 Client P.O.: 16-2285

This is a final report.

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Lab Section 3 results have been authorized by Pat Moser QP, Supervisor
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QP: Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

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Dec 15, 2016

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Attn: Karen Petersen

Date Samples Received: Sep-23-2016

Client P.O.: 16-2285

30438 **09/11/2016 WS2-LA-5-T *FISH FLESH***
30439 **09/11/2016 WS2-LA-5-B *FISH BONES***
30440 **09/11/2016 WS3-LA-5-T *FISH FLESH***

Analyte	Units	30438	30439	30440
Lab Section 2 (ICP)				
Aluminum	ug/g	0.8	1.7	0.5
Antimony	ug/g	<0.02	<0.05	<0.02
Arsenic	ug/g	0.04	0.05	0.04
Barium	ug/g	0.17	6.4	0.14
Beryllium	ug/g	<0.002	<0.01	<0.002
Boron	ug/g	<0.2	<0.5	<0.2
Cadmium	ug/g	<0.002	<0.01	<0.002
Chromium	ug/g	<0.1	<0.2	<0.1
Cobalt	ug/g	0.003	0.13	0.002
Copper	ug/g	0.27	1.6	0.40
Iron	ug/g	5.9	6.7	2.4
Lead	ug/g	<0.002	0.09	0.002
Manganese	ug/g	0.16	24	0.12
Mercury	ug/g	0.076	0.03	0.049
Molybdenum	ug/g	<0.02	<0.05	<0.02
Nickel	ug/g	0.02	0.04	0.03
Selenium	ug/g	0.24	0.20	0.20
Silver	ug/g	<0.002	<0.01	<0.002
Strontium	ug/g	0.63	175	0.20
Thallium	ug/g	<0.01	<0.02	<0.01
Tin	ug/g	<0.01	<0.02	<0.01
Titanium	ug/g	0.07	0.04	0.02
Uranium	ug/g	<0.001	<0.01	<0.001
Vanadium	ug/g	<0.02	<0.05	<0.02
Zinc	ug/g	5.4	23	4.9
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	<0.002	<0.001
Polonium-210	Bq/g	0.0006	0.001	0.0010
Radium-226	Bq/g	<0.00009	<0.001	Not Reported
Thorium-230	Bq/g	<0.0002	<0.002	Not Reported

30438 **09/11/2016 WS2-LA-5-T *FISH FLESH***
30439 **09/11/2016 WS2-LA-5-B *FISH BONES***
30440 **09/11/2016 WS3-LA-5-T *FISH FLESH***

Analyte	Units	30438	30439	30440
Lab Section 6 (Misc.)				
Moisture	%	77.42	52.98	78.71

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SRC Group # 2016-11422

Dec 15, 2016

EcoMetrix Inc.

30441 **09/11/2016 WS3-LA-5-B *FISH BONES***
30442 **09/11/2016 WS4-LA-5-T *FISH FLESH***
30443 **09/11/2016 WS4-LA-5-B *FISH BONES***

Analyte	Units	30441	30442	30443
Lab Section 2 (ICP)				
Aluminum	ug/g	0.7	0.9	0.7
Antimony	ug/g	<0.05	<0.02	<0.05
Arsenic	ug/g	0.05	0.03	0.04
Barium	ug/g	8.5	0.03	3.0
Beryllium	ug/g	<0.01	<0.002	<0.01
Boron	ug/g	<0.5	<0.2	<0.5
Cadmium	ug/g	<0.01	<0.002	<0.01
Chromium	ug/g	<0.2	<0.1	<0.2
Cobalt	ug/g	0.17	<0.002	0.06
Copper	ug/g	1.4	0.28	1.2
Iron	ug/g	18	2.6	9.3
Lead	ug/g	0.07	0.002	0.06
Manganese	ug/g	38	0.16	18
Mercury	ug/g	<0.01	0.045	0.03
Molybdenum	ug/g	<0.05	<0.02	<0.05
Nickel	ug/g	0.07	<0.01	<0.02
Selenium	ug/g	0.14	0.28	0.22
Silver	ug/g	<0.01	<0.002	<0.01
Strontium	ug/g	211	0.22	87
Thallium	ug/g	<0.02	<0.01	<0.02
Tin	ug/g	<0.02	<0.01	<0.02
Titanium	ug/g	0.02	<0.01	0.03
Uranium	ug/g	<0.01	<0.001	<0.01
Vanadium	ug/g	<0.05	<0.02	<0.05
Zinc	ug/g	33	4.1	17
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.002	<0.001	<0.002
Polonium-210	Bq/g	0.003	0.0016	0.003
Radium-226	Bq/g	<0.001	<0.00006	<0.001
Thorium-230	Bq/g	<0.002	<0.0001	<0.002
Lab Section 6 (Misc.)				
Moisture	%	51.54	77.93	49.88

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EcoMetrix Inc.

30444 **09/11/2016 WS5-LA-5-T *FISH FLESH***
30445 **09/11/2016 WS5-LA-5-B *FISH BONES***
30446 **09/16/2016 WS1-LA-6-T *FISH FLESH***

Analyte	Units	30444	30445	30446
Lab Section 2 (ICP)				
Aluminum	ug/g	<0.5	1.2	0.9
Antimony	ug/g	<0.02	<0.05	<0.02
Arsenic	ug/g	0.04	0.06	0.05
Barium	ug/g	0.04	6.9	0.02
Beryllium	ug/g	<0.002	<0.01	<0.002
Boron	ug/g	<0.2	<0.5	<0.2
Cadmium	ug/g	<0.002	<0.01	<0.002
Chromium	ug/g	<0.1	<0.2	<0.1
Cobalt	ug/g	0.007	0.14	<0.002
Copper	ug/g	0.42	1.1	0.28
Iron	ug/g	6.2	7.4	2.6
Lead	ug/g	0.002	0.05	0.002
Manganese	ug/g	0.15	35	0.13
Mercury	ug/g	0.028	0.02	0.035
Molybdenum	ug/g	<0.02	<0.05	<0.02
Nickel	ug/g	0.01	0.05	<0.01
Selenium	ug/g	0.25	0.23	0.18
Silver	ug/g	<0.002	<0.01	<0.002
Strontium	ug/g	0.28	190	0.22
Thallium	ug/g	<0.01	<0.02	<0.01
Tin	ug/g	<0.01	<0.02	<0.01
Titanium	ug/g	<0.01	0.04	<0.01
Uranium	ug/g	0.006	<0.01	<0.001
Vanadium	ug/g	<0.02	<0.05	<0.02
Zinc	ug/g	3.9	27	3.2
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	<0.002	<0.001
Polonium-210	Bq/g	0.0010	0.002	0.0014
Radium-226	Bq/g	<0.00008	<0.001	<0.00006
Thorium-230	Bq/g	<0.0002	<0.002	<0.0001
Lab Section 6 (Misc.)				
Moisture	%	76.87	54.23	78.72

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EcoMetrix Inc.

30447 **09/16/2016 WS1-LA-6-B *FISH BONES***
30448 **09/16/2016 WS2-LA-6-T *FISH FLESH***
30449 **09/16/2016 WS2-LA-6-B *FISH BONES***

Analyte	Units	30447	30448	30449
Lab Section 2 (ICP)				
Aluminum	ug/g	1.0	0.6	0.8
Antimony	ug/g	<0.05	<0.02	<0.05
Arsenic	ug/g	0.06	0.02	0.04
Barium	ug/g	5.5	0.05	3.8
Beryllium	ug/g	<0.01	<0.002	<0.01
Boron	ug/g	<0.5	<0.2	<0.5
Cadmium	ug/g	<0.01	<0.002	<0.01
Chromium	ug/g	<0.2	<0.1	<0.2
Cobalt	ug/g	0.12	0.056	0.08
Copper	ug/g	0.93	0.20	0.79
Iron	ug/g	8.1	2.8	4.0
Lead	ug/g	0.04	0.002	0.03
Manganese	ug/g	33	0.09	17
Mercury	ug/g	0.02	0.044	0.03
Molybdenum	ug/g	<0.05	<0.02	<0.05
Nickel	ug/g	0.04	0.08	0.03
Selenium	ug/g	0.17	0.22	0.18
Silver	ug/g	<0.01	<0.002	<0.01
Strontium	ug/g	145	0.20	92
Thallium	ug/g	<0.02	<0.01	<0.02
Tin	ug/g	<0.02	<0.01	<0.02
Titanium	ug/g	0.03	0.01	0.04
Uranium	ug/g	<0.01	<0.001	<0.01
Vanadium	ug/g	<0.05	<0.02	<0.05
Zinc	ug/g	21	4.3	16
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.002	<0.001	<0.002
Polonium-210	Bq/g	0.003	0.0018	0.002
Radium-226	Bq/g	<0.001	<0.00006	<0.001
Thorium-230	Bq/g	<0.002	<0.0001	<0.002
Lab Section 6 (Misc.)				
Moisture	%	52.83	78.09	52.82

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EcoMetrix Inc.

30450 **09/16/2016 WS3-LA-6-T *FISH FLESH***
30451 **09/16/2016 WS3-LA-6-B *FISH BONES***
30452 **09/16/2016 WS4-LA-6-T *FISH FLESH***

Analyte	Units	30450	30451	30452
Lab Section 2 (ICP)				
Aluminum	ug/g	0.6	0.9	0.7
Antimony	ug/g	<0.02	<0.05	<0.02
Arsenic	ug/g	0.06	0.07	0.04
Barium	ug/g	0.05	4.8	0.04
Beryllium	ug/g	<0.002	<0.01	<0.002
Boron	ug/g	<0.2	<0.5	<0.2
Cadmium	ug/g	<0.002	<0.01	<0.002
Chromium	ug/g	<0.1	<0.2	<0.1
Cobalt	ug/g	0.027	0.06	0.006
Copper	ug/g	0.24	0.84	0.38
Iron	ug/g	1.7	16	3.1
Lead	ug/g	<0.002	0.02	<0.002
Manganese	ug/g	0.28	18	0.11
Mercury	ug/g	0.024	0.02	0.070
Molybdenum	ug/g	<0.02	<0.05	<0.02
Nickel	ug/g	0.04	<0.02	<0.01
Selenium	ug/g	0.24	0.22	0.21
Silver	ug/g	<0.002	<0.01	<0.002
Strontium	ug/g	0.68	132	0.12
Thallium	ug/g	<0.01	<0.02	<0.01
Tin	ug/g	<0.01	<0.02	<0.01
Titanium	ug/g	<0.01	0.03	0.01
Uranium	ug/g	<0.001	<0.01	<0.001
Vanadium	ug/g	<0.02	<0.05	<0.02
Zinc	ug/g	3.0	21	3.9
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	<0.002	<0.001
Polonium-210	Bq/g	0.0008	0.002	0.0011
Radium-226	Bq/g	Not Reported	<0.001	<0.0001
Thorium-230	Bq/g	Not Reported	<0.002	<0.0002
Lab Section 6 (Misc.)				
Moisture	%	77.90	51.77	77.48

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30453 **09/16/2016 WS4-LA-6-B *FISH BONES***
30454 **09/16/2016 WS5-LA-6-T *FISH FLESH***
30455 **09/16/2016 WS5-LA-6-B *FISH BONES***

Analyte	Units	30453	30454	30455
Lab Section 2 (ICP)				
Aluminum	ug/g	0.9	0.6	0.8
Antimony	ug/g	<0.05	<0.02	<0.05
Arsenic	ug/g	0.05	0.06	0.05
Barium	ug/g	3.8	0.05	3.6
Beryllium	ug/g	<0.01	<0.002	<0.01
Boron	ug/g	<0.5	<0.2	<0.5
Cadmium	ug/g	<0.01	<0.002	<0.01
Chromium	ug/g	<0.2	<0.1	<0.2
Cobalt	ug/g	0.10	0.021	0.10
Copper	ug/g	0.73	0.42	0.77
Iron	ug/g	4.9	2.6	9.7
Lead	ug/g	0.02	0.003	0.03
Manganese	ug/g	26	0.22	27
Mercury	ug/g	0.02	0.025	0.03
Molybdenum	ug/g	<0.05	<0.02	<0.05
Nickel	ug/g	0.03	0.03	0.02
Selenium	ug/g	0.15	0.20	0.18
Silver	ug/g	<0.01	<0.002	<0.01
Strontium	ug/g	100	0.40	126
Thallium	ug/g	<0.02	<0.01	<0.02
Tin	ug/g	<0.02	<0.01	<0.02
Titanium	ug/g	0.04	<0.01	0.05
Uranium	ug/g	<0.01	<0.001	<0.01
Vanadium	ug/g	<0.05	<0.02	<0.05
Zinc	ug/g	16	3.9	16
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.002	<0.001	<0.002
Polonium-210	Bq/g	0.004	0.0015	0.004
Radium-226	Bq/g	<0.001	<0.00008	<0.001
Thorium-230	Bq/g	<0.002	<0.0002	0.003
Lab Section 6 (Misc.)				
Moisture	%	52.58	76.16	51.17

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N/R- Results not reported due to equipment failure.

SRC Group # 2016-11422

Dec 15, 2016

EcoMetrix Inc.

30456 **09/16/2016 NP1-LA-6T *FISH FLESH***
30457 **09/16/2016 NP1-LA-6B *FISH BONES***
30458 **09/16/2016 NP2-LA-6T *FISH FLESH***

Analyte	Units	30456	30457	30458
Lab Section 2 (ICP)				
Aluminum	ug/g	0.7	1.5	1.0
Antimony	ug/g	<0.02	<0.05	<0.02
Arsenic	ug/g	<0.01	<0.02	<0.01
Barium	ug/g	0.07	6.8	0.04
Beryllium	ug/g	<0.002	<0.01	<0.002
Boron	ug/g	<0.2	<0.5	<0.2
Cadmium	ug/g	<0.002	<0.01	<0.002
Chromium	ug/g	<0.1	<0.2	<0.1
Cobalt	ug/g	<0.002	0.13	<0.002
Copper	ug/g	0.23	0.63	0.16
Iron	ug/g	2.4	6.8	1.6
Lead	ug/g	0.004	0.03	0.002
Manganese	ug/g	0.23	13	0.10
Mercury	ug/g	0.074	0.03	0.18
Molybdenum	ug/g	<0.02	<0.05	<0.02
Nickel	ug/g	<0.01	0.09	<0.01
Selenium	ug/g	0.20	0.16	0.21
Silver	ug/g	<0.002	<0.01	<0.002
Strontium	ug/g	0.75	125	0.13
Thallium	ug/g	<0.01	<0.02	<0.01
Tin	ug/g	<0.01	<0.02	<0.01
Titanium	ug/g	0.02	0.04	0.01
Uranium	ug/g	0.002	<0.01	<0.001
Vanadium	ug/g	<0.02	<0.05	<0.02
Zinc	ug/g	4.1	56	4.0
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	<0.002	<0.001
Polonium-210	Bq/g	0.0026	0.002	0.0006
Radium-226	Bq/g	Not Reported	<0.001	<0.00009
Thorium-230	Bq/g	Not Reported	<0.002	<0.0002
Lab Section 6 (Misc.)				
Moisture	%	78.84	60.92	76.52

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Note for Sample # 30456
This sample was reanalyzed for Polonium 210. Reanalysis confirmed original results within the expected measurement uncertainty.

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30459 **09/16/2016 NP2-LA-6B *FISH BONES***
30460 **09/16/2016 NP3-LA-6T *FISH FLESH***
30461 **09/16/2016 NP3-LA-6B *FISH BONES***

Analyte	Units	30459	30460	30461
Lab Section 2 (ICP)				
Aluminum	ug/g	0.8	0.7	0.9
Antimony	ug/g	<0.05	<0.02	<0.05
Arsenic	ug/g	0.02	<0.01	0.02
Barium	ug/g	5.8	0.02	2.9
Beryllium	ug/g	<0.01	<0.002	<0.01
Boron	ug/g	<0.5	<0.2	<0.5
Cadmium	ug/g	<0.01	<0.002	<0.01
Chromium	ug/g	<0.2	<0.1	<0.2
Cobalt	ug/g	0.08	<0.002	0.04
Copper	ug/g	0.57	0.15	0.55
Iron	ug/g	3.6	1.5	3.9
Lead	ug/g	0.02	<0.002	0.02
Manganese	ug/g	9.2	0.08	6.0
Mercury	ug/g	0.03	0.30	0.08
Molybdenum	ug/g	<0.05	<0.02	<0.05
Nickel	ug/g	<0.02	<0.01	<0.02
Selenium	ug/g	0.13	0.23	0.16
Silver	ug/g	<0.01	<0.002	<0.01
Strontium	ug/g	111	0.09	50
Thallium	ug/g	<0.02	<0.01	<0.02
Tin	ug/g	<0.02	<0.01	<0.02
Titanium	ug/g	0.04	0.01	0.06
Uranium	ug/g	<0.01	<0.001	<0.01
Vanadium	ug/g	<0.05	<0.02	<0.05
Zinc	ug/g	38	3.1	36
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.002	<0.001	<0.002
Polonium-210	Bq/g	0.0006	0.0006	0.002
Radium-226	Bq/g	<0.001	<0.00007	<0.001
Thorium-230	Bq/g	<0.002	<0.0001	<0.003
Lab Section 6 (Misc.)				
Moisture	%	51.27	77.83	50.86

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N/R- Results not reported due to equipment failure.

30462 **09/16/2016 NP4-LA-6T *FISH FLESH***
30463 **09/16/2016 NP4-LA-6B *FISH BONES***
30464 **09/16/2016 NP5-LA-6T *FISH FLESH***

Analyte	Units	30462	30463	30464
Lab Section 2 (ICP)				
Aluminum	ug/g	0.9	0.9	1.1
Antimony	ug/g	<0.02	<0.05	<0.02
Arsenic	ug/g	<0.01	0.03	<0.01
Barium	ug/g	0.07	5.2	0.01
Beryllium	ug/g	<0.002	<0.01	<0.002
Boron	ug/g	<0.2	<0.5	<0.2
Cadmium	ug/g	<0.002	<0.01	<0.002
Chromium	ug/g	<0.1	<0.2	<0.1
Cobalt	ug/g	<0.002	0.09	<0.002
Copper	ug/g	0.18	0.55	0.15
Iron	ug/g	1.4	3.3	1.5
Lead	ug/g	0.002	0.02	0.002
Manganese	ug/g	0.10	11	0.11
Mercury	ug/g	0.14	0.03	0.30
Molybdenum	ug/g	<0.02	<0.05	<0.02
Nickel	ug/g	<0.01	<0.02	<0.01
Selenium	ug/g	0.20	0.12	0.22
Silver	ug/g	<0.002	<0.01	<0.002
Strontium	ug/g	0.15	109	0.14
Thallium	ug/g	<0.01	<0.02	<0.01
Tin	ug/g	<0.01	<0.02	<0.01
Titanium	ug/g	0.02	0.02	0.02
Uranium	ug/g	<0.001	<0.01	<0.001
Vanadium	ug/g	<0.02	<0.05	<0.02
Zinc	ug/g	3.9	34	4.3
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	<0.002	<0.001
Polonium-210	Bq/g	0.0009	0.0005	0.0008
Radium-226	Bq/g	<0.00007	<0.001	<0.00006
Thorium-230	Bq/g	<0.0001	<0.002	0.0002
Lab Section 6 (Misc.)				
Moisture	%	76.35	54.26	75.48

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N/R- Results not reported due to equipment failure.

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EcoMetrix Inc.

30465 **09/16/2016 NP5-LA-6B *FISH BONES***
30466 **09/17/2016 NP1-LA-1T *FISH FLESH***
30467 **09/17/2016 NP1-LA-1B *FISH BONES***

Analyte	Units	30465	30466	30467
Lab Section 2 (ICP)				
Aluminum	ug/g	1.2	1.0	1.0
Antimony	ug/g	<0.05	<0.02	<0.05
Arsenic	ug/g	0.02	<0.01	0.03
Barium	ug/g	6.2	0.02	4.4
Beryllium	ug/g	<0.01	<0.002	<0.01
Boron	ug/g	<0.5	<0.2	<0.5
Cadmium	ug/g	<0.01	<0.002	<0.01
Chromium	ug/g	<0.2	<0.1	<0.2
Cobalt	ug/g	0.11	<0.002	0.09
Copper	ug/g	0.54	0.16	0.64
Iron	ug/g	4.2	1.9	7.7
Lead	ug/g	0.02	0.003	0.02
Manganese	ug/g	11	0.10	20
Mercury	ug/g	0.04	0.11	0.03
Molybdenum	ug/g	<0.05	<0.02	<0.05
Nickel	ug/g	<0.02	<0.01	0.05
Selenium	ug/g	0.11	0.23	0.16
Silver	ug/g	<0.01	<0.002	<0.01
Strontium	ug/g	128	0.10	118
Thallium	ug/g	<0.02	<0.01	<0.02
Tin	ug/g	<0.02	<0.01	<0.02
Titanium	ug/g	0.05	0.02	0.03
Uranium	ug/g	<0.01	<0.001	<0.01
Vanadium	ug/g	<0.05	<0.02	<0.05
Zinc	ug/g	44	3.5	47
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.002	<0.001	<0.002
Polonium-210	Bq/g	<0.0005	0.0008	<0.0005
Radium-226	Bq/g	<0.001	Not Reported	<0.001
Thorium-230	Bq/g	<0.002	Not Reported	<0.002
Lab Section 6 (Misc.)				
Moisture	%	49.64	77.84	57.41

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N/R- Results not reported due to equipment failure.

SRC Group # 2016-11422

Dec 15, 2016

EcoMetrix Inc.

30468 **09/17/2016 NP2-LA-1T *FISH FLESH***
30469 **09/17/2016 NP2-LA-1B *FISH BONES***
30470 **09/17/2016 NP3-LA-1T *FISH FLESH***

Analyte	Units	30468	30469	30470
Lab Section 2 (ICP)				
Aluminum	ug/g	0.7	1.3	0.8
Antimony	ug/g	<0.02	<0.05	<0.02
Arsenic	ug/g	<0.01	0.03	<0.01
Barium	ug/g	0.10	5.0	0.04
Beryllium	ug/g	<0.002	<0.01	<0.002
Boron	ug/g	<0.2	<0.5	<0.2
Cadmium	ug/g	<0.002	<0.01	<0.002
Chromium	ug/g	<0.1	<0.2	<0.1
Cobalt	ug/g	<0.002	0.07	0.002
Copper	ug/g	0.14	0.82	0.17
Iron	ug/g	2.0	4.8	3.0
Lead	ug/g	<0.002	0.02	<0.002
Manganese	ug/g	0.11	15	0.12
Mercury	ug/g	0.082	0.02	0.25
Molybdenum	ug/g	<0.02	<0.05	<0.02
Nickel	ug/g	<0.01	<0.02	<0.01
Selenium	ug/g	0.20	0.16	0.25
Silver	ug/g	<0.002	<0.01	<0.002
Strontium	ug/g	0.15	118	0.28
Thallium	ug/g	<0.01	<0.02	<0.01
Tin	ug/g	<0.01	<0.02	<0.01
Titanium	ug/g	0.03	0.06	0.04
Uranium	ug/g	<0.001	<0.01	<0.001
Vanadium	ug/g	<0.02	<0.05	<0.02
Zinc	ug/g	3.9	49	9.0
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	<0.002	<0.001
Polonium-210	Bq/g	0.0015	0.001	0.0008
Radium-226	Bq/g	Not Reported	<0.0009	<0.00007
Thorium-230	Bq/g	Not Reported	<0.002	<0.0001
Lab Section 6 (Misc.)				
Moisture	%	79.35	64.52	76.17

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SRC Group # 2016-11422

Dec 15, 2016

EcoMetrix Inc.

30471	**09/17/2016 NP3-LA-1B *FISH BONES***
30472	**09/17/2016 NP4-LA-1T *FISH FLESH***
30473	**09/17/2016 NP4-LA-1B *FISH BONES***

Analyte	Units	30471	30472	30473
Lab Section 2 (ICP)				
Aluminum	ug/g	0.6	<0.5	0.5
Antimony	ug/g	<0.05	<0.02	<0.05
Arsenic	ug/g	<0.02	<0.01	<0.02
Barium	ug/g	4.4	0.03	9.8
Beryllium	ug/g	<0.01	<0.002	<0.01
Boron	ug/g	<0.5	<0.2	<0.5
Cadmium	ug/g	<0.01	<0.002	<0.01
Chromium	ug/g	<0.2	<0.1	<0.2
Cobalt	ug/g	0.10	<0.002	0.11
Copper	ug/g	0.66	0.23	0.50
Iron	ug/g	6.0	6.4	4.9
Lead	ug/g	0.03	<0.002	0.04
Manganese	ug/g	12	0.08	19
Mercury	ug/g	0.06	0.43	0.13
Molybdenum	ug/g	<0.05	<0.02	<0.05
Nickel	ug/g	<0.02	<0.01	<0.02
Selenium	ug/g	0.16	0.20	0.14
Silver	ug/g	<0.01	<0.002	<0.01
Strontium	ug/g	133	0.11	173
Thallium	ug/g	<0.02	<0.01	<0.02
Tin	ug/g	<0.02	<0.01	<0.02
Titanium	ug/g	0.04	0.01	0.02
Uranium	ug/g	<0.01	<0.001	<0.01
Vanadium	ug/g	<0.05	<0.02	<0.05
Zinc	ug/g	43	4.1	60
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.002	<0.001	<0.002
Polonium-210	Bq/g	<0.0005	0.0009	0.001
Radium-226	Bq/g	<0.001	Not Reported	<0.001
Thorium-230	Bq/g	<0.003	Not Reported	<0.002
Lab Section 6 (Misc.)				
Moisture	%	49.44	79.60	56.04

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SRC Group # 2016-11422

Dec 15, 2016

EcoMetrix Inc.

30474 **09/17/2016 NP5-LA-1T *FISH FLESH***
30475 **09/17/2016 NP5-LA-1B *FISH BONES***
30476 **09/19/2016 LA7-NP1-T *FISH FLESH***

Analyte	Units	30474	30475	30476
Lab Section 2 (ICP)				
Aluminum	ug/g	<0.5	<0.5	0.5
Antimony	ug/g	<0.02	<0.05	<0.02
Arsenic	ug/g	<0.01	<0.02	<0.01
Barium	ug/g	<0.01	4.5	0.03
Beryllium	ug/g	<0.002	<0.01	<0.002
Boron	ug/g	<0.2	<0.5	<0.2
Cadmium	ug/g	<0.002	<0.01	<0.002
Chromium	ug/g	<0.1	<0.2	<0.1
Cobalt	ug/g	<0.002	0.07	<0.002
Copper	ug/g	0.18	0.48	0.29
Iron	ug/g	2.7	6.8	3.5
Lead	ug/g	<0.002	0.02	0.004
Manganese	ug/g	0.11	20	0.13
Mercury	ug/g	0.10	0.03	0.18
Molybdenum	ug/g	<0.02	<0.05	<0.02
Nickel	ug/g	<0.01	<0.02	<0.01
Selenium	ug/g	0.24	0.18	0.23
Silver	ug/g	<0.002	<0.01	<0.002
Strontium	ug/g	0.07	97	0.36
Thallium	ug/g	<0.01	<0.02	<0.01
Tin	ug/g	<0.01	<0.02	<0.01
Titanium	ug/g	0.01	0.03	0.02
Uranium	ug/g	<0.001	<0.01	<0.001
Vanadium	ug/g	<0.02	<0.05	<0.02
Zinc	ug/g	6.2	62	5.3
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	<0.002	<0.001
Polonium-210	Bq/g	0.0010	0.0008	0.0012
Radium-226	Bq/g	Not Reported	<0.001	Not Reported
Thorium-230	Bq/g	Not Reported	<0.002	Not Reported
Lab Section 6 (Misc.)				
Moisture	%	77.71	57.64	77.63

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SRC Group # 2016-11422

Dec 15, 2016

EcoMetrix Inc.

30477 **09/19/2016 LA7-NP1-B *FISH BONES***
30478 **09/19/2016 LA7-NP2-T *FISH FLESH***
30479 **09/19/2016 LA7-NP2-B *FISH BONES***

Analyte	Units	30477	30478	30479
Lab Section 2 (ICP)				
Aluminum	ug/g	0.7	<0.5	0.8
Antimony	ug/g	<0.05	<0.02	<0.05
Arsenic	ug/g	<0.02	<0.01	<0.02
Barium	ug/g	4.4	0.02	6.5
Beryllium	ug/g	<0.01	<0.002	<0.01
Boron	ug/g	<0.5	<0.2	<0.5
Cadmium	ug/g	<0.01	<0.002	<0.01
Chromium	ug/g	<0.2	<0.1	0.4
Cobalt	ug/g	0.07	<0.002	0.11
Copper	ug/g	0.43	0.18	0.32
Iron	ug/g	13	2.4	6.9
Lead	ug/g	0.02	<0.002	0.01
Manganese	ug/g	7.8	0.09	9.2
Mercury	ug/g	0.04	0.31	0.07
Molybdenum	ug/g	<0.05	<0.02	<0.05
Nickel	ug/g	<0.02	<0.01	<0.02
Selenium	ug/g	0.13	0.23	0.15
Silver	ug/g	<0.01	<0.002	<0.01
Strontium	ug/g	97	0.07	149
Thallium	ug/g	<0.02	<0.01	<0.02
Tin	ug/g	<0.02	<0.01	<0.02
Titanium	ug/g	0.10	0.02	0.04
Uranium	ug/g	<0.01	<0.001	<0.01
Vanadium	ug/g	<0.05	<0.02	<0.05
Zinc	ug/g	51	5.4	67
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.002	<0.001	<0.002
Polonium-210	Bq/g	0.0008	0.0008	0.0008
Radium-226	Bq/g	<0.001	Not Reported	<0.001
Thorium-230	Bq/g	<0.002	Not Reported	<0.002
Lab Section 6 (Misc.)				
Moisture	%	53.29	77.14	54.40

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SRC Group # 2016-11422

Dec 15, 2016

EcoMetrix Inc.

30480 **09/19/2016 LA7-NP3-T *FISH FLESH***
30481 **09/19/2016 LA7-NP3-B *FISH BONES***
30482 **09/19/2016 LA7-NP4-T *FISH FLESH***

Analyte	Units	30480	30481	30482
Lab Section 2 (ICP)				
Aluminum	ug/g	1.0	0.7	0.7
Antimony	ug/g	<0.02	<0.05	<0.02
Arsenic	ug/g	<0.01	<0.02	<0.01
Barium	ug/g	0.10	4.6	0.07
Beryllium	ug/g	<0.002	<0.01	<0.002
Boron	ug/g	<0.2	<0.5	<0.2
Cadmium	ug/g	<0.002	<0.01	<0.002
Chromium	ug/g	<0.1	<0.2	<0.1
Cobalt	ug/g	<0.002	0.08	<0.002
Copper	ug/g	0.31	0.31	0.20
Iron	ug/g	4.2	4.5	2.2
Lead	ug/g	0.011	0.01	0.010
Manganese	ug/g	0.12	8.6	0.12
Mercury	ug/g	0.14	0.05	0.11
Molybdenum	ug/g	<0.02	<0.05	<0.02
Nickel	ug/g	<0.01	<0.02	<0.01
Selenium	ug/g	0.20	0.13	0.21
Silver	ug/g	<0.002	<0.01	<0.002
Strontium	ug/g	0.20	132	0.12
Thallium	ug/g	<0.01	<0.02	<0.01
Tin	ug/g	<0.01	<0.02	<0.01
Titanium	ug/g	0.03	0.03	0.04
Uranium	ug/g	<0.001	<0.01	<0.001
Vanadium	ug/g	<0.02	<0.05	<0.02
Zinc	ug/g	4.2	70	4.7
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	<0.002	<0.001
Polonium-210	Bq/g	0.0011	0.001	0.0012
Radium-226	Bq/g	<0.00007	<0.001	Not Reported
Thorium-230	Bq/g	<0.0001	<0.002	Not Reported
Lab Section 6 (Misc.)				
Moisture	%	78.03	58.34	76.89

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SRC Group # 2016-11422

Dec 15, 2016

EcoMetrix Inc.

30483 **09/19/2016 LA7-NP4-B *FISH BONES***
30484 **09/19/2016 LA7-NP5-T *FISH FLESH***
30485 **09/19/2016 LA7-NP5-B *FISH BONES***

Analyte	Units	30483	30484	30485
Lab Section 2 (ICP)				
Aluminum	ug/g	0.9	0.6	<0.5
Antimony	ug/g	<0.05	<0.02	<0.05
Arsenic	ug/g	<0.02	<0.01	<0.02
Barium	ug/g	3.4	0.06	4.2
Beryllium	ug/g	<0.01	<0.002	<0.01
Boron	ug/g	<0.5	<0.2	<0.5
Cadmium	ug/g	<0.01	<0.002	<0.01
Chromium	ug/g	<0.2	<0.1	<0.2
Cobalt	ug/g	0.07	<0.002	0.10
Copper	ug/g	0.30	0.21	0.26
Iron	ug/g	3.5	2.5	5.1
Lead	ug/g	0.01	0.004	<0.01
Manganese	ug/g	5.4	0.11	11
Mercury	ug/g	0.03	0.16	0.02
Molybdenum	ug/g	<0.05	<0.02	<0.05
Nickel	ug/g	<0.02	<0.01	<0.02
Selenium	ug/g	0.12	0.21	0.12
Silver	ug/g	<0.01	<0.002	<0.01
Strontium	ug/g	114	0.26	145
Thallium	ug/g	<0.02	<0.01	<0.02
Tin	ug/g	<0.02	<0.01	<0.02
Titanium	ug/g	0.08	0.02	0.05
Uranium	ug/g	<0.01	<0.001	<0.01
Vanadium	ug/g	<0.05	<0.02	<0.05
Zinc	ug/g	31	5.2	85
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.002	<0.001	<0.002
Polonium-210	Bq/g	0.0006	0.0015	0.0006
Radium-226	Bq/g	0.001	<0.00007	0.003
Thorium-230	Bq/g	<0.002	<0.0001	<0.002
Lab Section 6 (Misc.)				
Moisture	%	55.79	76.61	56.39

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SRC Group # 2016-11422

Dec 15, 2016

EcoMetrix Inc.

30486 **09/19/2016 LA7-WS1-T *FISH FLESH***
30487 **09/19/2016 LA7-WS1-B *FISH BONES***
30488 **09/19/2016 LA7-WS2-T *FISH FLESH***

Analyte	Units	30486	30487	30488
Lab Section 2 (ICP)				
Aluminum	ug/g	0.5	0.8	0.5
Antimony	ug/g	<0.02	<0.05	<0.02
Arsenic	ug/g	0.04	0.02	0.05
Barium	ug/g	0.15	3.4	0.12
Beryllium	ug/g	<0.002	<0.01	<0.002
Boron	ug/g	<0.2	<0.5	<0.2
Cadmium	ug/g	<0.002	<0.01	<0.002
Chromium	ug/g	<0.1	<0.2	<0.1
Cobalt	ug/g	<0.002	0.05	<0.002
Copper	ug/g	0.20	0.40	0.50
Iron	ug/g	3.2	6.4	3.6
Lead	ug/g	<0.002	0.01	0.004
Manganese	ug/g	0.15	11	0.33
Mercury	ug/g	0.018	0.01	0.020
Molybdenum	ug/g	<0.02	<0.05	<0.02
Nickel	ug/g	<0.01	<0.02	<0.01
Selenium	ug/g	0.23	0.20	0.22
Silver	ug/g	<0.002	<0.01	<0.002
Strontium	ug/g	0.35	122	0.61
Thallium	ug/g	<0.01	<0.02	<0.01
Tin	ug/g	<0.01	<0.02	<0.01
Titanium	ug/g	0.01	0.04	0.01
Uranium	ug/g	<0.001	<0.01	<0.001
Vanadium	ug/g	<0.02	<0.05	<0.02
Zinc	ug/g	3.3	18	4.9
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	<0.002	0.002
Polonium-210	Bq/g	0.0014	0.004	0.0017
Radium-226	Bq/g	Not Reported	<0.001	<0.00008
Thorium-230	Bq/g	Not Reported	<0.002	<0.0002
Lab Section 6 (Misc.)				
Moisture	%	79.55	56.68	78.34

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SRC Group # 2016-11422

Dec 15, 2016

EcoMetrix Inc.

30489 **09/19/2016 LA7-WS2-B *FISH BONES***
30490 **09/19/2016 LA7-WS3-T *FISH FLESH***
30491 **09/19/2016 LA7-WS3-B *FISH BONES***

Analyte	Units	30489	30490	30491
Lab Section 2 (ICP)				
Aluminum	ug/g	0.8	<0.5	<0.5
Antimony	ug/g	<0.05	<0.02	<0.05
Arsenic	ug/g	0.04	0.05	<0.02
Barium	ug/g	4.3	0.24	5.1
Beryllium	ug/g	<0.01	<0.002	<0.01
Boron	ug/g	<0.5	<0.2	<0.5
Cadmium	ug/g	<0.01	<0.002	<0.01
Chromium	ug/g	<0.2	<0.1	<0.2
Cobalt	ug/g	0.07	<0.002	0.07
Copper	ug/g	0.36	0.25	0.28
Iron	ug/g	7.4	3.0	7.1
Lead	ug/g	0.02	0.005	<0.01
Manganese	ug/g	13	0.23	12
Mercury	ug/g	0.01	0.019	<0.01
Molybdenum	ug/g	<0.05	<0.02	<0.05
Nickel	ug/g	<0.02	<0.01	<0.02
Selenium	ug/g	0.19	0.20	0.15
Silver	ug/g	<0.01	<0.002	<0.01
Strontium	ug/g	164	0.14	150
Thallium	ug/g	<0.02	<0.01	<0.02
Tin	ug/g	<0.02	<0.01	<0.02
Titanium	ug/g	0.04	<0.01	0.03
Uranium	ug/g	<0.01	<0.001	<0.01
Vanadium	ug/g	<0.05	<0.02	<0.05
Zinc	ug/g	22	4.5	21
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.002	<0.001	<0.002
Polonium-210	Bq/g	0.007	0.0025	0.006
Radium-226	Bq/g	<0.0009	Not Reported	<0.001
Thorium-230	Bq/g	<0.002	Not Reported	<0.002
Lab Section 6 (Misc.)				
Moisture	%	52.25	78.97	56.00

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Note for Sample # 30490
This sample was reanalyzed for Polonium 210. Reanalysis confirmed original results within the expected measurement uncertainty.

SRC Group # 2016-11422

Dec 15, 2016

EcoMetrix Inc.

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SRC Group # 2016-11422

Dec 15, 2016

EcoMetrix Inc.

30492	**09/20/2016 LA7-WS4-T *FISH FLESH***
30493	**09/20/2016 LA7-WS4-B *FISH BONES***
30494	**09/20/2016 LA7-WS5-T *FISH FLESH***

Analyte	Units	30492	30493	30494
Lab Section 2 (ICP)				
Aluminum	ug/g	<0.5	1.1	<0.5
Antimony	ug/g	<0.02	<0.05	<0.02
Arsenic	ug/g	0.05	<0.02	0.04
Barium	ug/g	0.14	3.7	0.05
Beryllium	ug/g	<0.002	<0.01	<0.002
Boron	ug/g	<0.2	<0.5	<0.2
Cadmium	ug/g	<0.002	<0.01	<0.002
Chromium	ug/g	<0.1	<0.2	<0.1
Cobalt	ug/g	0.002	0.07	<0.002
Copper	ug/g	0.19	0.20	0.21
Iron	ug/g	2.3	8.0	3.6
Lead	ug/g	0.003	<0.01	<0.002
Manganese	ug/g	0.14	13	0.14
Mercury	ug/g	0.012	<0.01	0.021
Molybdenum	ug/g	<0.02	<0.05	<0.02
Nickel	ug/g	<0.01	<0.02	<0.01
Selenium	ug/g	0.15	0.18	0.22
Silver	ug/g	<0.002	<0.01	<0.002
Strontium	ug/g	0.16	120	0.27
Thallium	ug/g	<0.01	<0.02	<0.01
Tin	ug/g	<0.01	<0.02	<0.01
Titanium	ug/g	0.02	0.09	0.01
Uranium	ug/g	<0.001	<0.01	<0.001
Vanadium	ug/g	<0.02	<0.05	<0.02
Zinc	ug/g	3.2	18	3.5
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	<0.002	<0.001
Polonium-210	Bq/g	0.0018	0.005	0.0019
Radium-226	Bq/g	<0.00008	0.001	<0.00008
Thorium-230	Bq/g	<0.0002	<0.002	<0.0002
Lab Section 6 (Misc.)				
Moisture	%	79.95	58.34	78.51

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SRC SASKATCHEWAN RESEARCH COUNCIL
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SRC Group # 2016-11422

Dec 15, 2016

EcoMetrix Inc.

30495 **09/20/2016 LA7-WS5-B *FISH BONES***
30496 **09/20/2016 LAB-NP1-T *FISH FLESH***
30497 **09/20/2016 LAB-NP1-B *FISH BONES***

Analyte	Units	30495	30496	30497
Lab Section 2 (ICP)				
Aluminum	ug/g	0.6	<0.5	1.2
Antimony	ug/g	<0.05	<0.02	<0.05
Arsenic	ug/g	0.02	<0.01	<0.02
Barium	ug/g	2.6	0.18	2.7
Beryllium	ug/g	<0.01	<0.002	<0.01
Boron	ug/g	<0.5	<0.2	<0.5
Cadmium	ug/g	<0.01	<0.002	<0.01
Chromium	ug/g	<0.2	<0.1	<0.2
Cobalt	ug/g	0.05	<0.002	0.14
Copper	ug/g	0.40	0.13	0.06
Iron	ug/g	15	1.3	3.3
Lead	ug/g	<0.01	0.002	<0.01
Manganese	ug/g	12	0.08	20
Mercury	ug/g	0.02	0.24	0.02
Molybdenum	ug/g	<0.05	<0.02	<0.05
Nickel	ug/g	<0.02	<0.01	<0.02
Selenium	ug/g	0.20	0.38	0.21
Silver	ug/g	<0.01	<0.002	<0.01
Strontium	ug/g	100	0.04	67
Thallium	ug/g	<0.02	<0.01	<0.02
Tin	ug/g	<0.02	<0.01	<0.02
Titanium	ug/g	<0.02	0.02	0.04
Uranium	ug/g	<0.01	<0.001	<0.01
Vanadium	ug/g	<0.05	<0.02	<0.05
Zinc	ug/g	16	3.9	46
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	0.005	<0.001	<0.002
Polonium-210	Bq/g	0.004	0.0020	0.0005
Radium-226	Bq/g	<0.001	<0.001	<0.001
Thorium-230	Bq/g	<0.002	<0.0002	<0.002
Lab Section 6 (Misc.)				
Moisture	%	55.71	77.11	53.41

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SRC Group # 2016-11422

Dec 15, 2016

EcoMetrix Inc.

30498 **09/21/2016 LAB-NP2-T *FISH FLESH***
30499 **09/21/2016 LAB-NP2-B *FISH BONES***
30500 **09/21/2016 LAB-NP3-T *FISH FLESH***

Analyte	Units	30498	30499	30500
Lab Section 2 (ICP)				
Aluminum	ug/g	<0.5	1.2	<0.5
Antimony	ug/g	<0.02	<0.05	<0.02
Arsenic	ug/g	0.01	<0.02	0.01
Barium	ug/g	<0.01	3.7	0.08
Beryllium	ug/g	<0.002	<0.01	<0.002
Boron	ug/g	<0.2	<0.5	<0.2
Cadmium	ug/g	<0.002	<0.01	<0.002
Chromium	ug/g	<0.1	<0.2	<0.1
Cobalt	ug/g	<0.002	0.12	<0.002
Copper	ug/g	0.14	0.23	0.17
Iron	ug/g	4.7	6.1	1.4
Lead	ug/g	<0.002	0.01	0.002
Manganese	ug/g	0.10	24	0.18
Mercury	ug/g	0.48	0.14	0.37
Molybdenum	ug/g	<0.02	<0.05	<0.02
Nickel	ug/g	<0.01	<0.02	<0.01
Selenium	ug/g	0.25	0.22	0.53
Silver	ug/g	<0.002	<0.01	<0.002
Strontium	ug/g	0.07	60	0.20
Thallium	ug/g	<0.01	<0.02	<0.01
Tin	ug/g	<0.01	<0.02	<0.01
Titanium	ug/g	<0.01	0.21	<0.01
Uranium	ug/g	<0.001	<0.01	<0.001
Vanadium	ug/g	<0.02	<0.05	<0.02
Zinc	ug/g	6.5	62	3.7
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	<0.002	<0.001
Polonium-210	Bq/g	0.0017	0.001	0.0030
Radium-226	Bq/g	Not Reported	<0.001	<0.00007
Thorium-230	Bq/g	Not Reported	<0.002	<0.0001
Lab Section 6 (Misc.)				
Moisture	%	81.50	58.28	77.33

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Note for Sample # 30500
This sample was reanalyzed for Polonium 210. Reanalysis confirmed original results within the expected measurement uncertainty.

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30501	**09/21/2016 LAB-NP3-B *FISH BONES***	
30502	**09/21/2016 LAB-NP4-T *FISH FLESH***	
30503	**09/21/2016 LAB-NP4-B *FISH BONES***	

Analyte	Units	30501	30502	30503
Lab Section 2 (ICP)				
Aluminum	ug/g	1.0	<0.5	0.9
Antimony	ug/g	<0.05	<0.02	<0.05
Arsenic	ug/g	0.02	0.02	0.02
Barium	ug/g	2.5	<0.01	2.6
Beryllium	ug/g	<0.01	<0.002	<0.01
Boron	ug/g	<0.5	<0.2	<0.5
Cadmium	ug/g	<0.01	<0.002	<0.01
Chromium	ug/g	<0.2	<0.1	<0.2
Cobalt	ug/g	0.18	<0.002	0.14
Copper	ug/g	0.21	0.09	0.29
Iron	ug/g	6.6	0.8	5.1
Lead	ug/g	0.01	<0.002	0.03
Manganese	ug/g	33	0.11	19
Mercury	ug/g	0.03	0.20	0.02
Molybdenum	ug/g	<0.05	<0.02	<0.05
Nickel	ug/g	0.03	<0.01	<0.02
Selenium	ug/g	0.27	0.30	0.20
Silver	ug/g	<0.01	<0.002	<0.01
Strontium	ug/g	77	0.04	90
Thallium	ug/g	<0.02	<0.01	<0.02
Tin	ug/g	<0.02	<0.01	<0.02
Titanium	ug/g	0.06	<0.01	0.02
Uranium	ug/g	<0.01	<0.001	<0.01
Vanadium	ug/g	<0.05	<0.02	<0.05
Zinc	ug/g	75	4.0	46
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.002	<0.001	<0.002
Polonium-210	Bq/g	0.0009	0.0010	0.0009
Radium-226	Bq/g	<0.001	0.00007	<0.001
Thorium-230	Bq/g	<0.003	<0.0001	<0.003
Lab Section 6 (Misc.)				
Moisture	%	47.92	77.24	49.19

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Dec 15, 2016

EcoMetrix Inc.

30504 **09/21/2016 LAB-NP5-T *FISH FLESH***
30505 **09/21/2016 LAB-NP5-B *FISH BONES***
30506 **09/21/2016 LAB-WS1-T *FISH FLESH***

Analyte	Units	30504	30505	30506
Lab Section 2 (ICP)				
Aluminum	ug/g	<0.5	1.3	<0.5
Antimony	ug/g	<0.02	<0.05	<0.02
Arsenic	ug/g	0.02	<0.02	<0.01
Barium	ug/g	0.06	3.3	0.03
Beryllium	ug/g	<0.002	<0.01	<0.002
Boron	ug/g	<0.2	<0.5	<0.2
Cadmium	ug/g	<0.002	<0.01	<0.002
Chromium	ug/g	<0.1	<0.2	<0.1
Cobalt	ug/g	<0.002	0.16	0.018
Copper	ug/g	0.08	0.31	0.16
Iron	ug/g	1.2	4.4	1.3
Lead	ug/g	<0.002	<0.01	<0.002
Manganese	ug/g	0.12	41	0.16
Mercury	ug/g	0.21	0.02	0.043
Molybdenum	ug/g	<0.02	<0.05	<0.02
Nickel	ug/g	<0.01	<0.02	<0.01
Selenium	ug/g	0.36	0.24	0.48
Silver	ug/g	<0.002	<0.01	<0.002
Strontium	ug/g	0.10	100	0.07
Thallium	ug/g	<0.01	<0.02	<0.01
Tin	ug/g	<0.01	<0.02	<0.01
Titanium	ug/g	<0.01	0.10	0.01
Uranium	ug/g	<0.001	<0.01	<0.001
Vanadium	ug/g	<0.02	<0.05	<0.02
Zinc	ug/g	8.6	63	3.0
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	<0.002	<0.001
Polonium-210	Bq/g	0.0010	0.0006	0.0008
Radium-226	Bq/g	<0.00003	<0.001	<0.00007
Thorium-230	Bq/g	<0.00006	<0.002	<0.0001
Lab Section 6 (Misc.)				
Moisture	%	77.66	55.71	81.11

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SRC Group # 2016-11422

Dec 15, 2016

EcoMetrix Inc.

30507 **09/21/2016 LAB-WS1-B *FISH BONES***
30508 **09/21/2016 LAB-WS2-T *FISH FLESH***
30509 **09/21/2016 LAB-WS2-B *FISH BONES***

Analyte	Units	30507	30508	30509
Lab Section 2 (ICP)				
Aluminum	ug/g	0.7	<0.5	0.5
Antimony	ug/g	<0.05	<0.02	<0.05
Arsenic	ug/g	<0.02	0.04	0.03
Barium	ug/g	2.1	0.02	1.3
Beryllium	ug/g	<0.01	<0.002	<0.01
Boron	ug/g	<0.5	<0.2	<0.5
Cadmium	ug/g	<0.01	<0.002	<0.01
Chromium	ug/g	<0.2	<0.1	<0.2
Cobalt	ug/g	0.13	<0.002	0.05
Copper	ug/g	0.50	0.32	0.38
Iron	ug/g	12	2.3	6.8
Lead	ug/g	0.02	<0.002	<0.01
Manganese	ug/g	41	0.42	45
Mercury	ug/g	0.02	0.025	<0.01
Molybdenum	ug/g	0.15	<0.02	0.23
Nickel	ug/g	<0.02	<0.01	<0.02
Selenium	ug/g	0.45	0.33	0.46
Silver	ug/g	<0.01	<0.002	<0.01
Strontium	ug/g	75	0.33	40
Thallium	ug/g	<0.02	<0.01	<0.02
Tin	ug/g	<0.02	<0.01	<0.02
Titanium	ug/g	0.09	<0.01	0.03
Uranium	ug/g	0.01	<0.001	<0.01
Vanadium	ug/g	<0.05	<0.02	<0.05
Zinc	ug/g	26	3.9	16
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.002	<0.001	<0.002
Polonium-210	Bq/g	0.005	0.0012	0.003
Radium-226	Bq/g	<0.001	<0.00008	<0.0008
Thorium-230	Bq/g	<0.002	<0.0002	<0.002
Lab Section 6 (Misc.)				
Moisture	%	60.49	80.49	64.36

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Dec 15, 2016

EcoMetrix Inc.

30510 **09/21/2016 LAB-WS3-T *FISH FLESH***
30511 **09/21/2016 LAB-WS3-B *FISH BONES***
30512 **09/21/2016 LAB-WS4-T *FISH FLESH***

Analyte	Units	30510	30511	30512
Lab Section 2 (ICP)				
Aluminum	ug/g	<0.5	<0.5	<0.5
Antimony	ug/g	<0.02	<0.05	<0.02
Arsenic	ug/g	0.02	<0.02	0.02
Barium	ug/g	0.02	2.1	0.04
Beryllium	ug/g	<0.002	<0.01	<0.002
Boron	ug/g	<0.2	<0.5	<0.2
Cadmium	ug/g	<0.002	<0.01	<0.002
Chromium	ug/g	<0.1	<0.2	<0.1
Cobalt	ug/g	0.010	0.10	<0.002
Copper	ug/g	0.18	0.45	0.21
Iron	ug/g	1.8	8.2	1.8
Lead	ug/g	<0.002	0.01	<0.002
Manganese	ug/g	0.28	67	0.17
Mercury	ug/g	0.022	<0.01	0.021
Molybdenum	ug/g	<0.02	0.20	<0.02
Nickel	ug/g	<0.01	<0.02	<0.01
Selenium	ug/g	0.56	0.59	0.46
Silver	ug/g	<0.002	<0.01	<0.002
Strontium	ug/g	0.14	72	0.05
Thallium	ug/g	<0.01	<0.02	<0.01
Tin	ug/g	<0.01	<0.02	<0.01
Titanium	ug/g	<0.01	0.04	0.02
Uranium	ug/g	<0.001	<0.01	<0.001
Vanadium	ug/g	<0.02	<0.05	<0.02
Zinc	ug/g	3.2	24	3.3
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	<0.002	<0.001
Polonium-210	Bq/g	0.0019	<0.0005	0.0021
Radium-226	Bq/g	<0.00007	<0.0008	0.0004
Thorium-230	Bq/g	<0.0001	<0.002	<0.0002
Lab Section 6 (Misc.)				
Moisture	%	78.93	61.00	78.29

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EcoMetrix Inc.

30513 **09/21/2016 LAB-WS4-B *FISH BONES***
30514 **09/21/2016 LAB-WS5-T *FISH FLESH***
30515 **09/21/2016 LAB-WS5-B *FISH BONES***

Analyte	Units	30513	30514	30515
Lab Section 2 (ICP)				
Aluminum	ug/g	0.7	<0.5	1.4
Antimony	ug/g	<0.05	<0.02	<0.05
Arsenic	ug/g	<0.02	0.05	0.03
Barium	ug/g	2.4	0.03	2.4
Beryllium	ug/g	<0.01	<0.002	<0.01
Boron	ug/g	<0.5	<0.2	<0.5
Cadmium	ug/g	<0.01	<0.002	<0.01
Chromium	ug/g	<0.2	<0.1	<0.2
Cobalt	ug/g	0.07	<0.002	0.09
Copper	ug/g	0.66	0.26	0.55
Iron	ug/g	8.7	2.1	11
Lead	ug/g	0.10	<0.002	0.01
Manganese	ug/g	68	0.18	49
Mercury	ug/g	<0.01	0.022	<0.01
Molybdenum	ug/g	0.13	<0.02	0.17
Nickel	ug/g	<0.02	<0.01	<0.02
Selenium	ug/g	0.39	0.38	0.32
Silver	ug/g	<0.01	<0.002	<0.01
Strontium	ug/g	69	0.12	61
Thallium	ug/g	<0.02	<0.01	<0.02
Tin	ug/g	<0.02	<0.01	<0.02
Titanium	ug/g	0.04	<0.01	0.11
Uranium	ug/g	<0.01	<0.001	<0.01
Vanadium	ug/g	<0.05	<0.02	<0.05
Zinc	ug/g	24	3.8	21
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.002	<0.001	<0.002
Polonium-210	Bq/g	0.003	0.0013	0.004
Radium-226	Bq/g	<0.0008	Not Reported	<0.0009
Thorium-230	Bq/g	<0.002	Not Reported	<0.002
Lab Section 6 (Misc.)				
Moisture	%	62.61	77.98	60.69

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Dec 15, 2016

EcoMetrix Inc.

30516 **09/17/2016 LA1-WS1-T *FISH FLESH***
30517 **09/17/2016 LA1-WS1-B *FISH BONES***
30518 **09/20/2016 LA1-WS2-T *FISH FLESH***

Analyte	Units	30516	30517	30518
Lab Section 2 (ICP)				
Aluminum	ug/g	0.8	0.6	0.5
Antimony	ug/g	<0.02	<0.05	<0.02
Arsenic	ug/g	0.03	<0.02	0.01
Barium	ug/g	0.15	5.5	0.12
Beryllium	ug/g	<0.002	<0.01	<0.002
Boron	ug/g	<0.2	<0.5	<0.2
Cadmium	ug/g	<0.002	<0.01	<0.002
Chromium	ug/g	<0.1	<0.2	<0.1
Cobalt	ug/g	<0.002	0.10	<0.002
Copper	ug/g	0.17	0.42	0.17
Iron	ug/g	3.1	5.2	2.2
Lead	ug/g	0.002	0.01	0.003
Manganese	ug/g	1.1	35	0.18
Mercury	ug/g	0.023	0.01	0.040
Molybdenum	ug/g	<0.02	<0.05	<0.02
Nickel	ug/g	<0.01	<0.02	<0.01
Selenium	ug/g	0.30	0.18	0.30
Silver	ug/g	<0.002	<0.01	<0.002
Strontium	ug/g	2.5	175	0.28
Thallium	ug/g	<0.01	<0.02	<0.01
Tin	ug/g	<0.01	<0.02	<0.01
Titanium	ug/g	0.03	0.06	0.02
Uranium	ug/g	<0.001	<0.01	<0.001
Vanadium	ug/g	<0.02	<0.05	<0.02
Zinc	ug/g	4.2	19	3.6
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	0.007	0.001
Polonium-210	Bq/g	0.0010	0.002	0.0012
Radium-226	Bq/g	<0.00008	<0.001	<0.00008
Thorium-230	Bq/g	<0.0002	<0.002	<0.0002
Lab Section 6 (Misc.)				
Moisture	%	78.71	57.59	79.42

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SRC Group # 2016-11422

Dec 15, 2016

EcoMetrix Inc.

30519 **09/20/2016 LA1-WS2-B *FISH BONES***
30520 **09/20/2016 LA1-WS3-T *FISH FLESH***
30521 **09/20/2016 LA1-WS3-B *FISH BONES***

Analyte	Units	30519	30520	30521
Lab Section 2 (ICP)				
Aluminum	ug/g	1.2	0.5	1.4
Antimony	ug/g	<0.05	<0.02	<0.05
Arsenic	ug/g	<0.02	0.02	0.03
Barium	ug/g	3.2	0.25	3.6
Beryllium	ug/g	<0.01	<0.002	<0.01
Boron	ug/g	<0.5	<0.2	<0.5
Cadmium	ug/g	<0.01	<0.002	<0.01
Chromium	ug/g	<0.2	<0.1	<0.2
Cobalt	ug/g	0.06	<0.002	0.06
Copper	ug/g	0.46	0.25	0.40
Iron	ug/g	8.9	3.1	8.6
Lead	ug/g	0.03	0.004	0.01
Manganese	ug/g	30	0.41	20
Mercury	ug/g	0.02	0.028	0.01
Molybdenum	ug/g	<0.05	<0.02	<0.05
Nickel	ug/g	<0.02	<0.01	<0.02
Selenium	ug/g	0.26	0.29	0.18
Silver	ug/g	<0.01	<0.002	<0.01
Strontium	ug/g	111	1.0	120
Thallium	ug/g	<0.02	<0.01	<0.02
Tin	ug/g	<0.02	<0.01	<0.02
Titanium	ug/g	0.04	0.02	0.09
Uranium	ug/g	<0.01	<0.001	<0.01
Vanadium	ug/g	<0.05	<0.02	<0.05
Zinc	ug/g	16	3.8	18
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.002	<0.001	<0.002
Polonium-210	Bq/g	0.004	0.0006	0.002
Radium-226	Bq/g	<0.001	Not Reported	<0.001
Thorium-230	Bq/g	<0.002	Not Reported	<0.002
Lab Section 6 (Misc.)				
Moisture	%	55.90	80.39	60.31

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Results are reported on a "raw weight" basis.
N/R- Results not reported due to equipment failure.

SRC Group # 2016-11422

Dec 15, 2016

EcoMetrix Inc.

30522 **09/20/2016 LA1-WS4-T *FISH FLESH***
30523 **09/20/2016 LA1-WS4-B *FISH BONES***

Analyte	Units	30522	30523
Lab Section 2 (ICP)			
Aluminum	ug/g	<0.5	0.8
Antimony	ug/g	<0.02	<0.05
Arsenic	ug/g	0.05	<0.02
Barium	ug/g	0.20	3.6
Beryllium	ug/g	<0.002	<0.01
Boron	ug/g	<0.2	<0.5
Cadmium	ug/g	<0.002	<0.01
Chromium	ug/g	<0.1	<0.2
Cobalt	ug/g	<0.002	0.06
Copper	ug/g	0.25	0.45
Iron	ug/g	2.9	7.9
Lead	ug/g	0.009	0.01
Manganese	ug/g	0.17	18
Mercury	ug/g	0.022	0.02
Molybdenum	ug/g	<0.02	<0.05
Nickel	ug/g	<0.01	0.12
Selenium	ug/g	0.23	0.20
Silver	ug/g	<0.002	<0.01
Strontium	ug/g	0.84	117
Thallium	ug/g	<0.01	<0.02
Tin	ug/g	<0.01	<0.02
Titanium	ug/g	0.01	0.05
Uranium	ug/g	<0.001	<0.01
Vanadium	ug/g	<0.02	<0.05
Zinc	ug/g	4.6	20
Lab Section 4 (Radiochemistry)			
Lead-210	Bq/g	<0.001	<0.002
Polonium-210	Bq/g	0.0015	0.004
Radium-226	Bq/g	<0.00009	<0.001
Thorium-230	Bq/g	<0.0002	<0.002
Lab Section 6 (Misc.)			
Moisture	%	79.93	58.41

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SRC SASKATCHEWAN RESEARCH COUNCIL

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Revised

SRC Group # 2016-11104

Aug 17, 2017

EcoMetrix Inc.
6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Karen Petersen

Date Samples Received: Sep-19-2016 Client P.O.: 16-2285

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Sections 1 and 2 have been authorized by Keith Gipman, Supervisor
Results from Lab Section 3 have been authorized by Pat Moser, Supervisor
Results from Lab Sections 4 and 5 have been authorized by Vicky Snook, Supervisor
Results from Lab Section 6 have been authorized by Marion McConnell, Supervisor

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* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

This is a final report.

Revised

SRC Group # 2016-11104

Aug 17, 2017

EcoMetrix Inc.
6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Karen Petersen

Date Samples Received: Sep-19-2016

Client P.O.: 16-2285

29905 **09/10/2016 NP1-LA-5-T *FISH FLESH***
29906 **09/10/2016 NP1-LA-5-B *FISH BONES***
29907 **09/10/2016 NP2-LA-5-T *FISH FLESH***

Analyte	Units	29905	29906	29907
Lab Section 2 (ICP)				
Aluminum	ug/g	1.3	1.3	0.7
Antimony	ug/g	<0.02	<0.05	<0.02
Arsenic	ug/g	0.01	0.03	<0.01
Barium	ug/g	0.06	7.2	<0.01
Beryllium	ug/g	<0.002	<0.01	<0.002
Boron	ug/g	<0.2	<0.5	<0.2
Cadmium	ug/g	<0.002	<0.01	<0.002
Chromium	ug/g	<0.1	<0.2	<0.1
Cobalt	ug/g	0.009	0.06	<0.002
Copper	ug/g	0.14	0.16	0.11
Iron	ug/g	2.3	11	1.1
Lead	ug/g	0.004	0.01	<0.002
Manganese	ug/g	0.11	17	0.11
Mercury	ug/g	0.047	0.02	0.16
Molybdenum	ug/g	<0.02	<0.05	<0.02
Nickel	ug/g	0.01	0.03	<0.01
Selenium	ug/g	0.17	0.17	0.15
Silver	ug/g	<0.002	<0.01	<0.002
Strontium	ug/g	0.14	121	0.37
Thallium	ug/g	<0.01	<0.02	<0.01
Tin	ug/g	<0.01	<0.02	<0.01
Titanium	ug/g	0.04	0.06	<0.01
Uranium	ug/g	<0.001	<0.01	<0.001
Vanadium	ug/g	<0.02	<0.05	<0.02
Zinc	ug/g	4.4	54	3.1
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	<0.002	<0.001
Polonium-210	Bq/g	0.0021	0.003	0.0004
Radium-226	Bq/g	0.0002	<0.001	<0.00007
Thorium-228	Bq/g	<0.0002	<0.002	<0.0001
Thorium-230	Bq/g	<0.0002	<0.002	<0.0001

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Revised

SRC Group # 2016-11104

Aug 17, 2017

EcoMetrix Inc.

29905 **09/10/2016 NP1-LA-5-T *FISH FLESH***
29906 **09/10/2016 NP1-LA-5-B *FISH BONES***
29907 **09/10/2016 NP2-LA-5-T *FISH FLESH***

Analyte	Units	29905	29906	29907
Lab Section 4 (Radiochemistry)				
Thorium-232	Bq/g	<0.0002	<0.002	<0.0001
Lab Section 6 (Misc.)				
Moisture	%	78.10	59.00	78.87

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Results are reported on an "as received" basis.

Note the addition of results for moisture as per client request. VE
Aug17/17

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SRC Group # 2016-11104

Aug 17, 2017

EcoMetrix Inc.

29908 **09/10/2016 NP2-LA-5-B *FISH BONES***
29909 **09/10/2016 NP3-LA-5-T *FISH FLESH***
29910 **09/10/2016 NP3-LA-5-B *FISH BONES***

Analyte	Units	29908	29909	29910
Lab Section 2 (ICP)				
Aluminum	ug/g	0.8	0.6	<0.5
Antimony	ug/g	<0.05	<0.02	<0.05
Arsenic	ug/g	0.03	<0.01	0.02
Barium	ug/g	6.7	<0.01	6.4
Beryllium	ug/g	<0.01	<0.002	<0.01
Boron	ug/g	<0.5	<0.2	<0.5
Cadmium	ug/g	<0.01	<0.002	<0.01
Chromium	ug/g	<0.2	<0.1	<0.2
Cobalt	ug/g	0.10	<0.002	0.10
Copper	ug/g	0.09	0.11	0.08
Iron	ug/g	4.2	0.8	1.4
Lead	ug/g	<0.01	<0.002	<0.01
Manganese	ug/g	14	0.08	12
Mercury	ug/g	0.03	0.23	0.04
Molybdenum	ug/g	<0.05	<0.02	<0.05
Nickel	ug/g	<0.02	<0.01	<0.02
Selenium	ug/g	0.10	0.19	0.09
Silver	ug/g	<0.01	<0.002	<0.01
Strontium	ug/g	155	0.16	162
Thallium	ug/g	<0.02	<0.01	<0.02
Tin	ug/g	<0.02	<0.01	<0.02
Titanium	ug/g	0.03	<0.01	0.05
Uranium	ug/g	<0.01	<0.001	<0.01
Vanadium	ug/g	<0.05	<0.02	<0.05
Zinc	ug/g	36	3.8	32
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.002	<0.001	<0.002
Polonium-210	Bq/g	<0.0005	0.0005	0.0008
Radium-226	Bq/g	<0.0008	<0.00009	<0.0009
Thorium-228	Bq/g	<0.002	<0.0002	<0.002
Thorium-230	Bq/g	<0.002	<0.0002	<0.002
Thorium-232	Bq/g	<0.002	<0.0002	<0.002
Lab Section 6 (Misc.)				
Moisture	%	60.70	78.39	58.53

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Revised

SRC Group # 2016-11104

Aug 17, 2017

EcoMetrix Inc.

Results are reported on an "as received" basis.

Note the addition of results for moisture as per client request. VE
Aug17/17

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SRC Group # 2016-11104

Aug 17, 2017

EcoMetrix Inc.

29911 **09/10/2016 NP4-LA-5-T *FISH FLESH***
29912 **09/10/2016 NP4-LA-5-B *FISH BONES***
29913 **09/10/2016 NP5-LA-5-T *FISH FLESH***

Analyte	Units	29911	29912	29913
Lab Section 2 (ICP)				
Aluminum	ug/g	0.6	<0.5	<0.5
Antimony	ug/g	<0.02	<0.05	<0.02
Arsenic	ug/g	<0.01	0.02	<0.01
Barium	ug/g	<0.01	7.2	0.01
Beryllium	ug/g	<0.002	<0.01	<0.002
Boron	ug/g	<0.2	<0.5	<0.2
Cadmium	ug/g	<0.002	<0.01	<0.002
Chromium	ug/g	<0.1	<0.2	<0.1
Cobalt	ug/g	0.014	0.09	0.009
Copper	ug/g	0.09	0.09	0.09
Iron	ug/g	1.0	3.7	0.9
Lead	ug/g	<0.002	0.01	<0.002
Manganese	ug/g	0.11	13	0.12
Mercury	ug/g	0.15	0.04	0.23
Molybdenum	ug/g	<0.02	<0.05	<0.02
Nickel	ug/g	0.02	<0.02	<0.01
Selenium	ug/g	0.17	0.10	0.17
Silver	ug/g	<0.002	<0.01	<0.002
Strontium	ug/g	0.10	156	0.29
Thallium	ug/g	<0.01	<0.02	<0.01
Tin	ug/g	<0.01	<0.02	<0.01
Titanium	ug/g	<0.01	0.04	<0.01
Uranium	ug/g	<0.001	<0.01	<0.001
Vanadium	ug/g	<0.02	<0.05	<0.02
Zinc	ug/g	3.5	41	3.3
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	<0.002	<0.001
Polonium-210	Bq/g	0.0002	0.001	0.0005
Radium-226	Bq/g	<0.00006	<0.0009	<0.00006
Thorium-228	Bq/g	<0.0001	<0.002	<0.0001
Thorium-230	Bq/g	<0.0001	<0.002	<0.0001
Thorium-232	Bq/g	<0.0001	<0.002	<0.0001
Lab Section 6 (Misc.)				
Moisture	%	77.82	57.99	81.06

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Revised

SRC Group # 2016-11104

Aug 17, 2017

EcoMetrix Inc.

Results are reported on an "as received" basis.

Note the addition of results for moisture as per client request. VE Aug17/17

Revised

SRC Group # 2016-11104

Aug 17, 2017

EcoMetrix Inc.

29914 **09/10/2016 NP5-LA-5-B *FISH BONES***
29915 **09/10/2016 WS1-LA-5-T *FISH FLESH***
29916 **09/10/2016 WS1-LA-5-B *FISH BONES***

Analyte	Units	29914	29915	29916
Lab Section 2 (ICP)				
Aluminum	ug/g	0.7	0.7	1.2
Antimony	ug/g	<0.05	<0.02	<0.05
Arsenic	ug/g	0.02	0.04	0.05
Barium	ug/g	7.2	0.01	4.4
Beryllium	ug/g	<0.01	<0.002	<0.01
Boron	ug/g	<0.5	<0.2	<0.5
Cadmium	ug/g	<0.01	<0.002	<0.01
Chromium	ug/g	<0.2	<0.1	<0.2
Cobalt	ug/g	0.10	<0.002	0.05
Copper	ug/g	0.08	0.16	0.26
Iron	ug/g	3.6	2.3	9.8
Lead	ug/g	0.01	0.004	0.01
Manganese	ug/g	12	0.14	21
Mercury	ug/g	0.06	0.014	0.02
Molybdenum	ug/g	<0.05	<0.02	<0.05
Nickel	ug/g	<0.02	0.01	<0.02
Selenium	ug/g	0.11	0.17	0.16
Silver	ug/g	<0.01	<0.002	<0.01
Strontium	ug/g	156	0.11	125
Thallium	ug/g	<0.02	<0.01	<0.02
Tin	ug/g	<0.02	<0.01	<0.02
Titanium	ug/g	0.06	0.02	0.05
Uranium	ug/g	<0.01	<0.001	<0.01
Vanadium	ug/g	<0.05	<0.02	<0.05
Zinc	ug/g	30	2.8	15
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.002	<0.001	<0.002
Polonium-210	Bq/g	0.0007	0.0006	0.002
Radium-226	Bq/g	0.002	<0.00009	0.001
Thorium-228	Bq/g	<0.002	<0.0002	<0.002
Thorium-230	Bq/g	<0.002	<0.0002	<0.002
Thorium-232	Bq/g	<0.002	<0.0002	<0.002
Lab Section 6 (Misc.)				
Moisture	%	60.29	79.64	57.78

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Revised

SRC Group # 2016-11104

Aug 17, 2017

EcoMetrix Inc.

Results are reported on an "as received" basis.

Note the addition of results for moisture as per client request. VE Aug17/17

SRC SASKATCHEWAN RESEARCH COUNCIL

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Revised

SRC Group # 2016-11104

Aug 17, 2017

EcoMetrix Inc.

29917 **09/11/2016 WS2-LA-5-T *FISH FLESH***

Analyte	Units	29917
Lab Section 2 (ICP)		
Aluminum	ug/g	0.6
Antimony	ug/g	<0.02
Arsenic	ug/g	0.03
Barium	ug/g	0.07
Beryllium	ug/g	<0.002
Boron	ug/g	<0.2
Cadmium	ug/g	<0.002
Chromium	ug/g	<0.1
Cobalt	ug/g	0.005
Copper	ug/g	0.27
Iron	ug/g	2.8
Lead	ug/g	0.006
Manganese	ug/g	0.21
Mercury	ug/g	0.055
Molybdenum	ug/g	<0.02
Nickel	ug/g	0.02
Selenium	ug/g	0.19
Silver	ug/g	<0.002
Strontium	ug/g	0.06
Thallium	ug/g	<0.01
Tin	ug/g	<0.01
Titanium	ug/g	0.01
Uranium	ug/g	<0.001
Vanadium	ug/g	<0.02
Zinc	ug/g	3.9
Lab Section 4 (Radiochemistry)		
Lead-210	Bq/g	<0.001
Polonium-210	Bq/g	0.0008
Radium-226	Bq/g	<0.00007
Thorium-228	Bq/g	<0.0001
Thorium-230	Bq/g	<0.0001
Thorium-232	Bq/g	<0.0001
Lab Section 6 (Misc.)		
Moisture	%	79.76

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Revised

SRC Group # 2016-11104

Aug 17, 2017

EcoMetrix Inc.

Results are reported on an "as received" basis.

Note the addition of results for moisture as per client request. VE Aug17/17

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Revised

SRC Group # 2017-6189

Aug 17, 2017

EcoMetrix Inc.
6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: J Tang

Date Samples Received: Jun-02-2017 Client P.O.: 16-2285

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Sections 1 and 2 have been authorized by Keith Gipman, Supervisor
Results from Lab Section 3 have been authorized by Pat Moser, Supervisor
Results from Lab Sections 4 and 5 have been authorized by Vicky Snook, Supervisor
Results from Lab Section 6 have been authorized by Marion McConnell, Supervisor

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
  * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
  * Environment Canada
  * US EPA
  * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

This is a final report.

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Revised

SRC Group # 2017-6189

Aug 17, 2017

EcoMetrix Inc.
6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: J Tang

Date Samples Received: Jun-02-2017

Client P.O.: 16-2285

22747 **LA1-NP1 *FISH FLESH***
22748 **LA1-NP2 *FISH FLESH***
22749 **LA1-NP3 *FISH FLESH***

Analyte	Units	22747	22748	22749
Lab Section 2 (ICP)				
Aluminum	ug/g	<0.5	<0.5	<0.5
Antimony	ug/g	<0.02	<0.02	<0.02
Arsenic	ug/g	<0.01	<0.01	<0.01
Barium	ug/g	0.02	0.02	0.02
Beryllium	ug/g	<0.002	<0.002	<0.002
Boron	ug/g	<0.2	<0.2	<0.2
Cadmium	ug/g	<0.002	<0.002	<0.002
Chromium	ug/g	0.2	<0.1	<0.1
Cobalt	ug/g	0.005	<0.002	<0.002
Copper	ug/g	0.30	0.28	0.55
Iron	ug/g	3.5	3.5	5.0
Lead	ug/g	<0.002	<0.002	<0.002
Manganese	ug/g	0.09	0.09	0.13
Mercury	ug/g	0.15	0.23	0.081
Molybdenum	ug/g	<0.02	<0.02	<0.02
Nickel	ug/g	0.02	<0.01	0.03
Selenium	ug/g	0.19	0.20	0.20
Silver	ug/g	<0.002	<0.002	0.002
Strontium	ug/g	0.25	0.11	0.39
Thallium	ug/g	<0.01	<0.01	<0.01
Tin	ug/g	<0.01	<0.01	<0.01
Titanium	ug/g	0.02	0.02	0.02
Uranium	ug/g	<0.001	<0.001	<0.001
Vanadium	ug/g	<0.02	<0.02	<0.02
Zinc	ug/g	5.3	9.7	8.6
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	0.001	<0.001
Polonium-210	Bq/g	<0.0002	0.0002	0.0007
Radium-226	Bq/g	<0.00007	<0.00006	<0.0002
Thorium-228	Bq/g	<0.0001	<0.0001	<0.0004
Thorium-230	Bq/g	<0.0001	<0.0001	<0.0004

Revised

SRC Group # 2017-6189

Aug 17, 2017

EcoMetrix Inc.

22747 LA1-NP1 *FISH FLESH*
22748 LA1-NP2 *FISH FLESH*
22749 LA1-NP3 *FISH FLESH*

Analyte	Units	22747	22748	22749
Lab Section 4 (Radiochemistry)				
Thorium-232	Bq/g	<0.0001	<0.0001	<0.0004
Lab Section 6 (Misc.)				
Moisture	%	77.74	80.09	77.81

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Results are reported on a "raw weight" basis.
Revised to include Mercury analysis as requested by client 08/10/2017 SB
Note the addition of results for moisture as per client request. VE Aug 17/17

Revised

SRC Group # 2017-6189

Aug 17, 2017

EcoMetrix Inc.

22750 LA1-NP4 *FISH FLESH*
22751 LA1-WS1 *FISH FLESH*
22752 LA1-WS2 *FISH FLESH*

Analyte	Units	22750	22751	22752
Lab Section 2 (ICP)				
Aluminum	ug/g	<0.5	<0.5	<0.5
Antimony	ug/g	<0.02	<0.02	<0.02
Arsenic	ug/g	<0.01	0.03	<0.01
Barium	ug/g	0.03	0.07	0.06
Beryllium	ug/g	<0.002	<0.002	<0.002
Boron	ug/g	<0.2	<0.2	<0.2
Cadmium	ug/g	<0.002	<0.002	<0.002
Chromium	ug/g	<0.1	0.2	<0.1
Cobalt	ug/g	0.004	0.005	0.014
Copper	ug/g	0.48	0.62	0.24
Iron	ug/g	3.2	4.6	3.0
Lead	ug/g	0.002	0.003	<0.002
Manganese	ug/g	0.10	0.12	0.15
Mercury	ug/g	0.075	0.068	0.046
Molybdenum	ug/g	<0.02	<0.02	<0.02
Nickel	ug/g	<0.01	0.11	0.02
Selenium	ug/g	0.24	0.21	0.30
Silver	ug/g	<0.002	<0.002	0.018
Strontium	ug/g	0.58	0.24	0.22
Thallium	ug/g	<0.01	<0.01	<0.01
Tin	ug/g	<0.01	<0.01	<0.01
Titanium	ug/g	0.02	0.03	0.01
Uranium	ug/g	<0.001	<0.001	<0.001
Vanadium	ug/g	<0.02	<0.02	<0.02
Zinc	ug/g	8.0	4.9	3.9
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	<0.001	<0.001
Polonium-210	Bq/g	0.0008	0.0008	0.0008
Radium-226	Bq/g	<0.0002	<0.0002	<0.00008
Thorium-228	Bq/g	<0.0004	<0.0003	<0.0002
Thorium-230	Bq/g	<0.0004	<0.0003	<0.0002
Thorium-232	Bq/g	<0.0004	<0.0003	<0.0002
Lab Section 6 (Misc.)				
Moisture	%	79.36	76.07	77.75

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Revised

SRC Group # 2017-6189

Aug 17, 2017

EcoMetrix Inc.

Note for Sample # 22751
This sample was reanalyzed for Nickel. Reanalysis confirms original results are within the expected measurement uncertainty.

Note for Sample # 22752
This sample was reanalyzed for Silver. Reanalysis confirms original results are within the expected measurement uncertainty.

Results are reported on a "raw weight" basis.
Revised to include Mercury analysis as requested by client 08/10/2017 SB
Note the addition of results for moisture as per client request. VE Aug 17/17

Revised

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EcoMetrix Inc.

22753 **LA5-WS1 *FISH FLESH***
22754 **LA6-NP1 *FISH FLESH***
22755 **LA6-WS1 *FISH FLESH***

Analyte	Units	22753	22754	22755
Lab Section 2 (ICP)				
Aluminum	ug/g	<0.5	<0.5	<0.5
Antimony	ug/g	<0.02	<0.02	<0.02
Arsenic	ug/g	0.02	0.02	0.02
Barium	ug/g	<0.01	0.09	0.04
Beryllium	ug/g	<0.002	<0.002	<0.002
Boron	ug/g	<0.2	<0.2	<0.2
Cadmium	ug/g	<0.002	<0.002	<0.002
Chromium	ug/g	<0.1	<0.1	<0.1
Cobalt	ug/g	0.009	0.010	0.007
Copper	ug/g	0.42	0.16	0.28
Iron	ug/g	5.6	1.4	3.5
Lead	ug/g	0.002	<0.002	<0.002
Manganese	ug/g	0.70	0.18	0.10
Mercury	ug/g	0.051	0.17	0.044
Molybdenum	ug/g	<0.02	<0.02	<0.02
Nickel	ug/g	0.02	0.02	<0.01
Selenium	ug/g	0.23	0.19	0.24
Silver	ug/g	<0.002	<0.002	<0.002
Strontium	ug/g	2.5	1.1	0.16
Thallium	ug/g	<0.01	<0.01	<0.01
Tin	ug/g	<0.01	<0.01	<0.01
Titanium	ug/g	0.03	0.02	0.02
Uranium	ug/g	<0.001	<0.001	<0.001
Vanadium	ug/g	<0.02	<0.02	<0.02
Zinc	ug/g	6.5	4.6	3.2
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	<0.001	<0.001
Polonium-210	Bq/g	0.0011	0.0010	0.0012
Radium-226	Bq/g	<0.00007	<0.00008	<0.0001
Thorium-228	Bq/g	<0.0001	<0.0002	<0.0002
Thorium-230	Bq/g	<0.0001	<0.0002	<0.0002
Thorium-232	Bq/g	<0.0001	<0.0002	<0.0002
Lab Section 6 (Misc.)				
Moisture	%	79.17	78.79	78.59

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

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EcoMetrix Inc.

Note for Sample # 22753
This sample was reanalyzed for Strontium and Manganese. Reanalysis confirms original results are within the expected measurement uncertainty.

Note for Sample # 22754
This sample was reanalyzed for Polonium 210. Reanalysis confirms original results are within the expected measurement uncertainty.

Results are reported on a "raw weight" basis.
Revised to include Mercury analysis as requested by client 08/10/2017 SB
Note the addition of results for moisture as per client request. VE Aug 17/17

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EcoMetrix Inc.

22756 LA7-NP1 *FISH FLESH*
22757 LA7-NP2 *FISH FLESH*
22758 LA7-NP3 *FISH FLESH*

Analyte	Units	22756	22757	22758
Lab Section 2 (ICP)				
Aluminum	ug/g	<0.5	<0.5	<0.5
Antimony	ug/g	<0.02	<0.02	<0.02
Arsenic	ug/g	<0.01	<0.01	<0.01
Barium	ug/g	0.01	0.02	0.06
Beryllium	ug/g	<0.002	<0.002	<0.002
Boron	ug/g	<0.2	<0.2	<0.2
Cadmium	ug/g	<0.002	<0.002	<0.002
Chromium	ug/g	<0.1	<0.1	<0.1
Cobalt	ug/g	0.004	0.005	0.034
Copper	ug/g	0.21	0.50	0.23
Iron	ug/g	1.0	3.4	2.2
Lead	ug/g	<0.002	<0.002	<0.002
Manganese	ug/g	0.07	0.07	0.15
Mercury	ug/g	0.067	0.11	0.085
Molybdenum	ug/g	<0.02	<0.02	<0.02
Nickel	ug/g	<0.01	0.02	0.07
Selenium	ug/g	0.17	0.18	0.17
Silver	ug/g	<0.002	<0.002	<0.002
Strontium	ug/g	0.26	0.31	1.1
Thallium	ug/g	<0.01	<0.01	<0.01
Tin	ug/g	0.02	<0.01	<0.01
Titanium	ug/g	0.01	0.02	0.02
Uranium	ug/g	<0.001	<0.001	<0.001
Vanadium	ug/g	<0.02	<0.02	<0.02
Zinc	ug/g	5.0	7.4	6.5
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	<0.001	<0.001
Polonium-210	Bq/g	0.0011	0.0006	0.0009
Radium-226	Bq/g	<0.00007	<0.0002	<0.00009
Thorium-228	Bq/g	<0.0001	<0.0003	<0.0002
Thorium-230	Bq/g	<0.0001	<0.0003	<0.0002
Thorium-232	Bq/g	<0.0001	<0.0003	<0.0002
Lab Section 6 (Misc.)				
Moisture	%	77.24	78.54	78.75

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

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EcoMetrix Inc.

Note for Sample # 22758
This sample was reanalyzed for Cobalt. Reanalysis confirms original results are within the expected measurement uncertainty.

Results are reported on a "raw weight" basis.
Revised to include Mercury analysis as requested by client 08/10/2017 SB
Note the addition of results for moisture as per client request. VE Aug 17/17

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EcoMetrix Inc.

22759 **LA7-WS1 *FISH FLESH***
22760 **LA7-WS2 *FISH FLESH***
22761 **LAB-NP1 *FISH FLESH***

Analyte	Units	22759	22760	22761
Lab Section 2 (ICP)				
Aluminum	ug/g	<0.5	<0.5	<0.5
Antimony	ug/g	<0.02	<0.02	<0.02
Arsenic	ug/g	0.03	0.02	0.02
Barium	ug/g	0.05	0.03	0.04
Beryllium	ug/g	<0.002	<0.002	<0.002
Boron	ug/g	<0.2	<0.2	<0.2
Cadmium	ug/g	<0.002	<0.002	<0.002
Chromium	ug/g	<0.1	<0.1	<0.1
Cobalt	ug/g	0.004	<0.002	0.008
Copper	ug/g	0.66	0.17	0.46
Iron	ug/g	5.3	2.2	4.4
Lead	ug/g	<0.002	<0.002	<0.002
Manganese	ug/g	0.09	0.12	0.20
Mercury	ug/g	0.027	0.014	0.14
Molybdenum	ug/g	<0.02	<0.02	<0.02
Nickel	ug/g	0.01	<0.01	<0.01
Selenium	ug/g	0.18	0.18	0.30
Silver	ug/g	<0.002	<0.002	<0.002
Strontium	ug/g	0.15	0.32	0.43
Thallium	ug/g	<0.01	<0.01	<0.01
Tin	ug/g	<0.01	<0.01	<0.01
Titanium	ug/g	<0.01	0.02	0.02
Uranium	ug/g	<0.001	<0.001	<0.001
Vanadium	ug/g	<0.02	<0.02	<0.02
Zinc	ug/g	5.8	2.7	9.8
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.001	<0.001	<0.001
Polonium-210	Bq/g	0.0008	0.0011	0.0012
Radium-226	Bq/g	<0.00007	<0.00007	<0.00007
Thorium-228	Bq/g	<0.0001	<0.0001	<0.0001
Thorium-230	Bq/g	<0.0001	<0.0001	<0.0001
Thorium-232	Bq/g	<0.0001	<0.0001	<0.0001
Lab Section 6 (Misc.)				
Moisture	%	80.16	81.85	79.19

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EcoMetrix Inc.

Note for Sample # 22761
This sample was reanalyzed for Polonium 210. Reanalysis confirms original results are within the expected measurement uncertainty.

Results are reported on a "raw weight" basis.
Revised to include Mercury analysis as requested by client 08/10/2017 SB
Note the addition of results for moisture as per client request. VE Aug 17/17

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EcoMetrix Inc.

22762 **LA1-NP1 *FISH BONES***
22763 **LA1-NP2 *FISH BONES***
22764 **LA1-NP3 *FISH BONES***

Analyte	Units	22762	22763	22764
Lab Section 2 (ICP)				
Aluminum	ug/g	<0.5	<0.5	<0.5
Antimony	ug/g	<0.05	<0.05	<0.05
Arsenic	ug/g	<0.02	<0.02	<0.02
Barium	ug/g	5.5	2.2	5.4
Beryllium	ug/g	<0.01	<0.01	<0.01
Boron	ug/g	<0.5	<0.5	<0.5
Cadmium	ug/g	<0.01	<0.01	<0.01
Chromium	ug/g	<0.2	<0.2	<0.2
Cobalt	ug/g	0.16	0.05	0.12
Copper	ug/g	0.16	0.32	0.28
Iron	ug/g	2.7	5.6	4.4
Lead	ug/g	0.04	<0.01	<0.01
Manganese	ug/g	14	5.7	16
Mercury	ug/g	0.03	0.20	0.02
Molybdenum	ug/g	<0.05	<0.05	<0.05
Nickel	ug/g	0.06	0.07	0.09
Selenium	ug/g	0.12	0.20	0.16
Silver	ug/g	<0.01	<0.01	<0.01
Strontium	ug/g	146	41	117
Thallium	ug/g	<0.02	<0.02	<0.02
Tin	ug/g	<0.02	<0.02	<0.02
Titanium	ug/g	0.21	0.31	0.24
Uranium	ug/g	<0.01	<0.01	<0.01
Vanadium	ug/g	<0.05	<0.05	<0.05
Zinc	ug/g	45	32	64
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.002	<0.002	<0.002
Polonium-210	Bq/g	0.0005	0.0005	0.0007
Radium-226	Bq/g	<0.001	<0.0009	<0.0007
Thorium-228	Bq/g	<0.002	<0.002	<0.001
Thorium-230	Bq/g	<0.002	<0.002	<0.001
Thorium-232	Bq/g	<0.002	<0.002	<0.001
Lab Section 6 (Misc.)				
Moisture	%	59.61	61.35	63.36

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EcoMetrix Inc.

Results are reported on a "raw weight" basis.
Revised to include Mercury analysis as requested by client 08/10/2017 SB
Note the addition of results for moisture as per client request. VE Aug 17/17

Revised

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EcoMetrix Inc.

22765 **LA1-NP4 *FISH BONES***
22766 **LA1-WS1 *FISH BONES***
22767 **LA1-WS2 *FISH BONES***

Analyte	Units	22765	22766	22767
Lab Section 2 (ICP)				
Aluminum	ug/g	<0.5	<0.5	<0.5
Antimony	ug/g	<0.05	<0.05	<0.05
Arsenic	ug/g	<0.02	<0.02	<0.02
Barium	ug/g	3.3	7.3	5.4
Beryllium	ug/g	<0.01	<0.01	<0.01
Boron	ug/g	<0.5	<0.5	<0.5
Cadmium	ug/g	<0.01	<0.01	<0.01
Chromium	ug/g	<0.2	<0.2	<0.2
Cobalt	ug/g	0.07	0.14	0.11
Copper	ug/g	0.27	0.27	0.38
Iron	ug/g	3.2	4.1	9.8
Lead	ug/g	<0.01	<0.01	<0.01
Manganese	ug/g	9.4	10	27
Mercury	ug/g	0.04	<0.01	0.02
Molybdenum	ug/g	<0.05	<0.05	<0.05
Nickel	ug/g	0.04	0.03	0.05
Selenium	ug/g	0.20	0.13	0.21
Silver	ug/g	<0.01	<0.01	0.02
Strontium	ug/g	67	188	119
Thallium	ug/g	<0.02	<0.02	<0.02
Tin	ug/g	<0.02	<0.02	<0.02
Titanium	ug/g	0.33	0.40	0.52
Uranium	ug/g	<0.01	<0.01	<0.01
Vanadium	ug/g	<0.05	<0.05	<0.05
Zinc	ug/g	34	18	21
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.002	<0.002	<0.002
Polonium-210	Bq/g	0.0008	0.001	0.002
Radium-226	Bq/g	<0.0009	<0.0009	<0.001
Thorium-228	Bq/g	<0.002	<0.002	<0.002
Thorium-230	Bq/g	<0.002	<0.002	<0.002
Thorium-232	Bq/g	<0.002	<0.002	<0.002
Lab Section 6 (Misc.)				
Moisture	%	62.20	52.68	53.40

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EcoMetrix Inc.

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Revised to include Mercury analysis as requested by client 08/10/2017 SB
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EcoMetrix Inc.

22768 **LA5-WS1 *FISH BONES***
22769 **LA6-NP1 *FISH BONES***
22770 **LA6-WS1 *FISH BONES***

Analyte	Units	22768	22769	22770
Lab Section 2 (ICP)				
Aluminum	ug/g	1.0	1.4	<0.5
Antimony	ug/g	<0.05	<0.05	<0.05
Arsenic	ug/g	0.02	<0.02	<0.02
Barium	ug/g	4.4	8.0	5.6
Beryllium	ug/g	<0.01	<0.01	<0.01
Boron	ug/g	<0.5	<0.5	<0.5
Cadmium	ug/g	<0.01	<0.01	<0.01
Chromium	ug/g	<0.2	<0.2	<0.2
Cobalt	ug/g	0.10	0.12	0.13
Copper	ug/g	0.37	0.26	0.42
Iron	ug/g	9.4	8.6	13
Lead	ug/g	0.01	<0.01	<0.01
Manganese	ug/g	22	15	36
Mercury	ug/g	0.01	0.06	0.02
Molybdenum	ug/g	<0.05	<0.05	<0.05
Nickel	ug/g	0.07	0.07	0.08
Selenium	ug/g	0.18	0.15	0.20
Silver	ug/g	<0.01	<0.01	<0.01
Strontium	ug/g	107	113	165
Thallium	ug/g	<0.02	<0.02	<0.02
Tin	ug/g	<0.02	<0.02	<0.02
Titanium	ug/g	0.25	0.24	0.23
Uranium	ug/g	<0.01	<0.01	<0.01
Vanadium	ug/g	<0.05	<0.05	<0.05
Zinc	ug/g	20	46	22
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.002	<0.002	<0.002
Polonium-210	Bq/g	0.001	0.0008	0.002
Radium-226	Bq/g	<0.0008	<0.0009	<0.0008
Thorium-228	Bq/g	<0.002	<0.002	<0.002
Thorium-230	Bq/g	<0.002	<0.002	<0.002
Thorium-232	Bq/g	<0.002	<0.002	<0.002
Lab Section 6 (Misc.)				
Moisture	%	57.26	61.99	61.72

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EcoMetrix Inc.

22771 LA7-NP1 *FISH BONES*
22772 LA7-NP2 *FISH BONES*
22773 LA7-NP3 *FISH BONES*

Analyte	Units	22771	22772	22773
Lab Section 2 (ICP)				
Aluminum	ug/g	0.7	<0.5	0.5
Antimony	ug/g	<0.05	<0.05	<0.05
Arsenic	ug/g	<0.02	0.02	<0.02
Barium	ug/g	4.9	4.1	4.5
Beryllium	ug/g	<0.01	<0.01	<0.01
Boron	ug/g	<0.5	<0.5	<0.5
Cadmium	ug/g	<0.01	<0.01	<0.01
Chromium	ug/g	<0.2	<0.2	<0.2
Cobalt	ug/g	0.14	0.13	0.11
Copper	ug/g	0.30	0.25	0.21
Iron	ug/g	7.5	7.6	6.1
Lead	ug/g	<0.01	<0.01	<0.01
Manganese	ug/g	6.8	6.0	7.8
Mercury	ug/g	0.01	0.04	0.03
Molybdenum	ug/g	<0.05	<0.05	<0.05
Nickel	ug/g	0.13	0.05	0.03
Selenium	ug/g	0.12	0.13	0.14
Silver	ug/g	<0.01	<0.01	<0.01
Strontium	ug/g	132	105	127
Thallium	ug/g	<0.02	<0.02	<0.02
Tin	ug/g	0.05	<0.02	<0.02
Titanium	ug/g	0.14	0.15	0.33
Uranium	ug/g	<0.01	<0.01	<0.01
Vanadium	ug/g	<0.05	<0.05	<0.05
Zinc	ug/g	43	44	39
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.002	0.002	<0.002
Polonium-210	Bq/g	<0.0005	0.0008	0.002
Radium-226	Bq/g	<0.001	<0.001	<0.0006
Thorium-228	Bq/g	<0.002	<0.003	<0.001
Thorium-230	Bq/g	<0.002	<0.003	<0.001
Thorium-232	Bq/g	<0.002	<0.003	<0.001
Lab Section 6 (Misc.)				
Moisture	%	55.72	51.09	66.94

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Aug 17, 2017

EcoMetrix Inc.

22774 LA7-WS1 *FISH BONES*
22775 LA7-WS2 *FISH BONES*
22776 LAB-NP1 *FISH BONES*

Analyte	Units	22774	22775	22776
Lab Section 2 (ICP)				
Aluminum	ug/g	<0.5	1.6	0.8
Antimony	ug/g	<0.05	<0.05	<0.05
Arsenic	ug/g	0.03	0.02	0.05
Barium	ug/g	5.2	4.7	1.9
Beryllium	ug/g	<0.01	<0.01	<0.01
Boron	ug/g	<0.5	<0.5	<0.5
Cadmium	ug/g	<0.01	<0.01	<0.01
Chromium	ug/g	<0.2	<0.2	<0.2
Cobalt	ug/g	0.15	0.06	0.12
Copper	ug/g	0.33	0.50	0.44
Iron	ug/g	150	120	150
Lead	ug/g	<0.01	<0.01	<0.01
Manganese	ug/g	16	6.4	17
Mercury	ug/g	<0.01	<0.01	0.05
Molybdenum	ug/g	<0.05	<0.05	<0.05
Nickel	ug/g	0.13	0.05	0.06
Selenium	ug/g	0.16	0.16	0.24
Silver	ug/g	<0.01	<0.01	<0.01
Strontium	ug/g	172	67	39
Thallium	ug/g	<0.02	<0.02	<0.02
Tin	ug/g	<0.02	0.02	<0.02
Titanium	ug/g	0.48	1.7	0.46
Uranium	ug/g	<0.01	<0.01	<0.01
Vanadium	ug/g	<0.05	<0.05	<0.05
Zinc	ug/g	21	11	31
Lab Section 4 (Radiochemistry)				
Lead-210	Bq/g	<0.002	<0.002	<0.002
Polonium-210	Bq/g	0.002	0.001	0.001
Radium-226	Bq/g	<0.001	<0.0009	<0.0007
Thorium-228	Bq/g	<0.002	<0.002	<0.001
Thorium-230	Bq/g	<0.002	<0.002	<0.001
Thorium-232	Bq/g	<0.002	<0.002	<0.001
Lab Section 6 (Misc.)				
Moisture	%	60.03	65.32	64.97

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Revised

SRC Group # 2017-6189

Aug 17, 2017

EcoMetrix Inc.

Results are reported on a "raw weight" basis.
Revised to include Mercury analysis as requested by client 08/10/2017 SB
Note the addition of results for moisture as per client request. VE Aug 17/17

CANADIAN CENTRE FOR DNA BARCODING
DNA Testing Laboratory Report

FORENSIC CASE INFORMATION

File Number:	CCDB-PRE-02763
Accession Number:	CCDB-PRE-02763
Client Name:	Fei Luo EcoMetrix, Inc. 6800 Campobello Road Mississauga, ON L5N 2L8 Canada Email: fluo@ecometrix.ca

ITEMS

Description: Environmental samples (22 tubes with NC filters preserved in ethanol)

Dates Received:	July 18, 2018
Received From:	Fei Luo
Dates of Analysis:	July 26, 2018 to August 14, 2018
Collector/Collection Site:	Natalia Ivanova / Canadian Centre for DNA Barcoding, Biodiversity of Ontario, University of Guelph, 50 Stone Road East, Guelph
Processed by:	Natalia Ivanova

METHODS

DNA extraction:

Upon receiving, each sample tube was accessioned with Process and kept at -20°C before processing. Prior to DNA extraction, all lab surfaces and pipettors were sterilized using 10% bleach, followed by 70% ethanol, as described in [1]. Pipettors were repeatedly cleaned with 10% bleach, followed by 70% ethanol during extraction and gloves were frequently changed. Centrifuge rotors, adapters, and tube racks were washed with diluted ELIMINase (Decon Labs) (1:10) and rinsed with deionized water. Prior to Extraction each filter was carefully unfolded using sterilized forceps (forceps were sterilized with 20% bleach, followed by 100% ethanol and triple flame sterilization between samples) and placed in DNEasy PowerWater Bead Tube. DNA was extracted using QIAGEN DNEasy PowerWater kit following manufacturer's instructions for alternative lysis procedure (heating samples at 65°C prior to grinding) and eluted in 100 µl of EB buffer. DNA was transferred into a 96-well plate in 3 replicates per sample.

The Next Generation Sequencing (NGS) workflows:

S5 workflow:
The target genetic marker – COI was amplified using the Polymerase Chain Reaction (PCR) for 40 cycles with M13-tailed primers (Table 1), using standard CCDB protocol for Platinum Taq to produce M13-tailed amplicon libraries. Resulted PCR products were diluted 2x and used for second round PCR with fusion primers for 20 cycles to create IonXpress MID-tag labeled libraries. AquaF2 library was pooled without normalization and purified using magnetic beads with 0.9 to 1 bead to product ratio, and diluted to 26 pM for S5 run using Ion 520/530 chef kit.

PGM workflow:
The target genetic marker – COI was amplified using the Polymerase Chain Reaction (PCR) for 40 cycles with regular primers (Table 1), using standard CCDB protocol for Platinum Taq to produce. Resulted PCR products were diluted 2x and used for second round PCR with fusion primers for 20 cycles to create IonXpress MID-tag labeled libraries.
Each library (AquaF2 and AquaF3) was pooled separately without normalization and purified using magnetic beads with 0.9 to 1 bead to product ratio, then each amplicon library was diluted to 13 pM. For the PGM run two libraries were combined in equal ratios and resulting normalized library was used for templating reaction. or Ion PGM Template Hi-Q View 400 kit, 316 chip and Hi-Q View Ion PGM Sequencing 400 Kit for Ion Torrent PGM were used for sequencing, according to manufacturer's instructions.

Note: For the S5 workflow, each DNA replicate was processed under a separate IonXpress MID-tag, while for the PGM workflow three DNA replicates for each sample were processed under the same IonXpress MID-tag.

The following procedure was used to process the raw NGS reads: Cutadapt (v1.8.1) was used to trim primer sequences; Sickle (v1.33) was used for size filtering (sequences from 100-205 bp were retained), while Uclust (v1.2.22q) was employed to recognize OTUs based on the >98% identity and a minimum read depth of 2 thresholds. The Local Blast 2.2.29+ algorithm was then used to compare each OTU to the reference sequences in five datasets: public fish data from BOLD filtered to genus and species ID level (130,357 sequences), and public BOLD data for Amphibia, Aves, Mammalia, and Reptilia represented by the following datasets: DS-EBACAMPH (11,018 sequences), DS-EBACAVES (28,914 sequences), DS-EBACMAMM (39,890 sequences), DS-EBACREPT (5,424 sequences). Raw Blast output results were parsed using a custom-built python scripts, processed results in tab-delimited format were imported to MS Excel, filtered by min score of 250, and 97-100% percent identity range. Blast search results were parsed and concatenated using custom Python scripts; exported to Excel and visualized using Tableau software.

Table 1. Primers used for eDNA amplification

Region/Primer name	Direction	Primer sequence	Reference
COX1			
AquaF2	F	[M13F]ATCACRACCATCATYAAYATRAARCC	[2]
AquaF3	F	[M13F]CCAGCCATTTCNCARTACCARACRCC	[1]
C_FishR1		**Cocktail primers (FR1d: FishR2; 1:1)**	[3]
FR1d	R	[M13R]ACCTCAGGGTGTCCGAARAAYCARAA	
FishR2	R	[M13R]ACTTCAGGGTGACCGAAGAATCAGAA	
M13-tails - S5 workflow			
M13F	F	TGTAAAACGACGGCCAGT	[4]
M13R	R	CAGGAAACAGCTATGAC	[4]
NGS-fusion			
IonA	F	CCATCTCATCCCTGCGTGTCTCC[GACT][IonExpress-MID][specific sequence]	Ion Torrent, Thermo Fisher Scientific
trP1	R	CCTCTCTATGGGCAGTCGGTGAT [specific sequence]	Ion Torrent, Thermo Fisher Scientific

DNA SEQUENCING RESULTS AND INTERPRETATION FOR NGS

NGS run reports are provided in Appendixes 1 and 2. Only high quality reads assigned to correct Ion Express MID tags were used in NGS data analysis. Only human reads were detected both in Samples and Negative controls. No vertebrate DNA was detected in environmental samples.

SUMMARY

Table 2. Summary of identification results filtered by min score 250. Green shading – samples processed on S5 and PGM instruments, no shading – S5 only.

				Instrument	
Process ID	**Sample ID**	**Top Hit Identification**	**Replicate**	**PGM**	**S5**
CCDB-ST02290	LA1DNA1	Homo sapiens	Rep1-3	8	
			Rep2		2
		NoTopHit	Rep1-3	2001	
			Rep2		2
			Rep3		2
CCDB-ST02291	LA1DNA2	Homo sapiens	Rep1-3	111328	
		NoTopHit	Rep1		8
			Rep1-3	10	
			Rep2		2
CCDB-ST02292	LA1DNA3	Homo sapiens	Rep1-3	10	
			Rep2		1056
		NoTopHit	Rep1		2
			Rep1-3	110	
			Rep3		2
CCDB-ST02293	LA1DNA4	Homo sapiens	Rep1-3	209221	
		NoTopHit	Rep1		5

			Rep1-3	135678	
			Rep2		8
CCDB-ST02294	LA1DNA5	Homo sapiens	Rep2		26
		NoTopHit	Rep1-3	11	
			Rep2		2
CCDB-ST02295	LA1DNA5	NoTopHit	Rep1		18640
			Rep1-3	203761	
			Rep3		277
CCDB-ST02296	LA1DNA6	Homo sapiens	Rep1-3	196873	
		NoTopHit	Rep1-3	14537	
CCDB-ST02297	LA1DNA7	Homo sapiens	Rep1-3	4	
		NoTopHit	Rep1-3	101	
CCDB-ST02298	LA1DNA8	Homo sapiens	Rep1-3	779	
		NoTopHit	Rep1-3	1946	
			Rep2		2
			Rep3		75
CCDB-ST02299	LA1DNA9	Homo sapiens	Rep1-3	5	
		NoTopHit	Rep1		5556
			Rep1-3	17687	
CCDB-ST02300	LA1DNA10	Homo sapiens	Rep1-3	4	
		NoTopHit	Rep1-3	2	
			Rep3		2
CCDB-ST02301	LA6DNA1	NoTopHit	Rep1		6122
			Rep1-3	5395	
			Rep2		457
			Rep3		3060
CCDB-ST02302	LA6DNA2	Homo sapiens	Rep1		42
			Rep1-3	15144	
		NoTopHit	Rep1		77939
			Rep1-3	45360	
			Rep2		146654
CCDB-ST02303	LA6DNA3	NoTopHit	Rep1		8
			Rep2		6
			Rep3		1400522
CCDB-ST02304	LA6DNA4	NoTopHit	Rep1		2360719
			Rep2		2
			Rep3		497780
CCDB-ST02305	LA6DNA5	NoTopHit	Rep1		3
			Rep2		2
			Rep3		709654
CCDB-ST02306	LA6DNA6	NoTopHit	Rep1		3
CCDB-ST02307	LA6DNA7	NoTopHit	Rep2		13
CCDB-ST02308	LA6DNA8	NoTopHit	Rep1		8
			Rep3		2

CCDB-ST02311	FieldBlk	Homo sapiens	Rep1-3	6	
		NoTopHit	Rep1		7
			Rep1-3	5	
CCDB-ST02312	CCDB-EXT-NEG	Homo sapiens	Rep1-3	4	
			Rep3		1038775
		NoTopHit	Rep1		3
			Rep2		4
CCDB-ST02313	CCDB-PCR-NEG	Homo sapiens	Rep1-3	2	
			Rep2		3
		NoTopHit	Rep1-3	8	
			Rep2		2
			Rep3		2

TROUBLESHOOTING

DNA was quantified using Qubit HS kit. Majority of samples (except for LA1DNA5B, LA6DNA1 and LA6DNA2, which barely passed sensitivity threshold) were below sensitivity threshold.

RECOMMENDATIONS

1) Optimize sampling and DNA extraction protocols using alternative kits or CCDB DNA extraction protocols, as there were reported issues with Qiagen version of DNEasy PowerWater kit: https://www.researchgate.net/post/Is_the_new_DNeasy_Power_Water_kit_from_Qiagen_working_properly_for_DNA_extraction
2) We suggest running mock experiment using water from aquarium and from Irvine creek in Elora on frozen and Ethanol-preserved filters using in-house DNA extraction method and DNeasy kit as a control. We need to develop proper filter handling technique which will allow to process samples in efficient manner. DNA extracted from the mock experiment (or PCR product generated from this DNA) can serve as a positive control for future NGS runs for this project.

EXAMPLE OF SUCCESSFUL eDNA SEQUENCING RUN

Example of successful eDNA sequencing run from our recent paper on eDNA detection [1] is provided in Appendix 3.

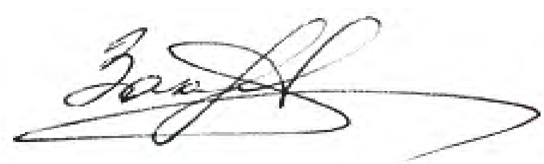
References

1. Valdez-Moreno M, Ivanova N V., Elias-Gutierrez M, Pedersen SL, Bessonov K, Hebert PDN. Using eDNA to biomonitor the fish community in a tropical oligotrophic lake. bioRxiv. 2018; 375089. doi:10.1101/375089
2. Ivanova N V, Clare EL, Borisenko A V. DNA barcoding in mammals. In: Kress J, Erickson D, editors. Analytical protocols In: DNA barcodes, methods in molecular biology. Humana Press; 2012. pp. 153–182. doi:10.1007/978-1-61779-591-6
3. Ivanova NV, Zemlak TS, Hanner RH, Hebert PDN. Universal primer cocktails for fish DNA barcoding. Mol Ecol Notes. 2007;7: 544–548.
4. Messing J. New M13 vectors for cloning. Methods Enzymol. 1983;101: 20–78.

RESULTS REPORTED BY:

Natalia Ivanova, Lead DNA Scientist

RESULTS REVIEWED BY:



Dr. Evgeny V. Zakharov, Director, CCDB

All inquiries pertaining to this report should be directed to Natalia Ivanova (nivanova@uoguelph.ca) and Evgeny V. Zakharov (zakharov@uoguelph.ca).
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Appendix 1. Ion Torrent S5 Report

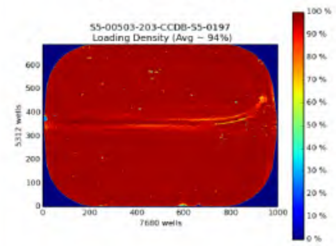
Run Report for Auto_user_S5-00503-203-CCDB-S5-0197_335

Run Summary

3.75 G	105
Total Bases	Key Signal

94%
ISP Loading

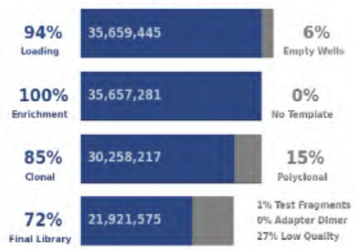
ISP Density



21,921,575
Total Reads

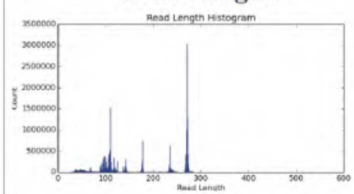
62%
Usable Reads

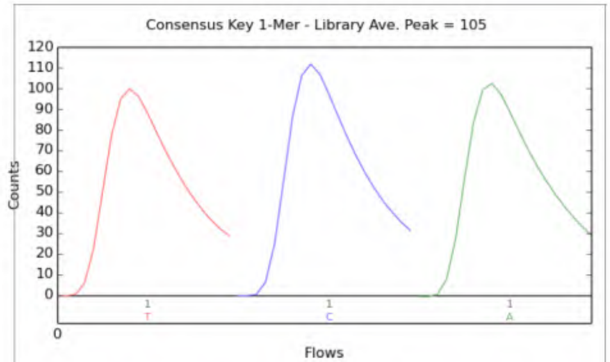
ISP Summary



171 bp	141 bp	270 bp
Mean	Median	Mode

Read Length

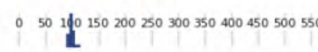
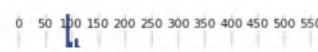




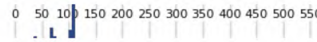
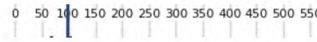
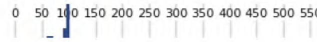
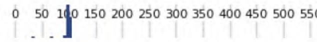
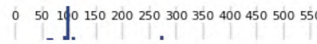
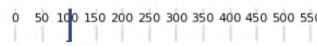
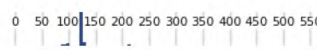
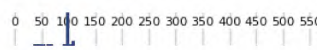
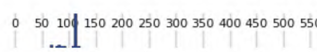
Addressable Wells	**37,849,615**	
With ISPs	35,659,445	94.2%
Live	35,657,281	100.0%
Test Fragment	314,933	00.9%
Library	35,342,348	99.1%

Library ISPs	**35,342,348**	
Filtered: Polyclonal	5,399,064	15.3%
Filtered: Low Quality	7,741,851	21.9%
Filtered: Adapter Dimer	1,067	00.0%
Final Library ISPs	**21,921,575**	**62.0%**

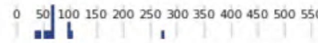
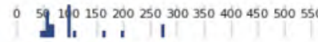
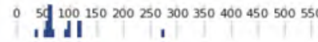
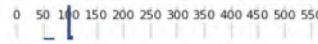
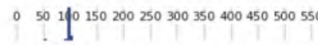
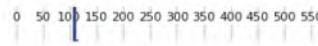
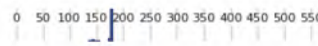
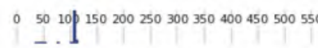
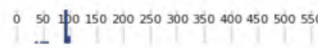
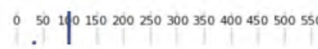
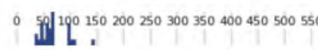
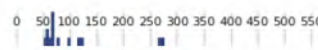
Notes: CCDB-PRE-02763. Fei Luo eDNA. DNeasy PowerWater Kit. AquaF2_t1-C_FishR1_t1. Platinum 40x20 cycles. 0.9 cleanup. 26 pM.

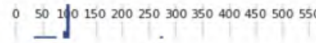
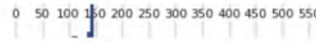
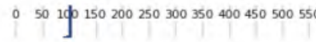
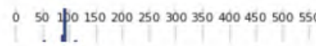
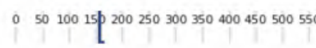
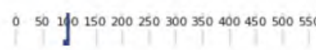
Barcode Name	Sample	Bases	$\geq Q20$	Reads	Mean Read Length	Read Length Histogram
No barcode	none	94,233,563	72,871,096	691,350	136 bp	
IonXpress_001	CCDB-ST02290_LA1DNA1_AquaF2t1-CFishR1t1_Rep1	455,321	409,439	4,738	96 bp	
IonXpress_002	CCDB-ST02290_LA1DNA1_AquaF2t1-CFishR1t1_Rep2	324,606	299,212	3,390	95 bp	
IonXpress_003	CCDB-ST02290_LA1DNA1_AquaF2t1-CFishR1t1_Rep3	57,431,110	51,416,164	522,459	109 bp	

iontorrent by Thermo Fisher Scientific

IonXpress_004	CCDB-ST02291_LA1DNA2_AquaF2t1-CFishR1t1_Rep1	52,768,389	45,706,094	554,957	95 bp	
IonXpress_005	CCDB-ST02291_LA1DNA2_AquaF2t1-CFishR1t1_Rep2	3,054	2,735	25	122 bp	
IonXpress_006	CCDB-ST02291_LA1DNA2_AquaF2t1-CFishR1t1_Rep3	15,177	13,929	157	96 bp	
IonXpress_007	CCDB-ST02292_LA1DNA3_AquaF2t1-CFishR1t1_Rep1	19,359,782	17,529,030	209,689	92 bp	
IonXpress_008	CCDB-ST02292_LA1DNA3_AquaF2t1-CFishR1t1_Rep2	378,242	339,528	1,513	249 bp	
IonXpress_009	CCDB-ST02292_LA1DNA3_AquaF2t1-CFishR1t1_Rep3	44,336	38,908	463	95 bp	
IonXpress_010	CCDB-ST02293_LA1DNA4_AquaF2t1-CFishR1t1_Rep1	2,759	2,613	23	119 bp	
IonXpress_011	CCDB-ST02293_LA1DNA4_AquaF2t1-CFishR1t1_Rep2	10,491	9,620	99	105 bp	
IonXpress_012	CCDB-ST02293_LA1DNA4_AquaF2t1-CFishR1t1_Rep3	1,633	1,383	20	81 bp	
IonXpress_013	CCDB-ST02294_LA1DNA5_AquaF2t1-CFishR1t1_Rep1	157,707	144,411	1,593	99 bp	
IonXpress_014	CCDB-ST02294_LA1DNA5_AquaF2t1-CFishR1t1_Rep2	14,075	12,553	76	185 bp	
IonXpress_015	CCDB-ST02294_LA1DNA5_AquaF2t1-CFishR1t1_Rep3	2,551	2,309	33	77 bp	
IonXpress_016	CCDB-ST02295_LA1DNA5_AquaF2t1-CFishR1t1_Rep1	63,894,088	57,495,463	516,193	123 bp	
IonXpress_017	CCDB-ST02295_LA1DNA5_AquaF2t1-CFishR1t1_Rep2	40,864,306	36,044,300	450,799	90 bp	
IonXpress_018	CCDB-ST02295_LA1DNA5_AquaF2t1-CFishR1t1_Rep3	5,155,818	4,413,581	48,517	106 bp	

CCDB, BIO, UofG, 50 Stone Rd E, Building 138, Guelph, ON. Canada N1G 2W1 Tel: 1-519-824-4120 Fax: 1-519-824-5703

IonXpress_019	CCDB-ST02296_LA1DNA6_AquaF2t1-CFishR1t1_Rep1	1,086	994	13	83 bp	
IonXpress_020	CCDB-ST02296_LA1DNA6_AquaF2t1-CFishR1t1_Rep2	2,094	1,876	16	130 bp	
IonXpress_021	CCDB-ST02296_LA1DNA6_AquaF2t1-CFishR1t1_Rep3	2,082	1,933	20	104 bp	
IonXpress_022	CCDB-ST02297_LA1DNA7_AquaF2t1-CFishR1t1_Rep1	1,307	1,151	15	87 bp	
IonXpress_023	CCDB-ST02297_LA1DNA7_AquaF2t1-CFishR1t1_Rep2	13,404	11,427	142	94 bp	
IonXpress_024	CCDB-ST02297_LA1DNA7_AquaF2t1-CFishR1t1_Rep3	2,302	2,050	19	121 bp	
IonXpress_025	CCDB-ST02298_LA1DNA8_AquaF2t1-CFishR1t1_Rep1	87,876	77,119	913	96 bp	
IonXpress_026	CCDB-ST02298_LA1DNA8_AquaF2t1-CFishR1t1_Rep2	9,782,037	8,812,172	92,015	106 bp	
IonXpress_027	CCDB-ST02298_LA1DNA8_AquaF2t1-CFishR1t1_Rep3	23,054	21,752	92	250 bp	
IonXpress_028	CCDB-ST02299_LA1DNA9_AquaF2t1-CFishR1t1_Rep1	287,403,674	256,896,423	1,731,359	165 bp	
IonXpress_029	CCDB-ST02299_LA1DNA9_AquaF2t1-CFishR1t1_Rep2	82,473,110	70,290,262	829,477	99 bp	
IonXpress_030	CCDB-ST02299_LA1DNA9_AquaF2t1-CFishR1t1_Rep3	17,288,090	14,434,306	193,587	89 bp	
IonXpress_031	CCDB-ST02300_LA1DNA10_AquaF2t1-CFishR1t1_Rep1	56,460	52,150	628	89 bp	
IonXpress_032	CCDB-ST02300_LA1DNA10_AquaF2t1-CFishR1t1_Rep2	1,902	1,561	28	67 bp	
IonXpress_033	CCDB-ST02300_LA1DNA10_AquaF2t1-CFishR1t1_Rep3	1,453	1,323	14	103 bp	

IonXpress_034	CCDB-ST02301_LA6DNA1_AquaF2t1-CFishR1t1_Rep1	40,715,490	35,124,314	450,159	90 bp	
IonXpress_035	CCDB-ST02301_LA6DNA1_AquaF2t1-CFishR1t1_Rep2	87,592,056	71,915,031	665,906	131 bp	
IonXpress_036	CCDB-ST02301_LA6DNA1_AquaF2t1-CFishR1t1_Rep3	30,406,570	28,237,067	306,120	99 bp	
IonXpress_037	CCDB-ST02302_LA6DNA2_AquaF2t1-CFishR1t1_Rep1	70,172,337	62,428,955	554,681	126 bp	
IonXpress_038	CCDB-ST02302_LA6DNA2_AquaF2t1-CFishR1t1_Rep2	155,508,084	132,675,436	1,129,858	137 bp	
IonXpress_039	CCDB-ST02302_LA6DNA2_AquaF2t1-CFishR1t1_Rep3	274,095,886	246,621,070	1,367,746	200 bp	
IonXpress_040	CCDB-ST02303_LA6DNA3_AquaF2t1-CFishR1t1_Rep1	11,425,122	9,743,682	129,926	87 bp	
IonXpress_041	CCDB-ST02303_LA6DNA3_AquaF2t1-CFishR1t1_Rep2	6,028	5,543	41	147 bp	
IonXpress_042	CCDB-ST02303_LA6DNA3_AquaF2t1-CFishR1t1_Rep3	492,884,625	442,615,230	1,987,850	247 bp	
IonXpress_043	CCDB-ST02304_LA6DNA4_AquaF2t1-CFishR1t1_Rep1	745,629,062	684,888,676	3,045,707	244 bp	
IonXpress_044	CCDB-ST02304_LA6DNA4_AquaF2t1-CFishR1t1_Rep2	784,070	715,716	5,089	154 bp	
IonXpress_045	CCDB-ST02304_LA6DNA4_AquaF2t1-CFishR1t1_Rep3	185,239,626	154,481,096	763,321	242 bp	
IonXpress_046	CCDB-ST02305_LA6DNA5_AquaF2t1-CFishR1t1_Rep1	2,884	2,586	23	125 bp	
IonXpress_047	CCDB-ST02305_LA6DNA5_AquaF2t1-CFishR1t1_Rep2	8,416,651	7,711,184	89,817	93 bp	
IonXpress_048	CCDB-ST02305_LA6DNA5_AquaF2t1-CFishR1t1_Rep3	235,407,678	213,739,174	1,061,301	221 bp	

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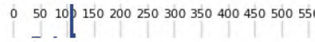
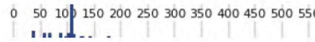
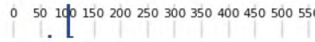
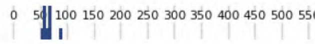
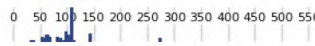
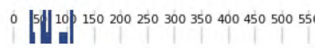
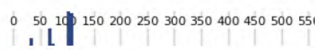
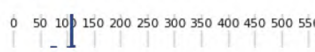
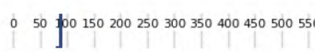
IonXpress_049	CCDB-ST02306_LA6DNA6_AquaF2t1-CFishR1t1_Rep1	3,685	3,140	37	99 bp	
IonXpress_050	CCDB-ST02306_LA6DNA6_AquaF2t1-CFishR1t1_Rep2	51,467,706	44,983,313	507,237	101 bp	
IonXpress_051	CCDB-ST02306_LA6DNA6_AquaF2t1-CFishR1t1_Rep3	4,070	3,527	43	94 bp	
IonXpress_052	CCDB-ST02307_LA6DNA7_AquaF2t1-CFishR1t1_Rep1	15,996	14,742	163	98 bp	
IonXpress_053	CCDB-ST02307_LA6DNA7_AquaF2t1-CFishR1t1_Rep2	9,036	7,898	51	177 bp	
IonXpress_054	CCDB-ST02307_LA6DNA7_AquaF2t1-CFishR1t1_Rep3	578	563	9	64 bp	
IonXpress_055	CCDB-ST02308_LA6DNA8_AquaF2t1-CFishR1t1_Rep1	6,151	5,567	46	133 bp	
IonXpress_056	CCDB-ST02308_LA6DNA8_AquaF2t1-CFishR1t1_Rep2	5,765	4,731	58	99 bp	
IonXpress_057	CCDB-ST02308_LA6DNA8_AquaF2t1-CFishR1t1_Rep3	1,224	1,130	8	153 bp	
IonXpress_058	CCDB-ST02309_LA6DUP_AquaF2t1-CFishR1t1_Rep1	1,274	1,212	19	67 bp	
IonXpress_059	CCDB-ST02309_LA6DUP_AquaF2t1-CFishR1t1_Rep2	1,917	1,811	27	71 bp	
IonXpress_060	CCDB-ST02309_LA6DUP_AquaF2t1-CFishR1t1_Rep3	862,378	790,749	9,463	91 bp	
IonXpress_073	CCDB-ST02310_LA6DNA9_AquaF2t1-CFishR1t1_Rep1	1,598	1,439	18	88 bp	
IonXpress_074	CCDB-ST02310_LA6DNA9_AquaF2t1-CFishR1t1_Rep2	56,423,854	49,647,442	537,078	105 bp	
IonXpress_075	CCDB-ST02310_LA6DNA9_AquaF2t1-CFishR1t1_Rep3	15,796,008	14,273,435	187,125	84 bp	

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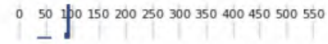
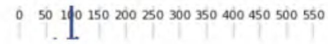
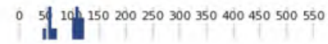
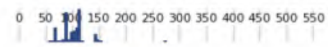
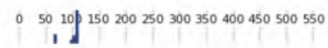
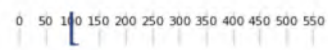
Run Report for Auto_user_S5-00503-203-CCDB-S5-0197_335

IonXpress_079	CCDB-ST02311_FieldBlk_AquaF2t1-CFishR1t1_Rep1	32,415,983	27,936,762	379,159	85 bp	
IonXpress_080	CCDB-ST02311_FieldBlk_AquaF2t1-CFishR1t1_Rep2	18,862,974	16,714,253	199,720	94 bp	
IonXpress_081	CCDB-ST02311_FieldBlk_AquaF2t1-CFishR1t1_Rep3	1,327	1,095	15	88 bp	
IonXpress_082	CCDB-ST02312_CCDB-EXT-NEG_AquaF2t1-CFishR1t1_Rep1	40,060	35,325	395	101 bp	
IonXpress_083	CCDB-ST02312_CCDB-EXT-NEG_AquaF2t1-CFishR1t1_Rep2	456,240	422,503	4,675	97 bp	
IonXpress_084	CCDB-ST02312_CCDB-EXT-NEG_AquaF2t1-CFishR1t1_Rep3	420,663,168	361,590,478	1,783,046	235 bp	
IonXpress_094	CCDB-ST02313_CCDB-PCR-NEG_AquaF2t1-CFishR1t1_Rep1	5,549,316	4,959,511	57,699	96 bp	
IonXpress_095	CCDB-ST02313_CCDB-PCR-NEG_AquaF2t1-CFishR1t1_Rep2	56,761,856	48,976,045	597,014	95 bp	
IonXpress_096	CCDB-ST02313_CCDB-PCR-NEG_AquaF2t1-CFishR1t1_Rep3	23,407,776	20,479,450	246,471	94 bp	

Test Fragment	Reads	Percent 50AQ17	Read Length Histogram
TF_1	**107,810**	**95**	

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Appendix 2. Ion Torrent PGM Report

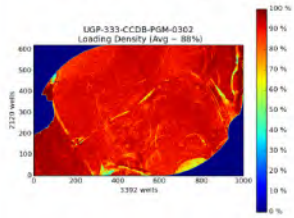
Run Report for Auto_user_UGP-333-CCDB-PGM-0302_213

Run Summary

395 M Total Bases — **78** Key Signal

88% ISP Loading

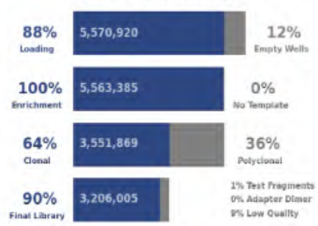
ISP Density



3,206,005 Total Reads

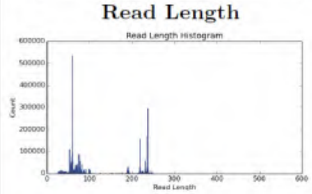
58% Usable Reads

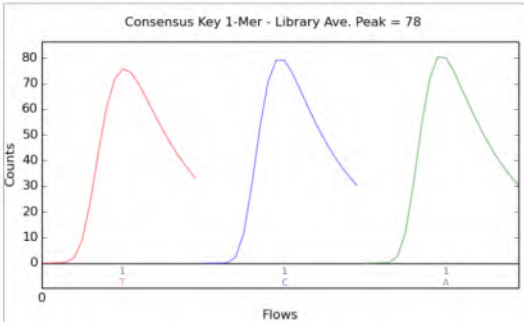
ISP Summary



123 bp Mean — **74 bp** Median — **58 bp** Mode

Read Length

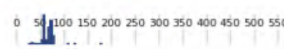




Addressable Wells	**6,337,389**	
With ISPs	5,570,920	87.9%
Live	5,563,385	99.9%
Test Fragment	36,425	00.7%
Library	5,526,960	99.3%

Library ISPs	**5,526,960**	
Filtered: Polyclonal	2,011,516	36.4%
Filtered: Low Quality	265,488	04.8%
Filtered: Adapter Dimer	83	00.0%
Final Library ISPs	**3,206,005**	**58.0%**

Notes: CCDB-PRE-02763. Fei Luo eDNA. DNeasy PowerWater Kit. AquaF2-F3C_FishR1. Platinum 40x20 cycles. 0.9 manual cleanup. 13 pM

Barcode Name	Sample	Bases	≥ Q20	Reads	Mean Read Length	Read Length Histogram
No barcode	none	14,684,175	11,381,644	177,138	82 bp	
IonXpress_040	CCDB-ST02290_LA1DNA1_AquaF2-F3-CFishR1	9,233,550	8,658,461	139,619	66 bp	
IonXpress_041	CCDB-ST02291_LA1DNA2_AquaF2-F3-CFishR1	32,522,576	30,871,924	202,335	160 bp	
IonXpress_042	CCDB-ST02292_LA1DNA3_AquaF2-F3-CFishR1	31,264,120	29,608,464	228,840	136 bp	

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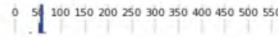
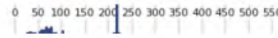
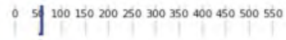
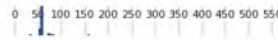
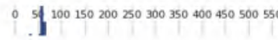
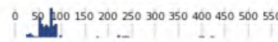
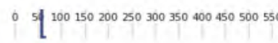
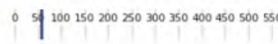
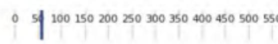
Run Report for Auto_user_UGP-333-CCDB-PGM-0302_213

IonXpress_043	CCDB-ST02293_LA1DNA4_AquaF2-F3-CFishR1	87,673,629	82,555,250	481,244	182 bp	
IonXpress_044	CCDB-ST02294_LA1DNA5_AquaF2-F3-CFishR1	2,765,183	2,606,517	49,496	55 bp	
IonXpress_045	CCDB-ST02295_LA1DNA5_AquaF2-F3-CFishR1	69,840,746	65,184,366	510,229	136 bp	
IonXpress_046	CCDB-ST02296_LA1DNA6_AquaF2-F3-CFishR1	58,303,327	55,332,442	331,953	175 bp	
IonXpress_047	CCDB-ST02297_LA1DNA7_AquaF2-F3-CFishR1	5,089,413	4,739,639	81,388	62 bp	
IonXpress_048	CCDB-ST02298_LA1DNA8_AquaF2-F3-CFishR1	5,163,433	4,888,657	82,634	62 bp	
IonXpress_049	CCDB-ST02299_LA1DNA9_AquaF2-F3-CFishR1	12,192,872	11,459,906	144,618	84 bp	
IonXpress_050	CCDB-ST02300_LA1DNA10_AquaF2-F3-CFishR1	3,376,554	3,166,743	58,996	57 bp	
IonXpress_051	CCDB-ST02301_LA6DNA1_AquaF2-F3-CFishR1	19,477,805	17,705,260	215,792	90 bp	
IonXpress_052	CCDB-ST02302_LA6DNA2_AquaF2-F3-CFishR1	31,607,735	30,029,186	302,909	104 bp	
IonXpress_053	CCDB-ST02311_FieldBlk_AquaF2-F3-CFishR1	4,268,180	3,967,145	74,203	57 bp	
IonXpress_054	CCDB-ST02312_CCDB-EXT-NEG_AquaF2-F3-CFishR1	3,131,615	2,950,690	54,668	57 bp	
IonXpress_055	CCDB-ST02313_CCDB-PCR-NEG_AquaF2-F3-CFishR1	3,998,678	3,747,359	69,903	57 bp	

Test Fragments Report

Run Report for Auto_user_UGP-333-CCDB-PGM-0302_213

TF_C	**22,591**	**98**	
TF_1	**12,107**	**92**	

Appendix 3. Example of productive S5 sequencing run on eDNA.

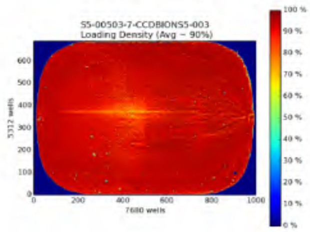
Run Report for Auto_user_S5-00503-7-CCDBIONS5-003_63

Run Summary

4.51 G	112
Total Bases	Key Signal

90%
ISP Loading

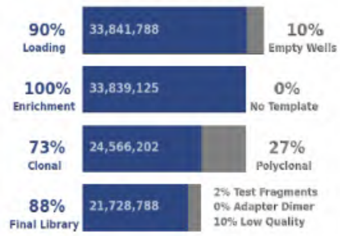
ISP Density



21,728,788
Total Reads

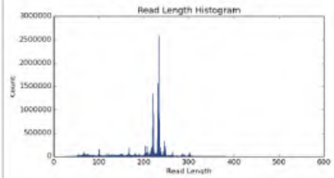
65%
Usable Reads

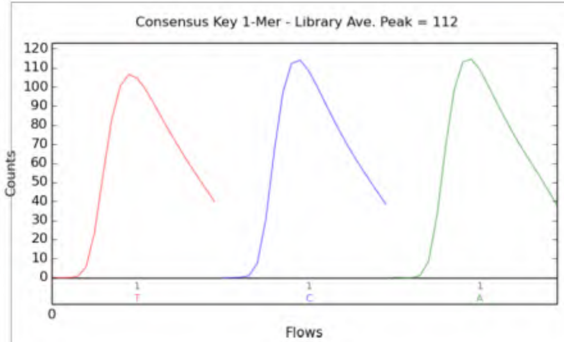
ISP Summary



207 bp	225 bp	233 bp
Mean	Median	Mode

Read Length





Addressable Wells	**37,559,830**	
With ISPs	33,841,788	90.1%
Live	33,839,125	100.0%
Test Fragment	464,815	01.4%
Library	33,374,310	98.6%

Library ISPs	**33,374,310**	
Filtered: Polyclonal	9,272,923	27.8%
Filtered: Low Quality	2,393,044	07.2%
Filtered: Adapter Dimer	335	00.0%
Final Library ISPs	**21,728,788**	**65.1%**

Notes: CCDBION187 eDNA re-purified. Mexico eDNA same library dilution. 1_2 of PGM dilution aiming for 26 pmol.

Barcode Name	Sample	Bases	≥ $Q20$	Reads	Mean Read Length
No barcode	none	2,265,502,459	2,086,838,687	11,318,236	200 bp
IonXpress_040	PW1-AquaF2-AquaF3-ion40-C_FishR1_trP1	178,498,912	168,563,853	815,252	219 bp
IonXpress_041	PW2-AquaF2-AquaF3-ion41-C_FishR1_trP1	157,020,826	147,834,242	737,133	213 bp
IonXpress_042	PW3-AquaF2-AquaF3-ion42-C_FishR1_trP1	166,857,470	157,797,927	759,707	220 bp
IonXpress_043	PW4-AquaF2-AquaF3-ion43-C_FishR1_trP1	174,092,897	163,434,131	812,073	214 bp
IonXpress_044	PW5-AquaF2-AquaF3-ion44-C_FishR1_trP1	112,142,766	105,286,997	516,418	217 bp

1

iontorrent by Thermo Fisher Scientific

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www.src.sk.ca/analytical

SRC Group # 2019-9335

Jul 22, 2019

EcoMetrix Inc.
6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Robert Eakins

Date Samples Received: Jul-08-2019 Client P.O.:

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 1, Lab Section 2 authorized by Keith Gipman, Supervisor
Results from Lab Section 4 authorized by Vicky Snook, Supervisor

---

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

This is a final report.

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SRC Group # 2019-9335

Jul 22, 2019

EcoMetrix Inc.

6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Robert Eakins

Date Samples Received: Jul-08-2019 Client P.O.:

37104 **07/05/2019 SA1 *WATER***
37105 **07/05/2019 SA1B *WATER***
37106 **07/05/2019 SA2 *WATER***

Analyte	Units	37104	37105	37106
Lab Section 1				
Bicarbonate	mg/L	8	7	5
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	0.5	0.4	0.4
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
pH	pH units	7.02	7.04	7.04
Specific conductivity	uS/cm	13	11	9
Sum of ions	mg/L	13	11	9
Total alkalinity	mg/L	7	6	4
Total hardness	mg/L	5	5	4
Ammonia as nitrogen	mg/L	<0.01	<0.01	<0.01
Nitrate	mg/L	<0.04	<0.04	<0.04
Total Kjeldahl nitrogen	mg/L	0.48	0.55	0.58
Mercury	ng/L	2	2	2
Organic carbon	mg/L	2.2	2.1	2.3
Organic carbon, dissolved	mg/L	2.4	2.5	2.7
Fluoride	mg/L	0.02	0.02	0.02
Total dissolved solids	mg/L	33	34	12
Total suspended solids	mg/L	1	1	<1
Lab Section 2				
Calcium	mg/L	1.2	1.2	1.1
Magnesium	mg/L	0.4	0.4	0.3
Potassium	mg/L	0.4	0.4	0.3
Sodium	mg/L	1.4	1.4	1.4
Sulfate	mg/L	0.7	0.6	0.6
Aluminum	mg/L	0.0054	0.0068	0.0071
Antimony	mg/L	<0.0002	<0.0002	<0.0002
Arsenic	ug/L	<0.1	<0.1	<0.1
Barium	mg/L	0.0022	0.0023	0.0020
Beryllium	mg/L	<0.0001	<0.0001	<0.0001
Boron	mg/L	<0.01	<0.01	<0.01

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SRC Group # 2019-9335

Jul 22, 2019

EcoMetrix Inc.

37104 **07/05/2019 SA1 *WATER***
37105 **07/05/2019 SA1B *WATER***
37106 **07/05/2019 SA2 *WATER***

Analyte	Units	37104	37105	37106
Lab Section 2				
Cadmium	mg/L	<0.00001	<0.00001	<0.00001
Chromium	mg/L	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0002	<0.0002	<0.0002
Iron	mg/L	0.12	0.11	0.066
Lead	mg/L	<0.0001	<0.0001	<0.0001
Manganese	mg/L	0.012	0.013	0.0098
Molybdenum	mg/L	<0.0001	<0.0001	<0.0001
Nickel	mg/L	<0.0001	<0.0001	<0.0001
Selenium	mg/L	<0.0001	<0.0001	<0.0001
Silver	mg/L	<0.00005	<0.00005	<0.00005
Strontium	mg/L	0.011	0.012	0.010
Thallium	mg/L	<0.0002	<0.0002	<0.0002
Tin	mg/L	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.0002	<0.0002	<0.0002
Uranium	ug/L	<0.1	<0.1	<0.1
Vanadium	mg/L	<0.0001	<0.0001	<0.0001
Zinc	mg/L	0.0017	0.0016	0.0020
Phosphorus	mg/L	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	<0.01	<0.01	<0.01
Lab Section 4				
Lead-210	Bq/L	<0.02	<0.02	<0.02
Polonium-210	Bq/L	<0.005	<0.005	<0.005
Radium-226	Bq/L	<0.005	0.005	<0.005
Thorium-228	Bq/L	<0.01	<0.01	<0.01
Thorium-230	Bq/L	<0.01	<0.01	<0.01
Thorium-232	Bq/L	<0.01	<0.01	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

The temperature of the cooler was 16.2 °C upon receipt.

SRC SASKATCHEWAN RESEARCH COUNCIL

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SRC Group # 2019-9335

Jul 22, 2019

EcoMetrix Inc.

37107 **07/05/2019 SA3 *WATER***
37108 **07/04/2019 SA4 *WATER***
37109 **07/04/2019 SA5 *WATER***

Analyte	Units	37107	37108	37109
Lab Section 1				
Bicarbonate	mg/L	5	11	7
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	0.6	0.5	0.3
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
pH	pH units	6.96	7.04	6.99
Specific conductivity	uS/cm	14	11	8
Sum of ions	mg/L	10	16	11
Total alkalinity	mg/L	4	9	6
Total hardness	mg/L	5	5	4
Ammonia as nitrogen	mg/L	0.02	<0.01	<0.01
Nitrate	mg/L	<0.04	<0.04	<0.04
Total Kjeldahl nitrogen	mg/L	0.24	0.27	0.21
Mercury	ng/L	2	2	2
Organic carbon	mg/L	2.3	2.6	2.2
Organic carbon, dissolved	mg/L	2.7	3.1	2.8
Fluoride	mg/L	0.02	0.02	0.02
Total dissolved solids	mg/L	17	40	36
Total suspended solids	mg/L	<1	1	<1
Lab Section 2				
Calcium	mg/L	1.4	1.3	1.1
Magnesium	mg/L	0.4	0.4	0.3
Potassium	mg/L	0.4	0.4	0.3
Sodium	mg/L	1.5	1.6	1.3
Sulfate	mg/L	0.8	0.6	0.6
Aluminum	mg/L	0.0033	0.0084	0.0078
Antimony	mg/L	<0.0002	<0.0002	<0.0002
Arsenic	ug/L	<0.1	<0.1	<0.1
Barium	mg/L	0.0025	0.0022	0.0022
Beryllium	mg/L	<0.0001	<0.0001	<0.0001
Boron	mg/L	<0.01	<0.01	<0.01
Cadmium	mg/L	<0.00001	<0.00001	<0.00001
Chromium	mg/L	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0002	<0.0002	<0.0002
Iron	mg/L	0.065	0.075	0.074

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SRC Group # 2019-9335

Jul 22, 2019

EcoMetrix Inc.

37107 **07/05/2019 SA3 *WATER***
37108 **07/04/2019 SA4 *WATER***
37109 **07/04/2019 SA5 *WATER***

Analyte	Units	37107	37108	37109
Lab Section 2				
Lead	mg/L	<0.0001	<0.0001	<0.0001
Manganese	mg/L	0.0076	0.012	0.0094
Molybdenum	mg/L	<0.0001	<0.0001	<0.0001
Nickel	mg/L	<0.0001	<0.0001	<0.0001
Selenium	mg/L	<0.0001	<0.0001	<0.0001
Silver	mg/L	<0.00005	<0.00005	<0.00005
Strontium	mg/L	0.013	0.012	0.0097
Thallium	mg/L	<0.0002	<0.0002	<0.0002
Tin	mg/L	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.0002	<0.0002	<0.0002
Uranium	ug/L	<0.1	<0.1	<0.1
Vanadium	mg/L	<0.0001	<0.0001	<0.0001
Zinc	mg/L	0.0021	0.0015	0.0024
Phosphorus	mg/L	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	<0.01	<0.01	<0.01
Lab Section 4				
Lead-210	Bq/L	<0.02	<0.02	<0.02
Polonium-210	Bq/L	<0.005	<0.005	<0.005
Radium-226	Bq/L	<0.005	<0.005	0.006
Thorium-228	Bq/L	<0.01	<0.01	<0.01
Thorium-230	Bq/L	<0.01	<0.01	<0.01
Thorium-232	Bq/L	<0.01	<0.01	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

The temperature of the cooler was 16.2 °C upon receipt.

SRC SASKATCHEWAN RESEARCH COUNCIL

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SRC Group # 2019-9335

Jul 22, 2019

EcoMetrix Inc.

37110	07/04/2019 SA6 *WATER*
37111	07/06/2019 RC1 *WATER*
37112	07/05/2019 FIELD BLANK *WATER*

Analyte	Units	37110	37111	37112
Lab Section 1				
Bicarbonate	mg/L	6	16	2
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	0.4	0.6	<0.1
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
pH	pH units	7.03	7.18	5.61
Specific conductivity	uS/cm	9	12	<1
Sum of ions	mg/L	10	21	2
Total alkalinity	mg/L	5	13	2
Total hardness	mg/L	4	5	<1
Ammonia as nitrogen	mg/L	<0.01	<0.01	<0.01
Nitrate	mg/L	<0.04	<0.04	<0.04
Total Kjeldahl nitrogen	mg/L	0.25	0.26	<0.05
Mercury	ng/L	2	2	1
Organic carbon	mg/L	2.3	2.2	<0.2
Organic carbon, dissolved	mg/L	2.8	2.6	0.3
Fluoride	mg/L	0.02	0.02	<0.01
Total dissolved solids	mg/L	35	38	<5
Total suspended solids	mg/L	<1	2	<1
Lab Section 2				
Calcium	mg/L	1.2	1.4	<0.1
Magnesium	mg/L	0.3	0.4	<0.1
Potassium	mg/L	0.4	0.4	<0.1
Sodium	mg/L	1.4	1.6	0.1
Sulfate	mg/L	0.6	0.5	<0.2
Aluminum	mg/L	0.0079	0.0046	0.0013
Antimony	mg/L	<0.0002	<0.0002	<0.0002
Arsenic	ug/L	<0.1	<0.1	<0.1
Barium	mg/L	0.0021	0.0020	<0.0005
Beryllium	mg/L	<0.0001	<0.0001	<0.0001
Boron	mg/L	<0.01	<0.01	<0.01
Cadmium	mg/L	<0.00001	<0.00001	<0.00001
Chromium	mg/L	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0002	<0.0002	<0.0002
Iron	mg/L	0.078	0.048	<0.0005

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SRC Group # 2019-9335

Jul 22, 2019

EcoMetrix Inc.

37110 **07/04/2019 SA6 *WATER***
37111 **07/06/2019 RC1 *WATER***
37112 **07/05/2019 FIELD BLANK *WATER***

Analyte	Units	37110	37111	37112
Lab Section 2				
Lead	mg/L	<0.0001	<0.0001	<0.0001
Manganese	mg/L	0.010	0.0073	<0.0005
Molybdenum	mg/L	<0.0001	<0.0001	<0.0001
Nickel	mg/L	<0.0001	<0.0001	<0.0001
Selenium	mg/L	<0.0001	<0.0001	<0.0001
Silver	mg/L	<0.00005	<0.00005	<0.00005
Strontium	mg/L	0.010	0.013	<0.0005
Thallium	mg/L	<0.0002	<0.0002	<0.0002
Tin	mg/L	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.0002	<0.0002	<0.0002
Uranium	ug/L	<0.1	<0.1	<0.1
Vanadium	mg/L	<0.0001	<0.0001	<0.0001
Zinc	mg/L	0.0016	0.0029	0.0019
Phosphorus	mg/L	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	<0.01	<0.01	<0.01
Lab Section 4				
Lead-210	Bq/L	<0.02	<0.02	<0.02
Polonium-210	Bq/L	0.007	<0.005	<0.005
Radium-226	Bq/L	0.006	<0.005	<0.005
Thorium-228	Bq/L	<0.01	<0.01	<0.01
Thorium-230	Bq/L	<0.01	<0.01	<0.01
Thorium-232	Bq/L	<0.01	<0.01	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Note for Sample # 37112
This sample was reanalyzed for Zinc and Organic carbon, dissolved.
Reanalysis confirms original results are within the expected measurement uncertainty.

The temperature of the cooler was 16.2 °C upon receipt.

SASKATCHEWAN RESEARCH COUNCIL
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SRC Group # 2019-12514

Sep 25, 2019

EcoMetrix Inc.
6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Fei Luo

Date Samples Received: Sep-03-2019 Client P.O.:

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 1, Lab Section 2 authorized by Keith Gipman, Supervisor
Results from Lab Section 4 authorized by Vicky Snook, Supervisor

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

SRC SASKATCHEWAN RESEARCH COUNCIL
Environmental Analytical Laboratories
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SRC Group # 2019-12514

Sep 25, 2019

EcoMetrix Inc.

6800 Campobello Road
Mississauga, ON L5N 2L8
Attn: Fei Luo

Date Samples Received: Sep-03-2019 Client P.O.:

49955 08/30/2019 SA1 *WATER*
49956 08/30/2019 SA2 *WATER*
49957 08/30/2019 SA3 *WATER*

Analyte	Units	49955	49956	49957
Lab Section 1				
Bicarbonate	mg/L	5	<1	<1
Carbonate	mg/L	<1	1	<1
Chloride	mg/L	0.4	0.3	0.7
Hydroxide	mg/L	<1	2	2
P. alkalinity	mg/L	<1	7	7
pH	pH units	7.06	6.92	6.98
Specific conductivity	uS/cm	13	11	14
Sum of ions	mg/L	9	7	7
Total alkalinity	mg/L	4	8	7
Total hardness	mg/L	5	4	5
Ammonia as nitrogen	mg/L	0.02	0.02	0.01
Nitrate	mg/L	<0.04	<0.04	<0.04
Total Kjeldahl nitrogen	mg/L	0.25	0.26	0.26
Mercury	ng/L	4	4	6
Organic carbon	mg/L	2.1	2.2	2.2
Organic carbon, dissolved	mg/L	2.4	2.5	2.4
Fluoride	mg/L	0.01	0.01	0.01
Total dissolved solids	mg/L	22	26	24
Total suspended solids	mg/L	4	6	3
Lab Section 2				
Calcium	mg/L	1.2	1.1	1.4
Magnesium	mg/L	0.4	0.4	0.4
Potassium	mg/L	0.4	0.4	0.4
Sodium	mg/L	1.4	1.4	1.5
Sulfate	mg/L	0.6	0.6	0.7
Aluminum	mg/L	0.0034	0.0087	0.016
Antimony	mg/L	<0.0002	<0.0002	<0.0002
Arsenic	ug/L	0.1	0.1	<0.1
Barium	mg/L	0.0024	0.0023	0.0026
Beryllium	mg/L	<0.0001	<0.0001	<0.0001
Boron	mg/L	<0.01	<0.01	<0.01

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SRC Group # 2019-12514

Sep 25, 2019

EcoMetrix Inc.

49955 08/30/2019 SA1 *WATER*
49956 08/30/2019 SA2 *WATER*
49957 08/30/2019 SA3 *WATER*

Analyte	Units	49955	49956	49957
Lab Section 2				
Cadmium	mg/L	<0.00001	<0.00001	<0.00001
Chromium	mg/L	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0002	<0.0002	<0.0002
Iron	mg/L	0.12	0.11	0.072
Lead	mg/L	<0.0001	<0.0001	<0.0001
Manganese	mg/L	0.015	0.014	0.0063
Molybdenum	mg/L	<0.0001	<0.0001	<0.0001
Nickel	mg/L	<0.0001	<0.0001	0.0002
Selenium	mg/L	<0.0001	<0.0001	<0.0001
Silver	mg/L	<0.00005	<0.00005	<0.00005
Strontium	mg/L	0.012	0.011	0.014
Thallium	mg/L	<0.0002	<0.0002	<0.0002
Tin	mg/L	<0.0001	<0.0001	0.0009
Titanium	mg/L	<0.0002	<0.0002	<0.0002
Uranium	ug/L	<0.1	<0.1	<0.1
Vanadium	mg/L	<0.0001	<0.0001	<0.0001
Zinc	mg/L	<0.0005	0.0009	0.0008
Phosphorus	mg/L	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	<0.01	<0.01	<0.01
Lab Section 4				
Lead-210	Bq/L	<0.02	<0.02	<0.02
Polonium-210	Bq/L	<0.005	<0.005	<0.005
Radium-226	Bq/L	<0.005	<0.005	<0.005
Thorium-228	Bq/L	<0.01	<0.01	<0.01
Thorium-230	Bq/L	<0.01	<0.01	<0.01
Thorium-232	Bq/L	<0.01	<0.01	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

The temperature of the cooler was 10.9 °C upon receipt.

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SRC Group # 2019-12514

Sep 25, 2019

EcoMetrix Inc.

49958 **08/29/2019 SA4 *WATER***
49959 **08/29/2019 SA5 *WATER***
49960 **08/29/2019 SA6 *WATER***

Analyte	Units	49958	49959	49960
Lab Section 1				
Bicarbonate	mg/L	8	11	12
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	0.5	0.2	0.3
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
pH	pH units	6.97	6.89	6.93
Specific conductivity	uS/cm	16	10	11
Sum of ions	mg/L	13	15	16
Total alkalinity	mg/L	7	9	10
Total hardness	mg/L	5	4	5
Ammonia as nitrogen	mg/L	0.02	0.01	0.02
Nitrate	mg/L	<0.04	<0.04	<0.04
Total Kjeldahl nitrogen	mg/L	0.28	0.22	0.29
Mercury	ng/L	4	5	5
Organic carbon	mg/L	2.3	2.1	2.3
Organic carbon, dissolved	mg/L	2.4	2.1	2.6
Fluoride	mg/L	0.02	0.01	0.01
Total dissolved solids	mg/L	26	16	18
Total suspended solids	mg/L	5	4	5
Lab Section 2				
Calcium	mg/L	1.4	1.1	1.2
Magnesium	mg/L	0.4	0.3	0.4
Potassium	mg/L	0.4	0.3	0.3
Sodium	mg/L	1.6	1.3	1.4
Sulfate	mg/L	0.5	0.5	0.6
Aluminum	mg/L	0.0060	0.0063	0.0072
Antimony	mg/L	<0.0002	<0.0002	<0.0002
Arsenic	ug/L	<0.1	<0.1	0.1
Barium	mg/L	0.0023	0.0022	0.0022
Beryllium	mg/L	<0.0001	<0.0001	<0.0001
Boron	mg/L	<0.01	<0.01	<0.01
Cadmium	mg/L	<0.00001	<0.00001	<0.00001
Chromium	mg/L	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0002	<0.0002	<0.0002
Iron	mg/L	0.095	0.085	0.10

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SRC Group # 2019-12514

Sep 25, 2019

EcoMetrix Inc.

49958 **08/29/2019 SA4 *WATER***
49959 **08/29/2019 SA5 *WATER***
49960 **08/29/2019 SA6 *WATER***

Analyte	Units	49958	49959	49960
Lab Section 2				
Lead	mg/L	<0.0001	<0.0001	<0.0001
Manganese	mg/L	0.015	0.0097	0.013
Molybdenum	mg/L	<0.0001	<0.0001	<0.0001
Nickel	mg/L	<0.0001	<0.0001	<0.0001
Selenium	mg/L	<0.0001	<0.0001	<0.0001
Silver	mg/L	<0.00005	<0.00005	<0.00005
Strontium	mg/L	0.013	0.010	0.011
Thallium	mg/L	<0.0002	<0.0002	<0.0002
Tin	mg/L	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.0002	<0.0002	<0.0002
Uranium	ug/L	<0.1	<0.1	<0.1
Vanadium	mg/L	<0.0001	<0.0001	<0.0001
Zinc	mg/L	0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	<0.01	<0.01	<0.01
Lab Section 4				
Lead-210	Bq/L	<0.02	<0.02	<0.02
Polonium-210	Bq/L	<0.005	<0.005	0.005
Radium-226	Bq/L	<0.005	<0.005	0.005
Thorium-228	Bq/L	<0.01	<0.01	<0.01
Thorium-230	Bq/L	<0.01	<0.01	<0.01
Thorium-232	Bq/L	<0.01	<0.01	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

The temperature of the cooler was 10.9 °C upon receipt.

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SRC Group # 2019-12514

Sep 25, 2019

EcoMetrix Inc.

49961 **09/01/2019 RC1 *WATER***
49962 **09/01/2019 RC1D *WATER***
49963 **08/31/2019 FIELD BLANK *WATER***

Analyte	Units	49961	49962	49963
Lab Section 1				
Bicarbonate	mg/L	18	2	2
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	0.5	0.5	<0.1
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
pH	pH units	7.03	7.01	5.57
Specific conductivity	uS/cm	13	13	<1
Sum of ions	mg/L	23	7	2
Total alkalinity	mg/L	15	2	2
Total hardness	mg/L	5	5	<1
Ammonia as nitrogen	mg/L	0.04	0.02	0.01
Nitrate	mg/L	<0.04	<0.04	<0.04
Total Kjeldahl nitrogen	mg/L	0.29	0.28	<0.05
Mercury	ng/L	5	5	4
Organic carbon	mg/L	2.2	2.2	<0.2
Organic carbon, dissolved	mg/L	2.6	2.6	<0.2
Fluoride	mg/L	0.01	0.01	<0.01
Total dissolved solids	mg/L	26	26	<5
Total suspended solids	mg/L	5	3	<1
Lab Section 2				
Calcium	mg/L	1.4	1.4	<0.1
Magnesium	mg/L	0.4	0.4	<0.1
Potassium	mg/L	0.4	0.4	<0.1
Sodium	mg/L	1.6	1.6	0.1
Sulfate	mg/L	0.4	0.4	<0.2
Aluminum	mg/L	0.0041	0.0038	0.0008
Antimony	mg/L	<0.0002	<0.0002	<0.0002
Arsenic	ug/L	<0.1	0.1	<0.1
Barium	mg/L	0.0023	0.0023	<0.0005
Beryllium	mg/L	<0.0001	<0.0001	<0.0001
Boron	mg/L	<0.01	<0.01	0.01
Cadmium	mg/L	<0.00001	<0.00001	<0.00001
Chromium	mg/L	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0002	<0.0002	<0.0002
Iron	mg/L	0.081	0.069	<0.0005

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SRC Group # 2019-12514

Sep 25, 2019

EcoMetrix Inc.

49961 **09/01/2019 RC1 *WATER***
49962 **09/01/2019 RC1D *WATER***
49963 **08/31/2019 FIELD BLANK *WATER***

Analyte	Units	49961	49962	49963
Lab Section 2				
Lead	mg/L	<0.0001	<0.0001	<0.0001
Manganese	mg/L	0.013	0.012	<0.0005
Molybdenum	mg/L	<0.0001	<0.0001	<0.0001
Nickel	mg/L	<0.0001	<0.0001	<0.0001
Selenium	mg/L	<0.0001	<0.0001	<0.0001
Silver	mg/L	<0.00005	<0.00005	<0.00005
Strontium	mg/L	0.014	0.013	<0.0005
Thallium	mg/L	<0.0002	<0.0002	<0.0002
Tin	mg/L	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.0002	<0.0002	<0.0002
Uranium	ug/L	<0.1	<0.1	<0.1
Vanadium	mg/L	<0.0001	<0.0001	<0.0001
Zinc	mg/L	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	<0.01	<0.01	<0.01
Lab Section 4				
Lead-210	Bq/L	<0.02	<0.02	<0.02
Polonium-210	Bq/L	<0.005	<0.005	<0.005
Radium-226	Bq/L	<0.005	<0.005	<0.005
Thorium-228	Bq/L	<0.01	<0.01	<0.01
Thorium-230	Bq/L	<0.01	<0.01	<0.01
Thorium-232	Bq/L	<0.01	<0.01	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

The temperature of the cooler was 10.9 °C upon receipt.

Appendix C Stream Station Photographs

Photo 1: Stream station SA-1 looking downstream (17 September 2016). This Icelander River (drainage area A) station is situated approximately2 km downstream of lake LA-1 and 3 km upstream of Russell Lake.

Photo 2: Stream station SA-1 looking upstream (17 September 2016). Northern Pike exhibiting spawning behaviour were observed within this upstream reach during the May 2017 spawning survey.

Photo 3: Stream station SA-2 looking upstream (16 September 2016). This drainage area A station is situated on the northwest tributary of lake LA-1, immediately upstream of the lake, approximately 800 m downstream of lake LA-6.

Photo 4: Stream station SA-2 looking downstream (16 September 2016). Use of the reach by White Sucker and Walleye for spawning was observed during the May 2017 spawning survey.

Photo 5: Stream station SA-3 looking upstream (16 September 2016). This drainage area A station is situated on a shallow, wide, low-flowing, sandy-bottom stream with vertical banks, upstream of lake LA-1 and downstream of lake LA-2.

Photo 6: Stream station SA-3 looking downstream (16 September 2016). Water level elevation and streamflow (discharge) at SA-3 were 494.43 masl and 0.44 cms, respectively.

Photo 7: Stream station SA-4 looking upstream (10 September 2016). This drainage area A station is situated about 800 m upstream of lake LA-6 and approximately 2 km downstream of the outlet from of Kratchkowsky Lake (LA-7).

Photo 8: Stream station SA-4 looking upstream (26 May 2017). Use of the reach by White Sucker and Lake Chub for spawning was observed during the May 2017 spawning survey.

Photo 9: Stream station SA-5 looking downstream (10 September 2016). This drainage area A station is situated immediately upstream of lake LA-6 on the northeastern tributary that provides drainage from lakes LA-8 and LA-9.

Photo 10: Stream station SA-5 looking upstream (9 September 2016). A large school of White Suckers was observed in this ponded area situated immediately upstream of the road, during the May 2017 spawning survey.

Photo 11: Stream station SA-6 looking downstream (12 September 2016). This drainage area A station is situated on the connecting channel between lakes LA-6 (upstream) and LA-5 (downstream).

Photo 12: Stream station SA-6 looking downstream (12 September 2016). Suitable spawning habitat for Northern Pike occurred near the inlet to lake LA-5, and adult pike were observed in the vicinity during the May 2017 spawning survey.

Photo 13: Stream station SA-7 looking downstream (15 September 2016). This drainage area A station is situated on the southwestern inlet tributary to Kratchkowsky Lake (LA-7A), approximately 60 m upstream of the lake.

Photo 14: Stream station SA-7 looking upstream (15 September 2016). At this location, the watercourse is a narrow, marshy stream with vertical banks. The measured streamflow was 0.04 cms.

Photo 15: Stream station SA-8 looking downstream (15 September 2016). This drainage area A station is situated on the northwestern inlet tributary to Kratchkowsky Lake (LA-7A), approximately 15 m upstream of the lake.

Photo 16: Stream station SA-8 looking upstream (15 September 2016). At this location, the watercourse is a meandering narrow, sandy-bottom stream with steep banks. Some areas of the bank were undercut.

Photo 17: Stream station SA-9 looking downstream (18 September 2016). This drainage area A station is situated the southeastern outlet tributary of lake LA-8, approximately 50 m downstream of the lake.

Photo 18: Stream station SA-9 looking upstream (18 September 2016). At this location, the watercourse is shallow and the stream bottom is comprised mainly of sand, gravel, cobbles.

Photo 19: Stream station SA-10 looking downstream (18 September 2016). This drainage area A station is situated on the northern inlet tributary to lake LA-9, approximately 150 m upstream of the lake.

Photo 20: Stream station SA-10 looking upstream (18 September 2016). At this location, the watercourse is a wide, sandy-bottom stream with vertical banks. The water is deep and slow flowing.

Photo 21: Stream station SA-11 looking upstream (19 September 2016). This drainage area A station is situated on the northeastern inlet tributary to Kratchkowsky Lake (LA-7A) approximately 25 m upstream of the lake.

Photo 22: Stream station SA-11 looking upstream (19 September 2016). At this location, the stream bottom is comprised primarily of gravel and cobbles and the stream channel is braided.

Photo 23: Stream station RC-1 looking downstream (14 September 2016). This drainage area A station is situated immediately downstream of Kratchkowsky Lake (LA-7), approximately 2 km upstream of station SA-4

Photo 24: Stream station RC-1 looking downstream (29 May 2017). A spring spawning survey was undertaken at this location and use of the reach for spawning was not observed for any species during the May 2017 spawning survey.

Photo 25: Stream station SB-1 looking downstream (17 September 2016). This drainage area B station is situated at the McArthur River Mine Road crossing, approximately 650 m upstream of Russell Lake.

Photo 26: Stream station SB-1 looking upstream (17 September 2016). At this location, the stream banks were stable, the channel was ponded, and the gradient was low.

Photo 27: Stream station SB-2 looking upstream (17 September 2016). This station is situated on a tributary that drains from the west, and joins the primary drainage B watercourse immediately upstream of the McArthur River Mine Road crossing at SB-1.

Photo 28: Stream station SB-2 looking upstream (17 September 2016). At this location, the streambed was marshy with a thick organic base and no surface water connection with the primary drainage area B watercourse was observed.

Photo 29: Stream station SB-3 looking downstream (11 September 2016). This drainage area B station is situated approximately 100 m downstream of lake LB-2.

Photo 30: Stream station SB-3 looking upstream (11 September 2016). At this location, the stream bottom is comprised of organics, sand, cobbles and boulders, and the stream banks are nearly vertical.

Photo 31: Stream station SB-4 looking downstream (11 September 2016). This drainage area B station is situated on the southwestern inlet tributary to Williams Lake (LB-3), approximately 160 m upstream of the lake.

Photo 32: Stream station SB-4 looking upstream (11 September 2016). At this location, the stream banks are shallow and poorly defined. And the stream bottom is primarily boulders and large cobbles.

Photo 33: Stream station SB-5 looking upstream (14 September 2016). This drainage area B station is situated on the outlet tributary from Williams Lake (LB-3) at the Fox Lake Tote Road crossing, approximately 350 m downstream of the lake.

Photo 34: Stream station SB-5 looking downstream (14 September 2016). At this location, the stream bottom was composed of sand, gravel and cobbles.

Appendix D Fish species Photographs

Photo 1: Lake Chub (adult). Although this minnow species occurs in both lakes and streams within the study area, it was only captured in streams during the baseline studies.

Photo 2: Spottail Shiner (adult). This minnow species also occurs in both lakes and streams within the study area. During baseline studies it was frequently captured in lakes.

Photo 3: Longnose Sucker (adult). During baseline studies, this species was captured throughout drainage area A, in low abundance, primarily in stream habitats.

Photo 4: White Sucker (adult). This species was widely distributed throughout the study area during baseline studies, and occurred in high abundance in both lakes and streams.

Photo 5: Lake Whitefish (adult). This species was widely distributed throughout the study area during baseline studies, and occurred in high abundance, primarily in lakes.

Photo 6: Lake Trout (adult). During baseline studies, this species was only collected in very low abundance in lake LA-1 and Russell Lake.

Photo 6: Arctic Grayling (adult). During baseline studies, this species was captured low abundance in stream habitats.

Photo 7: Northern Pike (juvenile). This species was widely distributed throughout the study area during baseline studies, and was captured in high abundance in both lakes and streams.

Photo 9: Burbot (juvenile). Although this species occurs in both lakes and streams within the study area, it was captured in abundance only in the streams during baseline studies.

Photo 10: Ninespine Stickleback (adult). This small forage species was captured in lakes and streams throughout the study area, during baseline studies.

Photo 11: Slimy Sculpin (adult). This small species was captured only in streams, often in high abundance, during baseline studies.

Photo 12: Yellow Perch (juvenile). This species was collected in low abundance throughout the study area, in both lakes and streams, during baseline studies.

Photo 13: Walleye (adult). This species was widely distributed throughout the study area, occurring in both lakes and streams, and was captured in high abundance in lakes during baseline studies.

Appendix E Special Collection Permits

Ministry of
Environment

Saskatchewan

SPECIAL COLLECTION PERMIT

SCP-16-SC052

Under authority of *The Fisheries Act* (*Saskatchewan*), *1994*, permission is hereby granted to Brian Fraser and the individuals listed in Table 1 of the Appendix, of EcoMetrix Inc., on behalf of Denison Mines Corporation, to collect and keep fishes and aquatic invertebrates for fish community assessment work and chemical and radiological analysis sampling, from the lakes, ponds and streams outlined in Figure 1, located in the Denison's Wheeler River Project area at the approximate coordinates: 57°30'07"N, 105°21'34W.

This does not serve as a permit for research related to species at risk pursuant to the *Species at Risk Act* or *Fisheries Act*. Permit holders should contact the Department of Fisheries and Oceans regarding prohibitions and conditions, which may be in effect for their study area or species.

This Permit is valid from **August 16, 2016,** to **September 30, 2016,** inclusive.

Please note that the following conditions apply:

- All collection gear left unattended shall be visibly labeled with a sign marked with the name of the agency and the phrase "Scientific Collection".
- No biological sampling gear shall be left unattended in excess of 24 hours.
- No shortjaw cisco (*Coregonus zenithicus*) may be retained.
- All fish released must be returned to their originating water in suitable habitat close to the area of capture. All dead or non-releasable fish not being used for mercury sampling must be disposed of in an appropriate manor.
- Conservation Officers at the Ministry of Environment field office in Pinehouse must be contacted and advised of collection activities in advance at 306.884.2060.
- Any unidentifiable fish species or yellow highlighted species in the *Fish to Collect, Preserve, Drop Off, and Info* document should be preserved and sent to the fisheries officer as per outlined instructions.
- A *Fish Data Collection Return Form* is included with this permit. Upon conclusion of collection activities, the spreadsheet must be completed without alteration with the numbers and species taken and waters from which said species were taken and submitted to the issuing Fisheries Officer. A copy of any other prepared reports containing effort and sampling information may also be submitted.

Issued in Regina, Saskatchewan, on **August 16, 2016**.

Signature of Permittee

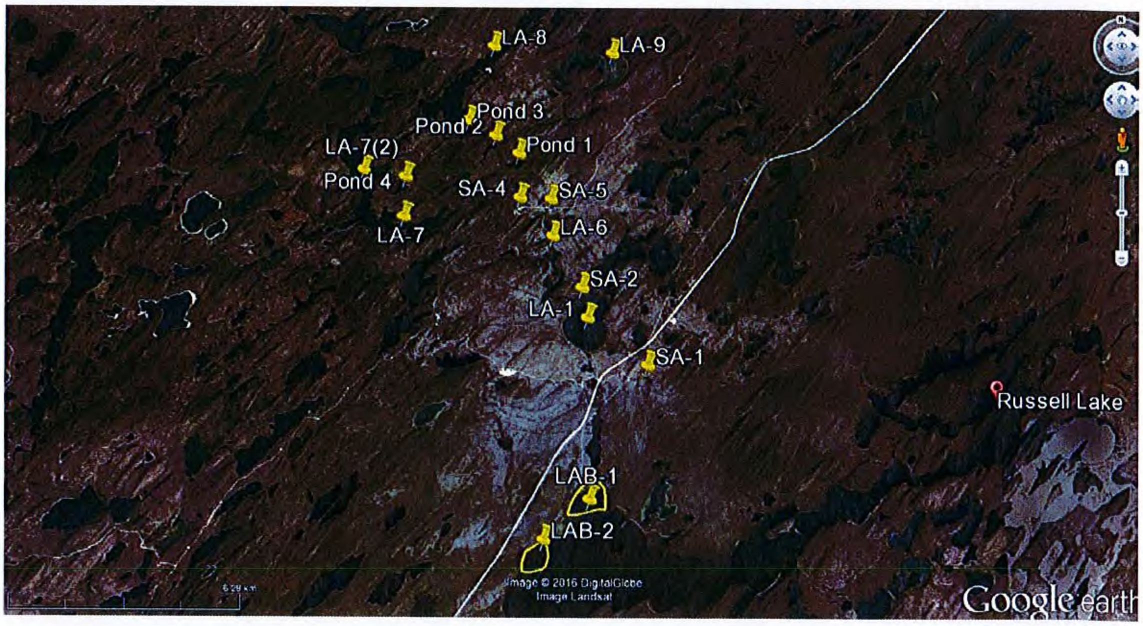
Curtis Kuntz
Fisheries Officer
Fish and Wildlife Branch

APPENDIX
SCP-16-SC052

Table 1: Additional EcoMetrix Inc. Special Collection Permit Holders:

Robert Eakins;
Joseph Tetreault;
Karen Petersen;
Carolyn Brown;
Nichole Wiemann; and
Janeen Tang.

Image 1: Lake and stream survey locations in the Denison's Wheeler River Project area.



Government of Saskatchewan

Ministry of Environment

SPECIAL COLLECTION PERMIT

SCP17-INV04

Under authority of *The Fisheries Act* (*Saskatchewan*), *1994*, permission is hereby granted to:

Robert Eakins and his authorized individuals listed in Table 1, of EcoMetrix Inc., on behalf of Denison Mines Corporation, to collect, keep and transport fishes and aquatic invertebrates for fish community assessment work and for the chemical and radiological analysis requirements outlined in Table 2, as part of ongoing baseline environmental studies, from waters located within the Denison's Wheeler River Project Site (Figure 1) located at the approximate geographical coordinates:

- 57°30'07"N, 105°21'34W.

This does not serve as a permit for research related to species at risk pursuant to the Species at Risk Act or Fisheries Act. Permit holders should contact the Department of Fisheries and Oceans regarding prohibitions and conditions, which may be in effect for their study area or species.

This Permit is valid from **April 15, 2017,** to **June 30, 2017,** inclusive.

The following conditions also apply:

- All collection gear left unattended shall be visibly labeled with a sign marked with the name of the agency and the phrase "Scientific Collection".
- No biological sampling gear shall be left unattended in excess of 24 hours.
- A sub-sample of any unidentifiable fish species or a species listed in the *Fish Submission and Preservation Requirements* document should be preserved and sent to the fisheries officer as per the instructions outlined.
- Any dead or non-releasable fish must be disposed in an environmentally acceptable manor.
- Conservation Officers at the Ministry of Environment field office in Pinehouse must be contacted and advised of collection activities in advance at (306) 884-2060.
- A *Fish Data Collection Return Form* is included with this permit. Upon conclusion of collection activities, the spreadsheet must be completed (without any alteration) with name and number of each species taken species taken and submitted to the issuing Fisheries Officer. A copy of any other prepared reports containing effort and sampling information should also be submitted.

Issued in Regina, Saskatchewan, on **April 12, 2017.**

Signature of Permittee

Curtis Kuntz
Fisheries Officer
Fish, Wildlife and Lands Branch

Government of Saskatchewan

SPC17-INV04
APPENDIX

Table 1: Additional EcoMetrix Inc. Special Collection Permit Holders:

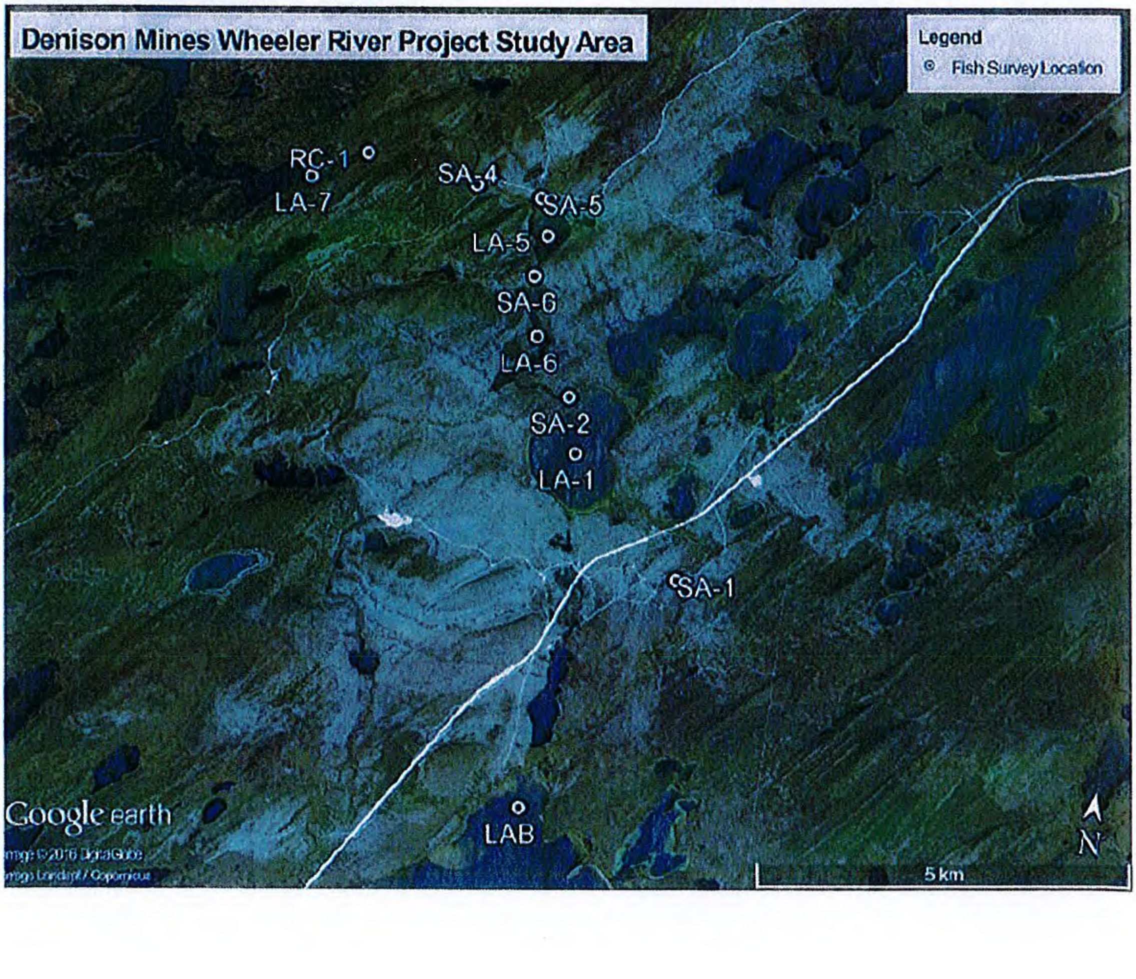
Kristine Campbell
Nichole Wiemann
Janeen Tang.

Table 2: Sampling Requirements for Chemical and Radiological Analysis.

A total of 16 fish required per lake, from 5 lakes within the study area comprised of:

- 9 Northern Pike
- 7 Common White Sucker

Figure 1: Lake and stream survey locations in the Denison's Wheeler River Project area.



Appendix F Golder Associates Ltd. 2014. 2012-2014 Aquatic Baseline Summary Report

May 2014

DENISON MINES - WHEELER RIVER PROJECT

2012 - 2014 Aquatic Baseline Summary Report

Submitted to:
Mr. Lawson Forand
Exploration Manager
Denison Mines Corporation
Suite 200 - 320 - 22nd Street East
Saskatoon, SK S7K 0E9

REPORT

Report Number: 12-1362-0050/4000/4400

Distribution:

2 Copies - Denison Mines Corporation
Saskatoon, Saskatchewan
2 Copies - Golder Associates Ltd.,
Saskatoon, Saskatchewan

Golder Associates

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FIGURES

APPENDICES

1.0 STUDY OBJECTIVES

Golder Associates Ltd. (Golder) was retained by Denison Mines Corporation (Denison) to carry out spring, summer, fall, and winter aquatics baseline investigations in two drainage areas north of Russell Lake from 2012 to 2014, and in the north bay of Russell Lake, Saskatchewan in 2012 and 2014 (the Project). The objectives of the 2012 - 2014 field sampling programs were as follows:

- to collect surface water quality samples and limnology profiles in selected streams (spring, summer, and fall of 2012 and 2013 and winter 2014) and lakes (summer 2012 and winter 2014) from the study area;
- to carry out bathymetric surveys of selected lakes in the Project study area (summer 2012); and
- to complete fish habitat assessments in the same selected lakes (summer 2012).

The data collected provides information on surface water quality of streams and lakes of the Project area, and on lake morphometry and fish habitat for selected lakes of the Project area. This information will help support future project planning, environmental assessment, and regulatory permitting activities. This field summary report describes the 2012 spring, summer, and fall field programs, carried out between May 8, 2012 and October 25, 2012; the 2013 spring, summer and fall field programs carried out between May 22, 2013 and October 19, 2013; as well as the 2014 winter field program carried out between March 22, 2014 and April 1, 2014.

2.0 SAMPLING

The 2012 field program included water quality sampling, bathymetric surveys, fish habitat assessments, and limnology measurements taken at stream and lake water quality sampling locations. The 2013 field program included water quality sampling and limnology measurements taken at stream water quality sampling locations. The winter 2014 field program included water quality sampling and limnology measurements taken at stream and lake water quality sampling locations. A total of four lakes (i.e., LA-1, LA-5, LA-6, and Williams Lake [LB-3]) and two portions of lakes (i.e., south-east bay of Kratchkowsky Lake and the Icelander River outlet bay of Russell Lake) were sampled for all components of the summer 2012 sampling program (Table 1, Figure 1). The same four lakes and two portions of lakes, as well as an additional four lakes (i.e., LA-2, LA-3, LA-4, and LB-2) were sampled for all components of the winter 2014 sampling program (Table 2, Figure 1). A total of 11 streams were sampled for water quality and limnology during each of the spring, summer, and fall sampling programs for 2012 and 2013 (Table 3, Figure 2) but only nine streams were sampled during the 2014 winter sampling program (Table 4, Figure 2) as bed fast ice was encountered in two streams (i.e., SB-2 and SB-5).

Table 1: Sampling in Lakes during the 2012 Summer Sampling Program

Drainage	Waterbody	Water Quality	Limnology	Bathymetry	Fish Habitat	UTM Coordinates[a]	
						Easting	Northing
A (Icelander River)	Lake LA-1	√	√	√	√	478873	6371901
	Lake LA-5	√	√	√	√	477939	6374466
	Lake LA-6	√	√	√	√	478043	6375324
	Kratchkowsky Lake (LA-7) (south-east bay)	√	√	√	√	473208	6375597
B (Unnamed)	Williams Lake[b] (LB-3)	√	√	√	√	473915	6373612
Russell Lake	Russell Lake (RL-A) (Icelander River outlet bay)	√	√	√	√	478549	6367476

[a] All location coordinates are in North American Datum 1983 (NAD 83), Zone 13.

[b] Local lake name.

UTM = Universal Transverse Mercator.

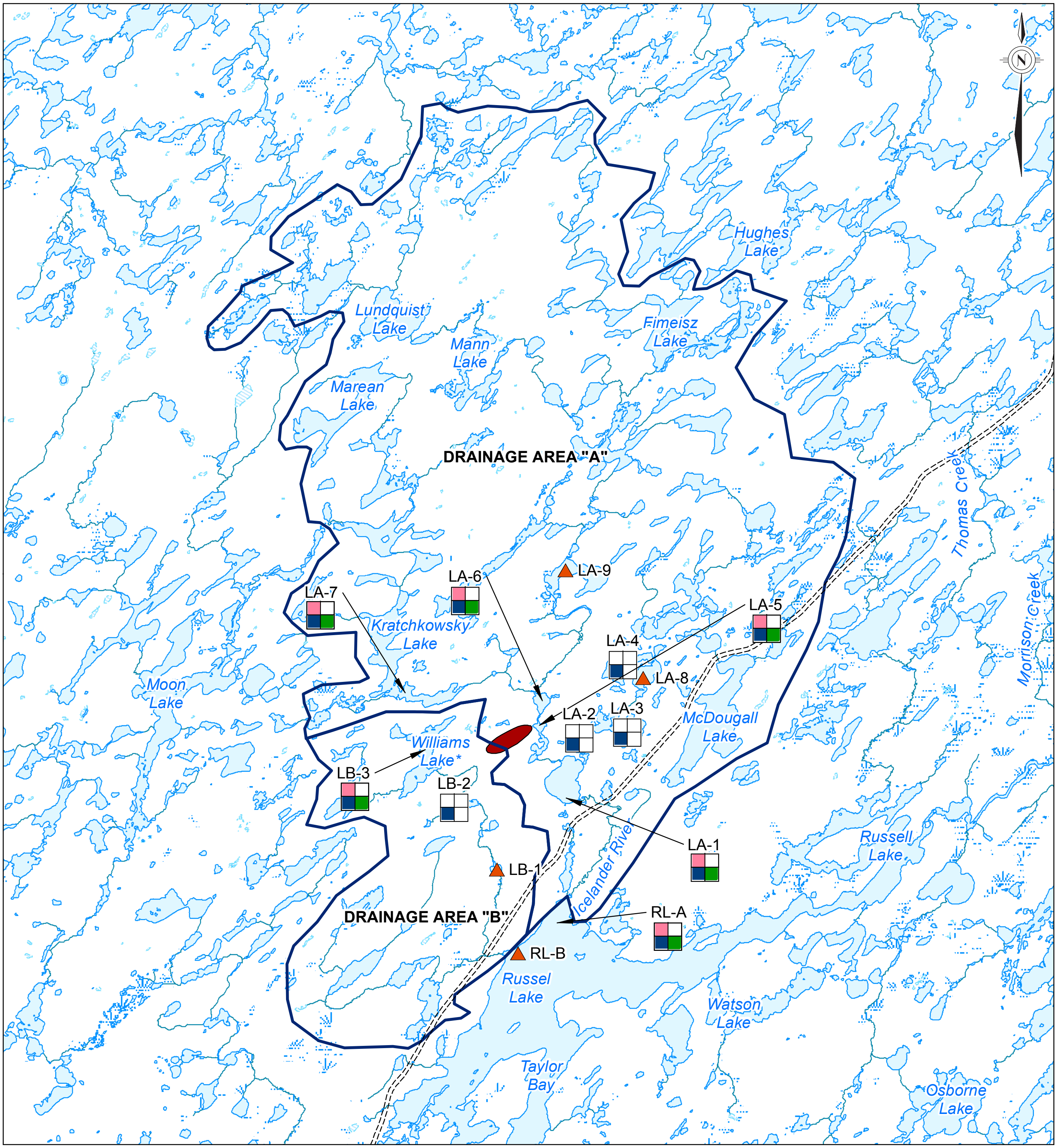
Table 2: Sampling in Lakes during the 2014 Winter Sampling Program

Drainage	Waterbody	Water Quality	Limnology	UTM Coordinates[a]	
				Easting	Northing
A (Icelander River)	Lake LA-1	√	√	478856	6371913
	Lake LA-2	√	√	479354	6374020
	Lake LA-3	√	√	481035	6374208
	Lake LA-4	√	√	480889	6376599
	Lake LA-5	√	√	477973	6374483
	Lake LA-6	√	√	478037	6375331
	Kratchkowsky Lake (LA-7) (south-east bay)	√	√	473200	6375598
B (Unnamed)	LB-2	√	√	474926	6371555
	Williams Lake[b] (LB-3)	√	√	473928	6373589
Russell Lake	Russell Lake (RL-A) (Icelander River outlet bay)	√	√	478559	6367460

[a] All location coordinates are in North American Datum 1983 (NAD 83), Zone 13.

[b] Local lake name.

UTM = Universal Transverse Mercator.



LEGEND

- LAKE NOT SAMPLED
- MCARTHUR RIVER MINE ACCESS ROAD
- ORE BODY
- DRAINAGE AREA BOUNDARY
- FISH HABITAT MAPPING
- BATHYMETRIC MAPPING
- WATER QUALITY SAMPLING

4 0 4

SCALE 1:200,000 KILOMETRES

NOTES

* LOCAL LAKE NAME

REFERENCE

NTS MAPSHEETS 74H02,03,04,05,06,07,10,11,12
NAD83 UTM ZONE 13

PROJECT

DENISON MINES CORP.
WHEELER RIVER PROPERTY

TITLE

AQUATIC BASELINE LAKE SAMPLING, 2012 AND 2014

Golder Associates
Saskatoon, Saskatchewan

PROJECT	12-1362-0050		FILE No.
DESIGN			SCALE AS SHOWN REV. 0
GIS	SM/LR	02/05/14	FIGURE: 1
CHECK	BLC	29/05/14	
REVIEW	BT	29/05/14	

G:\CLIENTS\DENISON MINES\Wheeler River\Figures\12-1362-0050\Aquatics\Phase 2000\Task 2500\Figure 1 - 12-1362-0050.2000-2500 - Aquatic Baseline Lake Sampling 2012 and 2014.mxd Date: 5/29/2014 2:27:07 PM

Table 3: Sampling in Streams during the 2012 and 2013 Spring, Summer, and Fall Sampling Programs

Drainage	Watercourse	Water Quality and Limnology			UTM Coordinates[a]	
		Spring	Summer	Fall	Easting	Northing
A (Icelander River)	SA-1	√	√	√	480368	6371123
	SA-2	√	√	√	478524	6373216
	SA-3	√	√	√	479415	6373234
	SA-4	√	√	√	476929	6375866
	SA-5	√	√	√	477804	6375716
	SA-6	√	√	√	477861	6374749
B (Unnamed)	SB-1	√	√	√	476041	6366362
	SB-2	√	√	√	475972	6366308
	SB-3	√	√	√	475866	6371655
	SB-4	√	√	√	472952	6372222
	SB-5	√	√	√	474615	6372695

(a) All location coordinates are in North American Datum 1983 (NAD 83), Zone 13.

UTM = Universal Transverse Mercator.

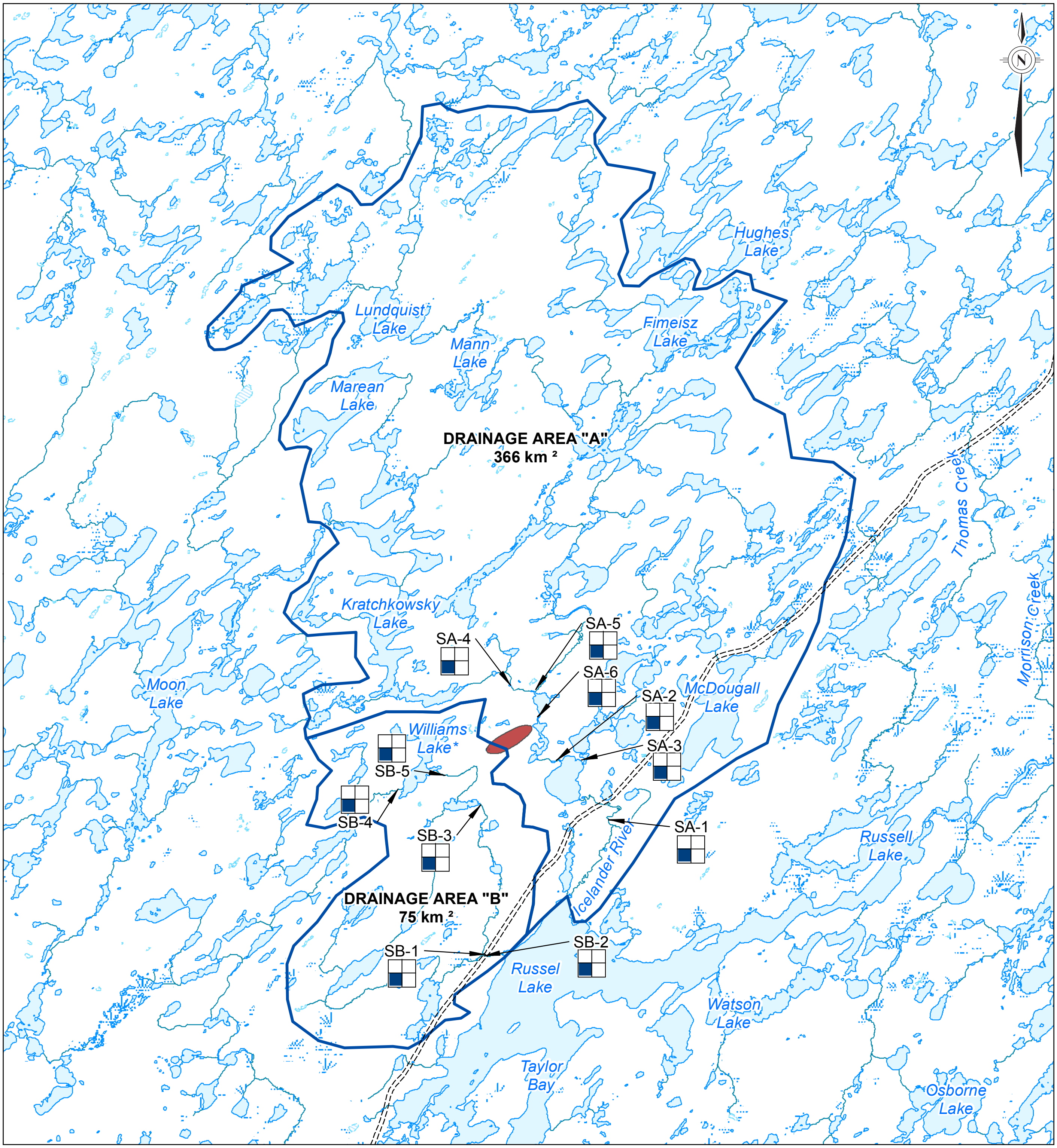
Table 4: Sampling in Streams during the 2014 Winter Sampling Program

Drainage	Watercourse	Water Quality and Limnology	UTM Coordinates[a]	
			Easting	Northing
A (Icelander River)	SA-1	√	480368	6371123
	SA-2	√	478524	6373216
	SA-3	√	479415	6373234
	SA-4	√	476929	6375866
	SA-5	√	477804	6375716
	SA-6	√	477861	6374749
B (Unnamed)	SB-1	√	476041	6366362
	SB-2	[b]	475972	6366308
	SB-3	√	475866	6371655
	SB-4	√	472952	6372222
	SB-5	[b]	474615	6372695

(a) All location coordinates are in North American Datum 1983 (NAD 83), Zone 13.

(b) Bed fast ice encountered.

UTM = Universal Transverse Mercator.



LEGEND

WATER QUALITY SAMPLING

MCARTHUR RIVER MINE ACCESS ROAD

ORE ZONE

DRAINAGE AREA BOUNDARY

4 0 4

SCALE 1:200,000 KILOMETRES

NOTES

* LOCAL LAKE NAME

REFERENCE

NTS MAPSHEETS 74H02,03,04,05,06,07,10,11,12
DATUM: NAD83 PROJECTION: UTM ZONE 13

PROJECT

DENISON MINES CORP.
WHEELER RIVER PROPERTY

TITLE

AQUATIC BASELINE STREAM SAMPLING, 2012 TO 2014

Golder Associates
Saskatoon, Saskatchewan

PROJECT		12-1362-0050	FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
GIS	SM/LR	02/05/14	FIGURE: 2	
CHECK	BLC	29/05/14		
REVIEW	BT	29/05/14		

G:\CLIENTS\DENISON MINES\Wheeler River\Figures\12-1362-0050\Aquatics\Phase 2000\Task 2500\Figure 2 - 12-1362-0050.2000-2500 - Aquatic Baseline Stream Sampling 2012 to 2014.mxd Date: 5/29/2014 2:33:17 PM

3.0 METHODS

The 2012 field program included water quality sampling, limnology measurements, bathymetric surveys and fish habitat assessments. The 2013 and 2014 field programs included water quality sampling and limnology measurements. The methods used to complete the program are detailed below.

3.1 Water Quality Sampling

Water quality samples were collected from lakes and streams of the Project area. Lake water samples consisted of a composite of three water samples collected from three depth intervals (top, middle, and bottom) using a Kemmerer water sampler. The water collected was mixed in a carboy triple rinsed with surface water. Stream water samples consisted of grab samples collected at mid-depth with a triple rinsed carboy. Water quality samples were collected in accordance with Golder's Technical Procedure 8.3-1 Surface Water Sampling Methods (unpublished).

Sample bottles were each labelled with a sample identification code and location, date, time, and project number. The sample code (e.g., D-LA-1-WQ001) followed a convention where D = Denison [client], LA-1 = site [Lake 1 in Drainage A], and WQ001 = water sample number. Information for each water quality station (i.e., date and time, location coordinates, weather information, limnology information, and sample depth) was recorded on the appropriate field data collection form.

3.1.1 Sample Processing

Water samples were collected and transported to the Denison mining camp for processing each evening. Processing included filtering water where necessary, filling individual triple rinsed Saskatchewan Research Council (SRC) Analytical Laboratory sample bottles unless otherwise instructed (i.e., if preservative was added to the bottles by the lab), and adding preservatives if required. Staff avoided contaminating the sample bottles by filling bottles in a sheltered area, not touching the inside of the lid or bottle, and by wearing gloves and other appropriate personal protective equipment when adding preservatives to the samples.

3.1.2 Sample Storage

Samples were stored in coolers with ice packs to keep samples cool (between 1 degree Celsius [°C] and 7°C). If samples were to be held for several days before shipping, ice packs were changed twice daily to keep temperatures between 1°C and 7°C. If samples were to be shipped immediately, the ice packs were changed before taping the coolers closed for shipment.

3.1.3 Chain-of-Custody and Sample Shipment

All water samples were brought directly back to the office by the Golder field crew. SRC Analytical Laboratory chain-of-custody forms were completed for each cooler of water samples. Quality Assurance/Quality Control (QA/QC) samples were split amongst the various coolers. All coolers of water samples were dropped off at the SRC laboratory, as well as any leftover sample preservative solutions.

3.1.4 Quality Assurance/Quality Control

The following water samples were collected for QA/QC purposes:

- eight random, single blind duplicate samples;
- six field blanks; and

- six trip blanks.

Duplicate Samples: eight duplicate samples were randomly collected, with one collected per sampling session (i.e., spring, summer, fall) per year (i.e., 2012 and 2013) and two collected during the 2014 winter sampling session. The sampling location of the duplicate sample was recorded in the field notebook or on the limnology datasheet, however the location was not recorded on the bottle as the sample was a single blind duplicate used to check the precision of analytical results.

Field Blank: six field blanks were filled while in the field, with two bottles in 2012 (none during the summer sampling session), three bottles in 2013, and one bottle in 2014. The field blank bottles were filled with de-ionized (DI) water provided by SRC, in the field at the same time as water samples were collected. Field blank samples were treated the same as actual samples (i.e., filtered when required, preservatives added when required).

Trip Blank: six trip blanks were carried around during the field sessions, with two bottles in 2012 (none during summer sampling session), three bottles in 2013, and one bottle in 2014. The trip blanks were filled with DI water at the SRC laboratory and remained sealed for the duration of the trip. They were stored in coolers with the other water samples.

3.2 Water Chemistry Analysis

Water quality samples were submitted to SRC Analytical Laboratories for chemistry analysis of the following parameters:

- conventional parameters (pH, total alkalinity, total hardness, specific conductivity, total dissolved solids, total suspended solids);
- major ions (bicarbonate, calcium, carbonate, chloride, fluoride, hydroxide, magnesium, P. alkalinity, potassium, sodium, sulphate, sum of ions);
- nutrients (total Kjeldahl nitrogen, total and unionized ammonia, nitrite+nitrate nitrogen, nitrite, total and dissolved phosphorus, orthophosphate, total and dissolved organic carbon);
- chlorophyll *a*;
- soluble silicon;
- total and dissolved metals, metalloids, and non-metals (aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, zinc); and
- radionuclides (lead-210, polonium-210, radium-226, thorium-228, thorium-230, thorium-232).

3.2.1 Samples Submitted

A total of 46 sets of water samples were submitted for chemical analyses (Table 5) in 2012, 42 sets in 2013, and 23 sets in 2014. The three 2012 duplicates submitted were for water samples from SB-1 in spring 2012, Russell Lake in summer 2012, and SB-5 in fall 2012. In 2013, the three duplicates submitted were for the water sample collected at SB-1 in spring 2013, SA-1 in summer 2013, and SA-1 in fall 2013. In winter 2014, the two duplicates submitted were for the water samples collected at SA-6 and LB-2.

Table 5: Quantity of Water Quality Samples Collected per Season during 2012 to 2014 Field Program

Year	Season	Streams	Lakes	Field Duplicate	Trip Blank	Field Blank	Total Sample Set
2012	Spring	11	0	1	1	1	14
	Summer	11	6	1	0	0	18
	Fall	11	0	1	1	1	14
2013	Spring	11	0	1	1	1	14
	Summer	11	0	1	1	1	14
	Fall	11	0	1	1	1	14
2014	Winter	9	10	2	1	1	23
Total		**75**	**16**	**8**	**6**	**6**	**111**

3.2.2 Comparison to Water Quality Guidelines/Objectives

Water chemistry values were compared to applicable provincial and federal water quality guidelines that are intended to protect aquatic species; namely, the Saskatchewan Surface Water Quality Objectives (SSWQO; Water Security Agency 2006) and the Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME CWQG; CCME 1999, with updates).

3.3 Limnology

Limnology profiles (i.e., dissolved oxygen, pH, specific conductivity, and water temperature) were collected at each lake sampling station in 2012 and in 2014 using a calibrated multi-meter (YSI 600 QS-O-M). Measurements in streams (2012, 2013, and 2014) were recorded at mid-depth. Measurements in lakes were recorded at the following regular depth intervals (e.g., 0.5 or 1.0 metre [m] intervals depending on lake depth):

- if the lake depth was less than 5 m, vertical profiles were collected at 0.5 m intervals from below the surface to 0.5 m above the lake bottom; or
- if the lake depth was greater than 5 m, vertical profiles were collected at 1.0 m intervals from below the surface to 1.0 m above the lake bottom.

Limnology data were collected in accordance with Golder's Technical Procedure TP-8.23-0 Basic Limnology and Bathymetry Procedures (unpublished).

3.4 Bathymetric Surveys

Bathymetric surveys were completed in 2012 on three lakes (i.e., LA-1, LA-5, LA-6) and one lake basin (i.e., LA-7) in Drainage A, one lake (i.e., LB-3) in Drainage B, as well as a portion (i.e., RL-A) of Russell Lake adjacent to the stream outflow from Drainage A (Icelander River; Table 1). A Garmin GPSMap 178C depth sounder was used to collect geo-referenced bathymetric data. The Global Positioning System component provided the position of the boat using satellite triangulation, while the sounding transducer provided the water depth at each location. The sounder was configured to record geo-referenced depths at five second intervals. Water depth at staff gauges in surveyed lakes was recorded at the time of the bathymetry survey to provide a geodetic water level for each lake surveyed. Figures showing depth contour lines were prepared for each lake, or portion of lake surveyed. Bathymetry data were collected in accordance with Golder's Technical Procedure TP-8.23-0 *Basic Limnology and Bathymetry Procedures*.

3.5 Fish Habitat Assessments

Fish habitat surveys were undertaken in 2012 for the same lakes, or portion of lakes, as identified in Section 3.4 Bathymetric Surveys. Habitat assessment included qualitative surveys of aquatic and shore vegetation and identification of major habitat types. The information was summarized on geo-referenced maps with appropriate photos to illustrate particular habitats. Fish habitat data were collected in accordance with Golder's Technical Procedures TP-8.19.0 *Lake Habitat Mapping*.

3.6 Quality Assurance/Quality Control

QA/QC programs consist of sampling and analytical procedures that are followed to limit the introduction of error into analytical data. Quality assurance procedures include appropriate training of sampling personnel, use of standard operating procedures when collecting the samples, appropriate sample handling and storage, submission of samples to accredited analytical laboratories, and use of data management systems. Quality control procedures are designed to assess data quality, including potential laboratory and field contamination, through the use of blanks, replicates, and spiked or reference materials.

Detailed specific work instructions were provided to Golder field personnel prior to commencing the field program in order to improve overall program and sampling success. As part of routine field operations for QA/QC, sampling equipment was calibrated frequently. Samples were collected by experienced personnel and were prepared, labelled, and transported according to Golder's Technical Procedures, and the SRC Laboratory protocols. Duplicate samples, trip blanks, and field blanks were used for QA/QC purposes.

Detailed field notes and environmental data were recorded on waterproof forms and field notebooks. Data collected during the field program underwent a variety of thorough QA/QC checks. Field data sheets were verified at the end of each day for completeness and accuracy by a crew member who did not record the data. Field data were transferred to an Excel spreadsheet upon returning to the office or were entered into the emLine™ database. Transcriptional quality assurance was completed on all information entered into Excel and emLine™ to reduce the potential for transcriptional errors. Prior to processing the data into tables, content quality assurance was completed to identify any inconsistencies in the data and other possible errors. Chain-of-custody forms were used to track sample shipment from the field to SRC Laboratories. Saskatchewan Research Council (SRC) Laboratories request forms were submitted with the water chemistry samples. A QA/QC check was completed comparing the hard copy report and the electronic data received from SRC Laboratories to verify there were no transcription errors in the water quality data.

4.0 RESULTS

In 2012, water quality samples and limnology measurements were collected during spring (May 8 and 9), summer (August 7 to 13) and fall (October 24 and 25). In 2013, water quality samples and limnology measurements were collected during spring (May 22), summer (August 15), and fall (October 18 and 19). In 2014, water quality samples and limnology measurements were collected during winter (March 28 to April 1). Bathymetry and fish habitat mapping information was collected during summer (August 9 to 13) of 2012.

4.1 Water Quality

4.1.1 2012 Sampling Program

In 2012, water sampling was conducted on four lakes or portions of lakes, and six streams from Drainage A (Icelander River drainage); on one lake and five streams from Drainage B; and on Russell Lake. Seven additional water samples were taken for QA/QC purposes: three field duplicates, two trip blanks, and two field blanks. Water chemistry results for samples collected in 2012 are presented in Table A1 (Appendix A).

Water quality of the lakes and streams sampled was comparable to other oligotrophic lakes in the region, being generally characterised by neutral or slightly acidic pH values, low concentrations of nutrients and ions, and metal concentrations that were near or below analytical detection limits (Appendix A, Table A1). Radionuclide concentrations were generally low and often below analytical detection limits. Radium-226[1] concentrations were below the SSWQO of 0.11 Becquerels per litre (Bq/L) for all samples collected in 2012 (Appendix A, Table A1).

Water chemistry values were generally below water quality guidelines/objectives for the protection of aquatic life (Appendix A, Table A1). The following parameters exceeded the guidelines/objectives in at least one sample: dissolved oxygen (measured just below surface), pH, aluminum, cadmium, iron, and lead. Dissolved oxygen measured at the surface of stream SB-2 during the spring session, of all lakes during the summer (n=6), and of all streams (with the exception of SB-1) during the summer was below the guideline/objective of 9.5 milligrams per litre (mg/L) for the protection of the early life stages of aquatic life located in cold water ecosystems. Field surface pH values were equal to or below the CCME CWQG in at least one sample from lake LA-1 and all streams sampled. Aluminum concentrations exceeded the pH-dependent guideline/objective in several streams, usually in samples where the pH value was below the guideline. Cadmium concentrations [2]exceeded the guideline/objective in at least one sample from every lake and stream sampled with the exception of streams SA-5 in Drainage Area A and all the streams in Drainage Area B (i.e., SB-1, SB-2, SB-3, SB-4, SB-5). Iron and lead concentrations exceeded the guideline/objective in stream SB-2 and lake LA-6, respectively.

4.1.2 2013 Sampling Program

In 2013, water sampling was conducted on six streams from Drainage A (Icelander River drainage); and on five streams from Drainage B. Nine additional water samples were taken for QA/QC purposes: three field duplicates, three trip blanks, and three field blanks. Water chemistry results for samples collected in 2013 are presented in Table A2 (Appendix A).

Water quality of the streams sampled was comparable to results from the 2012 sampling program, being generally characterised by neutral or slightly acidic pH values, low concentrations of nutrients and ions, and metal concentrations that were near or below analytical detection limits (Appendix A, Table A2). Radionuclide concentrations were generally low and often below analytical detection limits. Radium-226 concentrations were below the SSWQO of 0.11 Bq/L for all samples collected in 2013 (Appendix A, Table A2).

Water chemistry values were generally below water quality guidelines/objectives for the protection of aquatic life (Appendix A, Table A2). The following parameters exceeded the guidelines/objectives in at least one sample: dissolved oxygen (measured just below surface), pH, aluminum, cadmium, and iron. Dissolved oxygen measured at the surface of streams SB-2 and SB-4 during the spring session and of all streams (n=11) during the summer session was below the guideline/objective of 9.5 mg/L for the protection of the early life stages of aquatic life located in cold water ecosystems. Field surface pH values were equal to or below the CCME CWQG in at least one sample from all streams sampled with the exception of streams SA-1 and SB-3. Aluminum

[1] The Saskatchewan Surface Water Quality Objectives (SSWQO) for radium-226 was missed in the 2006 SSWQO (Water Security Agency [WSA] 2006) revisions; an objective of 0.11 Bq/L was presented in 1997 SSWQO (WSA) and is expected to be added to the next SSWQO revision (T. Moulding pers. comm.).

[2] In January 2014, the Canadian Council of Ministers of the Environment (CCME) updated the Canadian water quality guideline (CWQG) for cadmium. The new guideline was included in the 2012 and 2013 water quality tables and the result section.

concentrations exceeded the pH-dependent guideline/objective in several streams, usually in samples where the field pH value was below the guideline. Cadmium concentrations exceeded the guideline/objective in at least one sample from all streams sampled with the exception of streams SA-1, SA-3, and SA-4; a field blank sample was above detection limit and exceeded the objective in May 2013. Iron concentrations exceeded the guideline/objective in at least one sample from streams SA-1, SB-1, and SB-2.

4.1.3 2014 Sampling Program

In 2014, water sampling was conducted on six streams from Drainage A (Icelander River drainage); and only three streams from Drainage B as two streams (i.e., SB-2 and SB-5) had bed fast ice. Four additional water samples were taken for QA/QC purposes: two field duplicates, one trip blank, and one field blank. Water chemistry results for samples collected in 2014 are presented in Table A3 (Appendix A).

Water quality of the streams sampled was comparable to results from the 2012 and 2013 sampling programs, being generally characterised by neutral or slightly acidic pH values, low concentrations of nutrients and ions, and metal concentrations that were near or below analytical detection limits (Appendix A, Table A3). Radionuclide concentrations were generally low and often below analytical detection limits. Radium-226 concentrations were below the SSWQO of 0.11 Bq/L for all samples collected in 2014 (Appendix A, Table A3).

Water chemistry values were generally below water quality guidelines/objectives for the protection of aquatic life (Appendix A, Table A3). The following parameters exceeded the guidelines/objectives in at least one sample: dissolved oxygen (measured just below surface), pH, aluminum, and iron.

Dissolved oxygen measured at the surface of lakes LA5 and LB-2 and streams SA-7, SB-1, SB-2 and SB-5 during the winter session was below the guideline/objective of 9.5 mg/L for the protection of the early life stages of aquatic life located in cold water ecosystems. Field surface pH values were equal to or below the CCME CWQG in streams SA-2, SA-6, and SB-3. Aluminum concentrations exceeded the pH-dependent guideline/objective in lake LA-6, where the laboratory pH value was below the guideline. Iron concentrations exceeded the guideline/objective in stream SB-1.

4.2 Limnology

Limnology measurements were obtained for four lakes and six streams from Drainage A, for one lake and five streams from Drainage B, and for one station in Russell Lake during the 2012 water sampling program. Limnology results for 2012 are presented in Table B1 (Appendix B). Limnology profiles for all lakes measured in 2012 are presented in Figure 3.

Limnology measurements were obtained for six streams from Drainage A and for five streams from Drainage B during the 2013 water sampling program. Limnology results for 2013 are presented in Table B2 (Appendix B). Limnology measurements were obtained for seven lakes and six streams from Drainage A, for two lakes and three streams from Drainage B, and for one station in Russell Lake during the 2014 winter water sampling program. Limnology results for 2014 are presented in Table B3 (Appendix B). Limnology profiles for all lakes measured in 2014 are presented in Figure 4a and 4b.

Figure 3: Temperature and Dissolved Oxygen Profiles and Secchi Depth for Lakes in the Wheeler River Project Area, Summer 2012

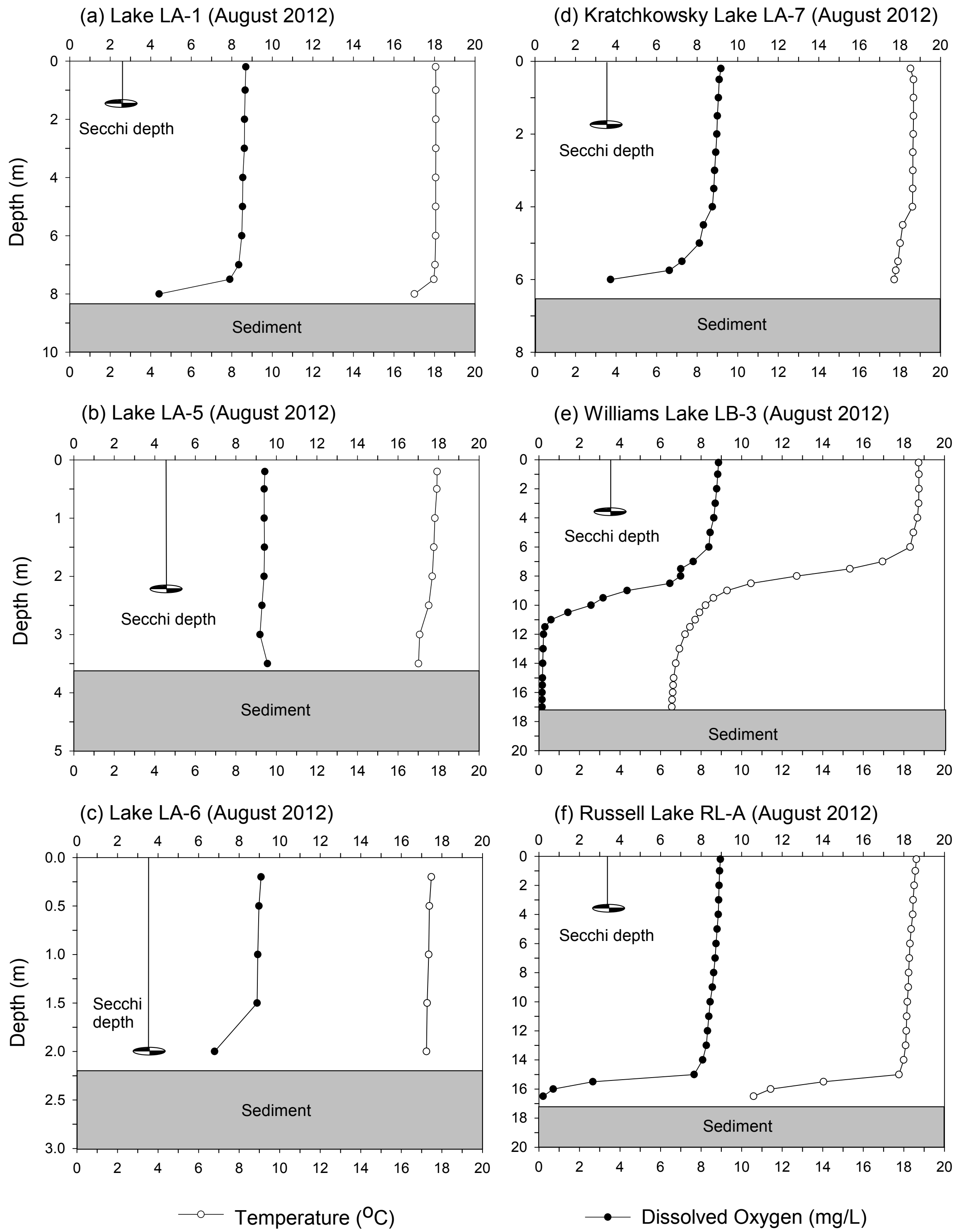


Figure 4a: Temperature and Dissolved Oxygen Profiles and Secchi Depth for Lakes in the Wheeler River Project Area, Winter 2014.

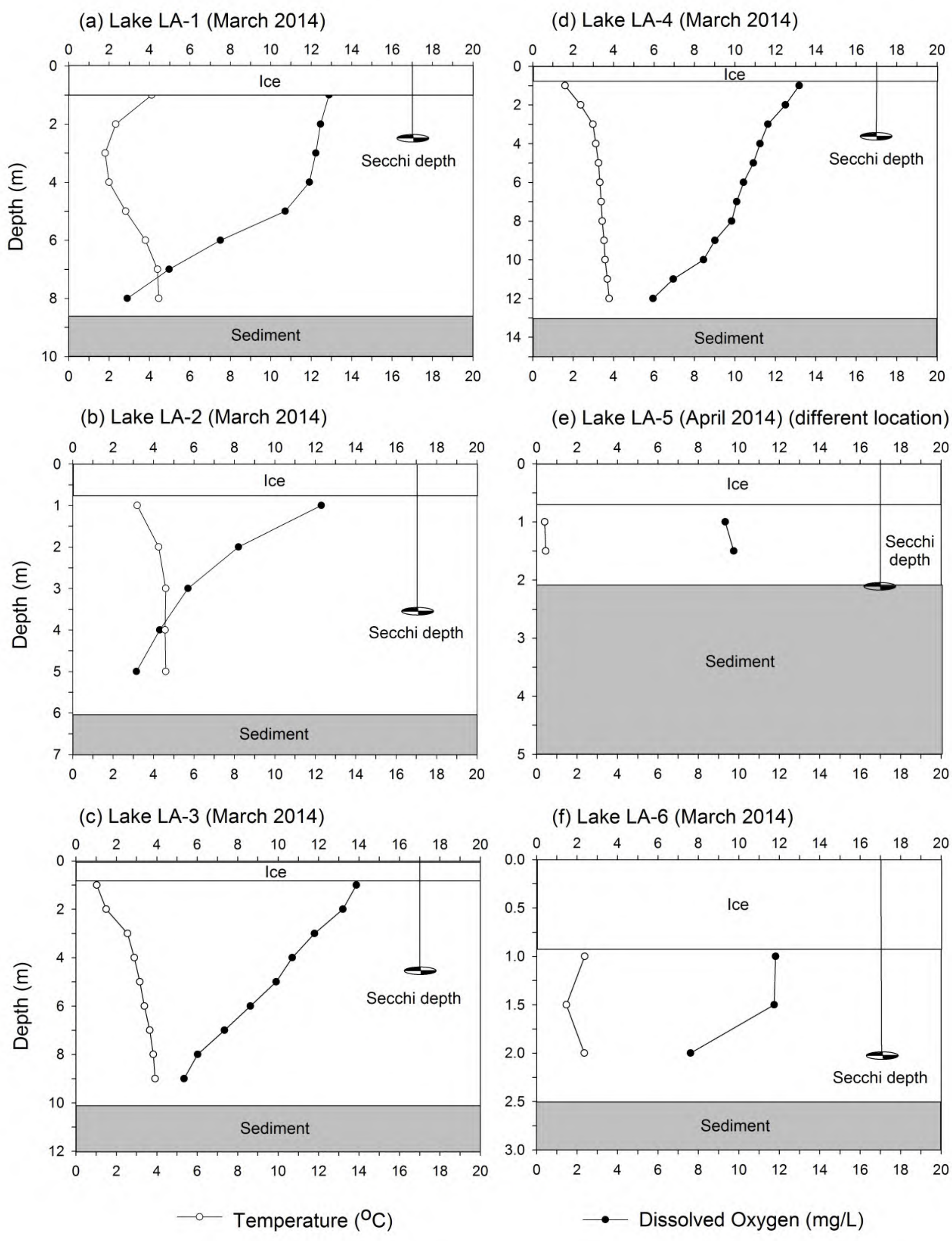
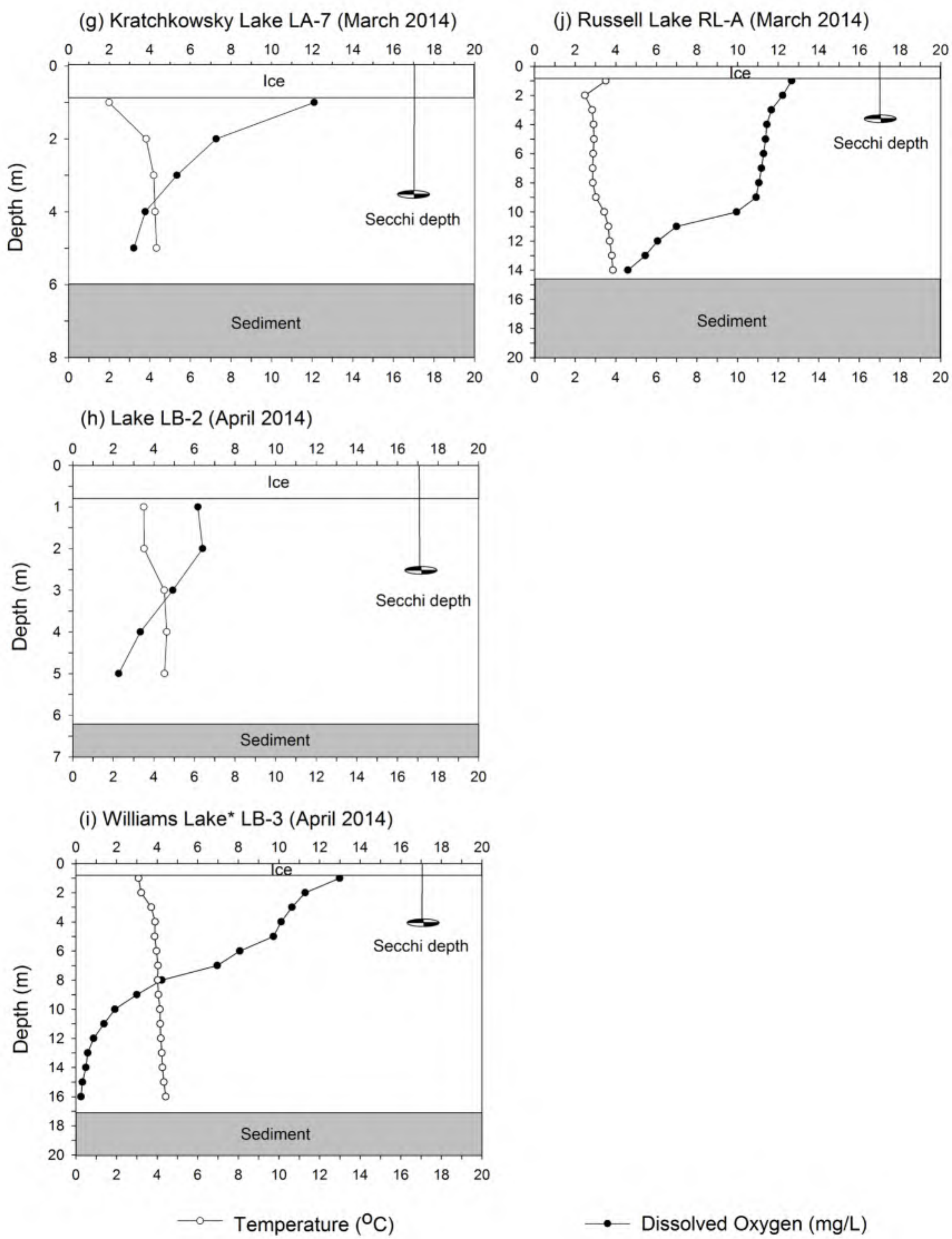


Figure 4b: *Temperature and Dissolved Oxygen Profiles and Secchi Depth for Lakes in the Wheeler River Project Area, Winter 2014.*



4.3 Bathymetric Surveys

In 2012, bathymetric surveys were completed on three lakes (i.e., LA-1, LA-5, LA-6) and one lake basin (i.e., south-east bay of Kratchkowsky Lake [LA-7]) in Drainage A; one lake (i.e., Williams Lake [LB-3]) in Drainage B; as well as a portion (i.e., RL-A) of Russell Lake adjacent to the stream outflow from Drainage A (Icelander River).

A summary of the lake morphometric information is presented in Table 6. All bathymetry maps are presented in Figures C1 to C6 (Appendix C).

4.4 Fish Habitat Assessments

In 2012, fish habitat assessments were completed on three lakes (i.e., LA-1, LA-5, LA-6) and one lake basin (i.e., south-east bay of Kratchkowsky Lake [LA-7]) in Drainage A, one lake (i.e., Williams Lake [LB-3]) in Drainage B, as well as a portion (i.e., RL-A) of Russell Lake adjacent to the stream outflow from Drainage A (Icelander River).

A summary of the fish habitat information is presented in Table 6. All habitat maps are presented in Figures D1 to D6 (Appendix D).

Table 6: Aquatic Habitat Summary for Lakes in the Wheeler River Project Area, Summer 2012

Drainage	Waterbody	Code	Date of Survey (dd-mmm-yy)	Lake Elevation (masl)	Maximum Length (km)	Surface Area (m^2)	Maximum Depth (m)	Mean Depth (m)	Volume (m^3)	Number of Islands	Perimeter (m)		Shoreline Development Index	Incidental Fish Observed	Substrate	Habitat Assessment
											Main Shore	Islands				
A (Icelander River)	Lake LA-1	LA-1	11-Aug-12 and 12-Aug-12	494.386	1.7	1,485,480	9.67	5.51	8,189,320	0	5,291	-	1.22	adult sucker	sand/boulder	Shoreline vegetation mainly consisted of shrubs and black spruce backed by jack pine forest; shallow to steep slopes with presence of old and active erosional areas; cover observed included emergent vegetation, interstitial spaces in coarse substrate, and overhanging vegetation.
	Lake LA-5	LA-5	13-Aug-12	500.037	1.5	324,049	4.07	1.08	332,502	2	5,487	146	2.79	juvenile sucker; juvenile and adult (60 cm) northern pike	sand/organic material	Shoreline vegetation mainly consisted of shrubs and black spruce backed by jack pine forest; shallow to steep slopes; cover observed included emergent and submergent vegetation, interstitial spaces in coarse substrate, overhanging vegetation, and woody debris.
	Lake LA-6	LA-6	13-Aug-12	500.058	0.78	262,740	2.71	1.57	413,505	1	2,654	153	1.54	juvenile northern pike	sand/organic material	Shoreline vegetation mainly consisted of shrubs and black spruce backed by jack pine forest; shallow to steep slopes with presence of active erosional areas; cover observed included emergent and submergent vegetation, interstitial spaces in coarse substrate, overhanging vegetation, and woody debris.
	South-east bay of Kratchkowsky Lake	LA-7	09-Aug-12	520.482	2.5	795,937	6.78	2.90	-	0	7,843	-	2.48	none observed	boulder/sand	Shoreline vegetation mainly consisted of shrubs and black spruce backed by jack pine forest; shallow to steep slopes; cover observed included emergent and submergent vegetation, interstitial spaces in coarse substrate, overhanging vegetation, and woody debris.

Table 6: Aquatic Habitat Summary for Lakes in the Wheeler River Project Area, Summer 2012 (continued)

Drainage	Waterbody	Code	Date of Survey (dd-mmm-yy)	Lake Elevation (masl)	Maximum Length (km)	Surface Area (m^2)	Maximum Depth (m)	Mean Depth (m)	Volume (m^3)	Number of Islands	Perimeter (m)		Shoreline Development Index	Incidental Fish Observed	Substrate	Habitat Assessment
											Main Shore	Islands				
B (Unnamed)	Williams Lake[(a)]	LB-3	08-Aug-12	518.524	3.5	1,522,984	17.82	4.55	6,933,788	3	10,925	544	2.62	juvenile northern pike; juvenile and adult yellow perch; spottail shiner; lake chub; abundant small-bodied fish	boulder/sand	Shoreline vegetation mainly consisted of shrubs and black spruce backed by jack pine forest; shallow to steep slopes; cover observed included emergent and submergent vegetation, interstitial spaces in coarse substrate, overhanging vegetation, and woody debris.
Russell Lake	Icelander River outlet bay of Russell Lake	RL-A	10-Aug-12 and 11-Aug-12	488.167	1.2	751,485	18.78	3.04	-	0	3,325	-	1.08	juvenile northern pike; ninespine stickleback	sand/cobble	Shoreline vegetation mainly consisted of shrubs and black spruce backed by jack pine forest; shallow to steep slopes with presence of old and active erosional areas; cover observed included emergent and submergent vegetation, interstitial spaces in coarse substrate, and overhanging vegetation.

(a) Local lake name.

dd-mmm-yy = dd-month-year; masl = metre above sea level; km = kilometre; m^2 = square metre; m^3 = cubic metre; m = metre; Aug = August; cm = centimetre.

5.0 CLOSURE

Golder appreciates the opportunity to assist Denison with this project. We trust that the information contained in this report meets your requirements. If you have any questions or concerns regarding the information presented, please contact the undersigned at (306) 665-7989 or brian_christensen@golder.com.

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6.0 REFERENCES

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APPENDIX A

Water Chemistry

Table A1. Water Chemistry Data for Waterbodies and Watercourses of the Denison Mines Wheeler River Project, May 8, 2012 to October 25, 2012

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Drainage A (Icelander River)									
				Lakes				Streams					
				Lake LA-1	Lake LA-5	Lake LA-6	Kratchkowsky Lake	SA-1			SA-2		
				LA-1b-WQ-U12	LA-5a-WQ-U12	LA-6a-WQ-U12	LA-7a-WQ-U12	SA-1c-WQ-P12	SA-1c-WQ-U12	SA-1c-WQ-F12[c]	SA-2b-WQ-P12	SA-2b-WQ-U12	SA-2b-WQ-F12[c]
				12-Aug-12	13-Aug-12	13-Aug-12	9-Aug-12	8-May-12	7-Aug-12	24-Oct-12	8-May-12	8-Aug-12	24-Oct-12
Conventional Parameters (Field-Measured)													
Dissolved Oxygen	mg/L	6.5 and 9.5[g]	6.5 and 9.5[g]	**8.69**	**9.43**	**9.08**	**9.17**	10.67	**8.88**	15.15	11.96	**9.01**	16.20
pH	pH units	6.5 to 9.0	-	**6.36**	7.06	6.73	7.22	**6.07**	6.73	**6.08**	6.76	6.82	**5.31**
Specific conductivity	µS/cm	-	-	18	17	17	17	19	18	17	16	17	17
Water temperature	°C	-	-	18.06	17.93	17.48	18.52	5.67	20.54	2.19	5.62	17.10	0.96
Conventional Parameters (Lab-Measured)													
pH	pH units	6.5 to 9.0	-	6.52	6.57	6.55	6.73	6.60	6.55	6.78	6.77	6.58	6.79
Specific conductivity	uS/cm	-	-	17	16	16	18	20	16	17	16	14	16
Total alkalinity	mg/L	-	-	4	3	4	21	4	4	10	2	2	8
Total dissolved solids	mg/L	-	-	23	22	24	26	20	21	25	13	19	23
Total hardness	mg/L	-	-	6	5	5	6	6	5	5	4	4	4
Total suspended solids	mg/L	-	-	3	3	2	3	2	3	2	2	3	2
Nutrients													
Ammonia as nitrogen	mg/L	[h]	[h]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite	mg/L	0.06	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Nitrite+Nitrate nitrogen	mg/L	-	-	0.06	<0.01	0.11	0.12	0.05	<0.01	<0.01	0.02	<0.01	<0.01
Organic carbon	mg/L	-	-	2.6	4.3	2.9	3.2	2.2	2.5	2.6	2.4	2.4	2.4
Organic carbon, dissolved	mg/L	-	-	2.4	2.5	2.5	2.8	2.1	2.3	2.2	2.2	2.4	2.2
Ortho-phosphate as P	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus	mg/L	-	-	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	-	-	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	-	<0.01	<0.01	-
Total Kjeldahl nitrogen	mg/L	-	-	0.31	0.34	0.29	0.34	0.28	0.24	0.28	0.16	0.24	0.20
Un-ionized ammonia-N	mg/L	0.019	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Organics													
Chlorophyll a	µg/L	-	-	5.6	3.7	2.8	4.4	3.4	<0.1	1.0	2.9	<0.1	0.8
Major Ions													
Bicarbonate	mg/L	-	-	5	4	5	26	5	5	12	2	2	10
Calcium	mg/L	-	-	1.4	1.3	1.3	1.5	1.6	1.3	1.3	1.3	1.2	1.2
Carbonate	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloride	mg/L	120	-	0.4	0.3	0.3	0.4	0.4	0.4	0.4	0.3	0.3	0.3
Fluoride	mg/L	0.12	-	0.02	0.02	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.01
Hydroxide	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Magnesium	mg/L	-	-	0.5	0.4	0.4	0.5	0.5	0.4	0.4	0.3	0.3	0.3
P. alkalinity	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Potassium	mg/L	-	-	0.4	0.4	0.3	0.4	0.3	0.2	0.4	0.1	0.3	0.4
Sodium	mg/L	-	-	1.5	1.5	1.5	1.6	1.6	1.4	1.5	1.2	1.3	1.4
Sulphate	mg/L	-	-	0.8	0.6	0.7	0.6	0.8	0.9	0.5	0.6	0.6	0.7
Sum of ions	mg/L	-	-	10	8	10	32	10	10	16	6	6	14
Other													
Silicon, soluble	mg/L	-	-	3.2	3.2	3.2	3.7	3.3	3.1	2.6	2.8	3.1	2.6

Table A1. Water Chemistry Data for Waterbodies and Watercourses of the Denison Mines Wheeler River Project, May 8, 2012 to October 25, 2012 (Continued)

Parameters	Units	CCME CWQG[(a)]	SSWQO[(b)]	Drainage A (Icelander River)									
				Lakes				Streams					
				Lake LA-1	Lake LA-5	Lake LA-6	Kratchkowsky Lake	SA-1			SA-2		
				LA-1b-WQ-U12	LA-5a-WQ-U12	LA-6a-WQ-U12	LA-7a-WQ-U12	SA-1c-WQ-P12	SA-1c-WQ-U12	SA-1c-WQ-F12[(c)]	SA-2b-WQ-P12	SA-2b-WQ-U12	SA-2b-WQ-F12[(c)]
				12-Aug-12	13-Aug-12	13-Aug-12	9-Aug-12	8-May-12	7-Aug-12	24-Oct-12	8-May-12	8-Aug-12	24-Oct-12
Metals (Total and Dissolved)													
Aluminum	mg/L	0.005 to 0.1 [(i)]	0.005 to 0.1 [(i)]	0.0010	0.0056	0.073	0.0051	0.0040	0.0056	0.0022	0.081	0.0068	0.0041
Aluminum, dissolved	mg/L	-	-	<0.0005	0.014	0.0013	0.0021	<0.0005	0.0021	<0.0005	0.0054	0.0027	<0.0005
Antimony	mg/L	-	-	<0.0002	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Antimony, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Arsenic	µg/L	5	5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1
Arsenic, dissolved	µg/L	-	-	0.1	0.1	0.1	<0.1	<0.1	0.1	0.3	<0.1	0.2	0.1
Barium	mg/L	-	-	0.0027	0.0021	0.0051	0.0024	0.0035	0.0025	0.0026	0.0041	0.0029	0.0023
Barium, dissolved	mg/L	-	-	0.0021	0.0017	0.0017	0.0020	0.0020	0.0022	0.0020	<0.0005	0.0024	0.012
Beryllium	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Beryllium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Boron	mg/L	1.5	-	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Boron, dissolved	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.00004[(j)]	0.000017 [(j)]	0.00002	0.00002	**0.00004**	0.00003	<0.00001	0.00002	<0.00001	0.00002	0.00001	<0.00001
Cadmium, dissolved	mg/L	-	-	0.00002	0.00002	0.00002	0.00003	<0.00001	0.00002	0.00001	<0.00001	<0.00001	<0.00001
Chromium	mg/L	0.001 [(k)]	0.001 [(k)]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium, dissolved	mg/L	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0034	<0.0001	<0.0001	<0.0001
Copper	mg/L	0.002 [(j)]	0.002 [(j)]	<0.0002	<0.0002	0.0004	<0.0002	<0.0002	<0.0002	<0.0002	0.0008	<0.0002	<0.0002
Copper, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0010	0.0002	<0.0002	<0.0002
Iron	mg/L	0.3	0.3	0.22	0.10	0.11	0.14	0.14	0.21	0.081	0.11	0.091	0.063
Iron, dissolved	mg/L	-	-	0.021	0.023	0.018	0.011	0.013	0.10	0.0057	0.020	0.050	0.0081
Lead	mg/L	0.001 [(j)]	0.001 [(j)]	<0.0001	<0.0001	**0.0012**	<0.0001	<0.0001	<0.0001	<0.0001	0.0003	<0.0001	<0.0001
Lead, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lithium	µg/L	-	-	0.8	0.6	0.7	0.7	0.7	0.8	0.6	0.6	0.6	0.6
Lithium, dissolved	µg/L	-	-	0.9	0.7	0.6	0.5	0.7	0.7	0.5	0.6	0.6	0.7
Manganese	mg/L	-	-	0.029	0.018	0.017	0.019	0.021	0.025	0.012	0.017	0.017	0.0091
Manganese, dissolved	mg/L	-	-	0.0008	<0.0005	<0.0005	0.0008	0.0008	0.0078	0.0010	0.0007	0.0034	<0.0005
Mercury	µg/L	0.026 [(l)]	0.026 [(l)]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury, Dissolved	µg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Molybdenum	mg/L	0.073	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.0001
Nickel	mg/L	0.025 [(j)]	0.025 [(j)]	<0.0001	<0.0001	0.0004	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001
Nickel, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	0.0042	<0.0001	<0.0001	<0.0001
Selenium	mg/L	0.001	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Selenium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silver	mg/L	0.0001	0.0001	<0.00005	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Silver, dissolved	mg/L	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Strontium	mg/L	-	-	0.014	0.012	0.014	0.014	0.014	0.013	0.012	0.012	0.012	0.012

Table A1. Water Chemistry Data for Waterbodies and Watercourses of the Denison Mines Wheeler River Project, May 8, 2012 to October 25, 2012 (Continued)

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Drainage A (Icelander River)									
				Lakes				Streams					
				Lake LA-1	Lake LA-5	Lake LA-6	Kratchkowsky Lake	SA-1			SA-2		
				LA-1b-WQ-U12	LA-5a-WQ-U12	LA-6a-WQ-U12	LA-7a-WQ-U12	SA-1c-WQ-P12	SA-1c-WQ-U12	SA-1c-WQ-F12[c]	SA-2b-WQ-P12	SA-2b-WQ-U12	SA-2b-WQ-F12[c]
				12-Aug-12	13-Aug-12	13-Aug-12	9-Aug-12	8-May-12	7-Aug-12	24-Oct-12	8-May-12	8-Aug-12	24-Oct-12
Metals (Total and Dissolved) (Continued)													
Strontium, dissolved	mg/L	-	-	0.014	0.012	0.012	0.013	0.015	0.014	0.011	0.011	0.013	0.010
Thallium	mg/L	0.0008	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Thallium, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tin	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin, dissolved	mg/L	-	-	0.0001	0.0001	<0.0001	0.0004	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	<0.0002	<0.0002	0.0002	0.0003	<0.0002	<0.0002	<0.0002	0.0015	<0.0002	<0.0002
Titanium, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Uranium	µg/L	15	15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium, dissolved	µg/L	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	mg/L	-	-	<0.0001	<0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001
Vanadium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Zinc	mg/L	0.03	0.03	<0.0005	<0.0005	0.020	<0.0005	0.0028	0.0006	<0.0005	0.0096	0.0008	<0.0005
Zinc, dissolved	mg/L	-	-	<0.0005	<0.0005	<0.0005	0.0026	<0.0005	<0.0005	0.0006	<0.0005	<0.0005	<0.0005
Radionuclides													
Lead-210	Bq/L	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	0.05
Polonium-210	Bq/L	-	-	<0.005	0.008	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Radium-226	Bq/L	-	0.11[m]	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	0.008	<0.005	0.01	0.006
Thorium-228	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium-230	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Thorium-232	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Table A1. Water Chemistry Data for Waterbodies and Watercourses of the Denison Mines Wheeler River Project, May 8, 2012 to October 25, 2012 (Continued)

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Drainage A (Icelander River)								
				Streams								
				SA-3			SA-4			SA-5		
				SA-3b-WQ-P12	SA-3b-WQ-U12	SA-3b-WQ-F12[c]	SA-4b-WQ-P12	SA-4b-WQ-U12[d]	SA-4b-WQ-F12[c]	SA-5b-WQ-P12	SA-5b-WQ-U12[d]	SA-5b-WQ-F12[e]
				8-May-12	7-Aug-12	24-Oct-12	8-May-12	7-Aug-12	24-Oct-12	8-May-12	7-Aug-12	24-Oct-12
Conventional Parameters (Field-Measured)												
Dissolved Oxygen	mg/L	6.5 and 9.5[g]	6.5 and 9.5[g]	10.23	**<u>9.22</u>**	15.78	16.10	**<u>9.12</u>**	16.03	11.23	**<u>9.45</u>**	10.47
pH	pH units	6.5 to 9.0	-	6.52	7.47	**5.99**	**6.45**	7.31	**5.86**	6.89	7.30	**5.51**
Specific conductivity	µS/cm	-	-	20	19	20	20	18	19	16	16	16
Water temperature	°C	-	-	6.55	18.70	1.34	7.73	17.62	1.30	9.41	17.51	1.38
Conventional Parameters (Lab-Measured)												
pH	pH units	6.5 to 9.0	-	6.60	6.60	6.85	6.80	6.58	6.88	6.76	6.57	6.78
Specific conductivity	uS/cm	-	-	20	18	19	20	17	18	16	14	15
Total alkalinity	mg/L	-	-	2	1	23	8	3	11	2	4	8
Total dissolved solids	mg/L	-	-	17	21	24	21	23	26	17	13	20
Total hardness	mg/L	-	-	6	5	6	6	5	5	5	4	4
Total suspended solids	mg/L	-	-	2	2	2	2	3	2	2	2	3
Nutrients												
Ammonia as nitrogen	mg/L	[h]	[h]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite	mg/L	0.06	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Nitrite+Nitrate nitrogen	mg/L	-	-	<0.01	<0.01	<0.01	0.02	0.03	<0.01	0.03	0.61	<0.01
Organic carbon	mg/L	-	-	2.2	2.6	2.6	2.6	2.5	2.4	2.7	2.3	2.5
Organic carbon, dissolved	mg/L	-	-	2.2	2.4	2.5	2.4	2.4	2.4	2.5	2.3	2.4
Ortho-phosphate as P	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	-	-	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	<0.01	-
Total Kjeldahl nitrogen	mg/L	-	-	0.25	0.25	0.28	0.22	0.19	0.28	0.28	0.18	0.29
Un-ionized ammonia-N	mg/L	0.019	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Organics												
Chlorophyll a	µg/L	-	-	3.0	0.5	0.4	6.2	<0.1	0.3	2.8	<0.1	0.4
Major Ions												
Bicarbonate	mg/L	-	-	2	1	28	10	4	13	2	5	10
Calcium	mg/L	-	-	1.6	1.5	1.5	1.7	1.4	1.4	1.3	1.2	1.2
Carbonate	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloride	mg/L	120	-	0.6	0.6	0.6	0.5	0.4	0.4	0.2	0.2	0.2
Fluoride	mg/L	0.12	-	<0.01	0.02	0.01	0.01	0.02	0.01	<0.01	0.02	0.01
Hydroxide	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1
Magnesium	mg/L	-	-	0.5	0.4	0.5	0.5	0.4	0.4	0.4	0.2	0.3
P. alkalinity	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1
Potassium	mg/L	-	-	0.4	0.3	0.4	0.3	0.3	0.4	0.2	0.3	0.4
Sodium	mg/L	-	-	1.5	1.5	1.5	1.6	1.4	1.6	1.4	1.3	1.4
Sulphate	mg/L	-	-	0.8	0.7	0.8	0.6	0.4	0.5	0.7	0.7	0.8
Sum of ions	mg/L	-	-	7	6	33	15	8	18	6	12	14
Other												
Silicon, soluble	mg/L	-	-	3.3	3.1	3.1	3.9	3.6	3.5	2.7	2.7	2.1

Table A1. Water Chemistry Data for Waterbodies and Watercourses of the Denison Mines Wheeler River Project, May 8, 2012 to October 25, 2012 (Continued)

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Drainage A (Icelander River)								
				Streams								
				SA-3			SA-4			SA-5		
				SA-3b-WQ-P12	SA-3b-WQ-U12	SA-3b-WQ-F12[c]	SA-4b-WQ-P12	SA-4b-WQ-U12[d]	SA-4b-WQ-F12[c]	SA-5b-WQ-P12	SA-5b-WQ-U12[d]	SA-5b-WQ-F12[e]
				8-May-12	7-Aug-12	24-Oct-12	8-May-12	7-Aug-12	24-Oct-12	8-May-12	7-Aug-12	24-Oct-12
Metals (Total and Dissolved)												
Aluminum	mg/L	0.005 to 0.1 [i]	0.005 to 0.1 [i]	0.0031	0.0039	0.0018	**0.0099**	0.0064	0.0033	0.014	0.0071	0.0047
Aluminum, dissolved	mg/L	-	-	0.0024	0.0007	<0.0005	0.0059	0.0038	<0.0005	<0.0005	0.0039	<0.0005
Antimony	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Antimony, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Arsenic	µg/L	5	5	<0.1	0.1	0.1	<0.1	0.1	<0.1	0.1	0.1	0.1
Arsenic, dissolved	µg/L	-	-	<0.1	0.1	<0.1	<0.1	0.1	<0.1	<0.1	0.1	<0.1
Barium	mg/L	-	-	0.0039	0.0027	0.0030	0.0029	0.0024	0.0022	0.0030	0.0031	0.0022
Barium, dissolved	mg/L	-	-	0.0016	0.0025	0.0013	0.0036	0.0022	<0.0005	<0.0005	0.0022	0.0009
Beryllium	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Beryllium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Boron	mg/L	1.5	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Boron, dissolved	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.00004[j]	0.000017 [j]	<0.00001	0.00002	<0.00001	<0.00001	**0.00007**	<0.00001	<0.00001	<0.00001	<0.00001
Cadmium, dissolved	mg/L	-	-	<0.00001	0.00001	<0.00001	<0.00001	0.00004	<0.00001	<0.00001	0.00001	<0.00001
Chromium	mg/L	0.001 [k]	0.001 [k]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium, dissolved	mg/L	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	0.002 [j]	0.002 [j]	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Copper, dissolved	mg/L	-	-	<0.0002	<0.0002	0.0004	<0.0002	<0.0002	0.0004	0.0008	<0.0002	0.0005
Iron	mg/L	0.3	0.3	0.072	0.13	0.062	0.086	0.13	0.064	0.11	0.11	0.067
Iron, dissolved	mg/L	-	-	0.0071	0.053	0.0026	0.013	0.042	0.0058	0.026	0.049	0.0067
Lead	mg/L	0.001 [j]	0.001 [j]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lead, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lithium	µg/L	-	-	0.6	0.7	0.6	0.7	0.9	0.7	0.5	0.4	0.5
Lithium, dissolved	µg/L	-	-	0.7	0.7	0.6	0.8	0.8	0.7	0.5	0.4	0.6
Manganese	mg/L	-	-	0.018	0.016	0.0084	0.0095	0.017	0.010	0.0086	0.018	0.010
Manganese, dissolved	mg/L	-	-	0.0066	0.0073	<0.0005	0.0021	0.0045	<0.0005	0.0014	0.0019	<0.0005
Mercury	µg/L	0.026 [l]	0.026 [l]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury, Dissolved	µg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01*	<0.01	<0.01	<0.01*	<0.01
Molybdenum	mg/L	0.073	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	mg/L	0.025 [j]	0.025 [j]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	0.0002
Selenium	mg/L	0.001	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Selenium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silver	mg/L	0.0001	0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Silver, dissolved	mg/L	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Strontium	mg/L	-	-	0.015	0.014	0.014	0.015	0.013	0.013	0.012	0.011	0.011

Table A1. Water Chemistry Data for Waterbodies and Watercourses of the Denison Mines Wheeler River Project, May 8, 2012 to October 25, 2012 (Continued)

Parameters	Units	CCME CWQG[(a)]	SSWQO[(b)]	Drainage A (Icelander River)								
				Streams								
				SA-3			SA-4			SA-5		
				SA-3b-WQ-P12	SA-3b-WQ-U12	SA-3b-WQ-F12[(c)]	SA-4b-WQ-P12	SA-4b-WQ-U12[(d)]	SA-4b-WQ-F12[(c)]	SA-5b-WQ-P12	SA-5b-WQ-U12[(d)]	SA-5b-WQ-F12[(e)]
				8-May-12	7-Aug-12	24-Oct-12	8-May-12	7-Aug-12	24-Oct-12	8-May-12	7-Aug-12	24-Oct-12
Metals (Total and Dissolved)												
Strontium, dissolved	mg/L	-	-	0.015	0.015	0.013	0.015	0.014	0.012	0.011	0.012	0.0096
Thallium	mg/L	0.0008	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Thallium, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tin	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Titanium, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Uranium	µg/L	15	15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium, dissolved	µg/L	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Vanadium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Zinc	mg/L	0.03	0.03	<0.0005	<0.0005	0.0008	0.0005	0.0012	<0.0005	<0.0005	<0.0005	<0.0005
Zinc, dissolved	mg/L	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005	0.0009	0.0006	0.0013
Radionuclides												
Lead-210	Bq/L	-	-	<0.02	<0.02	0.03	<0.02	<0.02	0.03	<0.02	<0.02	<0.02
Polonium-210	Bq/L	-	-	<0.005	<0.005	0.006	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Radium-226	Bq/L	-	0.11[(m)]	0.006	<0.005	0.01	<0.005	<0.005	0.006	<0.005	0.007	<0.005
Thorium-228	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium-230	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium-232	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01

Table A1. Water Chemistry Data for Waterbodies and Watercourses of the Denison Mines Wheeler River Project, May 8, 2012 to October 25, 2012 (Continued)

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Drainage A (Icelander River)			Drainage B (Unnamed)							
				Streams			Lake	Streams						
				SA-6			Williams Lake[f]	SB-1				SB-2		
				SA-6a-WQ-P12	SA-6a-WQ-U12	SA-6a-WQ-F12[c]	LB-3a-WQ-U12	SB-1a-WQ-P12	Dup1-P12	SB-1a-WQ-U12	SB-1a-WQ-F12[c]	SB-2b-WQ-P12	SB-2b-WQ-U12	SB-2b-WQ-F12[c]
				8-May-12	7-Aug-12	24-Oct-12	11-Aug-12	9-May-12		7-Aug-12	25-Oct-12	9-May-12	7-Aug-12	25-Oct-12
Conventional Parameters (Field-Measured)														
Dissolved Oxygen	mg/L	6.5 and 9.5[g]	6.5 and 9.5[g]	11.45	**9.32**	16.19	**8.86**	10.60		9.61	14.00	**8.29**	**3.62**	11.11
pH	pH units	6.5 to 9.0	-	6.88	7.29	**6.00**	7.03	**5.26**		**6.43**	**5.83**	**5.16**	6.59	**5.82**
Specific conductivity	µS/cm	-	-	16	16	17	15	15		16	15	15	19	14
Water temperature	°C	-	-	5.10	17.63	0.62	18.73	5.73		18.42	0.06	5.00	18.42	0.13
Conventional Parameters (Lab-Measured)														
pH	pH units	6.5 to 9.0	-	6.74	6.54	6.82	6.58	6.54	**6.42**	**6.38**	6.64	**6.21**	**6.05**	**6.41**
Specific conductivity	uS/cm	-	-	17	14	16	17	16	15	14	15	15	15	14
Total alkalinity	mg/L	-	-	3	3	8	6	3	3	5	8	5	5	5
Total dissolved solids	mg/L	-	-	16	19	15	22	19	18	22	25	19	26	28
Total hardness	mg/L	-	-	5	4	5	5	5	4	4	5	5	6	4
Total suspended solids	mg/L	-	-	2	5	6	2	2	2	<1	4	2	8	1
Nutrients														
Ammonia as nitrogen	mg/L	[h]	[h]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.06	<0.01	<0.01	<0.01
Nitrite	mg/L	0.06	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Nitrite+Nitrate nitrogen	mg/L	-	-	0.03	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Organic carbon	mg/L	-	-	2.6	2.4	2.5	3.0	4.6	4.8	4.6	4.5	6.7	5.3	7.6
Organic carbon, dissolved	mg/L	-	-	2.5	2.5	2.3	2.8	4.5	4.8	4.6	4.3	6.2	5.1	6.4
Ortho-phosphate as P	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	<0.01
Phosphorus, dissolved	mg/L	-	-	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	-
Total Kjeldahl nitrogen	mg/L	-	-	0.30	0.32	0.41	0.34	0.25	0.26	0.25	0.27	0.27	0.31	0.35
Un-ionized ammonia-N	mg/L	0.019	-	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Organics														
Chlorophyll a	µg/L	-	-	2.5	<0.1	2.6	2.2	2.7	1.2	<0.1	1.7	1.6	2.0	<0.1
Major Ions														
Bicarbonate	mg/L	-	-	4	4	10	7	4	4	6	10	6	6	6
Calcium	mg/L	-	-	1.3	1.2	1.3	1.4	1.2	1.2	1.3	1.2	1.3	1.4	1.1
Carbonate	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloride	mg/L	120	-	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.2	0.5	0.5	0.5
Fluoride	mg/L	0.12	-	<0.01	0.02	0.01	0.02	<0.01	<0.01	0.02	0.01	<0.01	0.02	0.01
Hydroxide	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Magnesium	mg/L	-	-	0.4	0.3	0.4	0.4	0.4	0.3	0.3	0.6	0.4	0.5	0.4
P. alkalinity	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Potassium	mg/L	-	-	0.2	0.3	0.4	0.4	0.3	0.3	0.3	0.4	0.2	0.3	0.3
Sodium	mg/L	-	-	1.4	1.3	1.4	1.4	1.3	1.2	1.2	1.4	1.0	1.1	1.2
Sulphate	mg/L	-	-	0.7	0.6	0.5	0.8	0.8	0.6	0.6	0.9	0.6	0.8	0.9
Sum of ions	mg/L	-	-	8	8	14	12	8	8	10	15	10	11	10
Other														
Silicon, soluble	mg/L	-	-	2.8	2.9	2.6	2.3	2.7	2.7	2.8	2.9	2.4	3.1	2.9

Table A1. Water Chemistry Data for Waterbodies and Watercourses of the Denison Mines Wheeler River Project, May 8, 2012 to October 25, 2012 (Continued)

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Drainage A (Icelander River)			Drainage B (Unnamed)							
				Streams			Lake	Streams						
				SA-6			Williams Lake[f]	SB-1				SB-2		
				SA-6a-WQ-P12	SA-6a-WQ-U12	SA-6a-WQ-F12[c]	LB-3a-WQ-U12	SB-1a-WQ-P12	Dup1-P12	SB-1a-WQ-U12	SB-1a-WQ-F12[c]	SB-2b-WQ-P12	SB-2b-WQ-U12	SB-2b-WQ-F12[c]
				8-May-12	7-Aug-12	24-Oct-12	11-Aug-12	9-May-12		7-Aug-12	25-Oct-12	9-May-12	7-Aug-12	25-Oct-12
Metals (Total and Dissolved)														
Aluminum	mg/L	0.005 to 0.1 [i]	0.005 to 0.1 [i]	0.020	0.016	**0.014**	0.0035	**0.022**	**0.019**	**0.016**	**0.025**	**0.051**	0.024	**0.020**
Aluminum, dissolved	mg/L	-	-	0.0045	0.0034	<0.0005	<0.0005	0.014	0.013	0.010	<0.0005	0.015	0.013	<0.0005
Antimony	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Antimony, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Arsenic	µg/L	5	5	0.1	0.1	0.1	0.1	<0.1	<0.1	0.1	0.1	<0.1	0.2	0.1
Arsenic, dissolved	µg/L	-	-	<0.1	0.1	<0.1	0.1	<0.1	<0.1	0.2	<0.1	<0.1	0.1	<0.1
Barium	mg/L	-	-	0.0030	0.0029	0.0029	0.0041	0.0025	0.0025	0.0026	0.0023	0.0022	0.0036	0.0017
Barium, dissolved	mg/L	-	-	<0.0005	0.0020	0.010	0.0034	0.029	0.0015	0.0026	0.014	0.011	0.0028	<0.0005
Beryllium	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Beryllium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Boron	mg/L	1.5	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Boron, dissolved	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.00004[j]	0.000017 [j]	0.00001	0.00002	0.00001	0.00002	<0.00001	0.00001	0.00001	<0.00001	0.00001	<0.00001	0.00001
Cadmium, dissolved	mg/L	-	-	<0.00001	0.00001	<0.00001	0.00002	<0.00001	<0.00001	0.00002	<0.00001	<0.00001	<0.00001	<0.00001
Chromium	mg/L	0.001 [k]	0.001 [k]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium, dissolved	mg/L	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001
Cobalt, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001
Copper	mg/L	0.002 [j]	0.002 [j]	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Copper, dissolved	mg/L	-	-	0.0003	<0.0002	<0.0002	<0.0002	0.0005	0.0004	<0.0002	<0.0002	0.0006	<0.0002	0.0003
Iron	mg/L	0.3	0.3	0.098	0.16	0.14	0.24	0.20	0.20	0.16	0.16	**0.49**	**1.34**	0.25
Iron, dissolved	mg/L	-	-	0.021	0.048	0.0064	0.084	0.13	0.11	0.12	0.071	0.26	0.56	0.19
Lead	mg/L	0.001 [j]	0.001 [j]	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001
Lead, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lithium	µg/L	-	-	0.6	0.7	0.6	0.8	0.7	0.7	0.8	0.7	0.7	0.8	0.6
Lithium, dissolved	µg/L	-	-	0.6	0.7	0.4	0.8	0.7	0.7	0.6	0.6	0.7	0.6	0.7
Manganese	mg/L	-	-	0.0095	0.029	0.018	0.028	0.0098	0.010	0.0071	0.0088	0.011	0.054	0.0085
Manganese, dissolved	mg/L	-	-	0.0013	0.0054	<0.0005	0.019	0.0063	0.0047	0.0025	0.0034	0.0073	0.040	0.0074
Mercury	µg/L	0.026 [l]	0.026 [l]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury, Dissolved	µg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Molybdenum	mg/L	0.073	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	mg/L	0.025 [j]	0.025 [j]	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0003	0.0002
Nickel, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	0.0004	0.0002	0.0002
Selenium	mg/L	0.001	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Selenium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silver	mg/L	0.0001	0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Silver, dissolved	mg/L	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Strontium	mg/L	-	-	0.012	0.012	0.012	0.013	0.011	0.011	0.013	0.011	0.012	0.015	0.010

Table A1. Water Chemistry Data for Waterbodies and Watercourses of the Denison Mines Wheeler River Project, May 8, 2012 to October 25, 2012 (Continued)

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Drainage A (Icelander River)			Drainage B (Unnamed)							
				Streams			Lake	Streams						
				SA-6			Williams Lake[f]	SB-1				SB-2		
				SA-6a-WQ-P12	SA-6a-WQ-U12	SA-6a-WQ-F12[c]	LB-3a-WQ-U12	SB-1a-WQ-P12	Dup1-P12	SB-1a-WQ-U12	SB-1a-WQ-F12[c]	SB-2b-WQ-P12	SB-2b-WQ-U12	SB-2b-WQ-F12[c]
				8-May-12	7-Aug-12	24-Oct-12	11-Aug-12	9-May-12		7-Aug-12	25-Oct-12	9-May-12	7-Aug-12	25-Oct-12
Metals (Total and Dissolved)														
Strontium, dissolved	mg/L	-	-	0.012	0.012	0.011	0.012	0.012	0.011	0.013	0.010	0.012	0.016	0.0096
Thallium	mg/L	0.0008	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Thallium, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tin	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	0.0003	<0.0002	0.0003	<0.0002	0.0004	0.0003	0.0003	0.0010	0.0018	0.0009	0.0003
Titanium, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	0.0002	<0.0002	<0.0002	<0.0002	0.0002	0.0004	0.0003
Uranium	µg/L	15	15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1
Uranium, dissolved	µg/L	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	mg/L	-	-	<0.0001	0.0001	<0.0001	<0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0001
Vanadium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Zinc	mg/L	0.03	0.03	<0.0005	0.0005	0.0006	0.0031	<0.0005	<0.0005	0.0007	<0.0005	0.0032	0.0006	<0.0005
Zinc, dissolved	mg/L	-	-	<0.0005	<0.0005	0.0006	<0.0005	0.0008	0.0009	<0.0005	<0.0005	0.0012	0.0010	<0.0005
Radionuclides														
Lead-210	Bq/L	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.04	<0.02
Polonium-210	Bq/L	-	-	<0.005	<0.005	0.006	<0.005	0.006	<0.005	<0.005	<0.005	0.008	0.01	<0.005
Radium-226	Bq/L	-	0.11[m]	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.009	<0.005
Thorium-228	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium-230	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium-232	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Table A1. Water Chemistry Data for Waterbodies and Watercourses of the Denison Mines Wheeler River Project, May 8, 2012 to October 25, 2012 (Continued)

Parameters	Units	CCME CWQG[(a)]	SSWQO[(b)]	Drainage B (Unnamed)									
				Streams									
				SB-3			SB-4			SB-5			
				SB-3b-WQ-P12	SB-3b-WQ-U12	SB-3b-WQ-F12[(c)]	SB-4a-WQ-P12	SB-4a-WQ-U12	SB-4a-WQ-F12[(c)]	SB-5a-WQ-P12	SB-5a-WQ-U12	SB-5a-WQ-F12[(c)]	Dup1-F12[(c)]
				9-May-12	8-Aug-12	25-Oct-12	8-May-12	7-Aug-12	24-Oct-12	9-May-12	7-Aug-12	25-Oct-12	
Conventional Parameters (Field-Measured)													
Dissolved Oxygen	mg/L	6.5 and 9.5[(g)]	6.5 and 9.5[(g)]	9.63	**8.91**	13.85	10.20	**7.15**	14.14	10.73	**8.71**	13.50	
pH	pH units	6.5 to 9.0	-	**5.78**	6.81	**6.12**	**6.16**	6.90	**6.19**	**5.52**	**6.45**	6.73	
Specific conductivity	µS/cm	-	-	17	17	17	15	15	14	17	17	17	
Water temperature	°C	-	-	4.48	20.01	1.21	4.46	18.13	0.65	4.40	20.13	1.15	
Conventional Parameters (Lab-Measured)													
pH	pH units	6.5 to 9.0	-	**6.50**	6.61	6.78	**6.37**	**6.35**	**6.50**	6.61	6.59	6.77	6.82
Specific conductivity	uS/cm	-	-	17	15	16	15	12	12	18	15	16	16
Total alkalinity	mg/L	-	-	3	3	24	2	4	7	5	4	9	12
Total dissolved solids	mg/L	-	-	14	18	21	19	22	26	16	20	19	26
Total hardness	mg/L	-	-	5	6	5	5	4	4	5	5	5	5
Total suspended solids	mg/L	-	-	2	3	3	2	3	2	2	2	2	2
Nutrients													
Ammonia as nitrogen	mg/L	[(h)]	[(h)]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite	mg/L	0.06	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Nitrite+Nitrate nitrogen	mg/L	-	-	0.02	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01
Organic carbon	mg/L	-	-	2.4	3.4	3.6	5.8	5.0	5.9	2.9	3.2	3.2	3.2
Organic carbon, dissolved	mg/L	-	-	2.2	3.4	3.4	5.9	4.8	5.6	2.9	3.1	3.2	3.2
Ortho-phosphate as P	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	-	-	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	<0.01	-	-
Total Kjeldahl nitrogen	mg/L	-	-	0.34	0.24	0.32	0.26	0.30	0.65	0.28	0.22	0.30	0.33
Un-ionized ammonia-N	mg/L	0.019	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Organics													
Chlorophyll a	µg/L	-	-	3.6	0.2	3.7	1.7	<0.1	8.4	3.8	<0.1	4.3	4.4
Major Ions													
Bicarbonate	mg/L	-	-	4	4	29	2	5	8	6	5	11	15
Calcium	mg/L	-	-	1.4	1.4	1.4	1.4	1.2	1.0	1.4	1.2	1.3	1.3
Carbonate	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloride	mg/L	120	-	0.1	0.2	0.2	<0.1	<0.1	<0.1	0.2	0.2	0.2	<0.1
Fluoride	mg/L	0.12	-	0.01	0.02	0.01	<0.01	0.02	0.01	0.01	0.02	0.01	0.01
Hydroxide	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Magnesium	mg/L	-	-	0.4	0.5	0.4	0.3	0.2	0.3	0.4	0.4	0.4	0.4
P. alkalinity	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Potassium	mg/L	-	-	0.2	0.3	0.4	0.1	0.3	0.3	0.2	0.3	0.4	0.4
Sodium	mg/L	-	-	1.3	1.2	1.4	0.9	1.1	1.1	1.4	1.3	1.4	1.4
Sulphate	mg/L	-	-	0.8	0.6	0.8	0.5	0.4	0.4	0.7	0.6	1.0	0.8
Sum of ions	mg/L	-	-	8	8	34	5	8	11	10	9	16	19
Other													
Silicon, soluble	mg/L	-	-	2.4	1.8	2.0	1.8	1.9	1.9	2.1	2.1	2.1	2.0

Table A1. Water Chemistry Data for Waterbodies and Watercourses of the Denison Mines Wheeler River Project, May 8, 2012 to October 25, 2012 (Continued)

Parameters	Units	CCME CWQG(a)	SSWQO(b)	Drainage B (Unnamed)									
				Streams									
				SB-3			SB-4			SB-5			
				SB-3b-WQ-P12	SB-3b-WQ-U12	SB-3b-WQ-F12(c)	SB-4a-WQ-P12	SB-4a-WQ-U12	SB-4a-WQ-F12(c)	SB-5a-WQ-P12	SB-5a-WQ-U12	SB-5a-WQ-F12(c)	Dup1-F12(c)
				9-May-12	8-Aug-12	25-Oct-12	8-May-12	7-Aug-12	24-Oct-12	9-May-12	7-Aug-12	25-Oct-12	
Metals (Total and Dissolved)													
Aluminum	mg/L	0.005 to 0.1 (i)	0.005 to 0.1 (i)	0.0074	0.0084	0.0081	0.033	0.022	0.026	0.0086	0.0074	0.0038	0.0040
Aluminum, dissolved	mg/L	-	-	0.0032	0.0040	<0.0005	0.025	0.014	<0.0005	0.0018	0.0037	<0.0005	<0.0005
Antimony	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Antimony, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Arsenic	µg/L	5	5	<0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1
Arsenic, dissolved	µg/L	-	-	<0.1	0.1	<0.1	<0.1	0.2	<0.1	<0.1	0.1	<0.1	<0.1
Barium	mg/L	-	-	0.0035	0.0030	0.0029	0.0034	0.0031	0.0025	0.0034	0.0028	0.0028	0.0029
Barium, dissolved	mg/L	-	-	0.011	0.0029	0.0026	0.0046	0.0031	0.0041	0.014	0.0024	0.0054	0.0049
Beryllium	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Beryllium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Boron	mg/L	1.5	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Boron, dissolved	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.00004(j)	0.000017 (j)	<0.00001	<0.00001	<0.00001	0.00001	<0.00001	<0.00001	<0.00001	0.00001	<0.00001	0.00001
Cadmium, dissolved	mg/L	-	-	<0.00001	0.00001	<0.00001	<0.00001	0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chromium	mg/L	0.001 (k)	0.001 (k)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium, dissolved	mg/L	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	0.002 (j)	0.002 (j)	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Copper, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Iron	mg/L	0.3	0.3	0.11	0.15	0.059	0.18	0.22	0.095	0.11	0.084	0.084	0.086
Iron, dissolved	mg/L	-	-	0.030	0.092	0.012	0.088	0.15	0.072	0.030	0.052	0.021	0.022
Lead	mg/L	0.001 (j)	0.001 (j)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lead, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lithium	µg/L	-	-	0.7	0.6	0.6	0.4	0.4	0.3	0.7	0.6	0.7	0.6
Lithium, dissolved	µg/L	-	-	0.7	0.6	0.6	0.4	0.3	0.3	0.7	0.4	0.6	0.5
Manganese	mg/L	-	-	0.020	0.017	0.0061	0.0066	0.011	0.0036	0.016	0.010	0.0071	0.0075
Manganese, dissolved	mg/L	-	-	0.011	0.0029	<0.0005	0.0021	0.0046	0.0098	0.011	0.0016	<0.0005	<0.0005
Mercury	µg/L	0.026 (l)	0.026 (l)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury, Dissolved	µg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Molybdenum	mg/L	0.073	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	mg/L	0.025 (j)	0.025 (j)	0.0001	0.0001	0.0001	0.0002	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel, dissolved	mg/L	-	-	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	<0.0001	<0.0001	0.0001	0.0002
Selenium	mg/L	0.001	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Selenium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silver	mg/L	0.0001	0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Silver, dissolved	mg/L	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Strontium	mg/L	-	-	0.013	0.013	0.012	0.012	0.012	0.0089	0.012	0.011	0.011	0.011

Table A1. Water Chemistry Data for Waterbodies and Watercourses of the Denison Mines Wheeler River Project, May 8, 2012 to October 25, 2012 (Continued)

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Drainage B (Unnamed)									
				Streams									
				SB-3			SB-4			SB-5			
				SB-3b-WQ-P12	SB-3b-WQ-U12	SB-3b-WQ-F12[c]	SB-4a-WQ-P12	SB-4a-WQ-U12	SB-4a-WQ-F12[c]	SB-5a-WQ-P12	SB-5a-WQ-U12	SB-5a-WQ-F12[c]	Dup1-F12[c]
				9-May-12	8-Aug-12	25-Oct-12	8-May-12	7-Aug-12	24-Oct-12	9-May-12	7-Aug-12	25-Oct-12	
Metals (Total and Dissolved)													
Strontium, dissolved	mg/L	-	-	0.013	0.014	0.011	0.012	0.012	0.0078	0.012	0.012	0.010	0.011
Thallium	mg/L	0.0008	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Thallium, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tin	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	<0.0002	<0.0002	<0.0002	0.0004	0.0003	0.0003	<0.0002	<0.0002	<0.0002	<0.0002
Titanium, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	0.0003	0.0004	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Uranium	µg/L	15	15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium, dissolved	µg/L	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	mg/L	-	-	<0.0001	<0.0001	<0.0001	0.0002	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Vanadium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Zinc	mg/L	0.03	0.03	<0.0005	0.0012	<0.0005	<0.0005	0.0007	<0.0005	<0.0005	0.0016	<0.0005	<0.0005
Zinc, dissolved	mg/L	-	-	0.0007	0.0008	0.0014	0.0006	0.0009	<0.0005	<0.0005	0.0011	0.0010	0.0008
Radionuclides													
Lead-210	Bq/L	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Polonium-210	Bq/L	-	-	<0.005	0.006	<0.005	0.006	0.005	0.01	<0.005	<0.005	<0.005	<0.005
Radium-226	Bq/L	-	0.11[m]	0.01	<0.005	0.006	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	<0.005
Thorium-228	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium-230	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium-232	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Table A1. Water Chemistry Data for Waterbodies and Watercourses of the Denison Mines Wheeler River Project, May 8, 2012 to October 25, 2012 (Continued)

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Russell Lake		QA/QC			
				Lake		Streams			
				Russell Lake		FIELD BLANK		TRIP BLANK	
				RL-Aa-WQ-U12	Dup1-U12	Field S-P12	Field S-F12	Trip S-P12	Trip S-F12[c]
				10-Aug-12	10-Aug-12	8-May-12	25-Oct-12	8-May-12	25-Oct-12
Conventional Parameters (Field-Measured)									
Dissolved Oxygen	mg/L	6.5 and 9.5[g]	6.5 and 9.5[g]	**8.95**		-	-	-	-
pH	pH units	6.5 to 9.0	-	6.59		-	-	-	-
Specific conductivity	µS/cm	-	-	34		-	-	-	-
Water temperature	°C	-	-	18.62		-	-	-	-
Conventional Parameters (Lab-Measured)									
pH	pH units	6.5 to 9.0	-	6.65	6.71	**6.44**	**5.32**	**6.33**	**5.30**
Specific conductivity	uS/cm	-	-	38	38	<1	<1	<1	<1
Total alkalinity	mg/L	-	-	2	3	4	<1	1	<1
Total dissolved solids	mg/L	-	-	35	33	<1	<1	<1	<1
Total hardness	mg/L	-	-	13	13	<1	<1	<1	<1
Total suspended solids	mg/L	-	-	1	<1	<1	<1	<1	1
Nutrients									
Ammonia as nitrogen	mg/L	(h)	(h)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite	mg/L	0.06	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Nitrite+Nitrate nitrogen	mg/L	-	-	0.30	0.02	<0.01	<0.01	<0.01	<0.01
Organic carbon	mg/L	-	-	2.6	2.6	<0.2	0.3	<0.2	0.3
Organic carbon, dissolved	mg/L	-	-	2.5	2.6	<0.2	0.2	<0.2	0.2
Ortho-phosphate as P	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	-	-	<0.01	<0.01	-	-	-	-
Total Kjeldahl nitrogen	mg/L	-	-	0.22	0.26	<0.05	0.05	<0.05	<0.05
Un-ionized ammonia-N	mg/L	0.019	-	-	-	N/R	N/R	N/R	N/R
Organics									
Chlorophyll a	µg/L	-	-	2.0	1.7	0.2	<0.1	0.4	<0.1
Major Ions									
Bicarbonate	mg/L	-	-	2	4	5	<1	1	<1
Calcium	mg/L	-	-	3.9	4.0	<0.1	<0.1	<0.1	<0.1
Carbonate	mg/L	-	-	<1	<1	<1	<1	<1	<1
Chloride	mg/L	120	-	0.4	0.4	<0.1	<0.1	<0.1	0.4
Fluoride	mg/L	0.12	-	0.03	0.03	<0.01	<0.01	<0.01	<0.01
Hydroxide	mg/L	-	-	<1	<1	<1	<1	<1	<1
Magnesium	mg/L	-	-	0.7	0.7	<0.1	<0.1	<0.1	<0.1
P. alkalinity	mg/L	-	-	<1	<1	<1	<1	<1	<1
Potassium	mg/L	-	-	0.6	0.6	<0.1	<0.1	<0.1	<0.1
Sodium	mg/L	-	-	1.7	1.7	<0.1	<0.1	<0.1	<0.1
Sulphate	mg/L	-	-	7.8	7.7	<0.2	<0.2	<0.2	<0.2
Sum of ions	mg/L	-	-	18	19	5	<1	1	<1
Other									
Silicon, soluble	mg/L	-	-	3.7	3.7	<0.01	<0.01	<0.01	<0.01

Table A1. Water Chemistry Data for Waterbodies and Watercourses of the Denison Mines Wheeler River Project, May 8, 2012 to October 25, 2012 (Continued)

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Russell Lake		QA/QC			
				Lake		Streams			
				Russell Lake		FIELD BLANK		TRIP BLANK	
				RL-Aa-WQ-U12	Dup1-U12	Field S-P12	Field S-F12	Trip S-P12	Trip S-F12[c]
				10-Aug-12	10-Aug-12	8-May-12	25-Oct-12	8-May-12	25-Oct-12
Metals (Total and Dissolved)									
Aluminum	mg/L	0.005 to 0.1 [i]	0.005 to 0.1 [i]	0.0023	0.0026	<0.0005	<0.0005	<0.0005	<0.0005
Aluminum, dissolved	mg/L	-	-	<0.0005	<0.0005	<0.0005	<0.0005	0.0028	<0.0005
Antimony	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Antimony, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Arsenic	µg/L	5	5	0.1	0.1	<0.1	<0.1	<0.1	<0.1
Arsenic, dissolved	µg/L	-	-	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Barium	mg/L	-	-	0.0033	0.0033	<0.0005	<0.0005	<0.0005	<0.0005
Barium, dissolved	mg/L	-	-	0.0028	0.0028	<0.0005	0.014	<0.0005	0.0017
Beryllium	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Beryllium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Boron	mg/L	1.5	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Boron, dissolved	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.00004[j]	0.000017 [j]	0.00001	0.00002	<0.00001	<0.00001	<0.00001	<0.00001
Cadmium, dissolved	mg/L	-	-	0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chromium	mg/L	0.001 [k]	0.001 [k]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium, dissolved	mg/L	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	0.002 [j]	0.002 [j]	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Copper, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0004
Iron	mg/L	0.3	0.3	0.056	0.051	<0.0005	<0.0005	<0.0005	<0.0005
Iron, dissolved	mg/L	-	-	0.0056	0.0059	<0.0005	<0.0005	<0.0005	<0.0005
Lead	mg/L	0.001 [j]	0.001 [j]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lead, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lithium	µg/L	-	-	12	12	<0.1	<0.1	<0.1	<0.1
Lithium, dissolved	µg/L	-	-	11	11	<0.1	<0.1	<0.1	<0.1
Manganese	mg/L	-	-	0.029	0.027	<0.0005	<0.0005	<0.0005	<0.0005
Manganese, dissolved	mg/L	-	-	0.0017	0.0016	<0.0005	<0.0005	<0.0005	<0.0005
Mercury	µg/L	0.026 [l]	0.026 [l]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury, Dissolved	µg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Molybdenum	mg/L	0.073	-	0.0007	0.0006	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum, dissolved	mg/L	-	-	0.0019	0.0013	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	mg/L	0.025 [j]	0.025 [j]	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel, dissolved	mg/L	-	-	0.0001	0.0001	<0.0001	0.0002	<0.0001	0.0002
Selenium	mg/L	0.001	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Selenium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silver	mg/L	0.0001	0.0001	<0.00005	<0.00005	0.00008	<0.00005	<0.00005	<0.00005
Silver, dissolved	mg/L	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Strontium	mg/L	-	-	0.018	0.018	<0.0005	<0.0005	<0.0005	<0.0005

Table A1. Water Chemistry Data for Waterbodies and Watercourses of the Denison Mines Wheeler River Project, May 8, 2012 to October 25, 2012 (Continued)

Parameters	Units	CCME CWQG[(a)]	SSWQO[(b)]	Russell Lake		QA/QC			
				Lake		Streams			
				Russell Lake		FIELD BLANK		TRIP BLANK	
				RL-Aa-WQ-U12	Dup1-U12	Field S-P12	Field S-F12	Trip S-P12	Trip S-F12[(c)]
				10-Aug-12	10-Aug-12	8-May-12	25-Oct-12	8-May-12	25-Oct-12
Metals (Total and Dissolved)									
Strontium, dissolved	mg/L	-	-	0.018	0.018	<0.0005	<0.0005	<0.0005	0.0024
Thallium	mg/L	0.0008	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Thallium, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tin	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin, dissolved	mg/L	-	-	0.0003	0.0002	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Titanium, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Uranium	µg/L	15	15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium, dissolved	µg/L	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Vanadium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Zinc	mg/L	0.03	0.03	<0.0005	0.0007	<0.0005	0.0011	<0.0005	<0.0005
Zinc, dissolved	mg/L	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Radionuclides									
Lead-210	Bq/L	-	-	<0.02	<0.02	<0.02	0.03	<0.02	0.05
Polonium-210	Bq/L	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Radium-226	Bq/L	-	0.11[(m)]	<0.005	<0.005	<0.005	<0.005	<0.005	0.006
Thorium-228	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium-230	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium-232	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Notes:

Values that exceed the CCME WQG are **bolded**. Values that Exceed the SSWQO are underlined.

(a) CCME CWQG = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 1999 with updates).

(b) SSWQO = Saskatchewan Surface Water Quality Objectives (Water Security Agency [WSA] 2006).

(c) This sample was reanalyzed for dissolved ICP-MS analytes. Reanalysis confirmed original results within the expected measurement uncertainty.

(d) Mercury results were reported from the Nitric acid preserved container. For best results the Mercury should be reported from the HNO_3/HCl preserved container.

(e) This sample was reanalyzed for dissolved ICP-MS analytes and Soluble Silicon. Reanalysis confirmed original results within the expected measurement uncertainty.

(f) Local lake name.

(g) The objectives and guidelines of dissolved oxygen for cold-water biota are 9.5 mg/L for early life stages and 6.5 mg/L for other life stages.

(h) The objectives/guidelines for ammonia are dependent on temperature and pH; the objective/guideline for each sample was calculated separately using the rounded field pH and rounded temperature measured at depth.

(i) The objectives/guidelines for aluminum are dependent on pH; the field pH for each sample was used in the screening.

(j) The objective/guidelines for cadmium, copper, lead, and nickel are hardness-dependent; The range of CCME WQG and SSWQO are listed and were calculated separately for each sample.

(k) The objective is for hexavalent chromium; total chromium was analyzed.

(l) The objective/guidelines are for inorganic mercury.

(m) The objective for radium-226 was missed in the 2006 SSWQO (WSA) revisions; an objective of 0.11 Bq/L was presented in 1997 SSWQO (SMOE) and is expected to be added to the next SSWQO revision (T. Moulding pers. comm.).

mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; ^{0}C = degrees Celsius; µg/L = micrograms per litre; Bq/L = Becquerels per litre; < = less than; - = not available; N/R = not reported; ICP-MS = Inductively coupled plasma mass spectrometry; HNO_3 = nitric acid; HCl = hydrochloric acid; SMOE = Saskatchewan Ministry of Environment.

Table A2. Water Chemistry Data for Watercourses of the Denison Mines Wheeler River Project, May 22, 2013 to October 19, 2013

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Drainage A (Icelander River)										
				Streams										
				SA-1					SA-2			SA-3		
				SA-1c-WQ-P13	SA-1c-WQ-U13	Dup1-U13	SA-1c-WQ-F13	Dup1-F13	SA-2b-WQ-P13	SA-2b-WQ-U13[c]	SA-2b-WQ-F13	SA-3b-WQ-P13	SA-3b-WQ-U13	SA-3b-WQ-F13
				22-May-13	15-Aug-13		18-Oct-13		22-May-13	15-Aug-13	18-Oct-13	22-May-13	15-Aug-13	18-Oct-13
Conventional Parameters (Field-Measured)														
Dissolved Oxygen	mg/L	6.5 and 9.5[f]	6.5 and 9.5[f]	11.98	**9.03**		12.5		11.17	**8.72**	12.74	11.41	**9.29**	12.44
pH	pH units	6.5 to 9.0	-	6.96	6.69		6.93		7.31	**6.19**	6.6	7.23	**6.5**	7.36
Specific conductivity	µS/cm	-	-	17	17		18		15	18	15	19	19	21
Water temperature	°C	-	-	6.84	21.72		4.72		11.6	21.24	2.51	8.81	21.37	2.43
Conventional Parameters (Lab-Measured)														
pH	pH units	6.5 to 9.0	-	**6.34**	6.68	6.70	6.95	6.99	6.59	6.72	7.01	**6.42**	6.66	7.02
Specific conductivity	uS/cm	-	-	19	18	17	18	18	16	18	18	20	19	20
Total alkalinity	mg/L	-	-	8	2	4	4	4	9	8	5	7	4	6
Total dissolved solids	mg/L	-	-	23	21	18	22	19	21	20	20	19	21	24
Total hardness	mg/L	-	-	5	5	5	5	6	4	5	6	6	5	6
Total suspended solids	mg/L	-	-	2	2	3	2	2	1	<1	1	<1	1	2
Nutrients														
Ammonia as nitrogen	mg/L	[g]	[g]	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite	mg/L	0.06	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Nitrite+Nitrate nitrogen	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Organic carbon	mg/L	-	-	1.8	2.2	2.2	2.2	2.2	2.1	2.4	2.2	1.8	2.5	2.5
Organic carbon, dissolved	mg/L	-	-	1.7	2.2	2.1	2.2	2.1	2	2.2	2.4	1.7	2.4	2.6
Ortho-phosphate as P	mg/L	-	-	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.01
Phosphorus	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Kjeldahl nitrogen	mg/L	-	-	0.19	0.21	0.27	0.28	0.3	0.25	0.31	<0.05	0.16	0.3	0.27
Un-ionized ammonia-N	mg/L	0.019	-	<0.01	<0.01	N/R	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Organics														
Chlorophyll a	µg/L	-	-	2	1.3	2.3	5.1	3.7	2.5	1.1	2.1	2.7	2.7	3.2
Major Ions														
Bicarbonate	mg/L	-	-	10	2	5	5	5	11	10	6	8	5	7
Calcium	mg/L	-	-	1.4	1.4	1.4	1.3	1.3	1.2	1.4	1.4	1.6	1.5	1.6
Carbonate	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloride	mg/L	120	-	0.4	0.4	0.6	0.4	0.6	0.2	0.4	0.3	0.5	0.7	0.6
Fluoride	mg/L	0.12	-	0.01	0.02	0.02	0.04	0.04	0.01	0.02	0.03	0.01	0.02	0.04
Hydroxide	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Magnesium	mg/L	-	-	0.3	0.4	0.3	0.4	0.7	0.3	0.4	0.6	0.5	0.4	0.4
P. alkalinity	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Potassium	mg/L	-	-	0.4	0.5	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Sodium	mg/L	-	-	1.4	1.6	1.5	1.6	1.6	1.4	1.5	1.6	1.5	1.6	1.6
Sulphate	mg/L	-	-	0.4	0.9	0.8	0.5	0.8	<0.2	0.6	0.7	0.4	0.8	0.7
Sum of ions	mg/L	-	-	14	7	10	10	10	14	15	11	13	10	12
Other														
Silicon, soluble	mg/L	-	-	3.1	3.4	3.4	2.7	2.7	2.6	3.4	3	3.3	3.6	3.8

Table A2 Water Chemistry Data for Watercourses of the Denison Mines Wheeler River Project, May 22, 2013 to October 19, 2013 (Continued)

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Drainage A (Icelander River)										
				Streams										
				SA-1					SA-2			SA-3		
				SA-1c-WQ-P13	SA-1c-WQ-U13	Dup1-U13	SA-1c-WQ-F13	Dup1-F13	SA-2b-WQ-P13	SA-2b-WQ-U13[c]	SA-2b-WQ-F13	SA-3b-WQ-P13	SA-3b-WQ-U13	SA-3b-WQ-F13
				22-May-13	15-Aug-13		18-Oct-13		22-May-13	15-Aug-13	18-Oct-13	22-May-13	15-Aug-13	18-Oct-13
Metals (Total and Dissolved)														
Aluminum	mg/L	0.005 to 0.1 (h)	0.005 to 0.1 (h)	0.0044	0.005	0.0035	0.0037	0.0035	0.0093	**0.005**	0.0039	0.0018	0.0017	0.006
Aluminum, dissolved	mg/L	-	-	0.004	<0.0005	<0.0005	0.004	0.0054	0.0019	<0.0005	0.0063	0.0005	<0.0005	0.0047
Antimony	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Antimony, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Arsenic	µg/L	5	5	<0.1	0.1	0.1	0.1	0.1	<0.1	0.1	<0.1	<0.1	0.1	0.1
Arsenic, dissolved	µg/L	-	-	<0.1	0.1	0.1	0.1	0.1	<0.1	0.1	0.1	<0.1	0.1	<0.1
Barium	mg/L	-	-	0.003	0.0024	0.0022	0.0026	0.0024	0.0023	0.0024	0.0023	0.0038	0.0025	0.0035
Barium, dissolved	mg/L	-	-	0.0018	0.0032	<0.0005	<0.0005	<0.0005	0.002	0.0032	<0.0005	0.0024	0.0011	0.0016
Beryllium	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Beryllium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Boron	mg/L	1.5	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Boron, dissolved	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.00004 (i)	0.000017 (i)	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Cadmium, dissolved	mg/L	-	-	0.00001	0.00001	<0.00001	<0.00001	<0.00001	0.00002	0.00001	<0.00001	0.00001	0.00001	<0.00001
Chromium	mg/L	0.001 (j)	0.001 (j)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium, dissolved	mg/L	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	0.002 (i)	0.002 (i)	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Copper, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Iron	mg/L	0.3	0.3	**0.31**	0.098	0.091	0.073	0.078	0.074	0.098	0.058	0.12	0.084	0.096
Iron, dissolved	mg/L	-	-	0.084	0.0088	0.0017	0.011	0.012	0.015	0.0088	0.0092	0.0094	0.0066	0.011
Lead	mg/L	0.001 (i)	0.001 (i)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lead, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lithium	µg/L	-	-	0.5	0.9	0.6	0.6	0.6	0.7	0.9	0.6	0.8	0.9	0.6
Lithium, dissolved	µg/L	-	-	0.7	0.6	0.7	0.6	0.7	0.6	0.6	0.5	0.7	0.6	0.7
Manganese	mg/L	-	-	0.023	0.015	0.016	0.011	0.01	0.0077	0.015	0.0062	0.023	0.013	0.011
Manganese, dissolved	mg/L	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0037	<0.0005	<0.0005
Mercury	µg/L	0.026 (k)	0.026 (k)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury, Dissolved	µg/L	-	-	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01
Molybdenum	mg/L	0.073	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum, dissolved	mg/L	-	-	0.0004	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0005	<0.0001	<0.0001
Nickel	mg/L	0.025 (i)	0.025 (i)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Selenium	mg/L	0.001	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Selenium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silver	mg/L	0.0001	0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Silver, dissolved	mg/L	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Strontium	mg/L	-	-	0.013	0.013	0.013	0.012	0.011	0.011	0.013	0.011	0.015	0.014	0.015

Table A2 Water Chemistry Data for Watercourses of the Denison Mines Wheeler River Project, May 22, 2013 to October 19, 2013 (Continued)

Parameters	Units	CCME CWQG[(a)]	SSWQO[(b)]	Drainage A (Icelander River)										
				Streams										
				SA-1					SA-2			SA-3		
				SA-1c-WQ-P13	SA-1c-WQ-U13	Dup1-U13	SA-1c-WQ-F13	Dup1-F13	SA-2b-WQ-P13	SA-2b-WQ-U13[(c)]	SA-2b-WQ-F13	SA-3b-WQ-P13	SA-3b-WQ-U13	SA-3b-WQ-F13
				22-May-13	15-Aug-13		18-Oct-13		22-May-13	15-Aug-13	18-Oct-13	22-May-13	15-Aug-13	18-Oct-13
Metals (Total and Dissolved) (Continued)														
Strontium, dissolved	mg/L	-	-	0.013	0.012	0.012	0.012	0.012	0.011	0.013	0.011	0.015	0.014	0.014
Thallium	mg/L	0.0008	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Thallium, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tin	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin, dissolved	mg/L	-	-	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Titanium, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Uranium	µg/L	15	15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium, dissolved	µg/L	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Vanadium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Zinc	mg/L	0.03	0.03	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc, dissolved	mg/L	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0006
Radionuclides														
Lead-210	Bq/L	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Polonium-210	Bq/L	-	-	<0.005	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.01
Radium-226	Bq/L	-	0.11[(l)]	<0.005	<0.005	0.008	<0.005	<0.005	0.008	<0.005	<0.005	0.006	<0.005	0.01
Thorium-228	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium-230	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium-232	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01

Table A2 Water Chemistry Data for Watercourses of the Denison Mines Wheeler River Project, May 22, 2013 to October 19, 2013 (Continued)

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Drainage A (Icelander River)								
				Streams								
				SA-4			SA-5			SA-6		
				SA-4b-WQ-P13	SA-4b-WQ-U13	SA-4b-WQ-F13	SA-5b-WQ-P13	SA-5b-WQ-U13	SA-5b-WQ-F13	SA-6a-WQ-P13	SA-6a-WQ-U13	SA-6a-WQ-F13
				22-May-13	15-Aug-13	18-Oct-13	22-May-13	15-Aug-13	18-Oct-13	22-May-13	15-Aug-13	18-Oct-13
Conventional Parameters (Field-Measured)												
Dissolved Oxygen	mg/L	6.5 and 9.5[f]	6.5 and 9.5[f]	11.64	**8.99**	12.67	11.91	**9.28**	13	11.14	**9.16**	12.65
pH	pH units	6.5 to 9.0	-	7.3	**6.12**	6.89	7.28	**6.22**	6.9	7.66	**5.95**	6.82
Specific conductivity	µS/cm	-	-	18	19	20	15	15	17	16	18	18
Water temperature	°C	-	-	7.8	20.37	2.83	7.65	20.22	2.03	10.61	19.67	2.94
Conventional Parameters (Lab-Measured)												
pH	pH units	6.5 to 9.0	-	6.67	6.76	7.02	**6.17**	6.66	6.92	**6.48**	6.75	6.94
Specific conductivity	uS/cm	-	-	19	19	20	16	15	17	16	18	18
Total alkalinity	mg/L	-	-	2	5	8	6	4	4	5	6	4
Total dissolved solids	mg/L	-	-	22	24	24	20	18	19	20	20	21
Total hardness	mg/L	-	-	6	5	6	5	4	5	5	5	6
Total suspended solids	mg/L	-	-	1	3	2	2	2	<1	3	5	1
Nutrients												
Ammonia as nitrogen	mg/L	[g]	[g]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite	mg/L	0.06	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Nitrite+Nitrate nitrogen	mg/L	-	-	0.02	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01
Organic carbon	mg/L	-	-	2	2.4	2.2	1.9	2.3	2.2	2	2.5	2.1
Organic carbon, dissolved	mg/L	-	-	2	2.4	2.2	1.8	2.3	2.3	2	2.3	2.2
Ortho-phosphate as P	mg/L	-	-	<0.01	<0.01	0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01
Phosphorus	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Kjeldahl nitrogen	mg/L	-	-	0.16	0.3	0.22	0.18	0.27	0.11	0.17	0.35	0.27
Un-ionized ammonia-N	mg/L	0.019	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Organics												
Chlorophyll a	µg/L	-	-	1.5	1.5	2.2	2.3	0.7	2.8	2.3	1.7	3.5
Major Ions												
Bicarbonate	mg/L	-	-	2	6	10	7	5	5	6	7	5
Calcium	mg/L	-	-	1.5	1.5	1.7	1.2	1.2	1.3	1.2	1.4	1.4
Carbonate	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloride	mg/L	120	-	0.4	0.5	0.4	0.2	0.3	0.3	0.3	0.3	0.4
Fluoride	mg/L	0.12	-	0.01	0.03	0.04	0.01	0.02	0.03	0.01	0.02	0.04
Hydroxide	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1
Magnesium	mg/L	-	-	0.6	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.5
P. alkalinity	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1
Potassium	mg/L	-	-	0.6	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Sodium	mg/L	-	-	1.5	1.7	1.7	1.6	1.4	1.4	1.4	1.4	1.6
Sulphate	mg/L	-	-	0.6	0.5	0.4	0.6	0.5	0.4	0.3	0.7	0.8
Sum of ions	mg/L	-	-	7	11	15	11	9	9	10	12	10
Other												
Silicon, soluble	mg/L	-	-	3.6	3.9	3.9	2.6	3	2.4	2.7	3.4	2.9

Table A2 Water Chemistry Data for Watercourses of the Denison Mines Wheeler River Project, May 22, 2013 to October 19, 2013 (Continued)

Parameters	Units	CCME CWQG[(a)]	SSWQO[(b)]	Drainage A (Icelander River)								
				Streams								
				SA-4			SA-5			SA-6		
				SA-4b-WQ-P13	SA-4b-WQ-U13	SA-4b-WQ-F13	SA-5b-WQ-P13	SA-5b-WQ-U13	SA-5b-WQ-F13	SA-6a-WQ-P13	SA-6a-WQ-U13	SA-6a-WQ-F13
				22-May-13	15-Aug-13	18-Oct-13	22-May-13	15-Aug-13	18-Oct-13	22-May-13	15-Aug-13	18-Oct-13
Metals (Total and Dissolved)												
Aluminum	mg/L	0.005 to 0.1 [(h)]	0.005 to 0.1 [(h)]	0.006	**0.0065**	0.0035	0.0078	**0.0058**	0.004	0.0084	**0.009**	0.0044
Aluminum, dissolved	mg/L	-	-	0.0042	0.0065	0.0064	<0.0005	<0.0005	0.0078	0.004	<0.0005	0.0056
Antimony	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Antimony, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Arsenic	µg/L	5	5	<0.1	0.1	0.1	<0.1	<0.1	0.1	<0.1	0.1	<0.1
Arsenic, dissolved	µg/L	-	-	<0.1	0.1	<0.1	<0.1	0.1	0.1	<0.1	0.1	<0.1
Barium	mg/L	-	-	0.0028	0.0024	0.0025	0.0028	0.0021	0.0022	0.0024	0.0028	0.0023
Barium, dissolved	mg/L	-	-	0.0022	0.0027	0.0034	0.0022	0.0022	0.0005	0.0023	0.0011	0.0008
Beryllium	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Beryllium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Boron	mg/L	1.5	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Boron, dissolved	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.00004 [(i)]	0.000017 [(i)]	<0.00001	<0.00001	<0.00001	<0.00001	**0.00004**	<0.00001	0.00003	**0.00005**	<0.00001
Cadmium, dissolved	mg/L	-	-	<0.00001	0.00001	<0.00001	0.00001	<0.00001	<0.00001	0.00002	<0.00001	<0.00001
Chromium	mg/L	0.001 [(j)]	0.001 [(j)]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium, dissolved	mg/L	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	0.002 [(i)]	0.002 [(i)]	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Copper, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0005
Iron	mg/L	0.3	0.3	0.077	0.12	0.058	0.095	0.086	0.035	0.061	0.12	0.052
Iron, dissolved	mg/L	-	-	0.017	0.0038	0.0049	0.022	0.0064	0.0081	0.017	0.0074	0.0079
Lead	mg/L	0.001 [(i)]	0.001 [(i)]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lead, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lithium	µg/L	-	-	0.6	0.8	0.7	0.4	0.6	0.4	0.6	0.7	0.3
Lithium, dissolved	µg/L	-	-	0.7	0.6	0.8	0.6	0.5	0.5	0.6	0.6	0.6
Manganese	mg/L	-	-	0.0089	0.019	0.011	0.0063	0.012	0.0047	0.0062	0.018	0.007
Manganese, dissolved	mg/L	-	-	0.0033	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Mercury	µg/L	0.026 [(k)]	0.026 [(k)]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury, Dissolved	µg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Molybdenum	mg/L	0.073	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	0.0004	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	mg/L	0.025 [(i)]	0.025 [(i)]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001
Nickel, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Selenium	mg/L	0.001	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Selenium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silver	mg/L	0.0001	0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Silver, dissolved	mg/L	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Strontium	mg/L	-	-	0.014	0.014	0.014	0.011	0.011	0.011	0.011	0.013	0.011

Table A2 Water Chemistry Data for Watercourses of the Denison Mines Wheeler River Project, May 22, 2013 to October 19, 2013 (Continued)

Parameters	Units	CCME CWQG[(a)]	SSWQO[(b)]	Drainage A (Icelander River)								
				Streams								
				SA-4			SA-5			SA-6		
				SA-4b-WQ-P13	SA-4b-WQ-U13	SA-4b-WQ-F13	SA-5b-WQ-P13	SA-5b-WQ-U13	SA-5b-WQ-F13	SA-6a-WQ-P13	SA-6a-WQ-U13	SA-6a-WQ-F13
				22-May-13	15-Aug-13	18-Oct-13	22-May-13	15-Aug-13	18-Oct-13	22-May-13	15-Aug-13	18-Oct-13
Metals (Total and Dissolved) (Continued)												
Strontium, dissolved	mg/L	-	-	0.014	0.013	0.014	0.011	0.011	0.011	0.012	0.013	0.011
Thallium	mg/L	0.0008	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Thallium, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tin	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001
Titanium	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Titanium, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Uranium	µg/L	15	15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium, dissolved	µg/L	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	mg/L	-	-	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Vanadium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Zinc	mg/L	0.03	0.03	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc, dissolved	mg/L	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0016
Radionuclides												
Lead-210	Bq/L	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Polonium-210	Bq/L	-	-	<0.005	<0.005	0.007	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Radium-226	Bq/L	-	0.11[(l)]	0.009	0.007	<0.005	0.005	0.007	<0.005	<0.005	<0.005	<0.005
Thorium-228	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium-230	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium-232	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Table A2 Water Chemistry Data for Watercourses of the Denison Mines Wheeler River Project, May 22, 2013 to October 19, 2013 (Continued)

Parameters	Units	CCME CWQG[(a)]	SSWQO[(b)]	Drainage B (Unnamed)									
				Streams									
				SB-1				SB-2			SB-3		
				SB-1a-WQ-P13	Dup1-P13	SB-1a-WQ-U13	SB-1a-WQ-F13	SB-2b-WQ-P13	SB-2b-WQ-U13	SB-2b-WQ-F13	SB-3b-WQ-P13	SB-3b-WQ-U13[(d)]	SB-3b-WQ-F13
				22-May-13		15-Aug-13	19-Oct-13	22-May-13	15-Aug-13	19-Oct-13	22-May-13	15-Aug-13	18-Oct-13
Conventional Parameters (Field-Measured)													
Dissolved Oxygen	mg/L	6.5 and 9.5[(f)]	6.5 and 9.5[(f)]	10.38		**6.97**	10.88	**7.66**	**5.08**	10.28	10.95	**8.87**	12.32
pH	pH units	6.5 to 9.0	-	6.8		**5.7**	**6.25**	**6.39**	**5.62**	**5.82**	6.84	6.53	7.01
Specific conductivity	µS/cm	-	-	15		20	17	16	21	15	16	17	17
Water temperature	°C	-	-	12.32		16.86	1.84	12.11	17.89	1.73	9.44	21.6	4.29
Conventional Parameters (Lab-Measured)													
pH	pH units	6.5 to 9.0	-	**6.27**	**6.29**	6.53	**6.46**	**6.08**	**6.44**	**6.37**	**6.18**	6.68	6.99
Specific conductivity	uS/cm	-	-	14	14	18	16	16	19	15	16	17	18
Total alkalinity	mg/L	-	-	4	6	6	6	4	3	3	7	4	4
Total dissolved solids	mg/L	-	-	18	18	22	25	21	24	25	22	17	22
Total hardness	mg/L	-	-	4	4	6	3	5	7	4	5	5	5
Total suspended solids	mg/L	-	-	1	<1	2	<1	2	3	2	2	4	2
Nutrients													
Ammonia as nitrogen	mg/L	(g)	(g)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite	mg/L	0.06	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Nitrite+Nitrate nitrogen	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	<0.01
Organic carbon	mg/L	-	-	3.1	3	4	3.8	4.2	5.3	4.6	2.8	3.4	3
Organic carbon, dissolved	mg/L	-	-	2.8	2.9	3.9	3.8	3.9	5.6	4.7	2.6	3.4	3
Ortho-phosphate as P	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Kjeldahl nitrogen	mg/L	-	-	0.15	0.16	0.24	0.28	0.18	0.4	0.29	0.16	0.28	0.26
Un-ionized ammonia-N	mg/L	0.019	-	<0.01	N/R	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Organics													
Chlorophyll a	µg/L	-	-	1.2	1.1	0.7	1.4	0.9	1.4	2	3.2	2.4	3.7
Major Ions													
Bicarbonate	mg/L	-	-	5	7	7	7	5	4	4	8	5	5
Calcium	mg/L	-	-	1.2	1.2	1.6	1.1	1.3	1.8	1.1	1.4	1.4	1.4
Carbonate	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloride	mg/L	120	-	0.2	0.2	0.2	0.4	0.3	0.5	0.6	0.1	0.2	0.2
Fluoride	mg/L	0.12	-	0.01	0.01	0.02	0.03	0.01	0.02	0.03	0.01	0.02	0.04
Hydroxide	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Magnesium	mg/L	-	-	0.3	0.3	0.5	<0.1	0.4	0.6	0.2	0.3	0.4	0.3
P. alkalinity	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Potassium	mg/L	-	-	0.3	0.4	0.2	0.4	0.4	0.2	0.3	0.4	0.4	0.4
Sodium	mg/L	-	-	1.2	1.4	1.3	1.3	1	1.2	1.3	1.5	1.7	1.4
Sulphate	mg/L	-	-	0.7	0.5	0.5	1.1	0.6	0.7	0.8	0.7	0.8	0.3
Sum of ions	mg/L	-	-	9	11	11	11	9	9	8	12	10	9
Other													
Silicon, soluble	mg/L	-	-	2.3	2.3	3.1	3.2	2.3	2.8	2.8	2.5	2	1.9

Table A2 Water Chemistry Data for Watercourses of the Denison Mines Wheeler River Project, May 22, 2013 to October 19, 2013 (Continued)

Parameters	Units	CCME CWQG[(a)]	SSWQO[(b)]	Drainage B (Unnamed)									
				Streams									
				SB-1				SB-2			SB-3		
				SB-1a-WQ-P13	Dup1-P13	SB-1a-WQ-U13	SB-1a-WQ-F13	SB-2b-WQ-P13	SB-2b-WQ-U13	SB-2b-WQ-F13	SB-3b-WQ-P13	SB-3b-WQ-U13[(d)]	SB-3b-WQ-F13
				22-May-13		15-Aug-13	19-Oct-13	22-May-13	15-Aug-13	19-Oct-13	22-May-13	15-Aug-13	18-Oct-13
Metals (Total and Dissolved)													
Aluminum	mg/L	0.005 to 0.1 [(h)]	0.005 to 0.1 [(h)]	0.015	0.015	**0.018**	**0.015**	**0.023**	**0.026**	**0.02**	0.012	0.0091	0.0052
Aluminum, dissolved	mg/L	-	-	0.001	<0.0005	0.0049	0.015	<0.0005	0.0062	0.021	0.008	<0.0005	0.0056
Antimony	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Antimony, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Arsenic	µg/L	5	5	<0.1	0.1	0.1	0.1	<0.1	0.2	0.1	<0.1	<0.1	0.1
Arsenic, dissolved	µg/L	-	-	0.1	0.1	0.1	<0.1	<0.1	0.2	<0.1	0.1	0.1	<0.1
Barium	mg/L	-	-	0.0023	0.0023	0.0032	0.002	0.0023	0.0030	0.0018	0.0035	0.0025	0.0027
Barium, dissolved	mg/L	-	-	0.0027	0.0022	0.0012	<0.0005	0.0026	0.0008	<0.0005	0.003	<0.0005	0.0009
Beryllium	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Beryllium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Boron	mg/L	1.5	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Boron, dissolved	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.00004 [(i)]	0.000017 [(i)]	**0.00004**	**0.00002**	<0.00001	0.00001	**0.00003**	**0.00002**	**0.00002**	**0.00002**	<0.00001	<0.00001
Cadmium, dissolved	mg/L	-	-	0.00001	0.00001	<0.00001	<0.00001	0.00001	0.00003	<0.00001	<0.00001	<0.00001	<0.00001
Chromium	mg/L	0.001 [(j)]	0.001 [(j)]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium, dissolved	mg/L	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	0.002 [(i)]	0.002 [(i)]	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Copper, dissolved	mg/L	-	-	<0.0002	0.0003	<0.0002	0.0003	<0.0002	0.0006	0.0009	<0.0002	0.0005	<0.0002
Iron	mg/L	0.3	0.3	0.18	0.18	**0.33**	0.18	**0.46**	**0.92**	**0.32**	0.22	0.062	0.042
Iron, dissolved	mg/L	-	-	0.071	0.093	0.11	0.13	0.17	0.29	0.15	0.055	0.0071	0.0072
Lead	mg/L	0.001 [(i)]	0.001 [(i)]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lead, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lithium	µg/L	-	-	0.4	0.6	0.8	0.8	0.5	0.7	0.8	0.6	0.6	0.4
Lithium, dissolved	µg/L	-	-	0.6	0.6	0.7	0.7	0.4	0.7	0.7	0.9	0.7	0.8
Manganese	mg/L	-	-	0.01	0.011	0.014	0.0084	0.024	0.036	0.011	0.015	0.01	0.0053
Manganese, dissolved	mg/L	-	-	0.0052	0.0064	0.0019	0.0077	0.019	0.007	0.009	0.0007	<0.0005	<0.0005
Mercury	µg/L	0.026 [(k)]	0.026 [(k)]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury, Dissolved	µg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Molybdenum	mg/L	0.073	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum, dissolved	mg/L	-	-	0.0003	0.0011	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0003	<0.0001	<0.0001
Nickel	mg/L	0.025 [(i)]	0.025 [(i)]	<0.0001	<0.0001	0.0002	0.0001	0.0001	0.0003	0.0002	<0.0001	0.0001	<0.0001
Nickel, dissolved	mg/L	-	-	<0.0001	<0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	<0.0001	<0.0001	<0.0001
Selenium	mg/L	0.001	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Selenium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silver	mg/L	0.0001	0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Silver, dissolved	mg/L	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Strontium	mg/L	-	-	0.012	0.012	0.016	0.011	0.014	0.019	0.01	0.012	0.013	0.012

Table A2 Water Chemistry Data for Watercourses of the Denison Mines Wheeler River Project, May 22, 2013 to October 19, 2013 (Continued)

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Drainage B (Unnamed)									
				Streams									
				SB-1				SB-2			SB-3		
				SB-1a-WQ-P13	Dup1-P13	SB-1a-WQ-U13	SB-1a-WQ-F13	SB-2b-WQ-P13	SB-2b-WQ-U13	SB-2b-WQ-F13	SB-3b-WQ-P13	SB-3b-WQ-U13[d]	SB-3b-WQ-F13
				22-May-13		15-Aug-13	19-Oct-13	22-May-13	15-Aug-13	19-Oct-13	22-May-13	15-Aug-13	18-Oct-13
Metals (Total and Dissolved) (Continued)													
Strontium, dissolved	mg/L	-	-	0.012	0.012	0.014	0.01	0.014	0.018	0.01	0.012	0.012	0.012
Thallium	mg/L	0.0008	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Thallium, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tin	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin, dissolved	mg/L	-	-	0.0004	0.0003	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0004	<0.0001	<0.0001
Titanium	mg/L	-	-	0.0002	0.0003	0.0004	0.0003	0.0006	0.0005	0.0006	<0.0002	<0.0002	<0.0002
Titanium, dissolved	mg/L	-	-	0.0003	<0.0002	0.0003	<0.0002	0.0004	0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Uranium	µg/L	15	15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium, dissolved	µg/L	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	mg/L	-	-	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0001	<0.0001	<0.0001	<0.0001
Vanadium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Zinc	mg/L	0.03	0.03	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc, dissolved	mg/L	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0009	<0.0005	<0.0005	<0.0005
Radionuclides													
Lead-210	Bq/L	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Polonium-210	Bq/L	-	-	<0.005	<0.005	<0.005	0.005	0.005	0.005	0.009	<0.005	<0.005	<0.005
Radium-226	Bq/L	-	0.11[l]	0.005	<0.005	<0.005	<0.005	0.006	0.008	0.007	0.007	<0.005	<0.005
Thorium-228	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01
Thorium-230	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium-232	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Table A2 Water Chemistry Data for Watercourses of the Denison Mines Wheeler River Project, May 22, 2013 to October 19, 2013 (Continued)

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Drainage B (Unnamed)											
				Streams											
				SB-4			SB-5			FIELD BLANK			TRIP BLANK		
				SB-4a-WQ-P13	SB-4a-WQ-U13[d]	SB-4a-WQ-F13	SB-5a-WQ-P13	SB-5a-WQ-U13[e]	SB-5a-WQ-F13	Field S-P13	Field S-U13	Field S-F13	Trip S-P13	Trip S-U13	Trip S-F13
				22-May-13	15-Aug-13	18-Oct-13	22-May-13	15-Aug-13	18-Oct-13	22-May-13	15-Aug-13	18-Oct-13	22-May-13	15-Aug-13	18-Oct-13
Conventional Parameters (Field-Measured)															
Dissolved Oxygen	mg/L	6.5 and 9.5[f]	6.5 and 9.5[f]	**7.67**	**7.19**	11.87	11.34	**8.6**	12.29	-		-	-		-
pH	pH units	6.5 to 9.0	-	**6.47**	**5.53**	**6.31**	6.75	**6.48**	6.74	-		-	-		-
Specific conductivity	µS/cm	-	-	13	18	15	16	17	17	-		-	-		-
Water temperature	°C	-	-	11.52	15.64	2.01	10.2	21.62	4.21	-		-	-		-
Conventional Parameters (Lab-Measured)															
pH	pH units	6.5 to 9.0	-	**6.07**	**6.49**	6.7	**6.47**	6.62	6.99	**5.43**	**5.36**	**5.82**	**5.52**	**5.32**	**5.68**
Specific conductivity	uS/cm	-	-	13	16	16	16	16	18	<1	<1	<1	<1	<1	<1
Total alkalinity	mg/L	-	-	4	3	4	6	3	7	1	1	<1	1	<1	<1
Total dissolved solids	mg/L	-	-	18	22	24	18	17	21	3	<1	<1	3	<1	<1
Total hardness	mg/L	-	-	5	5	5	4	5	4	<1	<1	<1	<1	<1	<1
Total suspended solids	mg/L	-	-	2	4	<1	2	3	<1	<1	<1	<1	<1	<1	<1
Nutrients															
Ammonia as nitrogen	mg/L	[g]	[g]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite	mg/L	0.06	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	
Nitrite+Nitrate nitrogen	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Organic carbon	mg/L	-	-	4.5	4.1	4	2.7	3.1	2.8	0.3	<0.2	<0.2	0.3	<0.2	<0.2
Organic carbon, dissolved	mg/L	-	-	4.2	4.5	4	2.6	3.1	2.8			0.2			
Ortho-phosphate as P	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Phosphorus	mg/L	-	-	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			<0.01			
Total Kjeldahl nitrogen	mg/L	-	-	0.22	0.3	0.35	0.25	0.3	0.3	<0.05	<0.05	0.08	<0.05	<0.05	0.08
Un-ionized ammonia-N	mg/L	0.019	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	N/R	N/R	N/R	N/R	N/R	N/R
Organics															
Chlorophyll a	µg/L	-	-	0.9	0.7	0.6	2.4	2.7	4.5			<0.1			
Major Ions															
Bicarbonate	mg/L	-	-	5	4	5	7	4	8	1	1	<1	1	<1	<1
Calcium	mg/L	-	-	1.2	1.4	1.2	1.3	1.3	1.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Carbonate	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloride	mg/L	120	-	<0.1	0.1	<0.1	0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoride	mg/L	0.12	-	0.01	0.02	0.03	0.01	0.02	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Hydroxide	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Magnesium	mg/L	-	-	0.4	0.4	0.4	0.3	0.4	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
P. alkalinity	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Potassium	mg/L	-	-	0.3	0.1	0.4	0.3	0.4	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sodium	mg/L	-	-	1.1	1.3	1.3	1.4	1.4	1.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sulphate	mg/L	-	-	0.5	0.6	0.5	0.6	0.8	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sum of ions	mg/L	-	-	8	8	9	11	8	12	1	1	<1	1	<1	<1
Other															
Silicon, soluble	mg/L	-	-	1.6	2.2	2.2	2.2	2.2	2.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Table A2 Water Chemistry Data for Watercourses of the Denison Mines Wheeler River Project, May 22, 2013 to October 19, 2013 (Continued)

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Drainage B (Unnamed)											
				Streams											
				SB-4			SB-5			FIELD BLANK			TRIP BLANK		
				SB-4a-WQ-P13	SB-4a-WQ-U13[d]	SB-4a-WQ-F13	SB-5a-WQ-P13	SB-5a-WQ-U13[e]	SB-5a-WQ-F13	Field S-P13	Field S-U13	Field S-F13	Trip S-P13	Trip S-U13	Trip S-F13
				22-May-13	15-Aug-13	18-Oct-13	22-May-13	15-Aug-13	18-Oct-13	22-May-13	15-Aug-13	18-Oct-13	22-May-13	15-Aug-13	18-Oct-13
Metals (Total and Dissolved)															
Aluminum	mg/L	0.005 to 0.1 [h]	0.005 to 0.1 [h]	**0.029**	**0.023**	**0.019**	0.0086	**0.0066**	0.0025	0.0071	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Aluminum, dissolved	mg/L	-	-	<0.0005	0.011	0.016	0.005	0.0095	0.0056			0.0037			
Antimony	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Antimony, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002			<0.0002			
Arsenic	µg/L	5	5	<0.1	0.2	0.1	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Arsenic, dissolved	µg/L	-	-	0.2	0.1	0.1	0.1	0.1	0.1			<0.1			
Barium	mg/L	-	-	0.0035	0.0036	0.0025	0.0033	0.0026	0.0027	0.0071	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Barium, dissolved	mg/L	-	-	0.0015	0.0016	0.0008	0.0028	<0.0005	<0.0005			<0.0005			
Beryllium	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Beryllium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001			
Boron	mg/L	1.5	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Boron, dissolved	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			<0.01			
Cadmium	mg/L	0.00004 [i]	0.000017 [i]	0.00002	<0.00001	<0.00001	**0.00004**	0.00002	0.00002	0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Cadmium, dissolved	mg/L	-	-	<0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001			<0.00001			
Chromium	mg/L	0.001 [j]	0.001 [j]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium, dissolved	mg/L	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005			<0.0005			
Cobalt	mg/L	-	-	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001			
Copper	mg/L	0.002 [i]	0.002 [i]	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Copper, dissolved	mg/L	-	-	<0.0002	0.0005	<0.0002	0.0012	<0.0002	0.0005			<0.0002			
Iron	mg/L	0.3	0.3	0.25	0.29	0.11	0.16	0.097	0.13	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron, dissolved	mg/L	-	-	0.13	0.08	0.046	0.1	0.0087	0.03			<0.0005			
Lead	mg/L	0.001 [i]	0.001 [i]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lead, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001			
Lithium	µg/L	-	-	0.2	0.4	0.3	0.5	0.7	0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lithium, dissolved	µg/L	-	-	0.2	0.5	0.4	0.5	0.6	0.6			<0.1			
Manganese	mg/L	-	-	0.0074	0.016	0.0067	0.012	0.012	0.009	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Manganese, dissolved	mg/L	-	-	0.0008	0.0011	0.0053	0.0019	<0.0005	<0.0005			<0.0005			
Mercury	µg/L	0.026 [k]	0.026 [k]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury, Dissolved	µg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			<0.01			
Molybdenum	mg/L	0.073	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum, dissolved	mg/L	-	-	0.0006	<0.0001	<0.0001	0.0038	<0.0001	<0.0001			<0.0001			
Nickel	mg/L	0.025 [i]	0.025 [i]	<0.0001	0.0003	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel, dissolved	mg/L	-	-	<0.0001	<0.0001	0.0002	0.0002	<0.0001	<0.0001			<0.0001			
Selenium	mg/L	0.001	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Selenium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001			
Silver	mg/L	0.0001	0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Silver, dissolved	mg/L	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005			<0.00005			
Strontium	mg/L	-	-	0.012	0.013	0.01	0.012	0.011	0.012	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Table A2 Water Chemistry Data for Watercourses of the Denison Mines Wheeler River Project, May 22, 2013 to October 19, 2013 (Continued)

Parameters	Units	CCME CWQG[(a)]	SSWQO[(b)]	Drainage B (Unnamed)											
				Streams											
				SB-4			SB-5			FIELD BLANK			TRIP BLANK		
				SB-4a-WQ-P13	SB-4a-WQ-U13[(d)]	SB-4a-WQ-F13	SB-5a-WQ-P13	SB-5a-WQ-U13[(e)]	SB-5a-WQ-F13	Field S-P13	Field S-U13	Field S-F13	Trip S-P13	Trip S-U13	Trip S-F13
				22-May-13	15-Aug-13	18-Oct-13	22-May-13	15-Aug-13	18-Oct-13	22-May-13	15-Aug-13	18-Oct-13	22-May-13	15-Aug-13	18-Oct-13
Metals (Total and Dissolved) (Continued)															
Strontium, dissolved	mg/L	-	-	0.011	0.013	0.01	0.012	0.011	0.011			<0.0005			
Thallium	mg/L	0.0008	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Thallium, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002			<0.0002			
Tin	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001			<0.0001			
Titanium	mg/L	-	-	0.0005	0.0004	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Titanium, dissolved	mg/L	-	-	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002			<0.0002			
Uranium	μg/L	15	15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium, dissolved	μg/L	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1			
Vanadium	mg/L	-	-	0.0002	0.0002	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Vanadium, dissolved	mg/L	-	-	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001			
Zinc	mg/L	0.03	0.03	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0006	0.0009	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc, dissolved	mg/L	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0008			<0.0005			
Radionuclides															
Lead-210	Bq/L	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Polonium-210	Bq/L	-	-	0.006	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Radium-226	Bq/L	-	0.11[(l)]	<0.005	<0.005	0.007	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Thorium-228	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium-230	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium-232	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Notes:

Values that exceed the CCME WQG are **bolde**d. Values that Exceed the SSWQO are <u>underlined</u>.

[(a)] CCME CWQG = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 1999 with updates).

[(b)] SSWQO = Saskatchewan Surface Water Quality Objectives (Water Security Agency [WSA] 2006).

[(c)] This sample was reanalyzed for barium. Reanalysis confirmed original results within the expected measurement uncertainty.

[(d)] This sample was reanalyzed for copper. Reanalysis confirmed original results within the expected measurement uncertainty.

[(e)] This sample was reanalyzed for aluminumm. Reanalysis confirmed original results within the expected measurement uncertainty.

[(f)] The objectives and guidelines of dissolved oxygen for cold-water biota are 9.5 mg/L for early life stages and 6.5 mg/L for other life stages.

[(g)] The objectives/guidelines for ammonia are dependent on temperature and pH; the objective/guideline for each sample was calculated separately using the rounded field pH and rounded temperature measured at depth.

[(h)] The objectives/guidelines for aluminum are dependent on pH; the field pH for each sample was used in the screening.

[(i)] The objective/guidelines for cadmium, copper, lead, and nickel are hardness-dependent; The range of CCME WQG and SSWQO are listed and were calculated separately for each sample.

[(j)] The objective is for hexavalent chromium; total chromium was analyzed.

[(k)] The objective/guidelines are for inorganic mercury.

[(l)] The objective for radium-226 was missed in the 2006 SSWQO (WSA) revisions; an objective of 0.11 Bq/L was presented in 1997 SSWQO (SMOE) and is expected to be added to the next SSWQO revision (T. Moulding pers. comm.).

mg/L = milligrams per litre; μS/cm = microSiemens per centimetre; °C = degrees Celsius; μg/L = micrograms per litre; Bq/L = Becquerels per litre; < = less than; - = not available; N/R = not reported; SMOE = Saskatchewan Ministry of Environment.

Table A3. Water Chemistry Data for Waterbodies and Watercourses of the Denison Minew Wheeler River Project, March 28 to April 1, 2014

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Drainage A (Icelander River)									
				Lakes							Streams		
				Lake LA-1	Lake LA-2	Lake LA-3	Lake LA-4	Lake LA-5	Lake LA-6	Kratchkowsky Lake	SA-1	SA-2	SA-3
				LA-1b-WQ-W14	LA-2a-WQ-W14	LA-3a-WQ-W14	LA-4a-WQ-W14	LA-5b-WQ-W14	LA-6a-WQ-W14	LA-7a-WQ-W14	SA-1c-WQ-W14	SA-2b-WQ-W14	SA-3b-WQ-W14
				29-Mar-14	28-Mar-14	28-Mar-14	29-Mar-14	1-Apr-14	30-Mar-14	29-Mar-14	30-Mar-14	29-Mar-14	31-Mar-14
Conventional Parameters (Field-Measured)													
Dissolved Oxygen	mg/L	6.5 and 9.5[d]	6.5 and 9.5[d]	12.9	12.3	13.9	13.2	9.3	11.8	12.1	11.4	13.7	9.8
pH	pH unis	6.5 to 9.0	-	6.9	7.0	7.7	7.6	6.6	7.1	7.1	7.2	6.5	6.9
Specific conductivity[e]	µS/cm	-	-	-	-	-	-	-	-	-	-	-	-
Water Temperature	°C	-	-	4.1	3.2	1.0	1.6	0.4	2.4	2.0	1.1	0.4	0.9
Conventional Parameters (Lab-Measured)													
pH	pH units	6.5 to 9.0	-	6.83	6.9	6.92	6.98	7.01	5.71	6.82	6.98	6.87	6.99
Specific conductivity	µS/cm	-	-	24	25	24	26	22	21	26	22	22	24
Total alkalinity	mg/L	-	-	10	12	10	16	13	38	19	13	11	13
Total dissolved solids	mg/L	-	-	22	26	25	36	29	29	29	24	30	26
Total hardness	mg/L	-	-	6	7	6	7	6	5	7	6	6	7
Total suspended solids	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Nutrients													
Ammonia as nitrogen	mg/L	[f]	[f]	0.09	0.04	0.04	0.07	0.05	0.05	0.12	0.04	0.04	0.04
Nitrate (calc. from NO2+NO3-N)	mg/L	13.0	-	0.49	0.53	0.4	0.18	0.26	0.31	0.26	0.26	0.31	0.26
Nitrite[g]	mg/L	0.06	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Nitrite+Nitrate nitrogen	mg/L	-	-	0.11	0.12	0.09	0.04	0.06	0.07	0.06	0.06	0.07	0.06
Organic carbon	mg/L	-	-	2.3	2.2	2.3	1.5	1.9	2.2	2	2.1	2.1	2.3
Organic carbon, dissolved	mg/L	-	-	2.1	2.1	2.2	1.6	2	2	2.1	2	1.9	2.2
Ortho-phosphate as P	mg/L	-	-	<0.01	<0.01	0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	-	-	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Kjeldahl nitrogen	mg/L	-	-	0.17	0.15	0.16	0.08	0.14	0.24	0.44	0.11	0.12	0.13
Un-ionized ammonia-N	mg/L	0.019	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Organics													
Chlorophyll a	µg/L	-	-	0.4	0.8	0.8	0.5	0.1	<0.1	0.7	0.3	0.4	1.1
Major Ions													
Bicarbonate	mg/L	-	-	12	15	12	20	16	46	23	16	13	16
Calcium	mg/L	-	-	1.7	1.9	1.8	2	1.6	1.5	2	1.7	1.7	1.9
Carbonate	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloride	mg/L	120	-	0.5	0.7	0.9	0.6	0.4	0.3	0.7	0.5	0.4	0.7
Fluoride	mg/L	0.12	-	0.03	0.07	0.07	0.01	0.07	0.07	0.06	0.07	0.01	0.07
Hydroxide	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Magnesium	mg/L	-	-	0.5	0.6	0.5	0.5	0.4	0.4	0.5	0.5	0.4	0.5
P. alkalinity	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Potassium	mg/L	-	-	0.5	0.5	0.5	0.5	0.4	0.4	0.5	0.4	0.4	0.5
Sodium	mg/L	-	-	1.8	1.8	1.8	2	1.7	1.8	2	1.7	1.8	1.8
Sulfate	mg/L	-	-	0.8	0.8	0.9	1.3	0.7	0.7	0.5	0.8	0.7	0.8
Sum of ions	mg/L	-	-	18	22	19	27	22	51	30	22	19	22
Other													
Silicon, soluble	mg/L	-	-	4.2	4.4	3.7	5.9	4	3.7	4.7	3.9	4.2	4
Metals (Total and Dissolved)													
Aluminum	mg/L	0.005 to 0.1[h]	0.005 to 0.1[h]	0.0023	0.001	0.0014	0.0009	0.0048	0.005	0.0006	0.0029	0.0042	0.0013
Aluminum, dissolved	mg/L	-	-	0.0017	0.0006	0.0006	<0.0005	0.0031	0.0033	0.0006	0.0024	0.003	0.0007
Antimony	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Antimony, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Arsenic	µg/L	5	5	0.1	0.1	0.1	0.1	<0.1	0.1	0.1	0.1	0.1	0.1
Arsenic, dissolved	µg/L	-	-	0.1	<0.1	<0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Table A3. Water Chemistry Data for Waterbodies and Watercourses of the Denison Minew Wheeler River Project, March 28 to April 1, 2014 (continued)

Parameters	Units	CCME CWQG[(a)]	SSWQO[(b)]	Drainage A (Icelander River)									
				Lakes							Streams		
				Lake LA-1	Lake LA-2	Lake LA-3	Lake LA-4	Lake LA-5	Lake LA-6	Kratchkowsky Lake	SA-1	SA-2	SA-3
				LA-1b-WQ-W14	LA-2a-WQ-W14	LA-3a-WQ-W14	LA-4a-WQ-W14	LA-5b-WQ-W14	LA-6a-WQ-W14	LA-7a-WQ-W14	SA-1c-WQ-W14	SA-2b-WQ-W14	SA-3b-WQ-W14
				29-Mar-14	28-Mar-14	28-Mar-14	29-Mar-14	1-Apr-14	30-Mar-14	29-Mar-14	30-Mar-14	29-Mar-14	31-Mar-14
Barium	mg/L	-	-	0.0038	0.0043	0.0041	0.0039	0.0032	0.0032	0.0038	0.0032	0.0031	0.004
Barium, dissolved	mg/L	-	-	0.0038	0.0044	0.004	0.0037	0.0032	0.0032	0.0039	0.0033	0.0032	0.0039
Beryllium	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Beryllium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Boron	mg/L	1.5	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Boron, dissolved	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.00004[(i)]	0.000017[(i)]	0.00001	0.00001	<0.00001	0.00001	<0.00001	<0.00001	0.00001	<0.00001	<0.00001	<0.00001
Cadmium, dissolved	mg/L	-	-	0.00001	0.00001	0.00001	0.00001	<0.00001	0.00001	<0.00001	<0.00001	0.00001	<0.00001
Chromium	mg/L	0.001[(j)]	0.001[(j)]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium, dissolved	mg/L	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	0.002[(i)]	0.002[(i)]	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Copper, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Iron	mg/L	0.3	0.3	0.051	0.081	0.066	0.0087	0.04	0.085	0.15	0.031	0.041	0.036
Iron, dissolved	mg/L	-	-	0.014	0.014	0.017	0.0011	0.02	0.045	0.07	0.012	0.018	0.0098
Lead	mg/L	0.001[(i)]	0.001[(i)]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lead, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lithium	µg/L	-	-	0.8	0.7	0.7	1	0.7	0.7	0.8	0.8	0.6	0.7
Lithium, dissolved	µg/L	-	-	0.8	0.8	0.7	1	0.7	0.7	0.8	0.7	0.7	0.8
Manganese	mg/L	-	-	0.02	0.03	0.014	0.029	0.0046	0.0062	0.026	0.0041	0.0044	0.0098
Manganese, dissolved	mg/L	-	-	0.018	0.026	0.011	0.027	0.0042	0.0056	0.025	0.0027	0.0035	0.0081
Mercury	µg/L	0.026[(k)]	0.026[(k)]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury, Dissolved	µg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Molybdenum	mg/L	0.073	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	mg/L	0.025[(i)]	0.025[(i)]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel, dissolved	mg/L	-	-	<0.0001	<0.0001	0.0002	0.0002	<0.0001	<0.0001	<0.0001	0.0002	0.0001	<0.0001
Selenium	mg/L	0.001	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Selenium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silver	mg/L	0.0001	0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Silver, dissolved	mg/L	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Strontium	mg/L	-	-	0.016	0.018	0.018	0.017	0.015	0.014	0.019	0.015	0.015	0.018
Strontium, dissolved	mg/L	-	-	0.016	0.018	0.018	0.018	0.015	0.014	0.018	0.015	0.015	0.018
Thallium	mg/L	0.0008	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Thallium, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tin	mg/L	-	-	0.0013	0.0004	0.0004	0.0012	0.0008	0.0011	0.0009	<0.0001	<0.0001	<0.0001
Tin, dissolved	mg/L	-	-	0.0013	0.0011	0.0006	0.0011	0.0009	0.0012	0.0009	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0002	<0.0002	<0.0002	0.0002
Titanium, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Uranium	µg/L	15	15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium, dissolved	µg/L	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Vanadium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Zinc	mg/L	0.03	0.03	<0.0005	<0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0011
Zinc, dissolved	mg/L	-	-	<0.0005	0.0015	0.0008	0.001	<0.0005	0.0009	<0.0005	0.0008	0.0008	0.0006
Radionuclides													
Lead-210	Bq/L	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Polonium-210	Bq/L	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Radium-226	Bq/L	-	0.11[(l)]	<0.005	<0.005	0.006	<0.005	0.01	<0.005	<0.005	0.009	<0.005	0.005
Thorium-228	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium-230	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium-232	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Table A3. Water Chemistry Data for Waterbodies and Watercourses of the Denison Minew Wheeler River Project, March 28 to April 1, 2014 (continued)

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Drainage A (Icelander River)				Drainage B (Unnamed)					
				Streams				Lakes			Streams		
				SA-4	SA-5	SA-6		LB-2		Williams Lake[c]	SB-1	SB-3	SB-5
				SA-4b-WQ-W14	SA-5b-WQ-W14	SA-6a-WQ-W14	Dup1-W14	LB-2a-WQ-W14	Dup2-W14	LB-3a-WQ-W14	SB-1a-WQ-W14	SB-3b-WQ-W14	SB-5a-WQ-W14
				30-Mar-14	30-Mar-14	1-Apr-14		1-Apr-14		1-Apr-14	31-Mar-14	31-Mar-14	31-Mar-14
Conventional Parameters (Field-Measured)													
Dissolved Oxygen	mg/L	6.5 and 9.5[d]	6.5 and 9.5[d]	13.3	12.3	7.0		6.2		13.0	8.1	8.6	8.9
pH	pH unis	6.5 to 9.0	-	6.8	6.7	6.5		6.8		7.5	6.6	6.3	6.6
Specific conductivity[e]	µS/cm	-	-	-	-	-		-		-	-	-	-
Water Temperature	°C	-	-	0.6	0.6	0.2		3.5		3.1	0.4	0.7	0.4
Conventional Parameters (Lab-Measured)													
pH	pH units	6.5 to 9.0	-	7.16	6.97	7.07	7.02	6.82	6.86	7	6.86	6.86	6.96
Specific conductivity	µS/cm	-	-	25	20	23	24	22	22	22	26	22	23
Total alkalinity	mg/L	-	-	15	7	13	14	12	12	14	20	12	13
Total dissolved solids	mg/L	-	-	32	28	28	31	30	30	23	36	26	24
Total hardness	mg/L	-	-	7	5	6	6	6	6	6	8	6	6
Total suspended solids	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	1	<1	<1
Nutrients													
Ammonia as nitrogen	mg/L	[f]	[f]	0.05	0.05	0.04	0.05	0.04	0.04	0.04	0.1	0.04	0.04
Nitrate (calc. from NO2+NO3-N)	mg/L	13.0	-	0.35	0.31	0.35	0.35	0.66	0.66	0.44	0.31	0.4	0.4
Nitrite[g]	mg/L	0.06	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Nitrite+Nitrate nitrogen	mg/L	-	-	0.08	0.07	0.08	0.08	0.15	0.15	0.1	0.07	0.09	0.09
Organic carbon	mg/L	-	-	2.1	2.1	1.9	1.9	2.7	2.7	3.1	3.3	3.2	2.9
Organic carbon, dissolved	mg/L	-	-	2.1	2	1.9	1.9	2.6	2.7	2.9	3.2	3.1	2.9
Ortho-phosphate as P	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01
Phosphorus	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Kjeldahl nitrogen	mg/L	-	-	0.13	0.11	0.15	0.14	0.13	0.11	0.18	0.2	0.2	0.18
Un-ionized ammonia-N	mg/L	0.019	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Organics													
Chlorophyll a	µg/L	-	-	0.7	0.5	<0.1	0.3	0.7	0.8	0.9	<0.1	0.4	1.7
Major Ions													
Bicarbonate	mg/L	-	-	18	8	16	17	15	15	17	24	15	16
Calcium	mg/L	-	-	2	1.4	1.8	1.8	1.8	1.8	1.7	2.2	1.7	1.7
Carbonate	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloride	mg/L	120	-	0.6	0.3	0.5	0.5	0.2	0.2	0.2	0.4	0.2	0.2
Fluoride	mg/L	0.12	-	0.07	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Hydroxide	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Magnesium	mg/L	-	-	0.4	0.3	0.4	0.5	0.4	0.4	0.4	0.7	0.4	0.5
P. alkalinity	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Potassium	mg/L	-	-	0.5	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5
Sodium	mg/L	-	-	2.1	1.6	1.9	1.9	1.6	1.6	1.8	2.1	1.7	1.7
Sulfate	mg/L	-	-	0.7	0.8	0.7	0.7	0.8	0.9	0.8	1.1	0.9	0.8
Sum of ions	mg/L	-	-	25	13	22	23	21	21	23	31	21	22
Other													
Silicon, soluble	mg/L	-	-	4.8	3.6	4.3	4.3	3.2	3.2	2.7	4.9	3.1	2.6
Metals (Total and Dissolved)													
Aluminum	mg/L	0.005 to 0.1[h]	0.005 to 0.1[h]	0.0025	0.0044	0.0032	0.0034	0.0067	0.0067	0.0018	0.014	0.0086	0.0016
Aluminum, dissolved	mg/L	-	-	0.0015	0.0033	0.0022	0.0026	0.0045	0.0045	0.0006	0.0084	0.0069	0.0017
Antimony	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Antimony, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Arsenic	µg/L	5	5	0.1	0.1	0.1	<0.1	0.1	0.1	0.1	<0.1	0.1	0.1
Arsenic, dissolved	µg/L	-	-	0.1	0.1	<0.1	0.1	0.1	<0.1	0.1	0.1	0.1	0.1

Table A3. Water Chemistry Data for Waterbodies and Watercourses of the Denison Minew Wheeler River Project, March 28 to April 1, 2014 (continued)

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Drainage A (Icelander River)				Drainage B (Unnamed)					
				Streams				Lakes			Streams		
				SA-4	SA-5	SA-6		LB-2		Williams Lake[c]	SB-1	SB-3	SB-5
				SA-4b-WQ-W14	SA-5b-WQ-W14	SA-6a-WQ-W14	Dup1-W14	LB-2a-WQ-W14	Dup2-W14	LB-3a-WQ-W14	SB-1a-WQ-W14	SB-3b-WQ-W14	SB-5a-WQ-W14
				30-Mar-14	30-Mar-14	1-Apr-14		1-Apr-14		1-Apr-14	31-Mar-14	31-Mar-14	31-Mar-14
Barium	mg/L	-	-	0.0032	0.003	0.0032	0.0032	0.0046	0.0045	0.0037	0.0039	0.0041	0.004
Barium, dissolved	mg/L	-	-	0.0032	0.003	0.0031	0.0032	0.0045	0.0044	0.0036	0.0038	0.004	0.0041
Beryllium	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Beryllium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Boron	mg/L	1.5	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Boron, dissolved	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.00004[i]	0.000017[i]	<0.00001	<0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Cadmium, dissolved	mg/L	-	-	<0.00001	0.00001	<0.00001	<0.00001	<0.00001	0.00001	0.00001	0.00001	<0.00001	<0.00001
Chromium	mg/L	0.001[j]	0.001[j]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium, dissolved	mg/L	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	0.002[i]	0.002[i]	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0004	<0.0002	<0.0002
Copper, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Iron	mg/L	0.3	0.3	0.034	0.03	0.036	0.036	0.15	0.15	0.045	0.64	0.042	0.036
Iron, dissolved	mg/L	-	-	0.013	0.014	0.015	0.015	0.057	0.057	0.028	0.18	0.024	0.015
Lead	mg/L	0.001[i]	0.001[i]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lead, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lithium	µg/L	-	-	0.9	0.6	0.7	0.8	0.8	0.9	0.8	0.9	0.8	0.8
Lithium, dissolved	µg/L	-	-	0.9	0.6	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9
Manganese	mg/L	-	-	0.0029	0.0025	0.0037	0.0035	0.037	0.035	0.0025	0.036	0.01	0.009
Manganese, dissolved	mg/L	-	-	0.0021	0.0018	0.0029	0.0029	0.033	0.033	0.0024	0.035	0.0094	0.0086
Mercury	µg/L	0.026[k]	0.026[k]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01
Mercury, Dissolved	µg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Molybdenum	mg/L	0.073	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	mg/L	0.025[i]	0.025[i]	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	0.0002	<0.0001	0.0006	0.0002	<0.0001
Nickel, dissolved	mg/L	-	-	<0.0001	0.0001	<0.0001	<0.0001	0.0002	0.0002	<0.0001	0.0003	0.0002	0.0001
Selenium	mg/L	0.001	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Selenium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silver	mg/L	0.0001	0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Silver, dissolved	mg/L	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Strontium	mg/L	-	-	0.018	0.013	0.016	0.016	0.016	0.016	0.015	0.021	0.015	0.015
Strontium, dissolved	mg/L	-	-	0.018	0.013	0.016	0.016	0.016	0.016	0.015	0.021	0.015	0.016
Thallium	mg/L	0.0008	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Thallium, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tin	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	0.0008	<0.0001	0.0016	0.0007	<0.0001	<0.0001
Tin, dissolved	mg/L	-	-	0.0006	0.0003	0.0002	<0.0001	0.0009	0.0002	0.003	0.0014	0.0007	0.0001
Titanium	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0004	<0.0002	0.0003	<0.0002	<0.0002
Titanium, dissolved	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0002	<0.0002	<0.0002
Uranium	µg/L	15	15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium, dissolved	µg/L	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001
Vanadium, dissolved	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Zinc	mg/L	0.03	0.03	0.0006	<0.0005	<0.0005	0.0011	0.0018	0.0006	0.002	0.0005	0.0006	<0.0005
Zinc, dissolved	mg/L	-	-	<0.0005	0.0005	<0.0005	0.0009	0.0008	0.0009	0.0012	0.0014	<0.0005	<0.0005
Radionuclides													
Lead-210	Bq/L	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Polonium-210	Bq/L	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	<0.005
Radium-226	Bq/L	-	0.11[l]	0.008	<0.005	<0.005	<0.005	0.008	<0.005	<0.005	0.01	<0.005	<0.005
Thorium-228	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Thorium-230	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium-232	Bq/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Table A3. Water Chemistry Data for Waterbodies and Watercourses of the Denison Minew Wheeler River Project, March 28 to April 1, 2014 (continued)

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Russell Lake	QA/QC	
				Lake	Streams	
				RL-Aa-WQ-W14	Field Blank	Trip Blank
				31-Mar-14	Field S-W14	Trip S-W14
				Russell Lake	28-Mar-14	1-Apr-14
Conventional Parameters (Field-Measured)						
Dissolved Oxygen	mg/L	6.5 and 9.5[d]	6.5 and 9.5[d]	12.7	-	-
pH	pH unis	6.5 to 9.0	-	7.7	-	-
Specific conductivity[e]	µS/cm	-	-	-	-	-
Water Temperature	°C	-	-	3.5	-	-
Conventional Parameters (Lab-Measured)						
pH	pH units	6.5 to 9.0	-	6.98	5.63	6.1
Specific conductivity	µS/cm	-	-	30	<1	<1
Total alkalinity	mg/L	-	-	14	<1	1
Total dissolved solids	mg/L	-	-	31	<1	<1
Total hardness	mg/L	-	-	9	<1	<1
Total suspended solids	mg/L	-	-	<1	<1	<1
Nutrients						
Ammonia as nitrogen	mg/L	[f]	[f]	0.05	0.02	0.02
Nitrate (calc. from NO2+NO3-N)	mg/L	13.0	-	0.44	<0.04	<0.04
Nitrite[g]	mg/L	0.06	-	<0.03	<0.03	-
Nitrite+Nitrate nitrogen	mg/L	-	-	0.1	<0.01	<0.01
Organic carbon	mg/L	-	-	2.2	<0.2	<0.2
Organic carbon, dissolved	mg/L	-	-	2.1	<0.2	-
Ortho-phosphate as P	mg/L	-	-	<0.01	<0.01	-
Phosphorus	mg/L	-	-	<0.01	<0.01	<0.01
Phosphorus, dissolved	mg/L	-	-	<0.01	<0.01	-
Total Kjeldahl nitrogen	mg/L	-	-	0.14	<0.05	<0.05
Un-ionized ammonia-N	mg/L	0.019	-	<0.01	N/R	N/R
Organics						
Chlorophyll a	µg/L	-	-	0.4	-	-
Major Ions						
Bicarbonate	mg/L	-	-	17	<1	1
Calcium	mg/L	-	-	2.7	<0.1	<0.1
Carbonate	mg/L	-	-	<1	<1	<1
Chloride	mg/L	120	-	0.5	<0.1	<0.1
Fluoride	mg/L	0.12	-	0.07	<0.01	0.01
Hydroxide	mg/L	-	-	<1	<1	<1
Magnesium	mg/L	-	-	0.5	<0.1	<0.1
P. alkalinity	mg/L	-	-	<1	<1	<1
Potassium	mg/L	-	-	0.6	<0.1	<0.1
Sodium	mg/L	-	-	2	<0.1	<0.1
Sulfate	mg/L	-	-	3.7	<0.2	<0.2
Sum of ions	mg/L	-	-	28	<1	1
Other						
Silicon, soluble	mg/L	-	-	4.4	<0.01	<0.01
Metals (Total and Dissolved)						
Aluminum	mg/L	0.005 to 0.1[h]	0.005 to 0.1[h]	0.0024	<0.0005	0.0006
Aluminum, dissolved	mg/L	-	-	0.0019	<0.0005	-
Antimony	mg/L	-	-	<0.0002	<0.0002	<0.0002
Antimony, dissolved	mg/L	-	-	<0.0002	<0.0002	-
Arsenic	µg/L	5	5	<0.1	<0.1	<0.1
Arsenic, dissolved	µg/L	-	-	0.1	<0.1	-

Table A3. Water Chemistry Data for Waterbodies and Watercourses of the Denison Minew Wheeler River Project, March 28 to April 1, 2014 (continued)

Parameters	Units	CCME CWQG[(a)]	SSWQO[(b)]	Russell Lake	QA/QC	
				Lake	Streams	
				RL-Aa-WQ-W14	Field Blank	Trip Blank
				31-Mar-14	Field S-W14	Trip S-W14
				Russell Lake	28-Mar-14	1-Apr-14
Barium	mg/L	-	-	0.0039	<0.0005	<0.0005
Barium, dissolved	mg/L	-	-	0.0038	<0.0005	-
Beryllium	mg/L	-	-	<0.0001	<0.0001	<0.0001
Beryllium, dissolved	mg/L	-	-	<0.0001	<0.0001	-
Boron	mg/L	1.5	-	<0.01	<0.01	<0.01
Boron, dissolved	mg/L	-	-	<0.01	<0.01	-
Cadmium	mg/L	0.00004[(i)]	0.000017[(i)]	0.00001	<0.00001	<0.00001
Cadmium, dissolved	mg/L	-	-	<0.00001	0.00001	-
Chromium	mg/L	0.001[(j)]	0.001[(j)]	<0.0005	<0.0005	<0.0005
Chromium, dissolved	mg/L	-	-	<0.0005	<0.0005	-
Cobalt	mg/L	-	-	<0.0001	<0.0001	<0.0001
Cobalt, dissolved	mg/L	-	-	<0.0001	<0.0001	-
Copper	mg/L	0.002[(i)]	0.002[(i)]	<0.0002	<0.0002	<0.0002
Copper, dissolved	mg/L	-	-	<0.0002	<0.0002	-
Iron	mg/L	0.3	0.3	0.08	<0.0005	<0.0005
Iron, dissolved	mg/L	-	-	0.02	<0.0005	-
Lead	mg/L	0.001[(i)]	0.001[(i)]	<0.0001	<0.0001	<0.0001
Lead, dissolved	mg/L	-	-	<0.0001	<0.0001	-
Lithium	µg/L	-	-	4.8	<0.1	<0.1
Lithium, dissolved	µg/L	-	-	5.1	<0.1	-
Manganese	mg/L	-	-	0.064	<0.0005	<0.0005
Manganese, dissolved	mg/L	-	-	0.06	<0.0005	-
Mercury	µg/L	0.026[(k)]	0.026[(k)]	0.01	<0.01	<0.01
Mercury, Dissolved	µg/L	-	-	0.01	<0.01	-
Molybdenum	mg/L	0.073	-	0.0003	<0.0001	<0.0001
Molybdenum, dissolved	mg/L	-	-	0.0003	<0.0001	-
Nickel	mg/L	0.025[(i)]	0.025[(i)]	<0.0001	<0.0001	<0.0001
Nickel, dissolved	mg/L	-	-	0.0001	<0.0001	-
Selenium	mg/L	0.001	0.001	<0.0001	<0.0001	<0.0001
Selenium, dissolved	mg/L	-	-	<0.0001	<0.0001	-
Silver	mg/L	0.0001	0.0001	<0.00005	<0.00005	<0.00005
Silver, dissolved	mg/L	-	-	<0.00005	<0.00005	-
Strontium	mg/L	-	-	0.017	<0.0005	<0.0005
Strontium, dissolved	mg/L	-	-	0.017	<0.0005	-
Thallium	mg/L	0.0008	-	<0.0002	<0.0002	<0.0002
Thallium, dissolved	mg/L	-	-	<0.0002	<0.0002	-
Tin	mg/L	-	-	0.001	<0.0001	<0.0001
Tin, dissolved	mg/L	-	-	0.0011	0.0001	-
Titanium	mg/L	-	-	<0.0002	<0.0002	<0.0002
Titanium, dissolved	mg/L	-	-	<0.0002	<0.0002	-
Uranium	µg/L	15	15	<0.1	<0.1	<0.1
Uranium, dissolved	µg/L	-	-	<0.1	<0.1	-
Vanadium	mg/L	-	-	<0.0001	<0.0001	<0.0001
Vanadium, dissolved	mg/L	-	-	<0.0001	<0.0001	-
Zinc	mg/L	0.03	0.03	<0.0005	<0.0005	<0.0005
Zinc, dissolved	mg/L	-	-	0.0006	<0.0005	-

Table A3. Water Chemistry Data for Waterbodies and Watercourses of the Denison Minew Wheeler River Project, March 28 to April 1, 2014 (continued)

Parameters	Units	CCME CWQG[a]	SSWQO[b]	Russell Lake	QA/QC	
				Lake	Streams	
				RL-Aa-WQ-W14	Field Blank	Trip Blank
				31-Mar-14	Field S-W14	Trip S-W14
				Russell Lake	28-Mar-14	1-Apr-14
Radionuclides						
Lead-210	Bq/L	-	-	<0.02	<0.02	<0.02
Polonium-210	Bq/L	-	-	<0.005	<0.005	<0.005
Radium-226	Bq/L	-	0.11[l]	<0.005	<0.005	<0.005
Thorium-228	Bq/L	-	-	<0.01	<0.01	<0.01
Thorium-230	Bq/L	-	-	<0.01	<0.01	<0.01
Thorium-232	Bq/L	-	-	<0.01	<0.01	<0.01

Values that equal or exceed the CCME CWQG are **bolded**; values that equal or exceed the SSWQO are underlined. DL that exceed objectives or guidelines are *italicized* .
(a) CCME CWQG = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 1999, with updates).
(b) SSWQO = Saskatchewan Surface Water Quality Objectives (Water Security Agency 2006).
(c) Local lake name.
(d) The objectives and guidelines of dissolved oxygen for cold-water biota are 9.5 mg/L for early life stages and 6.5 mg/L for other life stages.
(e) Most field specific conductivity values are out of range for this area. Values were removed.
(f) The objectives/guidelines for ammonia are dependent on temperature and pH; the objective/guideline for each sample was calculated separately using the rounded field pH and rounded water temperature measured in the field.
(g) Time between sampling and receipt in lab exceeds the recommended 48 hours.
(h) The objective/guidelines for aluminum are dependent on pH; the field pH for each sample was used in the screening.
(i) The objective/guidelines for cadmium, copper, lead, and nickel are hardness-dependent; the range of CCME CWQG and SSWQO are listed and were calculated separately for each sample.
(j) The objective/guidelines are for hexavalent chromium; total chromium was analyzed.
(k) The objective/guidelines are for inorganic mercury.
(l) The objective for radium-226 was missed in the 2006 SSWQO (WSA) revisions; an objective of 0.11 Bq/L was presented in 1997 SSWQO (SMOE) and is expected to be added to the next SSWQO revision (T. Moulding pers. comm.).
mg/L = milligram per litre; µS/cm = microSiemens per centimetre; °C = degrees Celsius; µg/L = micrograms per litre; Bq/L = Becquerels per litre; < = less than; - = not available; SMOE = Saskatchewan Ministry of Environment.

APPENDIX B

Limnology

Table B1. Limnology at Water Quality Stations in Waterbodies and Watercourses of the Denison Mines Wheeler River Project, May 8, 2012 to October 25, 2012

Drainage	Waterbody / Watercourse	Station Code	Date (dd-mmm-yy)	Time (hh:mm)	Air Temperature (°C)	Cloud Cover (%)	Precipitation Rate	Precipitation Type	Wind Direction	Wind Rate	Secchi Depth (m)	Maximum Depth (m)	Profile Depth (m)	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
A (Icelander River)	LA-1	LA-1b-WQ	12-Aug-12	13:04	16.1	75-100%	Light	Rain	North West	Moderate	1.5	8.3	0.2	18.1	8.7	18	6.4
													1.0	18.1	8.7	18	6.4
													2.0	18.1	8.6	18	6.4
													3.0	18.1	8.6	18	6.4
													4.0	18.1	8.5	18	6.4
													5.0	18.1	8.5	18	6.4
													6.0	18.1	8.5	18	6.4
													7.0	18.0	8.3	18	6.4
													7.5	18.0	7.9	18	6.4
													8.0	17.0	4.4	22	6.3
	LA-5	LA-5a-WQ	13-Aug-12	14:11	20.3	<25%	-	None	South East	Light	2.2	3.6	0.2	17.9	9.4	17	7.1
													0.5	17.9	9.4	17	7.1
													1.0	17.8	9.4	17	7.1
													1.5	17.8	9.4	17	7.0
													2.0	17.7	9.4	17	7.0
													2.5	17.5	9.3	17	7.0
													3.0	17.1	9.2	17	6.9
													3.5	17.0	9.6	17	7.0
	LA-6	LA-6a-WQ	13-Aug-12	14:59	20.3	25-50%	-	None	South West	Light	2	2.2	0.2	17.5	9.1	17	6.7
													0.5	17.4	9.0	17	6.8
													1.0	17.4	8.9	17	6.8
													1.5	17.3	8.9	17	6.8
													2.0	17.2	6.8	17	6.9
	Kratchkowsky Lake (LA-7)	LA-7a-WQ	9-Aug-12	15:32	16.8	75-100%	Light	Rain	North East	Light	1.75	6.5	0.2	18.5	9.2	17	7.2
													0.5	18.7	9.1	17	7.1
													1.0	18.7	9.1	17	7.1
													1.5	18.7	9.0	17	7.0
													2.0	18.7	9.0	17	6.9
													2.5	18.6	8.9	17	6.8
													3.0	18.6	8.9	17	6.8
													3.5	18.6	8.8	17	6.8
													4.0	18.6	8.8	17	6.8
													4.5	18.1	8.3	17	6.8
													5.0	18.0	8.1	17	6.8
													5.5	17.9	7.3	17	6.8
													5.8	17.8	6.6	18	6.7
													6.0	17.7	3.7	28	6.5
	SA-1	SA-1c-WQ	8-May-12	19:00	18.9	NR	-	None	South West	Moderate	-	NR	0.2	5.7	10.7	19	6.1
		SA-1c-WQ	7-Aug-12	14:30	22.8	NR	-	None	North West	Moderate	-	NR	0.4	20.5	8.9	18	6.7
		SA-1c-WQ	24-Oct-12	16:00	-1.7	NR	-	None	North East	Moderate	-	NR	0.1	2.2	15.2	17	6.1
	SA-2	SA-2b-WQ	8-May-12	16:15	18.7	NR	-	None	South West	Moderate	-	NR	0.2	5.6	12.0	16	6.8
		SA-2b-WQ	8-Aug-12	10:30	14.5	NR	-	None	South East	Light	-	NR	0.5	17.1	9.0	17	6.8
		SA-2b-WQ	24-Oct-12	13:00	-1.4	NR	-	None	North East	Moderate	-	NR	0.1	1.0	16.2	17	5.3
	SA-3	SA-3b-WQ	8-May-12	18:15	19.8	NR	-	None	South West	Moderate	-	NR	0.2	6.6	10.2	20	6.5
		SA-3b-WQ	7-Aug-12	10:30	21.0	NR	-	None	North West	Moderate	-	NR	0.3	18.7	9.2	19	7.5
		SA-3b-WQ	24-Oct-12	16:30	-1.9	NR	-	None	North East	Moderate	-	NR	0.2	1.3	15.8	20	6.0
	SA-4	SA-4b-WQ	8-May-12	13:00	14.8	NR	-	None	South West	Moderate	-	NR	0.2	7.7	16.1	20	6.5
		SA-4b-WQ	7-Aug-12	11:30	21.4	NR	-	None	North West	Moderate	-	NR	0.3	17.6	9.1	18	7.3
		SA-4b-WQ	24-Oct-12	14:15	-1.5	NR	-	None	North East	Moderate	-	NR	0.1	1.3	16.0	19	5.9
	SA-5	SA-5b-WQ	8-May-12	13:30	15.6	NR	-	None	South West	Moderate	-	NR	0.2	9.4	11.2	16	6.9
		SA-5b-WQ	7-Aug-12	11:15	21.0	NR	-	None	North West	Moderate	-	NR	0.4	17.5	9.5	16	7.3
		SA-5b-WQ	24-Oct-12	14:00	-1.5	NR	-	None	North East	Moderate	-	NR	0.9	1.4	10.5	16	5.5
	SA-6	SA-6a-WQ	8-May-12	15:00	16.6	NR	-	None	South West	Moderate	-	NR	0.2	5.1	11.5	16	6.9
		SA-6a-WQ	7-Aug-12	12:00	21.4	NR	-	None	North West	Moderate	-	NR	0.3	17.6	9.3	16	7.3
		SA-6a-WQ	24-Oct-12	14:30	-1.6	NR	-	None	North East	Moderate	-	NR	0.2	0.6	16.2	17	6.0

Table B1. Limnology at Water Quality Stations in Waterbodies and Watercourses of the Denison Mines Wheeler River Project, May 8, 2012 to October 25, 2012 (Continued)

Drainage	Waterbody / Watercourse	Station Code	Date (dd-mmm-yy)	Time (hh:mm)	Air Temperature (°C)	Cloud Cover (%)	Precipitation Rate	Precipitation Type	Wind Direction	Wind Rate	Secchi Depth (m)	Maximum Depth (m)	Profile Depth (m)	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
B (Unnamed)	Williams Lake* (LB-3)	LB-3a-WQ	11-Aug-12	9:47	17.5	<25%	-	None	West	Light	3.5	17.1	0.2	18.7	8.9	15	7.0
													1.0	18.7	8.8	15	7.0
													2.0	18.7	8.8	15	7.0
													3.0	18.7	8.7	15	6.9
													4.0	18.7	8.6	15	6.9
													5.0	18.5	8.5	15	6.8
													6.0	18.3	8.4	15	6.8
													7.0	17.0	7.6	15	6.9
													7.5	15.3	7.0	14	6.8
													8.0	12.7	7.0	14	6.8
													8.5	10.5	6.5	13	6.8
													9.0	9.3	4.4	13	6.7
													9.5	8.6	3.2	13	6.7
													10.0	8.2	2.6	13	6.7
													10.5	7.9	1.4	14	6.6
													11.0	7.7	0.6	14	6.5
													11.5	7.5	0.3	14	6.5
													12.0	7.2	0.2	18	6.4
													13.0	6.9	0.2	23	6.4
													14.0	6.8	0.2	27	6.3
													15.0	6.7	0.2	28	6.3
													15.5	6.6	0.2	28	6.2
													16.0	6.6	0.2	29	6.2
													16.5	6.6	0.2	31	6.2
													17.0	6.6	0.2	32	6.2
	SB-1	SB-1a-WQ	9-May-12	9:45	15.8	NR	-	None	South	Light	-	NR	0.2	5.7	10.6	15	5.3
		SB-1a-WQ	7-Aug-12	15:45	22.0	NR	-	None	North West	Moderate	-	NR	0.4	18.4	9.6	16	6.4
		SB-1a-WQ	25-Oct-12	9:30	-5.6	NR	Light	Snow	North	Moderate	-	NR	0.2	0.1	14.0	15	5.8
	SB-2	SB-2b-WQ	9-May-12	9:35	15.8	NR	-	None	South	Light	-	NR	0.2	5.0	8.3	15	5.2
		SB-2b-WQ	7-Aug-12	15:45	22.0	NR	-	None	North West	Moderate	-	NR	0.3	18.4	3.6	19	6.6
		SB-2b-WQ	25-Oct-12	9:30	-5.6	NR	Light	Snow	North	Moderate	-	NR	0.2	0.1	11.1	14	5.8
	SB-3	SB-3b-WQ	9-May-12	8:30	14.7	NR	-	None	South	Moderate	-	NR	0.2	4.5	9.6	17	5.8
		SB-3b-WQ	8-Aug-12	14:30	20.7	NR	-	None	South East	Light	-	NR	0.5	20.0	8.9	17	6.8
		SB-3b-WQ	25-Oct-12	9:00	-5.8	NR	Light	Snow	North	Light	-	NR	0.2	1.2	13.9	17	6.1
	SB-4	SB-4a-WQ	8-May-12	10:00	14.9	NR	-	None	South West	Moderate	-	NR	0.2	4.5	10.2	15	6.2
		SB-4a-WQ	7-Aug-12	8:45	19.2	NR	-	None	North West	Moderate	-	NR	0.3	18.1	7.2	15	6.9
		SB-4a-WQ	24-Oct-12	18:00	-2.0	NR	-	None	North	Moderate	-	NR	0.1	0.7	14.1	14	6.2
	SB-5	SB-5a-WQ	9-May-12	7:30	12.7	NR	-	None	South	Light	-	NR	0.2	4.4	10.7	17	5.5
		SB-5a-WQ	7-Aug-12	16:30	20.9	NR	-	None	North	Moderate	-	NR	0.4	20.1	8.7	17	6.5
		SB-5a-WQ	25-Oct-12	8:30	-5.8	NR	Light	Snow	North	Light	-	NR	0.3	1.2	13.5	17	6.7
Russell Lake	Russell Lake	RL-Aa-WQ	10-Aug-12	12:50	21.5	75-100%	-	None	South West	Moderate	3.5	17	0.2	18.6	9.0	34	6.6
													1.0	18.6	8.9	34	6.6
													2.0	18.5	8.9	34	6.6
													3.0	18.5	8.9	34	6.6
													4.0	18.4	8.9	34	6.6
													5.0	18.4	8.8	34	6.6
													6.0	18.3	8.7	34	6.6
													7.0	18.3	8.7	32	6.6
													8.0	18.2	8.6	34	6.6
													9.0	18.2	8.6	34	6.6
													10.0	18.2	8.5	33	6.6
													11.0	18.1	8.4	33	6.6
													12.0	18.1	8.3	33	6.7
													13.0	18.1	8.3	33	6.6
													14.0	18.0	8.1	32	6.6

Table B1. Limnology at Water Quality Stations in Waterbodies and Watercourses of the Denison Mines Wheeler River Project, May 8, 2012 to October 25, 2012 (Continued)

Drainage	Waterbody / Watercourse	Station Code	Date (dd-mmm-yy)	Time (hh:mm)	Air Temperature (°C)	Cloud Cover (%)	Precipitation Rate	Precipitation Type	Wind Direction	Wind Rate	Secchi Depth (m)	Maximum Depth (m)	Profile Depth (m)	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
Russell Lake	Russell Lake	RL-Aa-WQ	10-Aug-12	12:50	21.5	75-100%	-	None	South West	Moderate	3.5	17	15.0	17.8	7.7	32	6.6
													15.5	14.0	2.7	31	6.6
													16.0	11.4	0.7	29	6.6
													16.5	10.6	0.2	28	6.5

Note: Cloud coverage and maximum depth were not recorded for stream water quality stations.

*Local name.

dd-mmm-yy = day-month-year; hh:mm = hour:minute; °C = degree Celsius; % = percent; m = metres; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; Aug = August; Oct = October; - = not applicable; NR = not recorded.

Table B2. Limnology at Water Quality Stations in Watercourses of the Denison Mines Wheeler River Project, May 22, 2013 to October 19, 2013

Drainage	Watercourse	Station Code	Date (dd-mmm-yy)	Time (hh:mm)	Air Temperature (°C)	Cloud Cover (%)	Precipitation Rate	Precipitation Type	Wind Direction	Wind Rate	Secchi Depth (m)	Maximum Depth (m)	Profile Depth (m)	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
A (Icelander River)	SA-1	SA-1c-WQ	22-May-13	12:47	8.9	NR	-	None	NR	NR	-	NR	0.2	6.8	12.0	17	7.0
		SA-1c-WQ	15-Aug-13	16:58	29.1	NR	-	None	West	Moderate	-	NR	0.2	21.7	9.0	17	6.7
		SA-1c-WQ	18-Oct-13	16:00	0.5	NR	Light	Rain	North	Light	-	NR	NR	4.7	12.5	18	6.9
	SA-2	SA-2b-WQ	22-May-13	10:50	6.2	NR	-	None	NR	NR	-	NR	0.3	11.6	11.2	15	7.3
		SA-2b-WQ	15-Aug-13	15:10	28.8	NR	-	None	West	Moderate	-	NR	0.3	21.2	8.7	18	6.2
		SA-2b-WQ	18-Oct-13	9:30	-2.1	NR	Light	Snow	North	Light	-	NR	NR	2.5	12.7	15	6.6
	SA-3	SA-3b-WQ	22-May-13	11:30	6.2	NR	-	None	NR	NR	-	NR	0.1	8.8	11.4	19	7.2
		SA-3b-WQ	15-Aug-13	15:45	29.3	NR	-	None	West	Moderate	-	NR	0.2	21.4	9.3	19	6.5
		SA-3b-WQ	18-Oct-13	8:35	-2.1	NR	Light	Snow	North	Light	-	NR	NR	2.4	12.4	21	7.4
	SA-4	SA-4b-WQ	22-May-13	8:49	3.8	NR	-	None	NR	NR	-	NR	0.1	7.8	11.6	18	7.3
		SA-4b-WQ	15-Aug-13	13:10	25.7	NR	-	None	South West	Light	-	NR	0.1	20.4	9.0	19	6.1
		SA-4b-WQ	18-Oct-13	11:30	-1.3	NR	Light	Snow	North East	Light	-	NR	NR	2.8	12.7	20	6.9
	SA-5	SA-5b-WQ	22-May-13	9:15	3.8	NR	-	None	NR	NR	-	NR	0.4	7.7	11.9	15	7.3
		SA-5b-WQ	15-Aug-13	13:30	27.7	NR	-	None	South West	Moderate	-	NR	0.2	20.2	9.3	15	6.2
		SA-5b-WQ	18-Oct-13	10:50	-1.5	NR	Light	Snow	North	Light	-	NR	NR	2.0	13.0	17	6.9
	SA-6	SA-6a-WQ	22-May-13	8:15	3.3	NR	-	None	NR	NR	-	NR	0.2	10.6	11.1	16	7.7
		SA-6a-WQ	15-Aug-13	12:40	25.7	NR	-	None	South West	Light	-	NR	0.2	19.7	9.2	18	6.0
		SA-6a-WQ	18-Oct-13	12:05	-1.3	NR	Light	Snow	North East	Light	-	NR	NR	2.9	12.7	18	6.8
B (Unnamed)	SB-1	SB-1a-WQ	22-May-13	15:17	10.6	NR	-	None	NR	NR	-	NR	0.3	12.3	10.4	15	6.8
		SB-1a-WQ	15-Aug-13	10:50	25	NR	-	None	South West	Light	-	NR	0.2	16.9	7.0	20	5.7
		SB-1a-WQ	19-Oct-13	9:50	-1.5	NR	Light	Snow	North East	Light	-	NR	NR	1.8	10.9	17	6.3
	SB-2	SB-2b-WQ	22-May-13	15:32	12.3	NR	-	None	NR	NR	-	NR	0.5	12.1	7.7	16	6.4
		SB-2b-WQ	15-Aug-13	11:05	25	NR	-	None	South West	Light	-	NR	0.2	17.9	5.1	21	5.6
		SB-2b-WQ	19-Oct-13	10:55	-1.8	NR	Light	Snow	North East	Moderate	-	NR	NR	1.7	10.3	15	5.8
	SB-3	SB-3b-WQ	22-May-13	13:28	8.9	NR	-	None	NR	NR	-	NR	0.4	9.4	11.0	16	6.8
		SB-3b-WQ	15-Aug-13	18:05	26.8	NR	-	None	North West	NR	-	NR	0.2	21.6	8.9	17	6.5
		SB-3b-WQ	18-Oct-13	17:05	-0.1	NR	Light	Snow	North East	Light	-	NR	NR	4.3	12.3	17	7.0
	SB-4	SB-4a-WQ	22-May-13	18:36	13.8	NR	-	None	NR	NR	-	NR	0.2	11.5	7.7	13	6.5
		SB-4a-WQ	15-Aug-13	10:00	21.7	NR	-	None	South West	NR	-	NR	0.3	15.6	7.2	18	5.5
		SB-4a-WQ	18-Oct-13	13:05	-0.4	NR	Light	Snow	North West	Light	-	NR	NR	2.0	11.9	15	6.3
	SB-5	SB-5a-WQ	22-May-13	14:08	10	NR	-	None	NR	NR	-	NR	0.3	10.2	11.3	16	6.8
		SB-5a-WQ	15-Aug-13	18:43	26	NR	-	None	West	Light	-	NR	0.4	21.6	8.6	17	6.5
		SB-5a-WQ	18-Oct-13	17:40	-1.9	NR	Light	Snow	East	Light	-	NR	NR	4.2	12.3	17	6.7

Note: Cloud coverage and maximum depth were not recorded for stream water quality stations.

dd-mmm-yy = day-month-year; hh:mm = hour:minute; °C = degree Celsius; % = percent; m = metres; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; Aug = August; Oct = October; NR = not recorded; - = not applicable.

Table B3. Limnology at Water Quality Stations in Waterbodies and Watercourses of the Denison Mines Wheeler River Project, March 28 to April 1, 2014

Drainage	Waterbody / Watercourse	Station Code	Date (dd-mmm-yy)	Time (hh:mm)	Air Temperature (°C)	Cloud Cover (%)	Precipitation Rate	Precipitation Type	Wind Direction	Wind Rate	Snow Depth (m)	Ice Thickness (m)	Secchi Depth (m)	Maximum Depth (m)	Profile Depth (m)	Water Temperature (°C)	Dissolved Oxygen (mg/L)	pH
A (Icelander River)	LA-1	LA-1b-WQ	29-Mar-14	15:50	-7	50-75	Not applicable	None	South West	Moderate	0.3	0.97	2.5	8.5	1.0	4.1	12.9	6.9
															2.0	2.3	12.5	6.7
															3.0	1.8	12.2	6.5
															4.0	2.0	11.9	6.3
															5.0	2.8	10.7	6.0
															6.0	3.8	7.5	5.7
															7.0	4.4	5.0	5.6
															8.0	4.5	2.9	5.5
	LA-2	LA-2a-WQ	28-Mar-14	18:00	-10	25-50	Not applicable	None	South West	Moderate	0.35	0.76	3.5	6	1.0	3.2	12.3	7.0
															2.0	4.3	8.2	6.5
															3.0	4.6	5.7	6.3
															4.0	4.6	4.3	6.2
															5.0	4.6	3.2	6.1
	LA-3	LA-3a-WQ	28-Mar-14	16:45	-5	25-50	Not applicable	None	South West	Moderate	0.45	0.8	4.5	10	1.0	1.0	13.9	7.7
															2.0	1.5	13.2	7.6
															3.0	2.6	11.8	7.5
															4.0	2.9	10.7	7.4
															5.0	3.2	9.9	7.2
															6.0	3.4	8.6	7.0
															7.0	3.7	7.4	6.8
															8.0	3.8	6.0	6.6
															9.0	3.9	5.4	6.5
	LA-4	LA-4a-WQ	29-Mar-14	9:45	-7	50-75	Not applicable	None	West	Light	0.25	0.82	3.5	13	1.0	1.6	13.2	7.6
															2.0	2.4	12.5	7.4
															3.0	3.0	11.6	7.2
															4.0	3.1	11.2	7.1
															5.0	3.3	10.9	7.0
															6.0	3.3	10.4	6.8
															7.0	3.4	10.1	6.7
															8.0	3.4	9.8	6.6
															9.0	3.5	9.0	6.5
															10.0	3.6	8.5	6.4
															11.0	3.7	7.0	6.3
															12.0	3.8	6.0	6.2
	LA-5	LA-5b-WQ	1-Apr-14	11:30	-8	0	Not applicable	None	South West	Light	0.35	0.7	2.1	2.1	1.0	0.4	9.3	6.6
															1.5	0.5	9.8	6.4
	LA-6	LA-6a-WQ	30-Mar-14	9:50	-28	0	Not applicable	None	South West	Light	0.3	0.94	2	2.5	1.0	2.4	11.8	7.1
															1.5	1.5	11.8	6.9
															2.0	2.4	7.6	6.4
	Kratchkowsky Lake (LA-7)	LA-7a-WQ	29-Mar-14	12:15	-5	75-100	Light	Snow	North West	Moderate	0.3	0.85	3.5	6	1.0	2.0	12.1	7.1
															2.0	3.8	7.3	6.4
															3.0	4.2	5.3	6.2
															4.0	4.3	3.8	6.1
															5.0	4.3	3.2	6.1
	SA-1	SA-1c-WQ	30-Mar-14	17:00:00	-15	0	Not applicable	None	North East	Light	Not available	Not available	Not available	0.30	0.15	1.1	11.4	7.2
	SA-2	SA-2b-WQ	29-Mar-14	17:50:00	-7	50-75	Not applicable	None	South West	Moderate	Not available	Not available	Not available	0.44	0.15	0.4	13.7	6.5
	SA-3	SA-3b-WQ	31-Mar-14	16:30:00	-15	0	Not applicable	None	South West	Moderate	Not available	Not available	Not available	0.25	0.10	0.9	9.8	6.9
	SA-4	SA-4b-WQ	30-Mar-14	11:00:00	-20	25	Not available	Not available	Not available	Not available	Not available	Not available	Not available	0.40	0.15	0.6	13.3	6.8
	SA-5	SA-5b-WQ	30-Mar-14	11:55:00	-20	25	Not available	Not available	Not available	Not available	Not available	Not available	Not available	0.45	0.22	0.6	12.3	6.7
	SA-6	SA-6a-WQ	1-Apr-14	14:00:00	-5	0	Not applicable	None	South West	Light	Not available	Not available	Not available	0.80	0.40	0.2	7.0	6.5

Table B3. Limnology at Water Quality Stations in Waterbodies and Watercourses of the Denison Mines Wheeler River Project, March 28 to April 1, 2014 (Continued)

Drainage	Waterbody / Watercourse	Station Code	Date (dd-mmm-yy)	Time (hh:mm)	Air Temperature (°C)	Cloud Cover (%)	Precipitation Rate	Precipitation Type	Wind Direction	Wind Rate	Snow Depth (m)	Ice Thickness (m)	Secchi Depth (m)	Maximum Depth (m)	Profile Depth (m)	Water Temperature (°C)	Dissolved Oxygen (mg/L)	pH
B (Unnamed)	LB-2-WQ	LB-2a-WQ	1-Apr-14	16:15	-5	0	Not applicable	None	NW	Light	0.3	0.78	2.5	6.2	1.0	3.5	6.2	6.8
															2.0	3.5	6.4	6.5
															3.0	4.5	4.9	6.1
															4.0	4.6	3.3	6.0
															5.0	4.5	2.3	6.0
	Williams Lake* (LB-3)	LB-3a-WQ	1-Apr-14	9:00	-8	0	Not applicable	None	SW	Light	0.35	0.82	4	17	1.0	3.1	13.0	7.5
															2.0	3.2	11.3	6.8
															3.0	3.7	10.6	6.7
															4.0	3.9	10.1	6.5
															5.0	3.9	9.7	6.4
															6.0	4.0	8.1	6.3
															7.0	4.0	7.0	6.2
															8.0	4.0	4.2	6.1
															9.0	4.1	3.0	6.0
															10.0	4.1	1.9	6.0
															11.0	4.2	1.4	6.0
															12.0	4.2	0.9	6.0
															13.0	4.2	0.6	6.4
															14.0	4.3	0.5	6.5
															15.0	4.3	0.3	6.8
															16.0	4.4	0.3	6.9
	SB-1	SB-1a-WQ	31-Mar-14	10:00:00	-25	0	Not applicable	None	Not applicable	Calm	Not available	0.55	Not available	0.9	0.45	0.4	8.1	6.6
	SB-3	SB-3b-WQ	31-Mar-14	17:50:00	-15	0	Not applicable	None	South West	Moderate	Not available	Not available	Not available	0.2	0.07	0.7	8.6	6.3
	SB-5	SB-5a-WQ	31-Mar-14	18:25:00	-15	0	Not applicable	None	South West	Moderate	Not available	Not available	Not available	0.2	0.09	0.4	8.9	6.6
Russell Lake	Russell Lake	RL-Aa-WQ	31-Mar-14	14:40	-15	0	Not applicable	None	South West	Moderate	0.4	0.83	3.5	14.5	1.0	3.5	12.7	7.7
															2.0	2.5	12.2	7.5
															3.0	2.8	11.7	7.3
															4.0	2.9	11.4	7.2
															5.0	2.9	11.4	7.1
															6.0	2.9	11.3	7.1
															7.0	2.9	11.2	7.0
															8.0	2.9	11.1	7.0
															9.0	3.0	10.9	6.9
															10.0	3.4	10.0	6.8
															11.0	3.6	7.0	6.7
															12.0	3.7	6.1	6.7
															13.0	3.8	5.5	6.6
															14.0	3.9	4.6	6.6

Note: Snow depth and ice thickness as well as Secchi were often not recorded for stream water quality stations. All field specific conductivity values were out of range for this area; Values were removed.

*Local name.

dd-mmm-yy = day-month-year; hh:mm = hour:minute; °C = degree Celsius; % = percent; m = metres; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; Mar = March; Apr = April.

APPENDIX C

Bathymetry Maps

STATISTICS AT TIME OF SURVEY 11/08/2012 AND 12/08/2012	
ELEVATION (mASL)	494.386m
MAXIMUM LENGTH	1.7km
SURFACE AREA	1 485 480m²
VOLUME	8 189 320m³
MEAN DEPTH	5.51m
MAXIMUM DEPTH	9.67m
PERIMETER, MAIN SHORE	5 291m
PERIMETER, ISLANDS	n/a

NOTE

BATHYMETRIC MAPS ARE NOT FOR NAVIGATION OR DESIGN PURPOSES. BATHYMETRIC DATA WAS COLLECTED ALONG TRANSECTS AND THE DEPTH DATA BETWEEN THE TRANSECTS HAS BEEN INTERPOLATED. BATHYMETRIC CONTOURS SHOWN AT 0.5m INTERVALS.

150 0 150

SCALE 1:7,500 METRES

PROJECT

DENISON MINES CORPORATION
WHEELER RIVER PROJECT

TITLE

BATHYMETRY MAP LAKE LA1

Golder Associates
Saskatoon, Saskatchewan

PROJECT		12-1362-0050	FILE No.
DESIGN			SCALE AS SHOWN REV. 0
CADD	TAH	21/08/12	
CHECK	BDH	27/05/13	
REVIEW	BLC	27/05/13	

FIGURE: C1

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G:\CLIENTS\DENISON MINES\Wheeler River\Figures\12-1362-0050\Aquatics\12-1362-0050 - LA5 LA6 SA6 Bathymetry Map.dwg 1/30/2013 2:52 PM

STATISTICS AT TIME OF SURVEY 13/08/2012	
ELEVATION (mASL)	500.037m
MAXIMUM LENGTH	1.5km
SURFACE AREA	324 049m²
VOLUME	332 502m³
MEAN DEPTH	1.08m
MAXIMUM DEPTH	4.07m
PERIMETER, MAIN SHORE	5 487m
PERIMETER, ISLANDS	146m

2.5 0 2.5

SCALE 1:125 METRES

NOTE

BATHYMETRIC MAPS ARE NOT FOR NAVIGATION OR DESIGN PURPOSES.
BATHYMETRIC DATA WAS COLLECTED ALONG TRANSECTS AND THE DEPTH DATA BETWEEN THE TRANSECTS HAS BEEN INTERPOLATED. BATHYMETRIC CONTOURS SHOWN AT 0.5m INTERVALS.

PROJECT

DENISON MINES CORPORATION
WHEELER RIVER PROJECT

TITLE

BATHYMETRY MAP
LAKE LA5

Golder Associates
Saskatoon, Saskatchewan

PROJECT	12-1362-0050		FILE No.
DESIGN			SCALE AS SHOWN REV. 0
CADD	TAH	21/08/12	**FIGURE: C2**
CHECK	BDH	27/05/13	
REVIEW	BLC	27/05/13	

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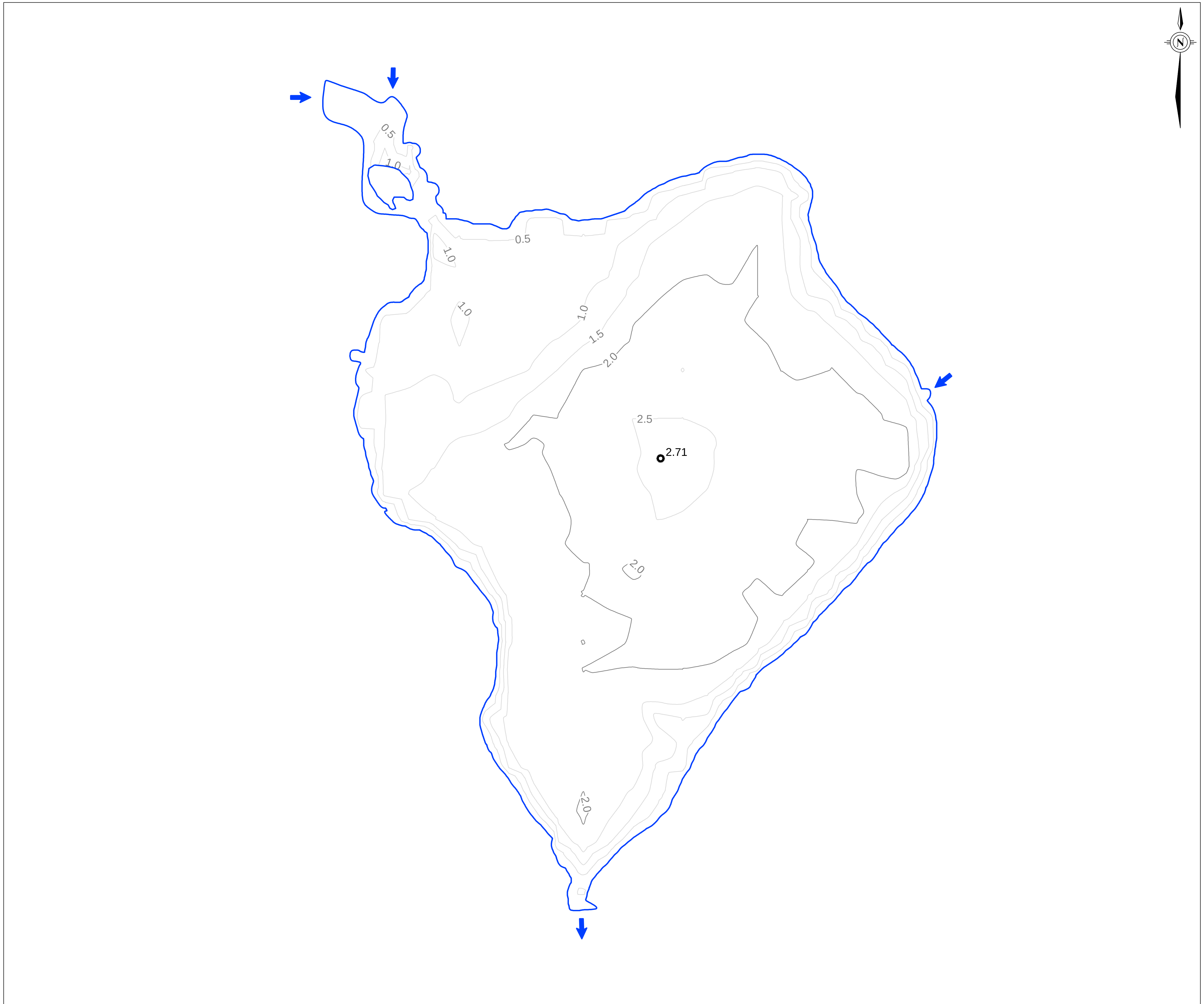

STATISTICS AT TIME OF SURVEY 13/08/2012	
ELEVATION (mASL)	500.058m
MAXIMUM LENGTH	0.78km
SURFACE AREA	262 740m²
VOLUME	413 505m³
MEAN DEPTH	1.57m
MAXIMUM DEPTH	2.71m
PERIMETER, MAIN SHORE	2 654m
PERIMETER, ISLANDS	153m

NOTE

BATHYMETRIC MAPS ARE NOT FOR NAVIGATION OR DESIGN PURPOSES. BATHYMETRIC DATA WAS COLLECTED ALONG TRANSECTS AND THE DEPTH DATA BETWEEN THE TRANSECTS HAS BEEN INTERPOLATED. BATHYMETRIC CONTOURS SHOWN AT 0.5m INTERVALS.

100 0 100

SCALE 1:4,000 METRES

PROJECT

DENISON MINES CORPORATION
WHEELER RIVER PROJECT

TITLE

BATHYMETRY MAP
LAKE LA6

Golder Associates
Saskatoon, Saskatchewan

PROJECT	12-1362-0050		FILE No.
DESIGN			SCALE AS SHOWN REV. 0
CADD	TAH	21/08/12	FIGURE: C3
CHECK	BDH	27/05/13	
REVIEW	BLC	27/05/13	

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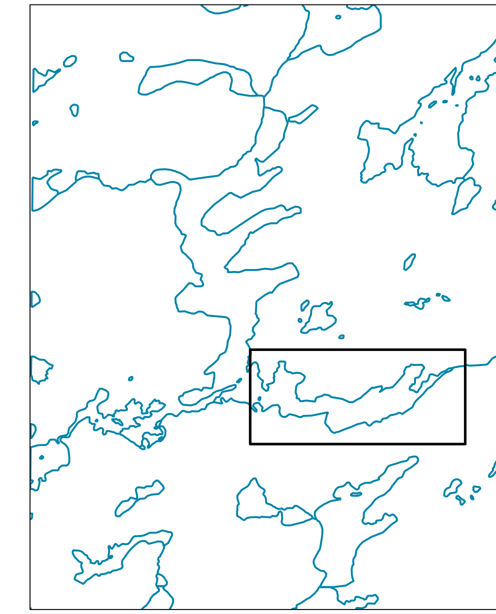

KEY PLAN

STATISTICS AT TIME OF SURVEY 09/08/2012	
ELEVATION (mASL)	520.482m
MAXIMUM LENGTH	2.5km
SURFACE AREA	795 937m²
VOLUME	-
MEAN DEPTH	2.90m
MAXIMUM DEPTH	6.78m
PERIMETER, MAIN SHORE	7 843m
PERIMETER, ISLANDS	n/a

NOTE

BATHYMETRIC MAPS ARE NOT FOR NAVIGATION OR DESIGN PURPOSES. BATHYMETRIC DATA WAS COLLECTED ALONG TRANSECTS AND THE DEPTH DATA BETWEEN THE TRANSECTS HAS BEEN INTERPOLATED. BATHYMETRIC CONTOURS SHOWN AT 0.5m INTERVALS.

200 0 200

SCALE 1:10,000 METRES

PROJECT

DENISON MINES CORPORATION
WHEELER RIVER PROJECT

TITLE

BATHYMETRY MAP
KRATCHKOWSKY LAKE (LA7)
(SOUTH-EAST BAY)

Golder Associates
Saskatoon, Saskatchewan

PROJECT	12-1362-0050		FILE No.
DESIGN			SCALE AS SHOWN REV. 0
CADD	TAH	20/08/12	
CHECK	BDH	27/05/13	FIGURE: C4
REVIEW	BLC	27/05/13	

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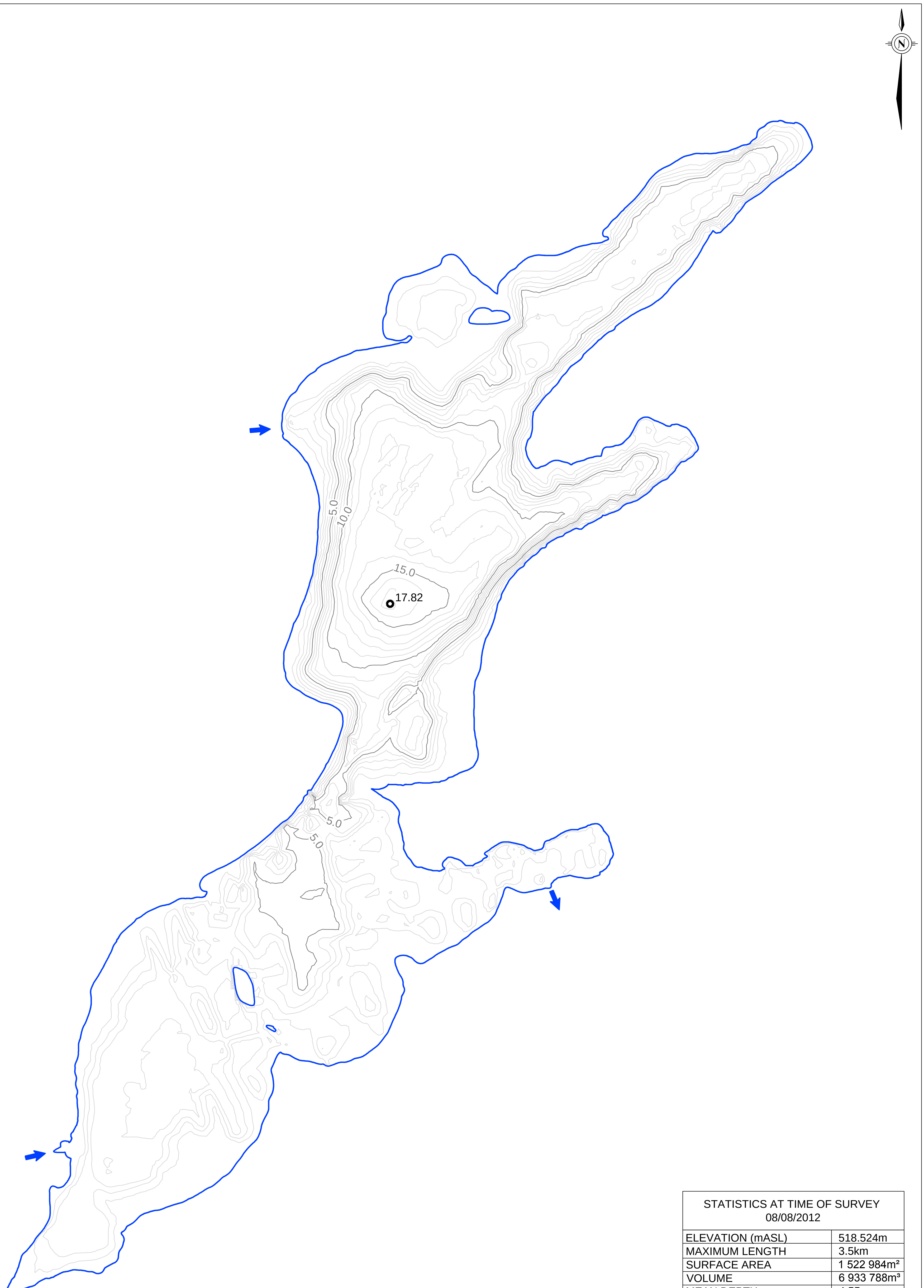


STATISTICS AT TIME OF SURVEY
08/08/2012

ELEVATION (mASL)	518.524m
MAXIMUM LENGTH	3.5km
SURFACE AREA	1 522 984m²
VOLUME	6 933 788m³
MEAN DEPTH	4.55m
MAXIMUM DEPTH	17.82m
PERIMETER, MAIN SHORE	10 925m
PERIMETER, ISLANDS	544m

200 0 200
SCALE 1:10,000 METRES

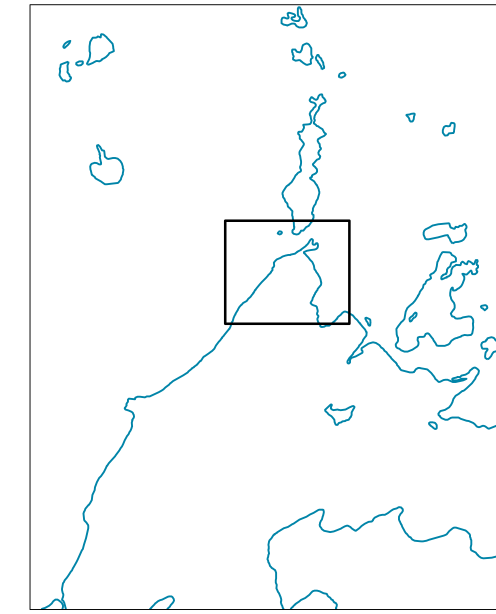
PROJECT
DENISON MINES COPORATION
WHEELER RIVER PROJECT

TITLE
BATHYMETRY MAP
WILLIAMS LAKE* (LB3)

Golder Associates
Saskatoon, Saskatchewan

PROJECT	12-1362-0050		FILE No.
DESIGN			SCALE AS SHOWN REV. 0
CADD	TAH	20/08/12	**FIGURE: C5**
CHECK	BDH	27/05/13	
REVIEW	BLC	27/05/13	

NOTE
* LOCAL LAKE NAME
BATHYMETRIC MAPS ARE NOT FOR NAVIGATION OR DESIGN PURPOSES. BATHYMETRIC DATA WAS COLLECTED ALONG TRANSECTS AND THE DEPTH DATA BETWEEN THE TRANSECTS HAS BEEN INTERPOLATED. BATHYMETRIC CONTOURS SHOWN AT 1.0m INTERVALS.



KEY PLAN

STATISTICS AT TIME OF SURVEY 10/08/2012 AND 11/08/2012	
ELEVATION (mASL)	488.167m
MAXIMUM LENGTH	1.2km
SURFACE AREA	751 485m²
VOLUME	-
MEAN DEPTH	3.04m
MAXIMUM DEPTH	18.78m
PERIMETER, MAIN SHORE	3 325m
PERIMETER, ISLANDS	n/a

NOTE

BATHYMETRIC MAPS ARE NOT FOR NAVIGATION OR DESIGN PURPOSES. BATHYMETRIC DATA WAS COLLECTED ALONG TRANSECTS AND THE DEPTH DATA BETWEEN THE TRANSECTS HAS BEEN INTERPOLATED. BATHYMETRIC CONTOURS SHOWN AT 0.5m INTERVALS.

1 0 1

SCALE 1:50,000 KILOMETRES

PROJECT

DENISON MINES CORPORATION
WHEELER RIVER PROJECT

TITLE

BATHYMETRY MAP
RUSSELL LAKE
(ICELANDER RIVER OUTLET BAY)

Golder Associates
Saskatoon, Saskatchewan

PROJECT		12-1362-0050	FILE No.
DESIGN			SCALE AS SHOWN REV. 0
CADD	TAH	20/08/12	
CHECK	BDH	27/05/13	**FIGURE: C6**
REVIEW	BLC	27/05/13	

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APPENDIX D

Fish Habitat Maps

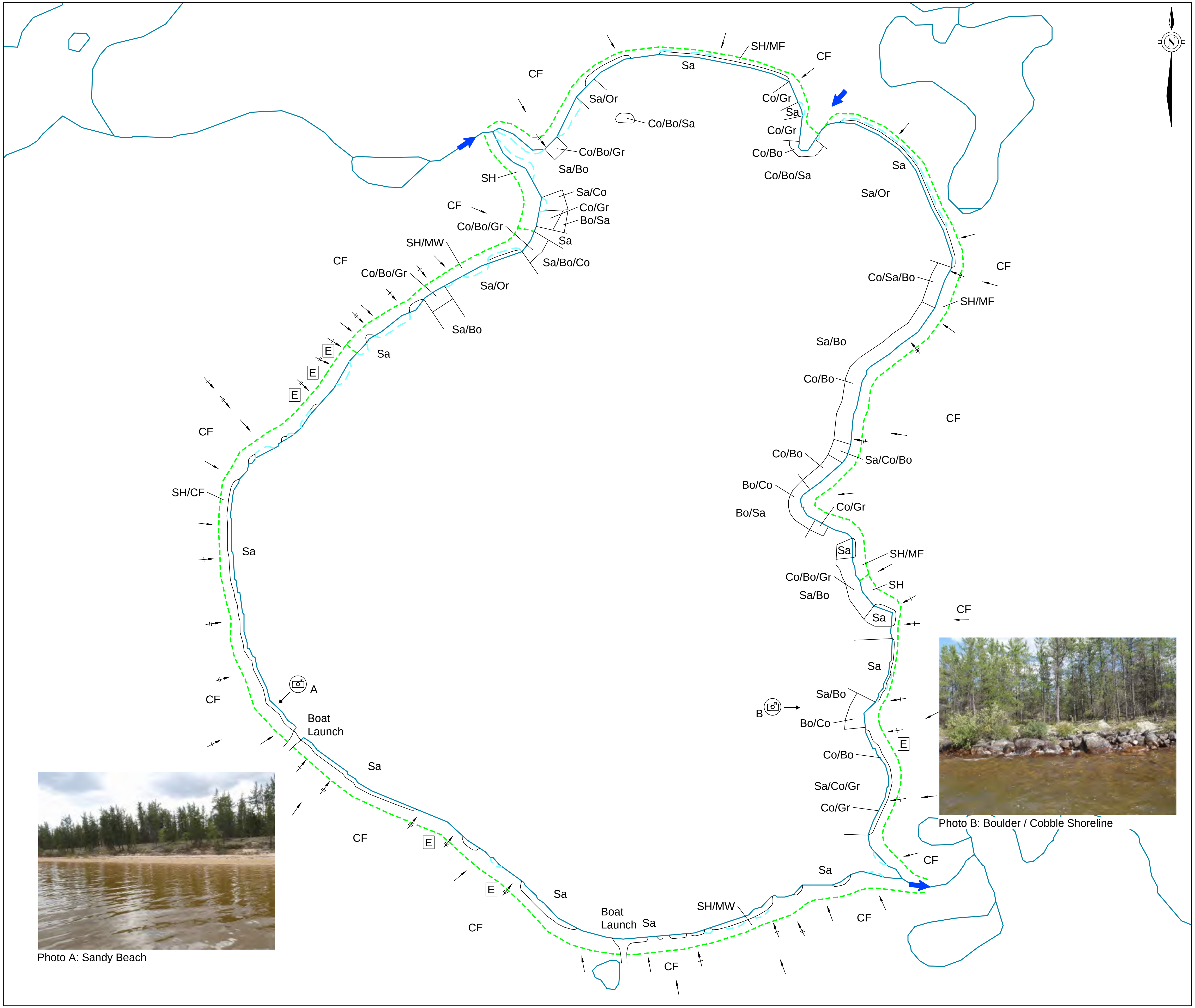

Photo A: Sandy Beach

Photo B: Boulder / Cobble Shoreline

REFERENCE

DIGITIZED FROM FIELD SKETCH
NTS MAPSHEET 74H/06, 74H/11
NAD83 UTM ZONE 14

150 0 150

SCALE 1:7,500 METRES

PROJECT

DENISON MINES CORPORATION
WHEELER RIVER PROJECT

TITLE

HABITAT MAP
LAKE LA1

Golder Associates
Saskatoon, Saskatchewan

PROJECT		12-1362-0050	FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
CADD	BDS	16/01/13	FIGURE: D1	
CHECK	BDH	27/05/13		
REVIEW	BLC	27/05/13		

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Legend - Lakes, Wetlands, Ponds

Substrate Types	
Cl	Clay
Si	Silt
Sa	Sand
Gr	Gravel
Co	Cobble
Bo	Boulder
Bd	Bedrock
Or	Organic

Habitat Features		
XXXX	BD	Beaver Dam
	MD	Man-Made Dam
	BL	Beaver Lodge
	BG	Boulder Garden
		Bridge
		Culvert
	DP	Debris Pile
	EM	Emergent Vegetation
		Flow Direction
	ISC	Instream Cover
	IV	Instream Vegetation
	INV	Inundated Vegetation
	LWD	Large Woody Debris
	LE	Ledge
	LJ	Log Jam
	LS	Landslide
	MIL	Multiple Island
	OHV	Overhanging Vegetation
	OHC	Overhead Cover
	RW	Root Wad
		Sand Bar
	SIL	Singular Island
	SWD	Small Woody Debris
	SM	Submergent Vegetation
	UCB	Undercut Bank
	USB	Unstable Bank

Sample Type Symbols		
		Water
		Sediment
		Benthic
		Fish

Bank/Upland Vegetation Types		
	BA	Bare Ground
	OT	Open Tundra
	MU	Muskeg/Bog
	DF	Deciduous Forest
	CF	Coniferous Forest
	MW	Mixedwood Forest
	GS	Grassland
	GF	Grass/Forbs
	GF/SH	Grass/Forbs/Shrubs
	SE	Sedge
	SH	Shrubs
	EM	Emergent Vegetation
	MO	Moss
	OR	Organic

Bank Slope	
	Shallow Slope (0-5%)
	Intermediate Slope (6-30%)
	Steep Slope (31-70%)
	Very Steep Slope (>70%)

Bank Instability Ratings	
A	Aggrading
E	Eroding
S	Slumping
G	Gullying

Capture Methods		
	BP	Electrofishing - Backpack
	EF	Electrofishing - Boat
	GN	Gill Net
	SN	Seine
	FF	Fish Fence
	MT	Minnow Trap
	AN	Angling
	HN/TN	Hoop Net/Trap Net

General	
C	Photo Location/Direction
	Habitat Type Divider
	Fish Bearing/Potential Bearing Watercourse
	Width
	Depth

Site Summary Symbol

Lake (L), Wetland (W) or Pond (P)
Surface Area (ha)
Main Shoreline Perimeter (m)
Max Depth (m)
Secchi Depth (m)
Dissolved Oxygen (mg/L)
Conductivity (µS/cm)
pH

Fish Species

Notes:
ha = hectares
m = metres
mg/L = milligrams per litre
µS/cm = microseimens per centimetre
Max depth was the depth recorded at sampling locations.

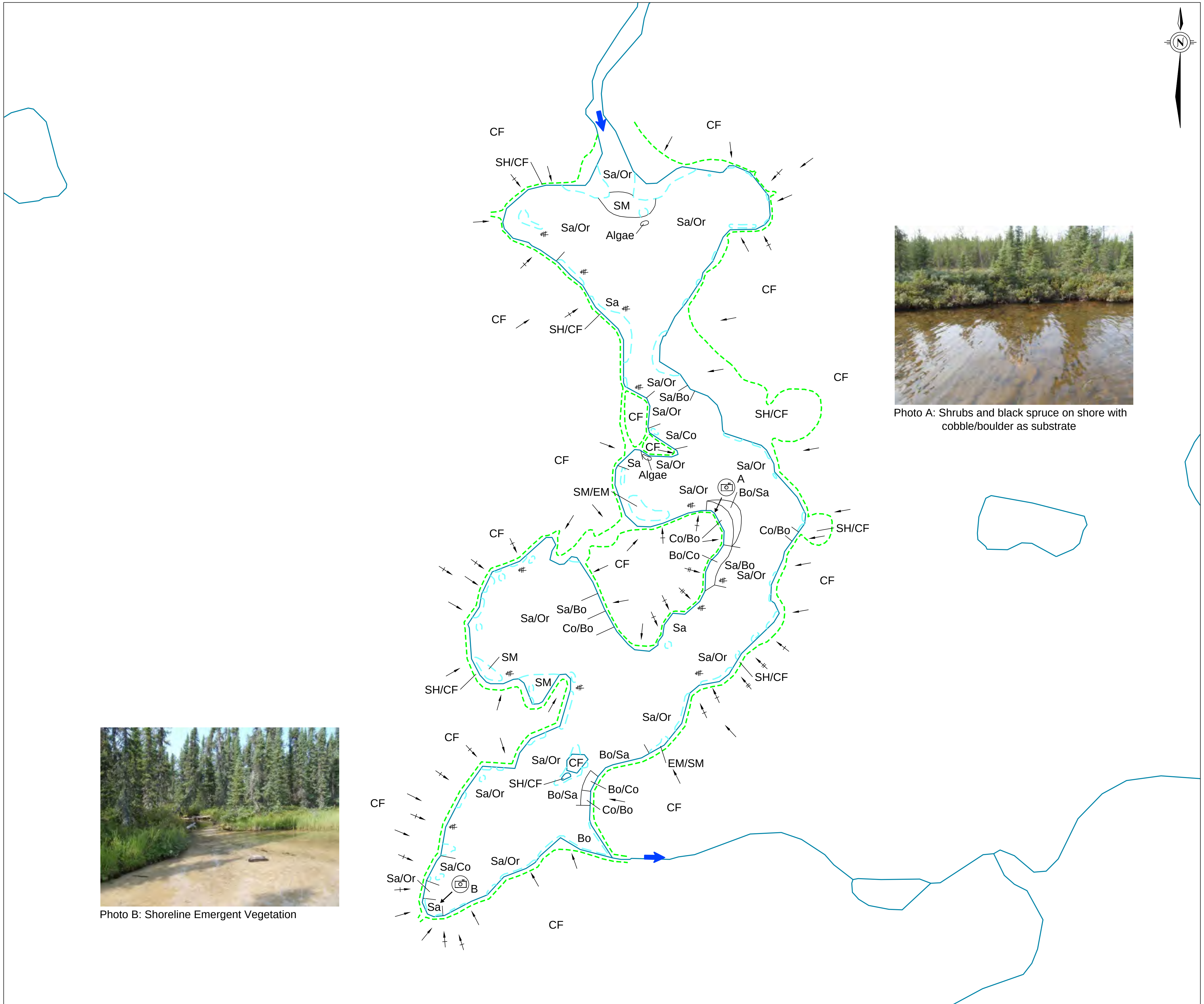

Photo A: Shrubs and black spruce on shore with cobble/boulder as substrate

Photo B: Shoreline Emergent Vegetation

REFERENCE

DIGITIZED FROM FIELD SKETCH
NTS MAPSHEET 74H/06, 74H/11
NAD83 UTM ZONE 14

PROJECT

DENISON MINES CORPORATION
WHEELER RIVER PROJECT

TITLE

HABITAT MAP
LAKE LA5

Golder Associates
Saskatoon, Saskatchewan

PROJECT	12-1362-0050		FILE No.			
DESIGN			SCALE	AS SHOWN	REV.	0
CADD	BDS	16/01/13	FIGURE: D2			
CHECK	BDH	27/05/13				
REVIEW	BLC	27/05/13				

G:\CLIENTS\DENISON MINES\Wheeler River\Figures\12-1362-0050\Aquatics\Phase 2000\12-1362-0050 - Habitat Map LA5.dwg 1/31/2013 9:53 AM

Legend - Lakes, Wetlands, Ponds

Substrate Types	
Cl	Clay
Si	Silt
Sa	Sand
Gr	Gravel
Co	Cobble
Bo	Boulder
Bd	Bedrock
Or	Organic

Habitat Features		
XXXX	BD	Beaver Dam
	MD	Man-Made Dam
	BL	Beaver Lodge
	BG	Boulder Garden
		Bridge
		Culvert
	DP	Debris Pile
	EM	Emergent Vegetation
		Flow Direction
	ISC	Instream Cover
	IV	Instream Vegetation
	INV	Inundated Vegetation
	LWD	Large Woody Debris
	LE	Ledge
	LJ	Log Jam
	LS	Landslide
	MIL	Multiple Island
	OHV	Overhanging Vegetation
	OHC	Overhead Cover
	RW	Root Wad
		Sand Bar
	SIL	Singular Island
	SWD	Small Woody Debris
	SM	Submergent Vegetation
	UCB	Undercut Bank
	USB	Unstable Bank

Sample Type Symbols		
		Water
		Sediment
		Benthic
		Fish

Bank/Upland Vegetation Types		
	BA	Bare Ground
	OT	Open Tundra
	MU	Muskeg/Bog
	DF	Deciduous Forest
	CF	Coniferous Forest
	MW	Mixedwood Forest
	GS	Grassland
	GF	Grass/Forbs
	GF/SH	Grass/Forbs/Shrubs
	SE	Sedge
	SH	Shrubs
	EM	Emergent Vegetation
	MO	Moss
	OR	Organic

Bank Slope	
	Shallow Slope (0-5%)
	Intermediate Slope (6-30%)
	Steep Slope (31-70%)
	Very Steep Slope (>70%)

Bank Instability Ratings	
A	Aggrading
E	Eroding
S	Slumping
G	Gullying

Capture Methods		
	BP	Electrofishing - Backpack
	EF	Electrofishing - Boat
	GN	Gill Net
	SN	Seine
	FF	Fish Fence
	MT	Minnow Trap
	AN	Angling
	HN/TN	Hoop Net/Trap Net

General	
C	Photo Location/Direction
	Habitat Type Divider
	Fish Bearing/Potential Bearing Watercourse
	Width
	Depth

Site Summary Symbol

Lake (L), Wetland (W) or Pond (P)
Surface Area (ha)
Main Shoreline Perimeter (m)
Max Depth (m)
Secchi Depth (m)
Dissolved Oxygen (mg/L)
Conductivity (µS/cm)
pH

Fish Species

Notes:
ha = hectares
m = metres
mg/L = milligrams per litre
µS/cm = microseimens per centimetre
Max depth was the depth recorded at sampling locations.

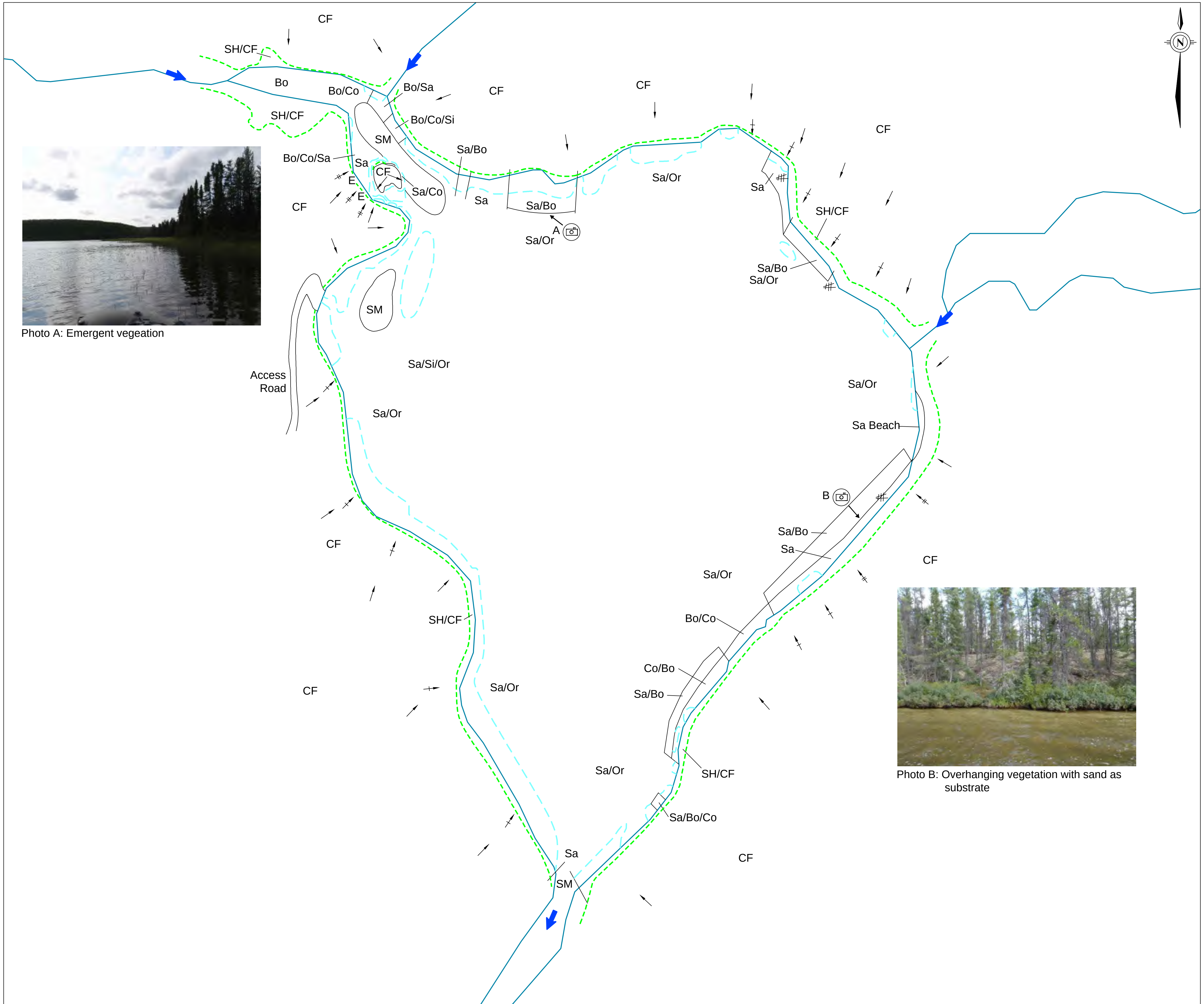

Photo A: Emergent vegeation

Photo B: Overhanging vegetation with sand as substrate

REFERENCE

DIGITIZED FROM FIELD SKETCH
NTS MAPSHEET 74H/11
NAD83 UTM ZONE 14

100 0 100

SCALE 1:4,000 METRES

PROJECT

DENISON MINES CORPORATION
WHEELER RIVER PROJECT

TITLE

HABITAT MAP
LAKE LA6

Golder Associates
Saskatoon, Saskatchewan

PROJECT	12-1362-0050		FILE No.
DESIGN			SCALE AS SHOWN REV. 0
CADD	TAH	18/01/13	**FIGURE: D3**
CHECK	BDH	27/05/13	
REVIEW	BLC	27/05/13	

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Legend - Lakes, Wetlands, Ponds

Substrate Types	
Cl	Clay
Si	Silt
Sa	Sand
Gr	Gravel
Co	Cobble
Bo	Boulder
Bd	Bedrock
Or	Organic

Habitat Features		
XXXX	BD	Beaver Dam
	MD	Man-Made Dam
	BL	Beaver Lodge
	BG	Boulder Garden
		Bridge
		Culvert
	DP	Debris Pile
	EM	Emergent Vegetation
		Flow Direction
	ISC	Instream Cover
	IV	Instream Vegetation
	INV	Inundated Vegetation
	LWD	Large Woody Debris
	LE	Ledge
	LJ	Log Jam
	LS	Landslide
	MIL	Multiple Island
	OHV	Overhanging Vegetation
	OHC	Overhead Cover
	RW	Root Wad
		Sand Bar
	SIL	Singular Island
	SWD	Small Woody Debris
	SM	Submergent Vegetation
	UCB	Undercut Bank
	USB	Unstable Bank

Sample Type Symbols		
		Water
		Sediment
		Benthic
		Fish

Bank/Upland Vegetation Types		
	BA	Bare Ground
	OT	Open Tundra
	MU	Muskeg/Bog
	DF	Deciduous Forest
	CF	Coniferous Forest
	MW	Mixedwood Forest
	GS	Grassland
	GF	Grass/Forbs
	GF/SH	Grass/Forbs/Shrubs
	SE	Sedge
	SH	Shrubs
	EM	Emergent Vegetation
	MO	Moss
	OR	Organic

Bank Slope	
	Shallow Slope (0-5%)
	Intermediate Slope (6-30%)
	Steep Slope (31-70%)
	Very Steep Slope (>70%)

Bank Instability Ratings	
A	Aggrading
E	Eroding
S	Slumping
G	Gullying

Capture Methods		
	BP	Electrofishing - Backpack
	EF	Electrofishing - Boat
	GN	Gill Net
	SN	Seine
	FF	Fish Fence
	MT	Minnow Trap
	AN	Angling
	HN/TN	Hoop Net/Trap Net

General	
C	Photo Location/Direction
	Habitat Type Divider
	Fish Bearing/Potential Bearing Watercourse
	Width
	Depth

Site Summary Symbol

Lake (L), Wetland (W) or Pond (P) / Surface Area (ha) / Main Shoreline Perimeter (m) / Max Depth (m) / Secchi Depth (m) / Dissolved Oxygen (mg/L) / Conductivity (µS/cm) / pH

Fish Species

Notes:
ha = hectares
m = metres
mg/L = milligrams per litre
µS/cm = microseimens per centimetre
Max depth was the depth recorded at sampling locations.

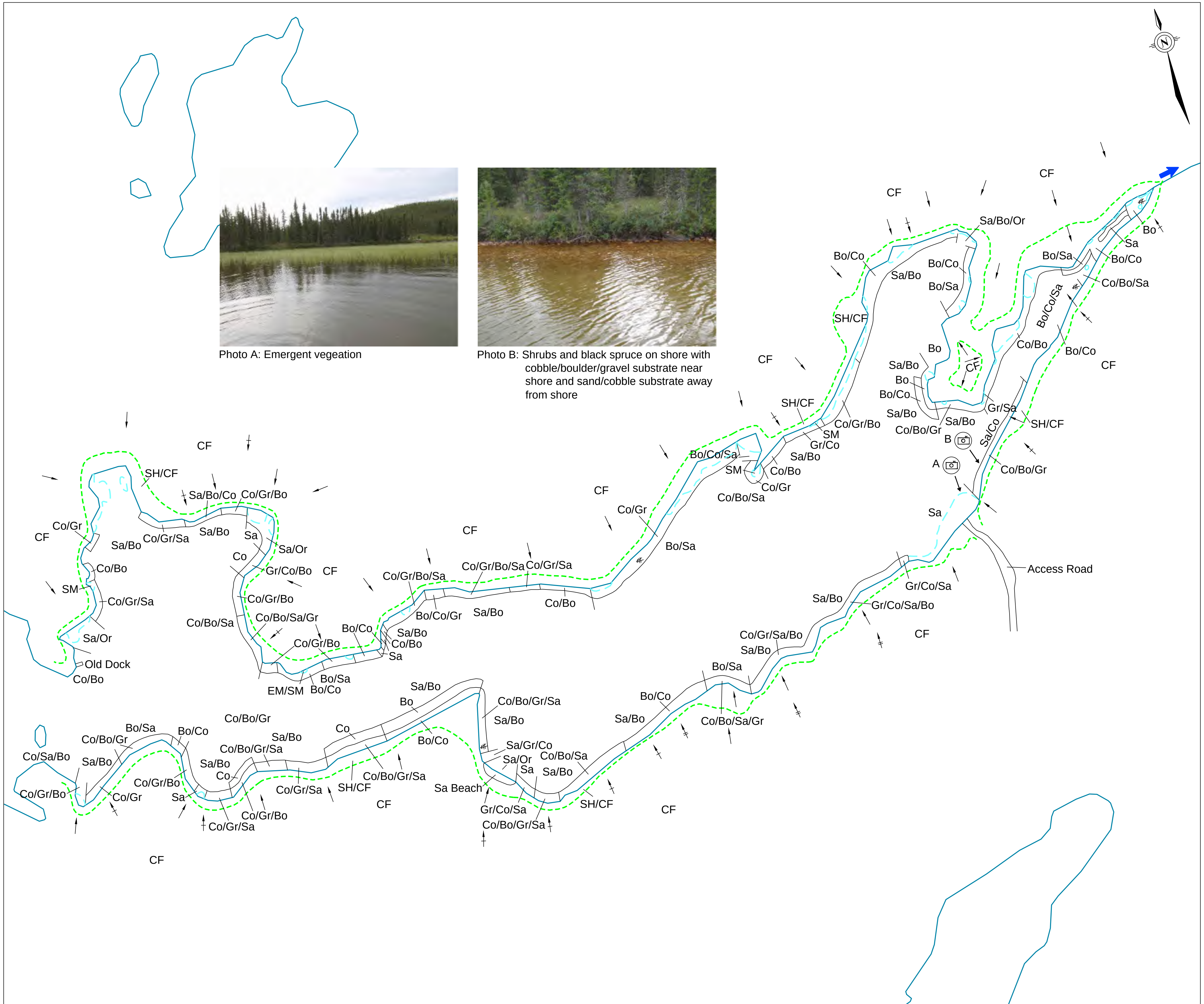


Photo A: Emergent vegeation

Photo B: Shrubs and black spruce on shore with cobble/boulder/gravel substrate near shore and sand/cobble substrate away from shore

REFERENCE
DIGITIZED FROM FIELD SKETCH
NTS MAPSHEET 74H/11
NAD83 UTM ZONE 14

200 0 200
SCALE 1:8,000 METRES

PROJECT
DENISON MINES CORPORATION
WHEELER RIVER PROJECT

TITLE
HABITAT MAP KRATCHKOWSKY LAKE (SOUTH-EAST BAY)

Golder Associates
Saskatoon, Saskatchewan

PROJECT		12-1362-0050	FILE No.
DESIGN			SCALE AS SHOWN REV. 0
CADD	BDS	22/01/13	
CHECK	BDH	27/05/13	**FIGURE: D4**
REVIEW	BLC	27/05/13	

G:\CLIENTS\DENISON MINES\Wheeler River\Figures\12-1362-0050\Aquatics\Phase 2000\12-1362-0050 - Habitat Map LA7.dwg 1/31/2013 9:57 AM

Legend - Lakes, Wetlands, Ponds

Substrate Types	
Cl	Clay
Si	Silt
Sa	Sand
Gr	Gravel
Co	Cobble
Bo	Boulder
Bd	Bedrock
Or	Organic

Habitat Features		
XXXX	BD	Beaver Dam
	MD	Man-Made Dam
	BL	Beaver Lodge
	BG	Boulder Garden
		Bridge
		Culvert
	DP	Debris Pile
	EM	Emergent Vegetation
		Flow Direction
	ISC	Instream Cover
	IV	Instream Vegetation
	INV	Inundated Vegetation
	LWD	Large Woody Debris
	LE	Ledge
	LJ	Log Jam
	LS	Landslide
	MIL	Multiple Island
	OHV	Overhanging Vegetation
	OHC	Overhead Cover
	RW	Root Wad
		Sand Bar
	SIL	Singular Island
	SWD	Small Woody Debris
	SM	Submergent Vegetation
	UCB	Undercut Bank
	USB	Unstable Bank

Sample Type Symbols		
		Water
		Sediment
		Benthic
		Fish

Bank/Upland Vegetation Types		
	BA	Bare Ground
	OT	Open Tundra
	MU	Muskeg/Bog
	DF	Deciduous Forest
	CF	Coniferous Forest
	MW	Mixedwood Forest
	GS	Grassland
	GF	Grass/Forbs
	GF/SH	Grass/Forbs/Shrubs
	SE	Sedge
	SH	Shrubs
	EM	Emergent Vegetation
	MO	Moss
	OR	Organic

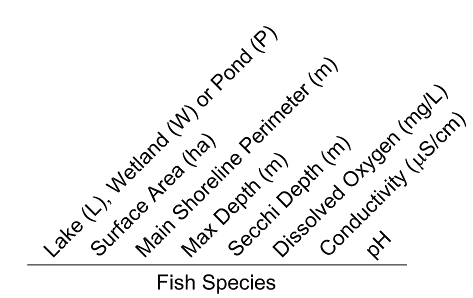
Bank Slope	
	Shallow Slope (0-5%)
	Intermediate Slope (6-30%)
	Steep Slope (31-70%)
	Very Steep Slope (>70%)

Bank Instability Ratings	
A	Aggrading
E	Eroding
S	Slumping
G	Gullying

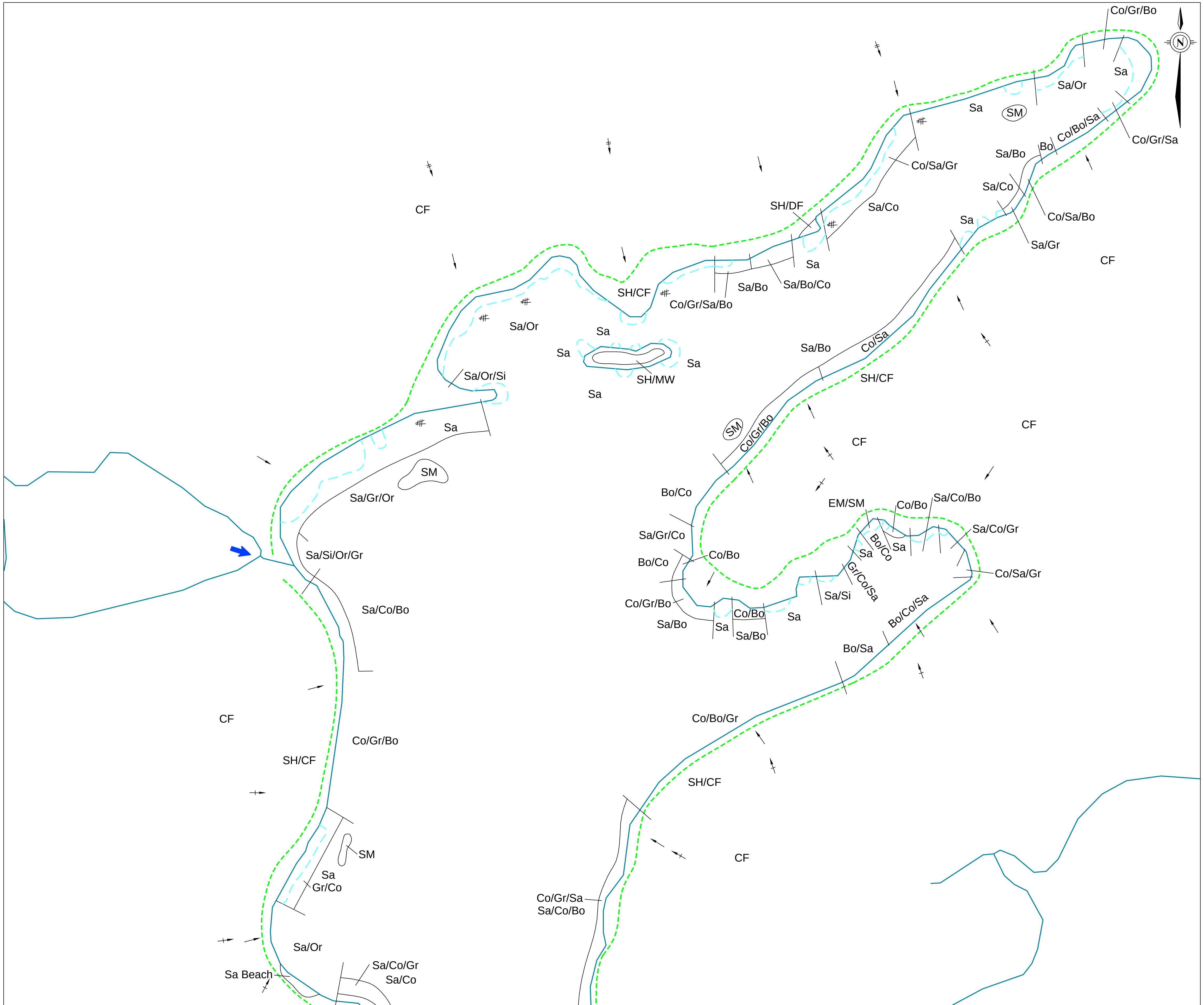
Capture Methods		
	BP	Electrofishing - Backpack
	EF	Electrofishing - Boat
	GN	Gill Net
	SN	Seine
	FF	Fish Fence
	MT	Minnow Trap
	AN	Angling
	HN/TN	Hoop Net/Trap Net

General	
C	Photo Location/Direction
	Habitat Type Divider
	Fish Bearing/Potential Bearing Watercourse
	Width
	Depth

Site Summary Symbol



Notes:
ha = hectares
m = metres
mg/L = milligrams per litre
µS/cm = microseimens per centimetre
Max depth was the depth recorded at sampling locations.



NOTES
* LOCAL LAKE NAME

REFERENCE
DIGITIZED FROM FIELD SKETCH
NTS MAPSHEET 74H/06, 74H/11
NAD83 UTM ZONE 14

100 0 100
SCALE 1:6,000 METRES

PROJECT

DENISON MINES CORPORATION
WHEELER RIVER PROJECT

TITLE

HABITAT MAP
NORTH HALF OF WILLIAMS LAKE*

PROJECT	12-1362-0050	FILE No.	
DESIGN		SCALE AS SHOWN	REV. 0
CADD	TAH	22/01/13	
CHECK	BDH	27/05/13	
REVIEW	BLC	27/05/13	

Golder Associates
Saskatoon, Saskatchewan

FIGURE: D5a

G:\CLIENTS\DENISON MINES\Wheeler River\Figures\12-1362-0050\Aquatics\Phase 2000\12-1362-0050 - Habitat Map LA3.dwg 1/31/2013 10:02 AM

Legend - Lakes, Wetlands, Ponds

Substrate Types	
Cl	Clay
Si	Silt
Sa	Sand
Gr	Gravel
Co	Cobble
Bo	Boulder
Bd	Bedrock
Or	Organic

Habitat Features		
XXXX	BD	Beaver Dam
	MD	Man-Made Dam
	BL	Beaver Lodge
	BG	Boulder Garden
		Bridge
		Culvert
	DP	Debris Pile
	EM	Emergent Vegetation
		Flow Direction
	ISC	Instream Cover
	IV	Instream Vegetation
	INV	Inundated Vegetation
	LWD	Large Woody Debris
	LE	Ledge
	LJ	Log Jam
	LS	Landslide
	MIL	Multiple Island
	OHV	Overhanging Vegetation
	OHC	Overhead Cover
	RW	Root Wad
		Sand Bar
	SIL	Singular Island
	SWD	Small Woody Debris
	SM	Submergent Vegetation
	UCB	Undercut Bank
	USB	Unstable Bank

Sample Type Symbols		
		Water
		Sediment
		Benthic
		Fish

Bank/Upland Vegetation Types		
	BA	Bare Ground
	OT	Open Tundra
	MU	Muskeg/Bog
	DF	Deciduous Forest
	CF	Coniferous Forest
	MW	Mixedwood Forest
	GS	Grassland
	GF	Grass/Forbs
	GF/SH	Grass/Forbs/Shrubs
	SE	Sedge
	SH	Shrubs
	EM	Emergent Vegetation
	MO	Moss
	OR	Organic

Bank Slope	
	Shallow Slope (0-5%)
	Intermediate Slope (6-30%)
	Steep Slope (31-70%)
	Very Steep Slope (>70%)

Bank Instability Ratings	
A	Aggrading
E	Eroding
S	Slumping
G	Gullying

Capture Methods		
	BP	Electrofishing - Backpack
	EF	Electrofishing - Boat
	GN	Gill Net
	SN	Seine
	FF	Fish Fence
	MT	Minnow Trap
	AN	Angling
	HN/TN	Hoop Net/Trap Net

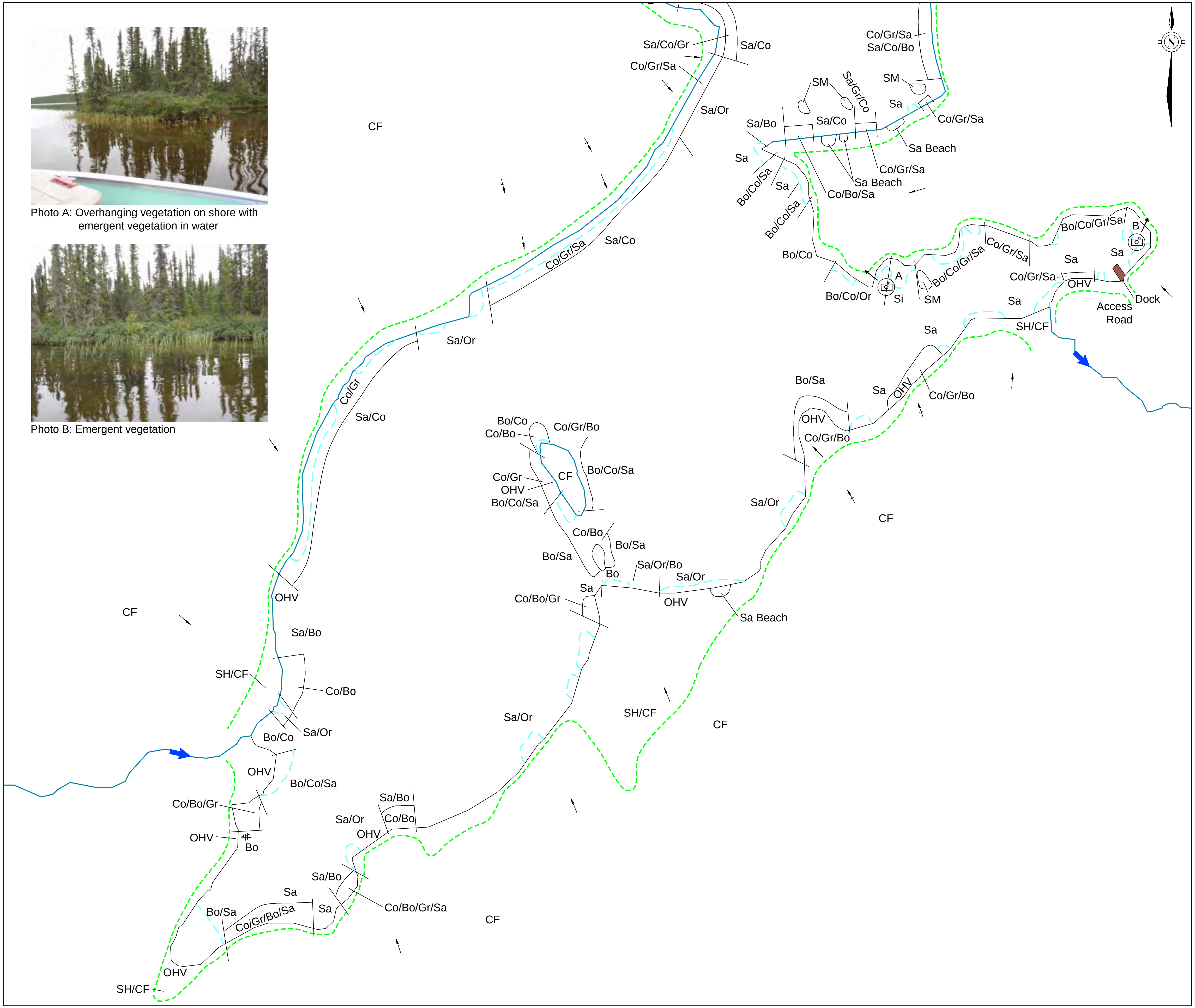
General	
C	Photo Location/Direction
	Habitat Type Divider
	Fish Bearing/Potential Bearing Watercourse
	Width
	Depth

Site Summary Symbol

Lake (L), Wetland (W) or Pond (P)
Surface Area (ha)
Main Shoreline Perimeter (m)
Max Depth (m)
Secchi Depth (m)
Dissolved Oxygen (mg/L)
Conductivity (µS/cm)
pH

Fish Species

Notes:
ha = hectares
m = metres
mg/L = milligrams per litre
µS/cm = microseimens per centimetre
Max depth was the depth recorded at sampling locations.



NOTES
* LOCAL LAKE NAME

REFERENCE
DIGITIZED FROM FIELD SKETCH
NTS MAPSHEET 74H/06, 74H/11
NAD83 UTM ZONE 14

100 0 100
SCALE 1:6,000 METRES

PROJECT
DENISON MINES CORPORATION
WHEELER RIVER PROJECT

TITLE
HABITAT MAP
SOUTH HALF OF WILLIAMS LAKE*

Golder Associates
Saskatoon, Saskatchewan

PROJECT		12-1362-0050	FILE No.
DESIGN			SCALE AS SHOWN REV. 0
CADD	TAH	22/01/13	FIGURE: D5b
CHECK	BDH	27/05/13	
REVIEW	BLC	27/05/13	

G:\CLIENTS\DENISON MINES\Wheeler River\Figures\12-1362-0050\Aquatics\Phase 2000\12-1362-0050 - Habitat Map LA3.dwg 1/31/2013 10:02 AM

Legend - Lakes, Wetlands, Ponds

Substrate Types	
Cl	Clay
Si	Silt
Sa	Sand
Gr	Gravel
Co	Cobble
Bo	Boulder
Bd	Bedrock
Or	Organic

Habitat Features		
XXXX	BD	Beaver Dam
	MD	Man-Made Dam
	BL	Beaver Lodge
	BG	Boulder Garden
		Bridge
		Culvert
	DP	Debris Pile
	EM	Emergent Vegetation
		Flow Direction
	ISC	Instream Cover
	IV	Instream Vegetation
	INV	Inundated Vegetation
	LWD	Large Woody Debris
	LE	Ledge
	LJ	Log Jam
	LS	Landslide
	MIL	Multiple Island
	OHV	Overhanging Vegetation
	OHC	Overhead Cover
	RW	Root Wad
		Sand Bar
	SIL	Singular Island
	SWD	Small Woody Debris
	SM	Submergent Vegetation
	UCB	Undercut Bank
	USB	Unstable Bank

Sample Type Symbols		
		Water
		Sediment
		Benthic
		Fish

Bank/Upland Vegetation Types		
	BA	Bare Ground
	OT	Open Tundra
	MU	Muskeg/Bog
	DF	Deciduous Forest
	CF	Coniferous Forest
	MW	Mixedwood Forest
	GS	Grassland
	GF	Grass/Forbs
	GF/SH	Grass/Forbs/Shrubs
	SE	Sedge
	SH	Shrubs
	EM	Emergent Vegetation
	MO	Moss
	OR	Organic

Bank Slope	
	Shallow Slope (0-5%)
	Intermediate Slope (6-30%)
	Steep Slope (31-70%)
	Very Steep Slope (>70%)

Bank Instability Ratings	
A	Aggrading
E	Eroding
S	Slumping
G	Gullying

Capture Methods		
	BP	Electrofishing - Backpack
	EF	Electrofishing - Boat
	GN	Gill Net
	SN	Seine
	FF	Fish Fence
	MT	Minnow Trap
	AN	Angling
	HN/TN	Hoop Net/Trap Net

General	
C	Photo Location/Direction
	Habitat Type Divider
	Fish Bearing/Potential Bearing Watercourse
	Width
	Depth

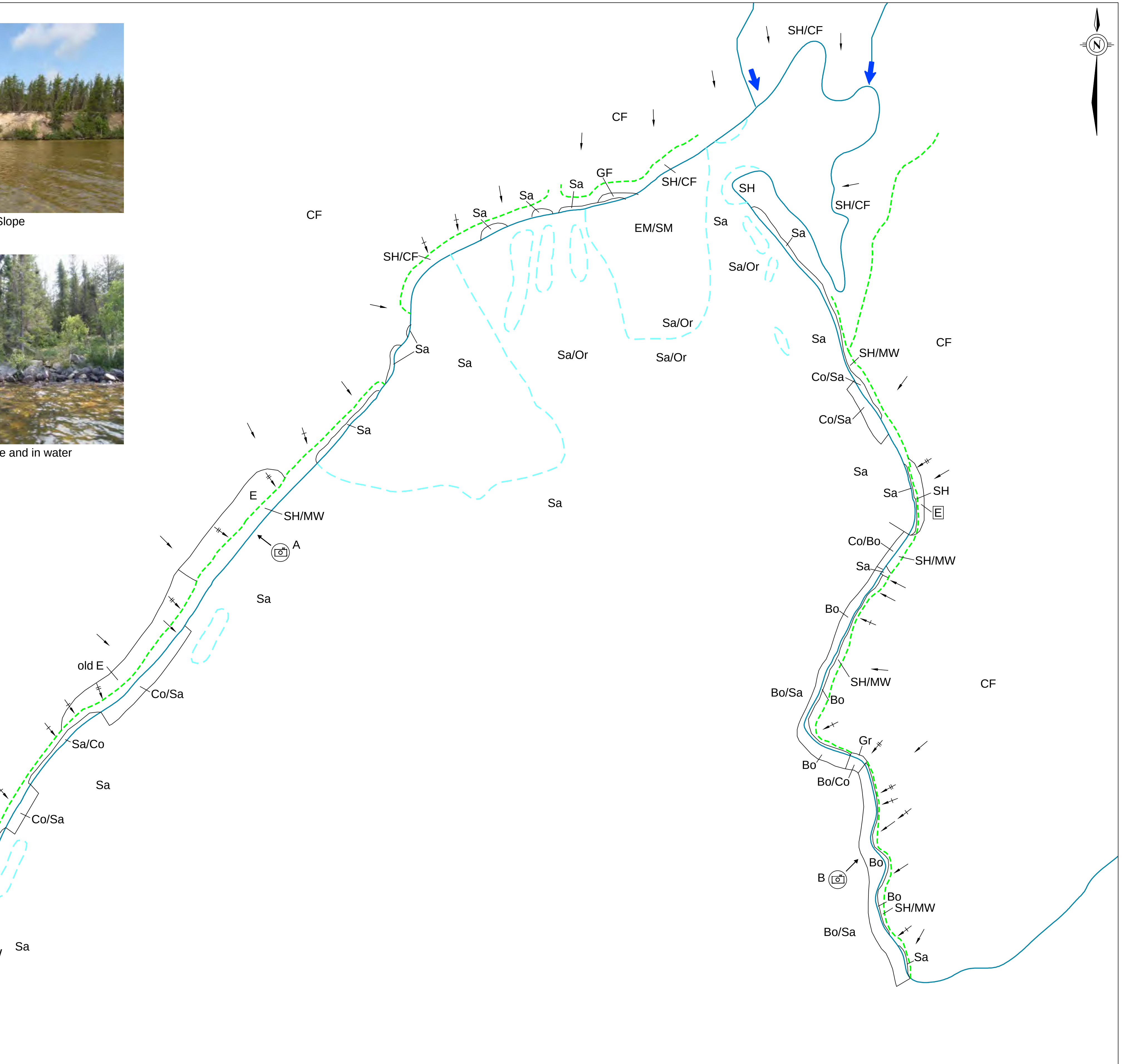
Site Summary Symbol

Lake (L), Wetland (W) or Pond (P)
Surface Area (ha)
Main Shoreline Perimeter (m)
Max Depth (m)
Secchi Depth (m)
Dissolved Oxygen (mg/L)
Conductivity (µS/cm)
pH
Fish Species

Notes:
ha = hectares
m = metres
mg/L = milligrams per litre
µS/cm = microseimens per centimetre
Max depth was the depth recorded at sampling locations.

Photo A: Active Eroding Slope

Photo B: Boulder on shore and in water



REFERENCE
DIGITIZED FROM FIELD SKETCH
NTS MAPSHEET 74H/11
NAD83 UTM ZONE 14

100 0 100
SCALE 1:5,000 METRES

PROJECT
DENISON MINES CORPORATION
WHEELER RIVER PROJECT

TITLE
HABITAT MAP
RUSSELL LAKE
(ICELANDER RIVER OUTLET BAY)

Golder Associates
Saskatoon, Saskatchewan

PROJECT	12-1362-0050		FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
CADD	BDS	23/01/13		
CHECK	BDH	27/05/13	FIGURE: D6	
REVIEW	BLC	27/05/13		

G:\CLIENTS\DENISON MINES\Wheeler River\Figures\12-1362-0050\Aquatics\Phase 2000\12-1362-0050 - Habitat Map Russell Lake.dwg 1/31/2013 10:04 AM

Legend - Lakes, Wetlands, Ponds

Substrate Types	
Cl	Clay
Si	Silt
Sa	Sand
Gr	Gravel
Co	Cobble
Bo	Boulder
Bd	Bedrock
Or	Organic

Habitat Features		
XXXX	BD	Beaver Dam
	MD	Man-Made Dam
	BL	Beaver Lodge
	BG	Boulder Garden
		Bridge
		Culvert
	DP	Debris Pile
	EM	Emergent Vegetation
		Flow Direction
	ISC	Instream Cover
	IV	Instream Vegetation
	INV	Inundated Vegetation
	LWD	Large Woody Debris
	LE	Ledge
	LJ	Log Jam
	LS	Landslide
	MIL	Multiple Island
	OHV	Overhanging Vegetation
	OHC	Overhead Cover
	RW	Root Wad
		Sand Bar
	SIL	Singular Island
	SWD	Small Woody Debris
	SM	Submergent Vegetation
	UCB	Undercut Bank
	USB	Unstable Bank

Sample Type Symbols		
		Water
		Sediment
		Benthic
		Fish

Bank/Upland Vegetation Types		
	BA	Bare Ground
	OT	Open Tundra
	MU	Muskeg/Bog
	DF	Deciduous Forest
	CF	Coniferous Forest
	MW	Mixedwood Forest
	GS	Grassland
	GF	Grass/Forbs
	GF/SH	Grass/Forbs/Shrubs
	SE	Sedge
	SH	Shrubs
	EM	Emergent Vegetation
	MO	Moss
	OR	Organic

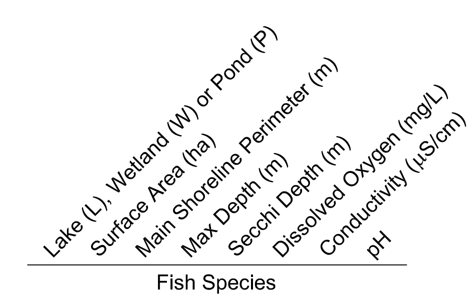
Bank Slope	
	Shallow Slope (0-5%)
	Intermediate Slope (6-30%)
	Steep Slope (31-70%)
	Very Steep Slope (>70%)

Bank Instability Ratings	
A	Aggrading
E	Eroding
S	Slumping
G	Gullying

Capture Methods		
	BP	Electrofishing - Backpack
	EF	Electrofishing - Boat
	GN	Gill Net
	SN	Seine
	FF	Fish Fence
	MT	Minnow Trap
	AN	Angling
	HN/TN	Hoop Net/Trap Net

General	
C	Photo Location/Direction
	Habitat Type Divider
	Fish Bearing/Potential Bearing Watercourse
	Width
	Depth

Site Summary Symbol



Notes:
ha = hectares
m = metres
mg/L = milligrams per litre
µS/cm = microseimens per centimetre
Max depth was the depth recorded at sampling locations.

At Golder Associates we strive to be the most respected global company providing consulting, design, and construction services in earth, environment, and related areas of energy. Employee owned since our formation in 1960, our focus, unique culture and operating environment offer opportunities and the freedom to excel, which attracts the leading specialists in our fields. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America, and South America.

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Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
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South America	+ 55 21 3095 9500

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Saskatoon, Saskatchewan, Canada S7H 0T4
Canada
T: +1 (306) 665 7989

Appendix G EcoMetrix Incorporated. 2019. 2011-2019 Hydrology Baseline Summary Report for Wheeler River Project

2011 – 2019 BASELINE HYDROLOGY SUMMARY REPORT - WHEELER RIVER PROJECT, DENISON MINES

Report prepared for:

DENISON MINES CORP.
230 22nd Street East, Suite 200
Saskatoon, SK
S7K 0E9, Canada

Report prepared by:

ECOMETRIX INCORPORATED
www.ecometrix.ca
Mississauga, ON

Ref. 19-2589
25 March 2020

EcoMetrix
INCORPORATED

2011 – 2019 BASELINE HYDROLOGY SUMMARY REPORT - WHEELER RIVER PROJECT, DENISON MINES

Fei Luo, PhD
Project Manager

Brian Fraser, MSc
Project Principal and Reviewer

EXECUTIVE SUMMARY

The Denison Mines Corp. (Denison) Wheeler River Project (Project) is located in north central Saskatchewan, in the eastern portion of the Athabasca Basin. It is situated approximately 35 kilometres northeast of Cameco Corporation's Key Lake Operation and 35 kilometres southwest of Cameco Corporation's McArthur River Operation. Hydrology baseline studies in the Project area are required to support feasibility engineering studies, technical assessments and environmental approvals processes. EcoMetrix Incorporated (EcoMetrix) was retained by Denison to implement hydrology baseline studies over the period 2016 through 2019 and to synthesize this more recent data with existing hydrological information for the study area. The current understanding of hydrological conditions in the study area based on the full hydrological data set is provided herein.

Project Site Setting

The Project site is located in the Athabasca Plain Ecoregion that extends south from Lake Athabasca to Cree Lake. The area is characterized as a morainal plain, with southwest trending drumlins and eskers and glaciofluvial outwash areas overlying Athabasca sandstones. Numerous interconnected lakes occur in the area, along with low-lying, poorly drained areas of muskeg. The area is in the subarctic climate zone with long, usually cold winters, and short, cool to mild summers. The ice-covered season extends from late October to late April or early May. Precipitation in the Project area is low throughout the year, and mostly occurs in the warmer months.

The Project area lies within the Wheeler River watershed, which is part of the Churchill River Basin. Surface water from the Project site is drained by two sub-basins of the Wheeler River, the Icelander River drainage and the Williams Lake drainage. Both drainages flow generally south into the northwest portion of Russell Lake. The estimated drainage areas of the Icelander River and the Williams Lake drainages are 371 km^2 and 78 km^2, respectively. Downstream of Russell Lake, the Wheeler River flows into the Geikie River, which subsequently discharges to Wollaston Lake.

2011 to 2014 Hydrological Characterization Program

Golder Associates (Golder) surveyed and summarized the hydrological characteristics of the Project site over the period 2011 to 2014. Water elevation survey locations were established at nine stream stations and eleven lake stations. Manual flow measurements were performed at each of the nine stream stations, and automated stream elevation instruments (level data loggers) were installed at all stream stations. Rating curves were established for each station based on the manual stream discharge measurements to permit estimation of hydrographic profiles for each location. The hydrological data collected during this period indicated that the average daily streamflow at the most downstream location in the Icelander River and the Williams Lake drainage areas ranged from 0.84 to

3.13 m^3/s and 0.067 to 1.5 m^3/s, respectively. Lake and pond surface water elevations ranged from 520.42 masl in the headwater lake of the Icelander River drainage to 488.24 masl at Russell Lake.

2016 to 2019 Hydrological Characterization Program

Hydrological surveys conducted between 2016 and 2019 built on the hydrological baseline work completed from 2011 to 2014. In addition to the previously established hydrometric stations, seven new stream stations and four new lake and pond stations were established. The scope of the 2016 to 2019 program included: the measurement of water level elevations at thirteen lakes and two ponds within the study area; the collection of manual streamflow measurements at seventeen watercourses to validate existing rating curves or establish rating curves for new monitoring locations; and, the installation of continuous streamflow monitoring equipment at eight stream locations in 2016 and elevation data loggers at two lake locations in 2018 and 2019. Six field programs were completed from fall 2016 to summer 2019 to capture seasonal flow conditions in spring, summer and fall. One winter field program was completed between March 15 and 19, 2018, to assess ice cover in the area and to gain a better understanding of winter baseflow conditions.

Key Hydrological Characteristics of the Study Area

Over the entire monitoring program (2011 to 2019), lake and pond surface water elevations ranged from 520.86 masl in the Icelander River drainage area headwater lake LA-8 to 487.99 masl at Russell Lake. In the Icelander River basin, water level elevations at the stream stations ranged from 520.84 masl at SA-11 to 492.55 masl at the most downstream station SA-1. In Williams River drainage area, water levels at stream stations ranged from 519.24 masl at SB-4, to 488.34 masl at the most downstream station. The hydrological data collected also indicated that the average daily streamflow at the most downstream location in the Icelander River and the Williams Lake drainage areas ranged from 0.655 to 3.23 m^3/s and 0.067 to 1.5 m^3/s, respectively.

Currently, continuous monitoring equipment is installed in stream stations SA-1, SA-4, SA-5, SA-6, SA-8, SA-9, SA-10, and SA-11, and lake station LA-1. For SA-1, SA-4, SA-5, SA-6 and SA-11, the water level data can be used to estimate stream flow using established rating curve relationships. Rating curves have not yet been established at other stations, as more manual stream measurements are needed over the range of expected flows to adequately characterize the relationship between stage and discharge.

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1.0 INTRODUCTION

EcoMetrix Incorporated (EcoMetrix) was retained by Denison Mines Corp. (Denison) to undertake hydrological baseline studies over the period 2016 through 2019 at the Wheeler River Project (Project) site that is located in the eastern portion of the Athabasca Basin region in northern Saskatchewan. Hydrology baseline studies in the Project area are required to support feasibility design and engineering studies, technical assessments and environmental approvals processes. The information collected over the period 2016 through 2019 has been synthesized with existing hydrological information in order to characterize the current understanding of hydrological conditions in the study area.

The Wheeler River hydrology baseline project started in 2011. Golder Associated Ltd. (Golder) collected and analyzed field data from 2011 through 2014 (Golder, 2014; see Appendix D). This current report builds on the earlier hydrological survey work, documents and analyzes all hydrologic data collected to date, serving as an updated hydrology baseline report for the Project. To avoid repetition, discussion about study design and monitoring methods presented herein focuses on the monitoring efforts started from 2016 and extending through 2019.

1.1 Site Location and General Area Description

The Project is located in north central Saskatchewan, in the south-eastern portion of the Athabasca Basin region (**Figure 1-1**). It is situated approximately 35 kilometres (km) northeast of Cameco Corporation's Key Lake Operation and 35 km southwest of Cameco's McArthur River Operation. Access to the Project site is by the provincial highway system to the Key Lake mill, then by the ore haul road between the Key Lake and McArthur River operations that leads to the eastern part of the property.

The Project site is located in the Athabasca Plain Ecoregion which extends south from Lake Athabasca to Cree Lake (ESWG, 1996). The area in which the Project is located is characterized as a morainal plain, with southwest trending drumlins and eskers and glaciofluvial outwash areas overlying Athabasca sandstones. Numerous interconnected lakes occur in the area, along with low-lying, poorly drained areas of muskeg.

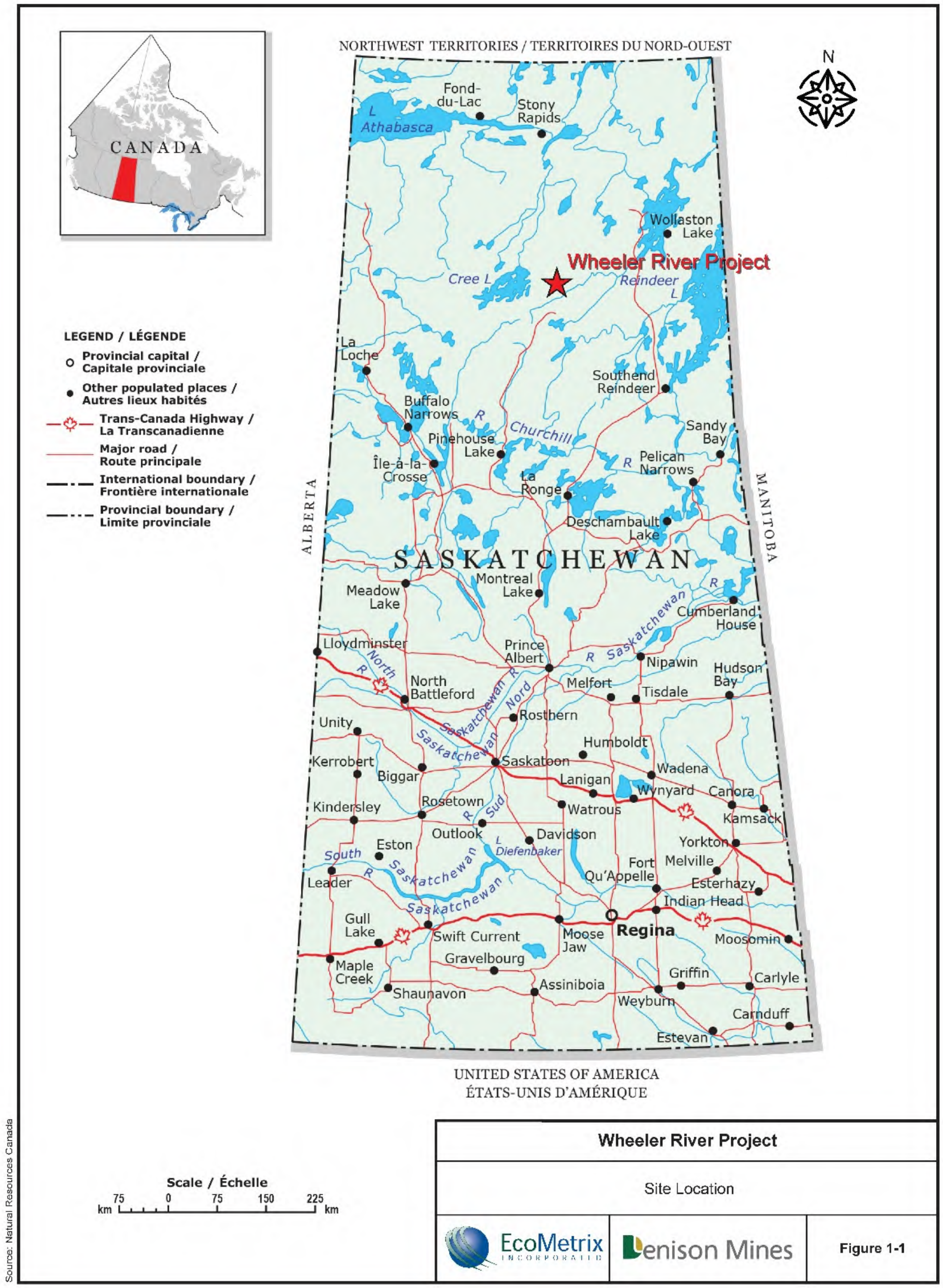

Figure 1-1: Location of the Wheeler River Project Site in north central Saskatchewan

1.2 Climate and Weather

Regional climatic characteristics are a function of various conditions, such as proximity to large bodies of water, altitude, and latitude. The Project site is in the subarctic climate zone that extends across mid and high latitude areas across the entirety of the country excluding coastal areas in the west. The subarctic climate zone is characterized by long, usually cold winters, and short, cool to mild summers. Precipitation in subarctic climates is typically low on an annual basis and precipitation occurs mostly in the warmer months in areas not influenced by coastal climate effects.

On a more local scale, climate conditions, such as temperature, precipitation, evaporation and other processes play a crucial role in the hydrological cycle. Historical climate data collected by Environment Canada and Climate Change (ECCC) weather stations near Key Lake are appropriate to characterize general climate and weather conditions for the Project site. There are three weather stations in the vicinity of Key Lake, though climate norm data were only available for Climate Station 4063755, and therefore data for this station were used to represent the Project site[1]. Data from Station 4063755 were not available subsequent to September 2018. Climate data collected at Station 4063753, situated approximately 1 km from Station 4063755, was used to represent the 2019 climate data for the Project site. Daily average monthly air temperatures are shown below in **Table 1-1**. On average, January is the coldest month and six months have average daily temperatures below 0°C. July is the warmest month with an average daily temperature of 16.3°C. The annual average daily temperature for the Key Lake Station is -2.3°C.

Table 1-1: Temperature norms (daily average per month, °C) reported for the Key Lake Weather Station

Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Avg
-22.3	-18.7	-11.7	-1.9	6.5	13.3	16.3	14.7	8.0	0.0	-11.8	-19.5	-2.3

Precipitation is the primary input of surface water and as such, it provides important context for observed flow characteristics. **Figure 1-2** presents the precipitation record for the period 2011 through 2019, as well as historical averages for comparison. The data are presented on the basis of hydrological years that run from October 1 of one year to September 30 of the following year.

Total annual precipitation for the period 2011 through 2019 was on average 473 mm, similar to the total annual average precipitation reported for the period 1981 through 2010

[1] http://climate.weather.gc.ca/historical_data/search_historic_data_e.html

(483 mm). On average, precipitation is the greatest through the warmer months of the year (June, July, August) and relatively low during winter months extending into early spring.

Yearly observations for the period of 2011 through 2019 are provided below in **Section 1.3**, along with observations of local hydrology, as the precipitations significantly impact discharge in the monitoring station.

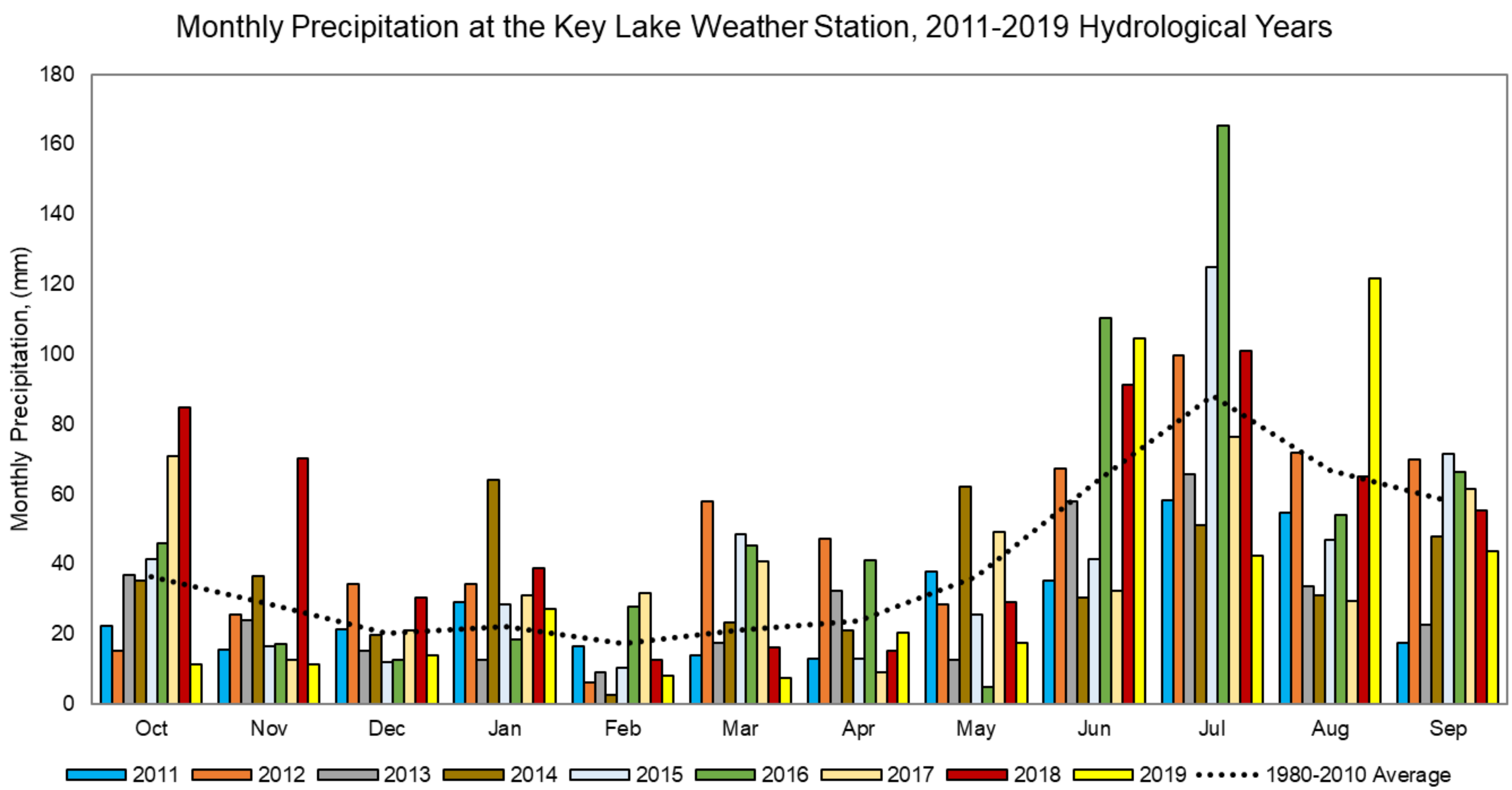

Figure 1-2: Key Lake Monthly Precipitation for Hydrological Years between 2011-2019 (ECCC, 2019).

1.3 Regional Hydrology

The Project site lies within the Wheeler River watershed, which is part of the Churchill River Basin. The Water Survey of Canada operates a hydrometric station on the Wheeler River downstream of Russell Lake (Station 06DA005). The station is located about 25 km east of the Project site and records flows from a contributing drainage area of 3,030 square kilometres (km^2). The hydrometric station has been in operation from 1973 to the present. Both real time and historical discharge and water level data are available in five minutes intervals. Although the drainage area of the hydrometric station is much larger than the drainage areas that are associated with surface water features on and around the Project site, as well as the Project site as a whole, the flow data collected at the station are relevant at the Project site level. The surface water features on the Project site are tributaries of the Wheeler River and land use on the Project site is characteristic of land use within the larger geographical area.

The mean monthly discharge rates at the Wheeler River for the period 2011 through 2019 are presented in **Figure 1-3**. Data corresponding to the period 1981 through 2010 are also presented in **Figure 1-3** for comparison. The data are presented on the basis of hydrological years that run from October 1 of one year to September 30 of the following year. It is noted that only provisional data are available for 2018 and 2019.

The annual average monthly discharge for the period 2011 through 2019 is on the order of 15 m^3/s, about 8% lower than the period 1981 through 2010. Average monthly flows for the period 2011 through 2019 ranged from 11.9 m^3/s in March to 19.6 m^3/s in June. The seasonal hydrograph for the river is represented by relatively low flows through the fall and winter, freshet-dominated flows that appear in May, peak in June and wane in July.

Yearly observations for period 2011 through 2019 are provided below, along with observations of annual precipitations:

- During the 2011 hydrological year (Oct 2010 to Sep 2011), the discharge at the Wheeler River monitoring station was slightly below the historical average throughout the winter (October–March) and remained well below average during the spring freshet (May and June), as well as the remainder of the summer and early fall. During this time, flows ranged from 58 percent (%) (September) to 82% (April) of the 1973-2009 normal. This observation may be in response to the low precipitation, as the precipitation during the 2011 hydrological year was less than average during most months, except January, May, and July. The low precipitation throughout most of the winter may have contributed to a smaller snowpack and a reduced spring freshet. Low summer and early fall precipitation may have also contributed to lower than normal flows during these periods.

- Precipitation during the 2012 hydrological year (Oct 2011 to Sep 2012) fluctuated around the 1981-2010 historical average, except in October and February when it was less than 50% of historical average, and in March and April when the precipitation was higher than twice the historical average. The discharge in the first half of the hydrological year did not correspond to the precipitation

- Precipitation during the 2013 hydrological year (Oct 2012-Sep 2013) was generally below the 1981-2010 historical average, except in April. This precipitation pattern contributed to a lower flow in the study area throughout the hydrological year of 2013, except between Oct to Dec 2012. The additional precipitation that was seen in April did not translate into higher river flows.

- During the late fall and winter of the 2014 hydrological year (Oct 2013-Mar 2014), the discharge at the Wheeler River monitoring station was well below normal. This did not correspond to the precipitation level, as the cumulative precipitation during this period of time was slightly higher than 1981-2010 historical normal, and in January 2014, snow fall was more than two times normal. Flows in the spring (April-May 2014) increased to almost the historical normal discharge, which may be a result from the May precipitation, which was 1.5 times compared to the historical average. It was a dry summer and early fall in the 2014 hydrological year; in contrast, the discharge in June and July 2014 surpassed the historical average, while it fell below average in the following two months.

- During the 2015 hydrological year, discharge was consistently less than the historical average. Peak discharge in May was 15.4 m^3/s, 30% below the historical average. Flows remained more than 30% below average during June to September. This flow pattern may be because the precipitation was near or below historical average in most months of this hydrological year. The snowfall in March exceeded the historical average by 130%, which may be the reason for increased discharge in April, despite low precipitation in that month. In July and September 2015, the precipitation was 40% and 23% above historical average, respectively; however, no increase in discharge was observed.

- Precipitation in the 2016 hydrological year (Oct 2015-Sep 2016) fluctuated around the 1981-2010 historical average from October to March, with the cumulative precipitation 15% above the historical average. In response, the late fall 2015 to winter 2016 discharge was below historical level, and the freshet-dominant flow in May 2016 increased to near the historical level, despite the precipitation was only 13% of the historical normal. Heavy rainfalls were observed at the monitoring station in June and July 2016, which could have been the reason for increased discharge from June to September to near or above the historical average.

- During the first quarter of 2017 hydrological year, the flow was above the 1981-2010 historical average, likely in response to the high amount of precipitation in the summer of 2016 and the above-historical-average rainfall in early fall 2016. The precipitation was all higher than average in the next quarter. However, the discharge data were not available from the hydrometric station in this period of time. From May to September, the monthly discharge rates in Wheeler River were all slightly above the historical average, despite the precipitation in the summer was lower than the historical average.

- During the first six months of the 2018 hydrological year, discharge in the Wheeler River was slightly above the historical average level, possibly corresponds to the high precipitation in the first quarter 2018 (50% above the historical average). From April through June, the discharge rate was similar to the historical average level, and slightly above average between July and September.

- During the 2019 hydrological year, despite the low precipitation in the first six months, the Wheeler River discharge was slightly above the historical average. The river discharge slowly decreased during the winter months, similar to the temporal trend in previous years. The discharge started to increase in May during the spring freshet and reached a peak of 24.9 m^3/s in September. The increased discharge over the summer and early fall corresponded to the high precipitation in June and August, which was more than 1.5 and 2 times, respectively, compared to the historical average.

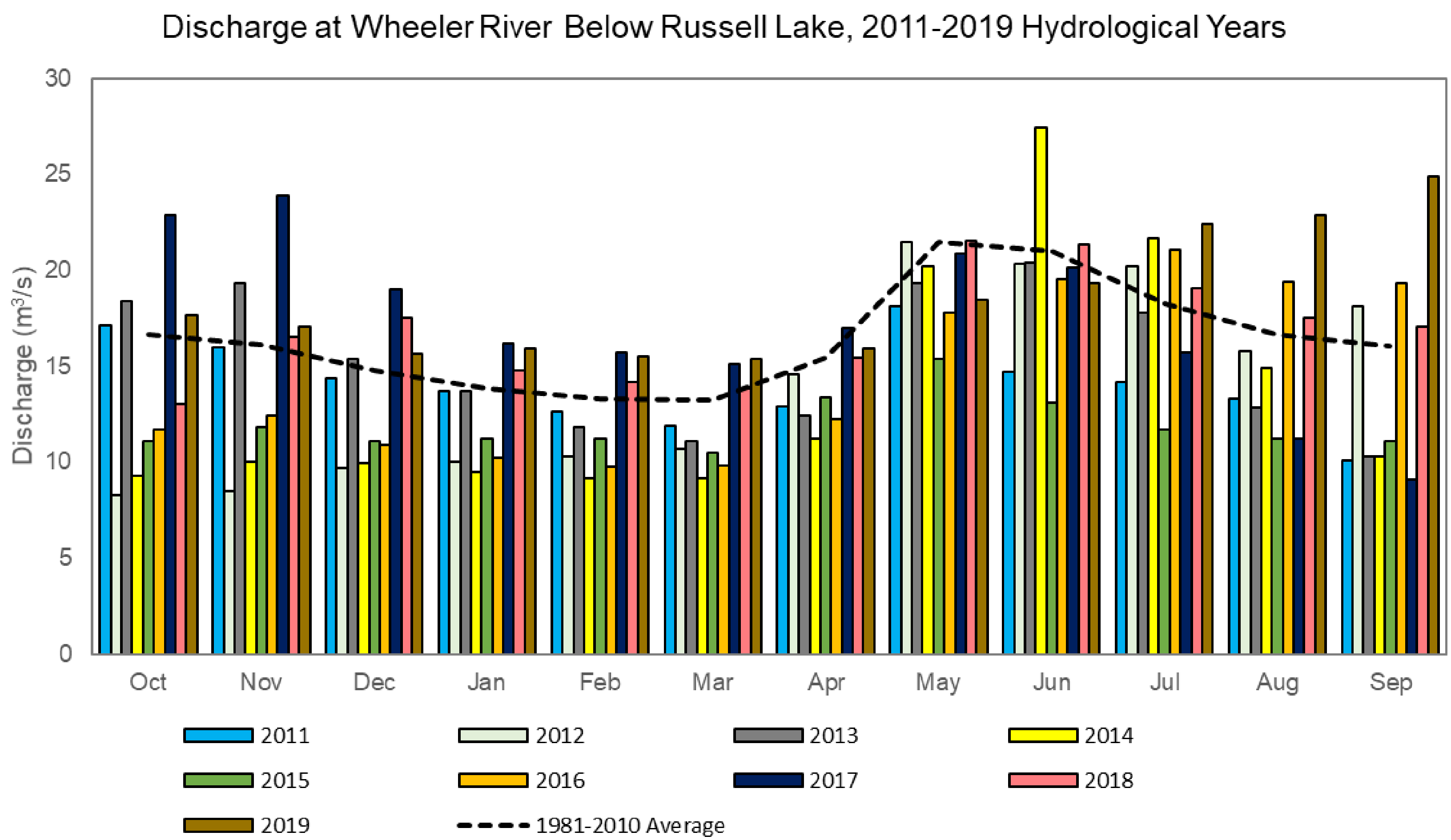

Figure 1-3: Wheeler River mean monthly discharge for the hydrological years between 2011 and 2019. (WSC 2019a, b).

1.4 Local Hydrology

As indicated above, the Project site lies within the Wheeler River watershed. Surface water from the Project area is drained by two sub-basins of the Wheeler River, the Icelander River drainage and the Williams Lake drainage (**Figure 1-4**). Both drainages flow generally south into the northwest portion of Russell Lake. The estimated drainage areas of the Icelander River drainage and the Williams Lake drainage are 371 km^2 and 78 km^2, respectively (**Appendix D**). Downstream of Russell Lake, the Wheeler River flows into the Geikie River which subsequently discharges to Wollaston Lake.

Hydrological information has been collected at the site by Denison since 2011. Details associated with the hydrological baseline program are described in **Section 3.0**.

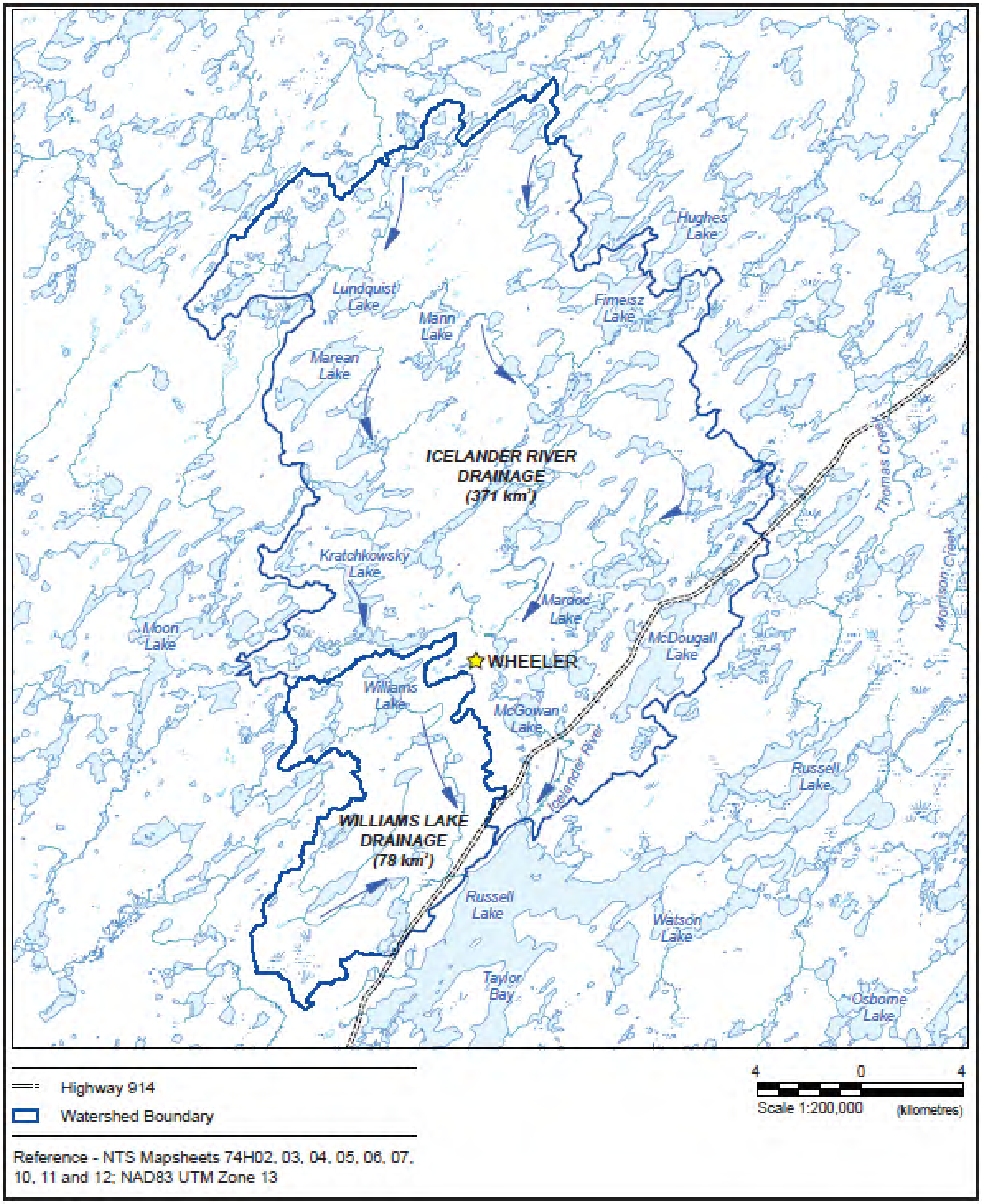

Figure 1-4: Overview of the local drainage areas, Wheeler River Project.

2.0 SCOPE OF THE HYDROLOGY BASELINE PROGRAM

Hydrology monitoring surveys were undertaken at the Project site between 2011 and 2014. The report associated with these efforts is provided as Appendix D of this current report (Golder, 2014). The data associated with the hydrological surveys completed at that time have been integrated with the data collected by EcoMetrix between 2016 and 2019 to provide a characterization of existing hydrologic conditions on the Project site over the entire period of record.

The Hydrology survey that was completed between 2016 and 2019 is described below. Other aquatic work completed between 2016 and 2019, including bathymetry, aquatic habitat characterization, stream morphology identification, etc., is provided in EcoMetrix (2020). The scope of the 2016 to 2019 hydrology program included: the measurement of water level elevations at thirteen lakes and two ponds within the study area; the collection of manual streamflow measurements at seventeen watercourses to validate existing rating curves or to establish rating curves for new monitoring locations; and, the installation of continuous streamflow monitoring equipment at eight stream locations and two lake locations in 2018. Four field programs were completed from fall 2016 to summer 2018 to capture seasonal flow conditions in spring, summer and fall. One additional winter field program was completed between March 15 and 19, 2018, to assess ice cover in the area and to gain a better understanding of winter baseflow conditions.

All monitoring activities that have been completed to date for which results are presented in this baseline study report are presented in **Table 2-1.** Corresponding monitoring locations in both streams and lakes are shown in **Figure 2-1**.

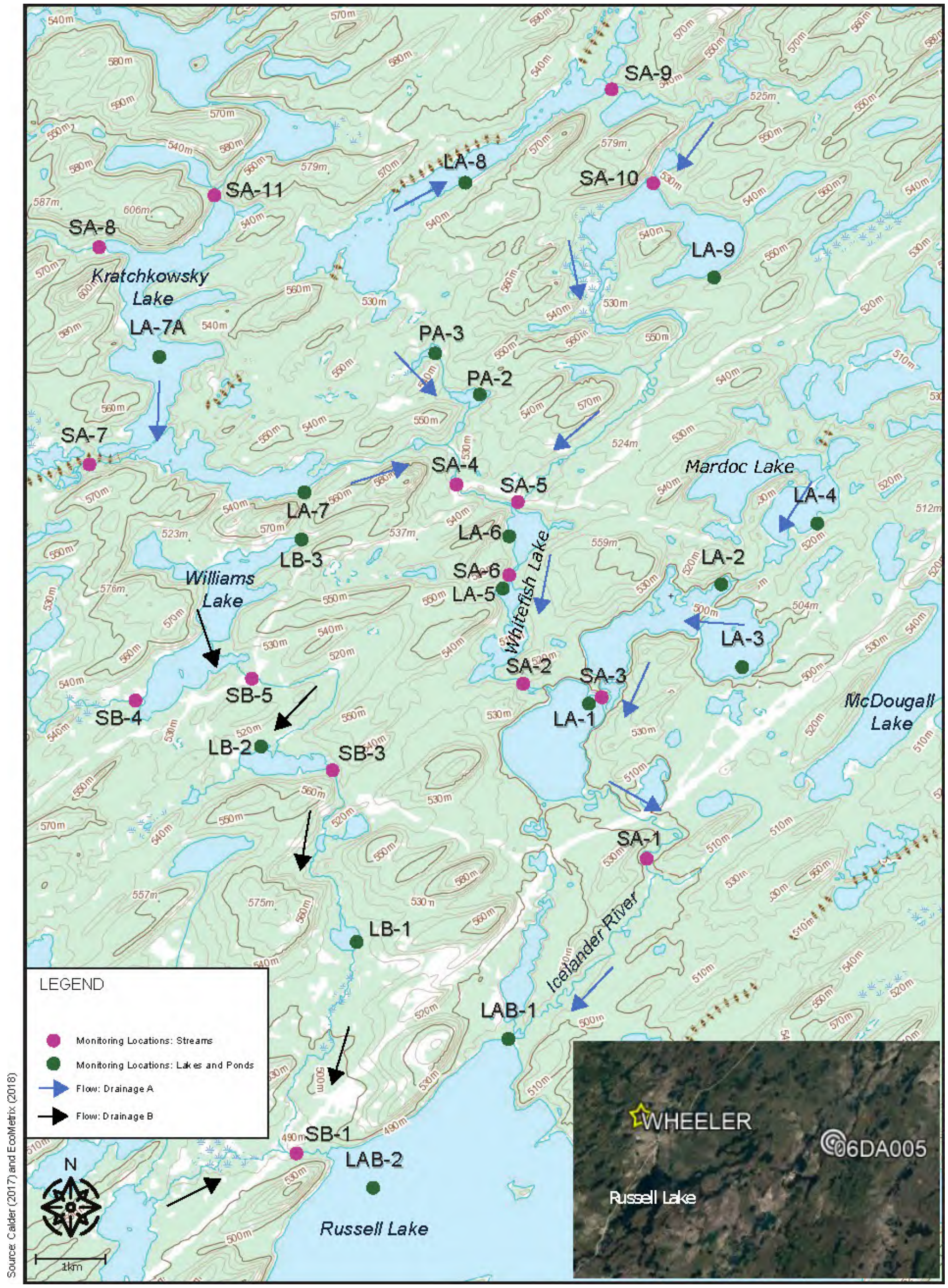

Figure 2-1: Hydrometric Monitoring Locations at Wheeler River Drainage. The location of the WSC hydrometric station 06DA005 downstream of Russell Lake is shown in the inset. Note: LA-5 and LA-6 are recognized as one waterbody (Whitefish Lake) by a local resident.

Table 2-1: Hydrology monitoring stations and monitoring activities

Station Name	Location (UTM NAD 83)	Instantaneous Discharge Measurements	Continuous Water Level Recording	Staff Gauge	Elevation Survey
Lake Level Monitoring Sites					
McGowan Lake (LA-1)	13 V 479399 6373215	-	-2019	2011, 2012, 2013	2011, 2012, 2013, 2014, 2016, 2018, 2019
LA-2	13 V 480852 6375164	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014, 2016
LA-3	13 V 481477 6373989	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014, 2016
Mardoc Lake (LA-4)	13 V 481989 6376180	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014, 2016
Whitefish Lake (LA-5)	13 V 477830 6374521	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014, 2016
Whitefish Lake (LA-6)	13 V 477763 6375274	-		2011, 2012, 2013	2011, 2012, 2013, 2014, 2016, 2018, 2019
Kratchkowsky Lake (LA-7)	13 V 474851 6375402	-	2012, 2013	2011, 2012, 2013	2011, 2012, 2013, 2014, 2016, 2017
LA-8	13 V 476253 6379929		-	-	2016, 2017
LA-9	13 V 479732 6379231		-	-	2016, 2017
PA-2	13 V 477082 6377227		-	-	2016
PA-3	13 V 476460 6377650		-	-	2016
LAB-1	13 V 478705 6368323	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014, 2016
LB-1	13 V 476598 6369377	-	-	2011, 2012, 2013	2011, 2012, 2013, 2016
LB-2	13 V 474882 6371871	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014, 2016
Williams Lake (LB-3)	13 V 474925 6374767	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014, 2016

Station Name	Location (UTM NAD 83)	Instantaneous Discharge Measurements	Continuous Water Level Recording	Staff Gauge	Elevation Survey
Stream Discharge Monitoring Sites					
SA-1	13 V 480368 6371123	2011, 2012, 2013, 2014, 2016, 2017, 2018, 2019	2011, 2012, 2013, 2014, 2016, 2017, 2018, 2019	-	2011, 2012, 2013, 2014, 2016, 2017, 2018, 2019
SA-2	13 V 478524 6373216	2011, 2012, 2013, 2014, 2016, 2019	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014, 2016, 2019
SA-3	13 V 479415 6373234	2011, 2012, 2013, 2014, 2016, 2019	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014, 2016, 2019
Kratchowsky Creek Outlet (RC-1)	13 V 475468 6375987	2016, 2018, 2019	-		2016, 2019
SA-4	13V 476926 6375868	2011, 2012, 2013, 2014, 2016, 2017, 2018, 2019	2012, 2013, 2014, 2016, 2017, 2018, 2019	-	2011, 2012, 2013, 2014, 2016, 2017, 2018, 2019
SA-5	13 V 477804 6375716	2011, 2012, 2013, 2014	2012, 2013, 2014, 2019	-	2011, 2012, 2013, 2014
	13 V 477822 6375737	2016, 2017, 2018, 2019	2016, 2017, 2018, 2019		2016, 2017, 2018, 2019
SA-6	13 V 477861 6374749	2011, 2012, 2013, 2014	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014
	13 V 477863 6374742	2016, 2017, 2018, 2019	2016, 2017, 2018, 2019	-	2016, 2017, 2018, 2019
SA-7	Not recorded	2016	-	-	-
SA-8	13 V 471579 6378303	2016, 2017, 2018	2016, 2017, 2018, 2019	-	2016, 2017, 2018
	13V 471542 6378314	2019	2019	-	2019
SA-9	13 V 478226 6381589	2016, 2017, 2019	2016, 2017, 2018, 2019	-	2016, 2017, 2019
SA-10	13 V 479003 6380421	2016, 2017, 2019	2016, 2017, 2018, 2019	-	2016, 2017, 2019
SA-11	13 V 473026 6379260	2016, 2017, 2019	2016, 2017, 2018, 2019	-	2016, 2017, 2018, 2019
SB-1	13 V 476041 6366362	2011, 2012, 2013, 2014, 2016	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014, 2016
SB-3	13 V 475866 6371655	2011, 2012, 2013, 2014, 2016	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014, 2016
SB-4	13 V 472952 6372222	2011, 2012, 2013, 2014, 2016	2012, 2013, 2014	-	2011, 2012, 2013, 2014, 2016
SB-5	13 V 474615 6372695	2016	-	-	2016

2.1 2016 to 2019 Water Elevation Surveys

Water elevation surveys were undertaken between September 09 and 22, 2016; May 30 and June 1, 2017; March 15 and 18, 2018; June 29 and July 3, 2018, July 4 and 6, 2019 and August 28 and September 1, 2019. Where possible, water elevations at previously established stations were referenced to geodetic benchmarks established by Golder. A description of how the geodetic elevations and benchmarks were established is described in **Appendix D**.

New locations (Lake and pond stations: LA-8, LA-9, PA-2 and PA-3; Stream stations: SA-8, SA-9, SA-10, SA-11, and SB-5) were referenced to temporary benchmarks, each with an assumed elevation of 100 masl, and subsequently converted to geodetic elevations using new benchmarks established in May 2017. The survey results of the all benchmarks used for this project are presented in **Appendix A.**

2.2 2016 to 2019 Instantaneous Flow Measurements

Between 2016 and 2019, streamflow measurements were taken at seventeen locations within the study area using the mid-section method detailed in in **Appendix E** and **Appendix F**. The mid-section method involves measuring the channel area and water velocities of a stream at a cross section. The channel is divided into a number of vertical subsections, adequate to characterize the irregular geometry of the channel. The depth and average velocity are measured at each subsection and are applied to a sub-area whose width extends half way to the preceding and following observation points. The area of each subsection is determined by directly measuring width and depth. The average water velocity in each sub-section is estimated using the measured velocity at selected locations in the vertical. The total discharge within the stream is the sum of the individual subsection discharges.

2.3 2016 to 2019 Continuous Water Level Recording

Eight temporary streamflow monitoring stations (SA-1, SA-4, SA-5, SA-6, SA-8, SA-9, SA-10, and SA-11) were installed in the fall of 2016. The streamflow monitoring stations were established to obtain information on local watercourse flow characteristics. The location of each flow station is presented in **Table 2-1**.

The Solinst Level data logger instrumentation measures absolute pressure, and therefore compensation is required for atmospheric pressure fluctuations. Barometric pressure compensation is achieved using an additional device (e.g., Barologger) to measure barometric pressure. A barologger was installed and deployed adjacent the SA-4 station.

The data collected from the barologger were used to apply barometric pressure compensation to data collected from the Solinst Level data logger instrumentation.

Level data loggers were installed by Golder in 2013 and left in place at SA-1, SA-6, SB-1, and SB-4. In the fall of 2016, level data loggers were located and retrieved at SB-1 and SA-6; however, no level data loggers were not found at SB-4 and SA-1. The logger at SA-6 was redeployed at the same location, and the logger at SB-1 was redeployed at SA-1. As no instantaneous stream data was recorded between April 2014 to September 2016 to validate the continuous flow measurement, the level data logger data collected during this time period was not presented in this report.

Recorded data from the level data loggers deployed in the fall of 2016 at streams SA-1, SA-4, SA-5, SA-6, SA-8, SA-9, SA10, SA-11 and the site barologger at SA-4 were retrieved in the spring of 2017, and all level data loggers were re-deployed after data downloading. Data were downloaded again in the summer of 2018 and 2019. Most level data loggers were re-deployed, except the logger at SA-6, which was replaced in 2019 due to battery life, and the logger at SA-8 that was moved upstream to mitigate influence of backwater from the Kratchowsky Lake In July 2018, level data loggers were installed in McGowan Lake (LA-1) and Whitefish Lake (LA-6). In early October 2018, the level data logger was dislodged from McGowan Lake by ice, and hence was removed. The logger was re-installed to LA-1 in August 2019. The level data logger installed in LA-6 was not located during the 2019 survey.

Barometric compensation for the 2016 to 2019 field program was completed using the barologger at SA-4, with any gaps filled using transformed data from the Key Lake Climate Station (Climate ID = 4063757) at 57°15'23.000" N, 105°37'03.000" W. The Key Lake Climate Station has an hourly barometric pressure record. The data were linearly interpolated to 15-minute intervals to develop the barometric compensation for the level data logger data.

2.4 Rating Curve Development and Validation

Rating curves are used to transform results from level data loggers installed in water courses to discharge rates. Golder (2014) presented rating curves for the stream stations SA-1, SA-2, SA-3, SA-4, SA-5, SA-6, SB-1, SB-3, and SB-4, and the lake stations McGowan Lake (LA-1), LA-2, Whitefish Lake (LA-5, LA-6), Kratchkowsky Lake (LA-7) and LB-2. The manual flow measurements taken as part of the 2016 to 2019 field program were graphed along with Golder's measurements and rating curves were reviewed for suitability for use with the new installations. For lake stations, discharge at the outlet stream was used to correlate to the water elevation. In 2019, the monitored stream discharge was greater at a few locations within the Icelander River Drainage (**Appendix B**), and therefore, rating curves were adjusted accordingly. Rating curves are presented for each hydrometric station within the Icelander River Drainage in **Appendix C**.

Based on the data, manual measurements at SA-1, SA-2, SA-3, SA-4, and SA-6 between 2011 and 2019 appear to fit within stage-discharge relationships, despite a few outliers (shown in **Appendix C**). In 2016, the SA-5 hydrometric station was installed upstream of the 2011-2014 monitoring location, with similar channel width and gradient. The rating curve for SA-5 was shifted upstream based on the five manual flow measurements taken between 2016 and 2019 (**Appendix C**).

Stage-discharge curves established by Golder (2014, **Appendix D**) were validated or adjusted incorporating the most recent monitoring data. The curves were used to process hydrographs to reflect discharge at stream stations within each open water season. As the emphasis of this report is on the long-term discharge of streams, all flow rates were averaged for each day of monitoring and presented in **Appendix C**.

For stream stations SA-8, SA-9, and SA-10, the manual flow measurements obtained to date were not sufficient to develop a reliable rating curve for conversion from level to flow, as more high/low extreme flow conditions needed to be captured to reduce uncertainty. For these flow stations, water elevation results are presented in **Appendix C**. A preliminary stage-discharge relationship was developed at SA-11.

2.5 2018 Measurement of Ice Thickness

Ice thickness in McGowan Lake (LA-1), Whitefish Lake (LA-6) and Kratchkowsky Lake (LA-7) was measured between March 15 and 18, 2018, at the deepest point of the lake. An ice auger was used to drill through the ice and thickness was measured using a measuring tape.

3.0 EXISTING HYDROLOGICAL CONDITIONS

A description of existing hydrological conditions at the Project site in consideration of all baseline data collected to date is provided below. For the stream monitoring stations this includes consideration of the stream monitoring locations, stream discharge data, the relationship of local (measured) to regional hydrology for select locations and the effects of ice on local stream flows. For lake monitoring locations, this includes lake elevations and ice cover.

3.1 Streams

3.1.1 Stream Monitoring Locations

The following presents a discussion of the physical features and monitoring characteristics observed at each site.

3.1.1.1 Icelander River Drainage

SA-1

SA-1 is located close to the outlet of Icelander River drainage area at Russell Lake. It is the most downstream monitoring station in Icelander River drainage area with an estimated upstream area of approximately 371 km^2. The monitoring station is located at the transition between an upstream low gradient meandering channel section and a downstream higher gradient riffle channel section. The stream substrate is comprised of boulders, cobble, gravel, and sand, and is approximately 15 m wide at the cross-section. Although the banks are well defined and stable with shrubs and moss, the left bank has a notable floodplain vegetated with shrubs and black spruce. SA-1 has a good cross-section and monitoring station. The station is in a low gradient section immediately upstream of a high gradient section. SA-1 produces a good stage- discharge relationship and accurate hydrograph. The logger left by Golder in 2014 was not located in the 2016 site visit, and was presumed to be lost. The level data logger retrieved from SB-1 was installed in this station. A level data logger is currently in place at SA-1.

SA-2

Streamflow monitoring station SA-2 flows into the northwest end of McGowan Lake. The monitoring station at SA-2 is located several meters downstream of the transition between an upstream meandering channel and a downstream riffle section. The monitoring site has a cross-section width of approximately 11 m, and is relatively shallow with high velocity flow. The stream is generally steep with vertical banks and high velocities. The substrate of SA-2 is primarily composed of boulders and cobble, with well-defined and stable vertical banks vegetated with shrubs and trees. SA-2 produces a fair stage-discharge relationship as shown in Appendix C. The two outliers correspond to 2016 and July 2019 measurements that were taken in a different stream cross section. The rest of the measurements fit well to the established stage-discharge relationship. No continuous flow monitoring has been conducted at SA-2 since 2014.

SA-3

Streamflow monitoring station SA-3 flows from LA-2 to McGowan Lake (LA-1). The entire stream length has a sandy and silty bottom with well-defined vertical banks vegetated with shrubs, willows and jack pine. The monitoring station is located near the middle of the stream length and has a cross-sectional width of approximately 11 m. SA-3 produces a good stage-discharge relationship and therefore relatively accurate hydrograph. Due to the proximity to LA-1, flow/water levels at this station are believed to be affected by the water level at the lake, especially during the high flow conditions in 2019. No logger was installed at this location in monitoring program since 2014.

SA-4

The stream discharge monitoring station SA-4 drains Kratchkowsky Lake, and is to the east of SA-5 and flows into the northwest end of LA-6. The monitoring site is located upstream of the existing temporary bridge and a fast flowing and narrow channel section. The channel has a cross-section width of approximately 6 m. The channel substrate is composed of large angular cobble and boulders. SA-4 produces a good stage-discharge relationship, and hence an accurate hydrograph. A level data logger and a barologger are currently in place at SA-4.

SA-5

Station SA-5 is to the east of SA-4 and flows into the northwest end of LA-6. The monitoring station originally established by Golder was located downstream of a small temporary bridge in a straight and relatively steep section of the stream. The new flow station established in 2016 by EcoMetrix is in a similar location slightly upstream of the Golder station. The substrate at the cross-section is primarily boulders and small cobble overlain sand. The stream has a width of approximately 8 m and has stable vertical organic banks vegetated with shrubs. The new continuous flow station was installed on a straight run downstream of the removed bridge crossing in 2016. The level data logger is still in place, and the level data have been retrieved annually to monitor continuous flow conditions. Manual stream measurements at SA-5 have yielded a reasonable stage-discharge relationship.

SA-6

Streamflow monitoring Station SA-6 is in the channel that drains from LA-6 and is upstream of LA-5. It is recognized by local resident as a narrow connecting LA-5 and LA-6 (the south and north basins of Whitefish Lake), rather than a stream. It is a wide sandy-bottomed stream with vertical banks. Flow in this stream is deep and slow. Although the right bank is well defined, high, and vegetated with trees, sand, and moss, the left bank is low lying with muskeg, shrubs and black spruce. The continuous monitoring station was installed approximately halfway between LA-6 and LA-5 and is currently active. The cross-section has a width of approximately 14 m. Manual stream measurements at SA-6 have yielded a fair stage-discharge relationship. The level data logger was replaced in 2019 due to battery life.

SA-7

SA-7 is a narrow marshy stream that flows into Kratchkowsky Lake. The stream channel has vertical, undercut banks. Flow in the stream is slow and deep. The gradient at the location is low and it is within the backwater area associated with the lake inlet and therefore water elevations there are influenced by the lake. SA-7 was originally identified for continuous water level monitoring. However, considering the flow condition, no logger was installed at this location. Elevation benchmark was not established, and instantaneous flow was monitored only once in September 2016. This station was replaced by SA-11.

SA-8

Streamflow station SA-8 is located in an inlet channel at the northwestern end of Kratchkowsky Lake. It is a meandering, narrow sandy bottom stream with deep banks. Some areas of the bank are undercut. The continuous monitoring station was installed in a relatively straight, faster flowing section of the channel immediately upstream of the lake in September 2016. In 2019, it was noted that this station is subject to backwater effects owing to its proximity to the lake, and therefore the station was moved upstream (**Appendix F**). A rating curve has yet to be established for this station – more manual measurements that include high and low flow events are needed to establish a reliable elevation-discharge relationship.

SA-9

SA-9 was initially located at the outlet of LA-8 that is accessible by an existing ATV trail. The stream channel in this section is shallow and relatively narrow. The stream substrate is comprised mainly of sand, gravel, and cobble. The monitoring station was located in a pool upstream of the road crossing. Stream banks are shallow and the surrounding land is relatively flat. The area has recently been impacted by a forest fire, so this station is at greater risk of trees/debris falling into the channel and impacting existing flow characteristics. Although level data logger data has been available since September 2016, the stage and discharge data collected from this site are not yet sufficient to establish a reliable rating curve.

SA-10

SA-10 is located in a wide sandy bottom stream channel that flows into the northwest part of LA-9. The stream banks are vertical and the water is deep and slow-moving. The continuous monitoring station was located in a relatively straight section of the channel with wadable depths in 2016, at the time of installation. More stage and discharge data are required to establish a reliable rating curve.

SA-11

SA-11 is located at the northern-most inlet to Kratchkowsky Lake, and serves as a replacement station for SA-7. The stream substrate is comprised primarily of gravel and cobbles. The stream channel here is braided, though the monitoring station was located in an unbraided section immediately upstream of the lake. A level data logger was installed in September 2016, and is still recording continuous water level data. A preliminary stage and discharge relationship was developed in 2019 (**Appendix E**).

RC-1

Stream station RC-1 is situated immediately downstream of Kratchkowsky Lake. The stream banks were stable and the channel was meandering. The canopy was mostly dense with some partly open areas. Instream cover was diverse, afforded by boulders, deep pools, aquatic macrophytes, logs and trees, and undercut banks. Substrates were comprised of cobble, boulder, gravel and sand. Aquatic vegetation included sedges and burreed. Slight algae growth and sediment were observed overlying the substrate. This station encompasses the stream reach in the vicinity of the proposed mine road crossing. Discharge measurements have been recorded, but no level data logger has been installed at this location.

3.1.1.2 Williams Lake Drainage

SB-1

SB-1 is located close to the outlet of the Williams Lake drainage at Russell Lake. The monitoring station is located immediately upstream of the culverts at the McArthur River haul road. The stream in this area is marshy with a thick organic base. The stream bottom in the immediate vicinity of the monitoring station has been altered as result of the road crossing and consists sand, gravel and boulders. Signs of beaver activity were observed both upstream and downstream of the monitoring location during work completed in 2016-2018. The rating curve associated with SB-1 shows a relatively weak stage-discharge relationship, likely the result of stream morphology at this location. The level data logger installed in 2014 was retrieved from this location in 2016, and no continuous flow monitoring has been conducted since then.

SB-3

SB-3 is located in the outlet channel of LB-2. The stream substrate is comprised of organics, sand, cobbles and boulders. The banks are nearly vertical with moss and shrubs, and the width is approximately 3 m. Manual stream measurements at SB-3 have yielded a good stage-discharge relationship. Continuous flow monitoring was conducted between 2011 and 2014.

SB-4

SB-4 is located in an inlet channel of Williams Lake. The stream banks are shallow and poorly defined. The bottom of the stream consists of large angular cobbles and boulders. At the Golder continuous flow station, the width of the stream was approximately 5 m. Manual stream measurements at SB-4 have yielded a fair stage-discharge relationship and hydrograph between 2012 and 2014, according to Golder (2014). It is to EcoMetrix' understanding that continuous monitoring equipment was left at this location; however, the logger was not found and was assumed to be lost. No level data logger was installed at SB-4 since 2016.

SB-5

SB-5 is located at the outlet of Williams Lake. The stream substrate is composed of sand, gravel and cobbles. Gauging was conducted in a relatively straight section of the channel downstream of the camp road crossing and upstream of a low gradient pool and braid. SB-5 is accessible by road. No level data logger was installed at SB-5.

3.1.2 Stream Stage and Discharge

Stage and discharge measurements made between 2016 and 2019 were compiled in combination with results from 2011-2014 as appropriate and are presented in **Appendix B**. Detailed information associated with the monitoring completed between 2016 and 2019 that was largely focused in the Icelander River drainage, including station maps, updated flow and elevation measurements and rating curves (if established or updated), continuous flow measurements (if applicable); and, photographic records are provided in **Appendix C**.

The average monthly discharge from stream stations during the open water season in 2011, 2012, 2013, 2017, 2018 and 2019 are presented in **Figure 3-1**. It is apparent from the graph that the intra-annual flow pattern at each stream station is consistent with the flow pattern at the Wheeler River station. Stream discharge is highest during the freshet, with flows decreasing throughout the summer and into the fall and winter baseflow periods. Comments concerning flows measured in each monitoring year are provided below.

In 2011, the highest observed flows were in the spring during level data logger installation by Golder (2014). The spring peak flow rate was likely not captured at any site. The flow receded throughout May and June. At all sites a secondary peak was observed during July and early August, which corresponds to relatively high rainfall, although the monthly mean discharges were still lower than May. Flows receded again until September and remained static for the balance of the monitoring season.

The stream flows were considerably higher in 2012 monitoring season than those observed in 2011, especially in Stream SA-1. The spring peak discharge rate, which occurred shortly after the first discharge measurement, was approximately captured at all sites. Discharge peaked in mid-May, and remained high till August, responsive to the increasing precipitation in June and July. At SA-1, peak flow in July exceeded the spring peak flow rate. At most sites, flow rates reached seasonal lows in late August before rising again during September and October, and stayed at the level lower than the discharges measured in spring.

In 2013, discharge peaked in late June instead of May in earlier years, and steadily receded after the peak, until moderate runoff responses occurred in late August and early September. Flows receded to seasonal lows in late September and remain static till end of the open water season.

Although level data logger data was retrieved from SB-1 and SA-6 in 2014 and 2015, no instantaneous flow data were available during this time period to validate the logger data. Therefore, no hydrograph or monthly mean flow data are presented between winter 2014 to fall 2016.

In fall 2016, the discharge level exceeded previously reported spring peak in most streams, possibly in response to the high precipitation in summer and fall 2016, which exceeded the precipitation level during the spring.

In 2017, spring peaks occurred in mid-May, and they were approximately captured. At most sites, flows receded in the summer and reach the seasonal low in Mid-September. In late October, flows have recovered to almost the similar level as measured in the spring, likely due to the precipitation level that was higher than normal.

In 2018, spring peak flows occurred in Mid-May, and the discharge at most stations remained relatively high till early July, when discharge decreased at most of the stations, and increased again in mid- to late July. Discharge level at most stations receded in August till end of the open water season, corresponding to lower precipitation during these months.

To date, the level data logger data were collected till the end of August, 2019. There was no apparent spring peak, likely because of the low precipitation over the winter. Flow receded slightly in Late May and early June, and increased to its seasonal high flow in late June to early July, likely corresponds to high precipitation in late June.

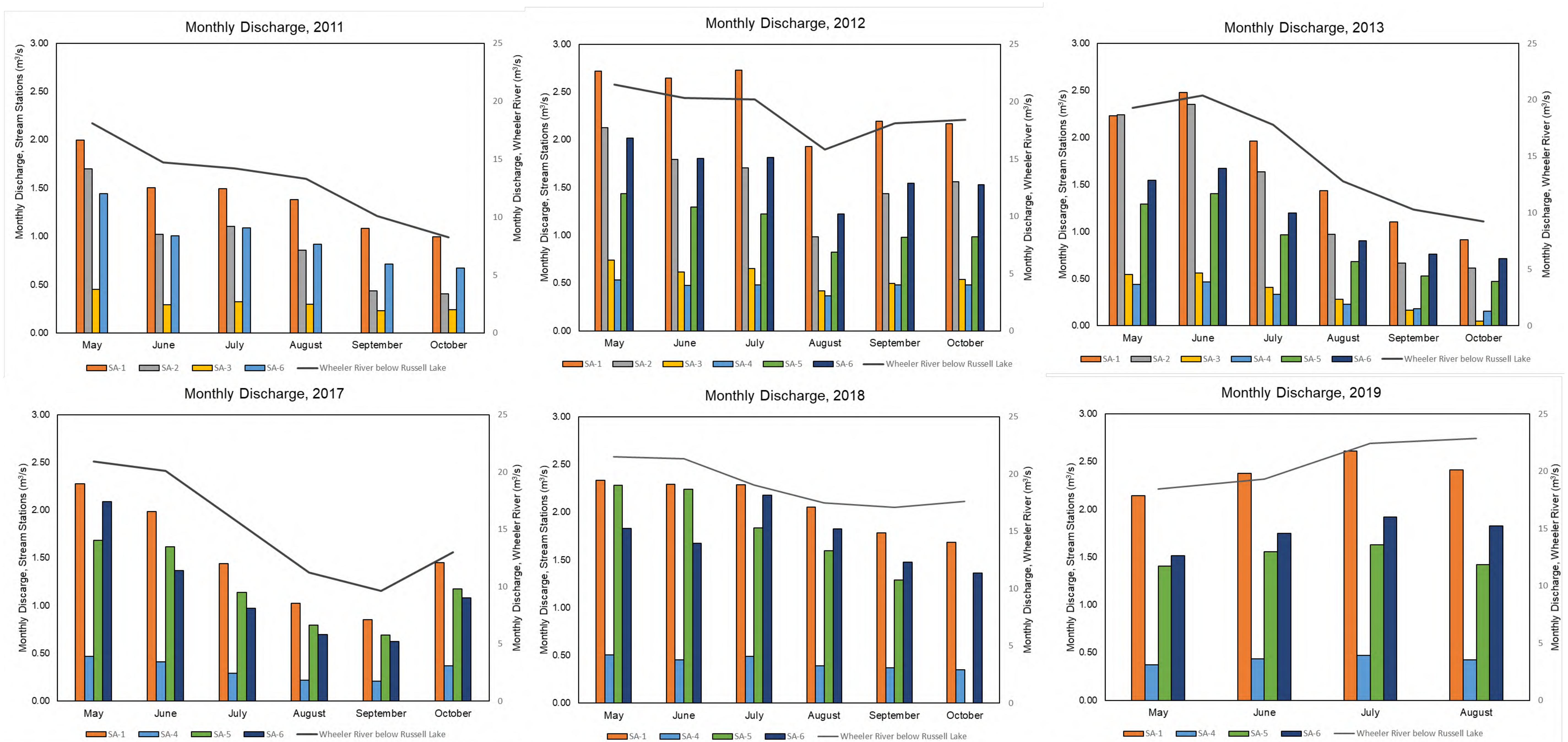

Figure 3-1: Monthly mean discharge at stream stations in the Wheeler River drainage area where level data logger was installed. A Canada Hydrometric Station is installed at Wheeler River downstream of Russell Lake (06DA005). Note: 1) Early ice-up was observed in SA-5 in October 2018, and therefore, the discharge in SA-5 was not plotted for this month; 2) Continuous discharge monitoring was updated to the last field trip in August 28-September 1, 2019.

3.1.3 Relationship to Regional Hydrology

Although the drainage area of the Water Survey of Canada (WSC, 2018a and 2018b) hydrometric station on the Wheeler River (3,030 km^2) is much larger than the drainage area associated with the site (371 km^2), these drainage areas are similar in terms of climate and geography. As shown in **Figure 3-1**, the flow patterns of at least a few stream stations are consistent with the flow pattern of the Wheeler River station at the WSC hydrometric station 06DA005. Therefore, a scaled relationship between flows at the WSC station 06DA005 and the project area could be established to project flows at the project area.

Golder (2014) provided examples of relationships between discharge for a subset of survey stations (SA-1, SB-3, SB-1) and WSC station 06DA005 using data measured between 2011 to 2013 (**Appendix D**). Such relationships can be developed for specific survey locations in the project area for the purpose of hindcasting and/or forecasting flows or developing site-specific flow statistics to support future project work, such as waste assimilative capacity assessments to support licensing. In this application, the flow data associated with WSC station 06DA005 and can be used to derive a watershed area adjusted low flow condition (7Q20) to assess the potential influence of mine site drainage on local receiving waters.

3.1.4 Effect of ice formation on discharge ratings

The formation of ice in stream channels affects stream flow and its measurement. Surface ice for example, changes streamflow from open-channel flow (i.e., flow having a free surface) to closed-conduit flow (i.e., flow not having a free surface). Under surface ice frictional resistance is increased because a water-ice interface replaces the water-air interface, hydraulic radius is decreased because of the additional wetted perimeter of the ice, and the cross-sectional area is decreased to a degree by the thickness of the ice (Rantz, 1982). As a result, the stream stage will therefore increase for a given discharge as the formation of surface ice causes a backwater effect. In these instances, an existing stage-discharge relationship that has been developed based on information collected in the ice-free season may not accurately represent winter flow conditions.

Rantz, (1982) describe three methods by which it is possible to compensate open-water discharge for ice effects. One such method is the discharge-ratio method whereby the open-water daily discharge is multiplied by a variable factor (K) to give the corrected discharge during periods of ice cover. The variable factor K, which varies from 0 to 1, is derived as the ratio of observed ice-covered discharge to the open-water rated discharge corresponding to the observed stage - K therefore varies with time and is a specific to each time a winter flow measurement is collected at each sampling location. The greater the ice cover the lower the K value. Golder (2014) calculated K for various stream survey locations in the project area in March 2014. These K values ranged from 0.3 to 0.8.

3.2 Lakes

3.2.1 Lake Elevation Measurements

The stages of McGowan Lake (LA-1), LA-2, LA-3, Mardoc Lake (LA-4), Whitefish Lake (LA-5 and LA-6), Kratchkowsky Lake (LA-7), LAB-1, LB-1, LB-2, and Williams Lake were measured during each site visit from 2011 to 2014, and in fall 2016. The compiled data are presented in **Appendix B, Table B-2**. In 2016, new survey stations were established at LA-8, LA-9, PA-2, and PA-3. The elevations of McGowan Lake and LA-6 were surveyed in 2018 and 2019. A summary of geodetic water level observed in all site visit are presented in **Table 3-1**. The difference between the minimum and maximum water levels were typically on the order of 0.4 m.

Table 3-1: Lake Water Level Summary during open water conditions, 2011-2019

Station	Minimum Measured Water Level (masl)	Maximum Measured Water Level (masl)
McGowan Lake (LA-1)	494.194	494.515
LA-2	494.467	494.654
LA-3	494.439	494.649
Mardoc Lake (LA-4)	498.507	498.649
LA-5	499.949	500.076
LA-6	499.943	500.118
Kratchkowsky Lake (LA-7)	520.424	520.536
LA-8	520.8	520.86
LA-9	514.25	514.28
LB-1	503.66	504.079
LB-2	510.392	510.573
Williams Lake (LB-3)	518.356	518.58
LAB-1	487.994	488.382
PA2	510.46	510.46
PA3	510.36	510.36

Based on the Wheeler River Project Provincial Technical Proposal and Federal Project Description, the anticipated mine water discharge location is the north basin of Whitefish Lake (LA-6;Denison, 2019). LA-6 drains through SA-6 to LA-5 as the only outlet, and as indictive above the stream reach represented by SA-6 is considered as a lake narrowing connecting two basins of Whitefish Lake (LA-5 and LA-6) by a local resident. The elevation of SA-6 correlates well with LA-6 (Appendix C, Appendix F) and therefore, level data logger installed in SA-6 is sufficient to represent the continuous discharge from LA-6.

The stage-discharge relationship established by Golder (2014) for McGowan Lake was validated with data collected in 2016 to 2019 (Appendix C), where discharge in SA-1 was measured to represent the discharge at McGowan Lake. This relationship can be used to calculate continuous discharge at LA-1 using the level data logger installed in August 2019.

3.2.2 Ice Thickness Measurements

Ice thickness has been measured at Project site lakes in March/April 2014 and again in March of 2018. This time of the year would generally be considered to be the period of maximum ice development, though year-to-year variability would be expected.

In 2014, ice thickness on study areas lakes was in the range of 0.70 m to 0.97 m with an average thickness of 0.83 m. Ice thickness values measured for McGowan Lake, LA-6, and Kratchkowsky Lake in March 2018 were 0.70, 0.71, and 0.70 m, respectively.

4.0 References

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Appendix A Ground Survey Results: Elevations of Benchmark at Each Monitoring Station

Table A-1 Information about benchmarks at each hydrometric station for elevation survey

Benchmark	Type	Northing (m)	Easting (m)	Elevation (m)
LA-2 BM1	Rebar	6375172.712	480842.634	497.339
LA-2 BM2	Rebar	6375174.795	480846.484	497.064
LA-2 BM3	Rebar	6375171.611	480846.491	496.34
LA-3 BM1	Rock	6373997.35	481487.807	496.134
LA-3 BM2	Rock	6373994.256	481487.899	496.034
LA-3 BM3	Rock	6373997.038	481478.058	494.831
Mardoc Lake (LA-4) BM1	Rebar	6376186.639	481994.794	500.365
Mardoc Lake (LA-4) BM2	Rebar	6376189.113	481991.522	500.252
Mardoc Lake (LA-4) BM3	Rebar	6376187.971	481988.774	499.699
LA-5 BM1	Rebar	6374540.225	477831.352	501.366
LA-5 BM2	Rebar	6374541.11	477824.823	501.014
LA-5 BM3	Rebar	6374538.032	477835.822	501.023
LA-6 BM1	Rebar	6375257.733	477749.298	502.388
LA-6 BM2	Rebar	6375254.317	477756.381	502.08
Kratchowsky Lake (LA-7) BM1	Rock	6375365.152	474859.273	522.374
Kratchowsky Lake (LA-7) BM2	Rock	6375370.136	474856.009	522.067
Kratchowsky Lake (LA-7) BM3	Rock	6375373.196	474852.454	521.8
LA-8 BM1	Rock	6379895.581	476250.738	523.991
LA-9 BM1	Rock	6379225.363	479725.394	515.312
PA-2 BM1	Rock	6377199.994	477105.453	511.303
PA-3 BM1	Rock	6377659.01	476450.79	517.851
LAB-1 BM1	Rebar	6368332.435	478695.192	489.243
LAB-1 BM2	Rebar	6368331.85	478688.921	489.745
LAB-1 BM3	Rebar	6368334.674	478697.583	489.597
LB-1 BM1	Rebar	6369366.788	476603.997	505.231
LB-1 BM2	Rebar	6369370.293	476602.209	505.04
LB-1 BM3	Rebar	6369363.85	476597.929	505.073
LB-2 BM1	Rebar	6371898.916	474903.385	511.767
LB-2 BM2	Rebar	6371901.778	474906.357	511.819
LB-2 BM3	Rebar	6371904.723	474900.057	511.806
Williams Lake (LB-3) BM1	Rebar	6374839.646	474884.439	520.159
Williams Lake (LB-3) BM2	Rebar	6374831.436	474893.291	519.42
Williams Lake (LB-3) BM3	Rebar	6374834.862	474895.379	520.021
SA-1 BM1	Rebar	6371129.601	480327.636	496.123
SA-1 BM2	Rock	6371125.303	480328.743	495.576
SA-1 BM3	Rebar	6371123.762	480357.257	494.361
SA-2 BM1	Rock	6373258.113	478533.16	498.369
SA-2 BM2	Rock	6373258.391	478529.59	498.354
SA-3/LA-1 BM1	Rebar	6373226.219	479403.75	495.714

Table A-1 Information about benchmarks at each hydrometric station for elevation survey

Benchmark	Type	Northing (m)	Easting (m)	Elevation (m)
SA-3/LA-1 BM2	Rebar	6373227.014	479408.484	495.55
SA-3/LA-1 BM3	Rebar	6373222.211	479402.381	495.616
SA-4 BM1	Rebar	6375855.114	476914.695	507.772
SA-4 BM2	Rock	6375853.025	476915.57	508.373
SA-5 BM1	Rebar	6375723.54	477791.074	502.58
SA-5 BM2	Rock	6375739.656	477807.701	502.045
SA-6 BM1	Rebar	6374757.968	477848.597	503.32
SA-6 BM2	Rebar	6374752.648	477849.463	503.205
SA-6 BM3	Rebar	6374746.296	477855.608	502.021
SA-8 TBM1	Nail	471581	6378307	521.17
SA-8 TBM2	Nail	471578	6378301	521.15
SA-8 TBM3	Nail	471586	6378314	521.13
SA-9 TBM1	Nail	478230	6381587	521.14
SA-9 TBM2	Nail	478231	6381591	520.86
SA-9 TBM3	Rock	478216	6381592	521.59
SA-10 TBM1	Nail	478999	6380421	515.01
SA-10 TBM2	Nail	479000	6380405	515.56
SA-10 TBM3	Nail	478997	6380406	515.8
SA-11 TBM1	Nail	473017	6379260	521.286
SA-11 TBM2	Rock	473018	6379272	521.025
SA-11 TBM3	Nail	473032	6379260	521.176
SB-1 BM1	Culvert	6366351.011	476038.945	489.602
SB-1 BM2	Culvert	6366355.284	476042.54	489.414
SB-1 BM3	Rock	6366375.139	476028.439	489.217
SB-3 BM1	Rebar	6371642.428	475847.211	511.473
SB-3 BM2	Rock	6371638.405	475838.409	511.897
SB-4 BM1	Rock	6372197.891	472953.818	520.307
SB-4 BM2	Rock	6372197.46	472955.741	520.205
SB-4 BM3	Rock	6372197.402	472957.726	520.305
SB-5 BM1	Nail	6372738.116	474631.507	518.673

Appendix B Stage and Discharge Measurement

Table B-1: Stream Elevation and Instantaneous Discharge Measurements

Location	Date	Elevation (Masl)	Discharge (m^3/s)	Source
Icelander River (SA-1)	14-May-11	492.714	2.307	Golder (2014)
	29-Jul-11	492.648	1.75	
	28-Oct-11	492.562	0.973	
	5-May-12	492.711	2.293	
	6-Aug-12	492.695	2.031	
	23-Oct-12	492.721	2.575	
	20-May-13	492.705	2.358	
	14-Aug-13	492.587	1.28	
	18-Oct-13	492.554	0.887	
	30-Mar-14	492.869	1.203	
	17-Sep-16	492.71	2.34	Calder (2017)
	31-May-17	492.72	2.43	
	2-Jul-19	494.043*	2.41	This report
	5-Jul-19	492.744	3.06	MWSI (2019)
	30-Aug-19	492.733	2.78	
SA-2	12-May-11	496.727	1.649	Golder (2014)
	30-Jul-11	496.698	1.387	
	27-Oct-11	496.667	0.809	
	8-May-12	496.748	2.008	
	8-Aug-12	*496.689*	1.305	
	24-Oct-12	496.734	2.03	
	21-May-13	496.727	1.842	
	14-Aug-13	496.66	0.863	
	16-Oct-13	496.641	0.741	
	24-Mar-14	496.805	1.18	
	16-Sep-16	496.46	2.24	Calder (2017)
	5-Jul-19	496.773	2.2095	MWSI (2019)
	30-Aug-19	496.748	1.9537	
SA-3	13-May-11	494.459	0.476	Golder (2014)
	29-Jul-11	494.392	0.37	
	28-Oct-11	494.322	0.239	
	4-May-12	494.473	0.528	
	5-Aug-12	494.443	0.478	
	23-Oct-12	494.487	0.578	
	20-May-13	494.482	0.564	
	14-Aug-13	494.344	0.255	
	16-Oct-13	494.243	0.051	
	24-Mar-14	494.248	0.362	
	16-Sep-16	494.43	0.44	Calder (2017)
	5-Jul-19	494.541	0.6219	MWSI (2019)
	30-Aug-19	494.506	0.5474	

Table B-1: Stream Elevation and Instantaneous Discharge Measurements

Location	Date	Elevation (Masl)	Discharge (m^3/s)	Source
SA-4	11-May-11	506.357	0.483	Golder (2014)
	30-Jul-11	506.314	0.335	
	31-Oct-11	506.31	0.199	
	4-May-12	506.348	0.466	
	5-Aug-12	506.329	0.361	
	22-Oct-12	506.367	0.497	
	19-May-13	506.369	0.519	
	13-Aug-13	506.277	0.276	
	17-Oct-13	506.249	0.206	
	23-Mar-14	506.381	0.33	
	10-Sep-16	506.35	0.49	Calder (2017)
	30-May-17	506.37	0.58	
	29-Jun-18	506.357	0.4845	This report
	4-Jul-19	506.387	0.6336	MWSI (2019)
	29-Aug-19	506.374	0.59	
SA-5	12-May-11	500.708	1.1	Golder (2014)
	30-Jul-11	500.668	0.858	
	29-Oct-11	500.609	0.476	
	4-May-12	500.717	1.111	
	5-Aug-12	500.684	1.026	
	22-Oct-12	500.718	1.269	
	19-May-13	500.726	1.381	
	13-Aug-13	500.629	0.616	
	17-Oct-13	500.622	0.507	
	23-Mar-14	500.798	0.886	
	9-Sep-16	500.9	1.27	Calder (2017)
	21-Sep-16	500.91	1.58	
	30-May-17	500.92	1.95	
	30-Jun-18	500.89	1.6567	This report
	4-Jul-19	500.955	1.6137	MWSI (2019)
	29-Aug-19	500.927	1.3589	
SA-6	13-May-11	500.084	1.631	Golder (2014)
	30-Jul-11	500.034	1.303	
	27-Oct-11	499.956	0.717	
	6-May-12	500.098	1.957	
	5-Aug-12	500.061	1.476	
	22-Oct-12	500.102	1.851	
	19-May-13	500.077	1.54	
	13-Aug-13	499.992	0.842	
	17-Oct-13	499.969	0.798	
	23-Mar-14	500.081	1.173	
	11-Sep-16	500.07	1.98	Calder (2017)
	31-May-17	500.08	1.77	
	30-Jun-18	500.125	1.56	This report
	4-Jul-19	500.125	2.27	MWSI (2019)
	29-Aug-19	500.11	2.02	
SA-7	15-Sep-16	No BM set	0.04	Calder (2017)

Table B-1: Stream Elevation and Instantaneous Discharge Measurements

Location	Date	Elevation (Masl)	Discharge (m^3/s)	Source
SA-8	15-Sep-16	520.6	0.01	Calder (2017)
SA-8	19-Sep-16	520.62	0.04	Calder (2017)
SA-8	30-May-17	520.54	0.04	Calder (2017)
SA-8	3-Jul-19	520.57	0.056	This report
SA-8	31-Aug-19	99.455**	0.0443	MWSI (2019)
SA-9	18-Sep-16	520.52	0.18	Calder (2017)
SA-9	1-Jun-17	520.49	0.16	Calder (2017)
SA-9	31-Aug-19	520.55	0.1457	MWSI (2019)
SA-10	18-Sep-16	514.35	1.55	Calder (2017)
SA-10	31-May-17	514.31	1.22	Calder (2017)
SA-10	31-Aug-19	514.34	1.31	MWSI (2019)
SA-11	19-Sep-16	520.73	0.42	Calder (2017)
SA-11	30-May-17	520.71	0.31	Calder (2017)
SA-11	2-Jul-18	520.84	Not Measured	This report
SA-11	31-Aug-19	520.71	0.31	MWSI (2019)
Kratchowsky Creek Outlet (RC-1)	14-Sep-16	520.3	0.58	Calder (2017)
Kratchowsky Creek Outlet (RC-1)	15-Mar-18	-	0.2303	This report
Kratchowsky Creek Outlet (RC-1)	6-Jul-19	-	0.6041	MWSI (2019)
Kratchowsky Creek Outlet (RC-1)	1-Sep-19	520.56	0.5514	MWSI (2019)
SB-1	14-May-11	488.486	0.517	Golder (2014)
SB-1	31-Jul-11	489.027	0.186	Golder (2014)
SB-1	30-Oct-11	488.418	0.217	Golder (2014)
SB-1	3-May-12	488.524	0.644	Golder (2014)
SB-1	6-Aug-12	488.522	0.358	Golder (2014)
SB-1	23-Oct-12	488.599	0.578	Golder (2014)
SB-1	18-May-13	488.484	0.547	Golder (2014)
SB-1	12-Aug-13	488.335	0.158	Golder (2014)
SB-1	19-Oct-13	488.85	0.277	Golder (2014)
SB-1	27-Mar-14	488.823	0.289	Golder (2014)
SB-1	17-Sep-16	488.55	0.64	Calder (2017)
SB-3	11-May-11	510.465	0.187	Golder (2014)
SB-3	31-Jul-11	510.406	0.109	Golder (2014)
SB-3	30-Oct-11	510.389	0.082	Golder (2014)
SB-3	5-May-12	510.506	0.235	Golder (2014)
SB-3	8-Aug-12	510.456	0.136	Golder (2014)
SB-3	21-Oct-12	510.517	0.255	Golder (2014)
SB-3	20-May-13	510.476	0.209	Golder (2014)
SB-3	14-Aug-13	510.421	0.107	Golder (2014)
SB-3	17-Oct-13	510.414	0.08	Golder (2014)
SB-3	25-Mar-14	510.423	0.09	Golder (2014)
SB-3	11-Sep-16	510.47	0.2	Calder (2017)
SB-4	15-May-11	519.134	0.074	Golder (2014)
SB-4	1-Aug-11	518.964	0.008	Golder (2014)
SB-4	30-Oct-11	519.07	0.018	Golder (2014)
SB-4	5-May-12	519.219	0.109	Golder (2014)
SB-4	6-Aug-12	519.144	0.032	Golder (2014)
SB-4	21-Oct-12	519.245	0.099	Golder (2014)
SB-4	21-May-13	519.185	0.114	Golder (2014)
SB-4	15-Aug-13	519.074	0.007	Golder (2014)
SB-4	17-Oct-13	519.115	0.036	Golder (2014)
SB-4	11-Sep-16	519.21	0.12	Calder (2017)
SB-5	14-Sep-16	518.33	0.14	Calder (2017)

* This may be an anomalous observation and therefore is not used in establishing stage-discharge curve.

** Referenced to local benchmark after moving measurement location.

Table B-2: Lake and Pond Surface Water Level Elevations

Location	Date	Elevation (m) (Arbitrary Datum)	Elevation (Masl)	Source
McGowan Lake (LA-1)	13-May-11	98.725	494.439	Golder (2014)
	29-Jul-11	98.613	494.327	
	28-Oct-11	98.504	494.218	
	4-May-12	98.709	494.423	
	5-Aug-12	98.672	494.386	
	23-Oct-12	98.734	494.448	
	21-May-13	98.726	494.44	
	14-Aug-13	98.551	494.265	
	16-Oct-13	98.48	494.194	
	25-Mar-14	98.584	494.298	
	16-Sep-16		494.39	Calder (2017)
	2-Jul-18	98.62	494.344	This report
	5-Jul-19		494.515	MWSI (2019)
	30-Aug-19		494.476	
LA-2	13-May-11	97.269	494.615	Golder (2014)
	30-Jul-11	97.256	494.602	
	29-Oct-11	97.203	494.549	
	4-May-12	97.264	494.61	
	6-Aug-12	97.274	494.62	
	23-Oct-12	97.308	494.654	
	20-May-13	97.278	494.624	
	13-Aug-13	97.197	494.543	
	16-Oct-13	97.121	494.467	
	26-Mar-14	97.236	494.582	
	13-Sep-16		494.58	Calder (2017)
LA-3	13-May-11	98.427	494.561	Golder (2014)
	30-Jul-11	98.433	494.567	
	29-Oct-11	98.427	494.561	
	4-May-12	98.472	494.606	
	6-Aug-12	98.456	494.59	
	23-Oct-12	98.485	494.619	
	20-May-13	98.459	494.593	
	13-Aug-13	98.387	494.521	
	16-Oct-13	98.305	494.439	
	26-Mar-14	98.515	494.649	
	18-Sep-16		494.57	Calder (2017)
Mardoc Lake (LA-4)	29-Jul-11	98.284	498.649	Golder (2014)
	30-Oct-11	98.152	498.517	
	4-May-12	98.223	498.588	
	5-Aug-12	98.248	498.613	
	6-Aug-12	98.257	498.622	
	23-Oct-12	98.262	498.627	
	20-May-13	98.259	498.624	
	13-Aug-13	98.164	498.529	
	16-Oct-13	98.142	498.507	
	27-Mar-14	98.249	498.614	
	13-Sep-16		498.62	Calder (2017)

Table B-2: Lake and Pond Surface Water Level Elevations

Location	Date	Elevation (m) (Arbitrary Datum)	Elevation (Masl)	Source
Whitefish Lake, South Basin (LA-5)	13-May-11	98.706	500.05	Golder (2014)
	31-Jul-11	98.67	500.014	
	27-Oct-11	98.605	499.949	
	6-May-12	98.73	500.074	
	5-Aug-12	98.693	500.037	
	22-Oct-12	98.728	500.072	
	21-May-13	98.729	500.073	
	13-Aug-13	98.625	499.969	
	17-Oct-13	98.606	499.95	
	23-Mar-14	98.732	500.076	
	12-Sep-16		500.06	Calder (2017)
Whitefish Lake, North Basin (LA-6)	13-May-11	97.675	500.063	Golder (2014)
	31-Jul-11	97.64	500.028	
	27-Oct-11	97.555	499.943	
	6-May-12	97.7	500.088	
	5-Aug-12	97.67	500.058	
	22-Oct-12	97.704	500.092	
	19-May-13	97.7	500.088	
	13-Aug-13	97.585	499.973	
	17-Oct-13	97.559	499.947	
	23-Mar-14	97.67	500.058	
	12-Sep-16	-	500.07	Calder (2017)
	30-Jun-18	97.718	500.106	This report
	29-Aug-19	-	500.118	MWSI (2019)
Kratchowsky Lake (LA-7)	29-Jul-11	98.108	520.482	Golder (2014)
	31-Oct-11	98.05	520.424	
	6-May-12	98.149	520.523	
	8-Aug-12	98.108	520.482	
	21-Oct-12	98.162	520.536	
	24-May-13	98.157	520.531	
	13-Aug-13	98.083	520.457	
	16-Oct-13	98.066	520.44	
	27-Mar-14	98.128	520.502	
	12-Sep-16	-	520.53	Calder (2017)
	30-May-17	-	520.53	
LA-8	20-Jan-00	-	520.86	Calder (2017)
	1-Jun-17	-	520.8	
LA-9	13-Sep-16	-	514.25	Calder (2017)
	31-May-17	-	514.28	
LAB-1	16-May-11	98.991	488.219	Golder (2014)
	1-Aug-11	98.891	488.119	
	30-Oct-11	98.776	488.004	
	9-May-12	99	488.228	
	6-Aug-12	98.939	488.167	
	23-Oct-12	98.987	488.215	
	21-May-13	99.005	488.233	
	12-Aug-13	98.879	488.107	
	19-Oct-13	98.766	487.994	
	25-Mar-14	99.154	488.382	
	22-Sep-16	-	488.26	Calder (2017)

Table B-2: Lake and Pond Surface Water Level Elevations

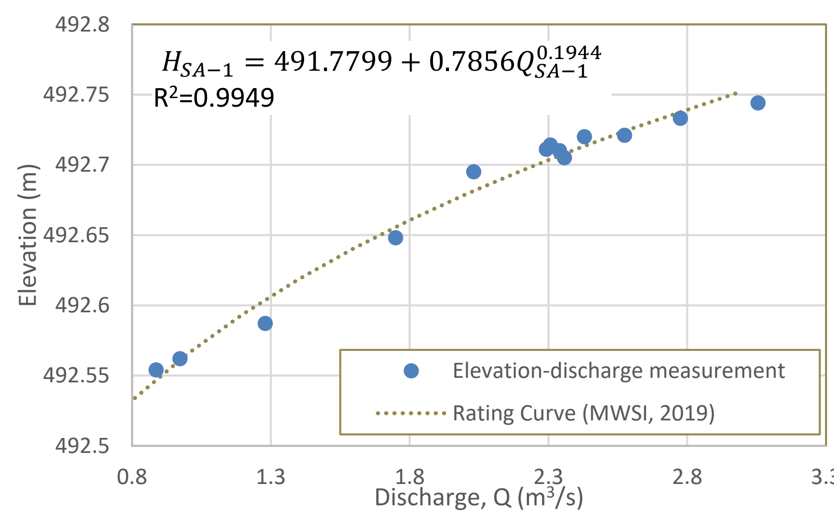
Location	Date	Elevation (m) (Arbitrary Datum)	Elevation (Masl)	Source
LB-1	14-May-11	98.666	503.902	Golder (2014)
	1-Aug-11	98.807	504.043	
	30-Oct-11	98.648	503.884	
	6-May-12	98.636	503.872	
	6-Aug-12	98.651	503.887	
	21-Oct-12	98.617	503.853	
	19-May-13	98.843	504.079	
	14-Aug-13	98.509	503.745	
	17-Oct-13	98.471	503.707	
	11-Sep-16		503.66	Calder (2017)
LB-2	14-May-11	98.767	510.523	Golder (2014)
	29-Jul-11	98.689	510.445	
	30-Oct-11	98.636	510.392	
	5-May-12	98.771	510.527	
	6-Aug-12	98.745	510.501	
	21-Oct-12	98.817	510.573	
	21-May-13	98.756	510.512	
	14-Aug-13	98.699	510.455	
	17-Oct-13	98.651	510.407	
	25-Mar-14	98.777	510.533	
	11-Sep-16	-	510.54	Calder (2017)
Williams Lake (LB-3)	15-May-11	98.365	518.519	Golder (2014)
	29-Jul-11	98.284	518.438	
	29-Oct-11	98.203	518.356	
	5-May-12	98.361	518.515	
	5-Aug-12	98.37	518.524	
	21-Oct-12	98.426	518.58	
	19-May-13	98.38	518.534	
	13-Aug-13	98.278	518.432	
	17-Oct-13	98.233	518.387	
	25-Mar-14	98.233	518.463	
	11-Sep-16	-	518.57	Calder (2017)
PA-2	15-Sep-16	-	510.46	Calder (2017)
PA-3	15-Sep-16	-	517.36	Calder (2017)

Appendix C Summary of Hydrometric Monitoring Stations in the Icelander River Drainage Area

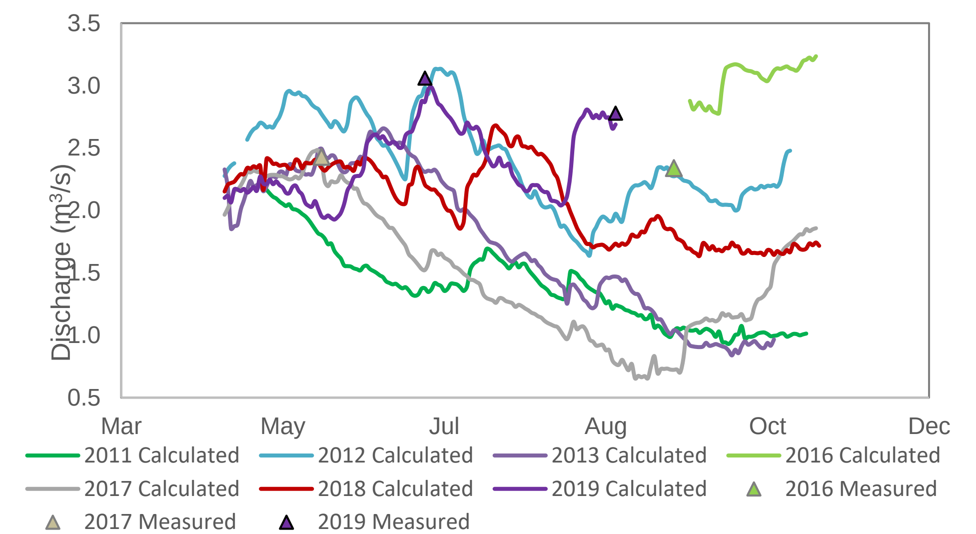
Appendix C: Summary of Hydrometric Monitoring Stations in the Icelander River Drainage Area

Station ID	SA-1	**Periods of continuous recording**	2011-2014, 2016-2019
GPS Coordinates	13 V 480368 6371123	**Instrument deployed**	Solinst levelogger, Serial number 1062051.
Access	By road	**Active measurement**	Continuous flow monitoring
Periods of monitoring	2011-2014, 2016-2019	**Comments**	SA-1 produces good stage and discharge relationship and accurate hydrograph. The stage-discharge relationship was modified in 2019 to fit new high discharge observed in 2019.
Measurements	Elevation, instantaneous discharge, continuous discharge		

Map: SA-1 hydrometric monitoring station.



Stage – Discharge Curve



Continuous flow monitoring, 2011-14 and 2016-2019 open water season

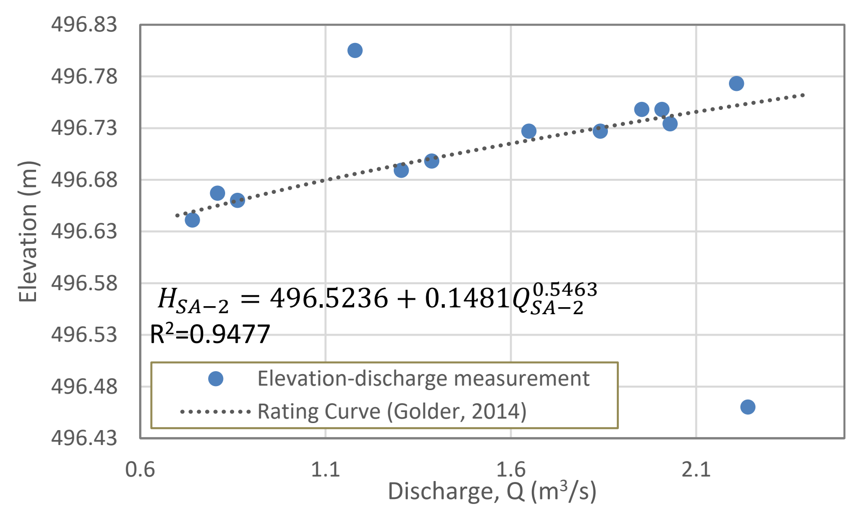
SA-1 facing downstream, May 2017.

SA-1 facing upstream, July 2018.

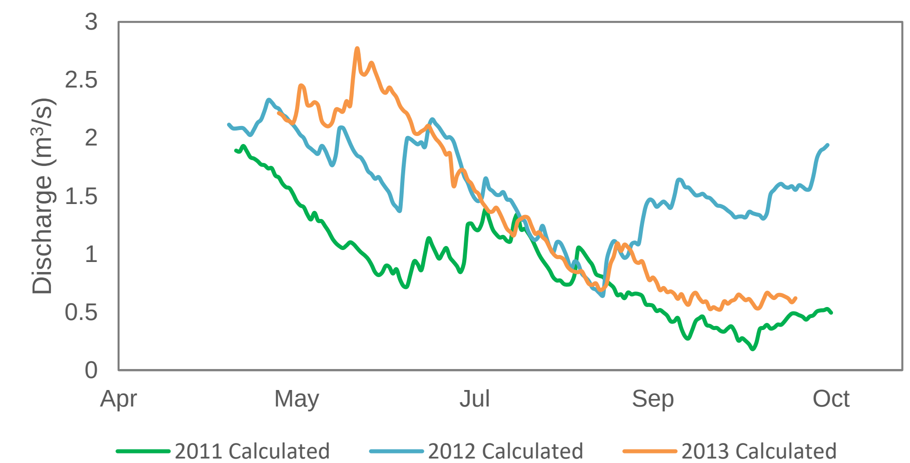
SA-1 facing downstream, July 2018.

Station ID	SA-2	**Periods of continuous recording**	2011-2013
GPS Coordinates	13 V 478524 6373216	**Instrument deployed**	N.A.
Access	By boat	**Active measurement**	N.A.
Periods of monitoring	2011-2014, 2016-2019	**Comments**	No continuous monitoring device is installed since 2014. Two outliers were observed in the stage-discharge curve as different cross section was used in 2016 and 2017. These two data points were not used to validate the stage-discharge relationship.
Measurements	Elevation, instantaneous discharge		

Map: SA-2 hydrometric monitoring station.



Stage – Discharge Curve



Continuous flow monitoring, 2011-2013 open water season

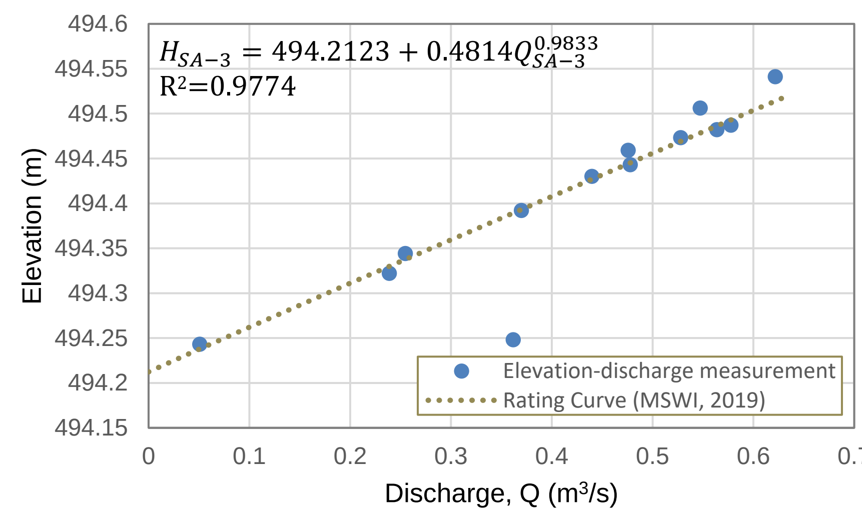
SA-2 facing upstream, May 2017.

SA-2 facing downstream, May 2017.

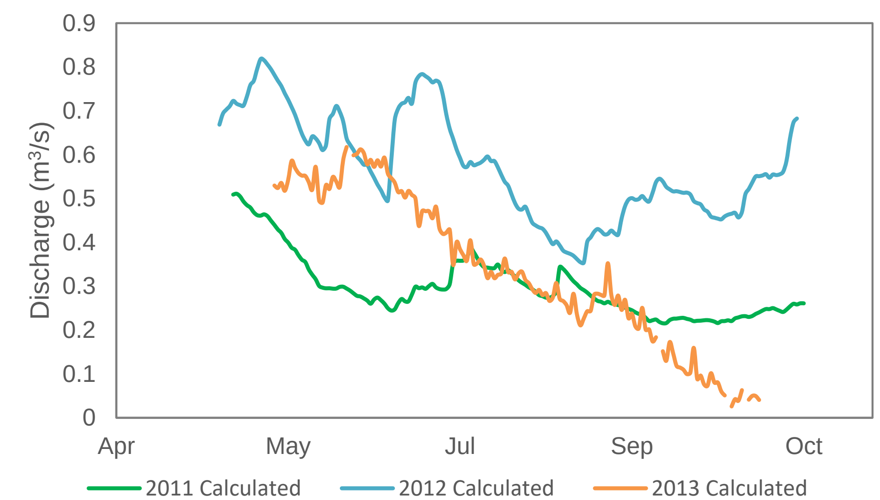
SA-2 facing upstream, March 2018.

Station ID	SA-3	Periods of continuous recording	2011-2013
GPS Coordinates	13 V 479415 6373234	Instrument deployed	N.A.
Access	By boat	Active measurement	N.A.
Periods of monitoring	2011-2014, 2016-2019	Comments	SA-3 produces good stage and discharge relationship. No continuous flow monitoring device was installed after 2014. The stage-discharge relationship was updated in 2019 with more recent monitoring data to expand the discharge range.
Measurements	Elevation, instantaneous discharge		

Map: SA-3 hydrometric monitoring station.



Stage – Discharge Curve



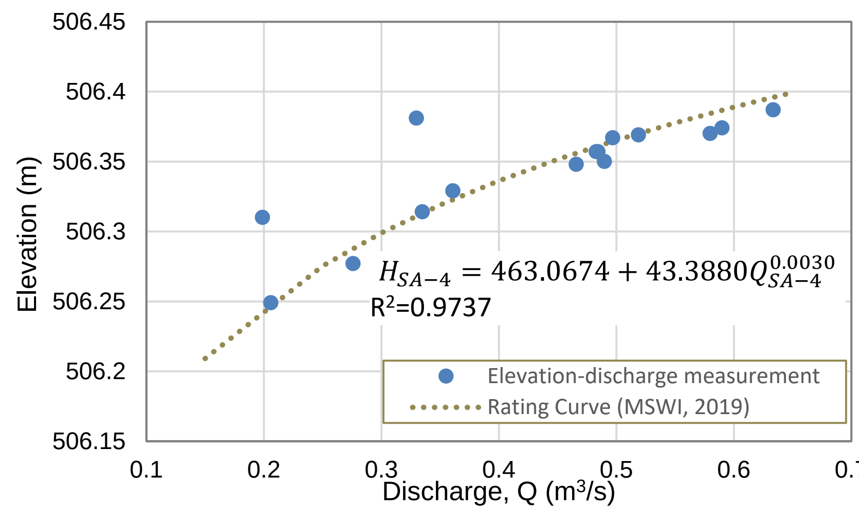
Continuous flow monitoring, 2011-2013 open water season

SA-3 facing upstream, September 2016.

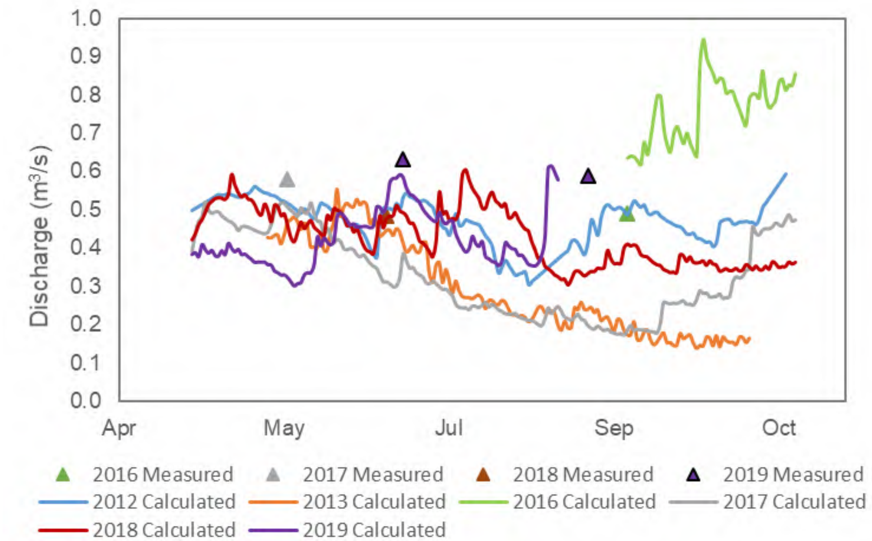
SA-3 facing downstream, September 2016.

Station ID	SA-4	**Periods of continuous recording**	2012-2014, 2016-2019
GPS Coordinates	13V 476926 6375868	**Instrument deployed**	Solinst levelogger, Serial number 2065001; Solinst barologger, serial number 2064922.
Access	By road	**Active measurement**	Continuous flow measurement
Periods of monitoring	2011-2014, 2016-2019	**Comments**	SA-4 produces a good stage-discharge relationship and hence an accurate hydrograph.
Measurements	Elevation, instantaneous discharge, continuous discharge		

Map: SA-4 hydrometric monitoring station.



Stage – Discharge Curve



Continuous flow monitoring, 2012-2014 and 2016-2019 open water season

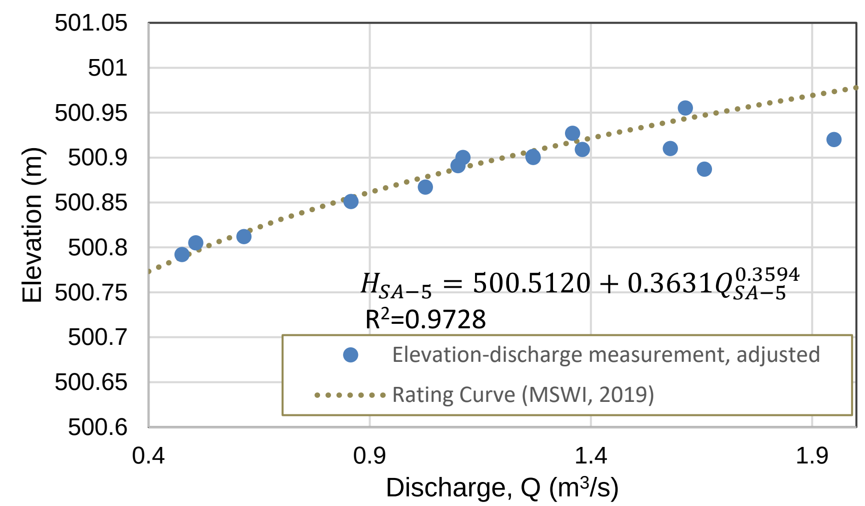
SA-4 facing upstream, June 2018.

SA-4 facing downstream, June 2018.

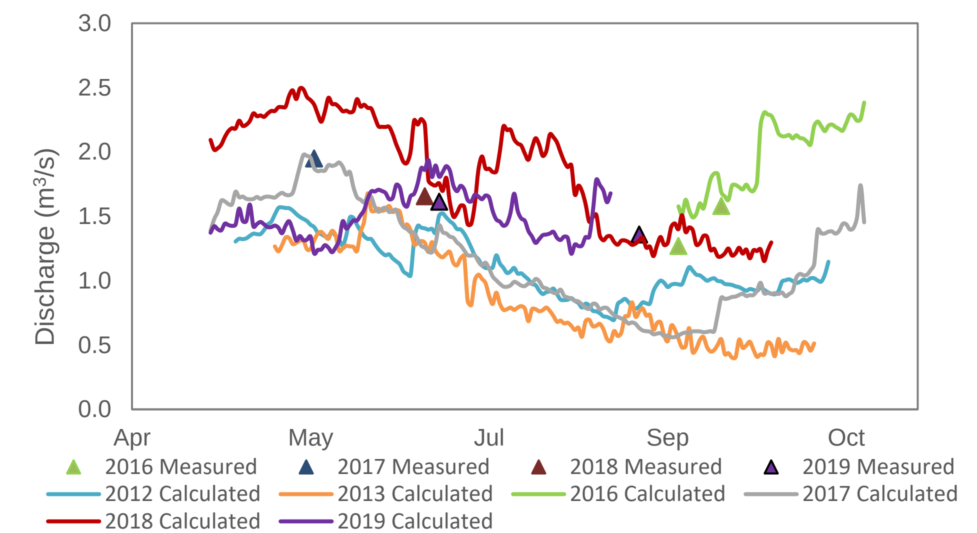
SA-4 facing upstream, March 2018.

Station ID	SA-5	**Periods of continuous recording**	2012-2014, 2016-2019
GPS Coordinates	13 V 477822 6375737	**Instrument deployed**	Solinst levelogger, Serial number 2064994
Access	By road	**Active measurement**	Continuous flow measurement
Periods of monitoring	2011-2014, 2016-2019	**Comments**	The monitoring station was moved upstream from previous location in 2016. The rating curve was adjusted to accommodate this change. SA-5 produces a fair stage-discharge relationship and hence hydrograph.
Measurements	Elevation, instantaneous discharge, continuous discharge		

Map: SA-5 hydrometric monitoring station.



Stage – Discharge Curve



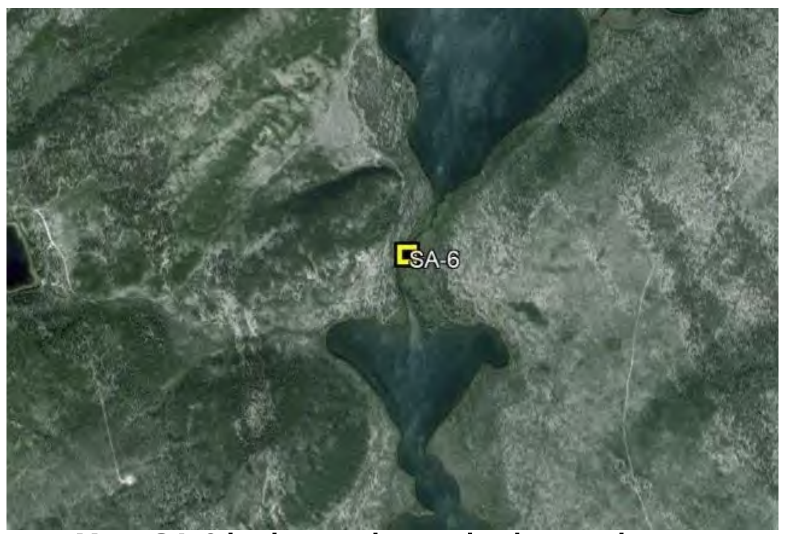
Continuous flow monitoring, 2012-2014 and 2016-2019 open water season

SA-5 facing upstream, May 2017.

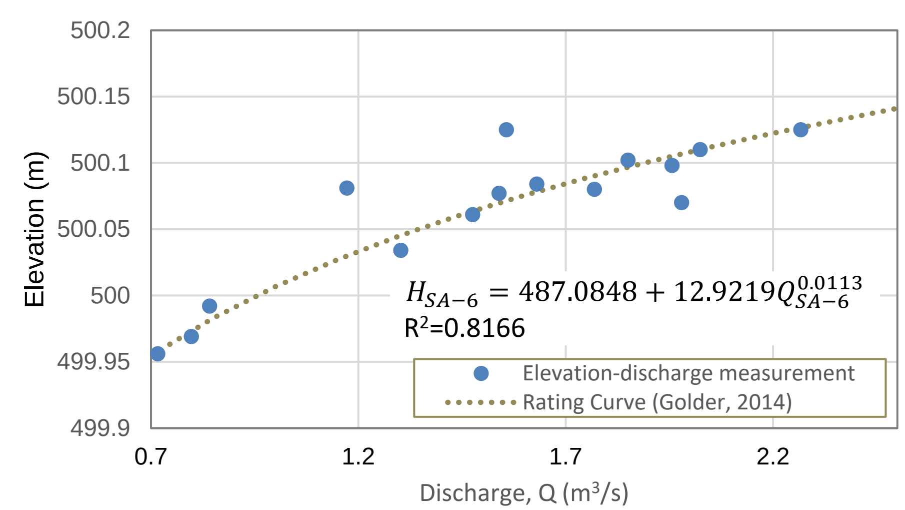
SA-5 facing downstream, May 2017.

SA-5 cross section, July 2019.

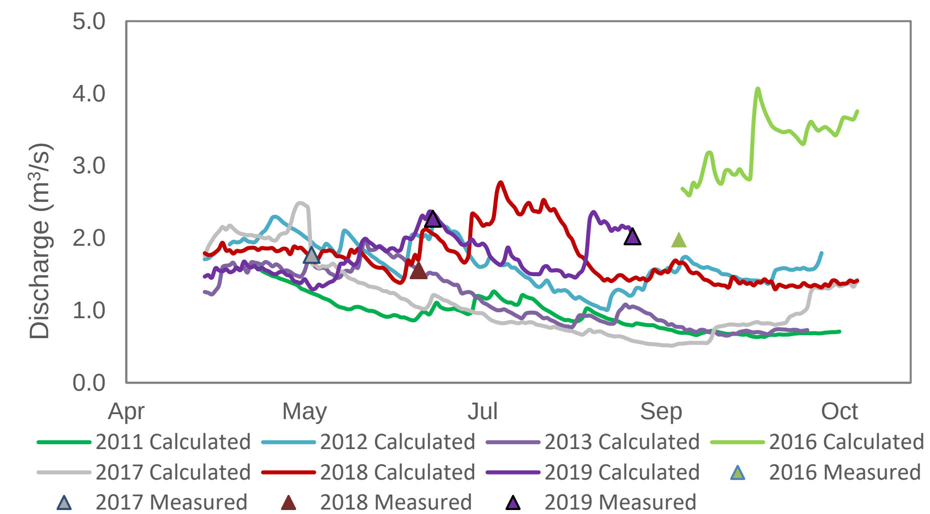
Station ID	SA-6	**Periods of continuous recording**	2011-2014, 2016-2019
GPS Coordinates	13 V 477863 6374742	**Instrument deployed**	Solinst levelogger, Serial number 1061428 (2016-2019). New logger deployed in August 2019 (Serial number 2110527).
Access	By road	**Active measurement**	Continuous flow measurement
Periods of monitoring	2011-2014, 2016-2019	**Comments**	SA-6 produced a fair stage-discharge relationship. SA-6 is recognized by local residence as a narrow connecting LA-5 and LA-6 as one lake (See LA-6 below).
Measurements	Elevation, instantaneous discharge, continuous discharge		



Map: SA-6 hydrometric monitoring station.



Stage – Discharge Curve



Continuous flow monitoring, 2012-2014 and 2016-2019 open water season

SA-6 facing upstream, March 2018.

Station ID	SA-7	**Periods of continuous recording**	N.A.
GPS Coordinates	13 V 472315 6375473	**Instrument deployed**	N.A.
Access	By boat	**Active measurement**	N.A.
Periods of monitoring	2016	**Comments**	SA-7 was a new station monitored since 2016. It is a narrow marshy stream and not suitable for continuous flow monitoring. This station was replaced by SA-11 in 2017.
Measurements	Elevation, instantaneous discharge.		

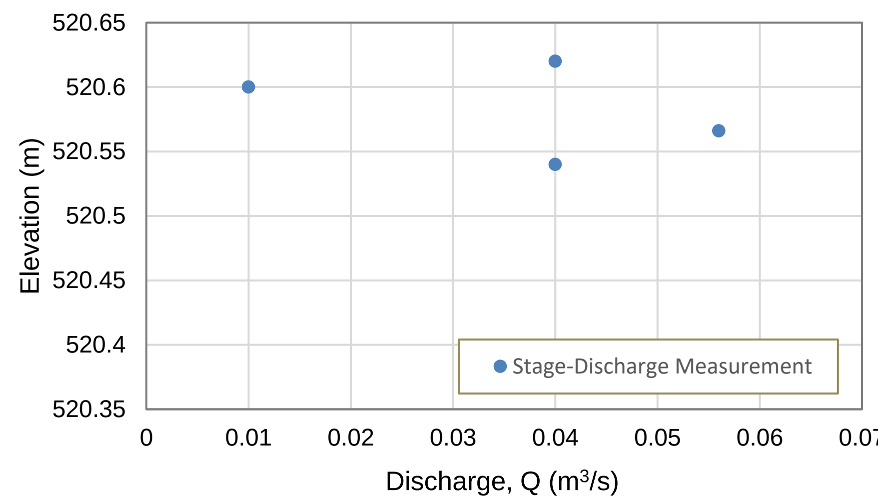
Map: SA-7 hydrometric monitoring station

SA-7 facing upstream, September 2016.

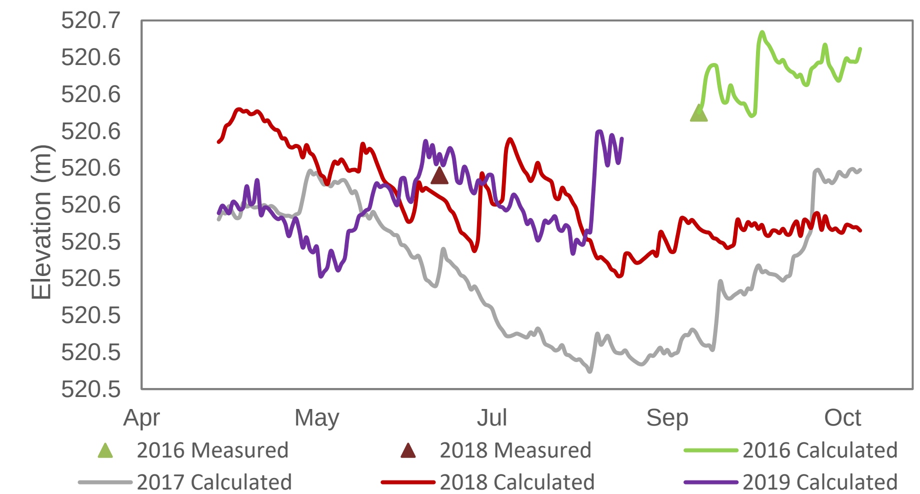
SA-7 facing downstream, September 2016.

Station ID	SA-8	**Periods of continuous recording**	2016-2019
GPS Coordinates	13 V 471579 6378303	**Instrument deployed**	Solinst levelogger, Serial number 2064996
Access	By boat	**Active measurement**	Continuous flow monitoring
Periods of monitoring	2016-2019	**Comments**	SA-8 is a new flow station has been monitored since 2016. It is a narrow stream with deep banks. More extreme flow data is required to establish a reliable rating curve. This station is believed to be impacted by elevation at the Kratchkowsy lake, and the station is moved upstream in 2019.
Measurements	Elevation, instantaneous discharge, continuous flow monitoring.		

Map: SA-8 hydrometric monitoring station



Stage – Discharge Relationship



Levelogger elevation results, 2016-2019 open water season

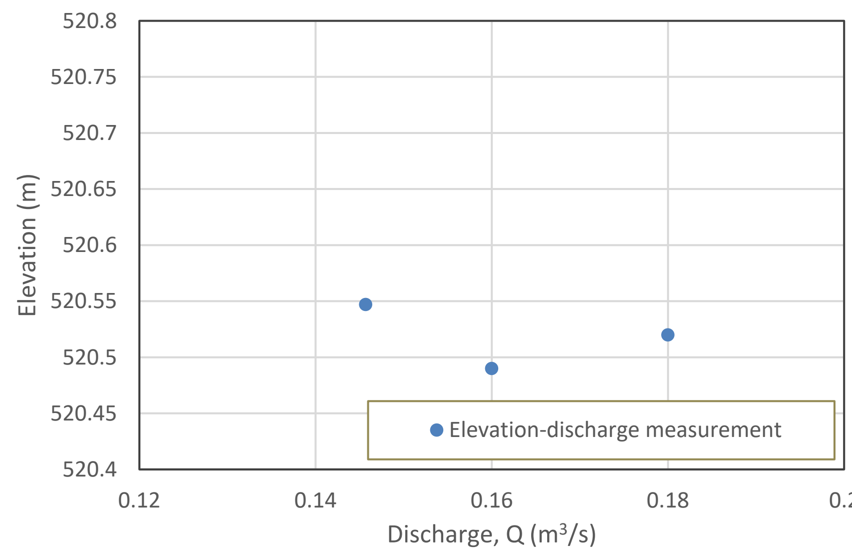
SA-8 facing upstream, September 2016.

SA-8 Hydrometric station, 2016-2019

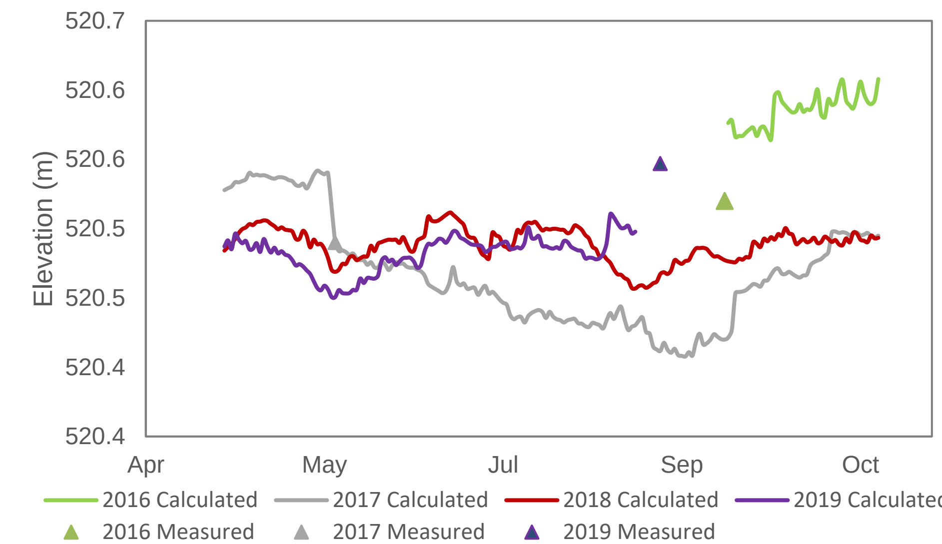
SA-8 new hydrometric station, Aug 2019.

Station ID	SA-9	Periods of continuous recording	2016-2019
GPS Coordinates	13 V 478226 6381589	Instrument deployed	Solinst levelogger, serial number 2065002
Access	By road	Active measurement	Continuous flow monitoring
Periods of monitoring	2016-2019	Comments	SA-9 was initially located at the outlet of a small lake downstream of LA-8. For access purpose, it was relocated to the outlet of LA-8 accessible by an existing ATV road. More stage and discharge data are required to establish a reliable rating curve.
Measurements	Elevation, instantaneous discharge, continuous flow monitoring.		

Map: SA-9 hydrometric monitoring station



Stage – Discharge Relationship



Levelogger elevation results, 2016-2019 open water season

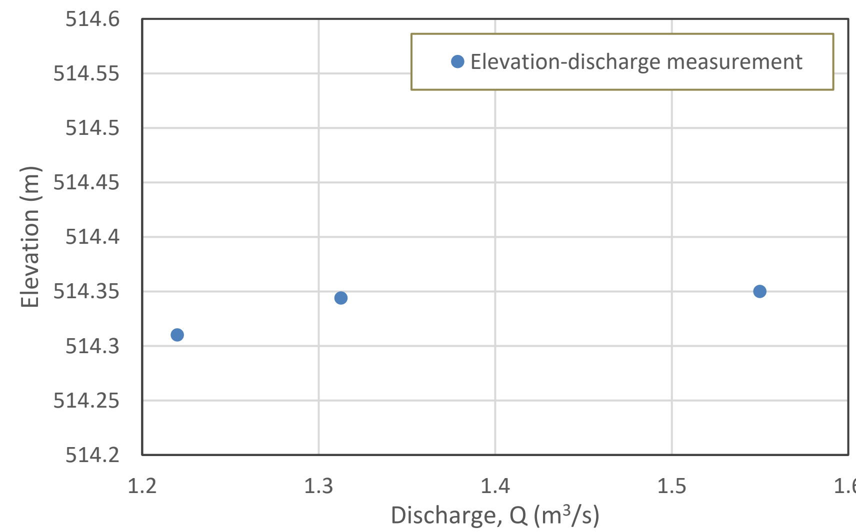

SA-9 facing upstream, Sep 2016.

SA-9 facing downstream, Sep 2016.

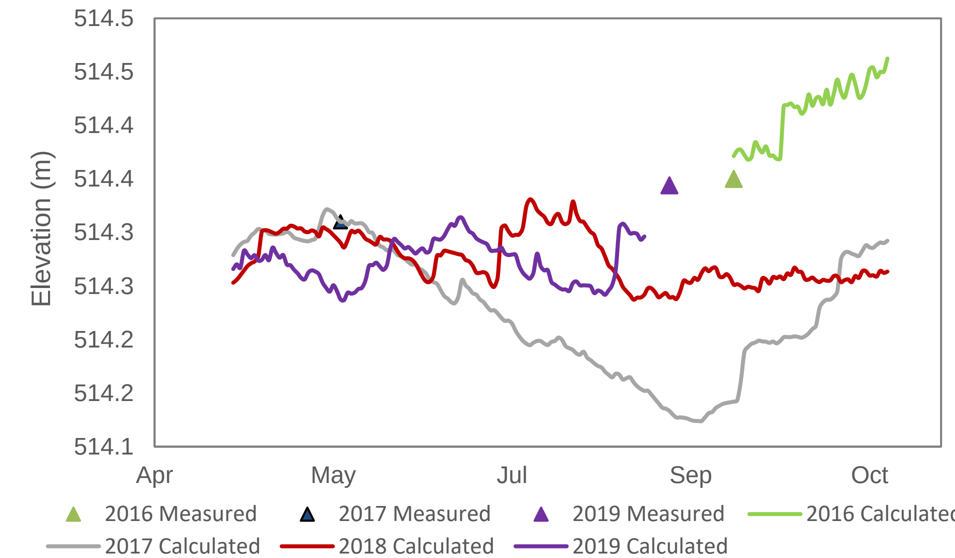

SA-9 cross section, Aug 2019.

Station ID	SA-10	**Periods of continuous recording**	2016-2019
GPS Coordinates	13 V 479003 6380421	**Instrument deployed**	Solinst levelogger, serial number 2065023
Access	By boat	**Active measurement**	Continuous flow monitoring
Periods of monitoring	2016-2019	**Comments**	More stage and discharge data are required to establish a reliable rating curve.
Measurements	Elevation, instantaneous discharge, continuous flow monitoring.		

Map: SA-10 hydrometric monitoring station



Stage – Discharge Relationship



Levelogger elevation results, 2016-2019 open water season

c

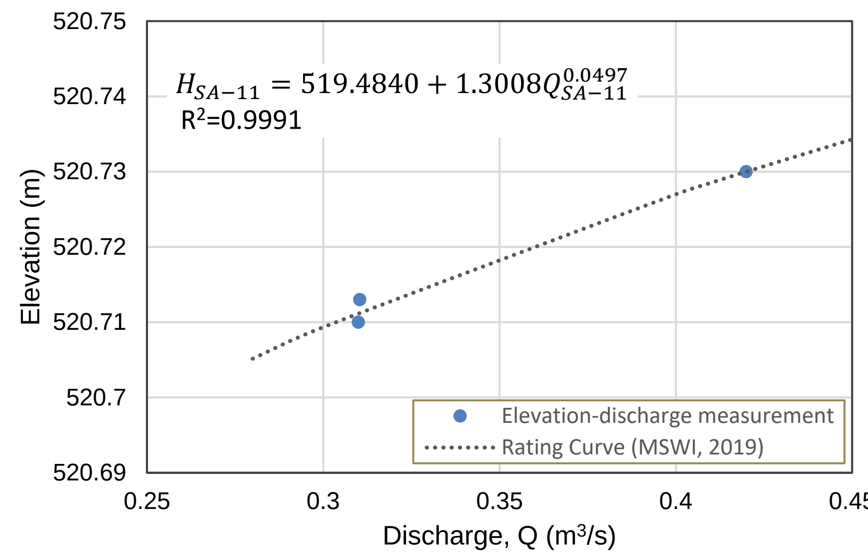
SA-10 facing upstream, September 2016.

SA-10 facing downstream, September 2016.

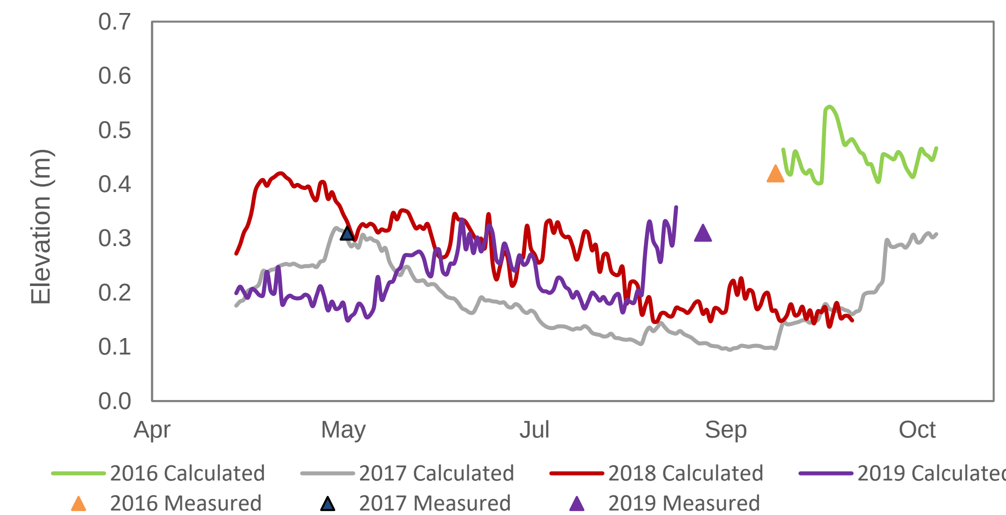
SA-10 cross section, Aug 2019

Station ID	SA-11	**Periods of continuous recording**	2016-2019
GPS Coordinates	13 V 473026 6379260	**Instrument deployed**	Solinst levelogger, serial number 2065010
Access	By boat	**Active measurement**	Continuous flow monitoring
Periods of monitoring	2016-2018 (EcoMetrix and Calder)	**Comments**	SA-11 is added to replace SA-7. A preliminary stage-discharge relationship is developed at SA-11. Validation is recommended to demonstrate accuracy of this relationship.
Measurements	Elevation, instantaneous discharge, continuous flow monitoring.		

Map: SA-11 hydrometric monitoring station



Stage – Discharge Relationship



Levelogger elevation results, 2016-2019 open water season

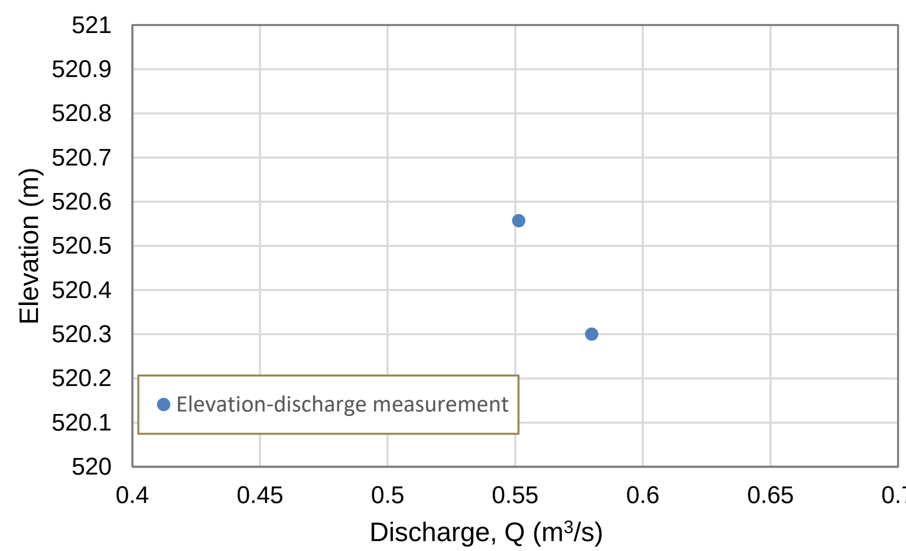

SA-11 facing upstream, September 2016


SA-11 facing downstream, September 2016.


SA-11 cross section, Aug 2019.

Station ID	RC-1 (Kratchkowsky Lake Outlet)	**Periods of continuous recording**	N.A.
GPS Coordinates	13 V 475468 6375987	**Instrument deployed**	N.A.
Access	By road	**Active measurement**	N.A.
Periods of monitoring	2016, 2018 (EcoMetrix and Calder)	**Comments**	RC-1 is situated immediately downstream of Kratchkowsky Lake. As it is accessible by a road crossing, it was the only location with instantaneous flow measured during the winter, 2018.
Measurements	Elevation, instantaneous discharge.		

Map: RC-1 hydrometric monitoring station



Stage – Discharge Relationship

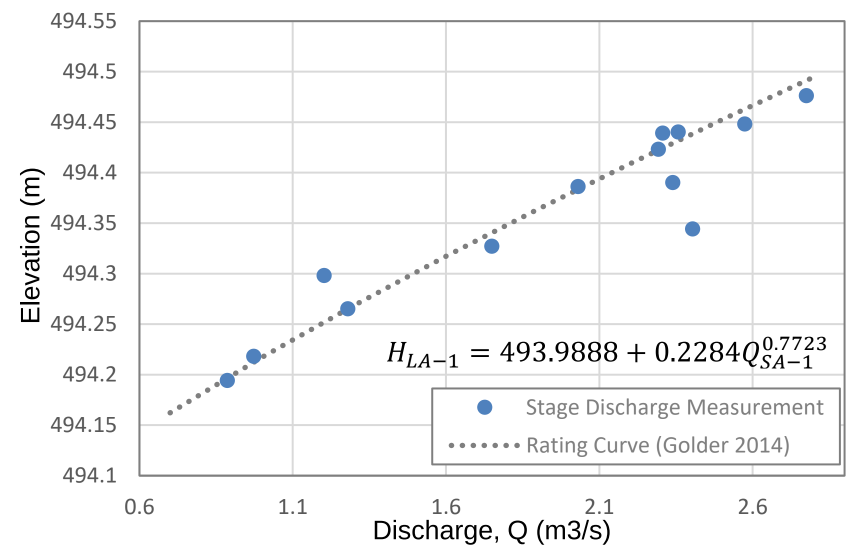
RC-1 facing upstream, September 2016

RC-1 facing downstream, September 2016.

RC-1 cross section, August 2019.

Station ID	McGowan Lake	Periods of continuous recording	2011-2014, 2019
GPS Coordinates	13 V 479399 6373215	Instrument deployed	Solinst levelogger, serial number 2110528 (installed August 2019).
Access	By road	Active measurement	Continuous flow monitoring
Periods of monitoring	2011-2014 (Golder), 2016, 2018 (EcoMetrix and Calder)	Comments	Discharge at SA-1 is used as the outlet of LA-1 to evaluate the stage-discharge relationship. A new data logger is installed in LA-1 in August 2019.
Measurements	Elevation, instantaneous discharge (SA-1), continuous flow monitoring (June -Oct, 2018)		

Map: McGowan Lake hydrometric monitoring station

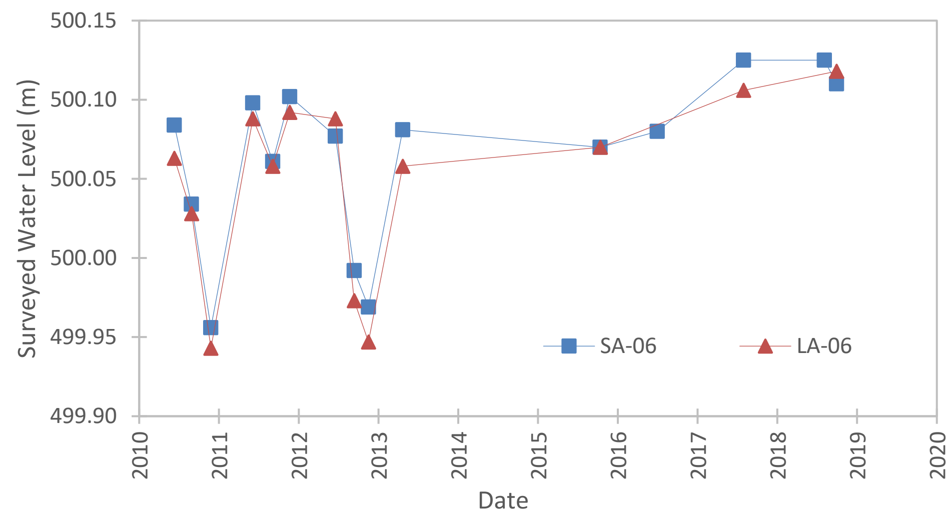


Stage – Discharge Curve

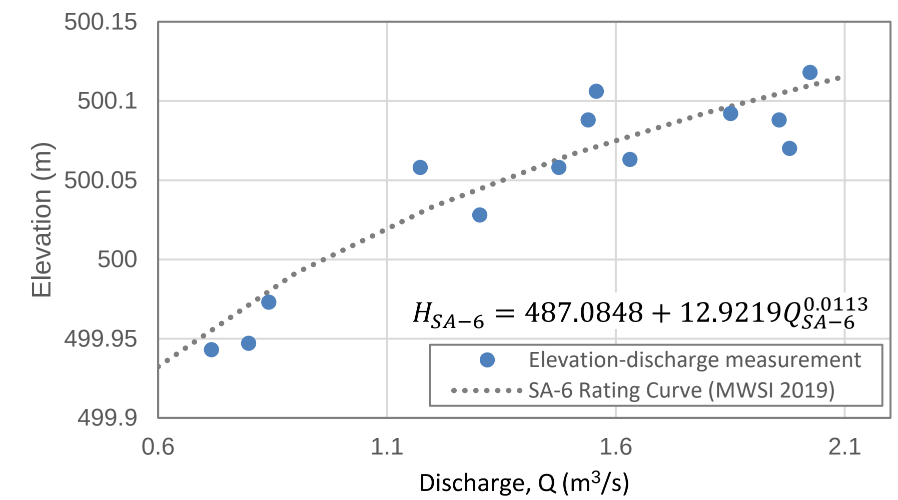
McGowan Lake photo, Sep 2016.

Station ID	LA-6	**Periods of continuous recording**	2011-2014
GPS Coordinates	13 V 477763 6375274	**Instrument deployed**	N.A.
Access	By road	**Active measurement**	N.A.
Periods of monitoring	2011-2014 (Golder), 2016, 2018 (EcoMetrix and Calder)	**Comments**	Both water level and discharge at SA-6 is representative to LA-6, and therefore level logger installed in SA-6 is used to continuously record discharge at this location. In addition, LA-5 and LA-6 is recognized as one lake (Whitefish Lake), and SA-6 is recognized as a narrow in this lake.
Measurements	Elevation, instantaneous discharge (SA-6), continuous flow monitoring (2018)		

Map: LA-6 hydrometric monitoring station



Water Elevation of LA-6 and SA-6



Stage – Discharge Curve

LA-6 photo, Sep 2016.


LA-6 photo, Aug 2019.

Appendix D 2012-2014 Baseline Hydrology Summary Report. Golder Associates

May 2014

DENISON MINES - WHEELER RIVER PROJECT

2012 - 2014 Baseline Hydrology Summary Report

Submitted to:
Mr. Lawson Forand
Exploration Manager
Denison Mines Corp.
Suite 200 - 320 - 22nd Street East
Saskatoon, SK
S7K 0E9

REPORT

Report Number: 12-1362-0050/5000

Distribution:

2 Copies Denison Mines Corporation.

2 Copies Golder Associates Limited.

Golder Associates

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TABLES

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FIGURES

APPENDICES

1.0 INTRODUCTION

1.1 Background Information

In 2011, Golder Associates Ltd. (Golder) was retained by Denison Mines Corp. (Denison) to undertake a hydrological baseline program as part of a pre-feasibility study of the Phoenix deposit at the Wheeler River property (the Project) near Key Lake, Saskatchewan. Golder completed hydrological investigations during the open water season of 2011, 2012, and 2013 as well as one during the ice covered season in 2014. The work was to collect the necessary hydrological baseline data to support various project requirements including environmental assessments, regulatory permitting, and providing design basis information for engineered structures such as fresh water diversions, water management systems, sedimentation ponds, and cross-drainage structures.

This report summarizes the baseline study design, methods and presents the results from the 2011 to 2013 field seasons as well as winter data collected in March 2014. This report builds on a similar interim report produced following the 2013 field season.

1.2 Site Information

The Project is located in north central Saskatchewan, in the south-eastern portion of the Athabasca Basin region, approximately 35 kilometres (km) northeast of Cameco Corporation's (Cameco's) Key Lake Operation and 35 km southwest of Cameco's McArthur River Operation. The site is accessible from the Key Lake – McArthur River haul road. The general Project area is characterized as a morainal plain with southwest trending drumlins and eskers, and glaciofluvial outwash areas, overlying Athabasca sandstones. Numerous interconnected lakes occur in the area, along with low-lying, poorly drained areas of muskeg. The Project is located in the Athabasca Plain Ecoregion which is characterized by jack pine, birch and poplar, and dense spruce forests.

1.3 Climate and Weather

Climate conditions play an important role in the local hydrological cycle by governing the primary inputs and outputs to the surface water environment, including precipitation and evaporation. Environment Canada (EC 2013) has collected data from two weather stations near Key Lake, which can be used to represent general conditions for the Project.

Runoff is a function of several environmental conditions, including rainfall and snow accumulation, evaporation from open water surfaces, evapotranspiration from terrestrial areas, and soil types (infiltration). Although discharge is not exclusively a function of local precipitation, it can provide important context for observed flow characteristic. Figure 1 presents the precipitation record for Key Lake (compiled from two Environment Canada weather stations at Key Lake; EC 2011) for the 2010-2011, 2011-2012, and 2012-2013 hydrological years (October 1 to September 30) and historical averages. The first six months of the 2013-2014 hydrological year are also presented.

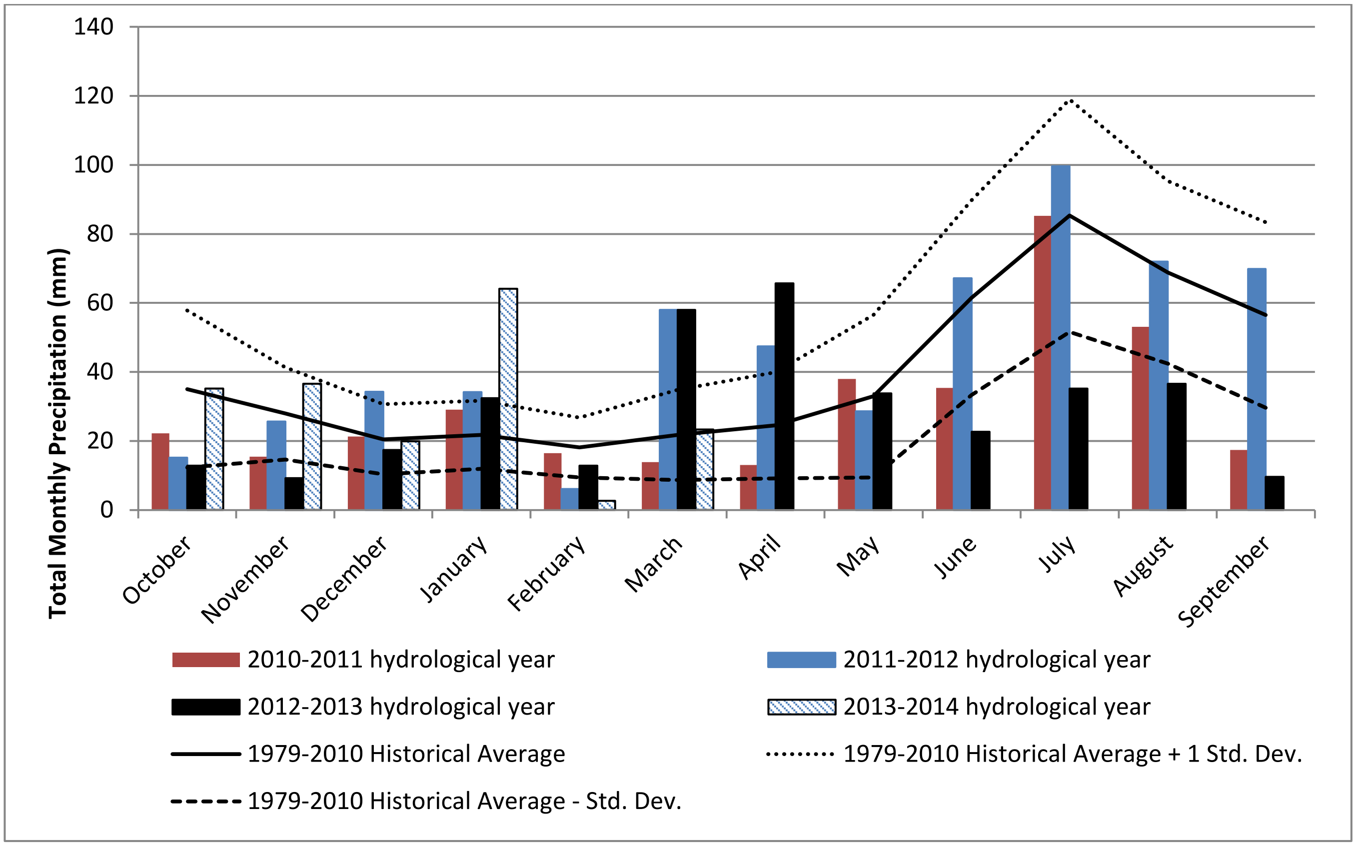


Figure 1: Key Lake Total Precipitation for Hydrological Years between 2010 and 2013 (EC 2013)

Precipitation during the 2010-2011 hydrological year was less than average during all months except January, May and July when precipitation was above average (January) or near average (May and July). The low precipitation throughout most of the winter would contribute to a smaller snowpack and a reduced spring freshet. Low summer and early fall precipitation would contribute to lower than normal flows during these periods.

Precipitation during the 2011-2012 hydrological year was generally near the 1979-2010 historical average. While cumulative precipitation from October to March was within 20% of the historical average, precipitation in March and April was more than twice the historical average. Near normal values were observed throughout the rest of the summer and early fall; the generally high precipitation rates in June through September could result in secondary peak flow events in summer and early fall.

Precipitation during the 2012-2013 hydrological year was below the 1979-2010 historical average. Cumulative precipitation from October to February was 30% below average. However, total precipitation of over twice the historic average during March and April resulted in cumulative precipitation of 20% above normal values by May. The summer of 2013 was dry with precipitation rates well below the historic average.

Precipitation during the first half of the 2013-2014 hydrological year was above the 1979-2010 historical average. Cumulative precipitation from October to March was 25% above average and snowfall during January was three times normal.

1.4 Regional Hydrology

Water Survey of Canada (WSC 2014a, 2014b) operates a hydrometric station on the Wheeler River, downstream of Russell Lake (Station 06DA005). The station is located about 25 km east of the Project site and records flows from a contributing drainage area of 3,030 square kilometres (km^2). The hydrometric station has been in operation from 1973 to the present and real time discharge and water level data are available. While the drainage area is much larger than those near the site (<371 km^2), the drainage areas relevant to the Project are tributaries to the Wheeler River and are thus expected to exhibit similar flow characteristics.

The mean monthly discharge rates at the Wheeler River for the hydrological years (October 1 to September 30) of 2010-2011 and 2011-2012 (WSC 2014a) as well as 2012-2013 and 2013-2014 (WSC 2014b) are presented in Figure 2.

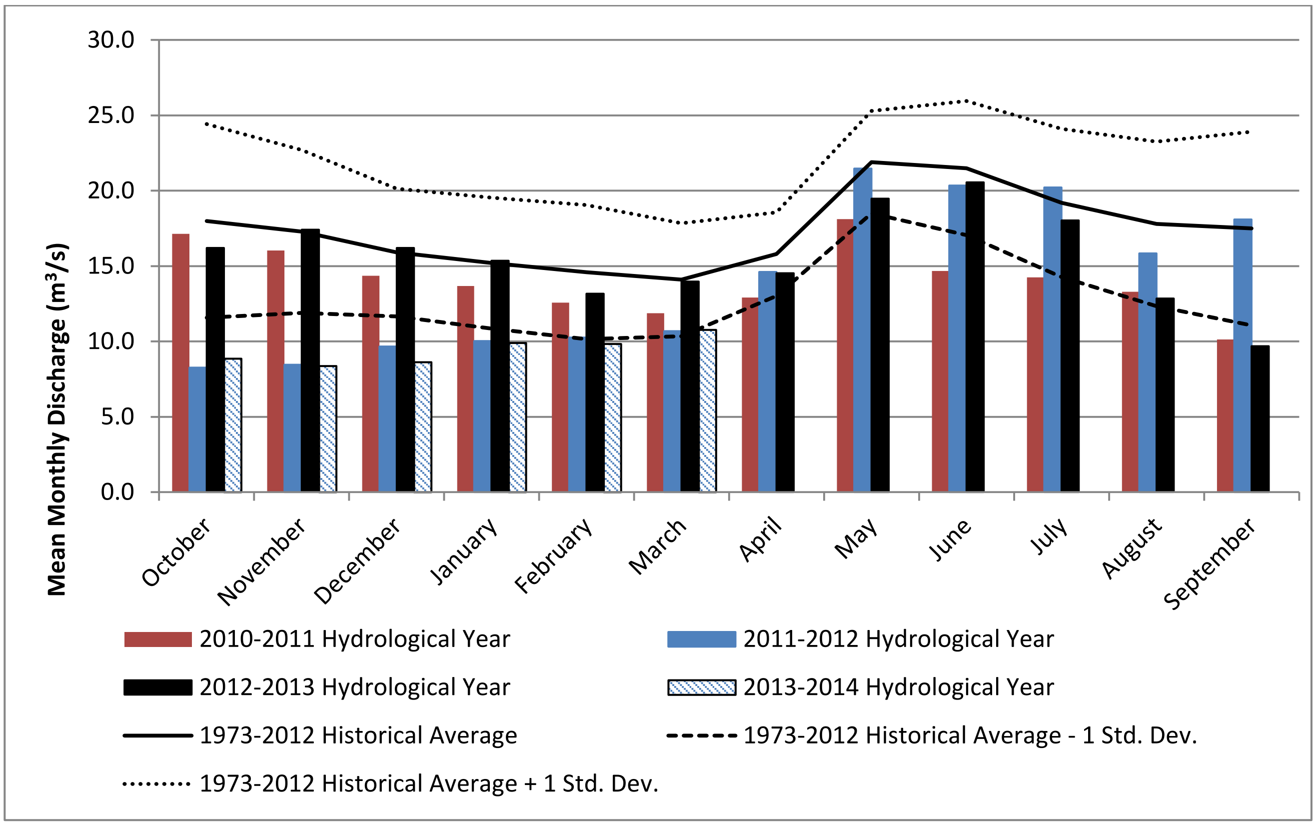


Figure 2: Wheeler River Mean Monthly Discharge for the Hydrological Years Between 2010 and 2013 (WSC 2013, 2014).

Although only provisional data that are subject to revision are available for 2012-2013 and 2013-2014 (Figure 2) these flow rates provide important context to the corresponding flow rates observed near the Project.

During the 2010-2011 hydrological year, discharge at the Wheeler River monitoring station was slightly below the historical average throughout the winter (October–March) and remained well below average during the spring freshet (May and June) and the remainder of the summer and early fall. During this time, flows ranged from 58 percent (%) (September) to 82% (April) of the 1973-2009 normal.

During the 2011-2012 hydrological year, discharge was below the historical average for the winter (January-March). Peak discharge in May approached the historical monthly average of 22 m^3/s, and remained near average during June, July, and September.

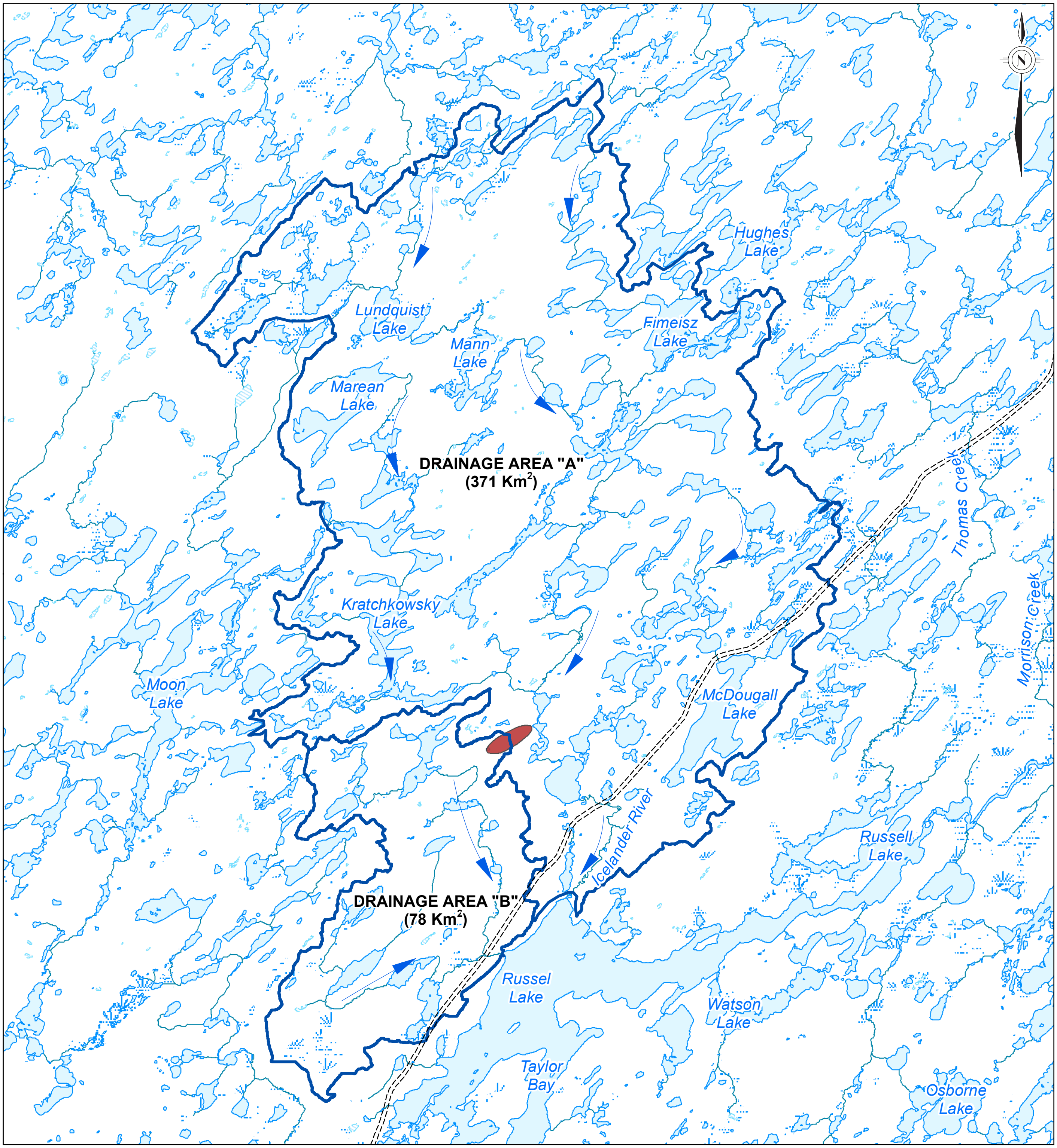
During the winter (October–March) of 2012-2013, discharge at the Wheeler River monitoring station was near or slightly below the historical average. Additional precipitation in April and March (Figure 1) were not matched by a similar streamflow response and discharge remained near but below average until July. In August and September discharge fell well below normal during late summer to 55% of the historical average by September.

During the winter (October–March) of 2013-2014, discharge at the Wheeler River monitoring station was slightly below the normal and rose slightly throughout the winter. The gradual increase in discharge over the winter is likely due to a combination of increased base flow and decreased lake storage. Base flow reaching the stream network is expected to have increased during the fall when evaporative demands ceased and base flow contributions originating in remote terrestrial uplands were free to flow slowly to the stream network. Above average snowfall shown on Figure 1 may also have contributed to higher flow between lakes by depressing the ice surface and decreasing lake storage volume. While flows recovered slightly throughout the winter, they remained one standard deviation below the mean. This increase in flows over winter from the very low levels in the fall of 2013 was also observed in flow data from Project monitoring stations.

2.0 LOCAL HYDROLOGY

2.1 Introduction

The Project is associated with two drainage areas that discharge into Russell Lake (Figure 3). Drainage Area A, with an estimated drainage area of 371 km^2, extends north and east of the Project area while Drainage Area B, with an estimated drainage area of 78 km^2, drains areas south of the Project. The drainage divide between Drainage Area A and Drainage Area B intersects the approximate location of the ore zone (Figure 3). Hydrological monitoring stations were established at six streams and seven lakes in Drainage Area A, and three streams and lakes in Drainage Area B during the 2011 to 2013 field programs; the monitored streams and lakes have been arbitrarily named (Figure 4). The monitored lakes and streams were selected to provide information on all the waterbodies potentially affected by the project and to characterise the general streamflow regime in the area. Table 1 provides the locations and monitoring activities at each waterbody.



LEGEND

==== MCARTHUR RIVER MINE ACCESS ROAD

ORE ZONE

WATERSHED BOUNDARY

4 0 4

SCALE 1:200,000 KILOMETRES

REFERENCE

NTS MAPSHEETS 74H02,03,04,05,06,07,10,11,12
NAD83 UTM ZONE 13

PROJECT

DENISON MINES CORP.
WHEELER RIVER PROPERTY

TITLE

DRAINAGE AREAS ASSOCIATED WITH THE PROJECT

Golder Associates
Saskatoon, Saskatchewan

PROJECT		12-1362-0050	FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
GIS	LMR/ANK	23/01/14	FIGURE: 3	
CHECK	RP	29/05/14		
REVIEW	BT	29/05/14		

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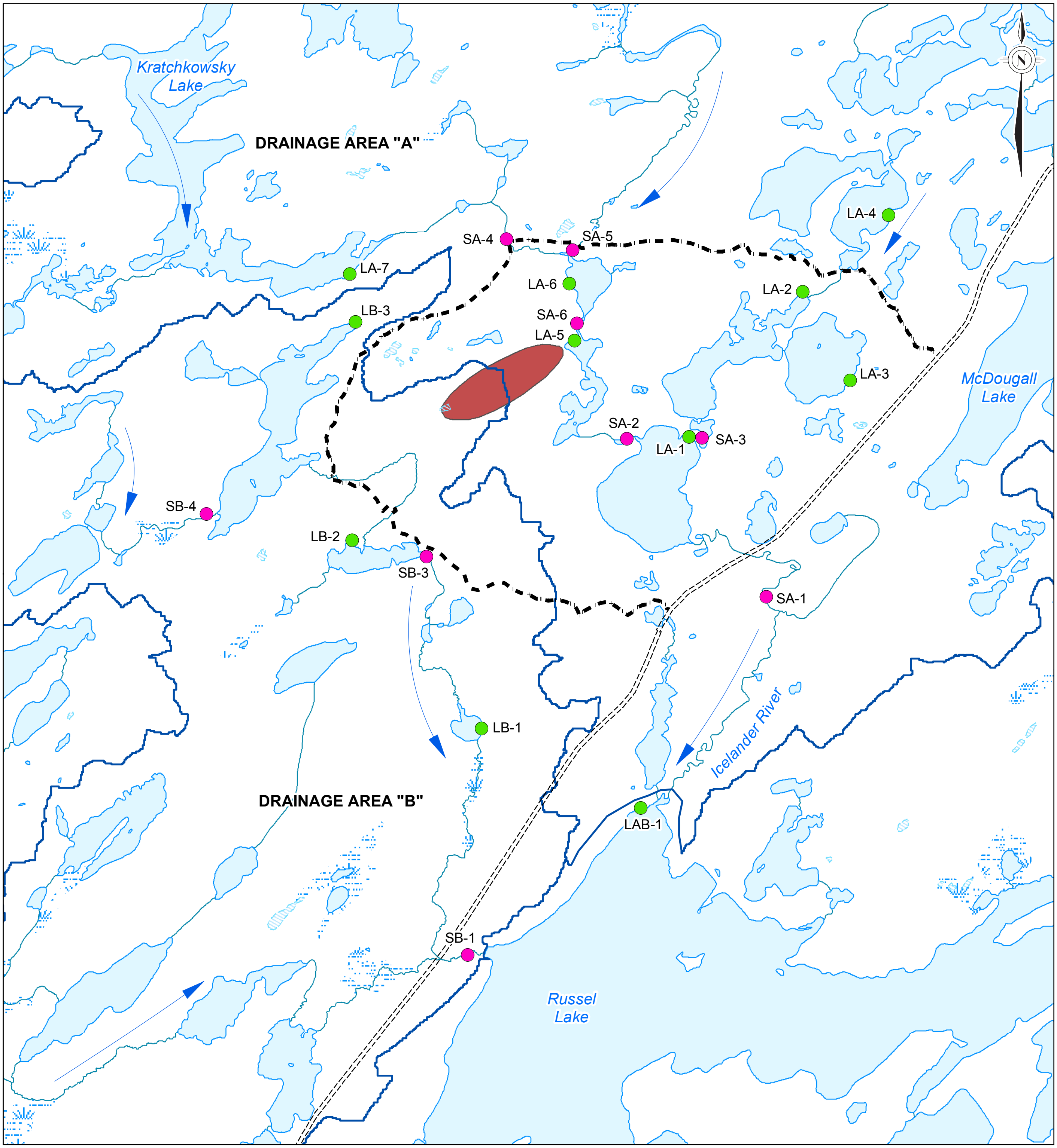

2 0 2

SCALE 1:75,000 KILOMETRES

LEGEND

- ==== MCARTHUR RIVER MINE ACCESS ROAD
- ORE ZONE
- WATERSHED BOUNDARY
- TRAIL
- LAKE MONITORING STATION
- STREAM MONITORING STATION

NOTE

THE GEOGRAPHIC LOCATIONS OF THE MONITORING STATIONS HAVE BEEN ALTERED FOR GRAPHICAL REPRESENTATION.

REFERENCE

NTS MAPSHEETS 74H02,03,04,05,06,07,10,11,12
NAD83 UTM ZONE 13

PROJECT

DENISON MINES CORP.
WHEELER RIVER PROPERTY

TITLE

STREAM AND LAKE MONITORING SITES

Golder Associates
Saskatoon, Saskatchewan

PROJECT		12-1362-0050	FILE No.	
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REVIEW	BT	29/05/14		

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Table 1: Hydrology Monitoring Stations

Station Name	Location (UTM NAD 83)	Instantaneous Discharge Measurements	Continuous Water Level Recording	Staff Gauge	Elevation Survey
Lake Level Monitoring Sites					
LA-1	13 V 479387 6373208	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014
LA-2	13 V 480852 6375164	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014
LA-3	13 V 479387 6373208	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014
LA-4	13 V 481989 6376180	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014
LA-5	13 V 477830 6374521	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014
LA-6	13 V 477763 6375274	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014
LA-7	13 V 474851 6375402	-	2012, 2013	2011, 2012, 2013	2011, 2012, 2013, 2014
LAB-1	13 V 478705 6368323	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014
LB-1	13 V 476598 6369377	-	-	2011, 2012, 2013	2011, 2012, 2013
LB-2	13 V 474882 6371871	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014
LB-3	13 V 474925 6374767	-	-	2011, 2012, 2013	2011, 2012, 2013, 2014
Stream Discharge Monitoring Sites					
SA-1	13 V 480368 6371123	2011, 2012, 2013, 2014	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014
SA-2	13 V 478524 6373216	2011, 2012, 2013, 2014	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014
SA-3	13 V 479415 6373234	2011, 2012, 2013, 2014	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014
SA-4	13 V 476929 6375866	2011, 2012, 2013, 2014	2012, 2013, 2014	-	2011, 2012, 2013, 2014
SA-5	13 V 477804 6375716	2011, 2012, 2013, 2014	2012, 2013, 2014	-	2011, 2012, 2013, 2014
SA-6	13 V 477861 6374749	2011, 2012, 2013, 2014	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014
SB-1	13 V 476041 6366362	2011, 2012, 2013, 2014	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014
SB-3	13 V 475866 6371655	2011, 2012, 2013, 2014	2011, 2012, 2013, 2014	-	2011, 2012, 2013, 2014
SB-4	13 V 472952 6372222	2011, 2012, 2013, 2014	2012, 2013, 2014	-	2011, 2012, 2013, 2014

Three field programs were completed each open water season in 2011, 2012, and 2013. The field programs were timed to capture the spring peak flows (spring program), summer, and fall, immediately prior to freeze-up. One additional winter field program was completed between March 22 and April 1, 2014. Table 2 indicates the dates of each field program.

Table 2: Field Program Dates

	2011	2012	2013	2014
Spring	May 11 - May16	May 3 – May 9	May 18 – 24	-
Summer	July 27 - July 31	August 5 – August 8	August 12 – 15	-
Fall	October 27 - October 31	October 21 – October 25	October 16 – 19	-
Winter	-	-	-	March 22 – April 1

2.2 Methods

2.2.1 Instantaneous Streamflow Monitoring

At each stream monitoring site, instantaneous streamflow measurements were taken during the spring, summer and fall field campaigns. A suitable cross-section was selected at each stream based on the following characteristics: good bank control, straight channel, most laminar flow, and accessibility. A tag line (a cable marked at regular intervals) was used to divide the channel into vertical segments, with each segment measuring approximately 5% of the channel width or less than 10% of the flow, for streams more than 2 m wide. The depth and velocity at each segment across the channel was measured using a SonTek Flow Tracker current meter attached to a top-set wading rod. The velocity was measured at a depth of 60% (for depths less than 0.75 m) or at 20% and 80% of the depth (for depths greater than 0.75 m). For each section, the product of the mean of the depths and the flow velocity was multiplied by the width of the section to determine the total discharge. This was repeated for each consecutive section across the stream and the total discharge for the stream was then obtained by summing the partial discharges (velocity-area method). The mid-section method was used for discharge calculations (Terzi 1981). Instantaneous winter streamflow measurements were collected for each stream monitoring site observed to have flowing water during the 2014 winter field program. Methods were similar to those used in the summer with the substitution of "effective" flow depth for open water depth to account for the influence of ice cover on flow. Standard methods for the observation of streamflow under ice were followed (Terzi 1981).

2.2.2 Staff Gauge and Elevation Measurements

Water level measurements were collected at each monitoring site. Primarily elevation measurements were collected using an engineer's rod and level and at some sites secondary elevation measurements were recorded using a staff gauge. At each site, up to three benchmarks were established using the highest point on a large, stable boulder, or a 1.5 m length of rebar driven into the ground. The benchmarks were spray painted, marked as BM1, BM2 or BM3 with flagging tape, and the location was recorded.

An engineer's rod and level were used to measure water elevations relative to BM1 at each location, which was assigned an arbitrary elevation of 100.000 m. The three benchmarks were used for quality control and to confirm benchmark stability. The water level was measured at the lake surface or at the streamflow monitoring location; if waves affected the accuracy of the reading, the potential error was also recorded. Staff gauges were installed using 2 m lengths of rebar or T-bar and the top (1.000 m) of the staff gauge was measured relative to the local BM1 to monitor potential staff gauge movement between site visits, particularly over winter when ice can disturb the staff gauges.

To convert arbitrary benchmark datums into the geodetic datum, survey results from the 2012 Denison Wheeler River Ground Survey Summary were integrated (Appendix A). This survey used Real Time Kinematic (RTK) GPS to determine the geodetic elevation of the benchmarks. While elevation data were collected for all benchmarks at each site, the vertical error associated with the RTK survey is greater than that associated with the rod and level survey. Therefore, the geodetic elevation of the benchmark with the most accurate reading, i.e., lowest positional dilution of precision (PDOP) value at each site was used to calculate the elevations of the other benchmarks at the site using rod and level survey results.

2.2.3 Continuous Water Level Recording

Water level was continuously measured using a pressure transducer/data logger system. Leveloggers, manufactured by Solinst Canada Ltd, were programmed to record water levels at 30 minute intervals. At each 30 minute interval, the Levelogger records total pressure (atmospheric pressure and water pressure) acting on the sensor, which is internally compensated for temperature. A barologger was also installed near the Denison Mines Wheeler River Exploration Camp. The barologger was only exposed to atmospheric pressure, thereby allowing for barometric compensation of the Levelogger data. The resultant water pressure is related to height of water above the sensor and thus water elevation.

Each Levelogger was secured inside a bracket consisting of a small aluminum pipe that was welded to an aluminum plate or a 0.5 m pin. The plate or pin was fixed in place in the streambed, at or near the discharge measurement cross-section. The elevation of the top of the sensor bracket was measured relative to BM1 during the elevation survey to monitor potential movement between site visits. The sensor's water level measurement and coincident water elevation survey relative to BM1 were used to adjust the continuous water level data to the BM1 datum. An open water stage-discharge rating curve derived from coincident measurements of water depth (stage) and stream discharge was applied to the continuous water level record to derive a continuous discharge record for each site during the open water season.

2.3 Results

2.3.1 Streams

Stage and discharge measurements (Appendix B) were used to create stage-discharge curves for each streamflow monitoring site, as presented in Appendix C. While the three data points typically cover the range of flows and levels observed for the 2011, 2012, and 2013 monitored seasons, the curves are preliminary and discharge records are subject to modification as more measurements are collected and the stage-discharge curves are refined. The hydrograph and instantaneous discharge measurements for streams are provided in Appendix D. Photographs for all streamflow monitoring locations are provided in Appendix E.

In 2011, all hydrographs reflect highest observed flows in the spring during installation. The rising limb of the hydrograph, and spring peak flow rate was not captured at any site. The flow receded throughout May and June, and at all sites a secondary peak was observed during July and early August, which corresponds to relatively high rainfall (Figure 1). Flows receded again until September and remained static for the balance of the monitoring season.

Flows were considerably higher for the 2012 monitoring season than those observed in 2011. In 2012, the spring peak discharge rate, which occurred shortly after the first discharge measurement, was approximately captured at all sites. Discharge peaked in mid-May, and while it generally receded until late August, several other runoff events occurred, and at some sites, reached or exceeded the spring peak flow rate. At most sites, flow rates reached seasonal lows in late August before rising again during September and October to rates approaching those measured in the spring.

Flows were high relative to previous years during spring 2013 but a dry summer meant that by fall, flows were well below those observed in fall 2012 and similar to those observed in fall 2011. Discharge peaked in late June and steadily receded until moderate runoff responses occurred in late August and early September. Flows receded to seasonal lows in late September.

Flows rose above fall 2013 levels through the winter of 2013-2014. The increase in flow through the streams was not matched by increased lake levels. Increased winter flows are expected to result from decreased lake storage due in part to high snow load accumulated on the ice covered lake surfaces.

The following presents a discussion of the physical features and monitoring characteristics observed at each site.

SA-1

SA-1 is the most downstream monitoring station in Drainage Area A with an estimated upstream area of approximately 371 km^2. The monitoring station is located at the transition between an upstream low gradient meandering channel section and a downstream higher gradient riffle channel section. The stream substrate is composed of boulders, cobble and sand and is approximately 15 m wide at the cross-section. Although the banks are well defined and stable with shrubs and moss, the left bank has a notable floodplain vegetated with shrubs and black spruce. SA-1 is a good cross-section and monitoring station, and produces a good stage-discharge relationship and accurate hydrograph.

SA-2

Streamflow monitoring station SA-2 flows into the northwest end of LA-1. The monitoring station at SA-2 is located several meters downstream of the transition between an upstream meandering channel and a downstream riffle section. The monitoring site has a cross-section width of approximately 11 m, is relatively shallow with high velocity flow. The substrate is primarily composed of boulders and cobble, with well-defined and stable vertical banks vegetated with shrubs and trees. SA-2 produces a fair stage-discharge relationship; however the slope is nearly linear, so it may overestimate low and high flows. Further measurements at extreme flows would help verify the accuracy of this rating curve.

SA-3

Streamflow monitoring station SA-3 flows from LA-2 to LA-1. The entire stream length has a sandy and silty substrate with well-defined high vertical banks vegetated with shrubs, willows and jack pine. The monitoring station is located near the middle of the stream length and has a cross-sectional width of approximately 11 m and is shallow. SA-3 produces a good stage-discharge relationship and therefore relatively accurate hydrograph.

SA-4

The stream discharge monitoring station SA-4 drains LA-7, and is to the east of SA-5 and flows into the northwest end of LA-6. The monitoring site is located upstream of the existing temporary bridge and a fast flowing, narrow channel section. The channel has a cross-section width of approximately 6 m. The channel bottom is composed of large angular cobble and boulders. SA-4 produces a poor stage-discharge relationship, likely due to the coarse substrate which increases the stage at low discharge.

SA-5

Station SA-5 is to the west of SA-4 and flows into the northwest end of LA-6. The monitoring station is located downstream of a small temporary bridge in a straight and relatively steep section of the stream. The substrate at the cross-section is primarily boulders and cobble with some sand. The stream has a width of approximately 8 m and has stable vertical organic banks vegetated with shrubs. SA-5 produces a fair stage-discharge relationship and therefore hydrograph.

SA-6

Streamflow monitoring Station SA-6 drains from LA-6 and is upstream of SA-2. The stream section at this monitoring site is characterized by a sandy substrate, slow, deep, and laminar flow, and vertical banks. Although the right bank is well defined, high, and vegetated with trees, sand, and moss, the left bank is low lying with muskeg, shrubs and black spruce. The cross-section has a width of approximately 14 m. SA-6 produces a very good stage-discharge relationship and hydrograph.

SB-1

SB-1 is the most downstream monitored stream in Drainage Area B. The monitoring station is located immediately upstream of the culverts on the Key Lake-McArthur River haul road. The location is characterized by a thick organic substrate, and anthropogenically altered, stable, sand, gravel, and boulder banks with grass, while the channel sections upstream and downstream of the road is generally classified as wetland. The cross-section is approximately 9 m wide and flow is typically deep with gentle laminar flow. SB-1 produces a poor stage-discharge relationship; spring discharge elevations are considerably lower for the corresponding discharge rates than summer and fall measurements. Beaver activity immediately upstream of the culverts affected the stage-discharge relationship during the summer of 2011. Beaver activity approximately 90 m downstream of the culverts resulted in affected water levels from early July and throughout the remainder of the 2013 open water season.

SB-3

Streamflow station SB-3 is located downstream of LB-2. The monitoring station is located in a narrow deep section of the stream with a substrate composed of cobble, boulder, sand and organics. The cross-section has vertical banks with moss and shrubs and a width of approximately 3 m. Although the right bank gains relief within several meters of the stream, the left bank is low lying and reflects flood plain characteristics for tens of meters. SB-3 produces a good stage-discharge relationship and hydrograph.

SB-4

Streamflow Station SB-4 flows into the southwest end of LB-3. The stream flows through low-lying muskeg and is poorly defined. A relatively controlled section was identified as suitable for the streamflow monitoring station;

however both banks are poorly defined, the substrate consists of angular cobbles and boulders, and the stream is surrounded by muskeg. This section of the stream is approximately 5 m wide, has organic banks, and an organic substrate with emergent aquatic vegetation. During the spring site visit, the channel upstream and downstream was blocked with ice. The low velocity and boulder substrate at the cross-section introduce considerable error into discharge measurements. Nevertheless, SB-4 produces a fair stage-discharge relationship and hydrograph. The flow characteristics here differ somewhat from the corresponding flow dynamics in Drainage Area A and SB-3, likely due to the flow characteristics through the muskeg, the buildup of ice during the winter and its gradual melting throughout the summer, and ice blockage during the spring and early summer. A Levelogger was not installed at this location during the 2011 open water season, and in 2012 an animal interfered with the continuous level measurements and disturbed measurements for a portion of July and August.

2.3.2 Relationship to Regional Hydrology

While the drainage area (3,030 km^2) of the Water Survey of Canada (WSC 2012a, 2012b) hydrometric station on the Wheeler River is much larger than those near the site (<371 km^2), the drainage areas relevant to the Project are climatically and physio-graphically similar to the other tributaries of the Wheeler River. As a result, a scaled relationship between flow observed at the larger streamflow stations and the Water Survey of Canada (WSC 2012a, 2012b) hydrometric station on the Wheeler River, downstream of Russell Lake (Station 06DA005) should be valid and could be used to simulate past daily flows in the Project Area based on the 1974-2012 record of flows in the Wheeler River, downstream of Russell Lake (Station 06DA005). A population of 509 samples of observed streamflow from station SA-1 collected over three years were regressed against WSC Station 06DA005 yielded Equation 1 with a correlation coefficient (R) of 0.972. A population of 509 samples of observed streamflow from station SB-3 were regressed against WSC Station 06DA005 yielded Equation 2 with a R= 0.903. A valid relationship between SB-1 and WSC station 06DA005 was not found based on the data collected to date.

$$Q_{SA1} = aQ_{06DA005}{}^{b} \qquad (1)$$

Where:

Q_{SA1} = Daily mean discharge for station SA-1 (m^3/s)
$Q_{06DA005}$= Daily mean discharge for WSC Station 06DA005 (m^3/s)
a = 0.091134488
b = 1.089166899

$$Q_{SB3} = aQ_{06DA005}{}^{b} \qquad (2)$$

Where:

Q_{SB3} = Daily mean discharge for station SB-3 (m^3/s)
$Q_{06DA005}$= Daily mean discharge for WSC Station 06DA005 (m^3/s)
a = 0.004426783
b = 1.272384298

2.3.3 Effect of Seasonal Ice Formation on Streamflow

The development of ice cover in stream channels causes a backwater which is influenced by the quantity and character of ice as well as the quantity of discharge flowing through the stream. Open water rating curves must be adapted to account for the backwater if they are to be applied during ice covered periods (USGS 1982). The backwater effect can be accounted for by comparison of streamflow data to weather records and nearby gaging stations as well as using adjustment factors. An adjustment factor, K, was derived as the ratio of observed ice covered discharge to the open water rated discharge corresponding to the observed stage. The K values observed during March 2014 are presented in Table 3. Late winter discharge could be estimated by multiplying the discharge read from the curves presented in Appendix C by the adjustment factor.

Table 3: Adjustment Factors (K) observed for Ice Covered Discharge

Station	Date	K
SA1	25-Mar-14	0.277
SA2	24-Mar-14	0.364
SA3	24-Mar-14	0.524
SA4	23-Mar-13	0.585
SA5	23-Mar-14	0.409
SA6	23-Mar-14	0.706
SB3	25-Mar-14	0.788

2.3.4 Lakes

Lake stage was measured during each site visit (Table 2), unless snow cover prevented the collection of accurate water level measurements in the spring and winter. In cases where discharge measurements were collected at the outflow channel, lake stage-discharge curves are presented in Appendix C. These data can be used to create continuous lake level records for the measurement periods. Additionally, a continuous water level sensor was installed at LA-7. Table 4 presents a summary of geodetic water levels at each monitored lake during open water conditions between 2011 and 2013. The difference between maximum and minimum water levels measured at the monitored lakes has typically been less than 0.3 m.

Table 4: Lake Water Level Summary

Station	Minimum Measured Water Level (masl)	Maximum Measured Water Level (masl)
LA-1	494.194	494.448
LA-2	494.467	494.654
LA-3	494.439	494.619
LA-4	498.507	498.649
LA-5	499.949	500.074
LA-6	499.943	500.092
LA-7	520.424	520.536
LB-1	503.707	504.079
LB-2	510.392	510.573
LB-3	518.356	518.580
LAB-1	487.994	488.233

masl = metres above sea level

Ice thickness was observed at the deepest point of each monitored lake between March 23, 2014 and April 1, 2014. Ice thickness observed at the end of March can be considered the maximum development of ice thickness for the winter of 2013-2014. Table 5 presents a summary of ice thicknesses. Observed lake ice thickness ranged from 0.70 m to 0.97 m with an average of 0.83 m.

Table 5: Lake Water Level Summary

Station	Ice Surface	Ice Thickness	Water Surface
LA-1	494.258	0.97	494.298
LA-2	494.582	0.76	494.582
LA-3	494.589	0.80	494.649
LA-4	498.634	0.82	498.614
LA-5	500.076	0.70	500.076
LA-6	500.058	0.94	500.058
LA-7	520.472	0.85	520.502
LB-1	n/a	n/a	n/a
LB-2	510.533	0.78	510.533
LB-3	518.463	0.82	518.463
LAB-1	488.332	0.83	488.382

masl = metres above sea level

3.0 CLOSURE

Golder Associates Ltd. appreciates the opportunity to assist Denison with this project. We trust that this report meets your needs at this time. Should you have any questions or comments, please do not hesitate to contact the undersigned.

GOLDER ASSOCIATES LTD.

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RP/BT/pls

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APPENDIX A

Denison Wheeler River Ground Survey Summary

MEMORANDUM

TO Lawson Forand, Denison Mines Corp. **DATE** January 3, 2013

CC Clark Gamelin, Denison Mines Corp.

FROM Ashley Dubnick/Brent Topp **PROJECT No.** 12-1362-0050/1000

DENISON WHEELER RIVER GROUND SURVEY SUMMARY

Introduction

Golder Associates Ltd. (Golder) was retained by Denison Mines Corp. (Denison) to perform a hydrological baseline program as part of a pre-feasibility study of the Phoenix deposit at the Wheeler River property (the Project) near Key Lake, Saskatchewan. As part of the program, Golder has established a number of hydrological monitoring stations to collect the necessary hydrological baseline data to support various project requirements including environmental assessments, regulatory permitting, and providing design basis information for engineered designs, including fresh water diversions, water management systems, sedimentation ponds, and cross-drainage structures. To most accurately complete these hydrological assessments, models that incorporate the hydrological information and the LiDAR surface, collected in June, 2010, may be created. However, to accurately combine these datasets, a topographic survey of the hydrological station benchmarks is necessary. This technical memorandum presents a summary of the geodetic survey results completed at the Denison Wheeler River property.

Methods

The geodetic ground survey was completed on October 21 to 24, 2012 using a GPS Base Station and RTK GPS Rover with the following specifications:

GPS Base Station

- Sokkia GRX1 base station receiver integrated with GPS and GLONASS tracking in conjunction with Satel differential correction external radio.
- Satel radio transmission repeater used to increase signal quality and range.

RTK GPS Rover

- Sokkia GRX1 RTK rover receiver integrated with GPS and GLONASS tracking in conjunction with Satel differential correction internal radio.
- RTK GPS attached to a fixed-height carbon fibre pole.

Because the benchmark or the control points used for the LiDAR survey were not accessible or useable for the purposes of this ground survey, site control was established using planted iron pins at four locations. The base station reference point was established by averaging 2700 autonomous GPS readings and a site-specific geoid model was used for all surveys. Geodetic elevations at all benchmarks established at hydrometric monitoring stations were collected.

Results

Over the course of the survey, no horizontal error exceeded 0.037m to established control and no vertical error exceeded 0.012m to established control. Table 1 presents the greatest errors to established control observed on each day of the survey.

Table 1: Greatest Error to Established Control

	Northing (m)	Easting (m)	Elevation (m)
October 21, 2012	0.017	0.015	0.012
October 22, 2012	0.016	0.013	0.006
October 23, 2012	0.002	0.015	0.010
October 24, 2012	0.021	0.037	0.007

Ground survey results are presented in Table 2 and include the location and elevation of each point as well as indicators of the point quality.

Table 2: Geodetic Survey Results

Benchmark	Type	Location (WGS 84)			Point Quality			
		Northing (m)	Easting (m)	Elevation (m)	HDOP Avg	VDOP Avg	PDOP Avg	Sat Avg
GolderWR CP1	Rebar	6372855.249	474661.887	519.868	-	-	-	-
GolderWR CP2	Rebar	6374770.522	475606.918	540.993	-	-	-	-
GolderWR CP2	Rebar	6370859.443	477535.796	556.213	-	-	-	-
GolderWR CP2	Rebar	6370371.120	477093.253	558.542	-	-	-	-
LA-2 BM1	Rebar	6375172.712	480842.634	497.339	0.8637	1.4567	1.6935	13
LA-2 BM2	Rebar	6375174.795	480846.484	497.064	1.0822	1.6114	1.9415	12
LA-2 BM3	Rebar	6375171.611	480846.491	496.34	0.8806	1.4144	1.6662	14
LA-3 BM1	Rock	6373997.350	481487.807	496.134	0.6176	1.0483	1.2167	16
LA-3 BM2	Rock	6373994.256	481487.899	496.034	0.6212	1.0813	1.2474	16
LA-3 BM3	Rock	6373997.038	481478.058	494.831	0.6510	1.1243	1.2992	15
LA-4 BM1	Rebar	6376186.639	481994.794	500.365	0.8486	1.2003	1.4700	15
LA-4 BM2	Rebar	6376189.113	481991.522	500.252	0.8522	1.2156	1.4846	14
LA-4 BM3	Rebar	6376187.971	481988.774	499.699	0.8540	1.2233	1.4919	15
LA-5 BM1	Rebar	6374540.225	477831.352	501.366	0.7518	1.1807	1.3997	13
LA-5 BM2	Rebar	6374541.110	477824.823	501.014	0.7609	1.1976	1.4189	13
LA-5 BM3	Rebar	6374538.032	477835.822	501.023	0.7499	1.1325	1.3584	13
LA-6 BM1	Rebar	6375257.733	477749.298	502.388	0.9719	1.7615	2.0118	12
LA-6 BM2	Rebar	6375254.317	477756.381	502.08	0.9763	1.8564	2.0981	11
LA-7 BM1	Rock	6375365.152	474859.273	522.374	0.7420	1.0764	1.3074	16
LA-7 BM2	Rock	6375370.136	474856.009	522.067	0.7449	1.0884	1.3188	16
LA-7 BM3	Rock	6375373.196	474852.454	521.8	0.7528	1.1217	1.3509	15
LAB-1 BM1	Rebar	6368332.435	478695.192	489.243	0.6562	1.1309	1.3075	16
LAB-1 BM2	Rebar	6368331.850	478688.921	489.745	0.7115	1.1969	1.3924	16
LAB-1 BM3	Rebar	6368334.674	478697.583	489.597	0.6292	1.0883	1.2571	18
LB-1 BM1	Rebar	6369366.788	476603.997	505.231	0.6245	1.0322	1.2066	17

Benchmark	Type	Location (WGS 84)			Point Quality			
		Northing (m)	Easting (m)	Elevation (m)	HDOP Avg	VDOP Avg	PDOP Avg	Sat Avg
LB-1 BM2	Rebar	6369370.293	476602.209	505.04	0.5854	0.9346	1.1029	19
LB-1 BM3	Rebar	6369363.850	476597.929	505.073	0.6873	1.1251	1.3185	15
LB-2 BM1	Rebar	6371898.916	474903.385	511.767	0.7817	1.3143	1.5293	14
LB-2 BM2	Rebar	6371901.778	474906.357	511.819	0.7503	1.3058	1.5060	15
LB-2 BM3	Rebar	6371904.723	474900.057	511.806	0.7563	1.3243	1.5251	15
LB-3 BM1	Rebar	6374839.646	474884.439	520.159	0.8050	1.3752	1.5935	15
LB-3 BM2	Rebar	6374831.436	474893.291	519.42	0.8075	1.3649	1.5859	14
LB-3 BM3	Rebar	6374834.862	474895.379	520.021	0.8710	1.4123	1.6595	13
SA-1 BM1	Rebar	6371129.601	480327.636	496.123	0.6503	1.1645	1.3338	16
SA-1 BM2	Rock	6371125.303	480328.743	495.576	0.8882	1.4407	1.6926	15
SA-1 BM3	Rebar	6371123.762	480357.257	494.361	0.6567	1.1236	1.3015	15
SA-2 BM1	Rock	6373258.113	478533.160	498.369	0.7284	1.1748	1.3824	14
SA-2 BM2	Rock	6373258.391	478529.590	498.354	0.7223	1.1761	1.3802	14
SA-3/LA-1 BM1	Rebar	6373226.219	479403.750	495.714	0.6648	0.9753	1.1803	15
SA-3/LA-1 BM2	Rebar	6373227.014	479408.484	495.55	0.6932	1.1317	1.3274	14
SA-3/LA-1 BM3	Rebar	6373222.211	479402.381	495.616	0.7095	1.0651	1.2798	15
SA-4 BM1	Rebar	6375855.114	476914.695	507.772	0.7494	1.1259	1.3528	12
SA-4 BM2	Rock	6375853.025	476915.570	508.373	0.6744	1.0823	1.2752	13
SA-5 BM1	Rebar	6375723.540	477791.074	502.58	0.8335	1.5526	1.7626	13
SA-5 BM2	Rock	6375739.656	477807.701	502.045	0.7208	1.3664	1.5449	15
SA-6 BM1	Rebar	6374757.968	477848.597	503.32	0.7968	1.2055	1.4451	13
SA-6 BM2	Rebar	6374752.648	477849.463	503.205	0.6627	1.0256	1.2210	15
SA-6 BM3	Rebar	6374746.296	477855.608	502.021	0.7816	1.2429	1.4682	13
SB-1 BM1	Culvert	6366351.011	476038.945	489.602	0.7076	1.1207	1.3254	16
SB-1 BM2	Culvert	6366355.284	476042.540	489.414	0.7191	1.1384	1.3465	15
SB-1 BM3	Rock	6366375.139	476028.439	489.217	0.7107	1.2371	1.4268	15
SB-3 BM1	Rebar	6371642.428	475847.211	511.473	0.6569	0.9922	1.1900	16
SB-3 BM2	Rock	6371638.405	475838.409	511.897	0.6562	0.9889	1.1868	16
SB-4 BM1	Rock	6372197.891	472953.818	520.307	0.6084	1.1287	1.2822	17
SB-4 BM2	Rock	6372197.460	472955.741	520.205	0.7005	1.3090	1.4847	13
SB-4 BM3	Rock	6372197.402	472957.726	520.305	0.6243	1.1415	1.3011	16

HDOPAvg: Horizontal dilution of precision

VDOPAvg Vertical dilution of precision

PDOPAvg: Positional (3D) dilution of precision

SatAvg: average number of satellites

Closure

Golder Associates Ltd. appreciates the opportunity to assist Denison with this project. We trust that this report meets your needs at this time. Should you have any questions or comments, please do not hesitate to contact us.

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APPENDIX B

Stage and Discharge Measurements

Table B1: Lake Stage Measurements

Location	Date	Elevation (m) (Arbitrary Datum)	Elevation (m) (Geodetic)
LA-1	13-May-11	98.725	494.439
	29-Jul-11	98.613	494.327
	28-Oct-11	98.504	494.218
	4-May-12	98.709	494.423
	5-Aug-12	98.672	494.386
	23-Oct-12	98.734	494.448
	21-May-13	98.726	494.44
	14-Aug-13	98.551	494.265
	16-Oct-13	98.48	494.194
	25-Mar-14	98.584	494.298
LA-2	13-May-11	97.269	494.615
	30-Jul-11	97.256	494.602
	29-Oct-11	97.203	494.549
	4-May-12	97.264	494.61
	6-Aug-12	97.274	494.62
	23-Oct-12	97.308	494.654
	20-May-13	97.278	494.624
	13-Aug-13	97.197	494.543
	16-Oct-13	97.121	494.467
	26-Mar-14	97.236	494.582
LA-3	13-May-11	98.427	494.561
	30-Jul-11	98.433	494.567
	29-Oct-11	98.427	494.561
	4-May-12	98.472	494.606
	6-Aug-12	98.456	494.59
	23-Oct-12	98.485	494.619
	20-May-13	98.459	494.593
	13-Aug-13	98.387	494.521
	16-Oct-13	98.305	494.439
	26-Mar-14	98.515	494.649

Table B1: Lake Stage Measurements (continued)

Location	Date	Elevation (m) (Arbitrary Datum)	Elevation (m) (Geodetic)
LA-4	29-Jul-11	98.284	498.649
	30-Oct-11	98.152	498.517
	4-May-12	98.223	498.588
	5-Aug-12	98.248	498.613
	6-Aug-12	98.257	498.622
	23-Oct-12	98.262	498.627
	20-May-13	98.259	498.624
	13-Aug-13	98.164	498.529
	16-Oct-13	98.142	498.507
	27-Mar-14	98.249	498.614
LA-5	13-May-11	98.706	500.050
	31-Jul-11	98.67	500.014
	27-Oct-11	98.605	499.949
	6-May-12	98.73	500.074
	5-Aug-12	98.693	500.037
	22-Oct-12	98.728	500.072
	21-May-13	98.729	500.073
	13-Aug-13	98.625	499.969
	17-Oct-13	98.606	499.95
	23-Mar-14	98.732	500.076
LA-6	13-May-11	97.675	500.063
	31-Jul-11	97.64	500.028
	27-Oct-11	97.555	499.943
	6-May-12	97.7	500.088
	5-Aug-12	97.67	500.058
	22-Oct-12	97.704	500.092
	19-May-13	97.7	500.088
	13-Aug-13	97.585	499.973
	17-Oct-13	97.559	499.947
	23-Mar-14	97.67	500.058

Table B1: Lake Stage Measurements (continued)

Location	Date	Elevation (m) (Arbitrary Datum)	Elevation (m) (Geodetic)
LA-7	29-Jul-11	98.108	520.482
	31-Oct-11	98.05	520.424
	6-May-12	98.149	520.523
	8-Aug-12	98.108	520.482
	21-Oct-12	98.162	520.536
	24-May-13	98.157	520.531
	13-Aug-13	98.083	520.457
	16-Oct-13	98.066	520.44
	27-Mar-14	98.128	520.502
LAB-1	16-May-11	98.991	488.219
	1-Aug-11	98.891	488.119
	30-Oct-11	98.776	488.004
	9-May-12	99	488.228
	6-Aug-12	98.939	488.167
	23-Oct-12	98.987	488.215
	21-May-13	99.005	488.233
	12-Aug-13	98.879	488.107
	19-Oct-13	98.766	487.994
	25-Mar-14	99.154	488.382
LB-1	14-May-11	98.666	503.902
	1-Aug-11	98.807	504.043
	30-Oct-11	98.648	503.884
	6-May-12	98.636	503.872
	6-Aug-12	98.651	503.887
	21-Oct-12	98.617	503.853
	19-May-13	98.843	504.079
	14-Aug-13	98.509	503.745
	17-Oct-13	98.471	503.707

Table B1: Lake Stage Measurements (continued)

Location	Date	Elevation (m) (Arbitrary Datum)	Elevation (m) (Geodetic)
LB-2	14-May-11	98.767	510.523
	29-Jul-11	98.689	510.445
	30-Oct-11	98.636	510.392
	5-May-12	98.771	510.527
	6-Aug-12	98.745	510.501
	21-Oct-12	98.817	510.573
	21-May-13	98.756	510.512
	14-Aug-13	98.699	510.455
	17-Oct-13	98.651	510.407
	25-Mar-14	98.777	510.533
LB-3	15-May-11	98.365	518.519
	29-Jul-11	98.284	518.438
	29-Oct-11	98.203	518.356
	5-May-12	98.361	518.515
	5-Aug-12	98.37	518.524
	21-Oct-12	98.426	518.58
	19-May-13	98.38	518.534
	13-Aug-13	98.278	518.432
	17-Oct-13	98.233	518.387
	25-Mar-14	98.233	518.463

Table B2: Stream Stage and Discharge Measurements

Location	Date	Elevation (m) (Arbitrary Datum)	Elevation (m) (Geodetic)	Discharge (m^3/s)
SA-1	14-May-11	97.793	492.714	2.307
	29-Jul-11	97.727	492.648	1.750
	28-Oct-11	97.641	492.562	0.973
	5-May-12	97.79	492.711	2.293
	6-Aug-12	97.774	492.695	2.031
	23-Oct-12	97.8	492.721	2.575
	20-May-13	97.784	492.705	2.358
	14-Aug-13	97.666	492.587	1.280
	18-Oct-13	97.633	492.554	0.887
	30-Mar-14	97.948	492.869	1.203
SA-2	12-May-11	98.37	496.727	1.649
	30-Jul-11	98.341	496.698	1.387
	27-Oct-11	98.31	496.667	0.809
	8-May-12	98.391	496.748	2.008
	8-Aug-12	*98.332*	*496.689*	1.305
	24-Oct-12	98.377	496.734	2.030
	21-May-13	98.37	496.727	1.842
	14-Aug-13	98.303	496.66	0.863
	16-Oct-13	98.284	496.641	0.741
	24-Mar-14	98.448	496.805	1.180
SA-3	13-May-11	98.745	494.459	0.476
	29-Jul-11	98.678	494.392	0.370
	28-Oct-11	98.608	494.322	0.239
	4-May-12	98.759	494.473	0.528
	5-Aug-12	98.729	494.443	0.478
	23-Oct-12	98.773	494.487	0.578
	20-May-13	98.768	494.482	0.564
	14-Aug-13	98.63	494.344	0.255
	16-Oct-13	98.529	494.243	0.051
	24-Mar-14	98.534	494.248	0.362

Table B2: Stream Stage and Discharge Measurements (continued)

Location	Date	Elevation (m) (Arbitrary Datum)	Elevation (m) (Geodetic)	Discharge (m^3/s)
SA-4	11-May-11	98.577	506.357	0.483
	30-Jul-11	98.534	506.314	0.335
	31-Oct-11	98.53	506.31	0.199
	4-May-12	98.568	506.348	0.466
	5-Aug-12	98.549	506.329	0.361
	22-Oct-12	98.587	506.367	0.497
	19-May-13	98.589	506.369	0.519
	13-Aug-13	98.497	506.277	0.276
	17-Oct-13	98.469	506.249	0.206
	23-Mar-13	98.601	506.381	0.330
SA-5	12-May-11	98.129	500.708	1.100
	30-Jul-11	98.089	500.668	0.858
	29-Oct-11	98.03	500.609	0.476
	4-May-12	98.138	500.717	1.111
	5-Aug-12	98.105	500.684	1.026
	22-Oct-12	98.139	500.718	1.269
	19-May-13	98.147	500.726	1.381
	13-Aug-13	98.05	500.629	0.616
	17-Oct-13	98.043	500.622	0.507
	23-Mar-14	98.219	500.798	0.886
SA-6	13-May-11	96.753	500.084	1.631
	30-Jul-11	96.703	500.034	1.303
	27-Oct-11	96.625	499.956	0.717
	6-May-12	96.767	500.098	1.957
	5-Aug-12	96.73	500.061	1.476
	22-Oct-12	96.771	500.102	1.851
	19-May-13	96.746	500.077	1.540
	13-Aug-13	96.661	499.992	0.842
	17-Oct-13	96.638	499.969	0.798
	23-Mar-14	96.75	500.081	1.173

Table B2: Stream Stage and Discharge Measurements (continued)

Location	Date	Elevation (m) (Arbitrary Datum)	Elevation (m) (Geodetic)	Discharge (m^3/s)
SB-1	14-May-11	98.884	488.486	0.517
	31-Jul-11	99.425	489.027	0.186
	30-Oct-11	98.816	488.418	0.217
	3-May-12	98.922	488.524	0.644
	6-Aug-12	98.92	488.522	0.358
	23-Oct-12	98.997	488.599	0.578
	18-May-13	98.882	488.484	0.547
	12-Aug-13	98.733	488.335	0.158
	19-Oct-13	99.248	488.85	0.277
	27-Mar-14	99.221	488.823	0.289
SB-3	11-May-11	98.964	510.465	0.187
	31-Jul-11	98.905	510.406	0.109
	30-Oct-11	98.888	510.389	0.082
	5-May-12	99.005	510.506	0.235
	8-Aug-12	98.955	510.456	0.136
	21-Oct-12	99.016	510.517	0.255
	20-May-13	98.976	510.476	0.209
	14-Aug-13	98.921	510.421	0.107
	17-Oct-13	98.914	510.414	0.080
	25-Mar-14	98.923	510.423	0.090
SB-4	15-May-11	98.827	519.134	0.074
	1-Aug-11	98.657	518.964	0.008
	30-Oct-11	98.763	519.07	0.018
	5-May-12	98.912	519.219	0.109
	6-Aug-12	98.837	519.144	0.032
	21-Oct-12	98.938	519.245	0.099
	21-May-13	98.875	519.185	0.114
	15-Aug-13	98.764	519.074	0.007
	17-Oct-13	98.805	519.115	0.036

APPENDIX C

Open Water Stage-Discharge Curves for Lake Level and Streamflow Monitoring Stations

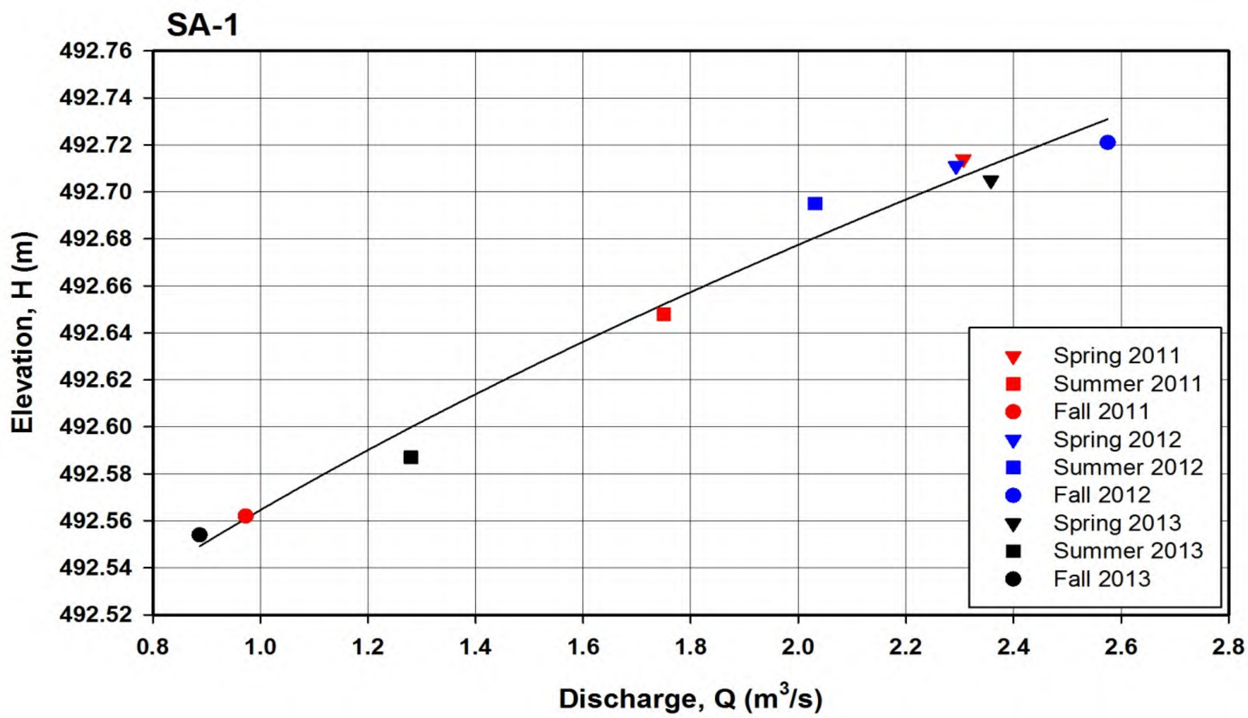

Figure C1: Relationship between Water Surface Elevation, H (m), and Discharge, Q (m^3/s), at Streamflow Station SA-1.

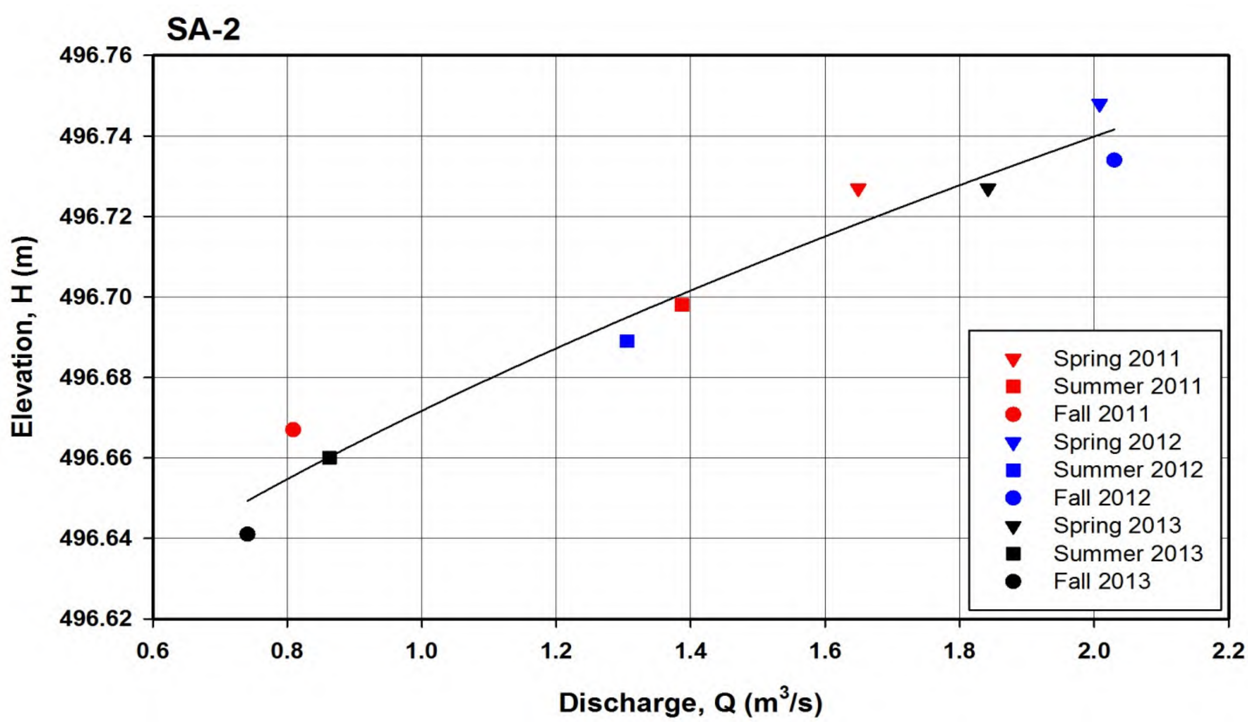

Figure C2: Relationship between Water Surface Elevation, H (m), and Discharge, Q (m^3/s), at Streamflow Station SA-2.

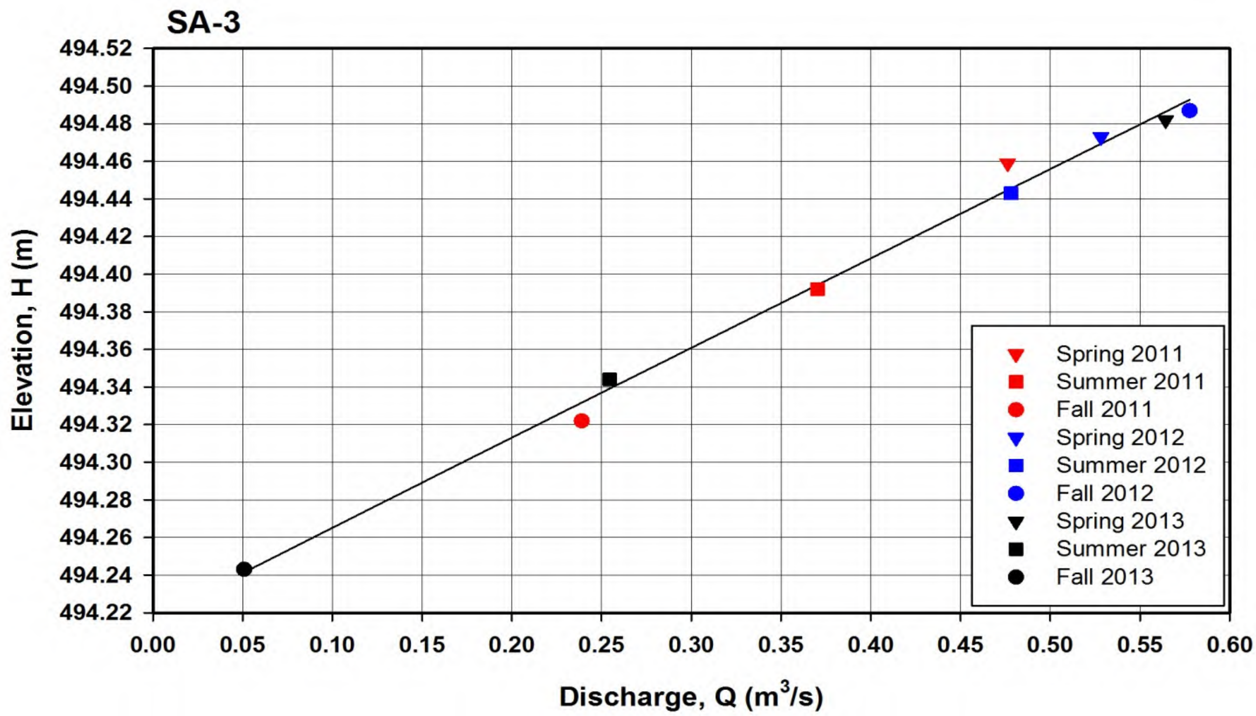

Figure C3: Relationship between Water Surface Elevation, H (m), and Discharge, Q (m^3/s), at Streamflow Station SA-3.

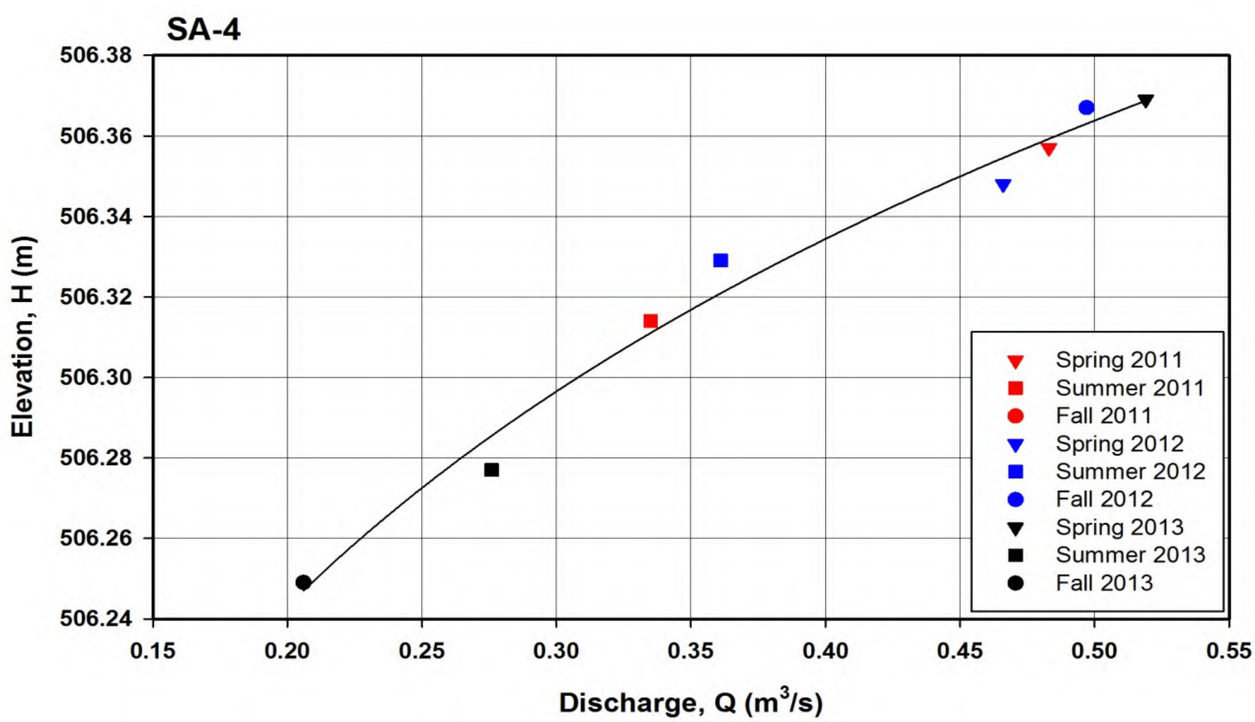

Figure C4: Relationship between Water Surface Elevation, H (m), and Discharge, Q (m^3/s), at Streamflow Station SA-4.

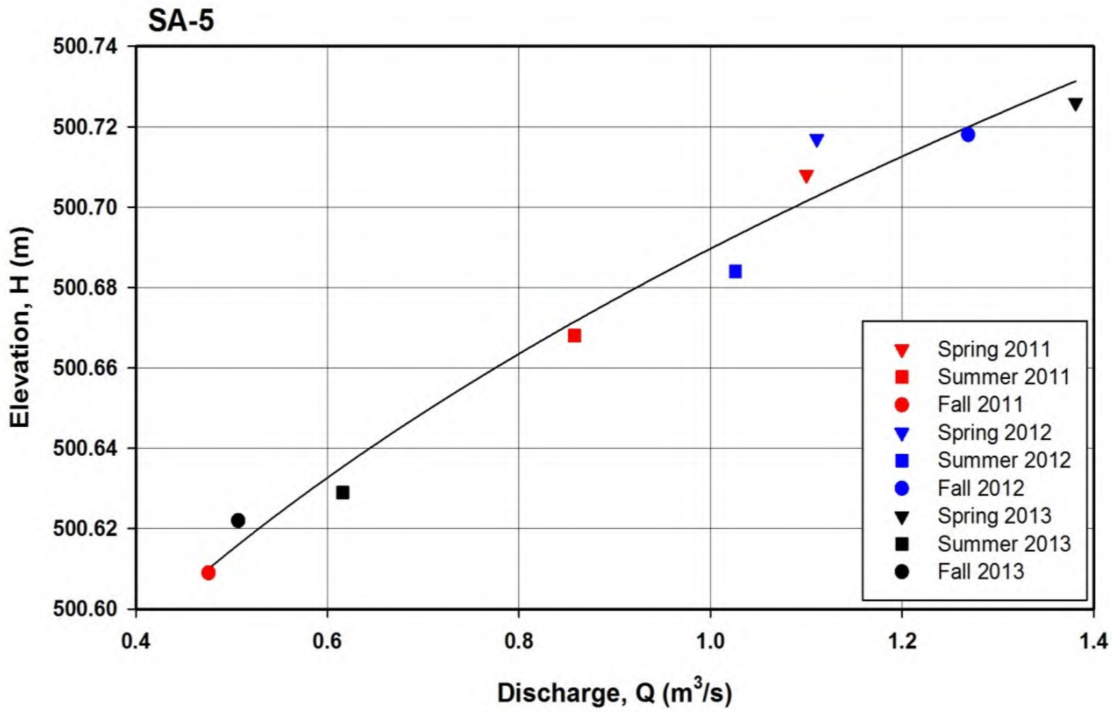

Figure C5: Relationship between Water Surface Elevation, H (m), and Discharge, Q (m^3/s), at Streamflow Station SA-5.

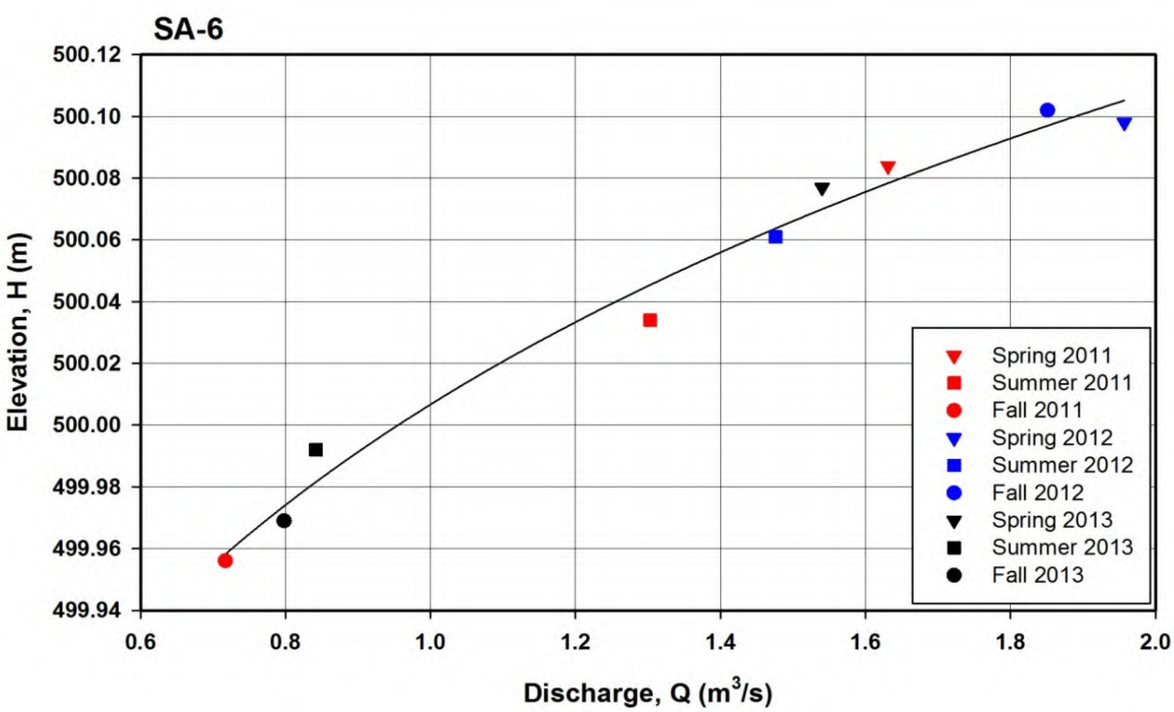

Figure C6: Relationship between Water Surface Elevation, H (m), and Discharge, Q (m^3/s), at Streamflow Station SA-6.

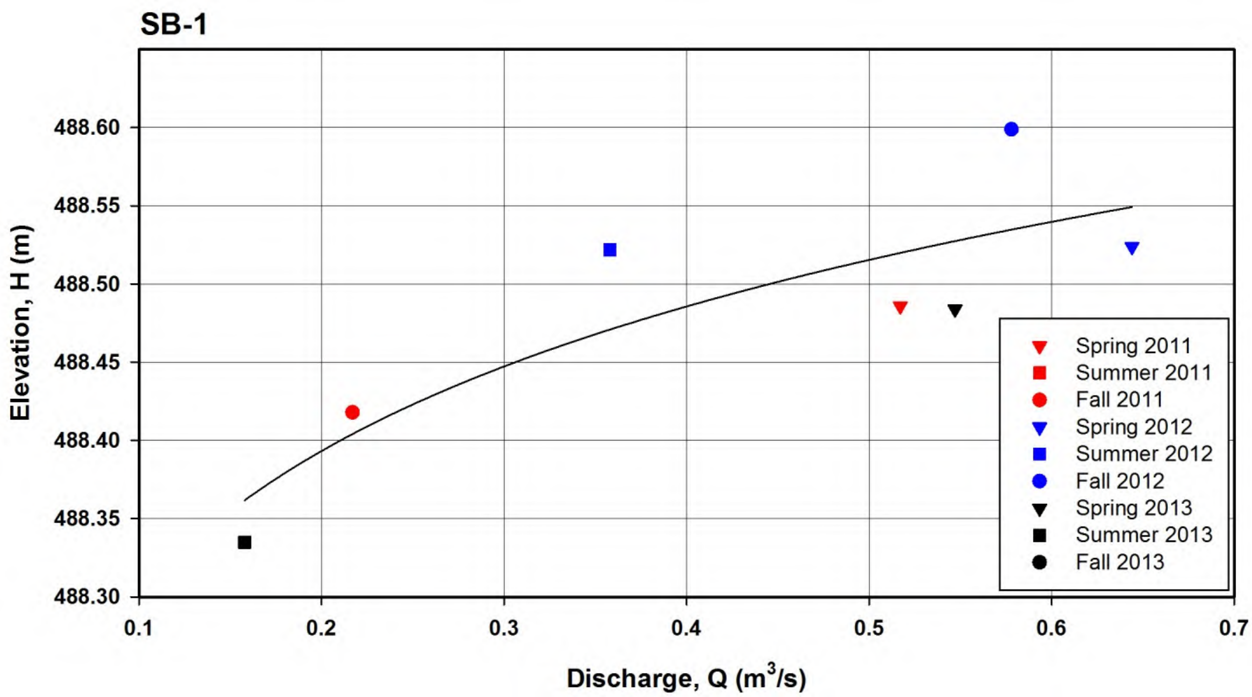

Figure C7: Relationship between Water Surface Elevation, H (m), and Discharge, Q (m^3/s), at Streamflow Station SB-1.

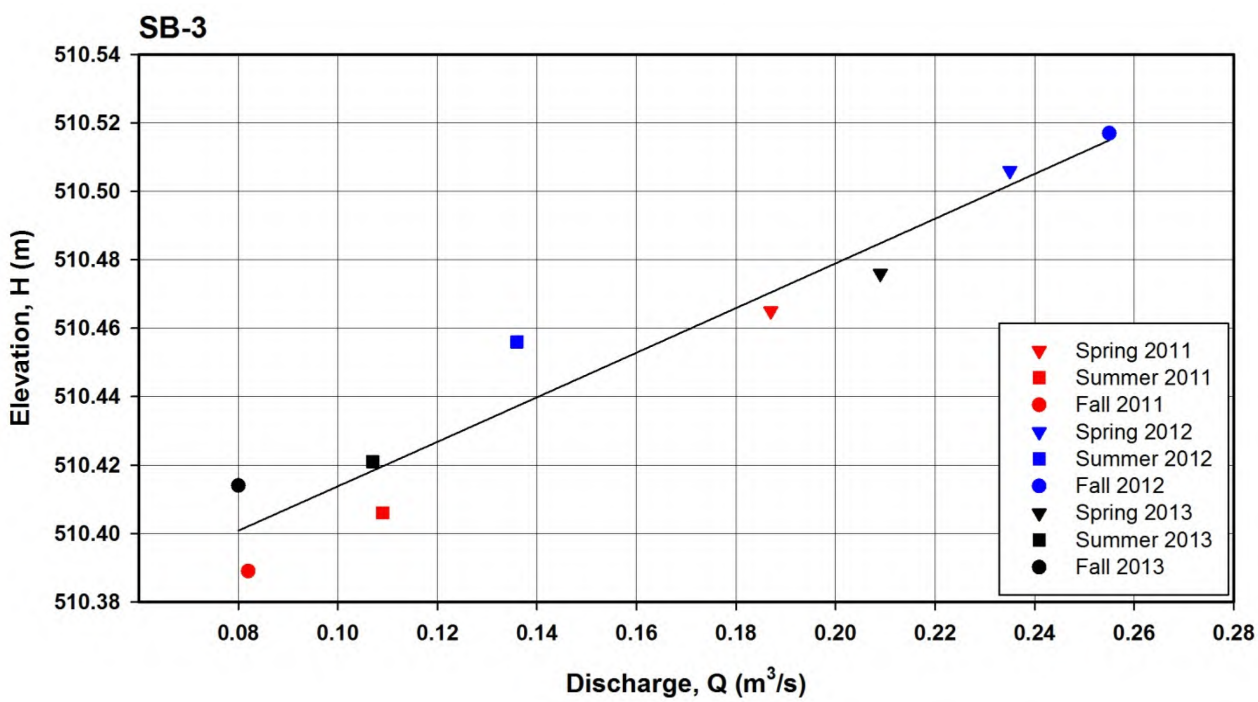

Figure C8: Relationship between Water Surface Elevation, H (m), and Discharge, Q (m^3/s), at Streamflow Station SB-3.

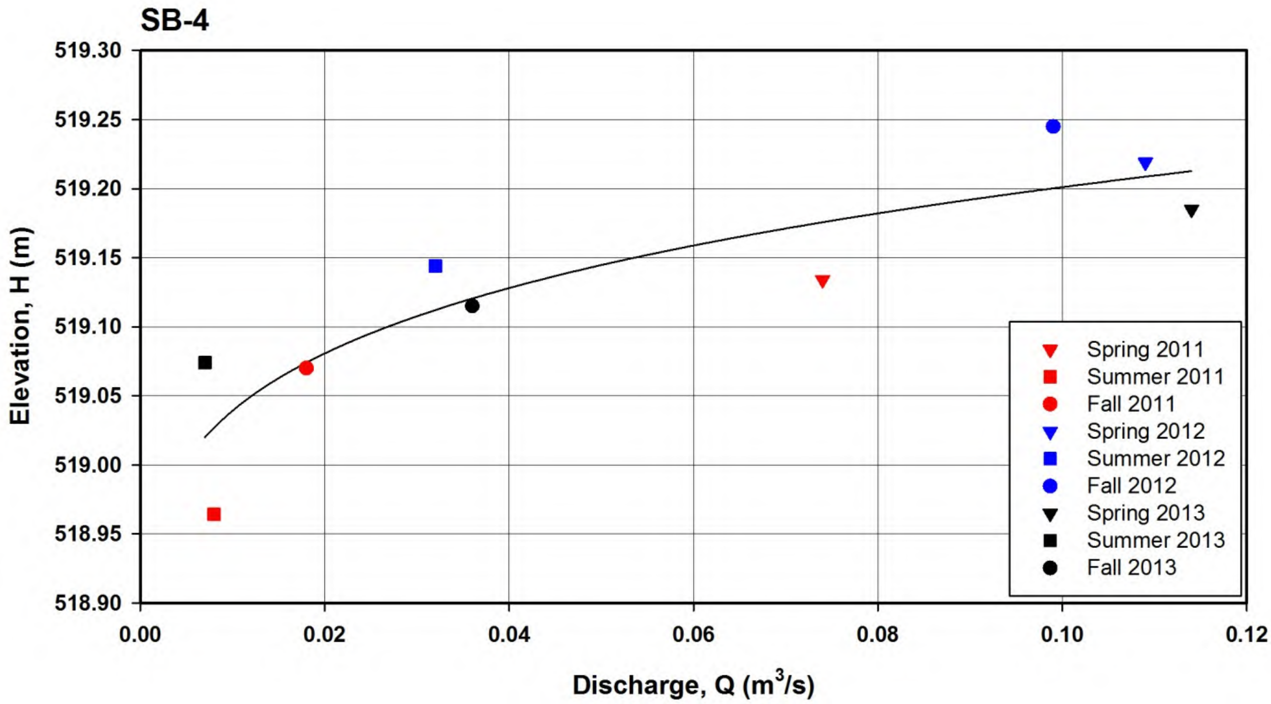

Figure C9: Relationship between Water Surface Elevation, H (m), and Discharge, Q (m^3/s), at Streamflow Station SB-4.

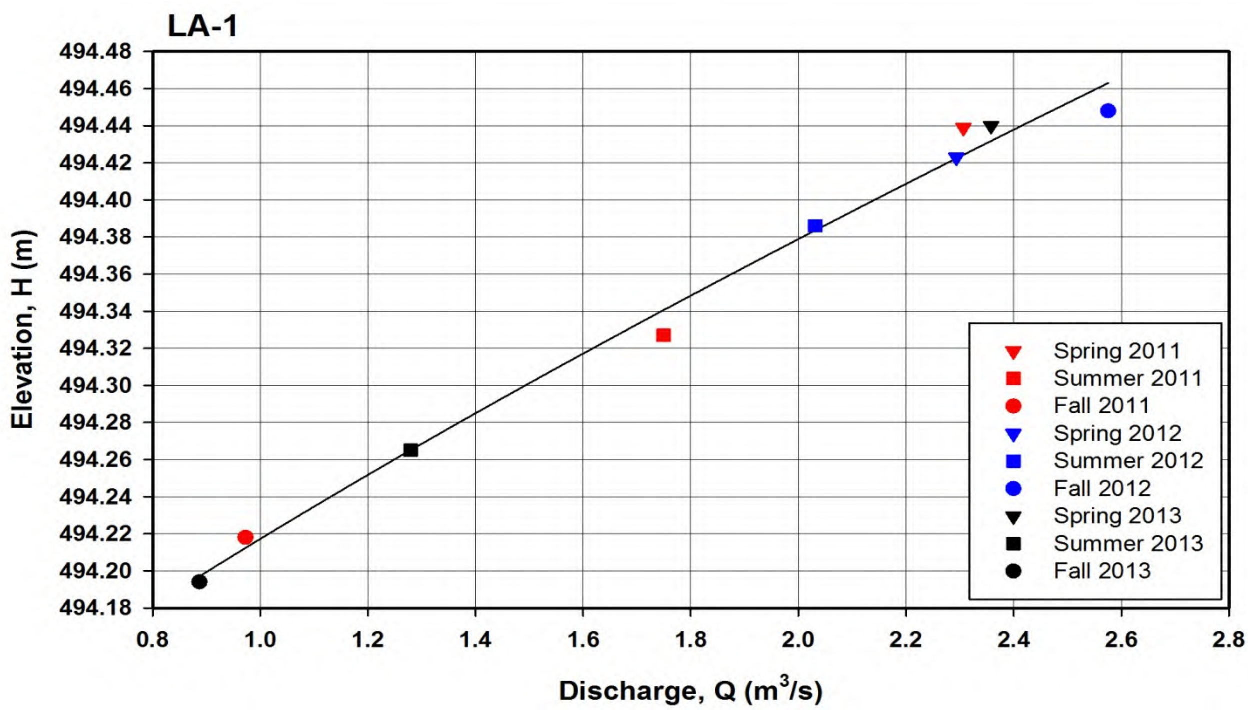

Figure C10: Relationship between Water Surface Elevation, H (m), and Outflow Discharge, Q (m^3/s), at Lake Level Station LA-1.

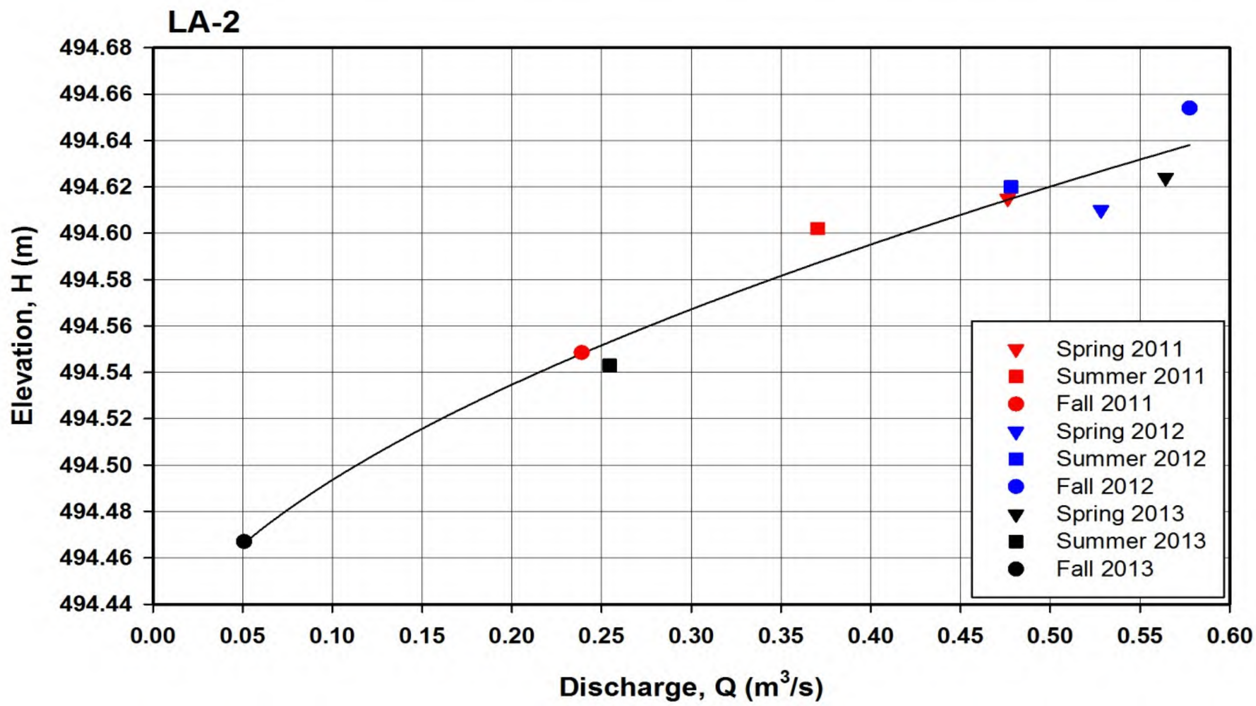

Figure C11: Relationship between Water Surface Elevation, H (m), and Outflow Discharge, Q (m^3/s), at Lake Level Station LA-2.

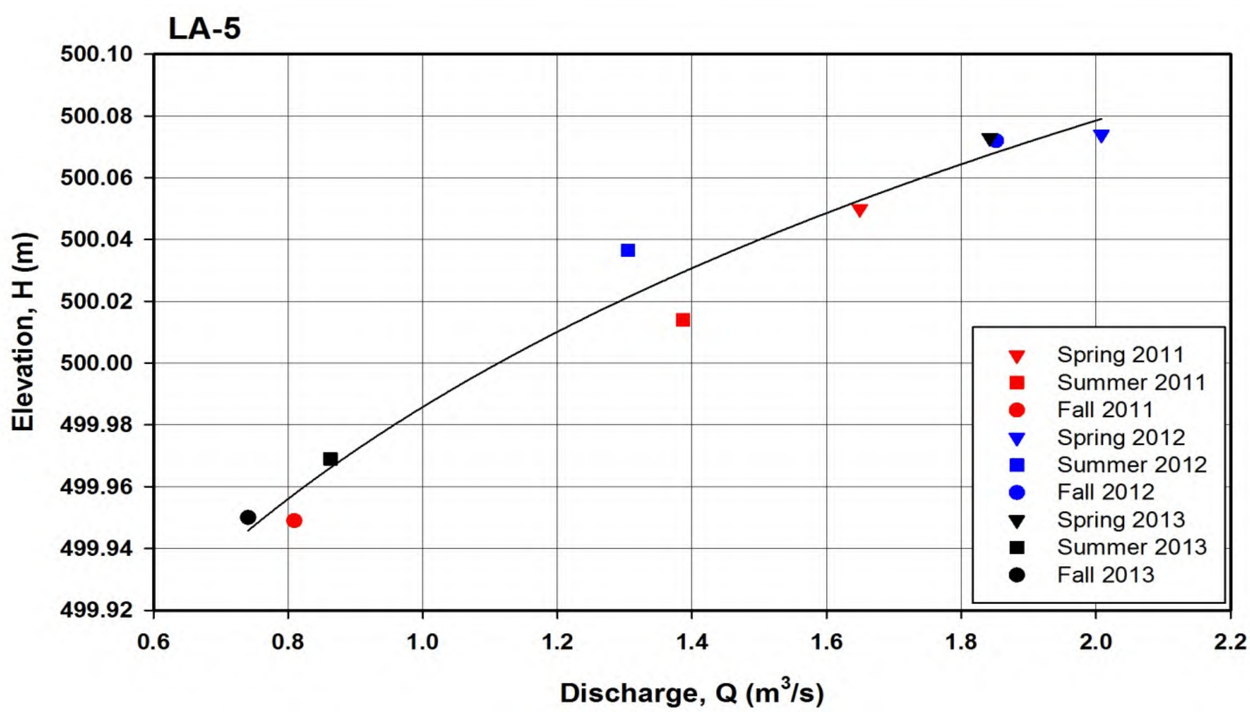

Figure C12: Relationship between Water Surface Elevation, H (m), and Outflow Discharge, Q (m^3/s), at Lake Level Station LA-5.

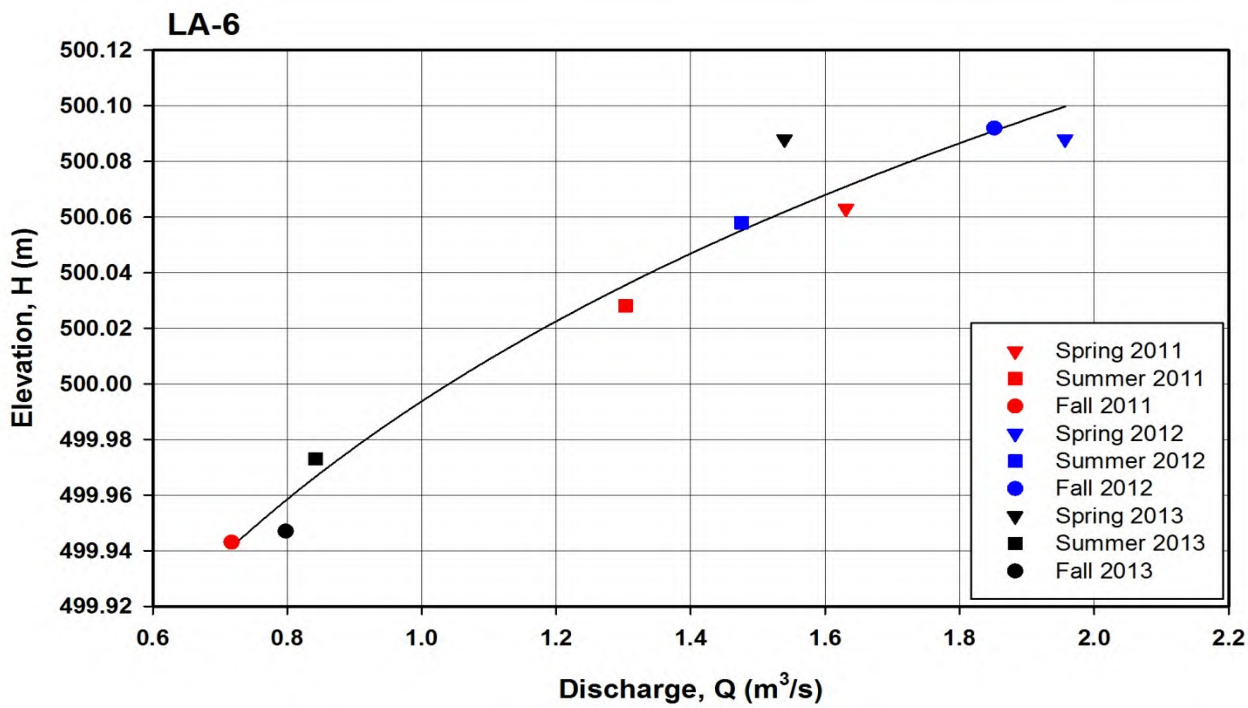

Figure C13: Relationship between Water Surface Elevation, H (m), and Outflow Discharge, Q (m^3/s), at Lake Level Station LA-6.

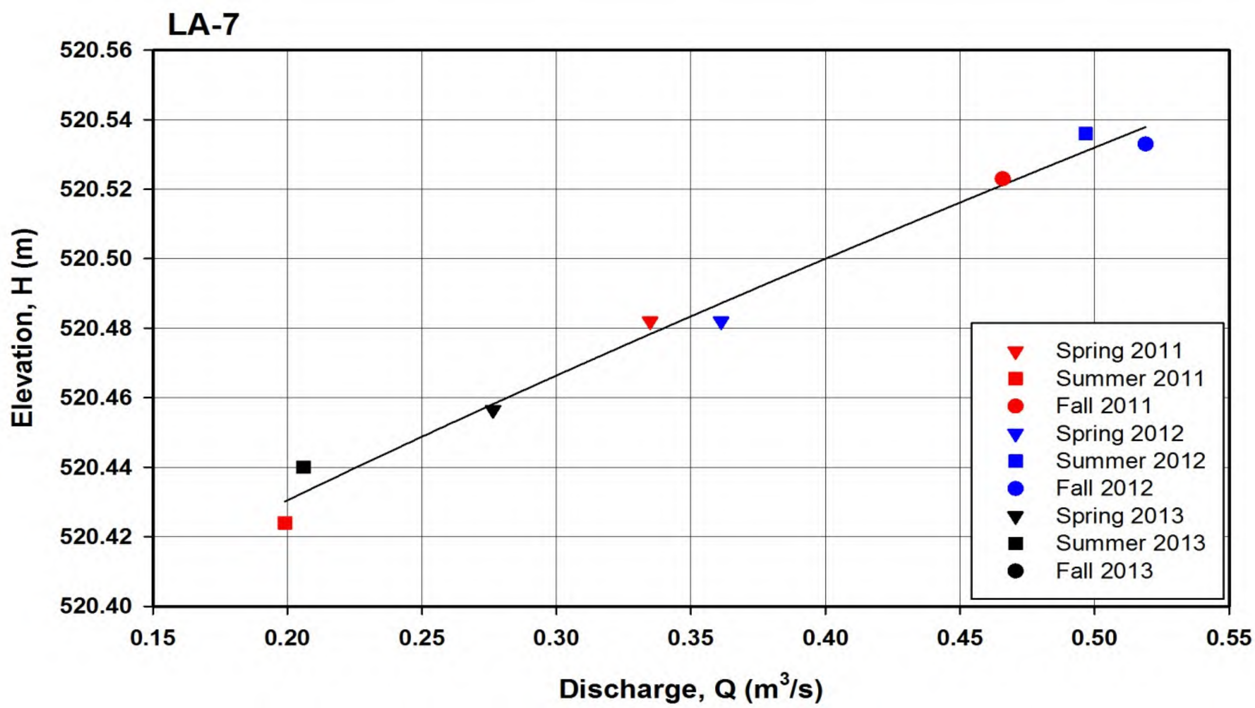

Figure C14: Relationship between Water Surface Elevation, H (m), and Outflow Discharge, Q (m^3/s), at Lake Level Station LA-7.

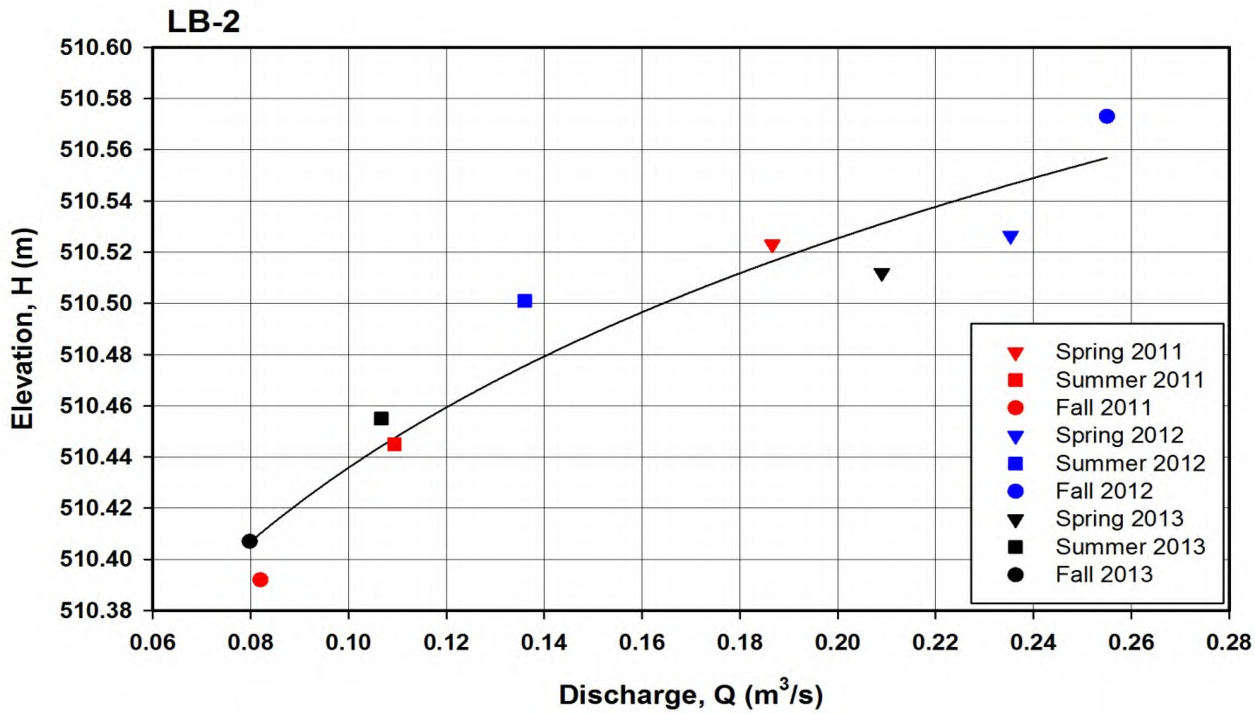

Figure C15: Relationship between Water Surface Elevation, H (m), and Outflow Discharge, Q (m³/s), at Lake Level Station LB-2.

Table C1: Open Water Stage-Discharge Equations

Site	Equation	R^2	Maximum Q	Minimum Q
SA-1	$H_{SFA1} = 492.3288 + 0.2358\ Q_{SA-1}^{0..5647}$	0.98	2.575	0.887
SA-2	$H_{SFA2} = 496.5236 + 0.1481 Q_{SA-2}^{0.5463}$	0.96	2.030	0.741
SA-3	$H_{SFA3} = 494.2166 + 0.4758\ Q_{SA-3}^{0.9914}$	0.99	0.578	0.051
SA-4	$H_{SFA4} = 463.0674 + 43.3880\ Q_{SA-4}^{0.0030}$	0.98	0.519	0.206
SA-5	$H_{SFA5} = 500.3430 + 0.3466\ Q_{SA-5}^{0.3517}$	0.97	1.381	0.476
SA-6	$H_{SFA6} = 487.0848 + 12.9219\ Q_{SA-6}^{0.0113}$	0.98	1.957	0.717
SB-1	$H_{SFB1} = 200.2805 + 288.3274\ Q_{SB-1}^{0.0005}$	0.74	0.644	0.158
SB-3	$H_{SFB3} = 510.3495 + 0.6573\ Q_{SB-3}^{1.0096}$	0.94	0.255	0.080
SB-4	$H_{SFB4} = 518.7461 + 0.7063\ Q_{SB-4}^{0.1911}$	0.79	0.114	0.007
LA-1	$H_{LLA1} = 493.9888 + 0.2284\ Q_{SA-1}^{0.7723}$	0.99	2.575	0.887
LA-2	$H_{LLA2} = 494.4063 + 0.3146\ Q_{SA-3}^{0.5570}$	0.96	0.578	0.051
LA-5	$H_{LLA5} = 483.1565 + 16.8293\ Q_{SA-2}^{0.0079}$	0.97	2.008	0.741
LA-6	$H_{LLA6} = 239.5643 + 260.4294\ Q_{SA-6}^{0.0006}$	0.98	1.957	0.717
LA-7	$H_{LLA7} = 520.3372 + 0.3401\ Q_{SA-4}^{0.0309}$	0.99	0.519	0.199
LB-2	$H_{LLB2} = 233.8270 + 276.9066\ Q_{SB-3}^{0.0005}$	0.93	0.255	0.080

* Where Q is discharge in m³/s and H is water level in metres above mean sea level.

APPENDIX D

Hydrographs for Streamflow Monitoring Stations

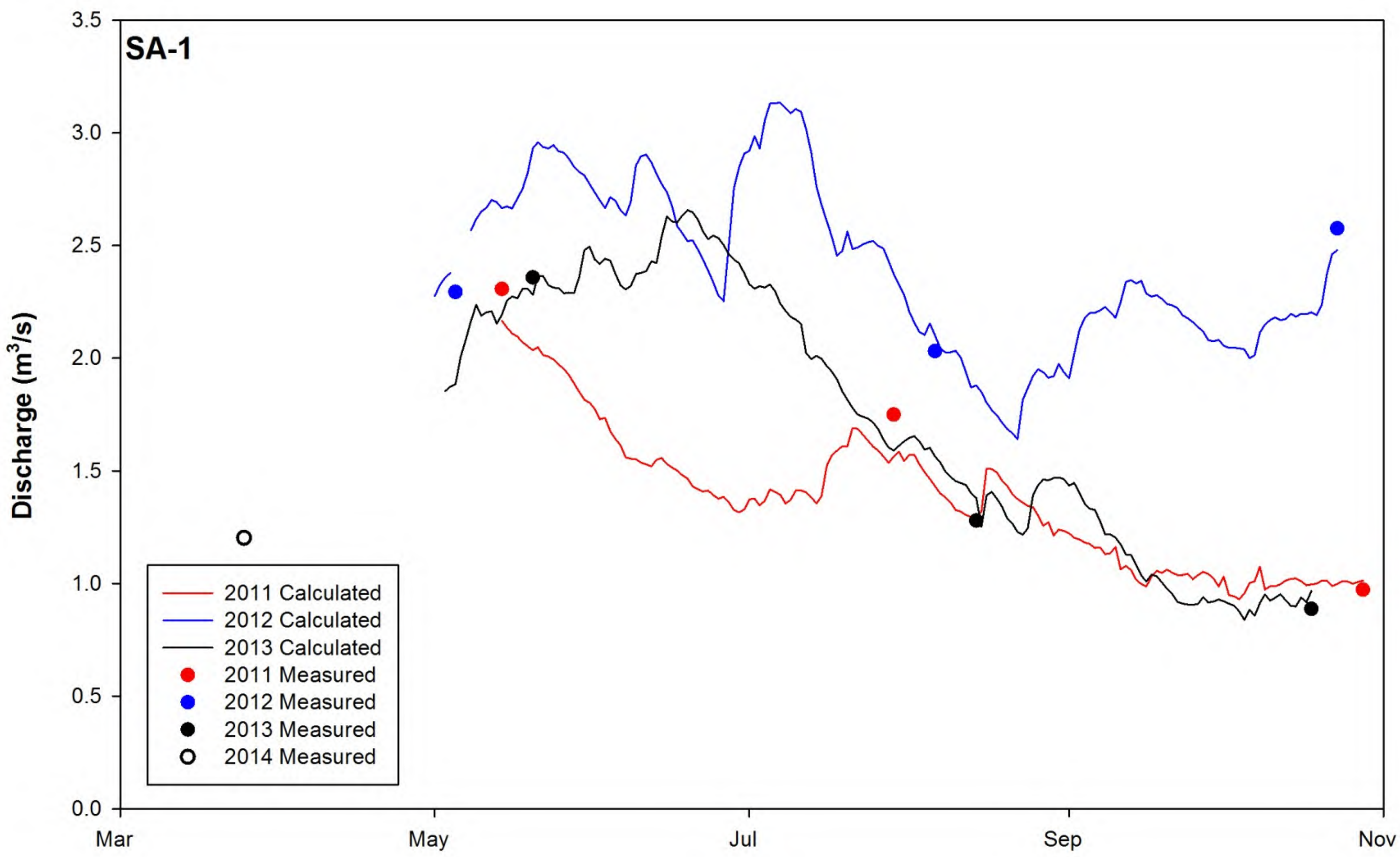

Figure D1: Measured and Calculated Discharge, Q (m^3/s), for Stream Monitoring Station SA-1.

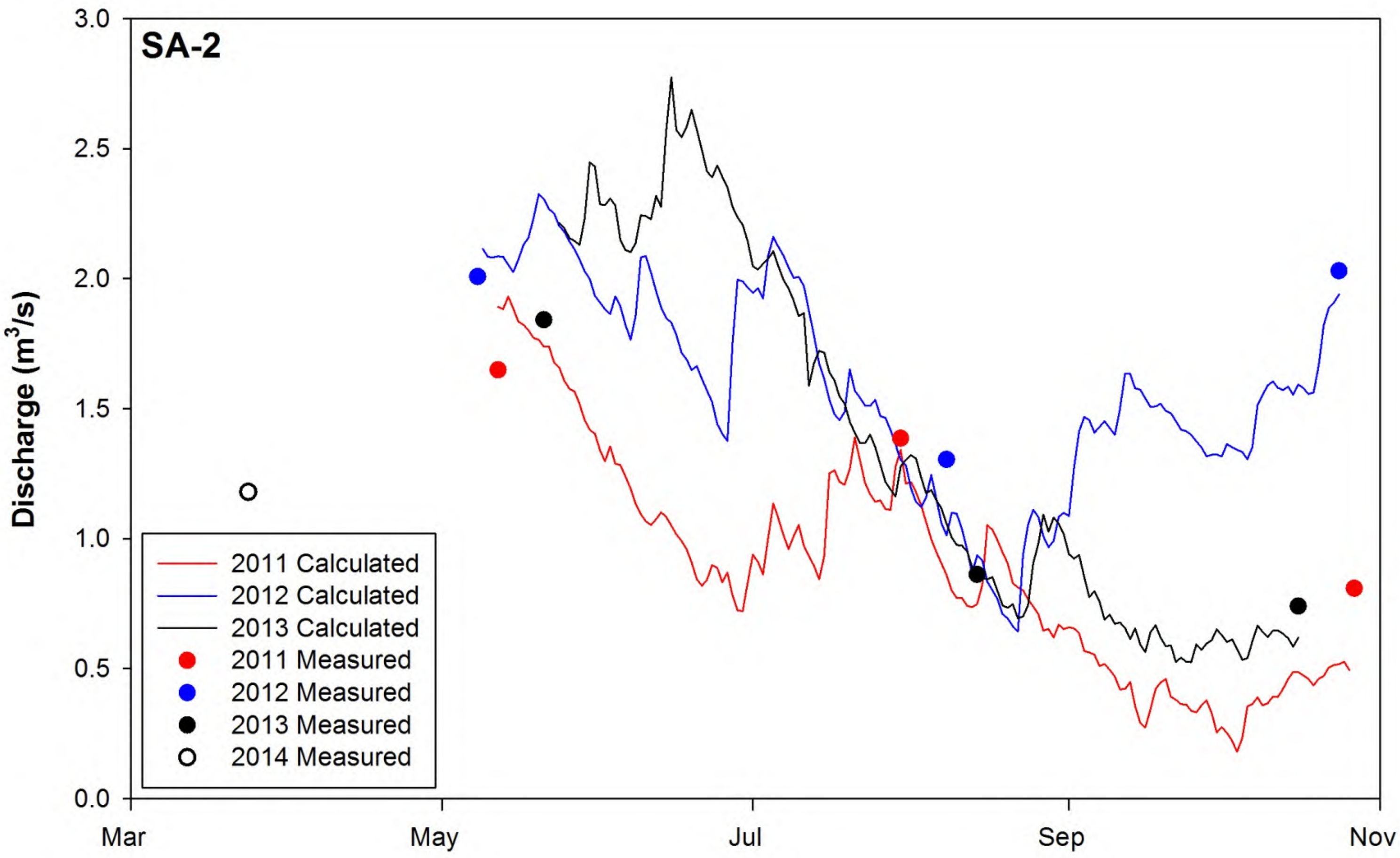

Figure D2: Measured and Calculated Discharge, Q (m^3/s), for Stream Monitoring Station SA-2.

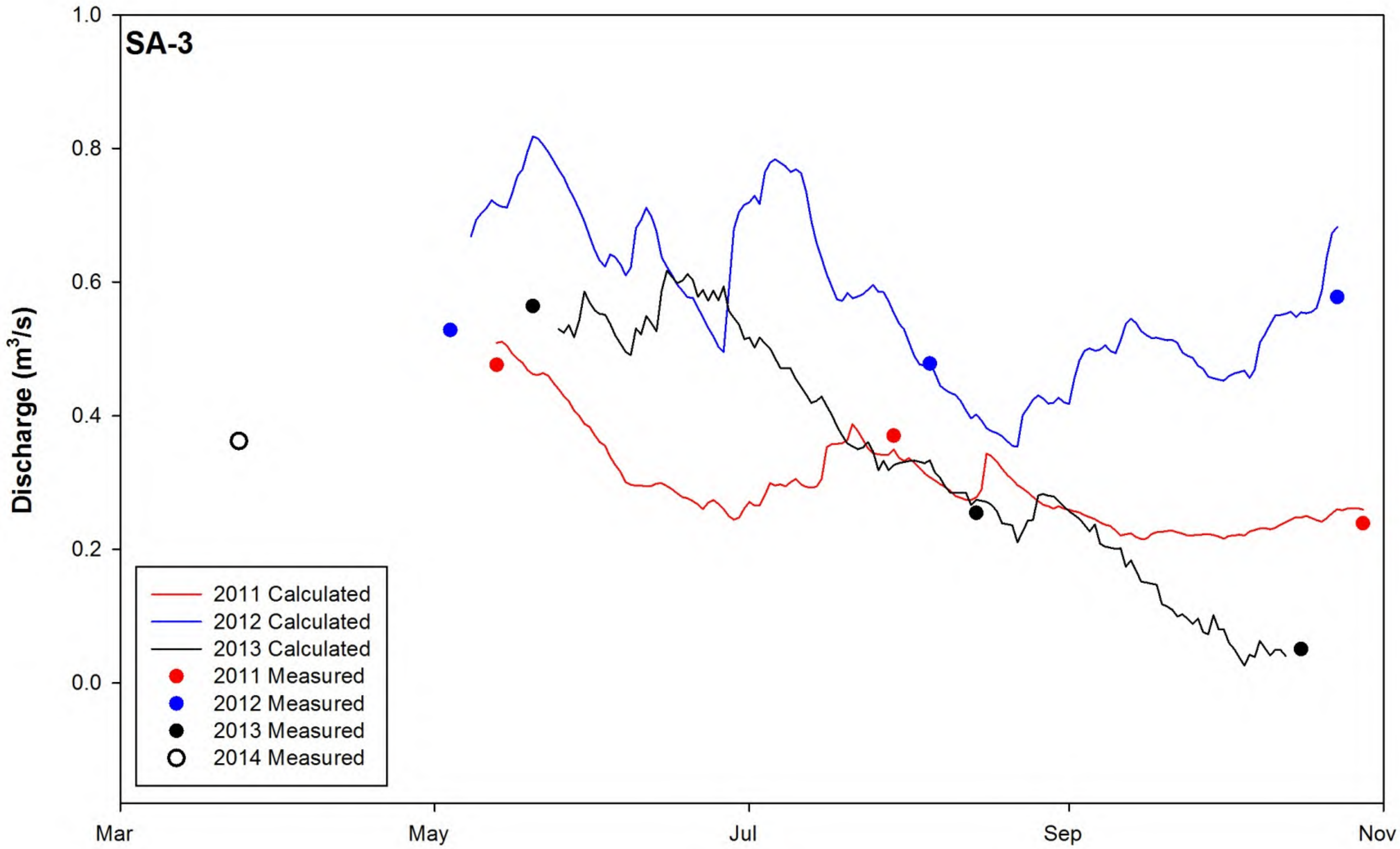

Figure D3: Measured and Calculated Discharge, Q (m^3/s), for Stream Monitoring Station SA-3.

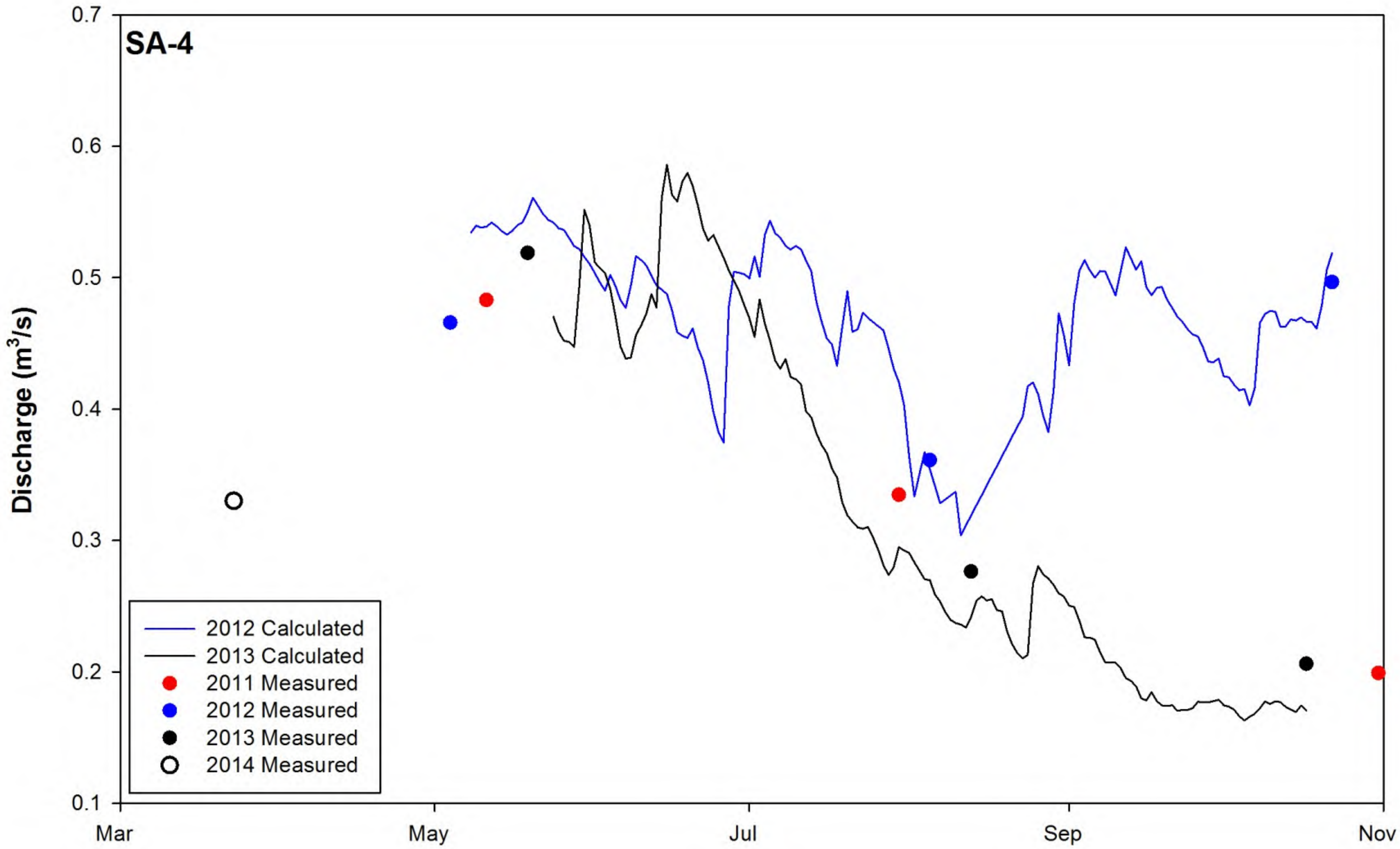

Figure D4: Measured and Calculated Discharge, Q (m^3/s), for Stream Monitoring Station SA-4.

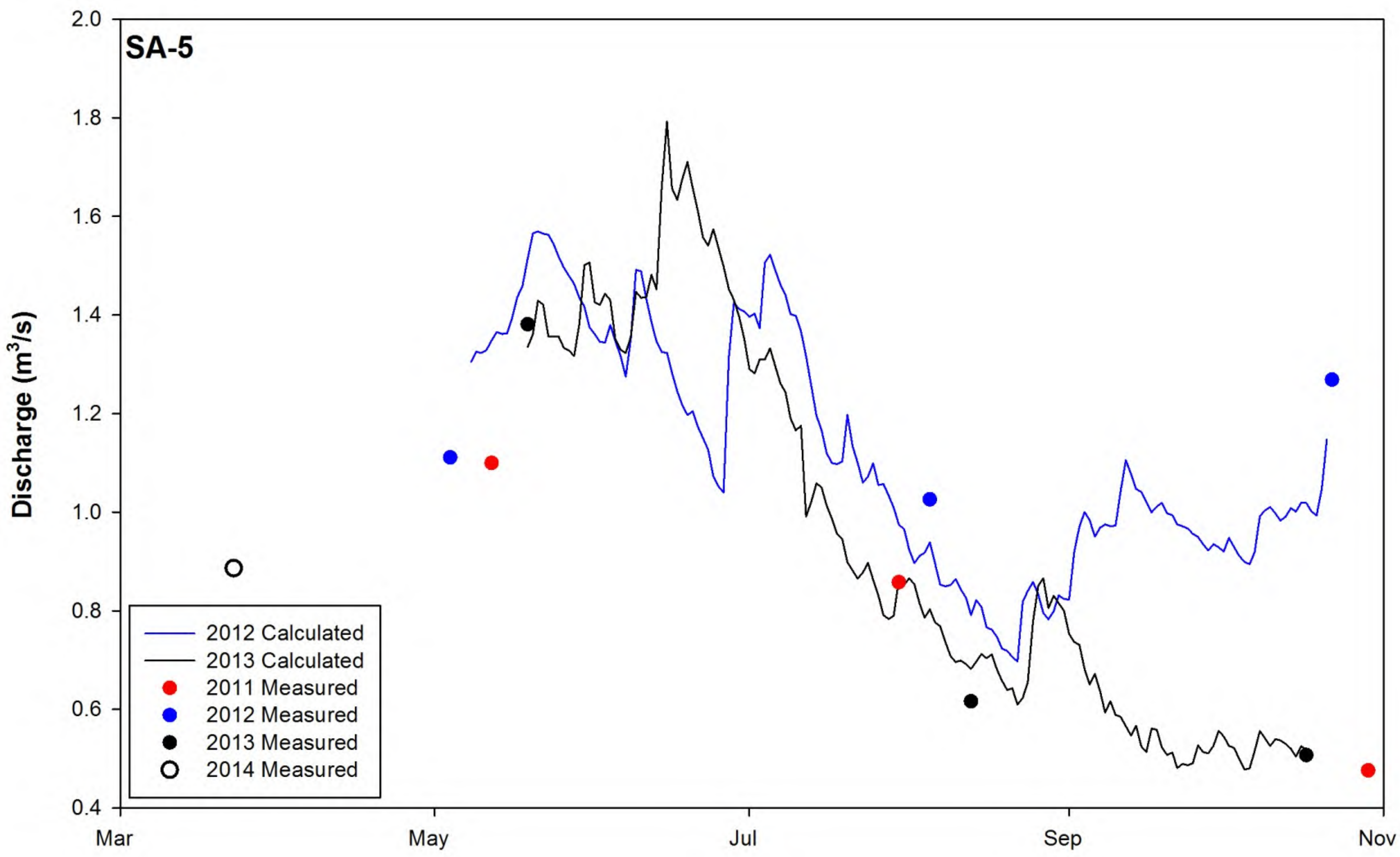

Figure D5: Measured and Calculated Discharge, Q (m^3/s), for Stream Monitoring Station SA-5.

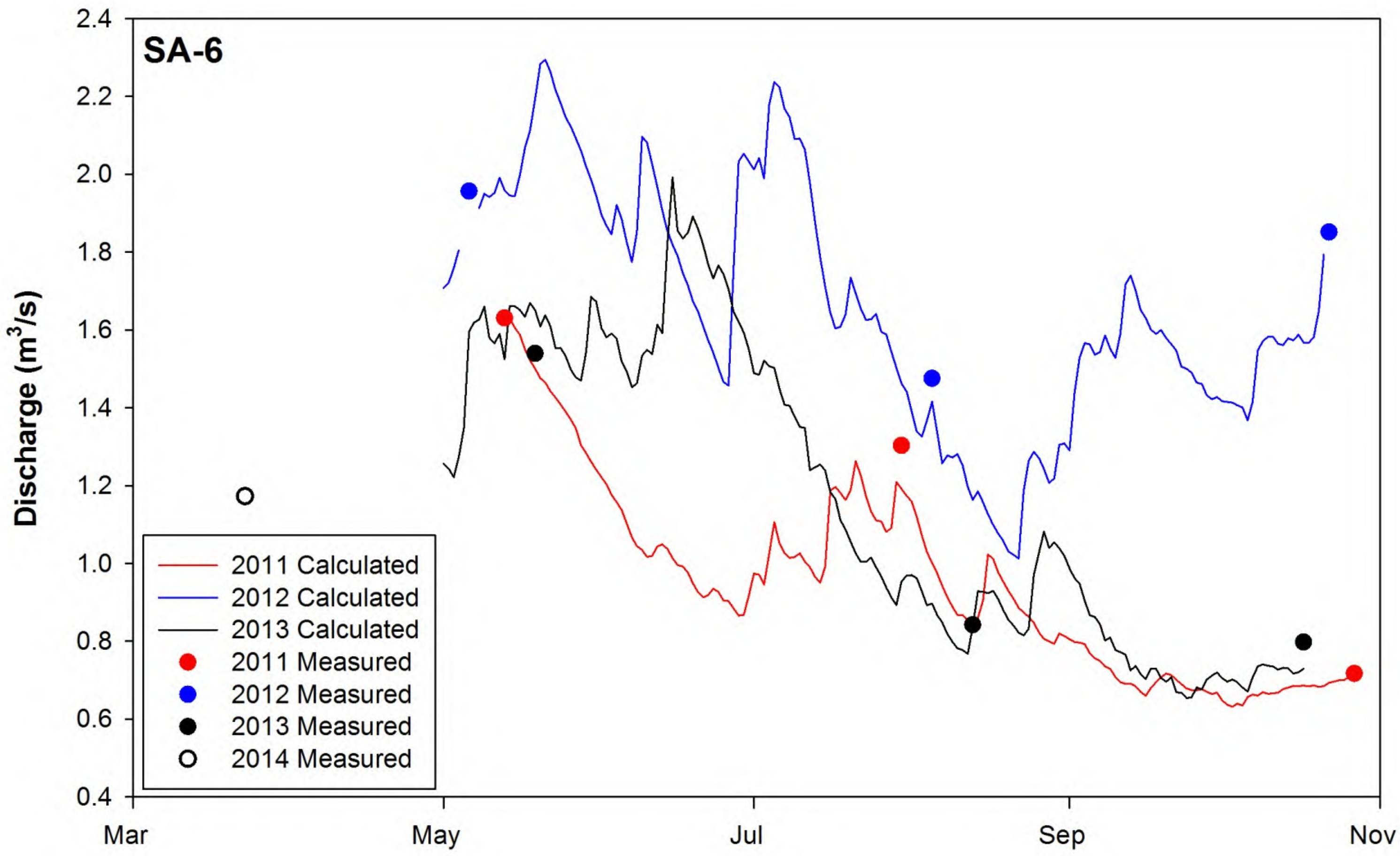

Figure D6: Measured and Calculated Discharge, Q (m^3/s), for Stream Monitoring Station SA-6.

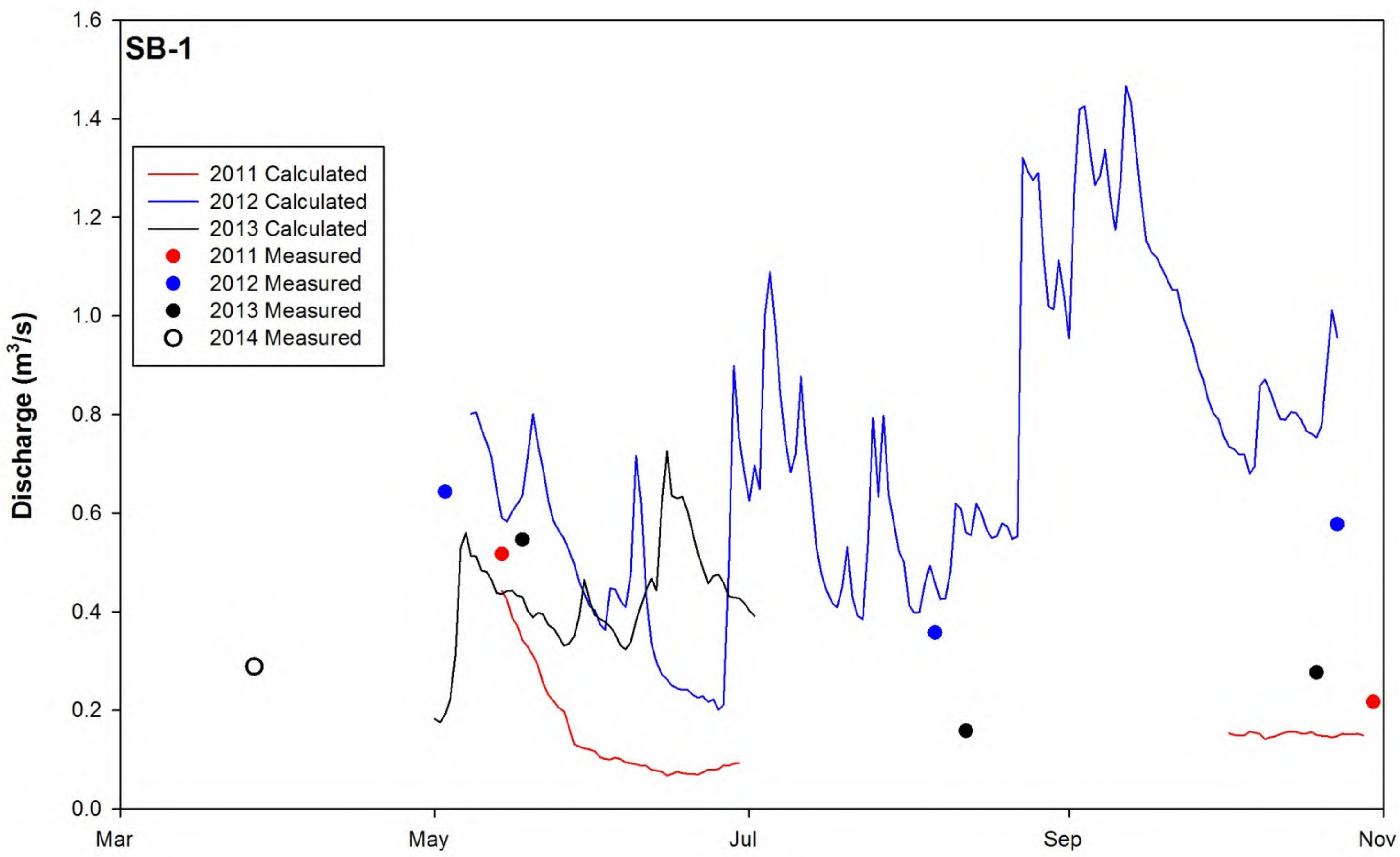

Figure D7: Measured and Calculated Discharge, Q (m^3/s), for Stream Monitoring Station SB-1.

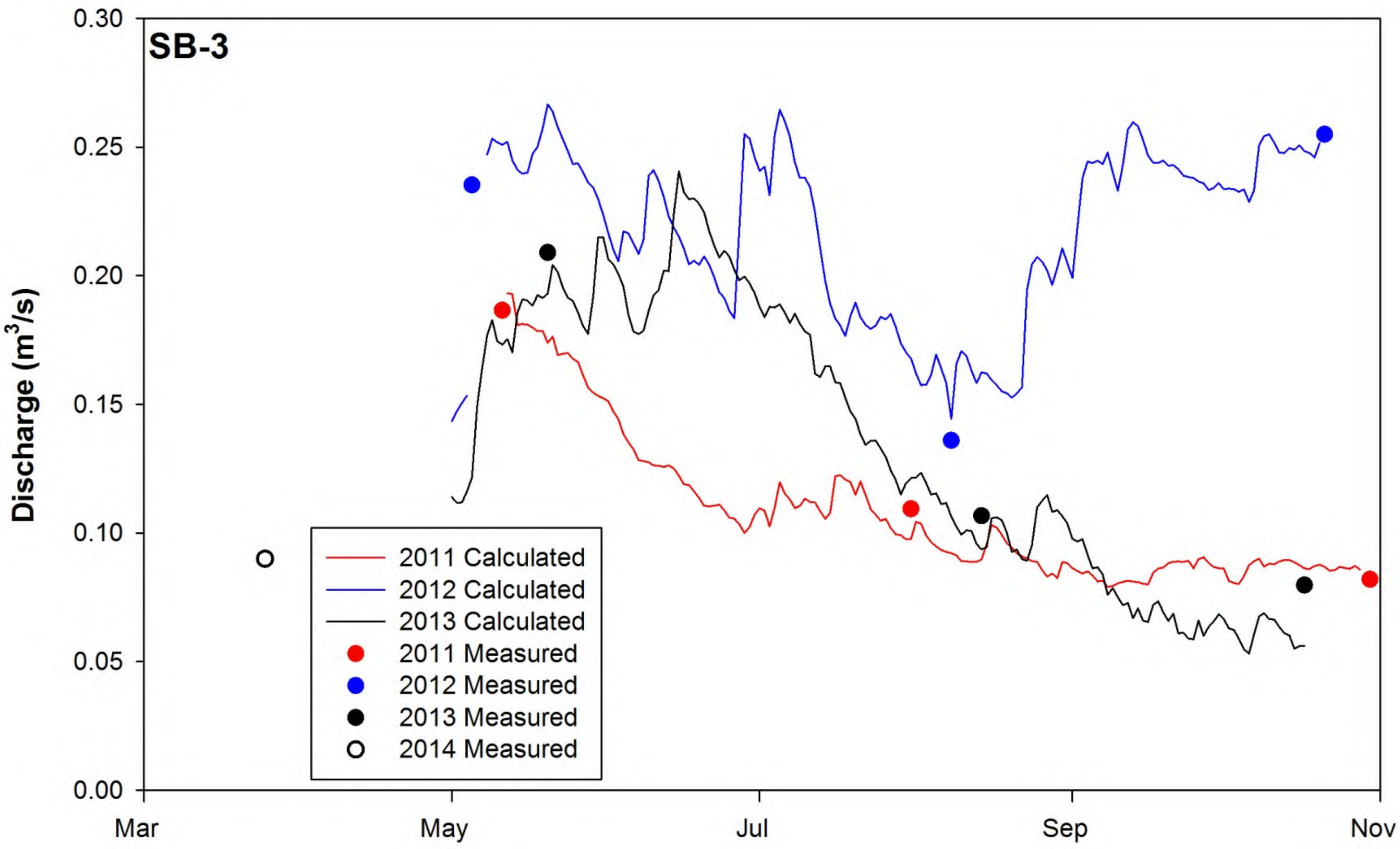

Figure D8: Measured and Calculated Discharge, Q (m^3/s), for Stream Monitoring Station SB-3.

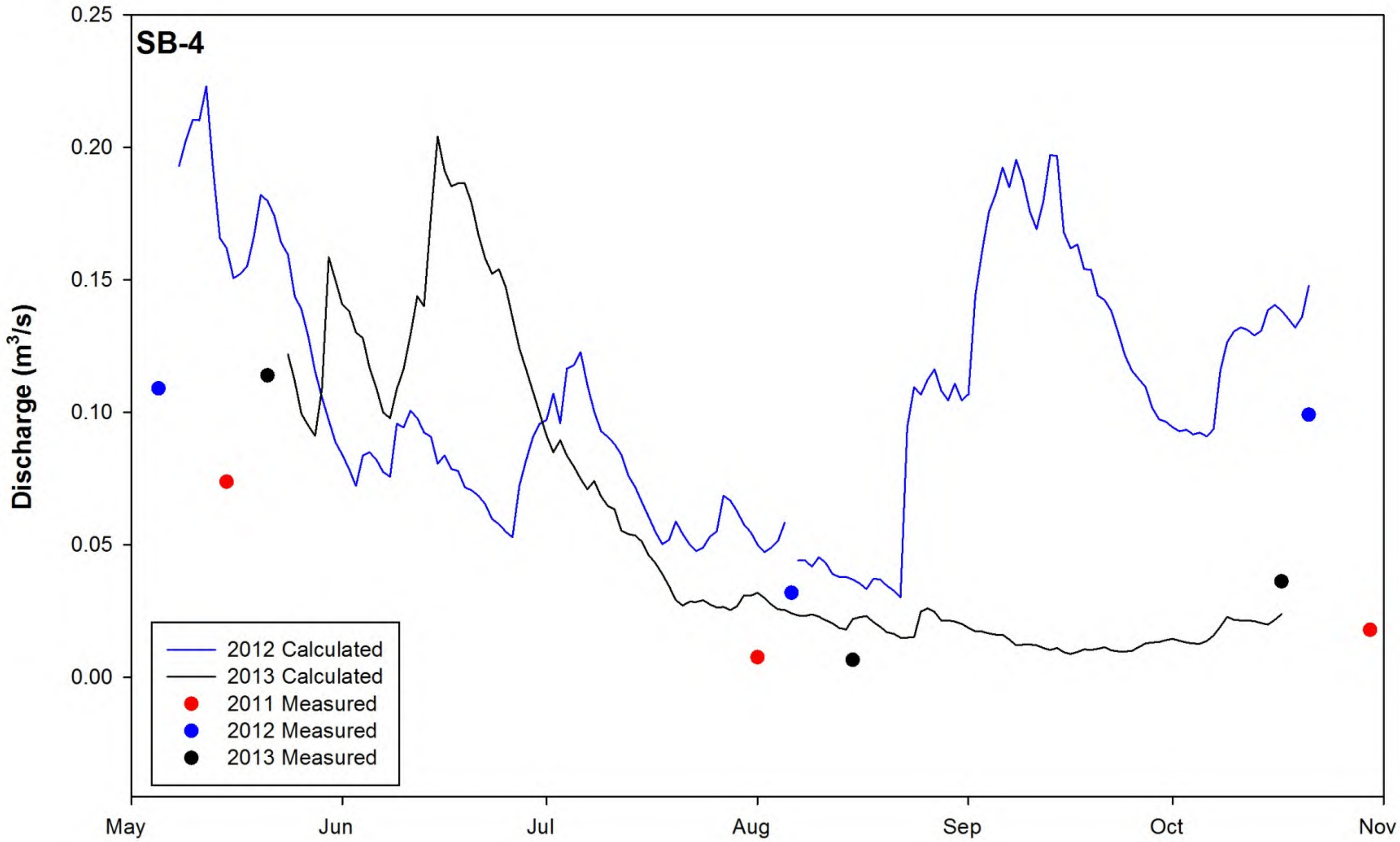

Figure D9: Measured and Calculated Discharge, Q (m^3/s),for Stream Monitoring Station SB-4.

APPENDIX E

Photos

Photo 1: SA-1 looking downstream. Photo taken May 14, 2011.

Photo 2: SA-2 looking downstream. Photo taken July 30, 2011.

Photo 3: SA-3 looking downstream. Photo taken May 13, 2011.

Photo 4: SA-4 looking downstream. Photo taken July 30, 2011.

Photo 5: SA-5 looking downstream. Photo taken July 31, 2011.

Photo 6: SA-6 looking upstream. Photo taken May 13, 2011.

Photo 7: SB-1 looking upstream. Photo taken May 14, 2011.

Photo 8: SB-3 looking upstream. Photo taken July 28, 2011.

Photo 9: SB-4 looking downstream. Photo taken July 31, 2011.

Photo 10: LA-1 looking west. Photo taken July 29, 2011.

Photo 11: LA-2 looking south. Photo taken July 29, 2011.

Photo 12: LA-3 looking northwest. Photo taken May 13, 2011.

Photo 13: LA-4 looking west. Photo taken July 29, 2011.

Photo 14: LA-5 looking south. Photo taken July 20, 2011.

Photo 15: LA-6 looking east. Photo taken July 30, 2011.

Photo 16: LA-7 looking north. Photo taken July 28. 2011.

Photo 17: LB-1 looking west. Photo taken July 31, 2011.

Photo 18: LB-2 looking southwest. Photo taken July 28, 2011.

Photo 19: LAB-1 looking east. Photo taken July 31, 2011.

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Golder Associates

Appendix E Wheeler River Lake Level Survey and 2016/2017 Streamflow Monitoring. Calder Engineering Ltd.

TECHNICAL MEMORANDUM

Project: **Wheeler River Lake Level Survey and 2016/2017 Streamflow Monitoring**
Wheeler Rive Mining Exploration, Key Lake, Saskatchewan
Calder Engineering Ltd. Project #16-190

To: **Janeen Tang**
EcoMetrix Incorporated

Date: **July 7th, 2017 revised August 2017**

INTRODUCTION

Provided in this Technical Memorandum is a summary of a lake level survey and streamflow monitoring program implemented in 2016/2017 at the Wheeler River Mine Exploration. The mine exploration is located in the Key Lake area of Saskatchewan. Surface water level elevations were surveyed at a number of lakes (13) and ponds (2) at the Wheeler River Mine Exploration Site. In addition, manual streamflow measurements were taken on 16 watercourses, continuous streamflow monitoring equipment was installed at 8 locations, and streamflow monitoring equipment was retrieved from 2 locations.

The respective pond/lake and streamflow locations are shown on **Figure 1(a and b)**.

LAKE AND POND LEVEL SURVEY

Surface water level elevations were surveyed for thirteen lakes and two ponds associated with the Wheeler River Mine Exploration near Key Lake, Saskatchewan. The water level elevation survey was performed by staff of Calder Engineering Ltd. and Ecometrix Incorporated between September 11 and September 22, 2016. Where possible, surface water elevations were referenced to geodetic benchmarks established by Golder Associates. New locations (LA8, LA9, PA2 and PA3) were initially referenced to temporary benchmarks. Geodetic elevations were assigned to the temporary benchmarks in June 2017 in conjunction with establishment of benchmarks by Webb Survey. An iron bar was installed at each of LA8, LA9, PA2 and PA3, and corrected static positions of each bar were determined from NRCAN. A copy of the report from Webb Survey is included as Attachment D.

A description of how the geodetic elevations of the Golder benchmarks were established is available in the 2012 – 2014 Baseline Hydrology Summary Report prepared by Golder Associates.

Summarized in Table 1 are surveyed pond and lake surface water level elevations. The pond and lake locations are shown on **Figure 1(a and b)**.

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Calder Engineering Ltd.

TABLE 1
LAKE AND POND SURFACE WATER LEVEL ELEVATIONS

Lake/Pond	Date	Water Level Elevation (m)
LB1	September 11, 2016	503.66
LB2	September 11, 2016	510.54
LB3 (Williams Lake)	September 11, 2016	518.57
LAB1 (Russel Lake)	September 22, 2016	488.26
LA1	September 16, 2016	494.39
LA2	September 13, 2016	494.58
LA3	September 18, 2016	494.57
LA4	September 13, 2016	498.62
LA5	September 12, 2016	500.06
LA6	September 12, 2016	500.07
LA7 (Kratchowsky Lake)	September 12, 2016	520.53
	May 30, 2017	520.53
LA8	September 13, 2016	520.86
	June 1, 2017	520.80
LA9	September 13, 2016	514.25
	May 31, 2017	514.28
PA2	September 15, 2016	510.46
PA3	September 15, 2016	517.36

Note:
1. Units: m – metres.
2. Water level elevations are referenced to benchmarks with geodetic elevations established by Golder Associates, except for LA8, LA9, PA2 and PA3 which are referenced to geodetic elevations established as part of this report.
3. Water level elevations based on survey conducted by Calder Engineering Ltd. and Ecometrix Incorporated

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STREAMFLOW MONITORING

Stream Descriptions

Provided below are descriptions of each stream. Photographs are provided in **Attachment A**.

SA1

SA1 is located close to the outlet of Drainage Area A at Russel Lake. The stream bottom is comprised of boulders, cobble, gravel and sand. It is our understanding that a logger was left at this location; however, this logger was not located during the site visit and is presumed to be lost. The logger retrieved from SB1 was installed in a low gradient section immediately upstream of a high gradient section. SA1 is accessible by road.

SA2

SA2 flows into the northwest end of LA1. The stream at SA2 is generally steep with vertical banks and high velocities. No logger was installed at this location. SA2 is accessible by boat.

SA3

SA3 is shallow wide sandy bottom stream with vertical banks that connects LA2 to LA1. No logger was installed at this location. SA3 is accessible by boat.

SA4

SA4 is located upstream of LA6. The channel bottom is composed primarily of cobbles and boulders. A logger was installed at this location and was located in a pool upstream of a fast high gradient section. The barometric logger was located on the bank at this station. SA4 is accessible by road.

SA5

SA5 is located upstream of LA6. The channel bottom is primarily small boulders and cobbles overlain sand. A logger was installed on a straight run downstream of the removed bridge crossing. SA5 is accessible by road.

SA6

SA6 is a wide sandy bottom stream with vertical banks connecting lakes LA5 and LA6. Flow in the stream is deep and slow. The logger installed by Golder Associates was retrieved and reinstalled at the same location. The stream gauging equipment was located approximately halfway between the two lakes. SA6 is accessible by road.

SA7

SA7 is a narrow marshy stream with vertical banks. SA7 was identified for continuous water level monitoring, however no logger was installed at this location. While the water levels at this stream

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could be monitored, it is unlikely that a reliable rating curve could be developed for this location to convert levels to flows due to the site conditions. Flow in the stream is slow and deep, with significant undercut banks. The gradient from LA7 is shallow, allowing backwater from the lake to influence stream water levels. SA7 is accessible by boat.

SA8

SA8 is a meandering narrow sandy bottom stream with deep banks. Some areas of the bank were undercut. The monitoring station was installed in a relatively straight faster section immediately upstream of the lake. SA8 is accessible by boat.

SA9

SA9 was initially located at the outlet a small lake downstream of LA8. For access purposes, this station was relocated to the outlet of LA8 which is accessible by an existing ATV road. The stream in this section is shallow and relatively narrow. The stream bottom is comprised mainly of sand, gravel, cobbles. The monitoring station was located in a pool upstream of the road crossing. Stream banks are shallow and the surrounding land is relatively flat. The area has recently been impacted by a forest fire, so this station is at greater risk of trees/debris falling into the flow and impacting water levels. SA9 is accessible by road.

SA10

SA10 is a wide sandy bottom stream with vertical banks flowing into the northwest part of LA9. The water is deep and slow moving. The monitoring station was located in a relatively straight section with wadeable depths at the time of installation. The water depths downstream closer to the lake were too deep to wade at the time of installation. SA10 is accessible by boat.

SA11

SA11 is an additional station added to replace SA7. SA11 is located at the northern most inlet of LA7. The stream bottom is comprised primarily of gravel and cobbles. The stream channel is braided. The monitoring station was located in an unbraided section immediately upstream of the lake. SA11 is accessible by boat.

SB1

SB1 is located close to the outlet of Drainage Area B at Russel Lake. The monitoring station was located immediately upstream of the culverts at the McArthur River haul road. The stream in this area is marshy with a thick organic base. The stream base in the immediate vicinity of the monitoring station has been altered as result of the road crossing and consists sand, gravel and boulders. Signs of beaver activity were observed both upstream and downstream of the monitoring location. The logger installed by Golder Associates was retrieved from this location and redeployed at another station. SB1 is accessible by road.

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SB2

SB2 is located in a second channel immediately west of SB1. The characteristics of SB2 are similar to SB1 – marshy with a thick organic base impacted by the road construction with signs of beaver activity. At the time of the field visit, no flow was observed at this location. It is suspected that it either flows laterally towards SB1 or seeps under the road embankment. SB2 is accessible by road.

SB3

SB3 is located downstream of LB2. The stream bottom is comprised of organics, sand, cobbles and boulders. The banks are nearly vertical. No monitoring equipment was installed or retrieved from this location. SB3 is accessible by road.

SB4

SB4 is located at the southwest inlet of LB3. The stream banks are shallow and poorly defined. It is our understanding that monitoring equipment was left at this location; however the logger was not found and is assumed to be lost. The stream bottom is primarily boulders and large cobbles. SB4 is accessible by boat.

SB5

SB5 is located at the outlet of LB3. Gauging was conducted in a relatively straight section downstream of the camp road crossing and upstream of a low gradient pool and braid. The stream bottom was composed of sand, gravel and cobbles. SB5 is accessible by road.

Streamflow Monitoring Stations

Eight temporary streamflow monitoring stations were installed by Calder at the Wheeler River Mine Exploration. The streamflow monitoring stations were established to obtain information on local watercourse flow characteristics. Summarized in Table 2 and shown on Figure 1 are locations of the eight streamflow monitoring stations.

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TABLE 2
SUMMARY OF STREAMFLOW MONITORING STATION LOCATIONS

Station	Installation Date	Easting	Northing
SA1	September 22, 2016	480368	6371123
SA4	September 10, 2016	476926	6375868
SA5	September 9, 2016	477822	6375737
SA6	September 12, 2016	477863	6374742
SA8	September 15, 2016	471579	6378303
SA9	September 18, 2016	478226	6381589
SA10	September 18, 2016	479003	6380421
SA11	September 19, 2016	473026	6379260

Note:
1. Refer to Figure 1 for location of streamflow monitoring stations.
2. Eastings and northings referenced to the UTM Zone 17 grid and NAD83 datum.

The streamflow monitoring installations each comprised a Solinst Model 3001 LT F15/M5 Levelogger programmed to record water level at 15 minute intervals on a continuous basis. The Solinst Leveloggers were installed at the dates listed in Table 2. Leveloggers were programmed in June 2017 to collect data until the memory is full – around June 2018.

The Solinst Levelogger instrumentation measures absolute pressure and therefore compensation is required for atmospheric pressure fluctuations. Barometric pressure compensation is achieved using an additional device (e.g., Barologger) to measure barometric pressure. A barologger was installed and deployed adjacent the SA4 site. The data collected from the barologger will be used to apply barometric pressure compensation to data collected from the Solinst Levelogger instrumentation.

Streamflow Measurements

Streamflow measurements were conducted at 16 watercourses within the study area. For the sites with streamflow monitoring equipment installed, with enough manual flow measurements they can be used to develop site specific rating curves for each station. Results are shown in Table 3, detailed calculations sheets are provided in **Attachment B**.

Streamflow measurements were undertaken by wading using a portable velocity meter (Marsh-McBirney Model 2000 Flow-mate) and 1 metre staff gauge graduated in 2 millimetre increments. Streamflow measurements were conducted in accordance with ASTM Standard D 3868 – Standard Test Method for Open-Channel Flow Measurement of Water by Velocity-Area Method, whereby flow velocity is measured at the 20% and 80% depth increments when water depths are greater than 1.0 meter, and at the 60% depth increment if water depth is less than 1.0 meter.

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With respect to streamflow measurements, typically, a minimum of 10 segments across the stream were used to measure flow depth and flow velocity. Flow velocity was measured at each segment and applicable depth increment four times. Flow was computed by multiplication of measured mean flow velocities by the determined cross-sectional flow area (for each segment) and summing the respective values.

Water elevation was determined by referencing the water surface elevation to benchmarks at each location. Benchmarks for streams SA1, SA2, SA3, SA4, SA5, SA6, SB1, SB3, and SB4 were established by Golder Associates as part of the 2012 – 2014 Baseline Hydrology Summary Report. Elevations at SA8, SA9, SA10, SA11, Kratchowsky Creek were transferred across the lake surface from the lake benchmarks established by Golder Associates. The benchmark elevation at SB5 was established by Webb Survey and Calder Engineering in June 2017. An iron bar was installed at SB5 and the corrected static positions of the bar determined from NRCAN. A copy of the report from Webb Survey is included as Attachment D.

TABLE 3
SUMMARY OF MANUAL STREAMFLOW MEASUREMENTS

Station	Date	Water Elevation (mASL)	Flow (cms)
SA1*	September 17, 2016	492.71	2.34
	May 31, 2017	492.72	2.43
SA2	September 16, 2016	496.46	2.24
SA3	September 16, 2016	494.43	0.44
Kratchowsky Creek Outlet	September 14, 2016	520.30	0.58
SA4*	September 10, 2016	506.35	0.49
	May 30, 2017	506.37	0.58
SA5*	September 9, 2016	500.90	1.27
	September 21, 2016	500.91	1.58
	May 30, 2017	500.92	1.95
SA6*	September 11, 2016	500.07	1.98
	May 31, 2017	500.08	1.77
SA7	September 15, 2016	No BM set	0.04
SA8*	September 15, 2016	520.60	0.01
	September 19, 2016	520.62	0.04
	May 30, 2017	520.54	0.04

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SA9*	September 18, 2016	520.52	0.18
	June 1, 2017	520.49	0.16
SA10*	September 18, 2016	514.35	1.55
	May 31, 2017	514.31	1.22
SA11*	September 19, 2016	520.73	0.42
	May 30, 2017	520.71	0.31
SB1	September 17, 2016	488.55	0.64
SB2	September 17, 2016	No measurement taken	
SB3	September 11, 2016	510.47	0.20
SB4	September 11, 2016	519.21	0.12
SB5	September 14, 2016	518.33	0.14

Note:
1. Units: mASL = metres above sea leavel; cms = cubic metres per second
2. Refer to Figure 1 for location of streamflow monitoring stations.
3. Water level elevations are referenced to benchmarks with geodetic elevations established by Golder Associates, except for SA8, SA9, SA10, SA11, and SB5 which are referenced to geodetic elevations established as part of this report.
4. Water level elevations based on survey conducted by Calder Engineering Ltd. and Ecometrix Incorporated
5. * - indicates that continuous monitoring equipment was installed

RATING CURVES

Golder Associates Ltd. (2013) presented rating curves for SA1, SA4, SA5 and SA6. The manual flow measurements taken as part of the 2016-2017 field program were graphed along with the measurements and rating curves by Golder (2013) to review for suitability for use with the new installations.

Based on the data, the new station for SA5 was installed upstream of the Golder location. The stream bed in this area is of consistent width and slope. The rating curve for SA5 was shifted upstream based on the three manual flow measurements taken in 2016 and 2017.

Manual flow measurements taken at SA1, SA4, and SA6 appear to fit into the existing rating curve and the rating curve can be applied to the level data.

For streams SA8, SA9, SA10 and SA11 the manual flow measurements taken to date are not sufficient to develop a rating curve for conversion from level to flow.

Rating curves are presented in **Attachment B**.

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CONTINUOUS WATER LEVEL DATA

It is our understanding that loggers installed by Golder in 2013 were left in place at the following locations: SB1, SB4, SA1, and SA6. Leveloggers were located and retrieved at SB1 and SA6 in the Fall of 2016; we were unable to locate equipment at SB4 and SA1. The logger at SA6 was redeployed at SA6 and the logger at SB1 was redeployed at SA1. Available on the instruments were level and temperature data from May 18, 2013 to August 30, 2015.

Recorded data from the leveloggers deployed in the Fall of 2016 at streams SA1, SA4, SA5, SA6, SA8, SA9 and SA10 and the site barologger was retrieved in the Spring of 2017.

Barometric Compensation

Barometric compensation for the 2016-2017 field program was completed using the site barologger with any gaps filled using transformed data from the Key Lake Climate Station (Climate ID = 4063757) at 57°15'23.000" N, 105°37'03.000" W. Barometric compensation for the retrieved 2013 to 2015 data at SB-1 and SA-6 was completed using transformed data from the Key Lake Climate Station.

The Key Lake Climate Station has an hourly barometric pressure record at 57°15'23.000" N, 105°37'03.000" W. The data was linearly interpolated to 15 minute and 30 minute intervals for use the levelogger data. A relationship between the barometric pressure at the site barologger and the Key Lake station was developed using the May 2017 data and applied to the Key Lake Climate Station data for use with the project Levelogger data.

Elevation Data

Calculated water elevation data for each of the locations is presented in **Attachment C**.

Calculated Flow

For stations SA1, SA4, SA6 and SB1 the water elevation data was converted to flow using rating curve relationships developed by Golder (May 2014). The modified rating curve was applied for SA5.

For streams SA8, SA9, SA10 and SA11 the manual flow measurements taken to date are not sufficient to develop a rating curve for conversion from level to flow.

Calculated flow data for each of SA1, SA4, SA5, SA6 and SB1 is presented in **Attachment C**.

Recommendations

- Additional manual flow measurements be taken at new monitoring locations: SA8, SA9, SA10, SA11 to establish a rating curve at each location
- Rating curves established by Golder Associates Ltd. for SA1, SA4, SA5 and SA6 be reviewed for suitability for use with the reinstallations, including additional manual flow measurements.

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Yours Sincerely,

CALDER ENGINEERING LTD.

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FIGURE 1a: LAKE AND POND LOCATIONS

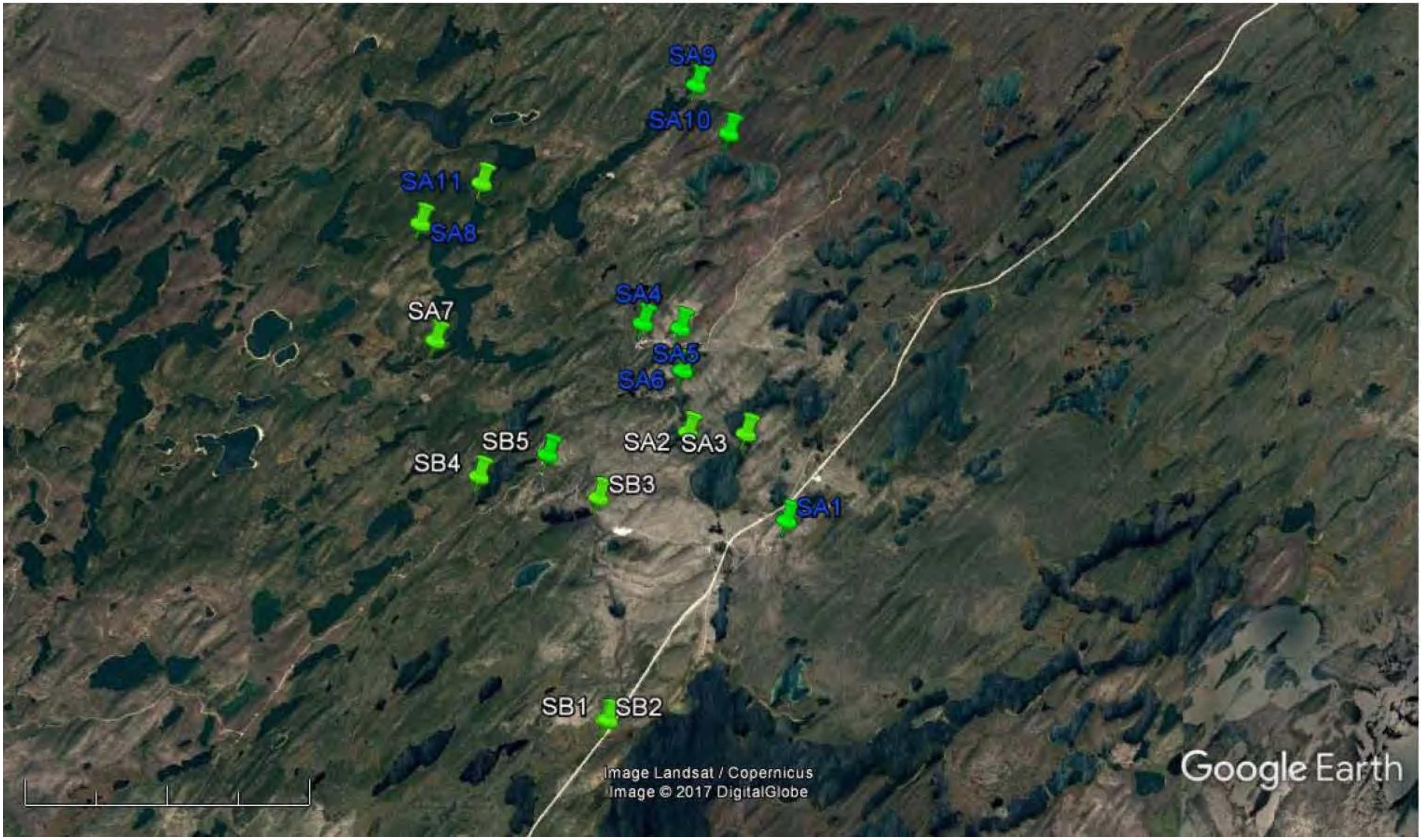


FIGURE 1b: STREAM LOCATIONS

ATTACHMENT A

PHOTOS

SA-1 facing upstream

SA-2 facing upstream

SA-1 facing downstream

SA-2 facing downstream

PHOTOS WHEELER RIVER	Calder Engeering Ltd.	SA1 and SA2	SEPT 2016 SHEET 1/9

SA-3 facing upstream

SA-4 facing upstream

SA-3 facing downstream

SA-4 facing downstream

PHOTOS WHEELER RIVER	Calder Engeering Ltd.	SA3 and SA4	SEPT 2016 SHEET 2/9

SA-5 facing upstream

SA-6 facing upstream

SA-5 facing downstream

SA-6 facing downstream

PHOTOS WHEELER RIVER	Calder Englneering Ltd.	SA5 and SA6	SEPT 2016 SHEET 3/9

SA-7 facing upstream

SA-8 facing upstream

SA-7 facing downstream

SA-8 facing downstream

PHOTOS WHEELER RIVER	Calder Engineering Ltd.	SA7 and SA8	SEPT 2016 SHEET 4/9

SA-9 facing upstream

SA-10 facing upstream

SA-9 facing downstream

SA-10 facing downstream

PHOTOS WHEELER RIVER	Calder Englneering Ltd.	SA9 and SA10	SEPT 2016 SHEET 5/9

SA-11 facing upstream


SA-11 facing downstream


Kratchkowsky Lake Outlet facing upstream

Kratchkowsky Lake Outlet facing downstream

PHOTOS WHEELER RIVER	Calder Englneering Ltd.	SA11 and Kractchowsky Lake Outlet	SEPT 2016 SHEET 6/9

SB-1 facing upstream

SB-2 facing upstream

SB-1 facing downstream

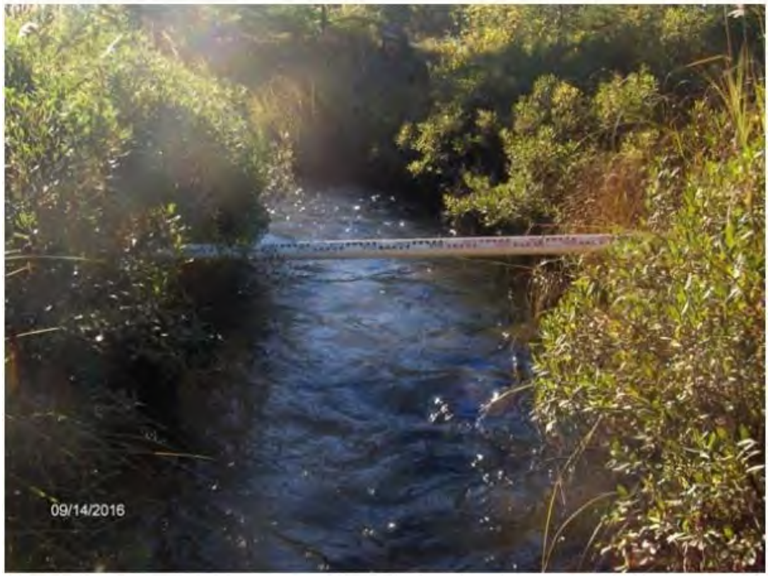
PHOTOS WHEELER RIVER	Calder Englneering Ltd.	SBI end SB2	SEPT 2016 SHEET 7/9

SB-4 facing upstream

SB-3 facing downstream

SB-4 facing downstream

PHOTOS WHEELER RIVER	Calder Engineering Ltd.	SB3 and S84	SEPT 2016 SHEET 8/9



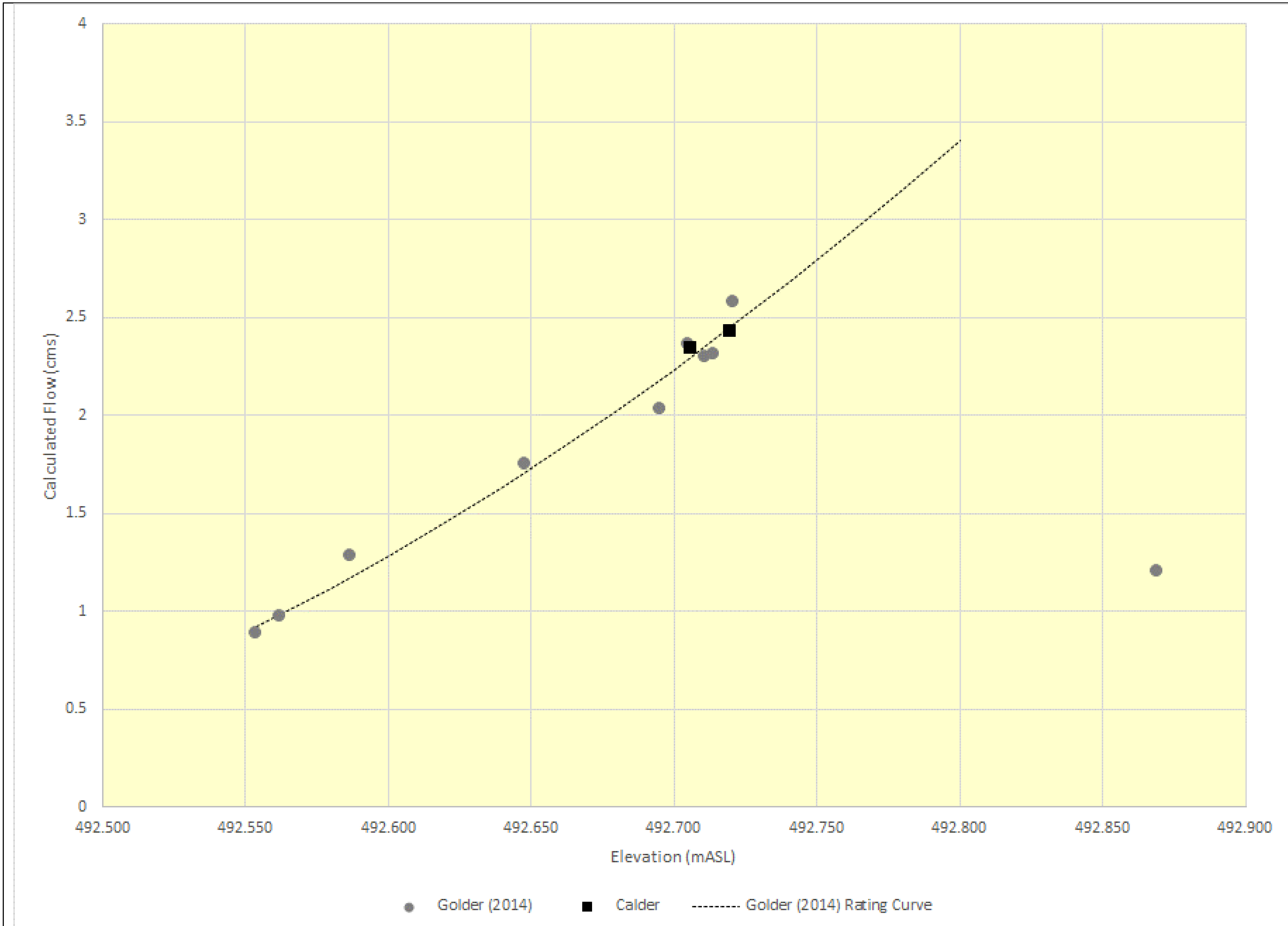
SB-5 facing upstream


SB-5 facing downstream

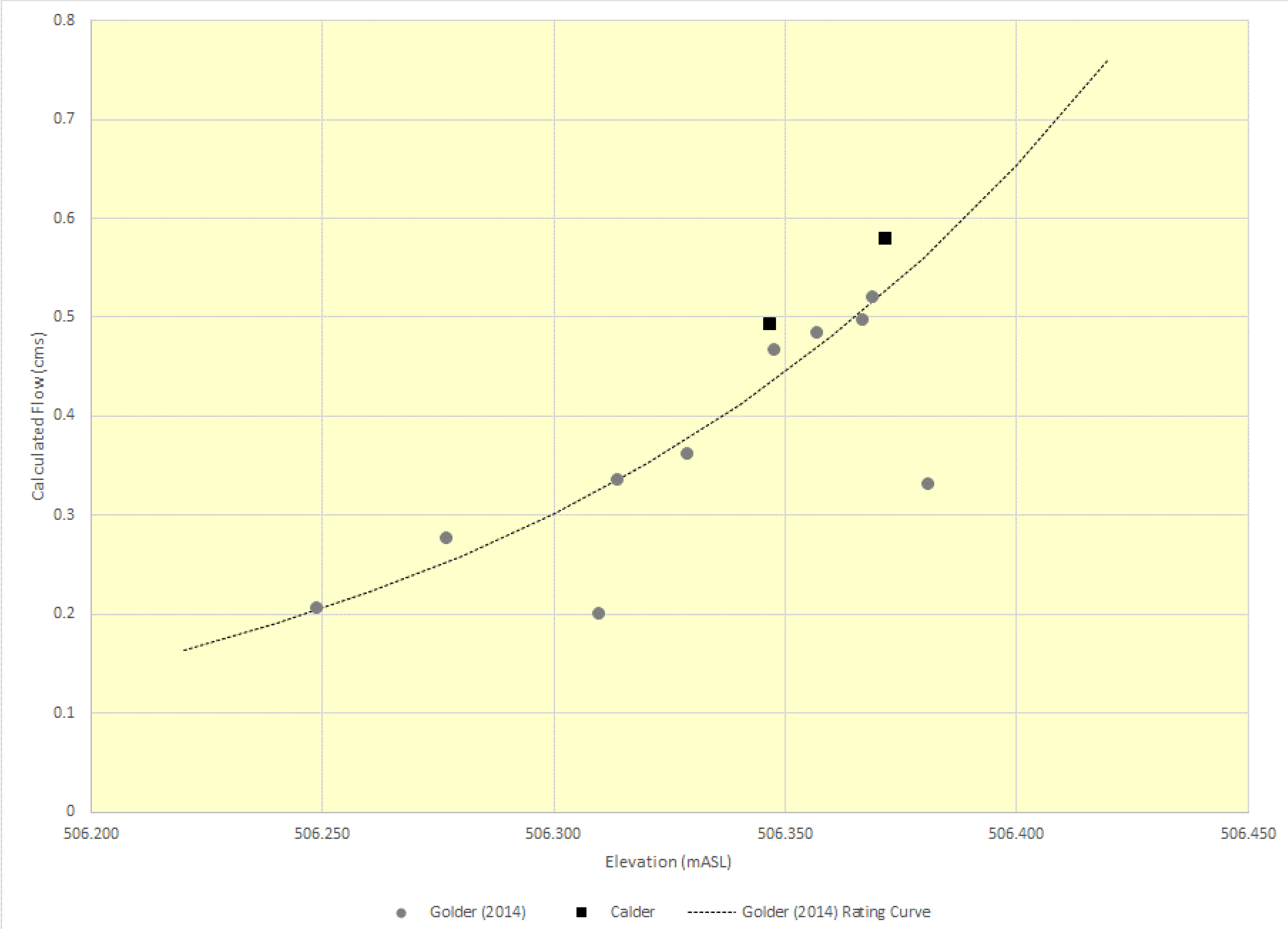
PHOTOS WHEELER RIVER	Calder Englneering Ltd.	SB5	SEPT 2016 SHEET 9/9

ATTACHMENT B

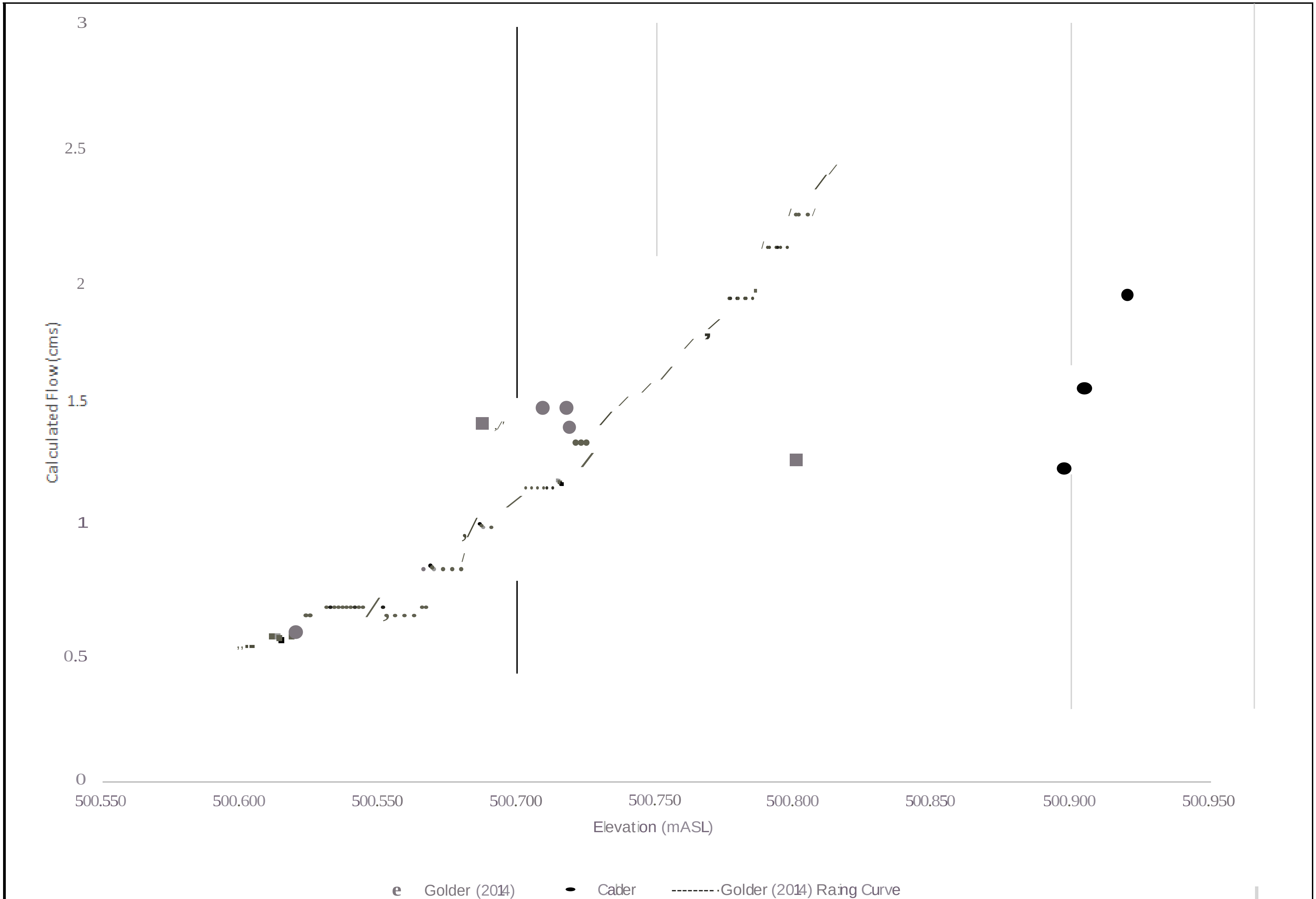
RATING CURVES AND MANUAL FLOW MEASUREMENTS



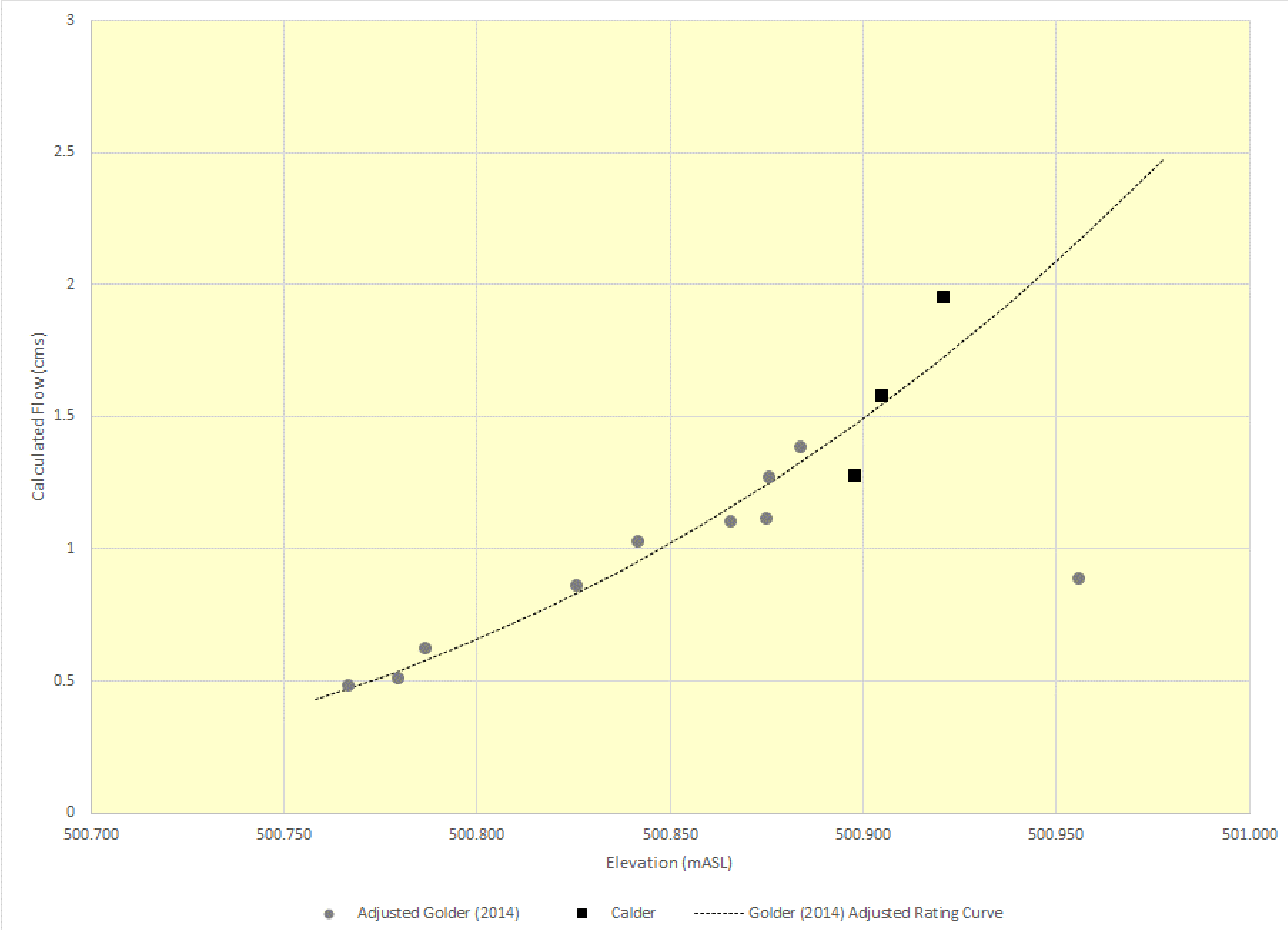
SA1 – MANUAL FLOW MEASUREMENTS AND RATING CURVE



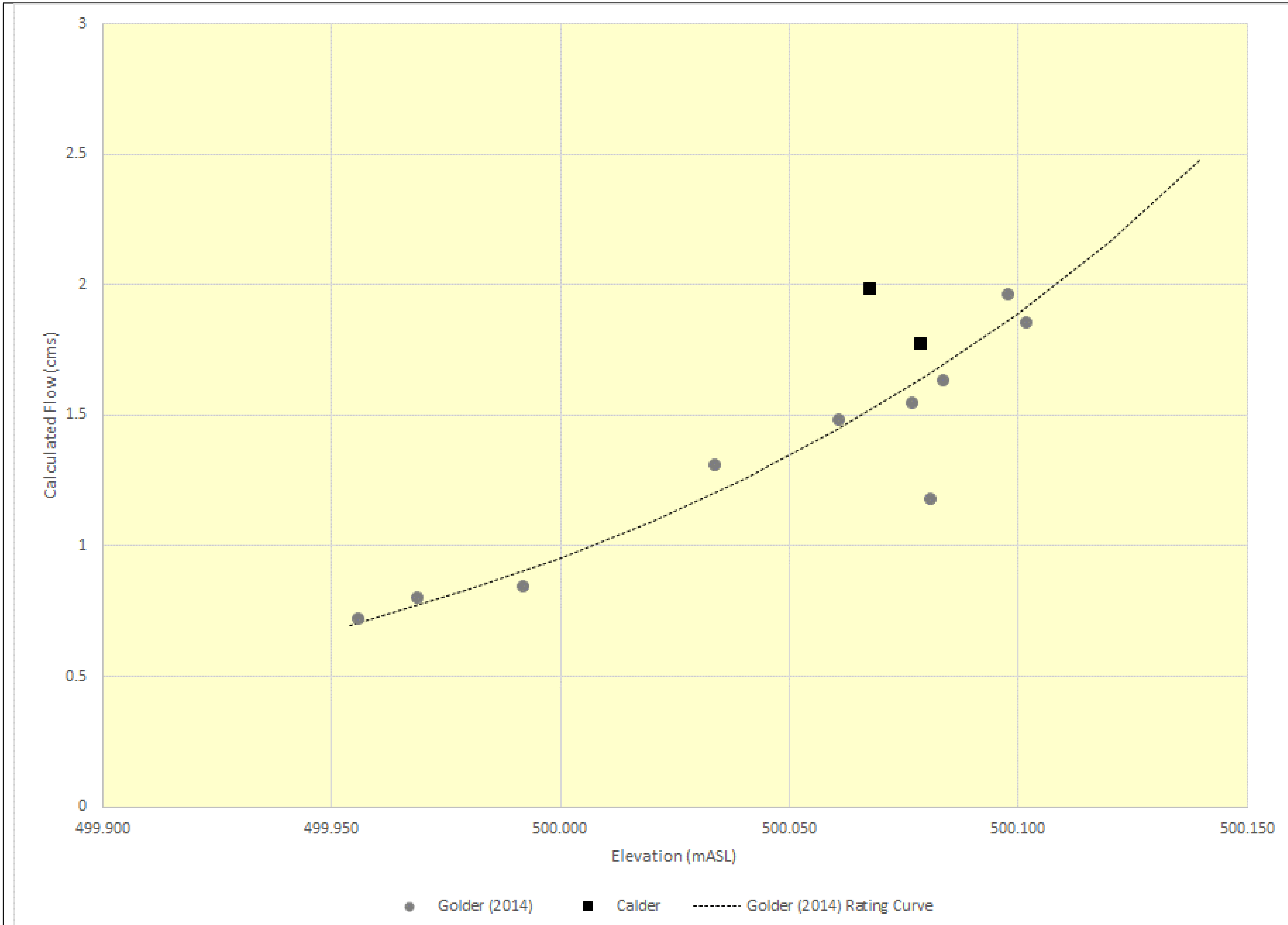
SA4 – MANUAL FLOW MEASUREMENTS AND RATING CURVE



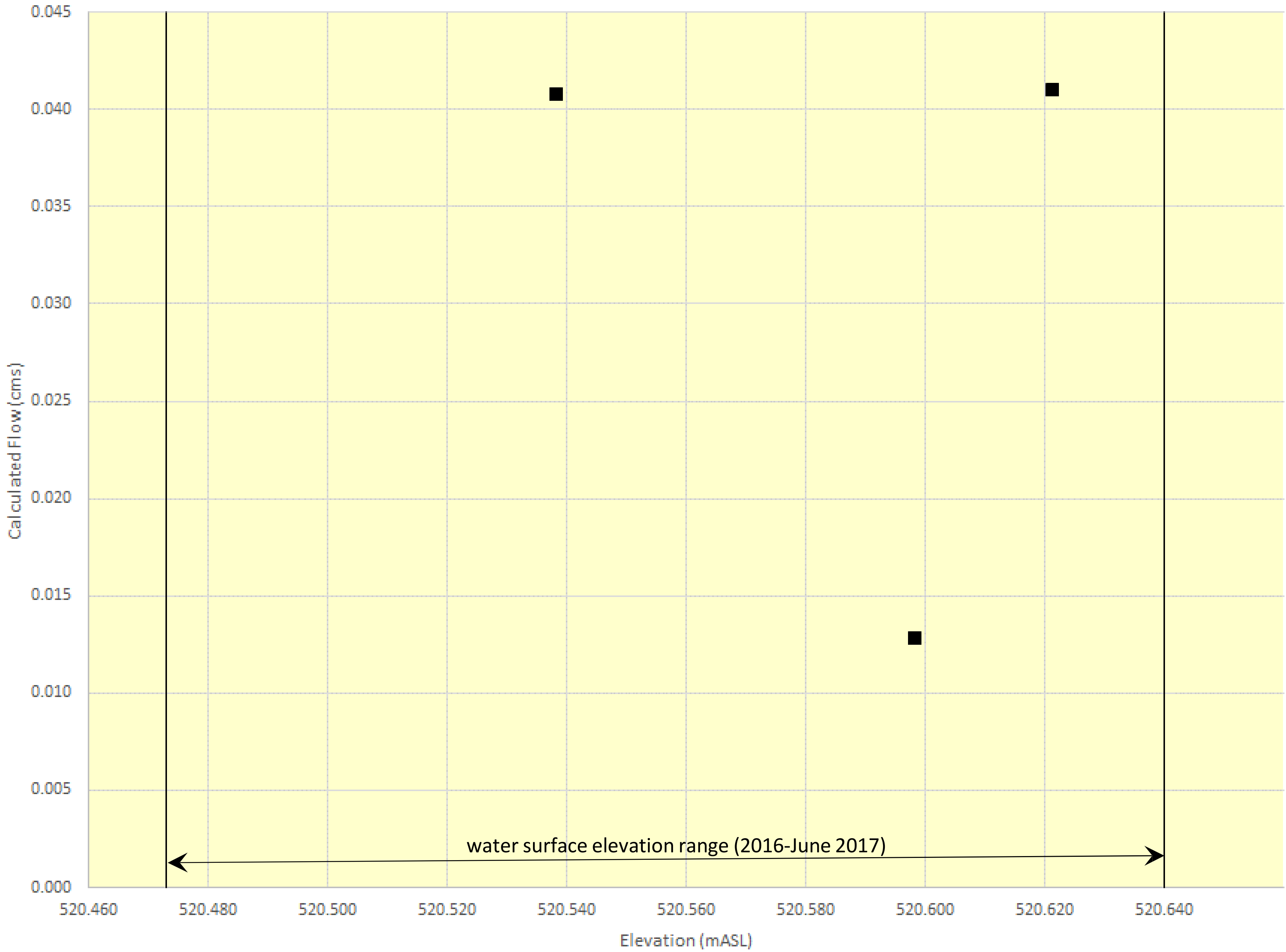
SA5 - MANUAL FLOW MEASUREMENTS AND RATING CURVE



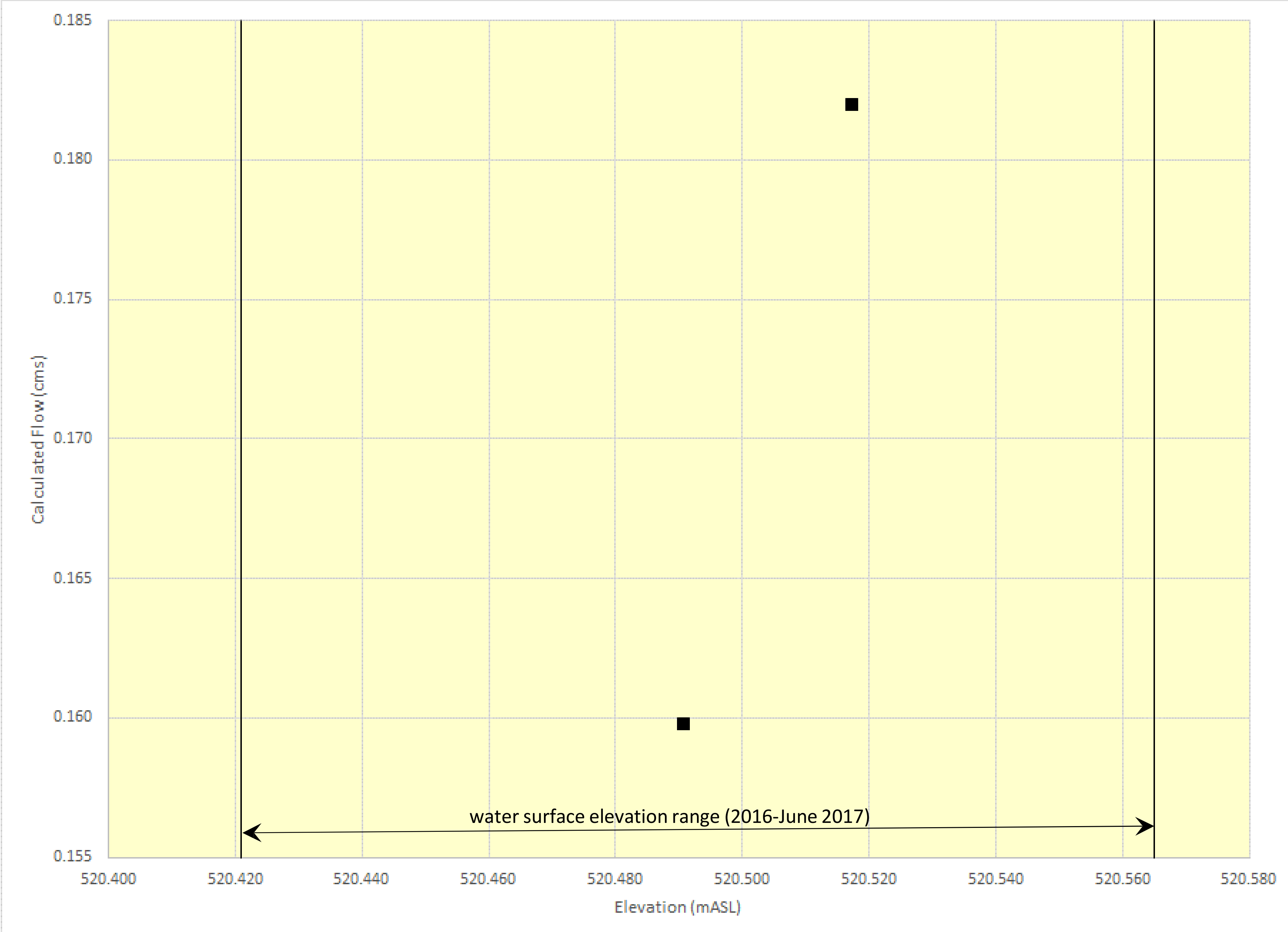
SA5 – ADJUSTED MANUAL FLOW MEASUREMENTS AND ADJUSTED RATING CURVE



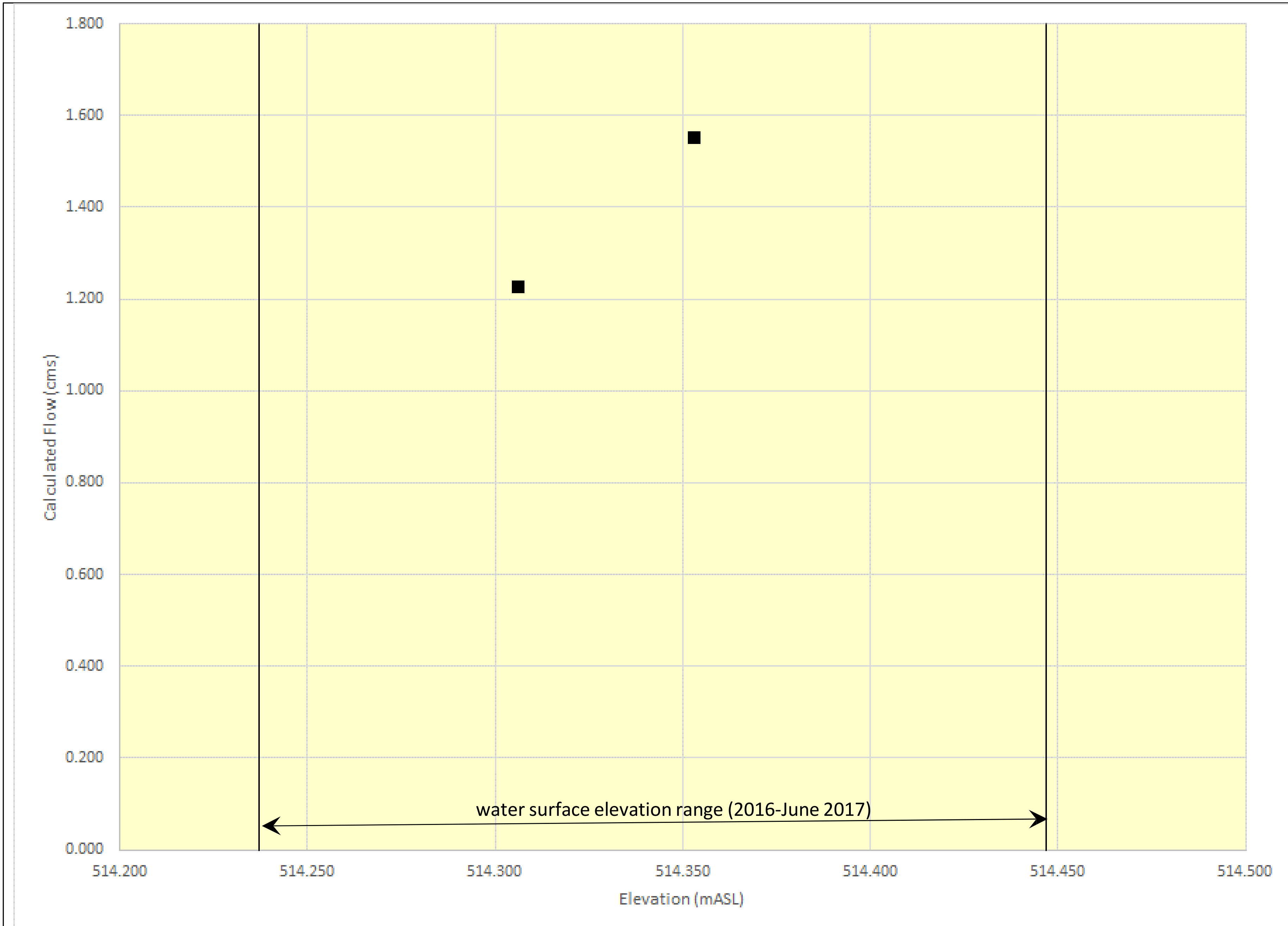
SA6 – MANUAL FLOW MEASUREMENTS AND RATING CURVE



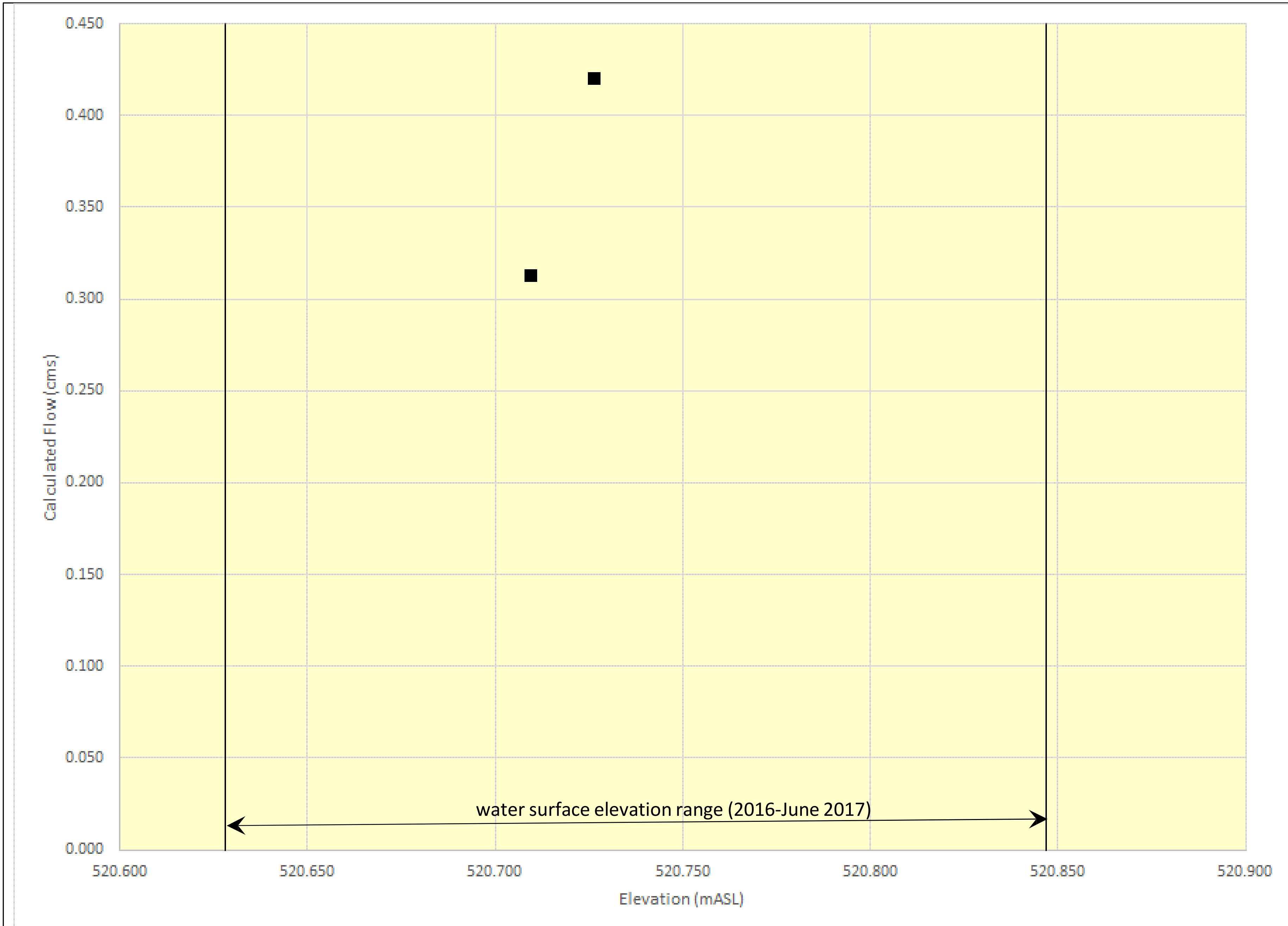
SA8 – MANUAL FLOW MEASUREMENTS



SA9 – MANUAL FLOW MEASUREMENTS



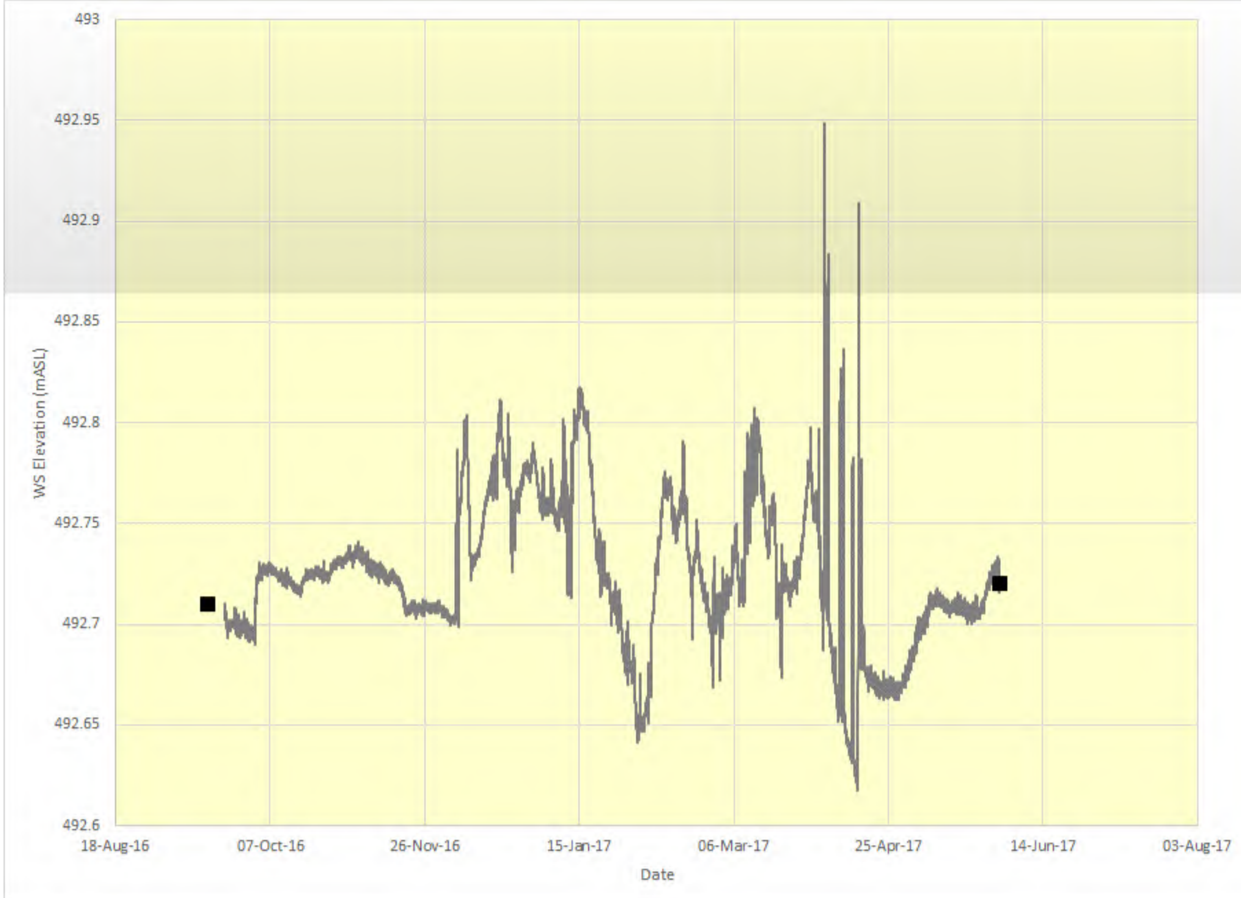
SA10 – MANUAL FLOW MEASUREMENTS



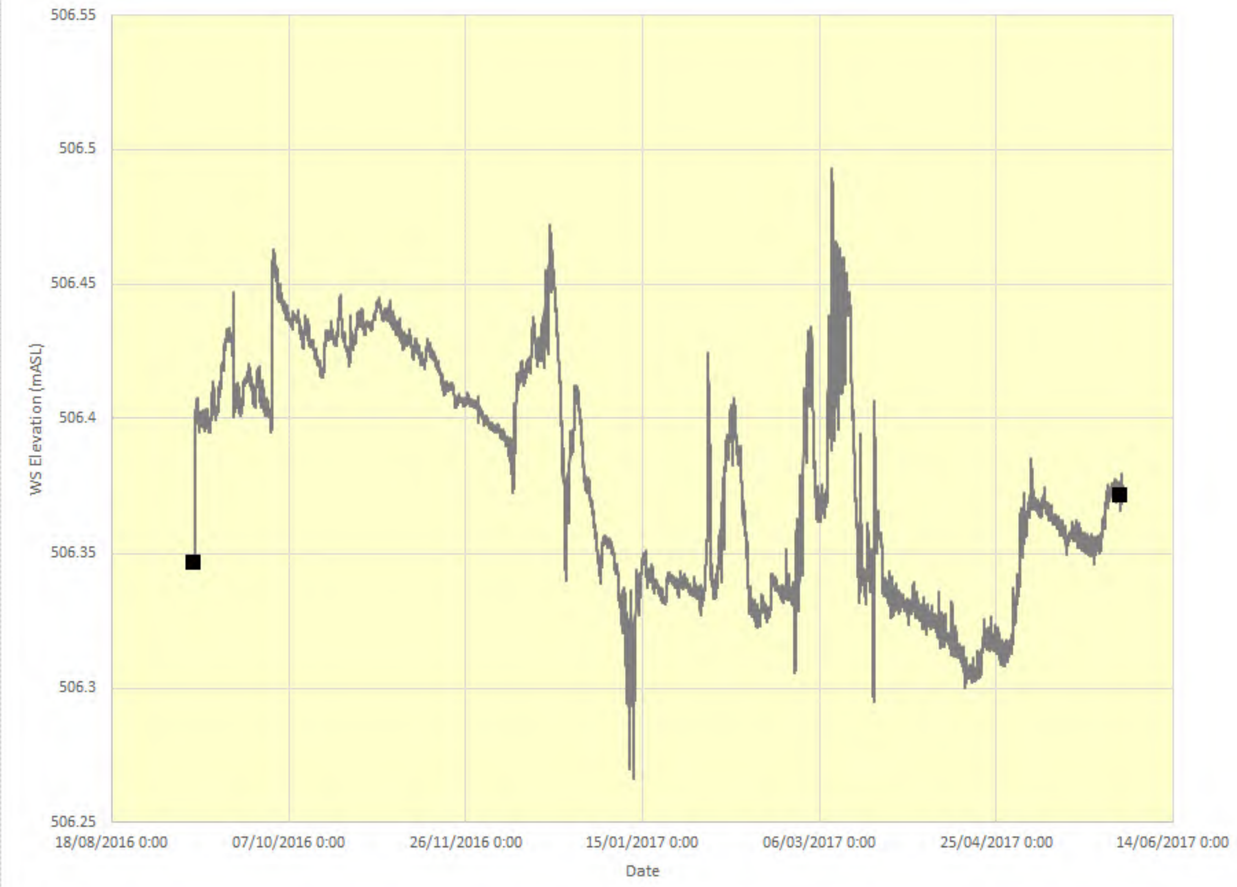
SA11 – MANUAL FLOW MEASUREMENTS

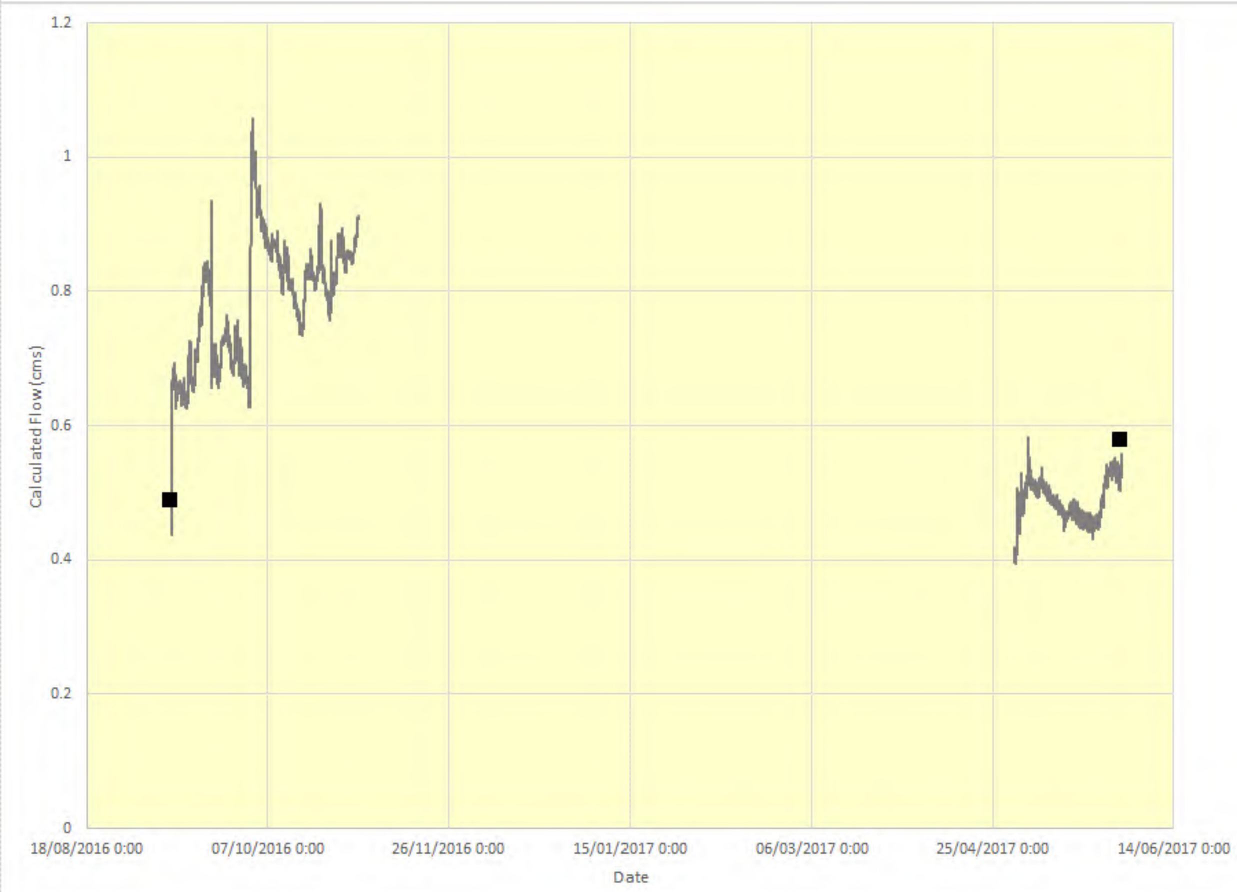
ATTACHMENT C

LEVEL LOGGER DATA

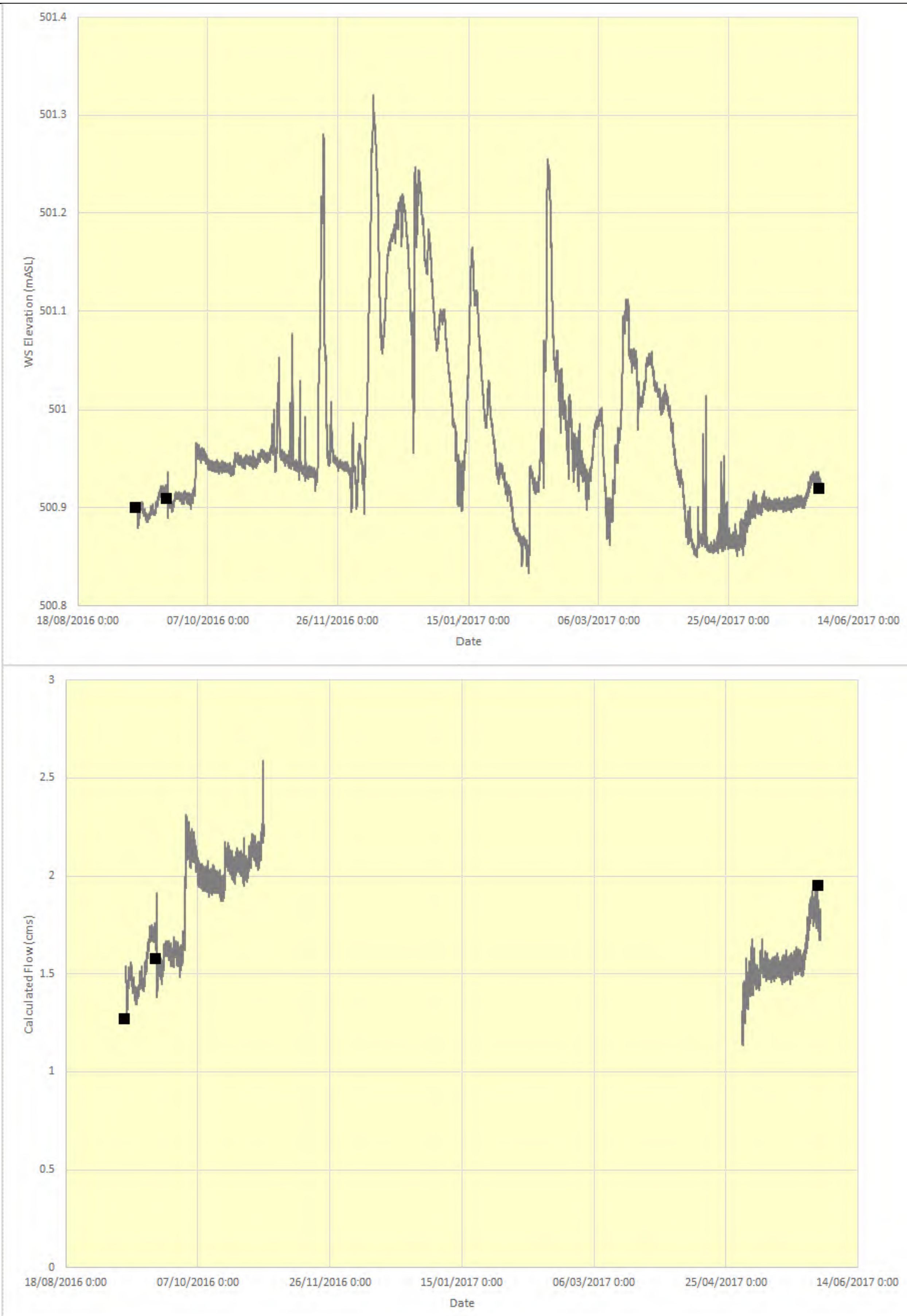


SA1 – Elevation and Discharge (September 2016 to June 2017)



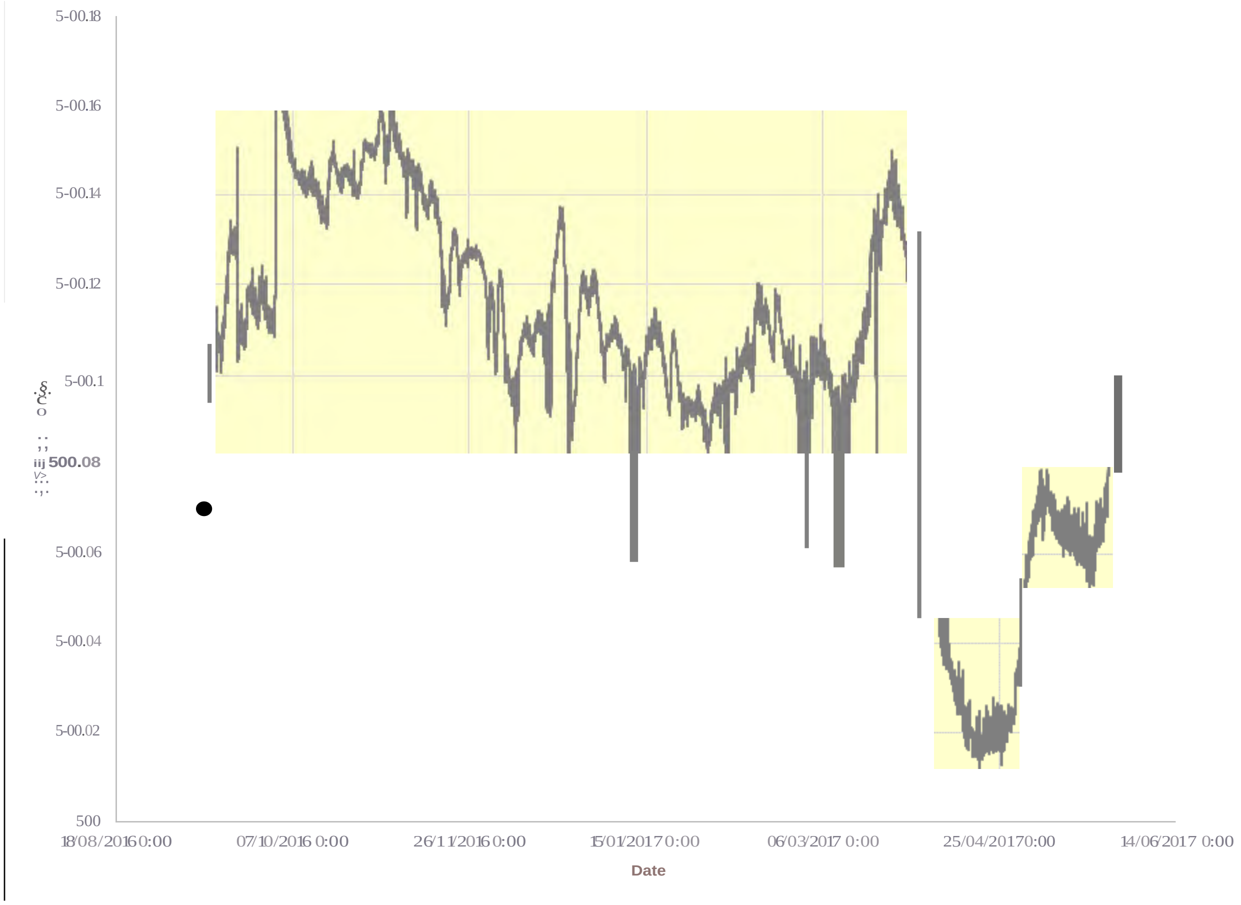


SA4 – Elevation and Discharge (September 2016 to June 2017)

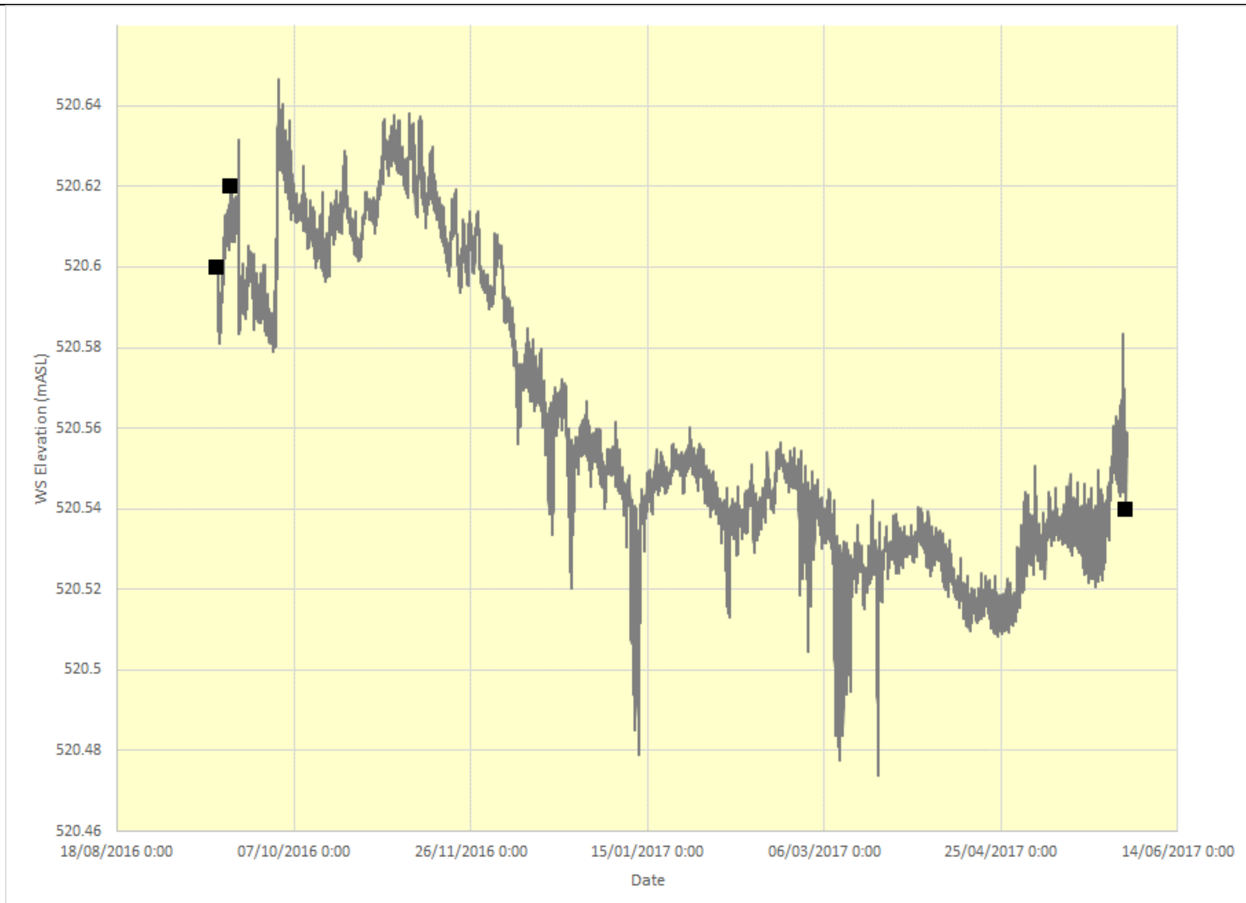


SA5 – Elevation and Discharge (September 2016 to June 2017)

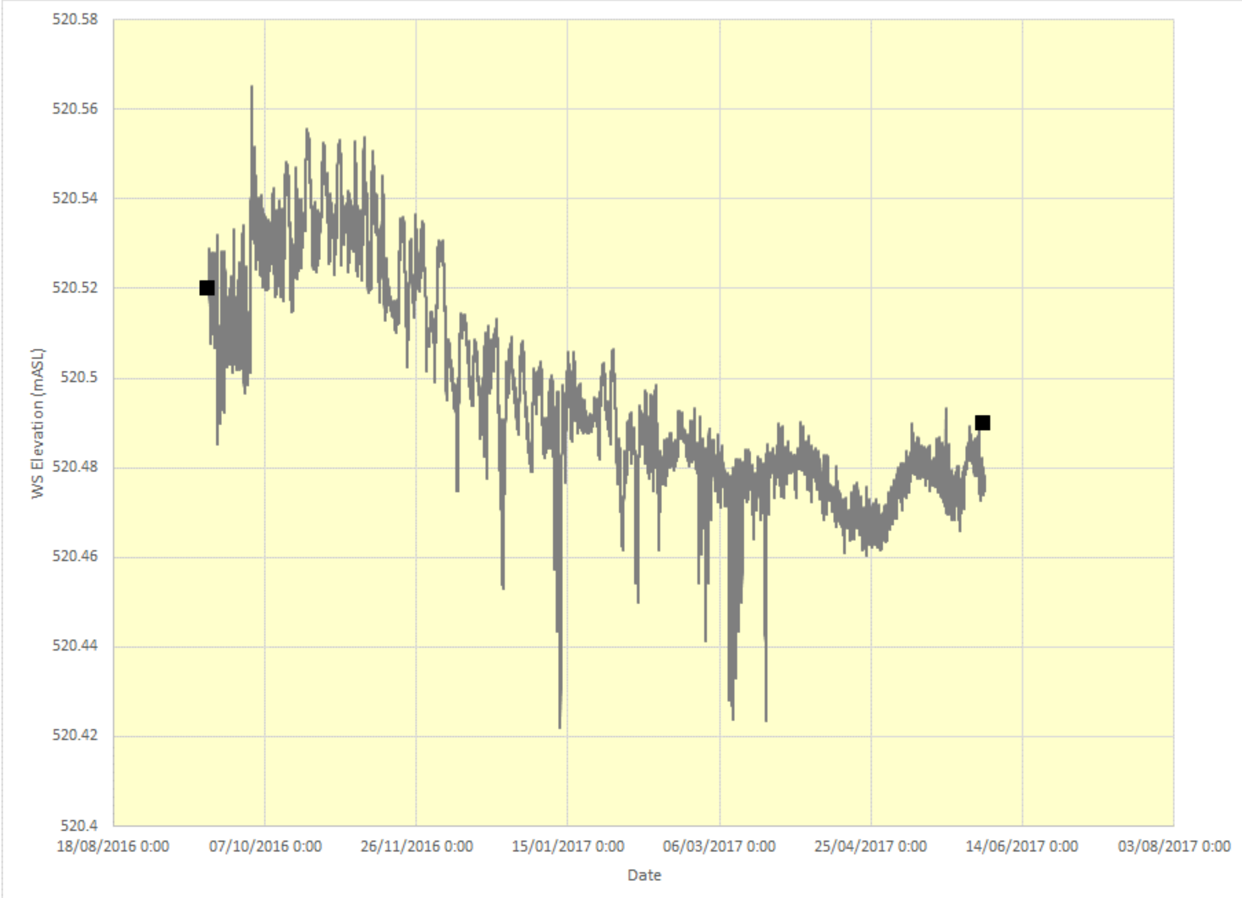
SA6 – Elevation and Discharge (March 2014 to August 2015)



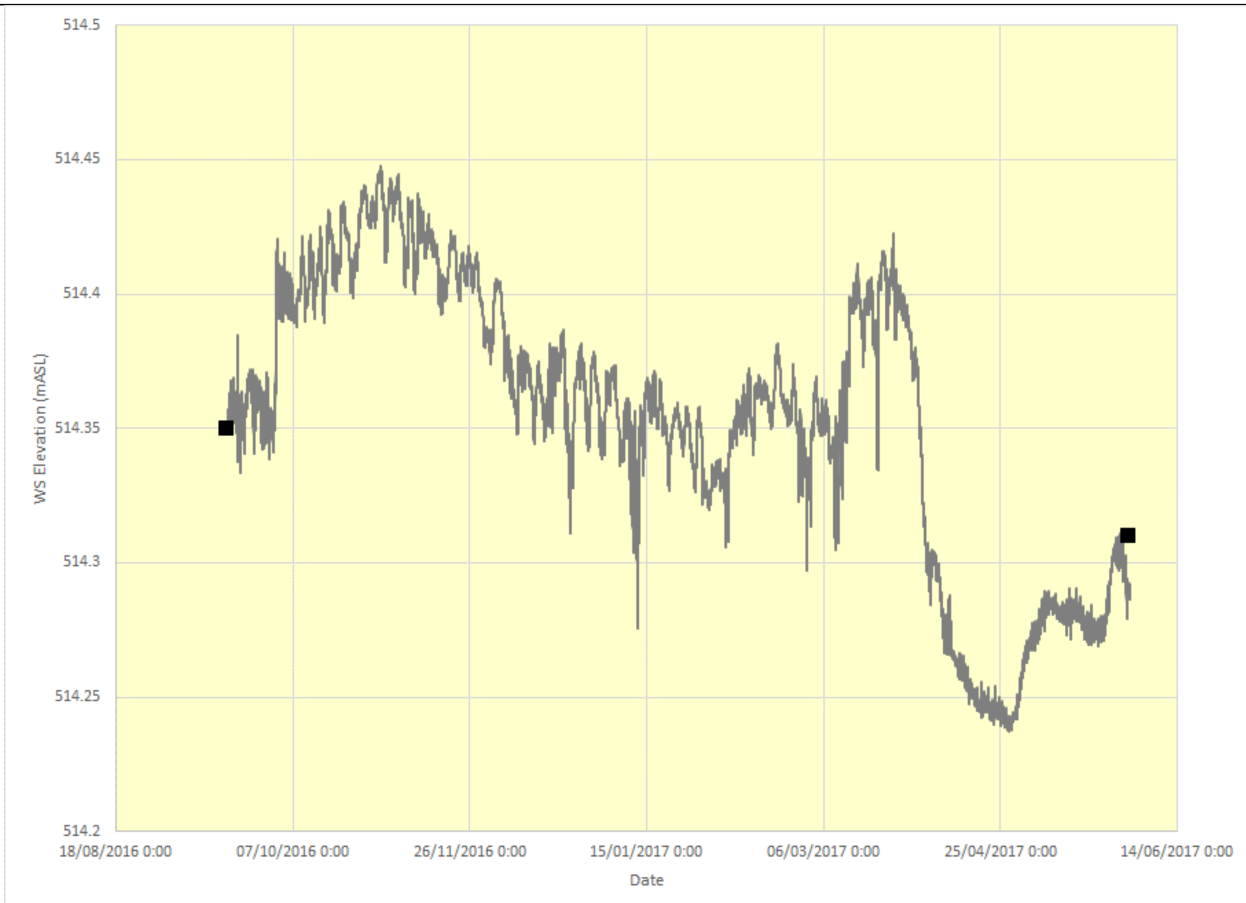
SA6 - Elevation and Discharge (September 2016 to June 2017)



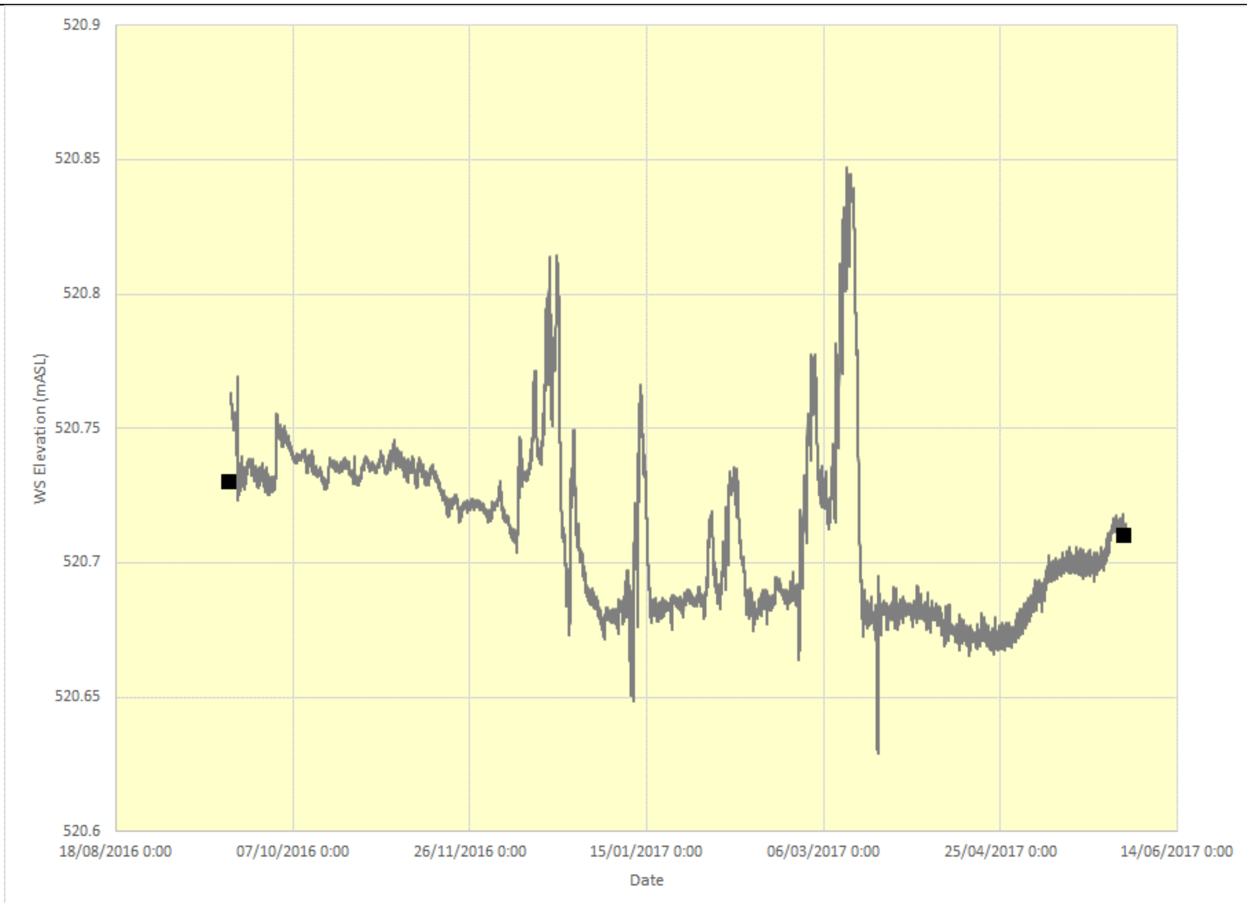
SA8 – Elevation (September 2016 to June 2017)



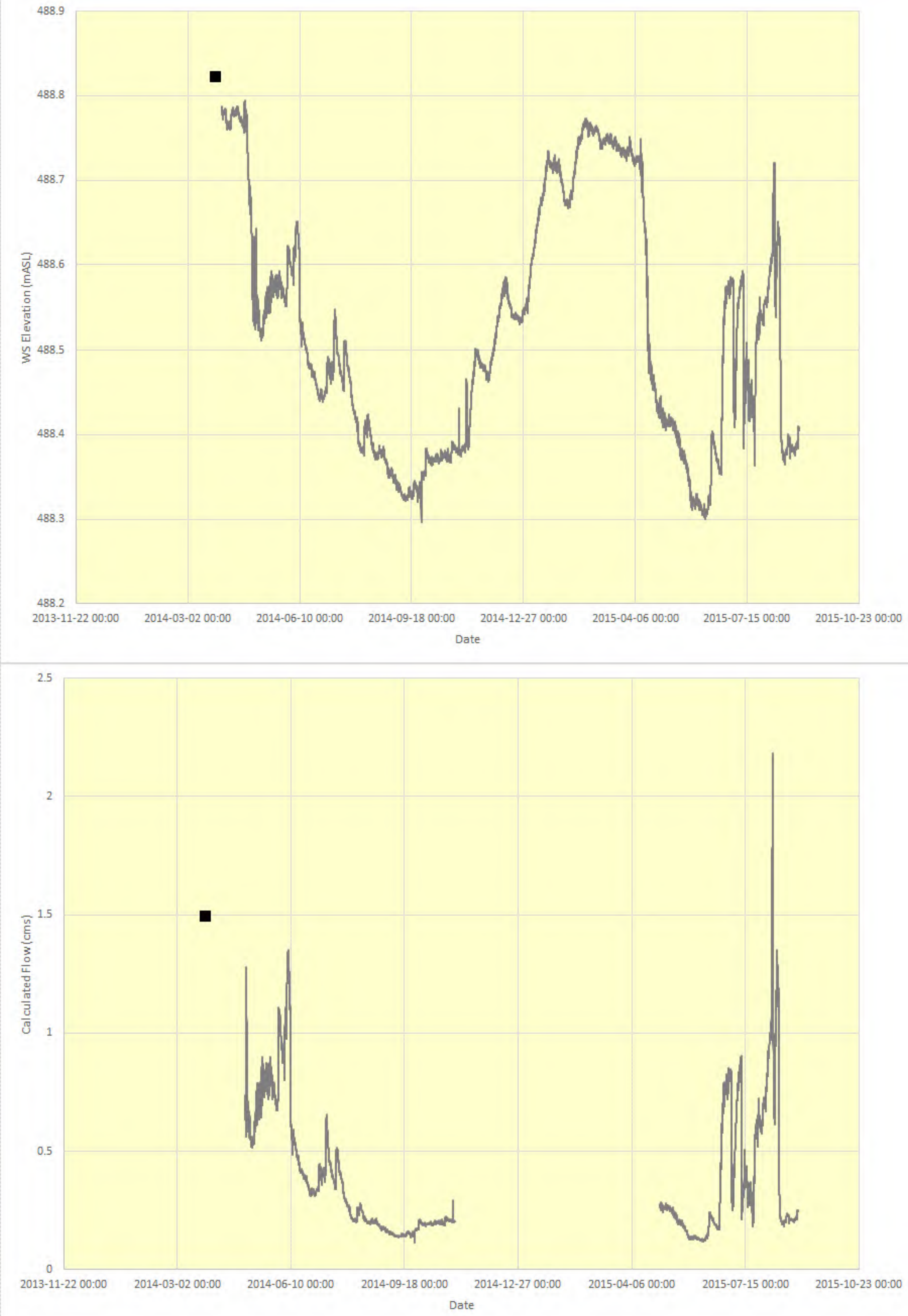
SA9 – Elevation (September 2016 to June 2017)



SA10 – Elevation (September 2016 to June 2017)



SA11 – Elevation (September 2016 to June 2017)



SB1 – Elevation and Discharge (March 2014 to August 2015)

ATTACHMENT D

WEBB SURVEY REPORT

Webb Surveys
REGISTERED LAND SURVEYORS
LAND DEVELOPMENT CONSULTANTS

June 6, 2017 WO# 17-246

Calder Engineering Ltd.
6440 King Street
Caledon, ON
L7C 0S1

Attn: Robert Whyte

Robert,

Please find attached the static reports from NRCAN showing the corrected static positions of the points that I surveyed between May 29 and June 1, 2017.

As a brief summary here is a list of the points and elevations:

LA8	523.991
LA9	515.312
PA2	511.303
PA3	517.851
SB5	518.673

Feel free to contact me if you have any questions.

Thank you,

D.L. (Dan) Codling, SLS, P.Surv

222 Jessop Avenue • Saskatoon SK • S7N 1Y4 • Phone: (306) 955-5330 • Fax: (306) 955-0292 • Email: admin@webbsurveys.ca

CSRS-PPP (V 1.05 11216)

LA8

Data Start	Data End	Duration of Observations
2017-06-01 15:47:00.000	2017-06-01 21:11:30.000	5h 24m 30.00s
Apri / Aposteriori Phase Std		**Apri / Aposteriori Code Std**
0.015m / 0.010m		2.0m / 2.092m
Observations	**Frequency**	**Mode**
Phase and Code	L1 and L2	Static
Elevation Cut-Off	**Rejected Epochs**	**Observation & Estimation Steps**
10.000 degrees	0.00 %	15.00 sec / 15.00 sec
Antenna Model	**APC to ARP**	**ARP to Marker**
TPSGR5 NONE	L1= 0.221 m L2= 0.218 m	1.459 m

(APC = antenna phase center; ARP = antenna reference point)

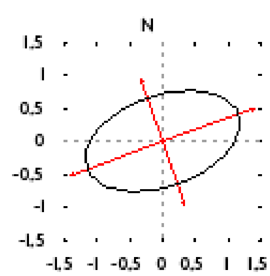
Estimated Position for LA8152p.17O

	Latitude (+n)	Longitude (+e)	Ell. Height
NAD83(CSRS) (1997)	57º 33’ 39.2611’’	-105º 23’ 48.9852’’	492.933 m
Sigmas(95%)	0.006 m	0.009 m	0.021 m
Apriori	57º 33’ 39.262’’	-105º 23’ 49.066’’	494.022 m
Estimated - Apriori	-0.042 m	1.352 m	-1.089 m

Orthometric Height
CGVD28 (HTv2.0)

523.991 m
(click for height reference information)

95% Error Ellipse (cm)
semi-major: 1.219cm
semi-minor: 0.688cm
semi-major azimuth: 71º 1’ 7.79’’



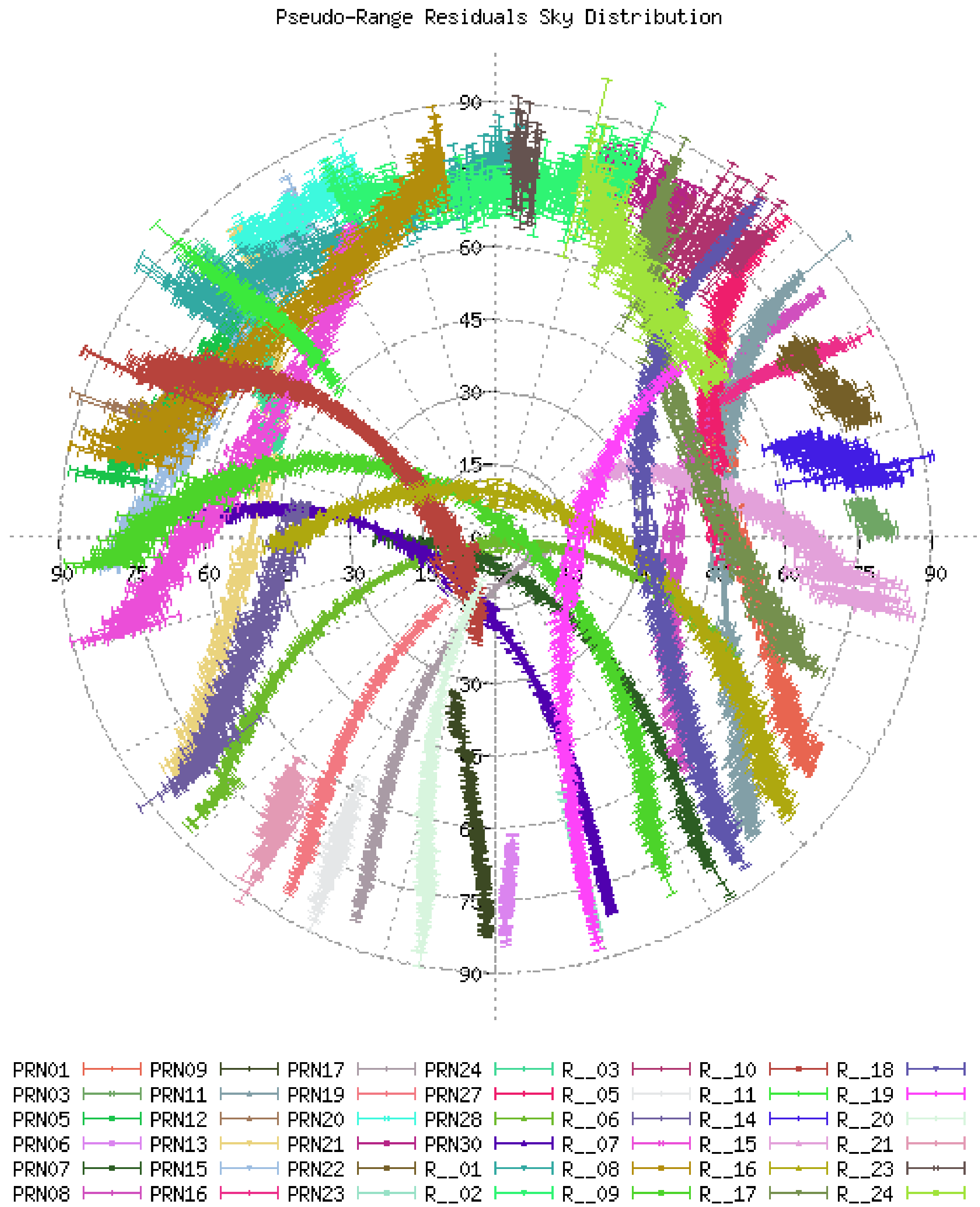
UTM (North) Zone 13

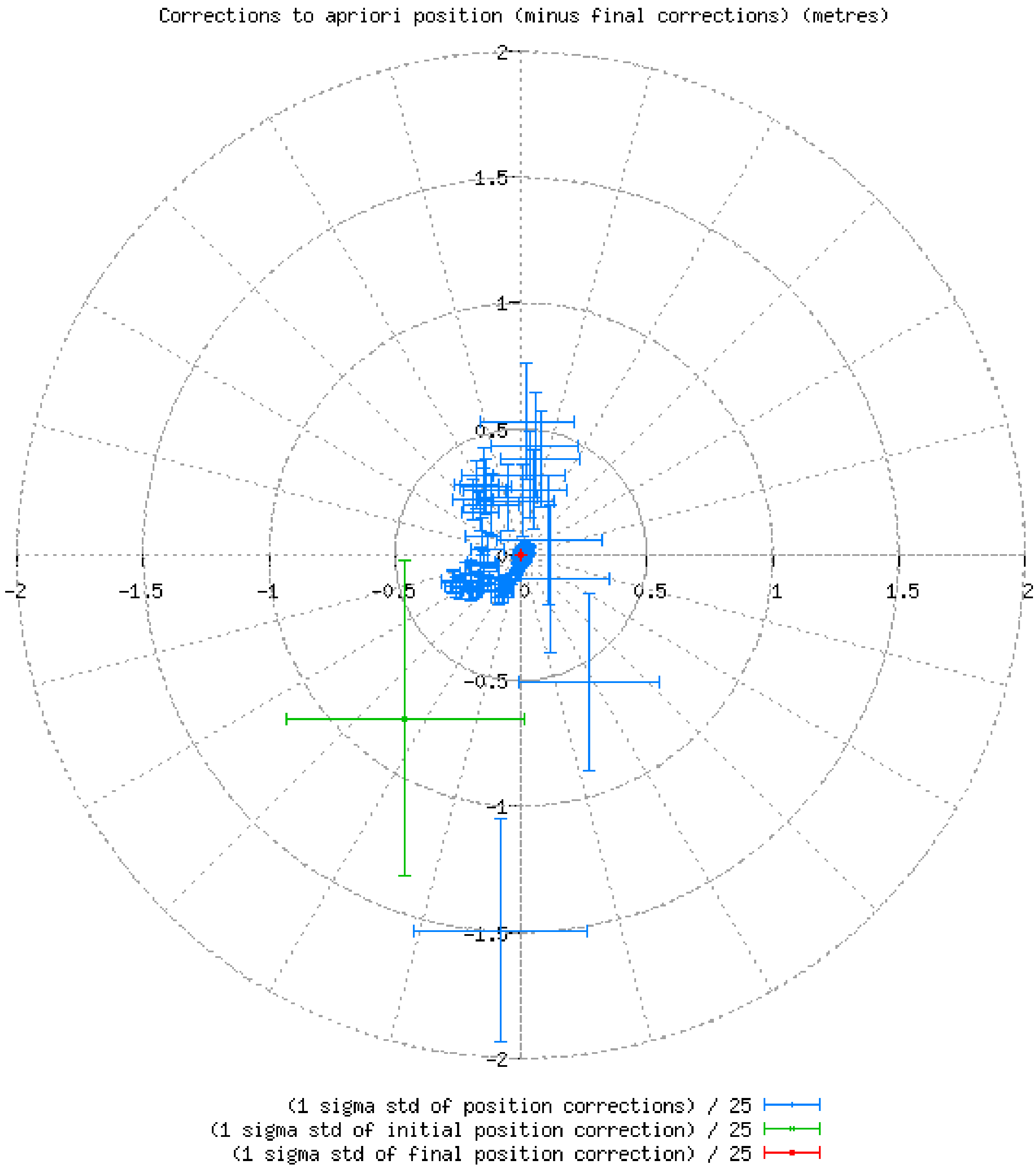
6379895.581m (N) 476250.738m (E)

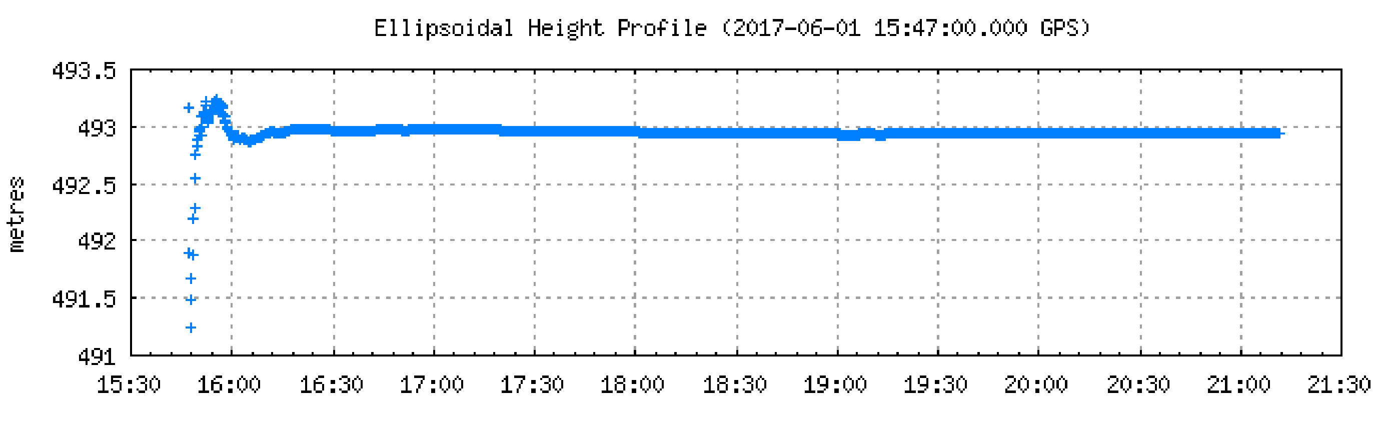
Scale Factors
0.99960692 (point)
0.99952959 (combined)

(Coordinates from RINEX file used as apriori position)

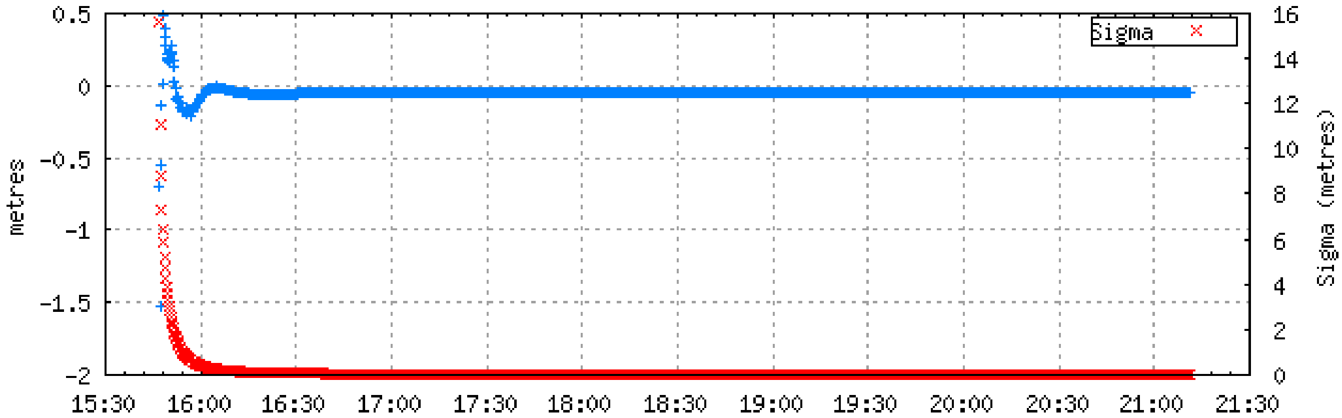
Estimated Parameters & Observations Statistics



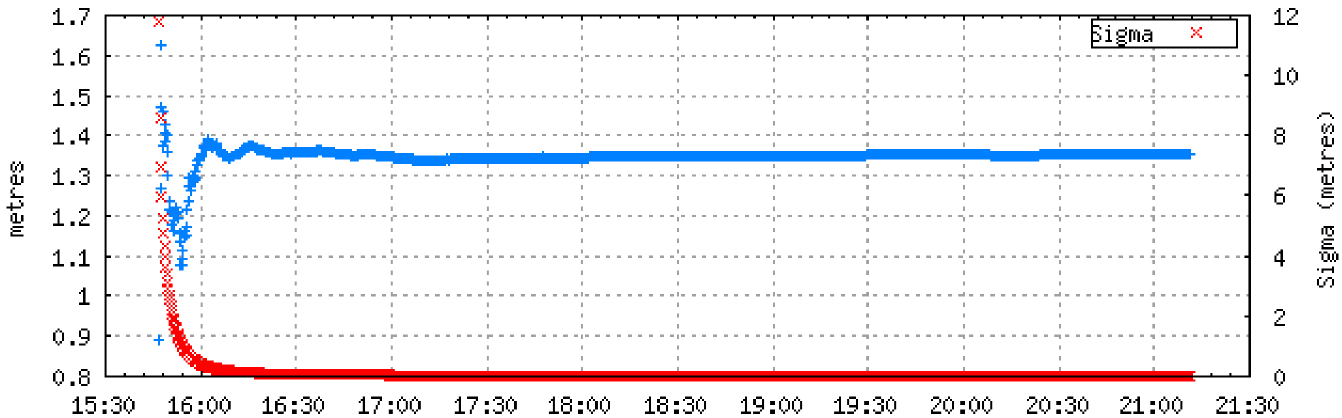

Corrections to apriori position (minus final corrections) (metres)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
(1 sigma std of position corrections) / 25
(1 sigma std of initial position correction) / 25
(1 sigma std of final position correction) / 25


Ellipsoidal Height Profile (2017-06-01 15:47:00.000 GPS)
metres
493.5
493
492.5
492
491.5
491
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30
21:00
21:30

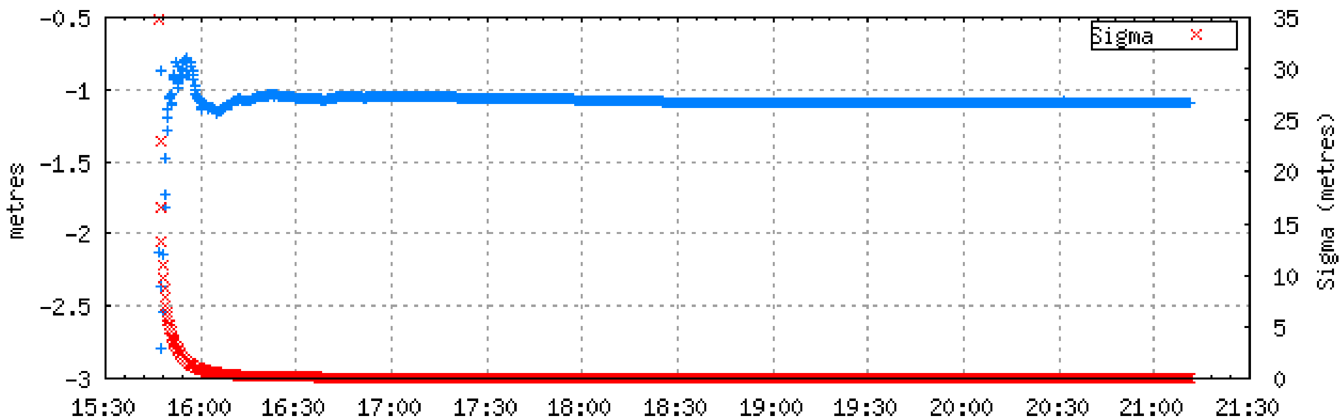
Latitude Differences (2017-06-01 15:47:00.000 GPS)

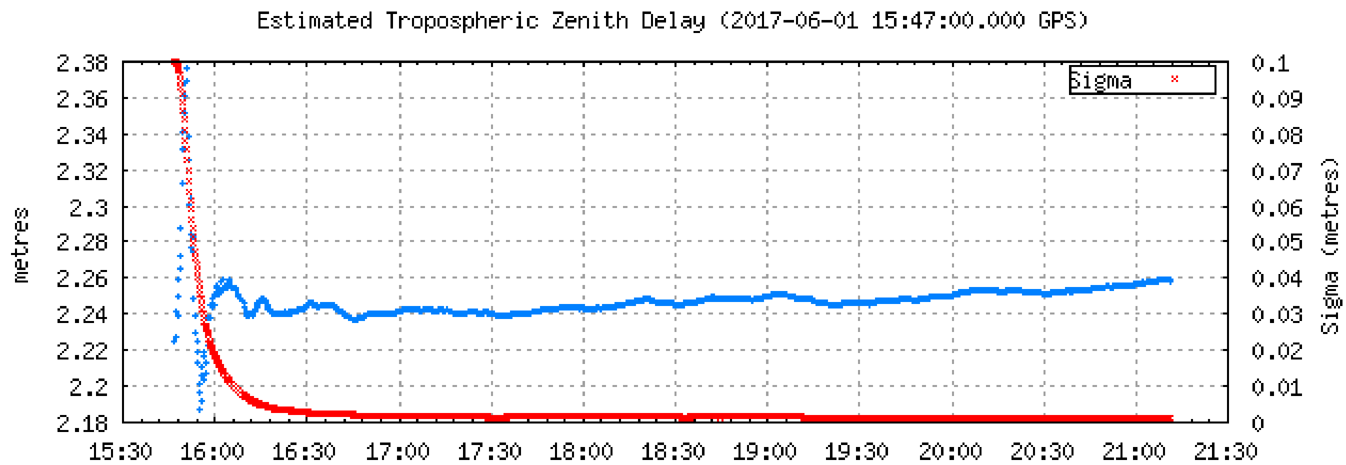


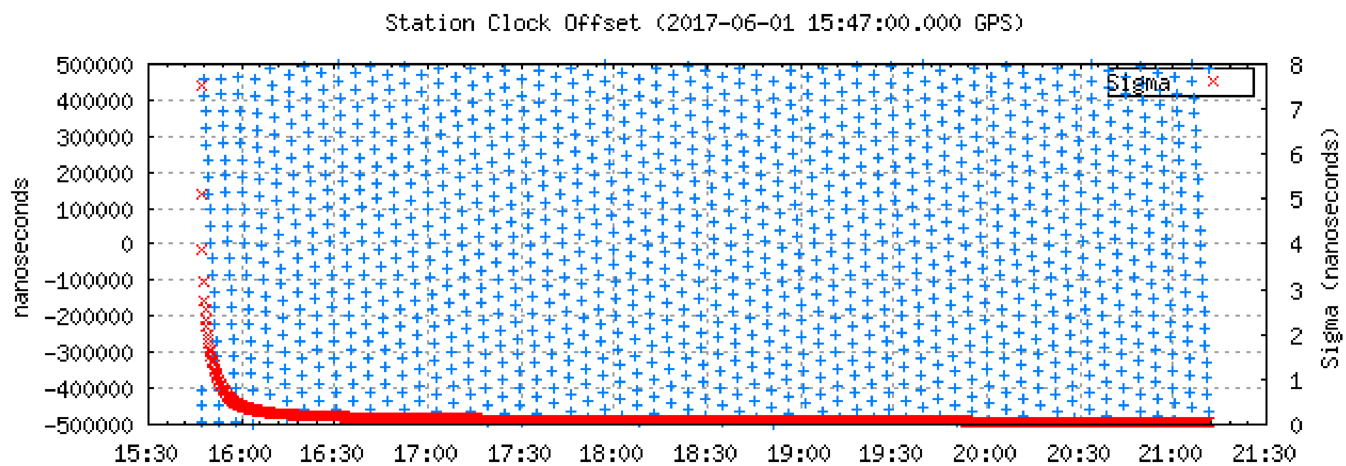
Longitude Differences (2017-06-01 15:47:00.000 GPS)

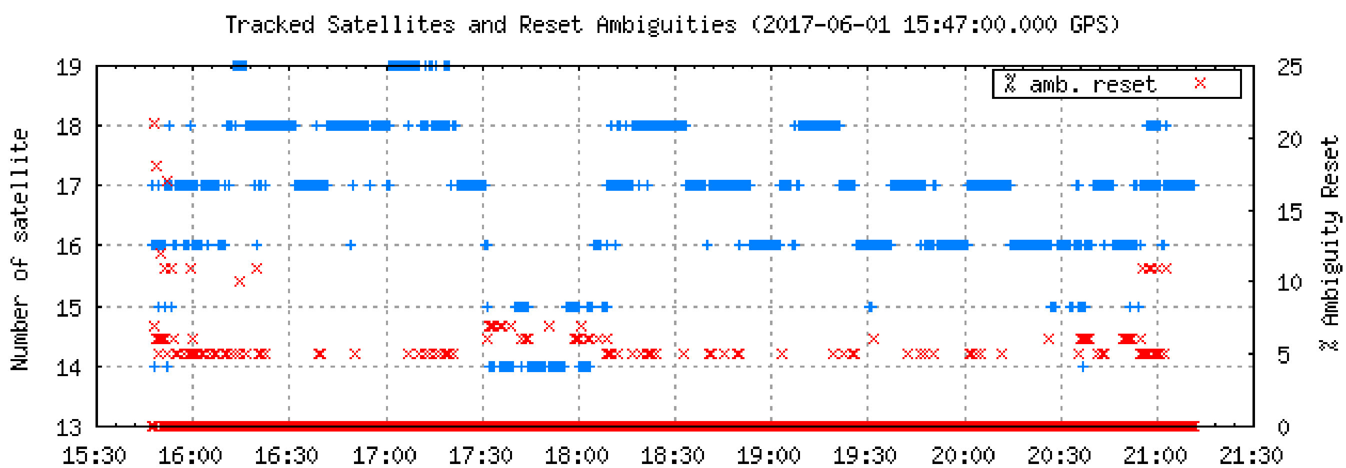


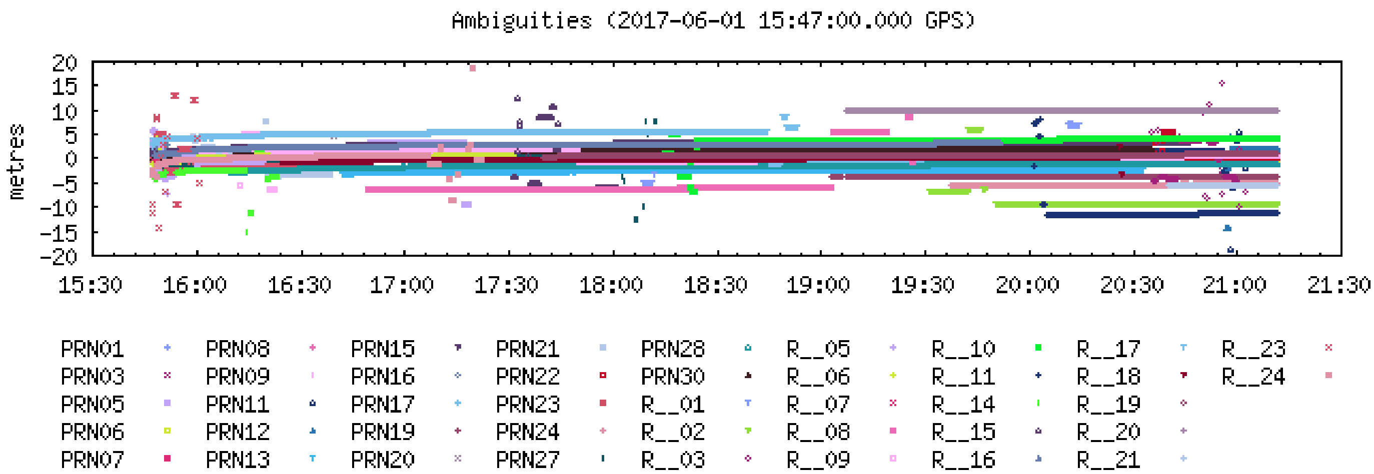
Height Differences (2017-06-01 15:47:00.000 GPS)

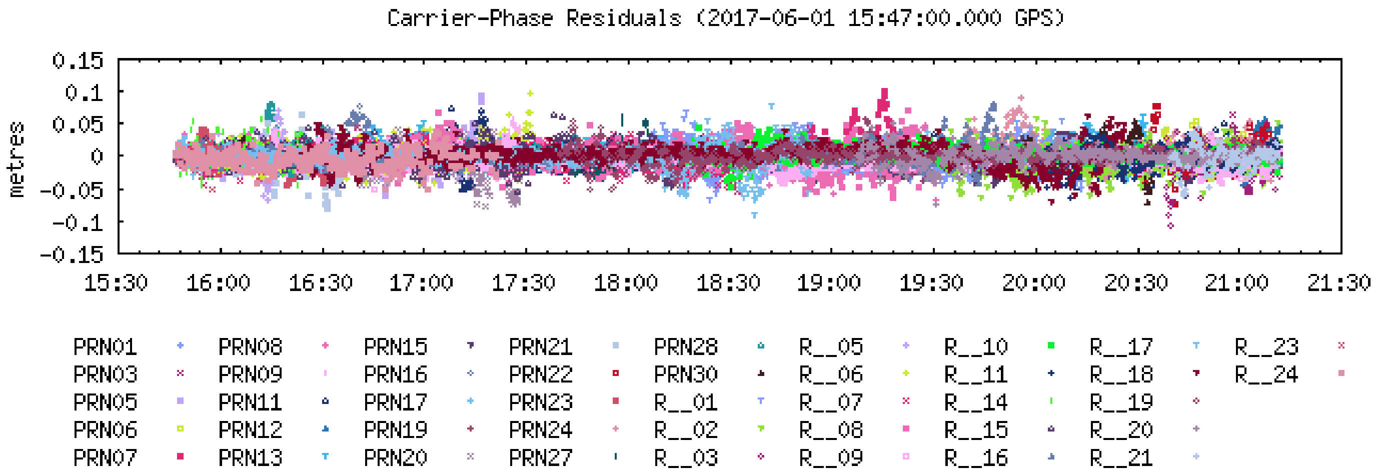


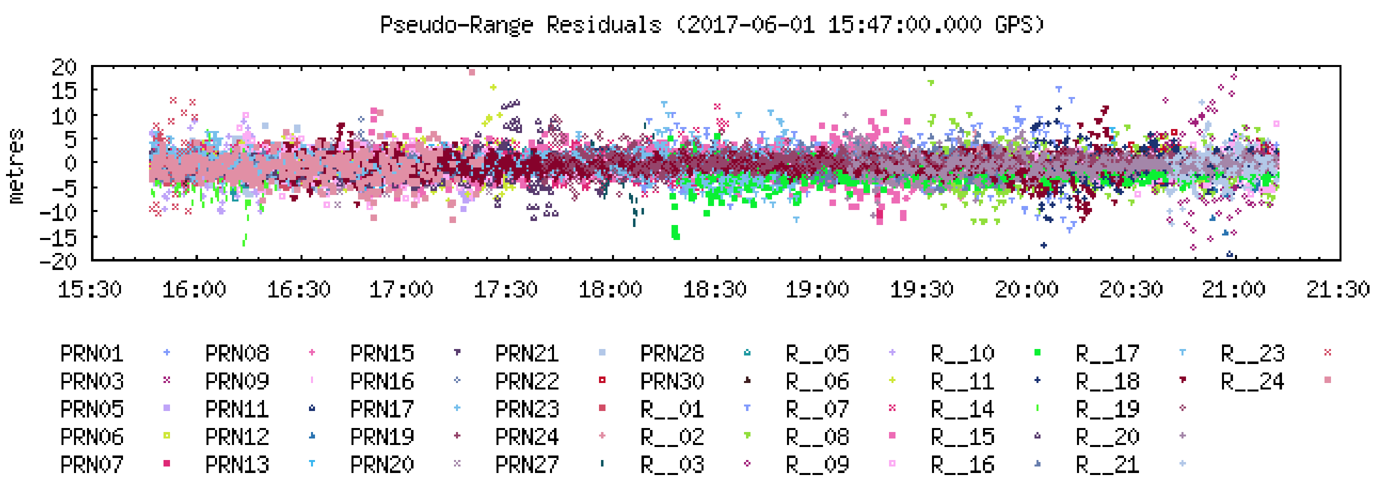

Estimated Tropospheric Zenith Delay (2017-06-01 15:47:00.000 GPS)
metres
Sigma (metres)
Sigma
2.38
2.36
2.34
2.32
2.3
2.28
2.26
2.24
2.22
2.2
2.18
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30
21:00
21:30


Station Clock Offset (2017-06-01 15:47:00.000 GPS)
nanoseconds
Sigma (nanoseconds)
Sigma
500000
400000
300000
200000
100000
0
-100000
-200000
-300000
-400000
-500000
8
7
6
5
4
3
2
1
0
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30
21:00
21:30


Tracked Satellites and Reset Ambiguities (2017-06-01 15:47:00.000 GPS)
Number of satellite
% Ambiguity Reset
% amb. reset
19
18
17
16
15
14
13
25
20
15
10
5
0
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30
21:00
21:30


Ambiguities (2017-06-01 15:47:00.000 GPS)
metres
20 15 10 5 0 -5 -10 -15 -20
15:30 16:00 16:30 17:00 17:30 18:00 18:30 19:00 19:30 20:00 20:30 21:00 21:30
PRN01 PRN03 PRN05 PRN06 PRN07
PRN08 PRN09 PRN11 PRN12 PRN13
PRN15 PRN16 PRN17 PRN19 PRN20
PRN21 PRN22 PRN23 PRN24 PRN27
PRN28 PRN30 R__01 R__02 R__03
R__05 R__06 R__07 R__08 R__09
R__10 R__11 R__14 R__15 R__16
R__17 R__18 R__19 R__20 R__21
R__23 R__24


Carrier-Phase Residuals (2017-06-01 15:47:00.000 GPS)
metres
0.15 0.1 0.05 0 -0.05 -0.1 -0.15
15:30 16:00 16:30 17:00 17:30 18:00 18:30 19:00 19:30 20:00 20:30 21:00 21:30
PRN01 PRN03 PRN05 PRN06 PRN07
PRN08 PRN09 PRN11 PRN12 PRN13
PRN15 PRN16 PRN17 PRN19 PRN20
PRN21 PRN22 PRN23 PRN24 PRN27
PRN28 PRN30 R__01 R__02 R__03
R__05 R__06 R__07 R__08 R__09
R__10 R__11 R__14 R__15 R__16
R__17 R__18 R__19 R__20 R__21
R__23 R__24


Pseudo-Range Residuals (2017-06-01 15:47:00.000 GPS)
metres
20 15 10 5 0 -5 -10 -15 -20
15:30 16:00 16:30 17:00 17:30 18:00 18:30 19:00 19:30 20:00 20:30 21:00 21:30
PRN01 PRN03 PRN05 PRN06 PRN07
PRN08 PRN09 PRN11 PRN12 PRN13
PRN15 PRN16 PRN17 PRN19 PRN20
PRN21 PRN22 PRN23 PRN24 PRN27
PRN28 PRN30 R__01 R__02 R__03
R__05 R__06 R__07 R__08 R__09
R__10 R__11 R__14 R__15 R__16
R__17 R__18 R__19 R__20 R__21
R__23 R__24

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Phone:343-292-6617

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CSRS-PPP (V 1.05 11216)

LA9

Data Start	Data End	Duration of Observations
2017-05-31 15:37:30.000	2017-05-31 20:08:15.000	4h 30m 45.00s
Apri / Aposteriori Phase Std		**Apri / Aposteriori Code Std**
0.015m / 0.010m		2.0m / 1.435m
Observations	**Frequency**	**Mode**
Phase and Code	L1 and L2	Static
Elevation Cut-Off	**Rejected Epochs**	**Observation & Estimation Steps**
10.000 degrees	0.00 %	15.00 sec / 15.00 sec
Antenna Model	**APC to ARP**	**ARP to Marker**
TPSGR5 NONE	L1= 0.221 m L2= 0.218 m	1.440 m

(APC = antenna phase center; ARP = antenna reference point)

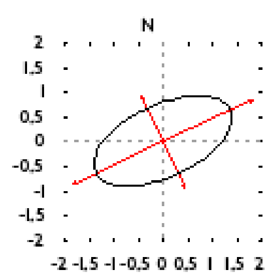
Estimated Position for LA9151p.17O

	Latitude (+n)	Longitude (+e)	Ell. Height
NAD83(CSRS) (1997)	57º 33’ 18.1971’’	-105º 20’ 19.7196’’	484.198 m
Sigmas(95%)	0.007 m	0.011 m	0.022 m
Apriori	57º 33’ 18.204’’	-105º 20’ 19.803’’	484.162 m
Estimated - Apriori	-0.207 m	1.393 m	0.036 m

Orthometric Height
CGVD28 (HTv2.0)

515.312 m
(click for height reference information)

95% Error Ellipse (cm)
semi-major: 1.502cm
semi-minor: 0.730cm
semi-major azimuth: 65º 23’ 47.07’’



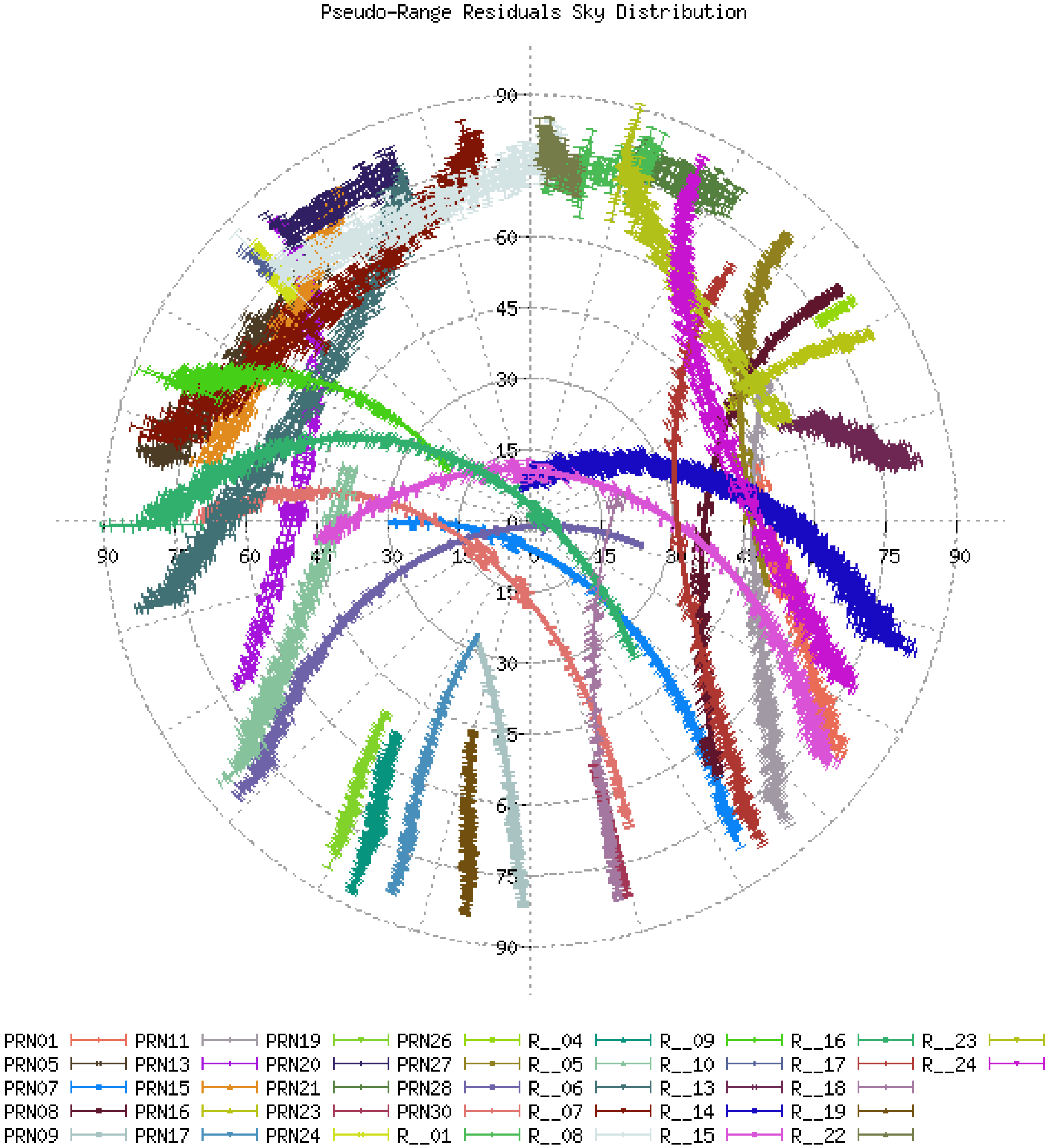
UTM (North) Zone 13

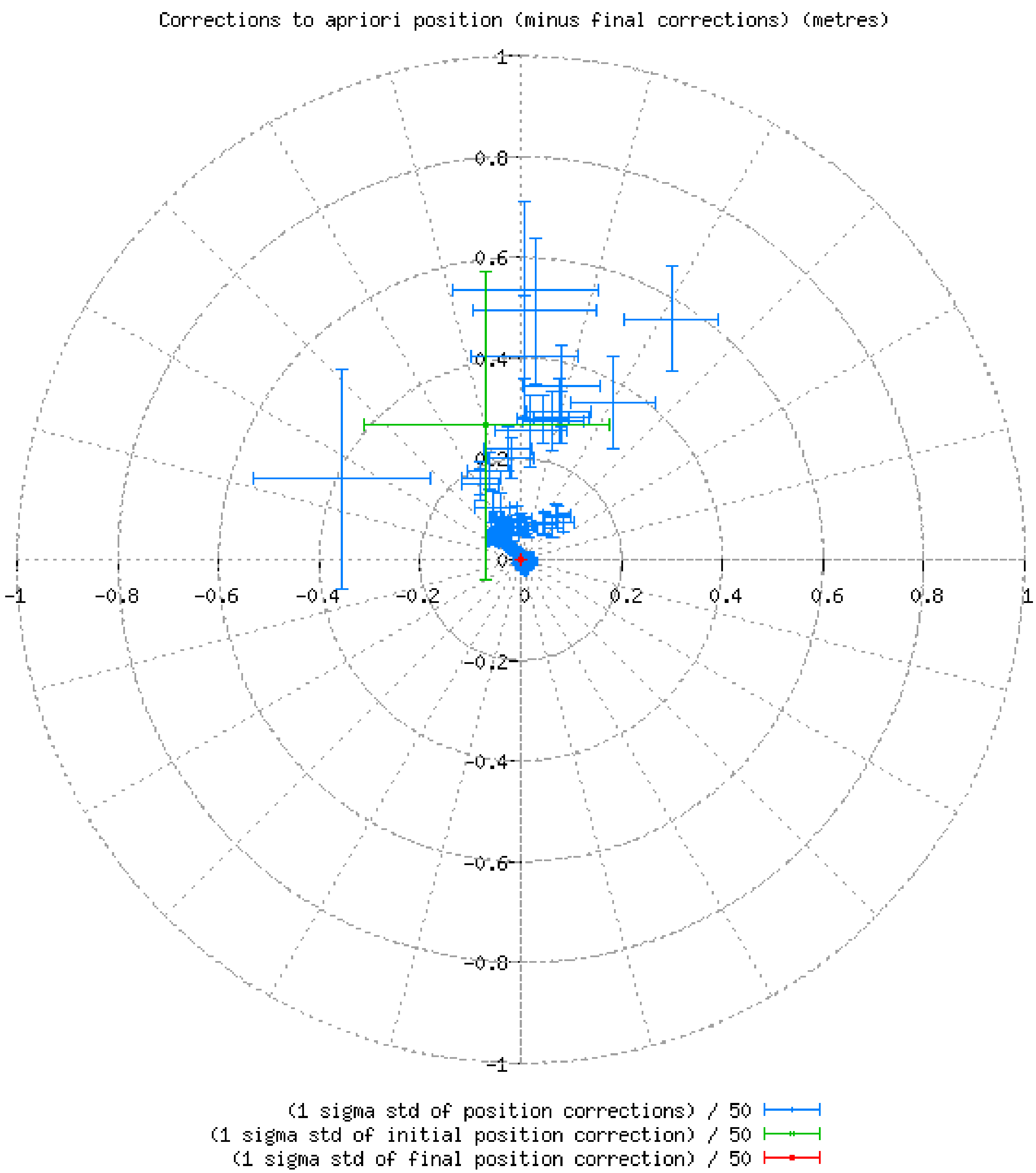
6379225.363m (N) 479725.394m (E)

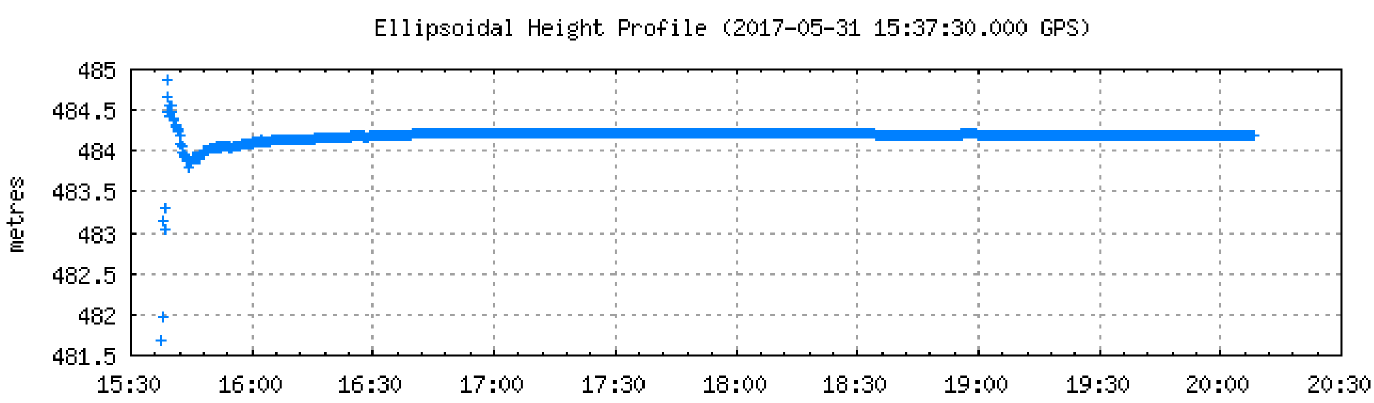
Scale Factors
0.99960504 (point)
0.99952908 (combined)

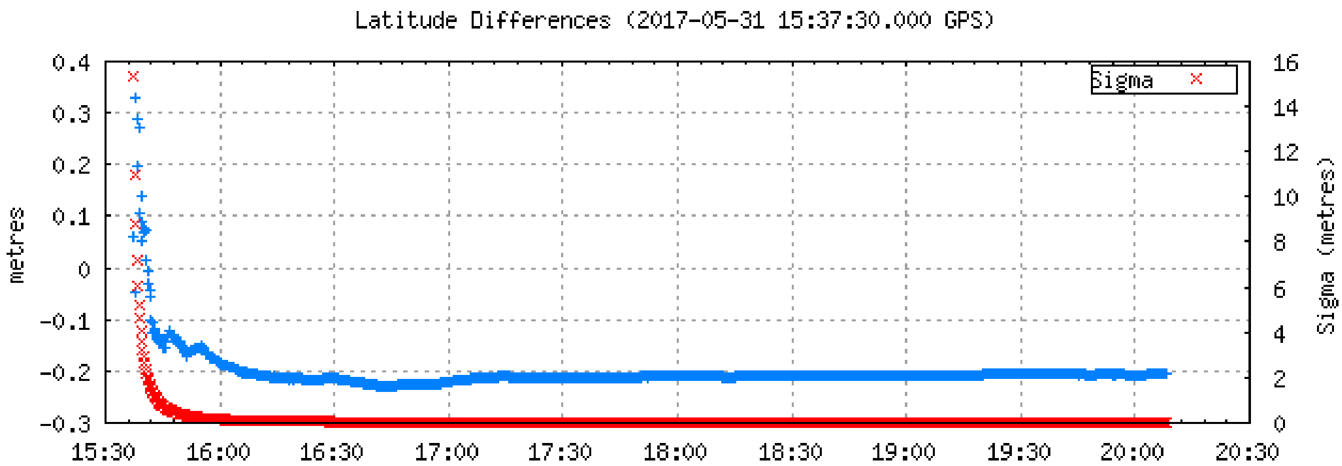
(Coordinates from RINEX file used as apriori position)

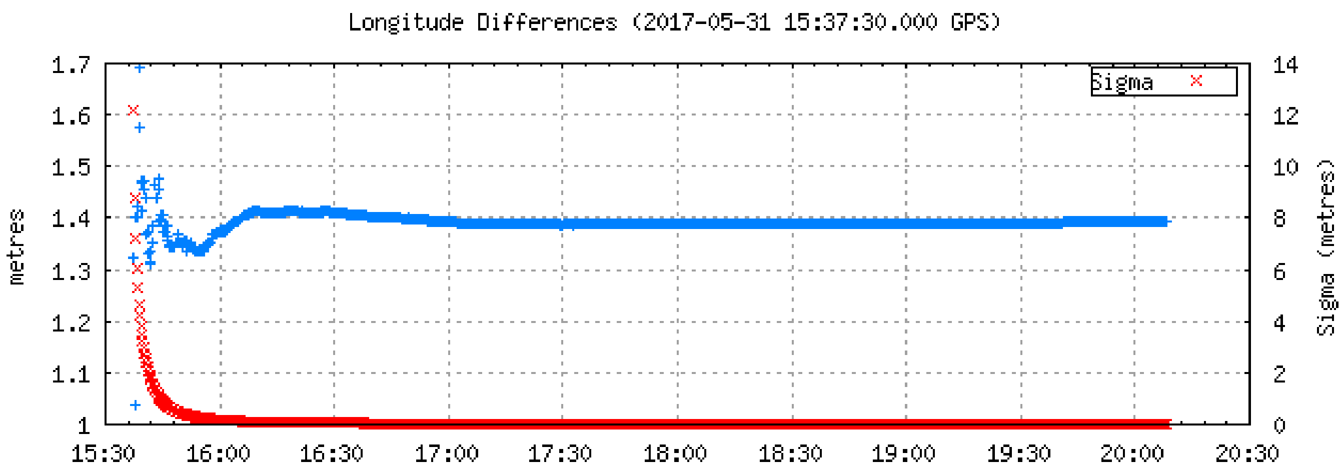
Estimated Parameters & Observations Statistics

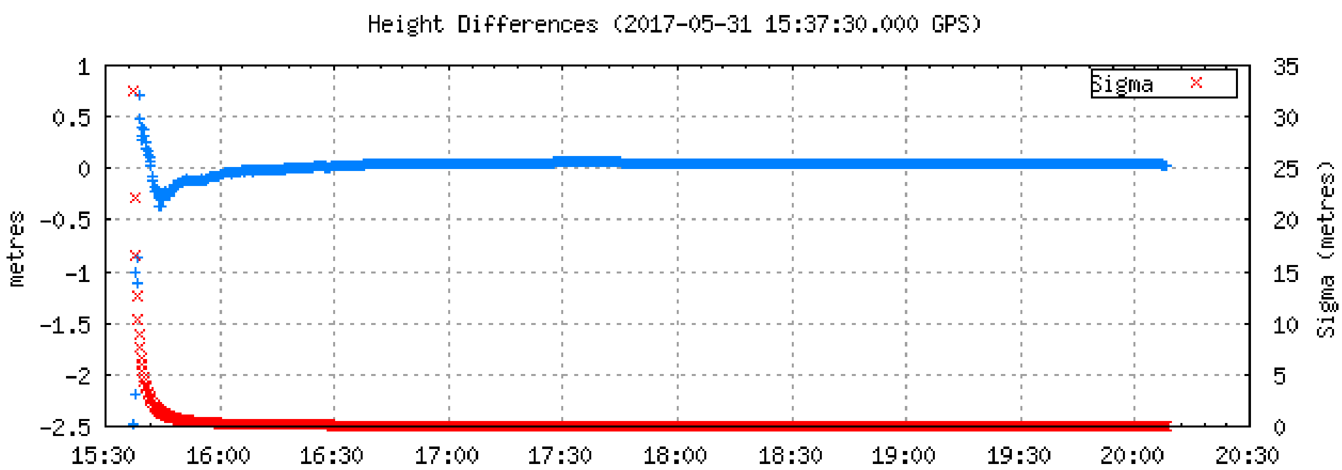



Corrections to apriori position (minus final corrections) (metres)
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
(1 sigma std of position corrections) / 50
(1 sigma std of initial position correction) / 50
(1 sigma std of final position correction) / 50

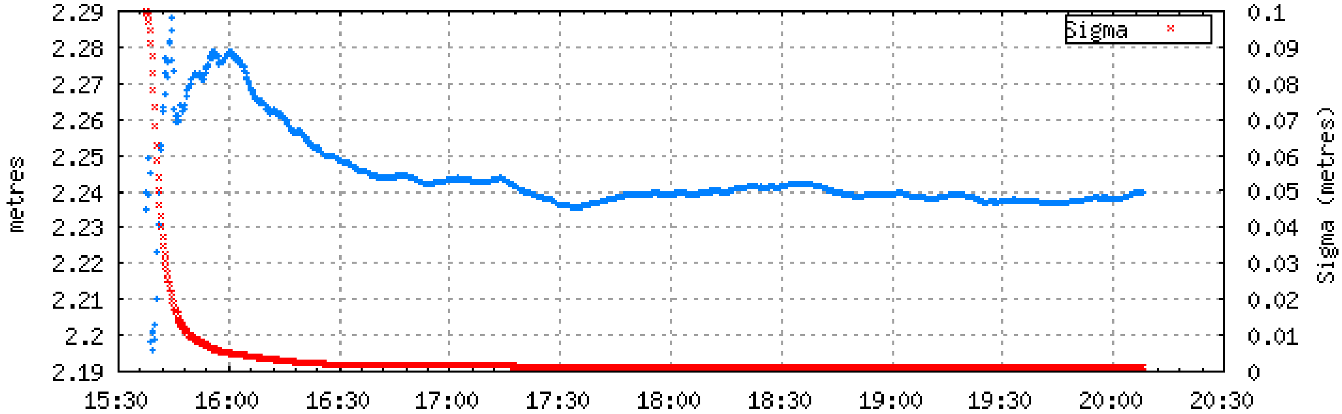

Ellipsoidal Height Profile (2017-05-31 15:37:30.000 GPS)
metres
485
484.5
484
483.5
483
482.5
482
481.5
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30


Latitude Differences (2017-05-31 15:37:30.000 GPS)
metres
Sigma (metres)
Sigma
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
16
14
12
10
8
6
4
2
0
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30

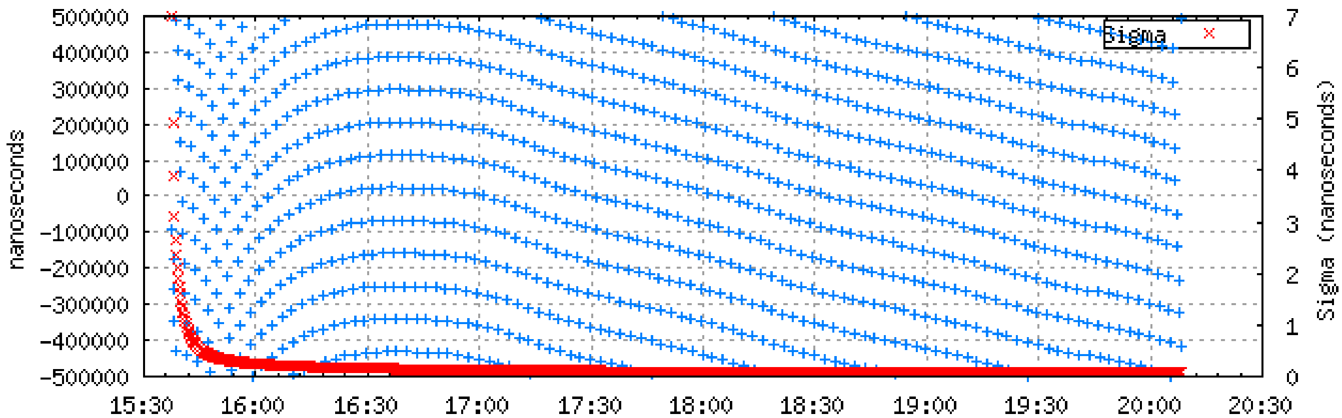

Longitude Differences (2017-05-31 15:37:30.000 GPS)
metres
Sigma (metres)
Sigma
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
14
12
10
8
6
4
2
0
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30


Height Differences (2017-05-31 15:37:30.000 GPS)
metres
Sigma (metres)
Sigma
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
35
30
25
20
15
10
5
0
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30

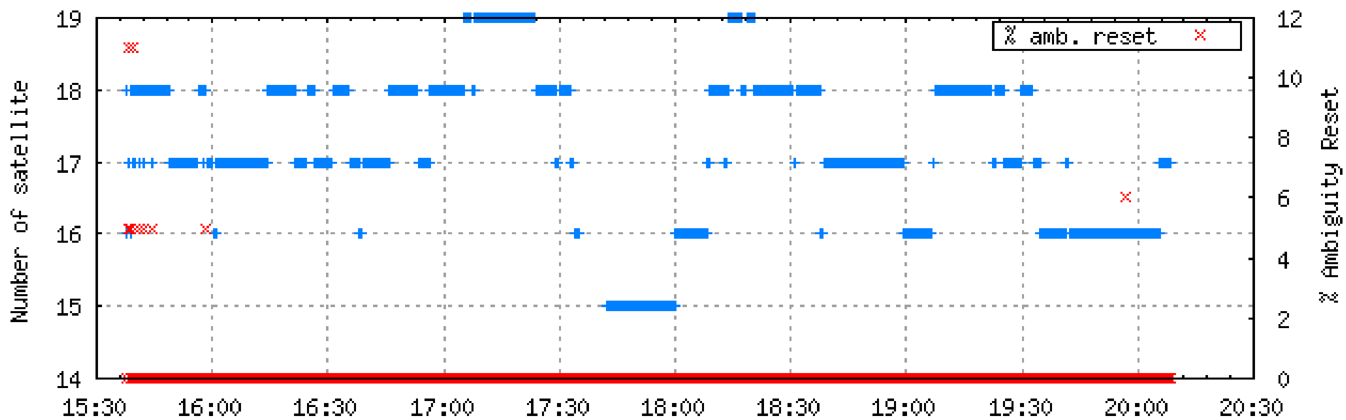
Estimated Tropospheric Zenith Delay (2017-05-31 15:37:30.000 GPS)

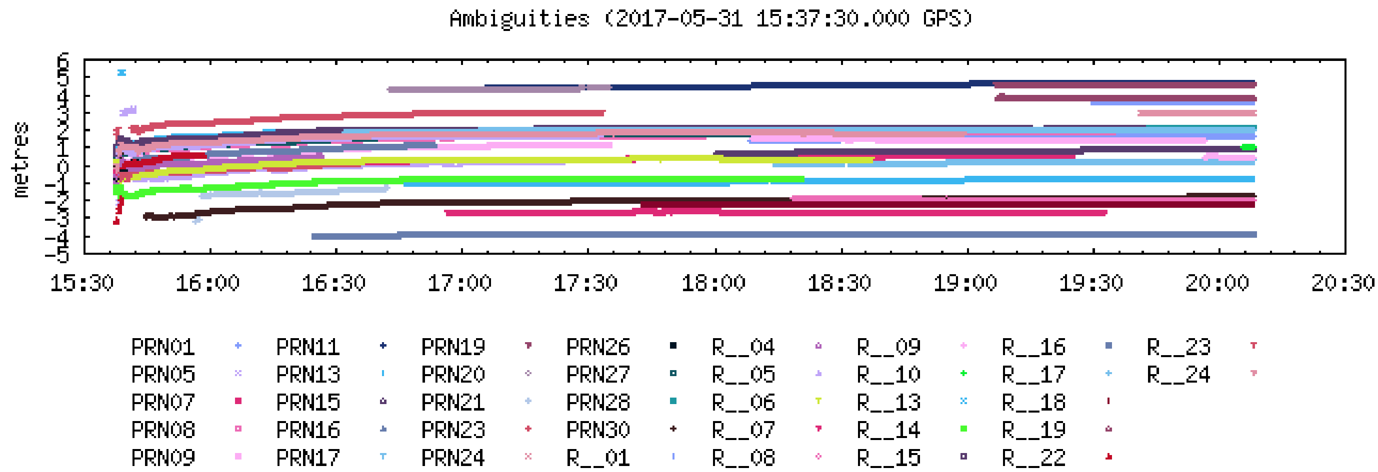


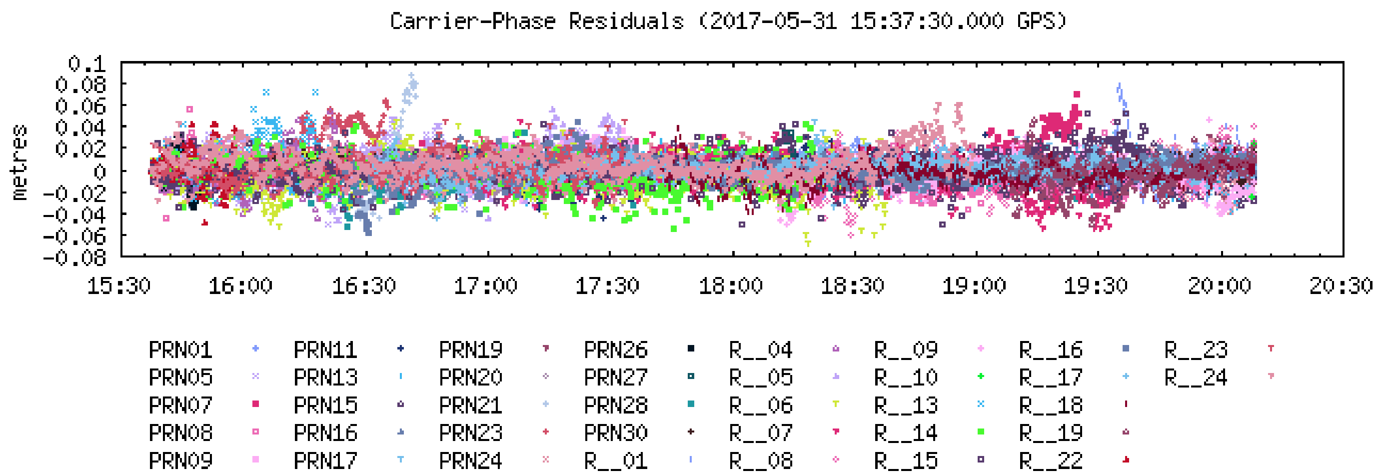
Station Clock Offset (2017-05-31 15:37:30.000 GPS)

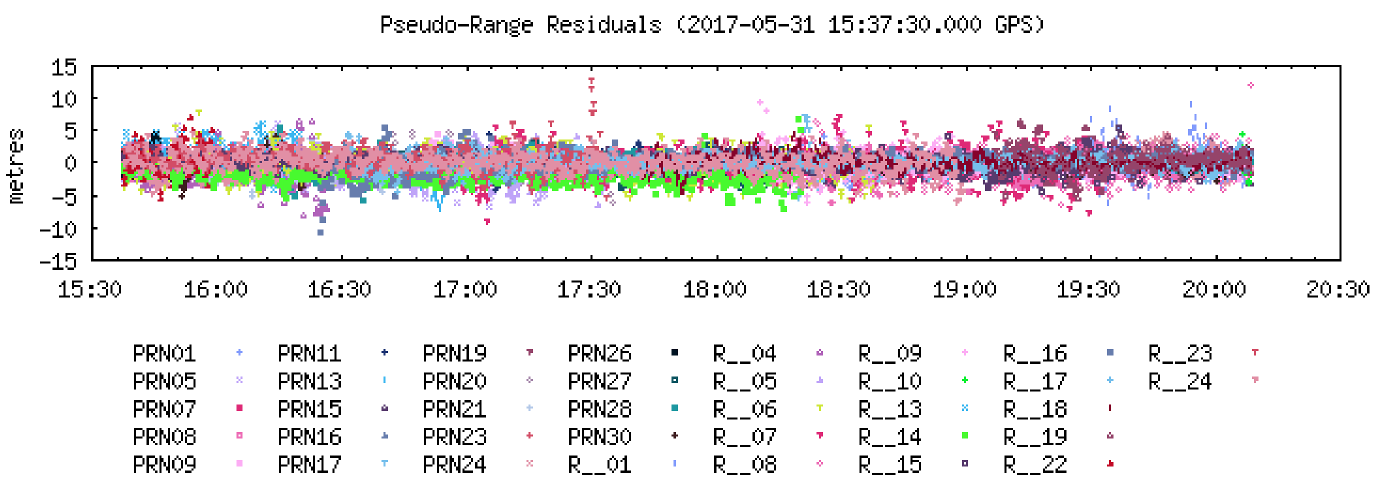


Tracked Satellites and Reset Ambiguities (2017-05-31 15:37:30.000 GPS)




Ambiguities (2017-05-31 15:37:30.000 GPS)
metres
15:30 16:00 16:30 17:00 17:30 18:00 18:30 19:00 19:30 20:00 20:30
PRN01 PRN05 PRN07 PRN08 PRN09 PRN11 PRN13 PRN15 PRN16 PRN17 PRN19 PRN20 PRN21 PRN23 PRN24 PRN26 PRN27 PRN28 PRN30 R__01 R__04 R__05 R__06 R__07 R__08 R__09 R__10 R__13 R__14 R__15 R__16 R__17 R__18 R__19 R__22 R__23 R__24


Carrier-Phase Residuals (2017-05-31 15:37:30.000 GPS)
metres
0.1 0.08 0.06 0.04 0.02 0 -0.02 -0.04 -0.06 -0.08
15:30 16:00 16:30 17:00 17:30 18:00 18:30 19:00 19:30 20:00 20:30
PRN01 PRN05 PRN07 PRN08 PRN09 PRN11 PRN13 PRN15 PRN16 PRN17 PRN19 PRN20 PRN21 PRN23 PRN24 PRN26 PRN27 PRN28 PRN30 R__01 R__04 R__05 R__06 R__07 R__08 R__09 R__10 R__13 R__14 R__15 R__16 R__17 R__18 R__19 R__22 R__23 R__24


Pseudo-Range Residuals (2017-05-31 15:37:30.000 GPS)
metres
15 10 5 0 -5 -10 -15
15:30 16:00 16:30 17:00 17:30 18:00 18:30 19:00 19:30 20:00 20:30
PRN01 PRN05 PRN07 PRN08 PRN09 PRN11 PRN13 PRN15 PRN16 PRN17 PRN19 PRN20 PRN21 PRN23 PRN24 PRN26 PRN27 PRN28 PRN30 R__01 R__04 R__05 R__06 R__07 R__08 R__09 R__10 R__13 R__14 R__15 R__16 R__17 R__18 R__19 R__22 R__23 R__24

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CSRS-PPP (V 1.05 11216)

PA2

Data Start	Data End	Duration of Observations
2017-05-30 15:19:45.000	2017-05-30 23:52:00.000	8h 32m 15.00s
Apri / Aposteriori Phase Std		**Apri / Aposteriori Code Std**
0.015m / 0.014m		2.0m / 2.594m
Observations	**Frequency**	**Mode**
Phase and Code	L1 and L2	Static
Elevation Cut-Off	**Rejected Epochs**	**Observation & Estimation Steps**
10.000 degrees	0.00 %	15.00 sec / 15.00 sec
Antenna Model	**APC to ARP**	**ARP to Marker**
TPSGR5 NONE	L1= 0.221 m L2= 0.218 m	1.303 m

(APC = antenna phase center; ARP = antenna reference point)

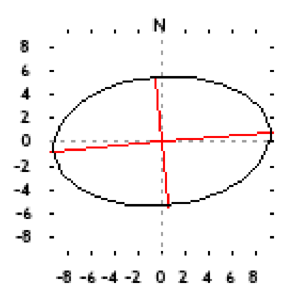
Estimated Position for PA2150p.17O

	Latitude (+n)	Longitude (+e)	Ell. Height
NAD83(CSRS) (1997)	57º 32' 12.2526''	-105º 22' 56.6452''	480.270 m
Sigmas(95%)	0.004 m	0.007 m	0.017 m
Apriori	57º 32' 12.253''	-105º 22' 56.731''	480.126 m
Estimated - Apriori	-0.019 m	1.422 m	0.144 m

Orthometric Height
CGVD28 (HTv2.0)

511.303 m
(click for height reference information)

95% Error Ellipse (mm)
semi-major: 9.266mm
semi-minor: 5.453mm
semi-major azimuth: 84º 48' 31.47''



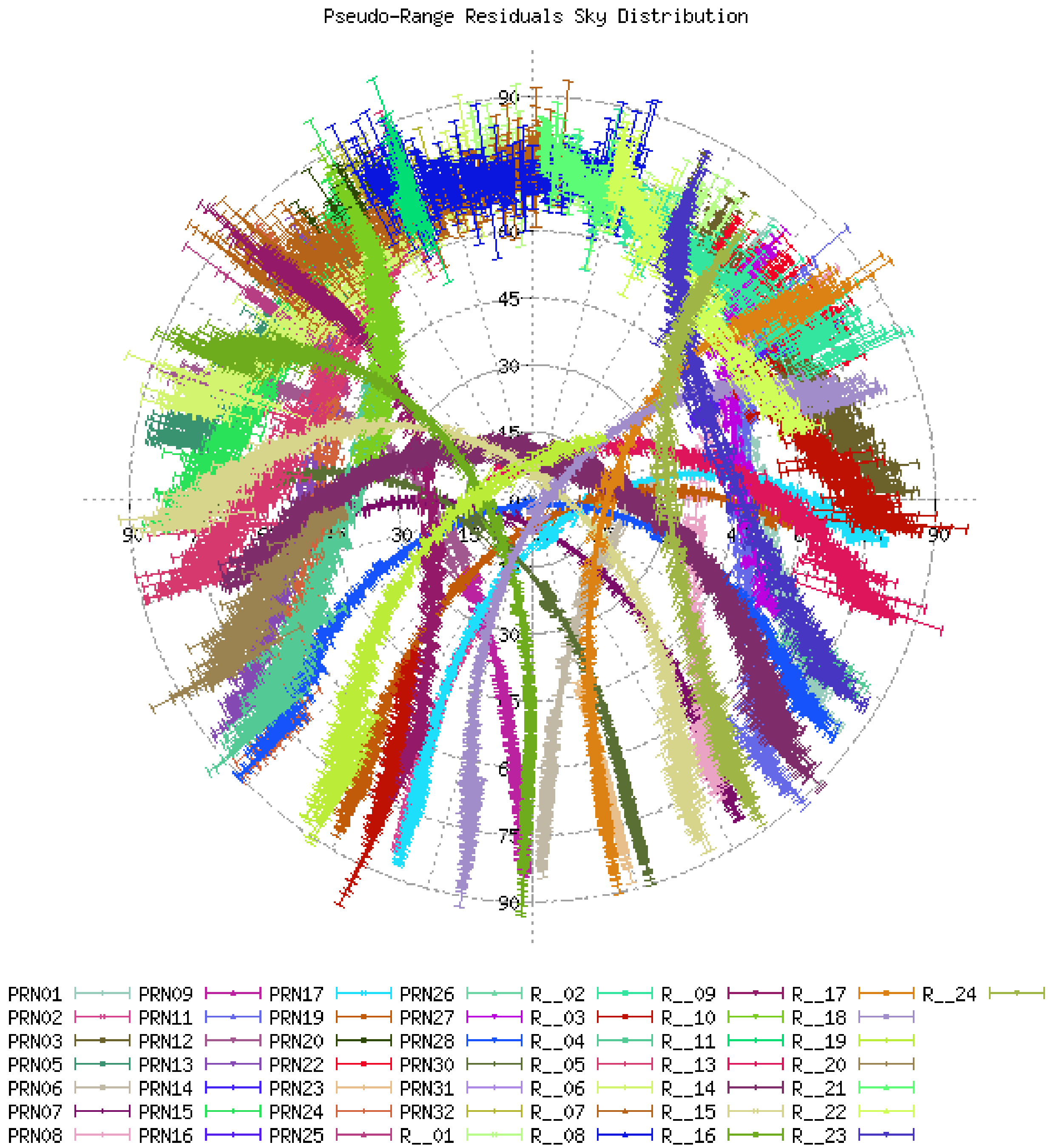
UTM (North) Zone 13

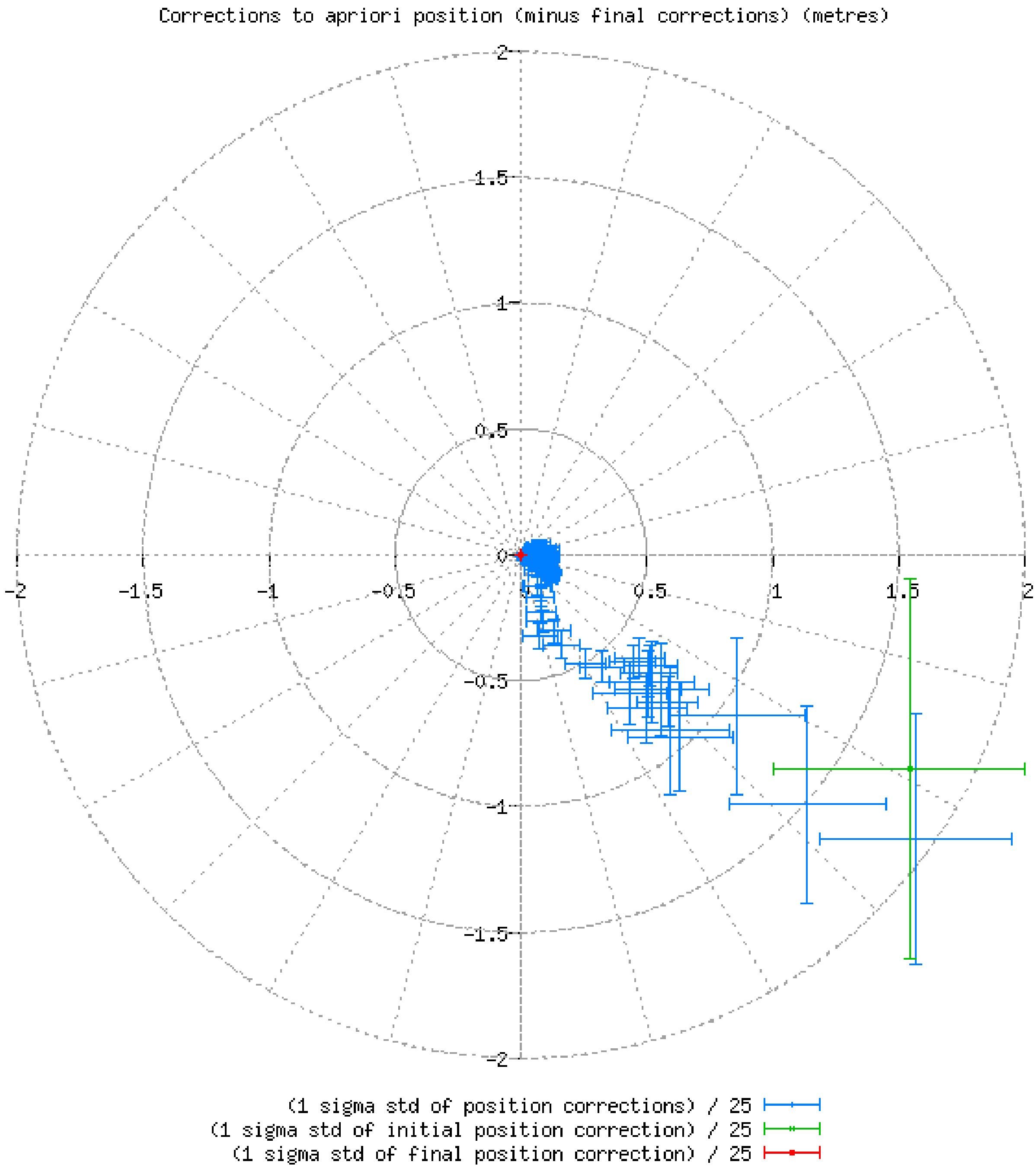
6377199.994m (N) 477105.453m (E)

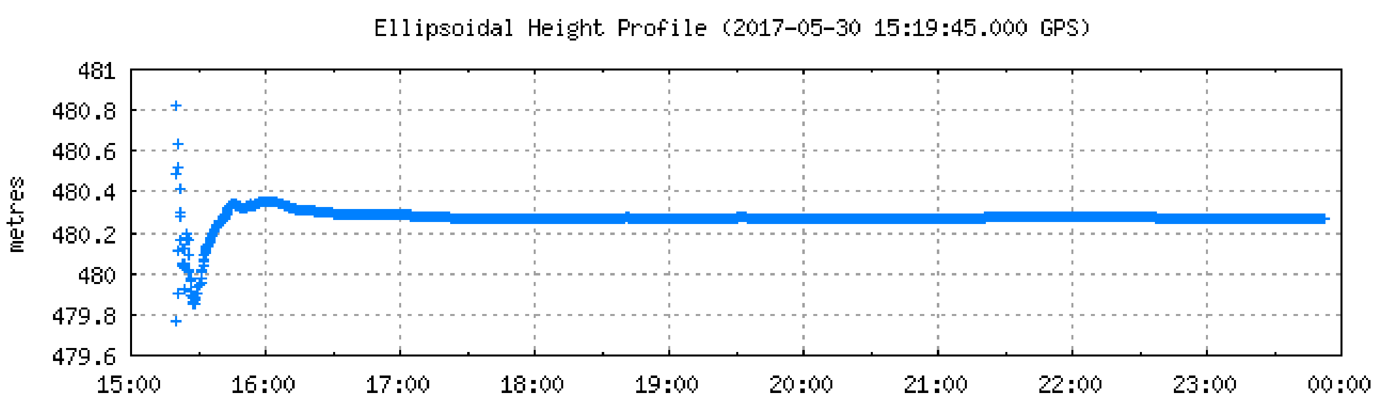
Scale Factors
0.99960643 (point)
0.99953108 (combined)

(Coordinates from RINEX file used as apriori position)

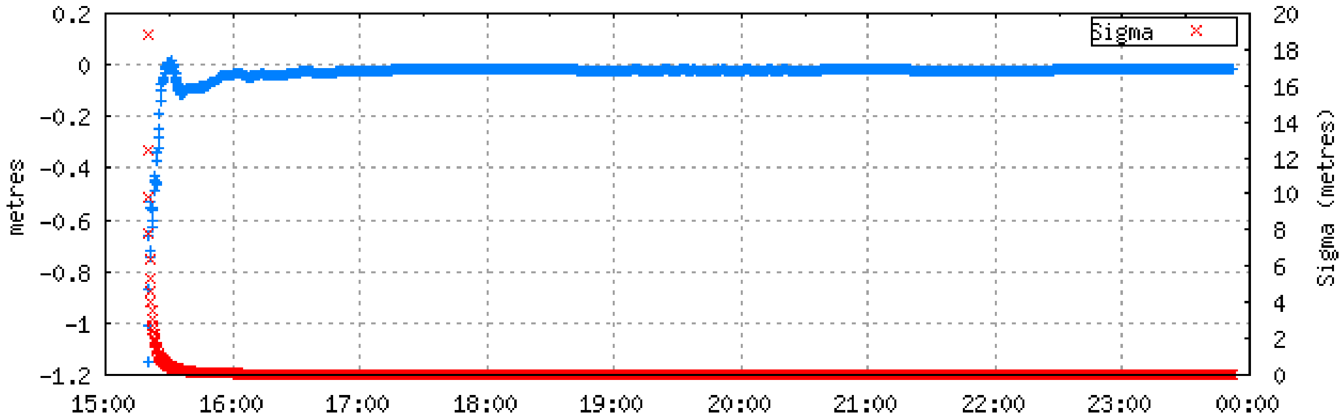
Estimated Parameters & Observations Statistics



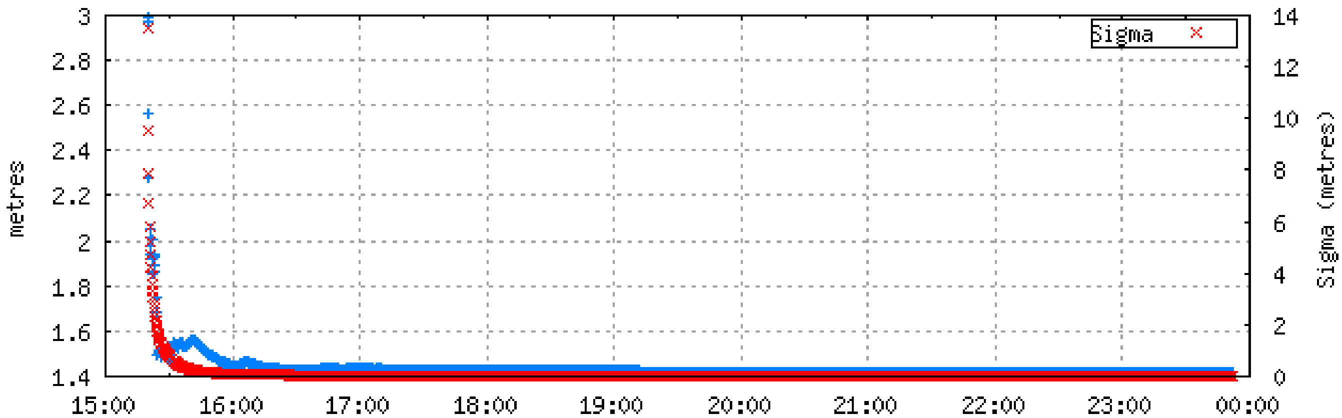

Corrections to apriori position (minus final corrections) (metres)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2
-1.5
-1
-0.5
0.5
1
1.5
2
(1 sigma std of position corrections) / 25
(1 sigma std of initial position correction) / 25
(1 sigma std of final position correction) / 25


Ellipsoidal Height Profile (2017-05-30 15:19:45.000 GPS)
metres
481
480.8
480.6
480.4
480.2
480
479.8
479.6
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00

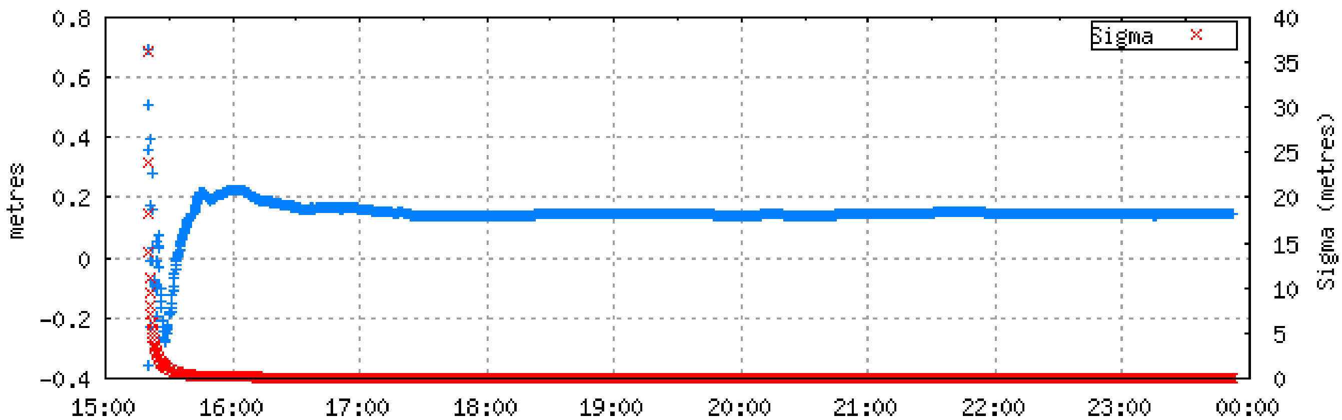
Latitude Differences (2017-05-30 15:19:45.000 GPS)

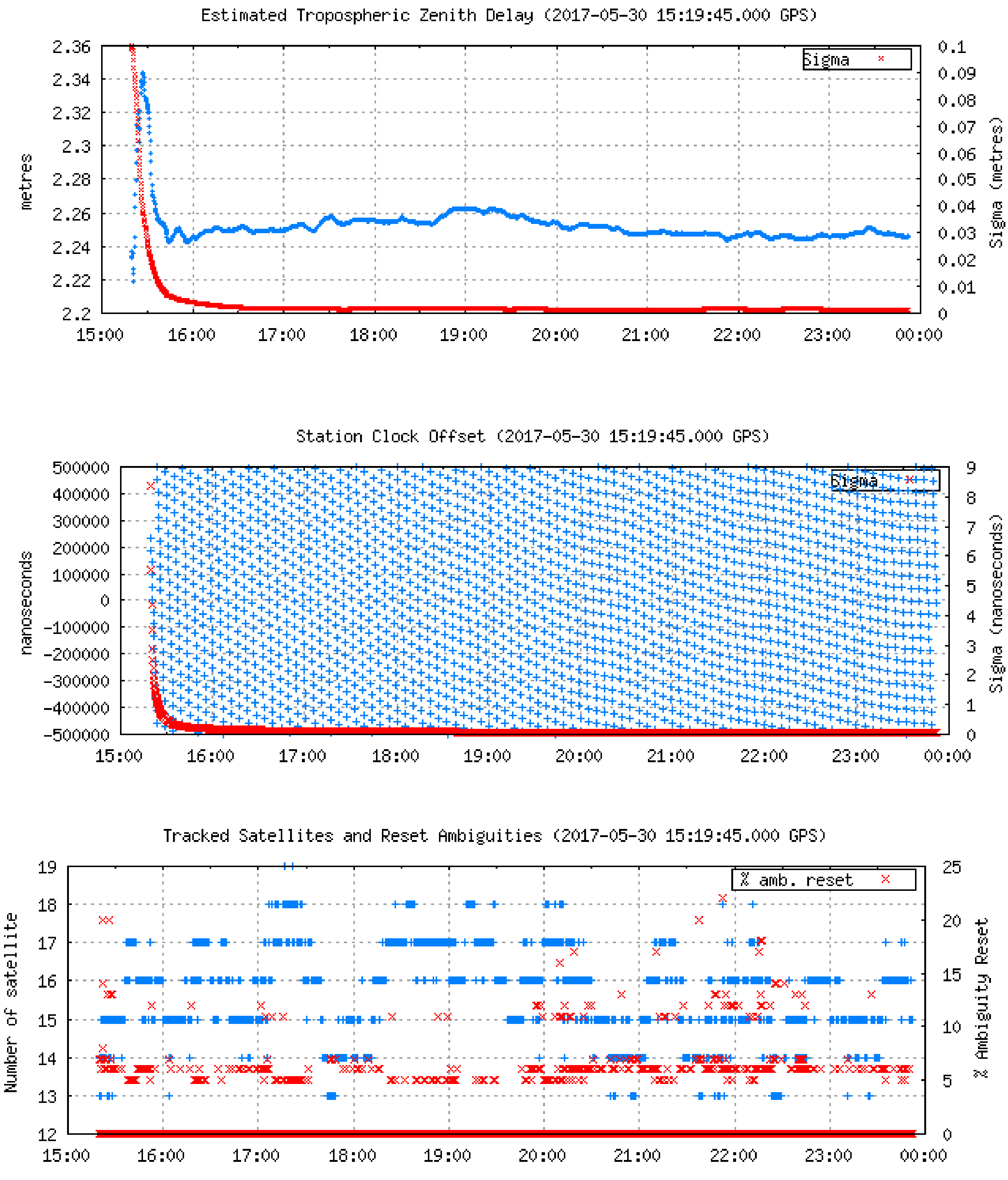


Longitude Differences (2017-05-30 15:19:45.000 GPS)

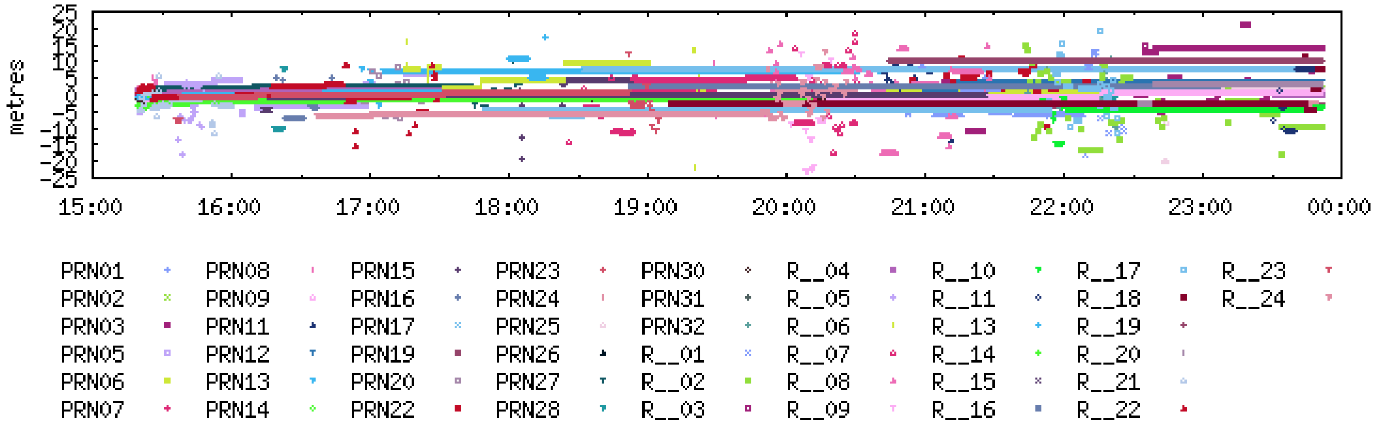


Height Differences (2017-05-30 15:19:45.000 GPS)

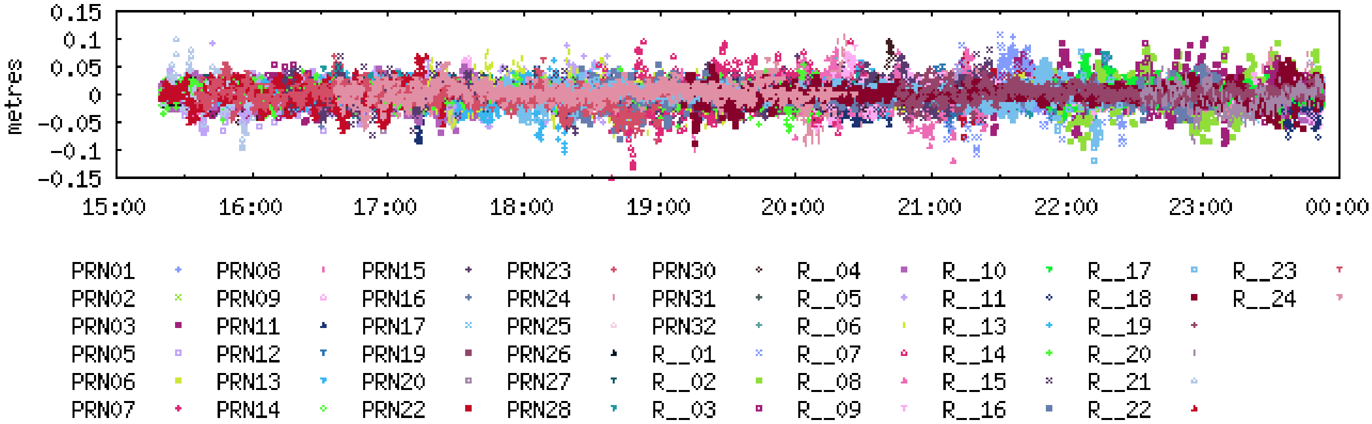



Estimated Tropospheric Zenith Delay (2017-05-30 15:19:45.000 GPS)
metres
Sigma (metres)
Sigma
2.36
2.34
2.32
2.3
2.28
2.26
2.24
2.22
2.2
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00
Station Clock Offset (2017-05-30 15:19:45.000 GPS)
nanoseconds
Sigma (nanoseconds)
Sigma
500000
400000
300000
200000
100000
0
-100000
-200000
-300000
-400000
-500000
9
8
7
6
5
4
3
2
1
0
Tracked Satellites and Reset Ambiguities (2017-05-30 15:19:45.000 GPS)
Number of satellite
% Ambiguity Reset
% amb. reset
19
18
17
16
15
14
13
12
25
20
15
10
5
0

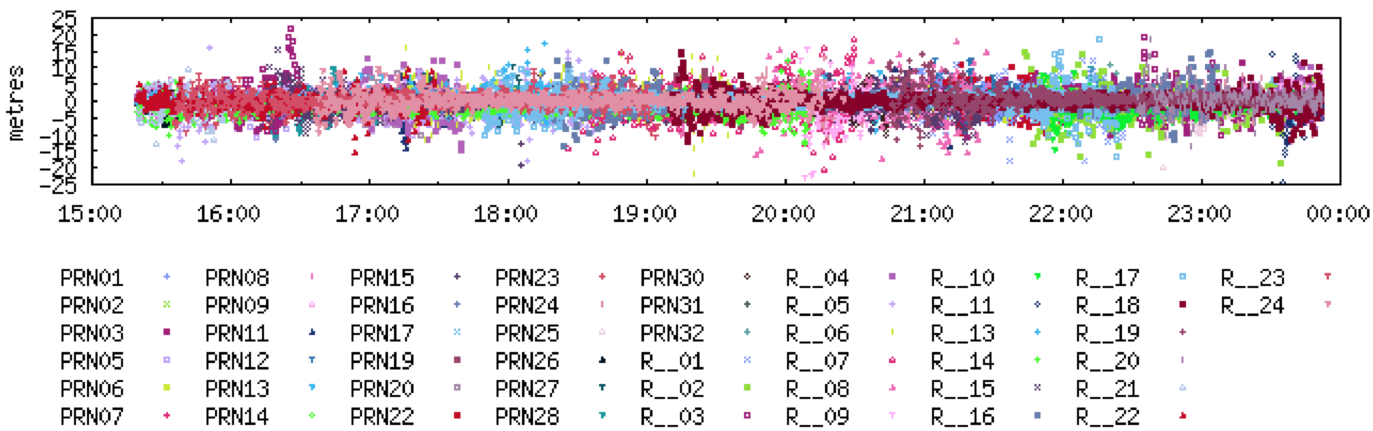
Ambiguities (2017-05-30 15:19:45.000 GPS)



Carrier-Phase Residuals (2017-05-30 15:19:45.000 GPS)



Pseudo-Range Residuals (2017-05-30 15:19:45.000 GPS)



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CSRS-PPP (V 1.05 11216)

PA3

Data Start	Data End	Duration of Observations
2017-05-30 15:57:00.000	2017-05-30 23:34:00.000	7h 36m 60.00s
Apri / Aposteriori Phase Std		**Apri / Aposteriori Code Std**
0.015m / 0.012m		2.0m / 2.020m
Observations	**Frequency**	**Mode**
Phase and Code	L1 and L2	Static
Elevation Cut-Off	**Rejected Epochs**	**Observation & Estimation Steps**
10.000 degrees	0.00 %	15.00 sec / 15.00 sec
Antenna Model	**APC to ARP**	**ARP to Marker**
TPSGR5 NONE	L1= 0.221 m L2= 0.218 m	1.327 m

(APC = antenna phase center; ARP = antenna reference point)

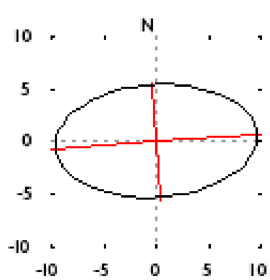
Estimated Position for PA3150p.17O

	Latitude (+n)	Longitude (+e)	Ell. Height
NAD83(CSRS) (1997)	57º 32’ 26.9749’’	-105º 23’ 36.1688’’	486.823 m
Sigmas(95%)	0.004 m	0.008 m	0.016 m
Apriori	57º 32’ 26.976’’	-105º 23’ 36.263’’	486.523 m
Estimated - Apriori	-0.039 m	1.567 m	0.299 m

Orthometric Height
CGVD28 (HTv2.0)

517.851 m
(click for height reference information)

95% Error Ellipse (mm)
semi-major: 9.630mm
semi-minor: 5.345mm
semi-major azimuth: 86º 16’ 41.17’’



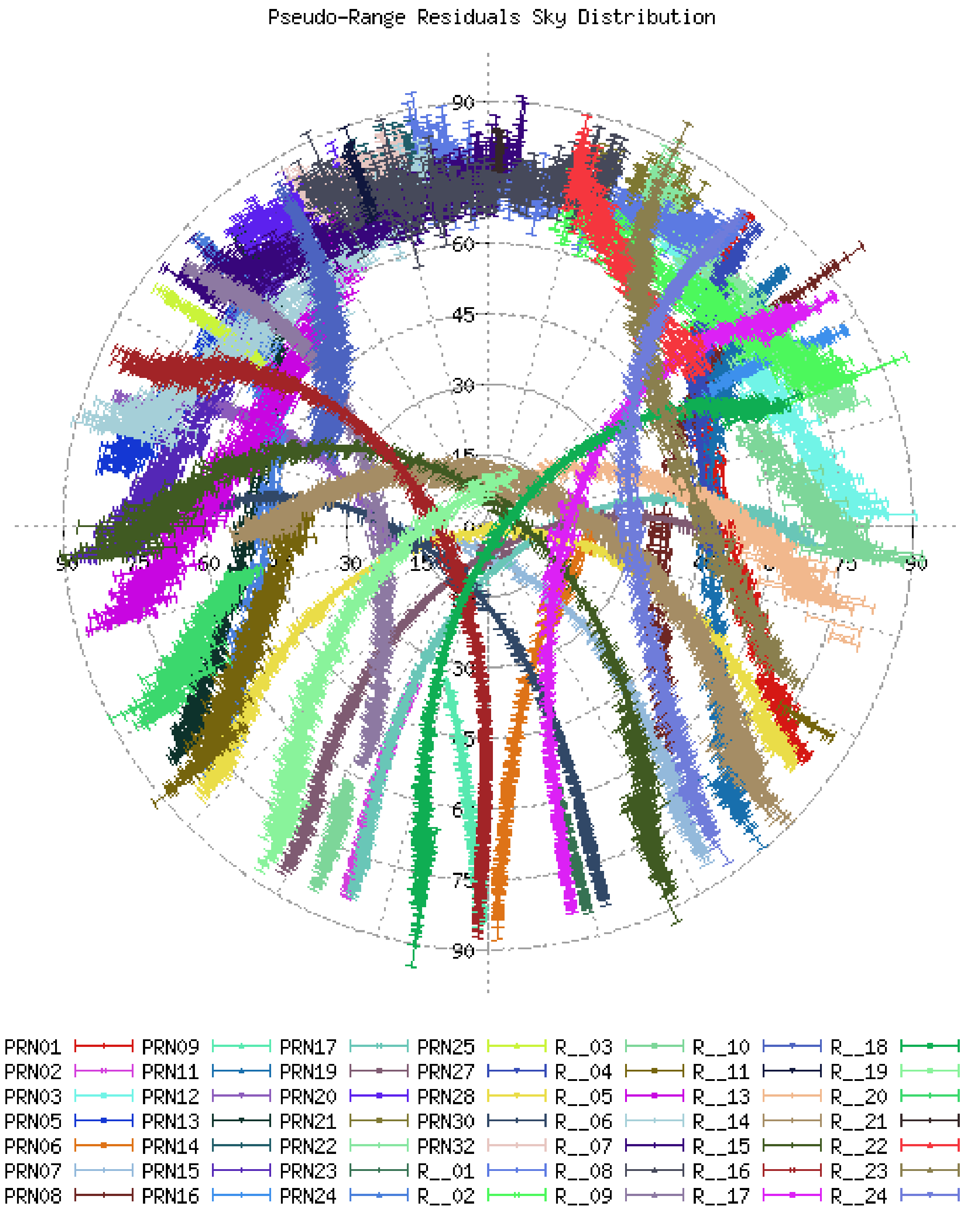
UTM (North) Zone 13

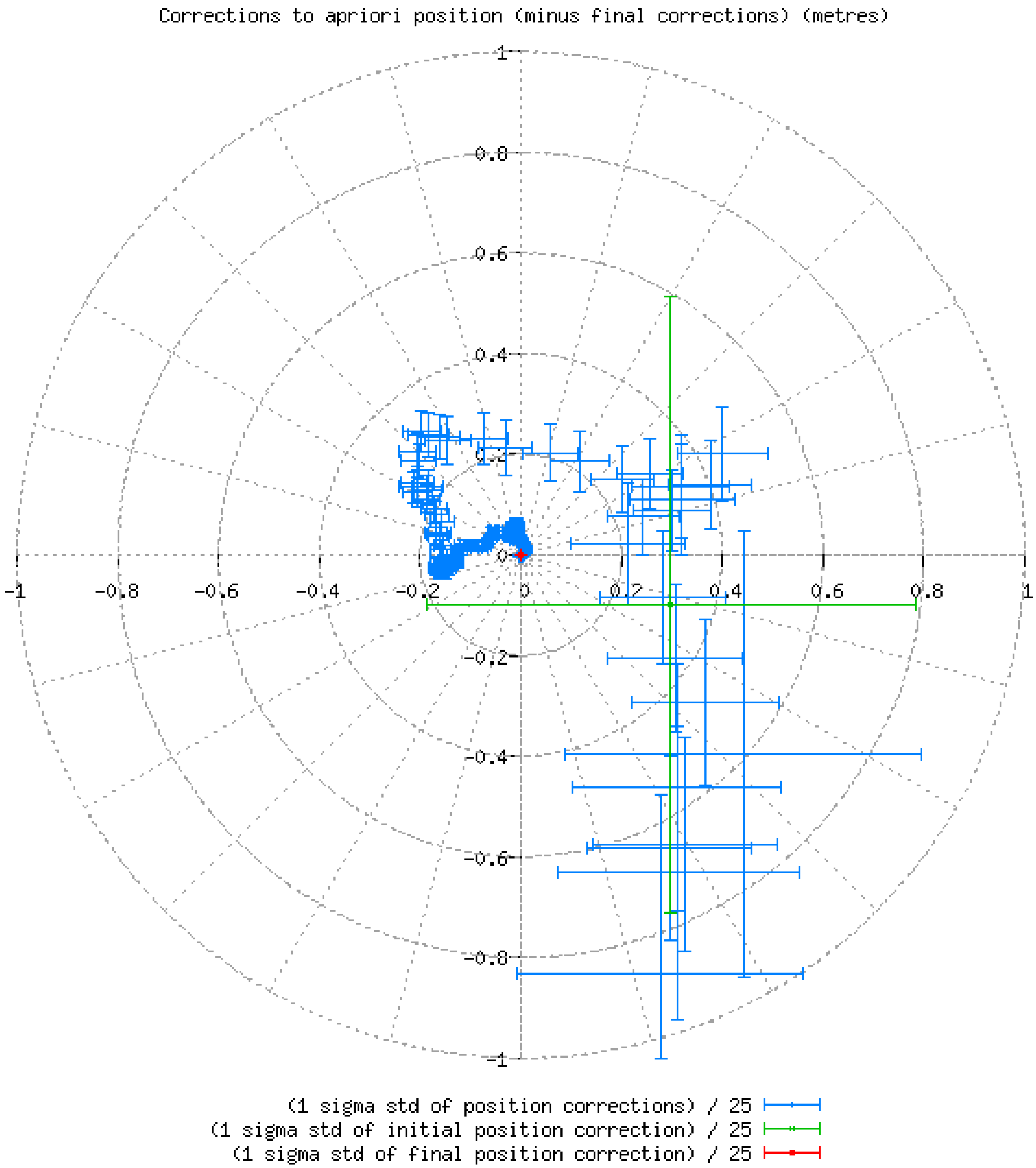
6377659.010m (N) 476450.790m (E)

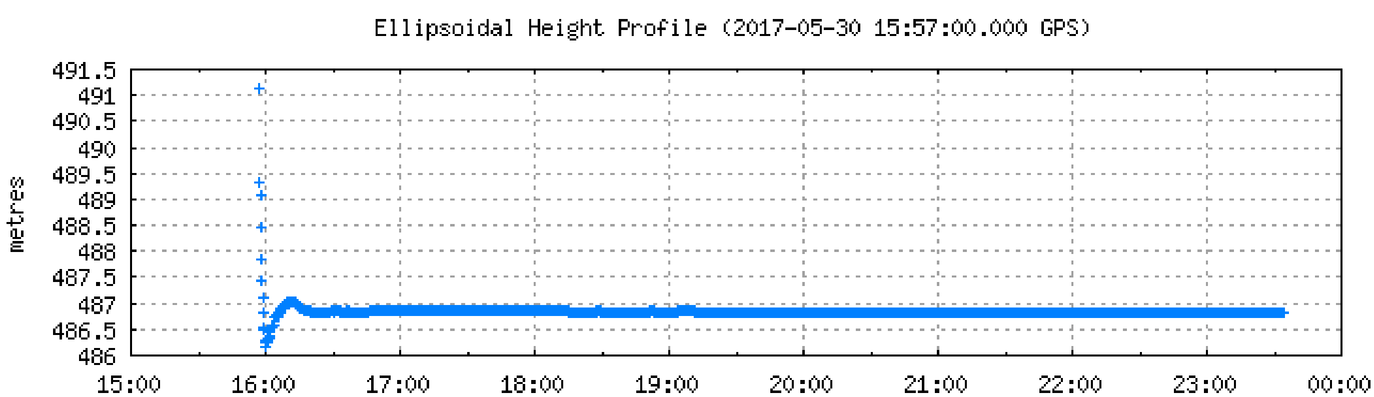
Scale Factors
0.99960680 (point)
0.99953042 (combined)

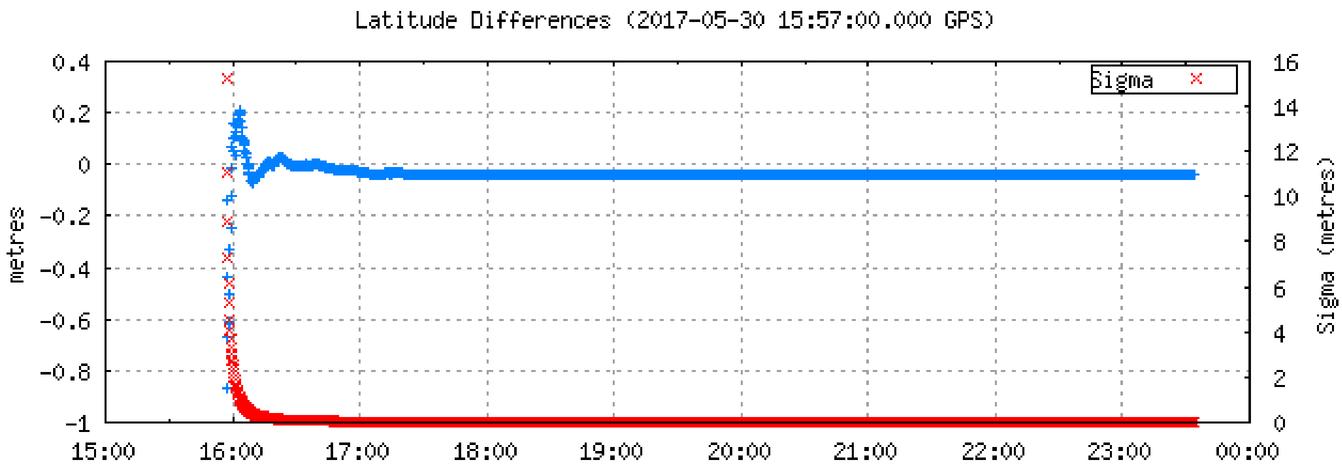
(Coordinates from RINEX file used as apriori position)

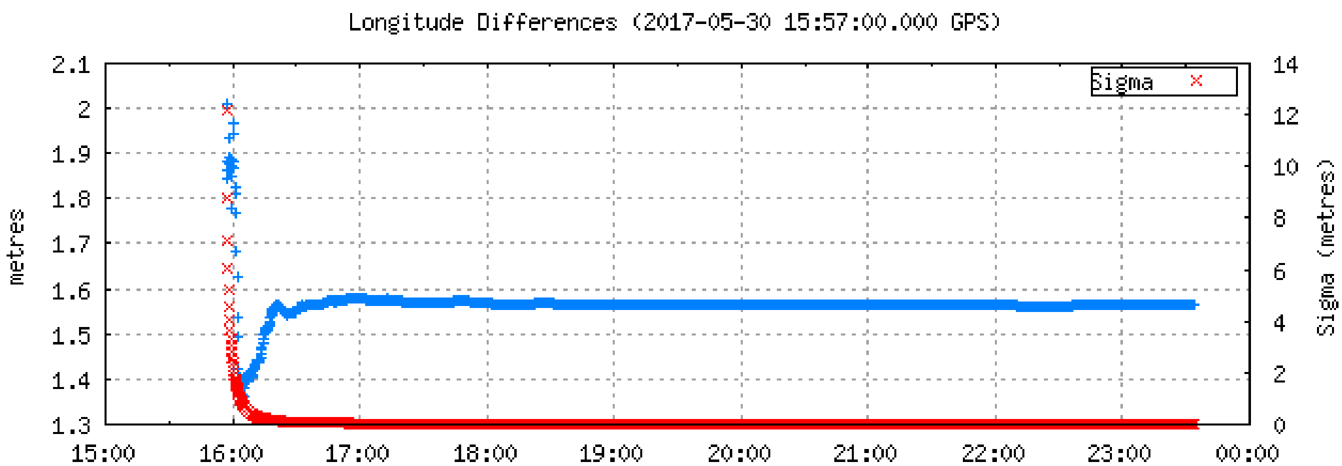
Estimated Parameters & Observations Statistics

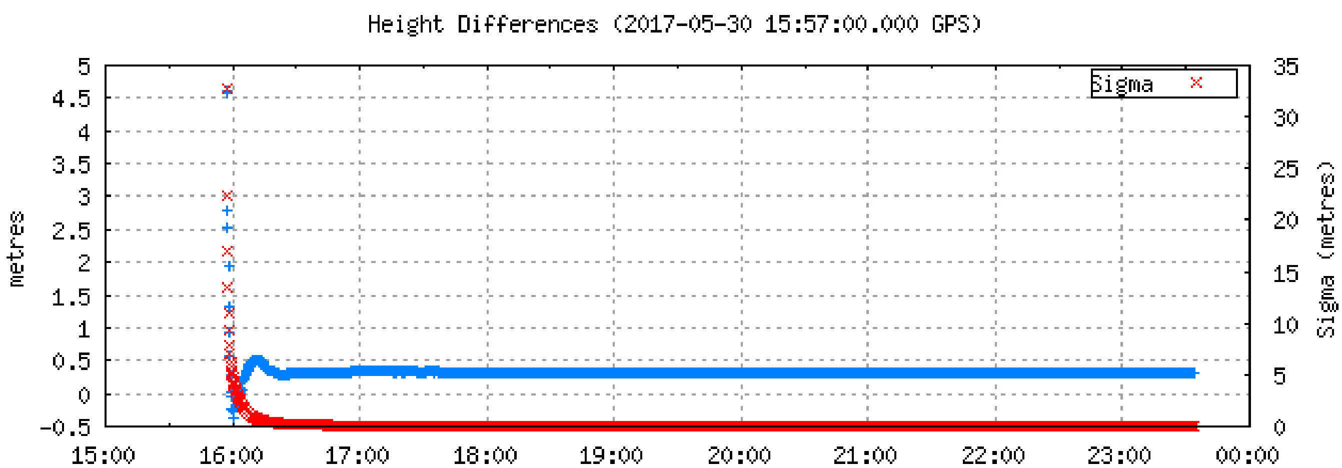


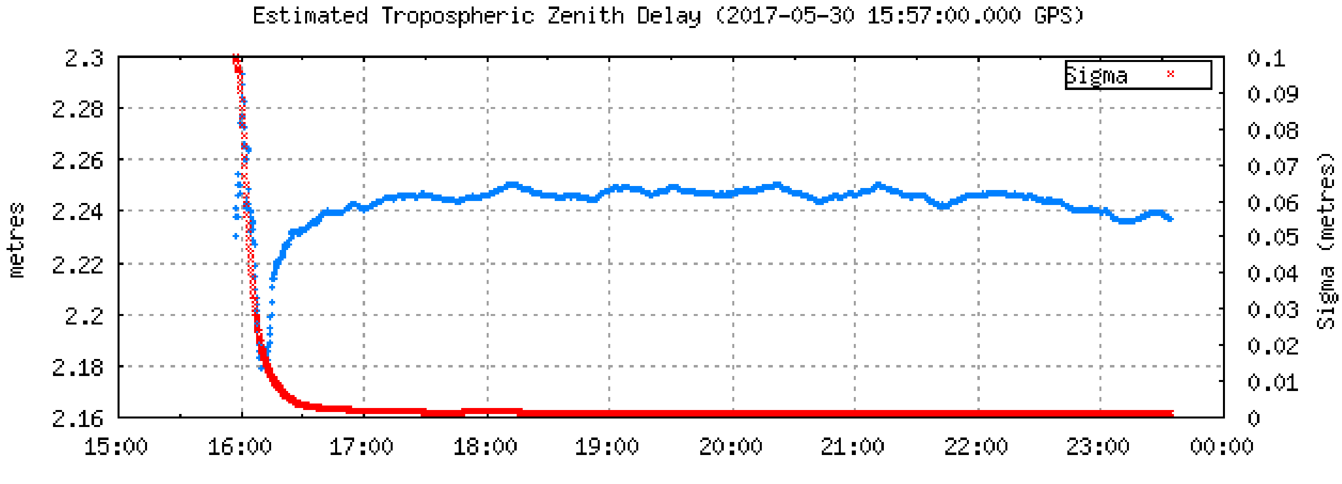

Corrections to apriori position (minus final corrections) (metres)
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
(1 sigma std of position corrections) / 25
(1 sigma std of initial position correction) / 25
(1 sigma std of final position correction) / 25


Ellipsoidal Height Profile (2017-05-30 15:57:00.000 GPS)
metres
491.5
491
490.5
490
489.5
489
488.5
488
487.5
487
486.5
486
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00


Latitude Differences (2017-05-30 15:57:00.000 GPS)
Sigma
metres
Sigma (metres)
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
16
14
12
10
8
6
4
2
0
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00


Longitude Differences (2017-05-30 15:57:00.000 GPS)
Sigma
metres
Sigma (metres)
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
14
12
10
8
6
4
2
0
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00


Height Differences (2017-05-30 15:57:00.000 GPS)
Sigma
metres
Sigma (metres)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
35
30
25
20
15
10
5
0
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00


Estimated Tropospheric Zenith Delay (2017-05-30 15:57:00.000 GPS)
Sigma
metres
Sigma (metres)
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2.28
2.26
2.24
2.22
2.2
2.18
2.16
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
15:00
16:00
17:00
18:00
19:00
20:00
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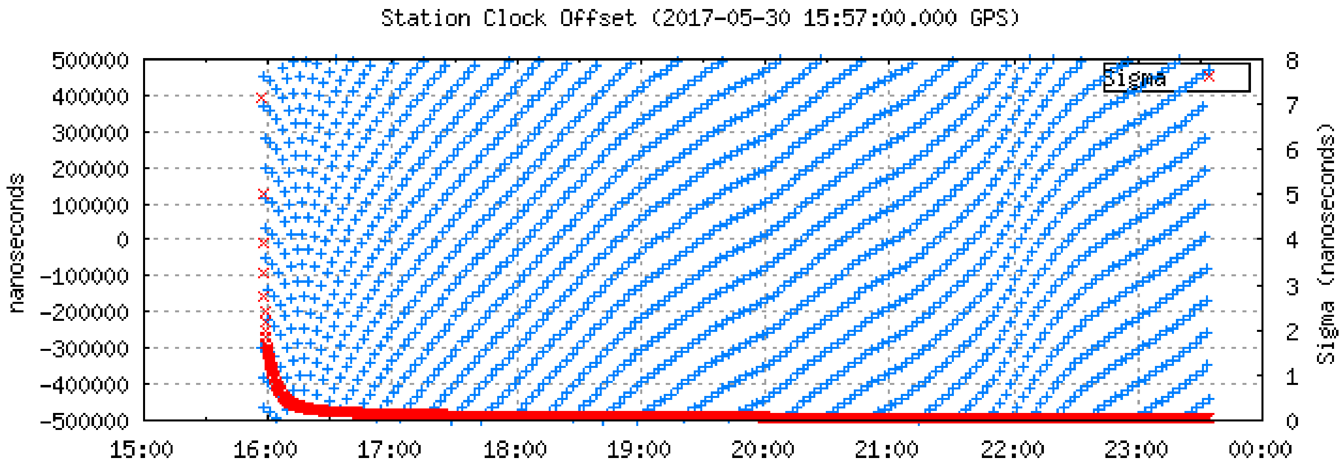
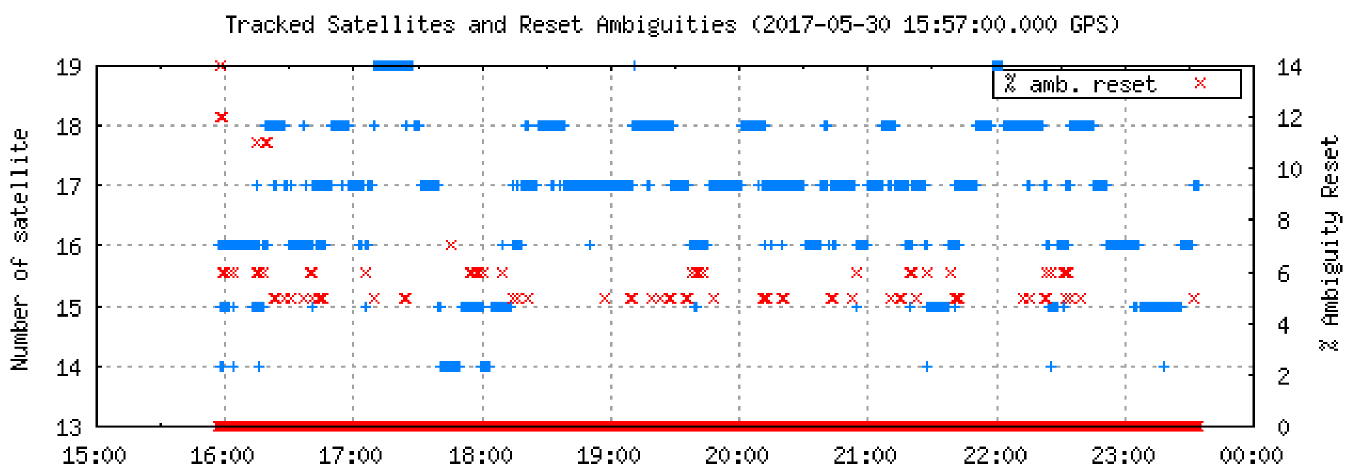
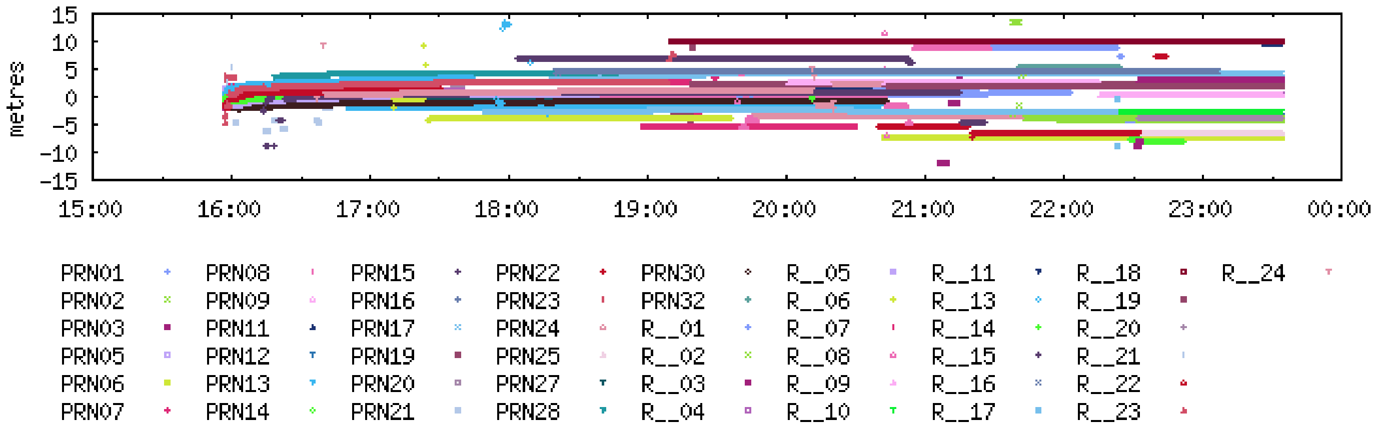
22:00
23:00
00:00

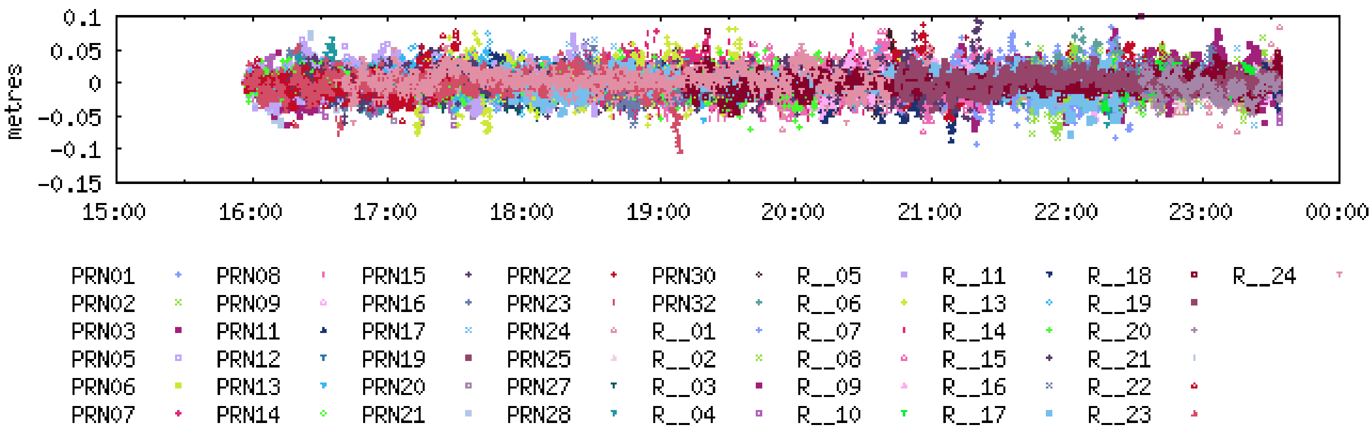

Station Clock Offset (2017-05-30 15:57:00.000 GPS)
Sigma
nanoseconds
Sigma (nanoseconds)
500000
400000
300000
200000
100000
0
-100000
-200000
-300000
-400000
-500000
8
7
6
5
4
3
2
1
0
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00


Tracked Satellites and Reset Ambiguities (2017-05-30 15:57:00.000 GPS)
% amb. reset
Number of satellite
% Ambiguity Reset
19
18
17
16
15
14
13
14
12
10
8
6
4
2
0
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00

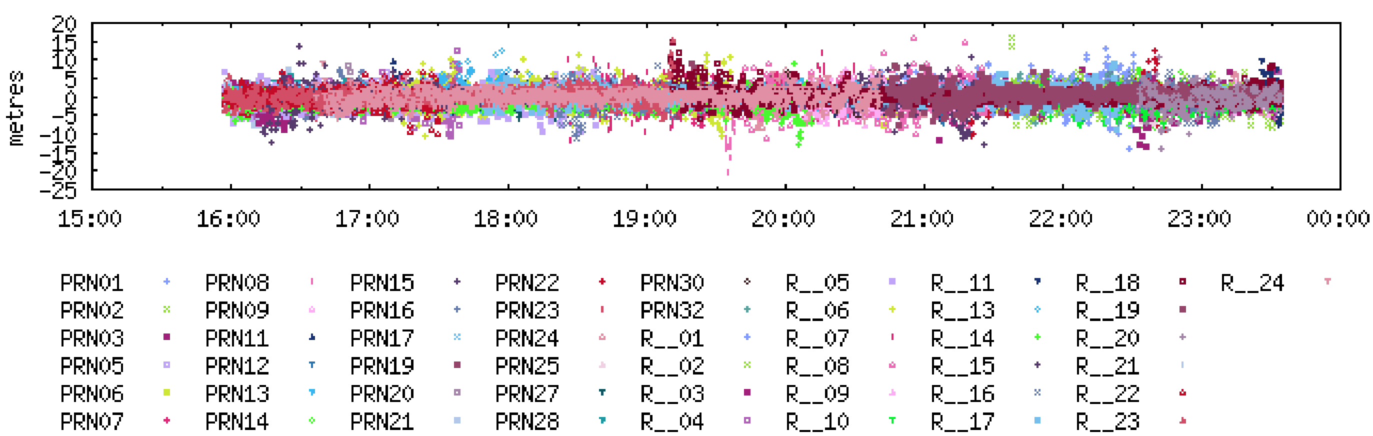
Ambiguities (2017-05-30 15:57:00.000 GPS)



Carrier-Phase Residuals (2017-05-30 15:57:00.000 GPS)



Pseudo-Range Residuals (2017-05-30 15:57:00.000 GPS)



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EMail: nrcan.geodeticinformationservices.rncan@canada.ca
Phone:343-292-6617

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CSRS-PPP (V 1.05 11216)

SB5

Data Start	Data End	Duration of Observations
2017-05-29 23:07:00.000	2017-05-30 01:49:00.000	2h 42m 0.00s
Apri / Aposteriori Phase Std		**Apri / Aposteriori Code Std**
0.015m / 0.010m		2.0m / 1.887m
Observations	**Frequency**	**Mode**
Phase and Code	L1 and L2	Static
Elevation Cut-Off	**Rejected Epochs**	**Observation & Estimation Steps**
10.000 degrees	0.00 %	10.00 sec / 10.00 sec
Antenna Model	**APC to ARP**	**ARP to Marker**
TPSGR5 NONE	L1= 0.221 m L2= 0.218 m	1.242 m

(APC = antenna phase center; ARP = antenna reference point)

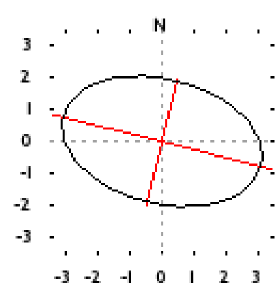
Estimated Position for SB5149x.17O

	Latitude (+n)	Longitude (+e)	Ell. Height
NAD83(CSRS) (1997)	57º 29’ 47.4940’’	-105º 25’ 23.7269’’	487.757 m
Sigmas(95%)	0.016 m	0.025 m	0.044 m
Apriori	57º 29’ 47.490’’	-105º 25’ 23.821’’	487.571 m
Estimated - Apriori	0.126 m	1.575 m	0.186 m

Orthometric Height
CGVD28 (HTv2.0)

518.673 m
(click for height reference information)

95% Error Ellipse (cm)
semi-major: 3.203cm
semi-minor: 1.946cm
semi-major azimuth: 103º 35’ 31.03’’



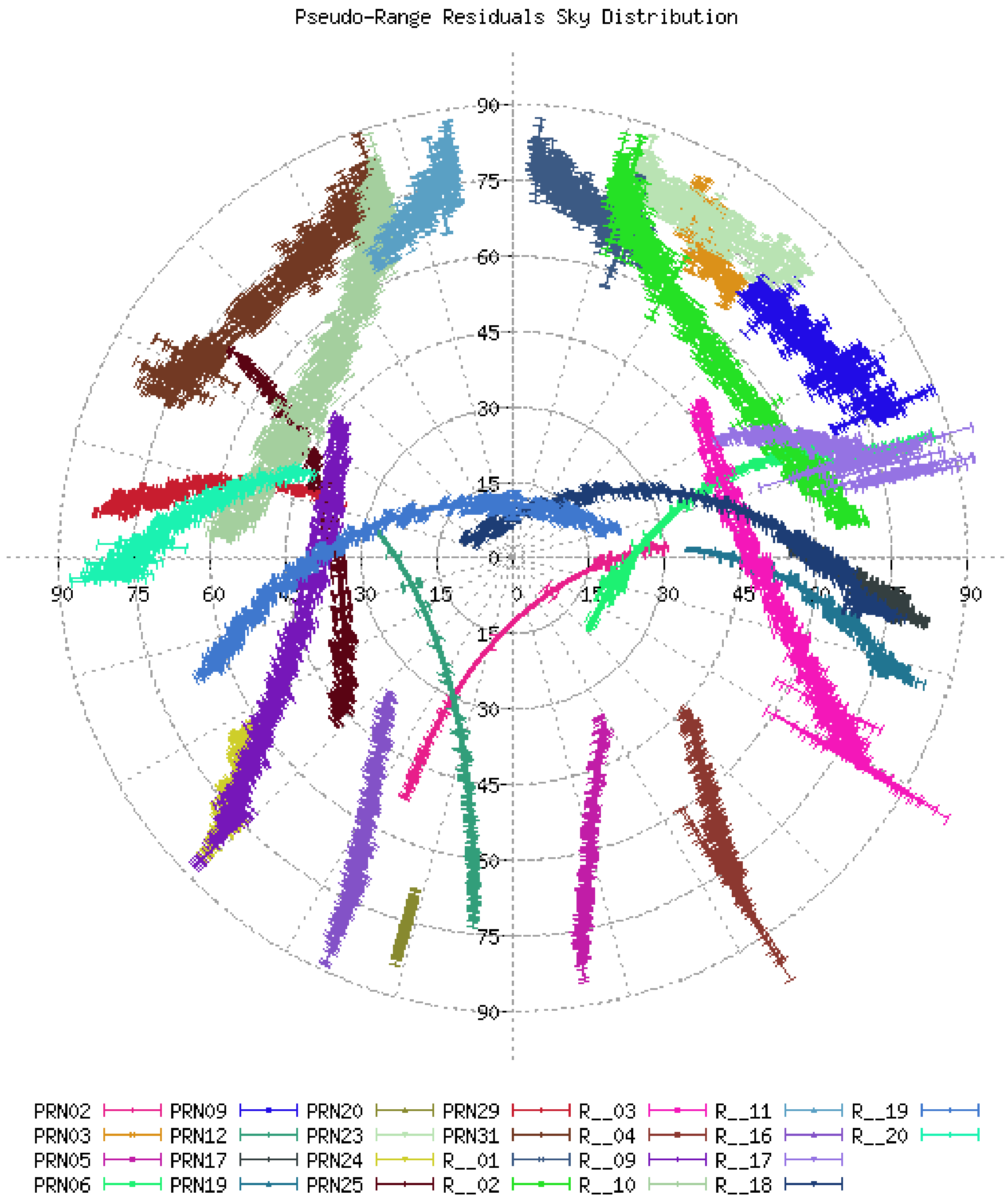
UTM (North) Zone 13

6372738.116m (N) 474631.507m (E)

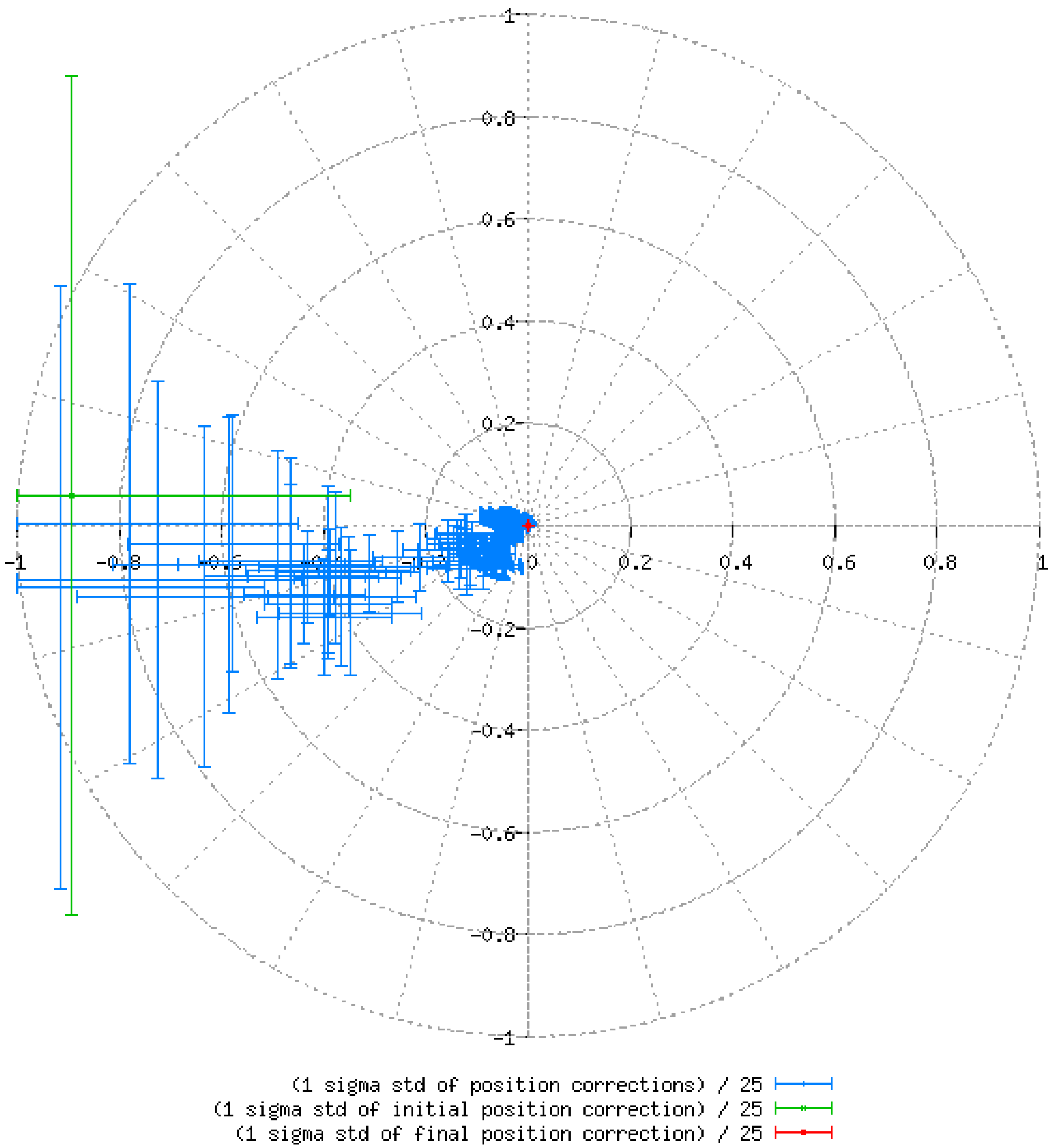
Scale Factors
0.99960789 (point)
0.99953137 (combined)

(Coordinates from RINEX file used as apriori position)

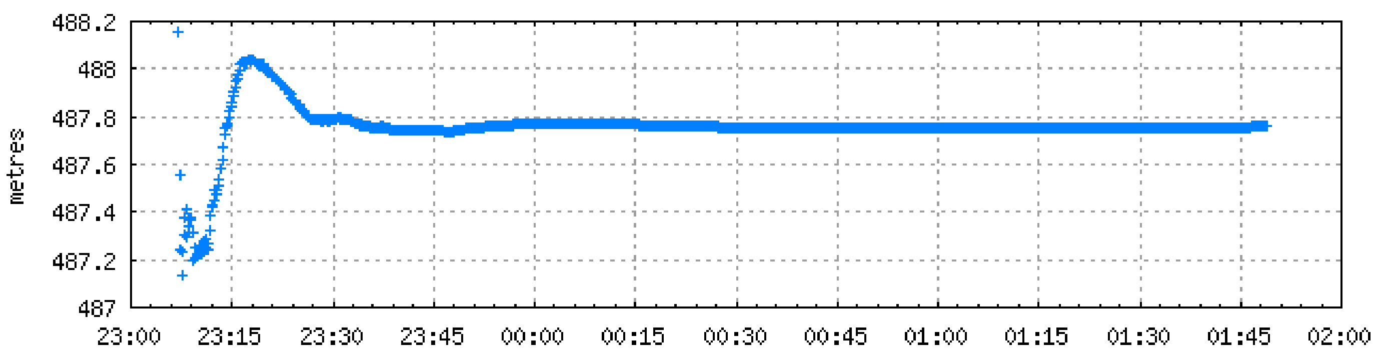
Estimated Parameters & Observations Statistics



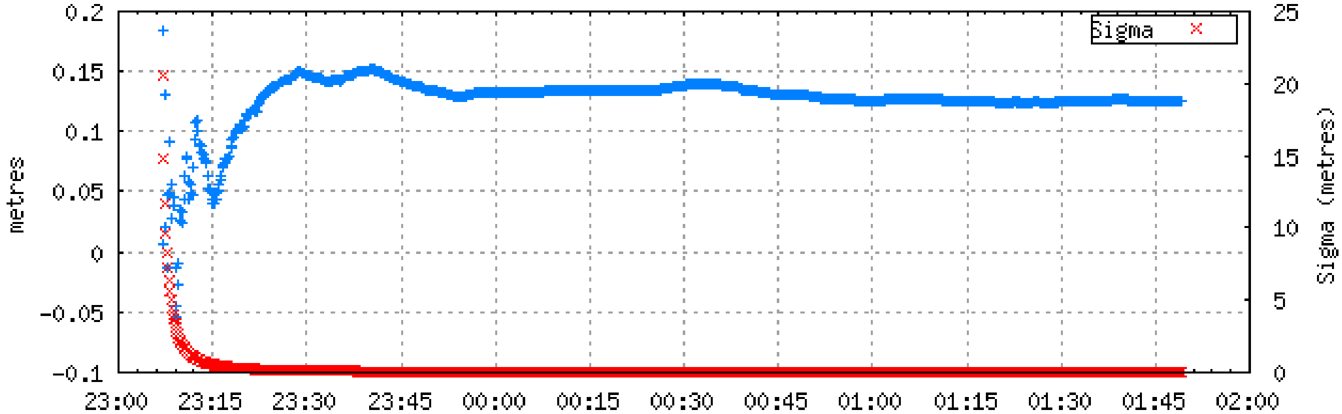
Corrections to apriori position (minus final corrections) (metres)



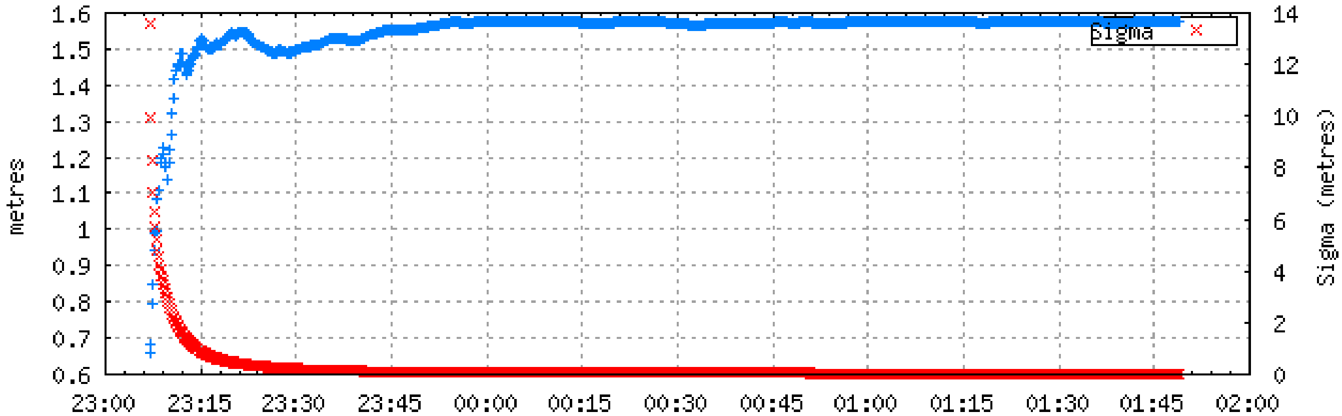
Ellipsoidal Height Profile (2017-05-29 23:07:00.000 GPS)



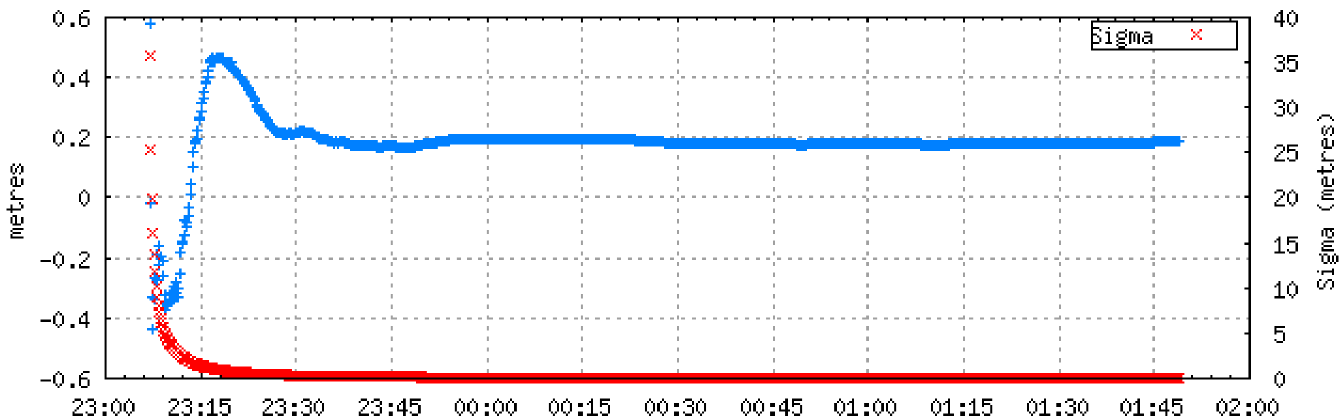
Latitude Differences (2017-05-29 23:07:00.000 GPS)



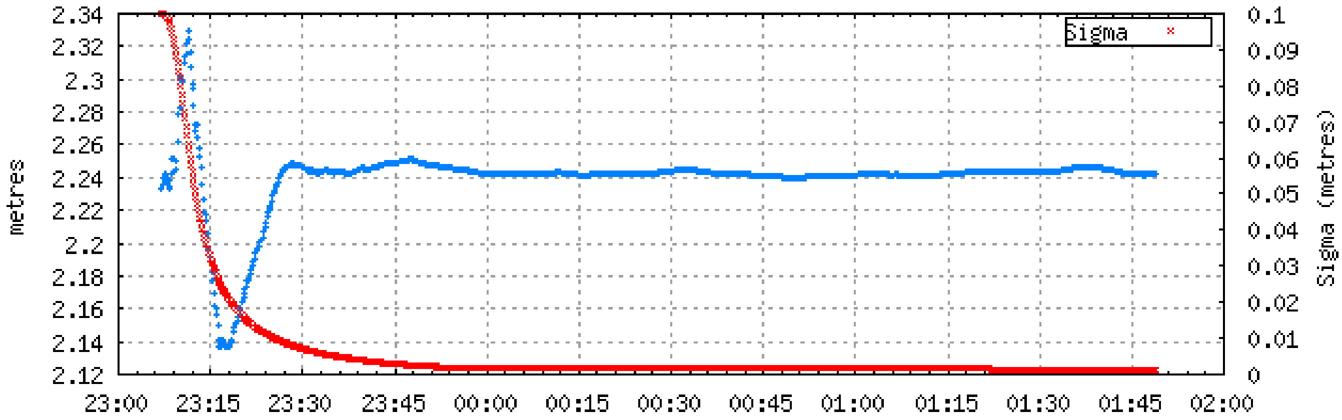
Longitude Differences (2017-05-29 23:07:00.000 GPS)



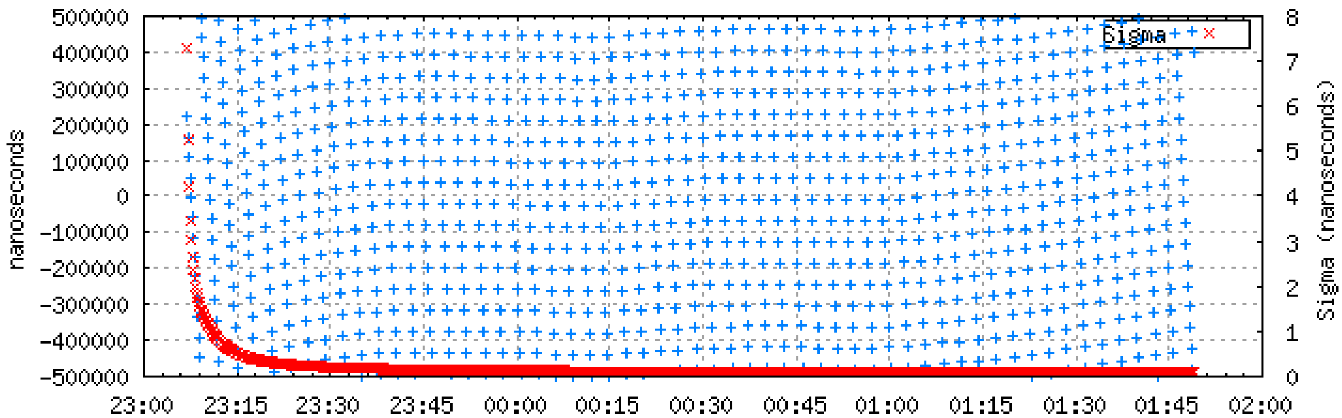
Height Differences (2017-05-29 23:07:00.000 GPS)



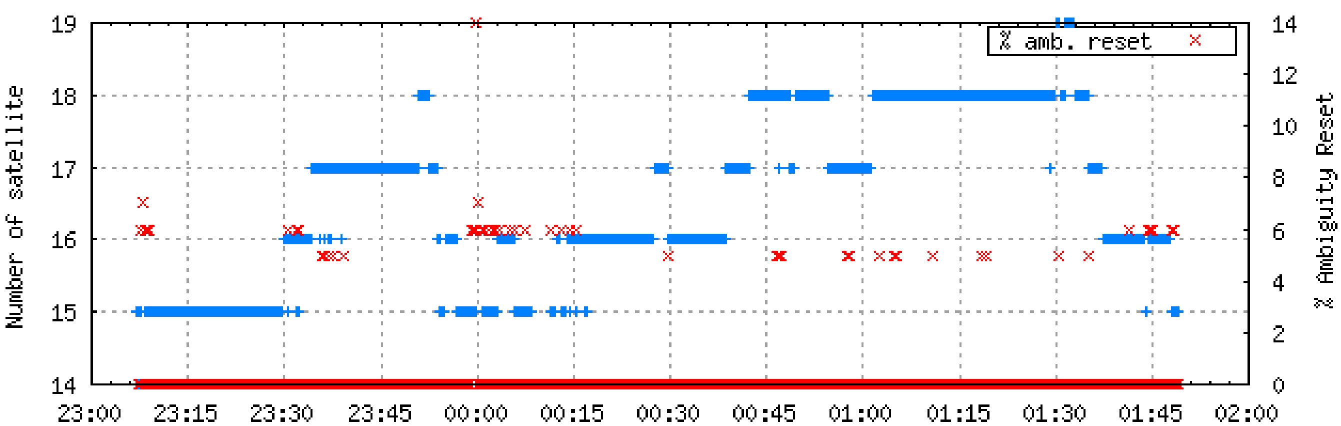
Estimated Tropospheric Zenith Delay (2017-05-29 23:07:00.000 GPS)



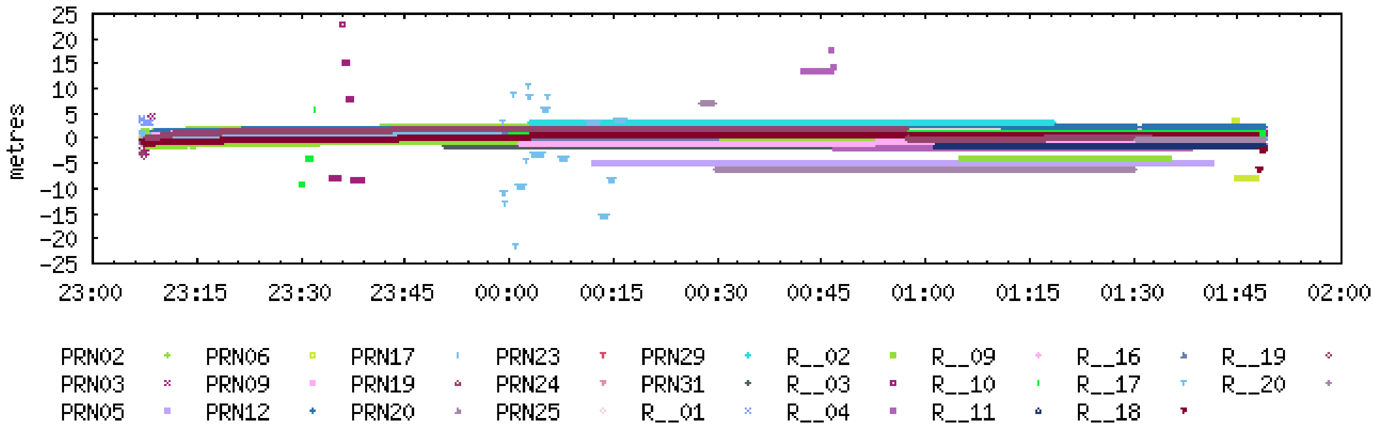
Station Clock Offset (2017-05-29 23:07:00.000 GPS)



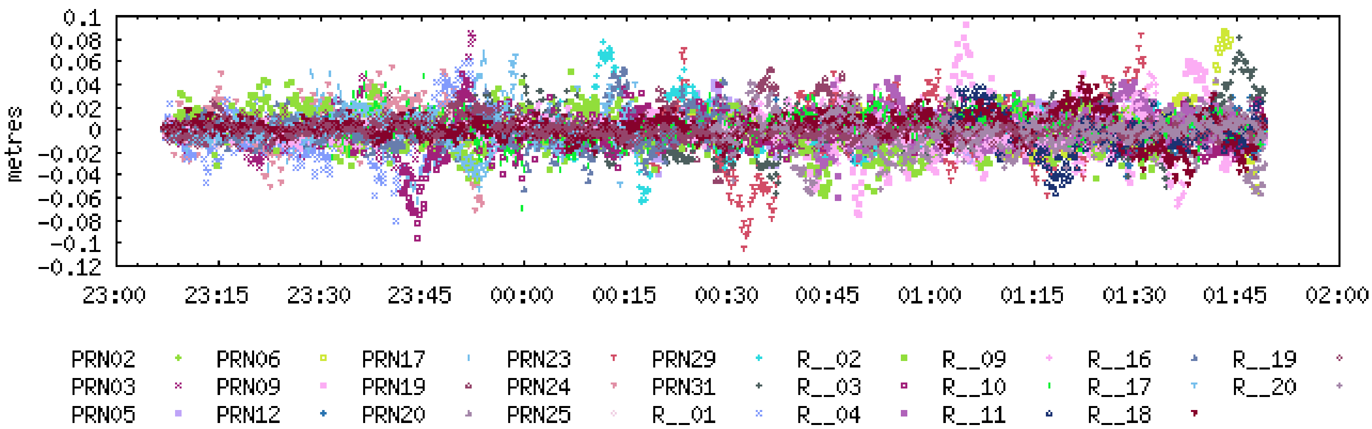
Tracked Satellites and Reset Ambiguities (2017-05-29 23:07:00.000 GPS)



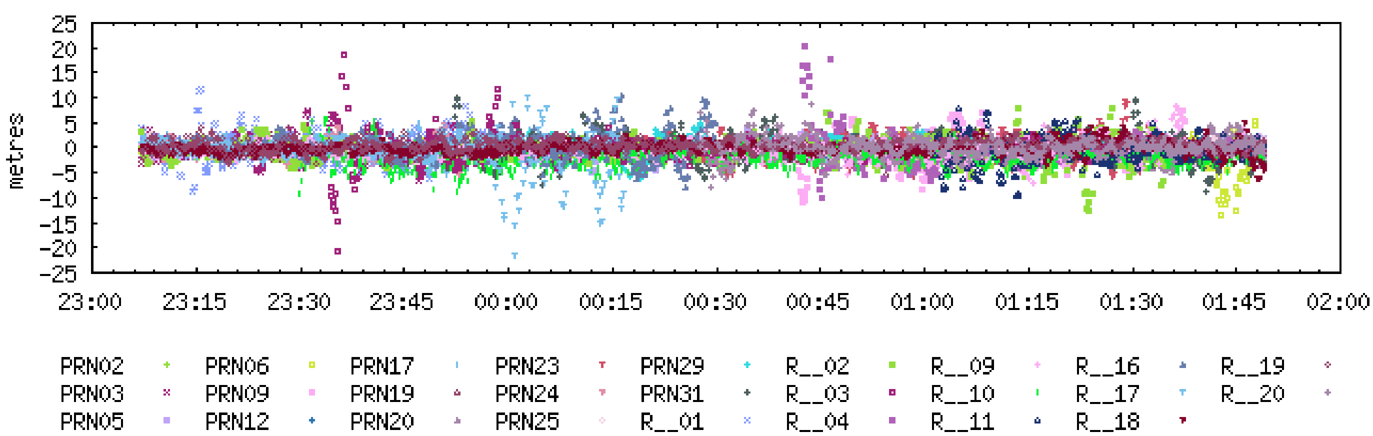
Ambiguities (2017-05-29 23:07:00.000 GPS)



Carrier-Phase Residuals (2017-05-29 23:07:00.000 GPS)



Pseudo-Range Residuals (2017-05-29 23:07:00.000 GPS)



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EMail: nrcan.geodeticinformationservices.rncan@canada.ca
Phone:343-292-6617

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Appendix F Wheeler River Hydrometric Monitoring Activity Summary 2019. Missinipi Water Solutions.

November 6, 2019 File Number: MWS-19-013

Dr. Fei Luo
Environmental Engineer
EcoMetrix Incorporated
6800 Campobello Road
Mississauga, ON L5N 2L8

RE: 2019 Wheeler River Hydrometric Monitoring Activity Summary

Dear Dr. Luo,

This letter is provided to you as a summary of field hydrometric monitoring activities during 2019 at Denison Mine's (Denison) Wheeler River Project (the Project). EcoMetrix Incorporated (EcoMetrix) is completing baseline monitoring for the Project on behalf of Denison and has retained Missinipi Water Solutions Inc. (MWSI) to provide hydrometric monitoring and water sampling at the Project.

Introduction

The Project is located approximately 750 km north of Saskatoon within Saskatchewan's Athabasca Basin. The Project is considered to be Denison's flagship project and Denison is currently proceeding with development of an Environmental Impact Statement (EIS) for the property. Data recorded during baseline monitoring are important to the development of an EIS in context of existing conditions and predicted impacts.

In coordination with EcoMetrix, MWSI completed two field programs at the project in 2019 from July 3 to 7 and August 28 to September 1. The purpose of each field program was as follows:

July Field Program

- Project introduction with EcoMetrix including guided access to all stations and identification of survey benchmarks;
- Discharge measurement and water level survey at SA-1, SA-2, SA-3, SA-4, SA-5, SA-6 and RC-1;
- Water level survey at LA-1; and,
- Water sampling at SA-1, SA-2, SA-3, SA-4, SA-5, SA-6 and RC-1.

August Field Program

- Discharge measurement and water level survey at SA-1, SA-2, SA-3, SA-4, SA-5, SA-6, SA-8, SA-9, SA-10, SA-11 and RC-1;
- Water level survey at LA-1 and LA-6; and,
- Water sampling at SA-1, SA-2, SA-3, SA-4, SA-5, SA-6 and RC-1.

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Saskatoon SK S7S 1N8
Tel: 306-242-4000
Email: info@missinipisolutions.ca

Some stations are equipped with water level dataloggers which were downloaded in 2019. Each station is discussed in detail below and notes any observations or changes to instrumentation. Discharge and water level data developed from installed dataloggers are being provided electronically to EcoMetrix as a part of, but not attached/appended to, this letter.

Methodology and Equipment

This monitoring program is a continuation of work completed by others and all relevant background data and previous measurements for each station are discussed by EcoMetrix (2019) in *Baseline Hydrology Summary Report – Wheeler River Project, Denison Mines*. Work completed by MWSI in 2019 included extension of the stage-discharge rating curves (rating curve) at each station and development of hydrographs.

A rating curve requires several measurements of water level (stage) and discharge measurement over a wide range of flow conditions. During 2019, discharge was measured at each station by in-stream velocity measurements via the Mid-Section Method (Terzi, 1981). A Sontek FlowTracker was used to record velocity measurements at all stations for the Project in 2019. Water levels were recorded by elevation surveys to previously installed benchmarks using an engineer's rod and level. At some locations (SA-1, SA-4, SA-5, SA-6, SA-8, SA-9, SA-10, SA-11 and LA-6) Solinst Leveloggers are installed to record water level.

The quality of the data collected and reported is directly related to the accuracy of the measurements collected in the field. MWSI regularly inspects and calibrates field equipment to provide quality data for analysis. As of the spring of 2019 there are no facilities in Canada to perform calibration of Sontek FlowTrackers; however, MWSI regularly calibrates the older mechanical flow meters and annual verification is completed to confirm that all flow meters have agreement under a range of velocities in a lab controlled hydraulic flume. Two Peg Test surveys are performed to verify the accuracy of survey equipment. During station monitoring additional survey collection and measurements are often completed to confirm and validate measurements prior to leaving the station.

Solinst Leveloggers installed in-stream record total pressure which is a combination of water level and barometric pressures. A Solinst Barologger is used to measure local barometric pressure and this data record can be confirmed and extended, if needed, using local climate station data. The barometric pressure record is subtracted from the total pressure record for all in-stream Leveloggers. This record is used to generate the hydrograph by correcting the record to the surveyed water level, referenced to local benchmarks, and applying the trendline equation from the rating curve at a given station. Any users of hydrograph data should exercise caution if a given hydrograph has data that are developed by extrapolation beyond the measured range of a rating curve.

Winter water level data records are often impacted by ice cover and encroachment of the channel by snow. All stations with dataloggers installed at the Project are similarly impacted. Winter flow data can be estimated from other regional stations, but this effort is not included as a part of this report.

During the 2019 field programs the dataloggers were observed to have a two hour time shift from Central Standard Time (CST). All dataloggers were reset to CST to ease future processing of logger data at a sampling frequency of 30 minutes.

Stream Discharge and Lake Level Monitoring

This section provides a summary of activities for each station as well as updated tables of measured stage and discharge. When possible the current stage-discharge rating curve is plotted including the equation for the fitted trendline and the coefficient of determination (R^2). In some cases, a measurement may be rejected from the trendline equation and R^2 assessment based upon the type of measurement (i.e. winter vs. open water) or professional judgment based on the perceived fit of the data point. Rejection of data points is based upon close scrutiny of the data set, consideration for the data and conditions associated with that measurement and the potential perceived influence of site conditions such as measurement location.

As previously discussed, this monitoring is a continuation of work completed by others. The measurements discussed below are a compilation of all work at each station where MWSI completed measurements made in 2019 and all other work is discussed by EcoMetrix (2019).

SA-1 (Icelander River)

Measurements were completed at SA-1 twice in 2019 (Table 1). A data logger is installed at this location and a new sensor housing was added during the August field program. The current data logger is an older model of the Solinst Levelogger product and will need replacement soon but was not believed to be required for 2019.

Some discrepancy was noted at this station regarding previously reported benchmark labels and elevations. For the 2019 data to fit with previously reported data in the rating curve (Figure 1) the benchmark elevation from BM3 (as previously reported by others) needed to be assigned to BM1. This is a somewhat arbitrary correction; however, it creates a proper fit to the rating curve based on the measured flow and stage data. Should other information regarding the benchmarks at SA-1 become available it could be used to provide any other correction which may be required.

Photo 1 and Photo 2 are photos of the cross-section at SA-1 taken in July and August, respectively.

Table 1: SA-1 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2011-05-14	492.714	2.3070
2011-07-29	492.648	1.7500
2011-10-28	492.562	0.9730
2012-05-05	492.711	2.2930
2012-08-06	492.695	2.0310
2012-10-23	492.721	2.5750
2013-05-20	492.705	2.3580
2013-08-14	492.587	1.2800
2013-10-18	492.554	0.8870
2014-03-30	492.869	1.2030
2016-09-17	492.710	2.3400
2017-05-31	492.720	2.4300
2018-07-02	494.043	2.4100
2019-07-05 9:00	492.744	3.0553
2019-08-30 9:30	492.733	2.7760

Figure 1: SA-1 Rating Curve

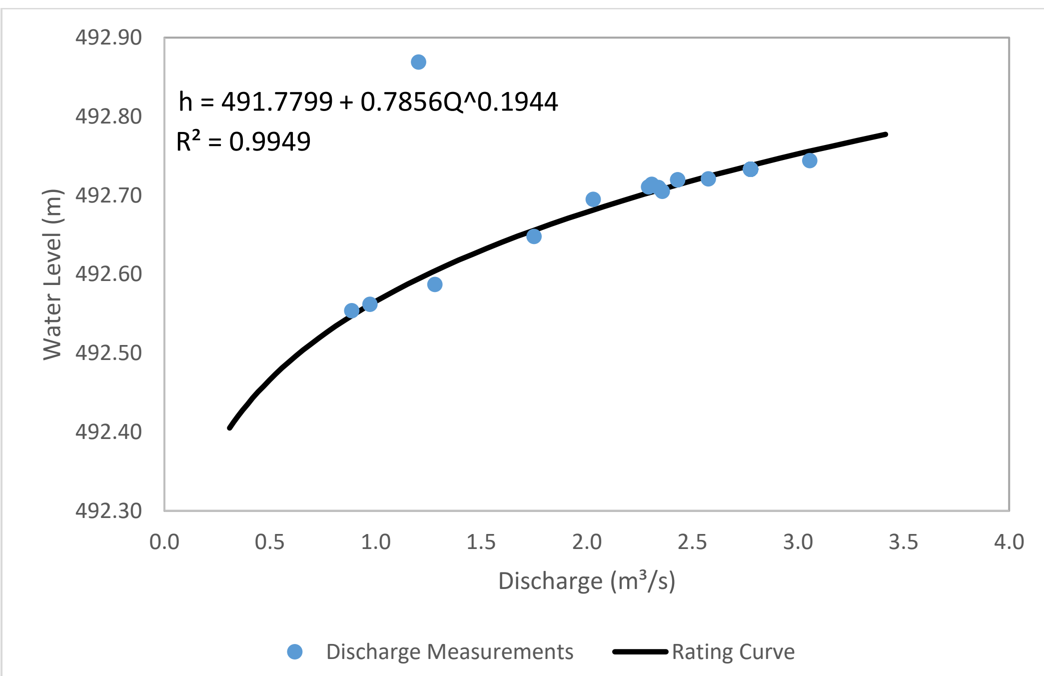


Photo 1: SA-1 - July Field Program

Photo 2: SA-1 - August Field Program

SA-2 (Northwest Flow into McGowan Lake)

Station SA-2 is located to the northwest of McGowan Lake. A datalogger is not installed at this location. During the 2019 monitoring program it was learned that the cross-section had been moved in 2016 creating a discrepancy in water levels. The old cross-section was identified during the August field program and sufficient data are available to correct the July 2019 measurement (Table 2 and Figure 2). The original cross-section will be used for measurements in future field monitoring programs. Photo 3 is taken of the cross-section used during the July field program while Photo 4 is the original cross-section used in August.

Table 2: SA-2 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2011-05-12	496.727	1.6490
2011-07-30	496.698	1.3870
2011-10-27	496.667	0.8090
2012-05-08	496.748	2.0080
2012-08-08	496.689	1.3050
2012-10-24	496.734	2.0300
2013-05-21	496.727	1.8420
2013-08-14	496.660	0.8630
2013-10-16	496.641	0.7410
2014-03-24	496.805	1.1800
2016-09-16	496.460	2.2400
2019-07-05 12:30	496.773	2.2095
2019-08-30 13:30	496.748	1.9537

Figure 2: SA-2 Rating Curve

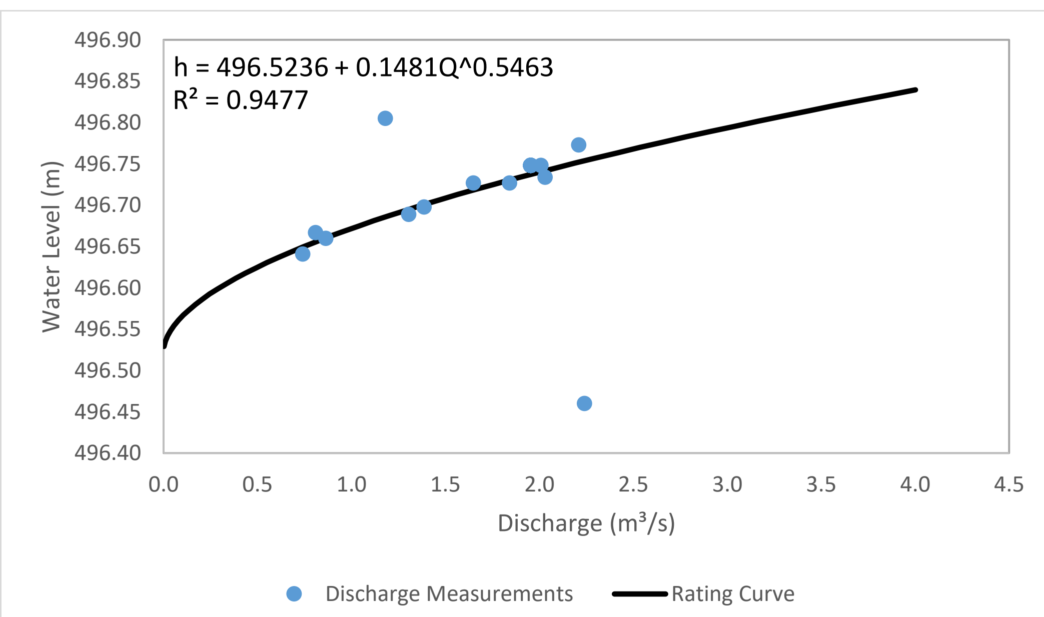


Photo 3: SA-2 - July Field Program

Photo 4: SA-2 - August Field Program

SA-3 (LA-2 to McGowan Lake)

SA-3 is located on an inflow stream to McGowan Lake from the northeast. The station does not have a datalogger. Stage and discharge measurement data are provided in Table 3 and plotted in Figure 3. Photo 5 and Photo 6 are taken during the July and August field programs, respectively. The stream at this location has a low gradient and, due to the proximity to the lake, is believed to have been slightly backwatered by McGowan Lake during 2019.

Table 3: SA-3 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2011-05-13	494.459	0.4760
2011-07-29	494.392	0.3700
2011-10-28	494.322	0.2390
2012-05-04	494.473	0.5280
2012-08-05	494.443	0.4780
2012-10-23	494.487	0.5780
2013-05-20	494.482	0.5640
2013-08-14	494.344	0.2550
2013-10-16	494.243	0.0510
2014-03-24	494.248	0.3620
2016-09-16	494.430	0.4400
2019-07-05 14:00	494.541	0.6219
2019-08-30 15:30	494.506	0.5474

Figure 3: SA-3 Rating Curve

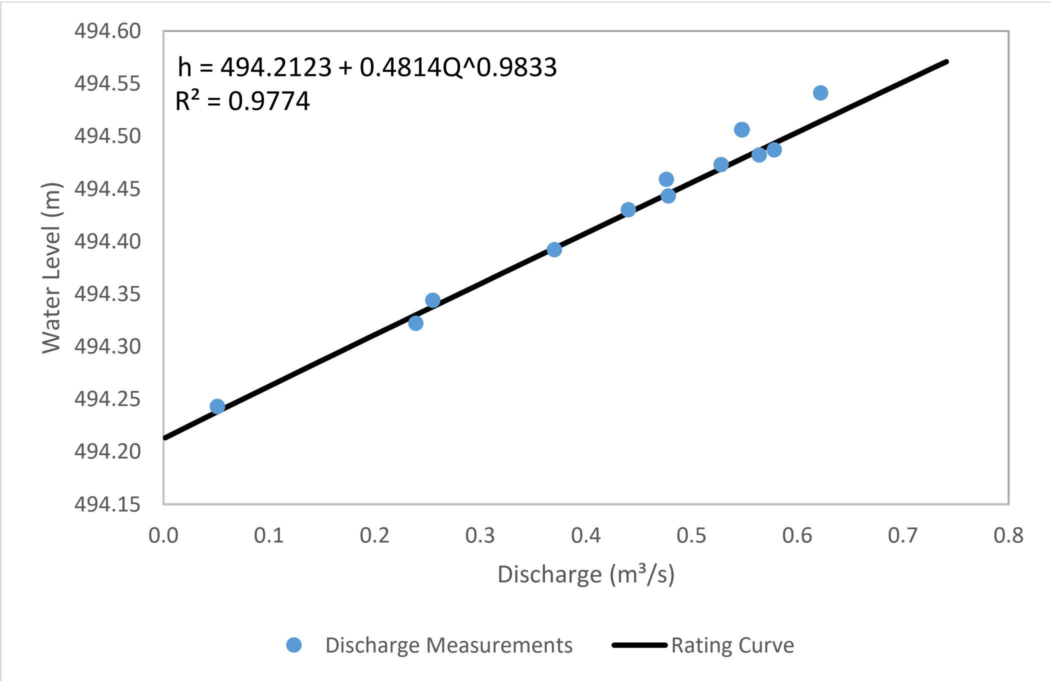


Photo 5: SA-3 - July Field Program

Photo 6: SA-3 - August Field Program

SA-4 (Downstream of Outflow from Kratchkowsky Lake)

SA-4 is located downstream of Kratchkowsky Lake and flows into LA-6 from the northwest. This station has a datalogger. The measured stage and discharge data are presented in Table 4 and Figure 4. Photo 7 was taken during the July field program while Photo 8 is from August.

Table 4: SA-4 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2011-05-11	506.357	0.4830
2011-07-30	506.314	0.3350
2011-10-31	506.310	0.1990
2012-05-04	506.348	0.4660
2012-08-05	506.329	0.3610
2012-10-22	506.367	0.4970
2013-05-19	506.369	0.5190
2013-08-13	506.277	0.2760
2013-10-17	506.249	0.2060
2014-03-23	506.381	0.3300
2016-09-10	506.350	0.4900
2017-05-30	506.370	0.5800
2018-06-29	506.357	0.4845
2019-07-04 12:00	506.387	0.6336
2019-08-29 13:00	506.374	0.5900

Figure 4: SA-4 Rating Curve

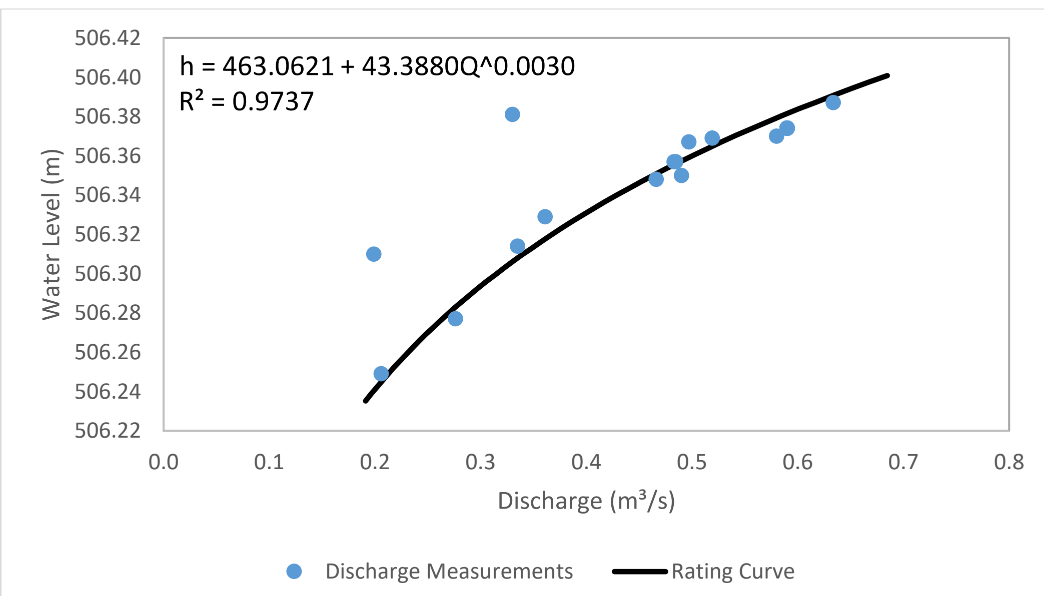


Photo 7: SA-4 - July Field Program

Photo 8: SA-4 - August Field Program

SA-5 (Northwest Inflow to LA-6)

A second northwest inflow to LA-6 is monitored at SA-5. This station is equipped with a datalogger and a new logger housing was installed during the August field program. Stage and discharge measurements are presented in Table 5 and the rating curve is shown in Figure 5. Photo 9 and Photo 10 show the cross-section during the July and August field programs, respectively.

This station has been measured at two cross-sections approximately 30 m apart. The reason for the change in cross-section is unknown at this time; however, efforts have been undertaken both in previous reporting and this document to shift all measurements to a common datum. This may not be justifiable in consideration of hydraulic characteristics but it will be possible in future measurements to confirm the shape of the rating curve and provide any additional shifts that may be required.

Table 5: SA-5 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2011-05-12	500.891	1.1000
2011-07-30	500.851	0.8580
2011-10-29	500.792	0.4760
2012-05-04	500.900	1.1110
2012-08-05	500.867	1.0260
2012-10-22	500.901	1.2690
2013-05-19	500.909	1.3810
2013-08-13	500.812	0.6160
2013-10-17	500.805	0.5070
2014-03-23	500.981	0.8860
2016-09-09	500.900	1.2700
2016-09-21	500.910	1.5800
2017-05-30	500.920	1.9500
2018-06-30	500.890	1.6567
2019-07-04 10:30	500.955	1.6137
2019-08-29 10:30	500.927	1.3589

Figure 5: SA-5 Rating Curve

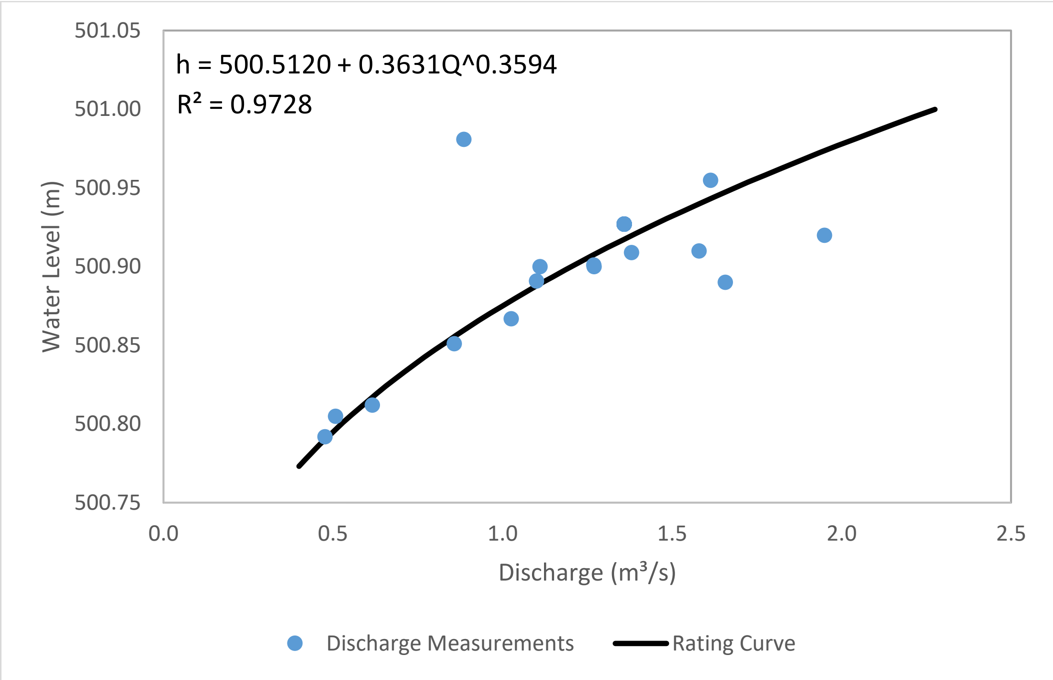


Photo 9: SA-5 - July Field Program

Photo 10: SA-5 - August Field Program

SA-6 (Outflow from LA-6)

SA-6 is the outflow from LA-6 and is equipped with a stage recording datalogger. The sensor and sensor housing at this location were replaced in August. Stage and discharge data for SA-6 are presented in Table 6 and the rating curve is shown as Figure 6. The cross-section is shown in Photo 11 for the July field program and Photo 12 is from the August field program.

Table 6: SA-6 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2011-05-13	500.084	1.6310
2011-07-30	500.034	1.3030
2011-10-27	499.956	0.7170
2012-05-06	500.098	1.9570
2012-08-05	500.061	1.4760
2012-10-22	500.102	1.8510
2013-05-19	500.077	1.5400
2013-08-13	499.992	0.8420
2013-10-17	499.969	0.7980
2014-03-23	500.081	1.1730
2016-09-11	500.070	1.9800
2017-05-31	500.080	1.7700
2018-06-30	500.125	1.5576
2019-07-04 14:30	500.125	2.2674
2019-08-29 16:00	500.110	2.0247

Figure 6: SA-6 Rating Curve

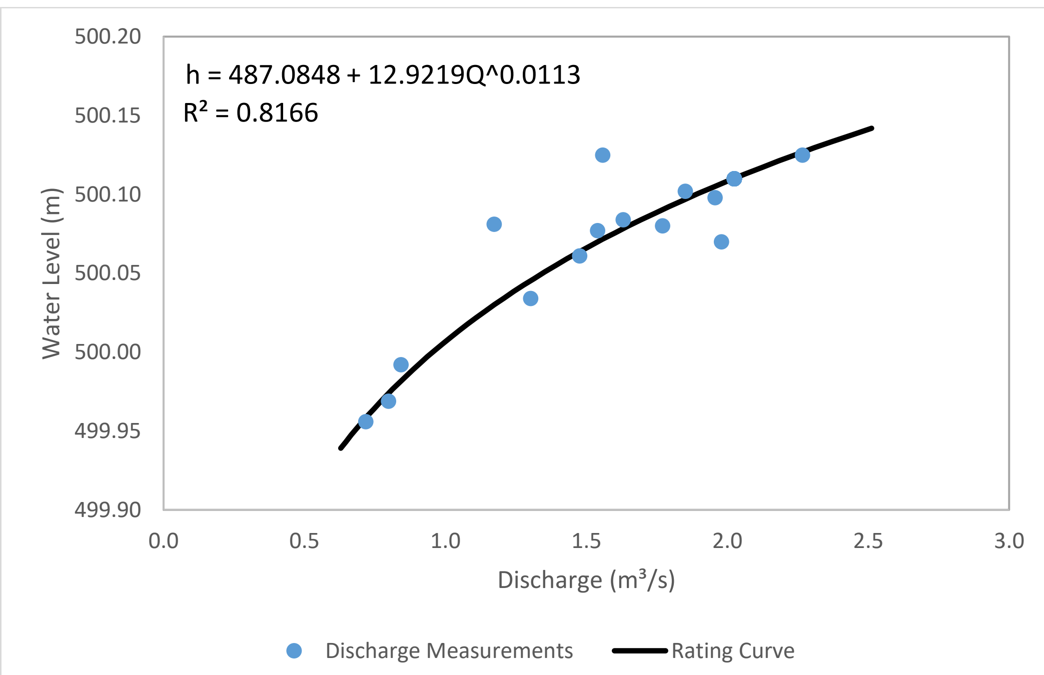


Photo 11: SA-6 - July Field Program

Photo 12: SA-6 - August Field Program

SA-8 (Inflow to Kratchkowsky Lake)

SA-8 is an inflow to Kratchkowsky Lake and was located immediately upstream of the shoreline. It is believed that stage measurements at that location were influenced by the lake level in Kratchkowsky Lake and not representative of the hydraulics of the inflow channel. The station was moved upstream and re-installed with a new sensor housing. The station was surveyed to new local benchmarks and not referenced to the old cross-section (Table 7). Photo 13 shows the old monitoring location during the July field program while Photo 14 was taken at the new upstream location in August.

Table 7: SA-8 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2016-09-15	520.600	0.0100
2016-09-19	520.620	0.0400
2017-05-30	520.540	0.0400
2018-07-03	520.570	0.0560
2019-08-31 10:00	99.455*	0.0443

* Referenced to local benchmark after moving measurement location.

Photo 13: SA-8 - July Field Program

Photo 14: SA-8 - August Field Program

SA-9 (Outflow from LA-8)

SA-9 is located downstream of LA-8 and is equipped with a datalogger. Insufficient stage and discharge measurement data (Table 8) are available to generate a rating curve at this time. Photo 15 was taken during the August field program.

Table 8: SA-9 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2016-09-18	520.520	0.1800
2017-06-01	520.490	0.1600
2019-08-31 14:10	520.547	0.1457

Photo 15: SA-9 - August Field Program

SA-10 (Northwest Inflow to LA-9)

SA-10 is an inflow to LA-9 and is equipped with a datalogger. Stage and discharge measurement data are presented in Table 9 but are insufficient to generate a rating curve. Photo 16 was taken during the August field program.

Table 9: SA-10 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2016-09-18	514.350	1.5500
2017-05-31	514.310	1.2200
2019-08-31 17:30	514.344	1.3127

Photo 16: SA-10 - August Field Program

SA-11 (North Inflow to Kratchkowsky Lake)

The north inflow to Kratchkowsky Lake is monitored at SA-11. This station is equipped with a datalogger. Stage and discharge measurement data are provided in Table 10 and the rating curve is shown in Figure 7. Due to the brevity of data, caution is advised when using this rating curve especially for extrapolation above the highest measured discharge. Photo 17 was taken of the cross-section during the August field program.

Table 10: SA-11 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2016-09-19	520.730	0.4200
2017-05-30	520.710	0.3100
2018-07-02	520.561	Not Measured
2019-08-31 11:00	520.713	0.3104

Figure 7: SA-11 Rating Curve

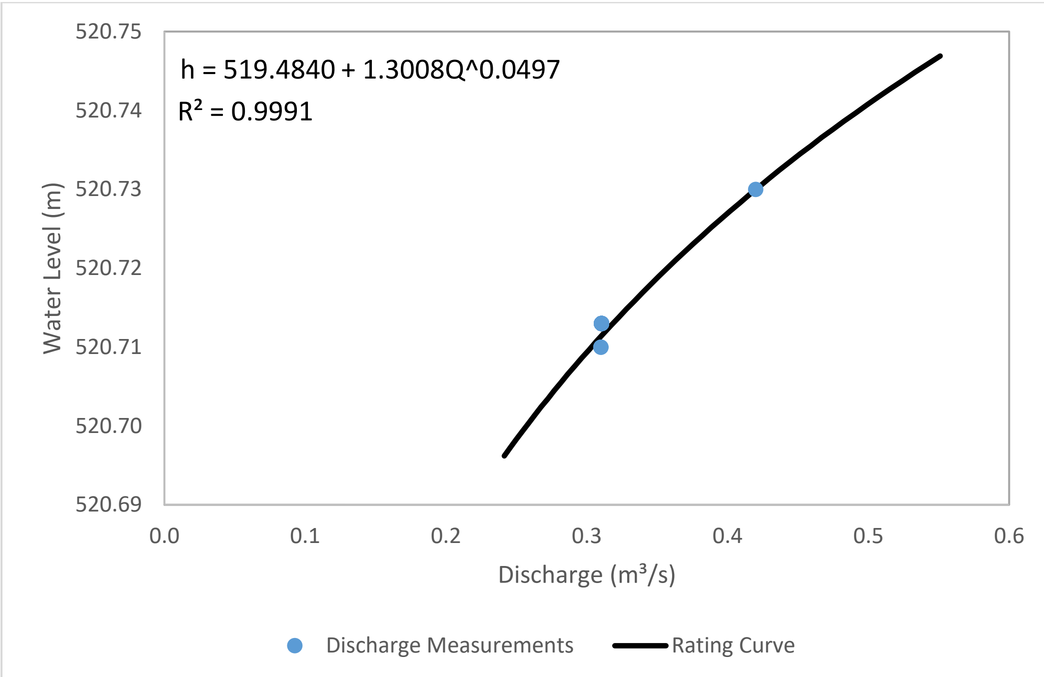


Photo 17: SA-11 - August Field Program

RC-1 (Outflow from Kratchkowsky Lake Upstream of SA-4)

RC-1 is measured near the outflow from Kratchkowsky Lake and upstream of SA-4. A datalogger is not installed at this location. Water level measurements in Table 11 are referenced to the lake water level measured at a different location on Kratchkowsky Lake. There are not enough data to generate a rating curve. Photo 18 and Photo 19 show the cross-section during the July and August field programs, respectively.

Table 11: RC-1 Stage and Discharge Measurements

Measurement Date & Time	Water Level (m)	Discharge (m^3/s)
2016-09-14	520.300	0.5800
2018-03-15	No WL Measured	0.2303
2019-07-06 9:00	No WL Measured	0.6041
2019-09-01 8:30	520.559	0.5514

Photo 18: RC-1 - July Field Program

Photo 19: RC-1 - August Field Program

LA-1 Water Level

Measurements of water level for LA-1 occur coincident with monitoring at SA-3. The stream and lake are separated by a long natural levy and survey benchmarks are located between the two stations and used for both water level surveys. Table 12 presents the survey data for LA-1. A new datalogger was installed at this location during the August field program.

Table 12: LA-1 - Water Level Measurements

Measurement Date & Time	Water Level (m)
2011-05-13	494.439
2011-07-29	494.327
2011-10-28	494.218
2012-05-04	494.423
2012-08-05	494.386
2012-10-23	494.448
2013-05-21	494.440
2013-08-14	494.265
2013-10-16	494.194
2014-03-24	494.298
2016-09-16	494.390
2018-07-02	494.344
2019-07-05 14:00	494.515
2019-08-30 15:30	494.476

LA-6 Water Level

LA-6 is upstream of SA-6. Water level survey (Table 13) was completed once during the August field program. A datalogger for LA-6 could not be found during the August field program; however, comparison of historical measurement between LA-6 and SA-6 (Figure 8) indicate that the water levels are similar enough to use water level data from the SA-6 datalogger to represent the water level of LA-6.

Table 13: LA-6 - Water Level Measurements

Measurement Date & Time	Water Level (m)
2011-05-13	500.063
2011-07-31	500.028
2011-10-27	499.943
2012-05-06	500.088
2012-08-05	500.058
2012-10-22	500.092
2013-05-19	500.088
2013-08-13	499.973
2013-10-17	499.947
2014-03-23	500.058
2016-09-12	500.070
2018-06-30	500.106
2019-08-29 14:25	500.118

Figure 8: Comparison of LA-6 and SA-6 Water Levels

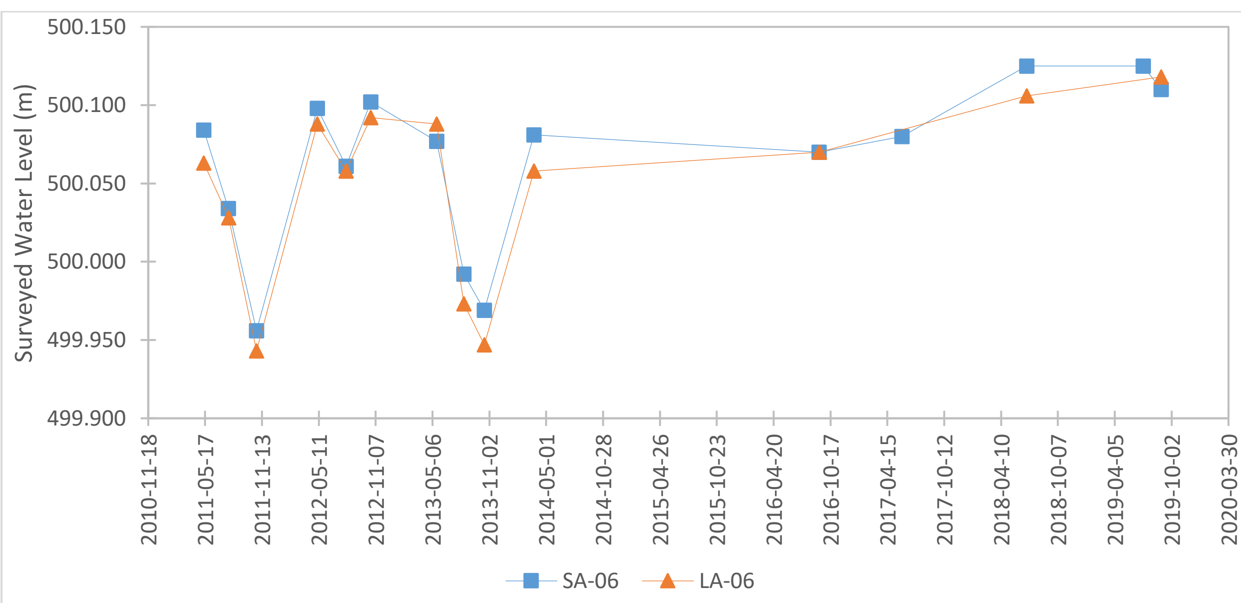


Photo 20: LA-6 - August Field Program

Water Quality Parameter Measurements

Water samples were collected during both 2019 field programs. Water quality parameters recorded during the August field program are presented in Table 14.

Table 14: August Water Quality Field Measurements

Station ID	SA-01	SA-02	SA-03	SA-04	SA-05	SA-06	RC-01
Water Depth (m):	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Water Temp (°C)	12.8	14	15.2	14.1	12.4	13.8	12.8
Conductivity (uS/cm):	14	13.7	16.7	15.8	12.3	13.7	15.4
Spec. Conductivity (uS/cm):	18.3	17.4	20.6	19.9	16.2	17.5	20.1
pH:	6.82	6.98	6.76	6.93	6.75	6.86	7.04
Dissolved Oxygen (mg/L):	8.91	9.11	9.21	7.15	7.81	7.33	9.09
DO Sat. (%):	84.1	88.2	92.3	70.2	73.2	71.1	86.1

Summary and Closure

On behalf of Denison, EcoMetrix has retained MWSI for monitoring and reporting of discharges in the vicinity of the Project. This reporting consists of the monitoring data and other pertinent observations recorded during two field programs in 2019.

This report has been prepared for the exclusive use of Denison and EcoMetrix. MWSI is not responsible for any unauthorized use or modification of this document. All third parties relying on information presented herein do so at their own risk.

MWSI appreciates the opportunity to work with Denison and EcoMetrix on this project. Should there be any questions regarding this document please contact the undersigned.

Respectfully submitted,

Missinipi Water Solutions Inc.

Tyrel J. Lloyd, M.Eng., P.Eng.

Senior Water Resources Engineer

References

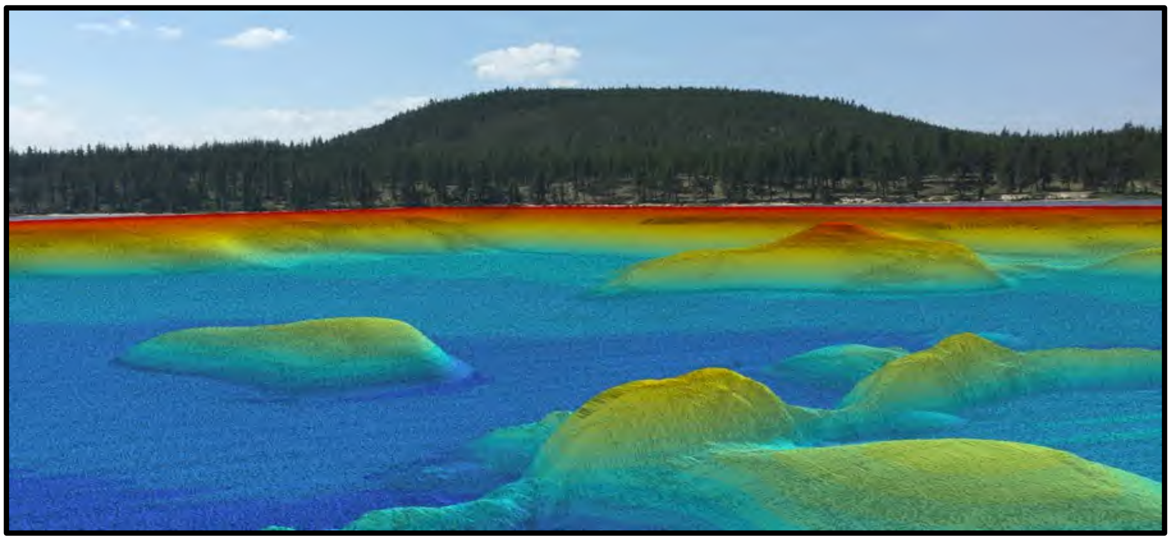
EcoMetrix Incorporated. 2019. Baseline Hydrology Summary Report – Wheeler River Project, Denison Mines. Ref. 16-2285. Mississauga, ON.

Terzi, R.A. 1981. Hydrometric Field Manual – Measurement of Streamflow. Inland Waters Directorate, Water Resources Branch, Environment Canada.

Appendix H Milne Technologies. 2018 Denison Mines (Wheeler River Site) Multibeam Sonar Bathymetry and Habitat Mapping Report

2018 DENISON MINES (WHEELER RIVER SITE) MULTIBEAM SONAR BATHYMETRY AND HABITAT MAPPING REPORT:

LAKES LA1 AND LA6



Prepared for:
Elaine Mason
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Scott W. Milne
September 18, 2018

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September 18, 2018

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Ms. Mason,

On behalf of Milne Technologies, I am pleased to present to you the final report from the 2018 Denison Mines (Wheeler River Site) Multibeam Sonar Bathymetry and Habitat Mapping Project in partial fulfillment of the data products and deliverables described in the Scope of Works provided to EcoMetrix Inc. on April 27, 2018.

The following document is intended to provide a detailed record of the data collection, post-processing methods and bathymetry/habitat map products.

All post-process data, geo-databases, GIS layers and supporting electronic files are provided on a USB memory chip and accompany this report. Other maps and figures of more detailed analyses are available in the Appendices.

Thank you for the opportunity to provide you with this report and I look forward to further collaborations in the near future. Please don't hesitate to contact me if you have any further questions.

Sincerely,

Scott W. Milne

Scott Milne

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1.0 INTRODUCTION

In 2018, EcoMetrix Inc. requested assistance from Milne Technologies to provide multibeam sonar bathymetry data collection, post-processing, map production and reporting towards producing high resolution bathymetry models and nearshore benthic habitat mosaics for a sub-set of Denison Mine, Wheeler River Site lakes. Lakes LA1 (west side of lake only) and LA6 were surveyed over a 3 day period in June 2018. The survey sites have been identified as areas where Denison Mine has proposed to construct intake and/or discharge structures to support mining operations.

The purpose of this report is to provide a detailed description of the data collection and post-processing methodologies as well as a summary of the bathymetry models and GIS deliverables.

2.0 DATA COLLECTION AND ANALYSIS METHODOLOGIES

2.1 STANDARDIZED DEPTH AND SURVEY ELEVATION

Survey elevation (msl) benchmarks were not available for the survey lakes, however we estimated the lake surface elevation (referenced to mean sea level) from the average observed real-time kinematic (RTK) corrected global positioning system (GPS) Orthometric height (elevation msl) recorded from a survey segment on each lake where $GPGGA GPS Quality Indicator = 4 and Number of Satellites >= 10.

Table 1. Average observed real-time kinematic (RTK) corrected global positioning system (GPS) orthometric height (elevation msl) recorded from a survey segment where $GPGGA GPS Quality Indicator = 4 and Number of Satellites >= 10.

Lake	Elevation (m) (inclds. 59 cm offset from GPS/INS to water surface)				
	Average	Std. Deviation	Minimum	Maximum	Count
LA1	493.88	0.02	493.81	493.97	200123
LA6	500.24	0.30	494.26	500.60	21650

2.2 KONGSBERG M^3 MULTIBEAM SONAR SYSTEM HARDWARE

Bathymetric profiling and imaging was completed using a Kongsberg-Mesotech Ltd. M^3 multi-mode multibeam (M^3) sonar system.

The M^3 sonar system has a nominal operating frequency of 500 kHz with 100 kHz bandwidth. The M^3 sonar system was operated in "profiling" mode to obtain high resolution vertical bathymetry points from the lake bottom.

In the sonar "profiling mode", pulses are generated and received on two independent transducer elements, consisting of a single channel transmitter and a 64 element receiver. The associated signal processing software forms a 120^o swath image (in the athwartship plane) of the water column formed by 256 receive beams, each with an apparent beam-width of <0.5^o x 3^o (figure 1). The M^3 host software provides a sophisticated bottom detection algorithm to generate 256 bottom points per acoustic transmission (or ping).

Raw beamformed data, collected in “fast-profiling” mode, were recorded in the Kongsberg *.mmb file format (see "\\..\EcoMetrix\DenisonMine\Data\M3\ mmb\”). Operating at a rate of 11 to 14 pings per second, the software builds a 3-dimensional point cloud of the bottom in real-time. In post-processing, all raw *.mmb data were replayed in the M3 Host software (version M3 ver. 2.20) using the beamforming over-ride batch processing method (using standard profiling beamforming) and profiling points were exported as Kongsberg *.all type files (see “\\\..\EcoMetrix\DenisonMine\Data\M3\REPLAY_ALL\”).

The Kongsberg M^3 multibeam sonar transducer head was mounted on a pole affixed to the port-side gunwale of the Denison Mines supplied aluminum boat. The face of the transducer was deployed approximately 38.0 cm below the water surface. The primary GPS antenna was positioned 192 cm starboard of the sonar head (or 96.5 cm starboard of inertial navigation system (INS)) and was raised up approximately 52.2 cm from the INS (figure 2). A summary of the hardware and software parameter settings are shown in Table 2a.

Field Note: *Strong magnetic interference was observed to negatively affect the performance of the inertial navigation system (INS) during the LA6 surveys. This resulted in inconsistent measures of vessel heading. Therefore the INS was taken off line at 15:24 and the heading was calculated from the course-over-ground (COG) and roll was fixed at 2.5^o for the remaining LA6 transects. The INS was recalibrated at camp that evening and operated as expected for the LA1 surveys the next day.*

Table 2a. Summary of the survey hardware and software parameter settings.

Hardware and/or Software	Parameter	Units / Comments	LA6	LA6 > 0018_20180624_152405.HS2x	LA1
Date			June 24	June 24	June 25
M3_Host_SW	CastAway M3 Max Sound Velocity	m/s	1484.3	1484.3	1484.8
	X Offset (m) athwartship	m	-0.965	-1.917	-0.965
	Y Offset (m) alongship	m	0	0	0
	DEPTH (m) Sonar to Surface	m	0.38	0.38	0.38
	Z Offset (m) Sonar to GPS	m	-0.97	-0.97	-0.97
	Orientation		Inverted Downward	Inverted Downward	Inverted Downward
	Pitch Angle	(º)	-90	-90	-90
	Roll Angle	(º)	0	0	0
	Yaw Angle	(º)	180	180	180
Ellipse-E INS Lever Arms to Antenna	X Offset (m) alongship	m (Aft is "-")	0	0	0
	Y Offset (m) athwartship	m (Port is "-")	0.952	0.952	0.952
	Z Offset (m) GPS Antenna to INS	m (GPS over INS "-" value)	-0.522	-0.522	-0.522
Ellipse-E INS Main Lever Arms to Centre Point	X Offset (m) athwartship	m (Aft is "-")	0	0	0
	Y Offset (m) alongship	m (Port is "-")	0	0	0
	Z Offset (m) INS to Centre of Mass	m (CTR over INS "-" value)	0	0	0

Table 2b. Summary of the Hypack Patch test and MBMAX64 parameter settings.

Hardware and/or Software	Parameter	Units / Comments	LA6	LA6 > 0018_20180624_ 152405.HS2x	LA1
Hypack Patch Test	Yaw Angle (o) Offset	(º)	1.25	1.25	1.25
	Pitch Angle (o) Offset	(º)	-1.5	0	-1.5
	Roll Angle (o) Offset	(º)	1.03	2.5	1.03
Hypack M3	Starboard Offset	m	0	-0.952	
	Vertical Offset	m	-0.59	-0.59	-0.59
MBMAX64	Filter - Over/Under		YES	YES	YES
	Filter - Beam limits per side	(º)	57	57	57

*Note vertical offset adjusted	
0034_20180624_160149.HS2x	0.69
0035_20180624_160544.HS2x	0.69
**Note ROLL offset adjusted	
0034_20180624_160149.HS2x	-1.5
0035_20180624_160544.HS2x	-1.5

2.3 REAL-TIME KINEMATIC (RTK) GPS CORRECTIONS AND VESSEL ATTITUDE CORRECTIONS (HEAVE, PITCH AND ROLL)

Horizontal spatial accuracy was typically better than 12 cm with the deployment of the on-site Hemisphere GPS R120 DGPS receiver RTK base-station that provided real-time GPS satellite receiver phase corrections to the survey data stream. The RTK base station was positioned on shore with an unobstructed view of the sky and also provided a consistent "line-of-sight" to the survey vessel (figure 3). RTK corrections were provided to the survey vessel using a pair of Microhard VIP 2.4 GHz radios and L-Comm 8 dB antennas. The rover GPS system was a Hemisphere VS110 DGPS with true-heading capabilities. Fine-scale pitch, roll and vessel heave corrections were measured at the sonar pole mount using an SBG Systems Ellipse-E Inertial Navigation System (INS).

2.4 PATCH TESTS (PITCH, ROLL, HEADING AND SENSOR LATENCY CALIBRATIONS)

The "patch test" corrects for residual mounting angle errors that remain after the static calibration (physical measurements of sensor mounting locations) is defined. The method utilizes the repeatability of lakebed features when viewed from different geometries (i.e. transect offsets, opposing transect directions and varying survey speeds) in order to determine the residual mounting angles between the sonar transducer, inertial navigation system and RTK corrected Differential Global Positioning System (DGPS). Patch tests are most successful over deep water where angle measurement errors are lowest. Patch test data were collected on Lake LA1 at the end of the survey day. Post-processing of the patch-test data followed the recommendations in the Kongsberg Mesotech "Collecting and processing bathymetry data: User Manual" (Smith 2013). Patch tests data were processed in Hypack 2018 HySWEEP hydrographic processing software (HYPACK, Inc., Middletown CT.). Patch test corrections are shown in Table 2b.

2.5 SOUND VELOCITY

The sound velocity profile was estimated from the observed water temperature, salinity and conductivity at the beginning of each survey day. "Conductivity-Temperature-Depth" (CTD) profile data were recorded using a Sontek CastAway profiling logger (figure 4). Sound velocity profiles were exported from the CastAway software as a *.vel file and imported into the Hypack 2018 HySWEEP hydrographic processing software.

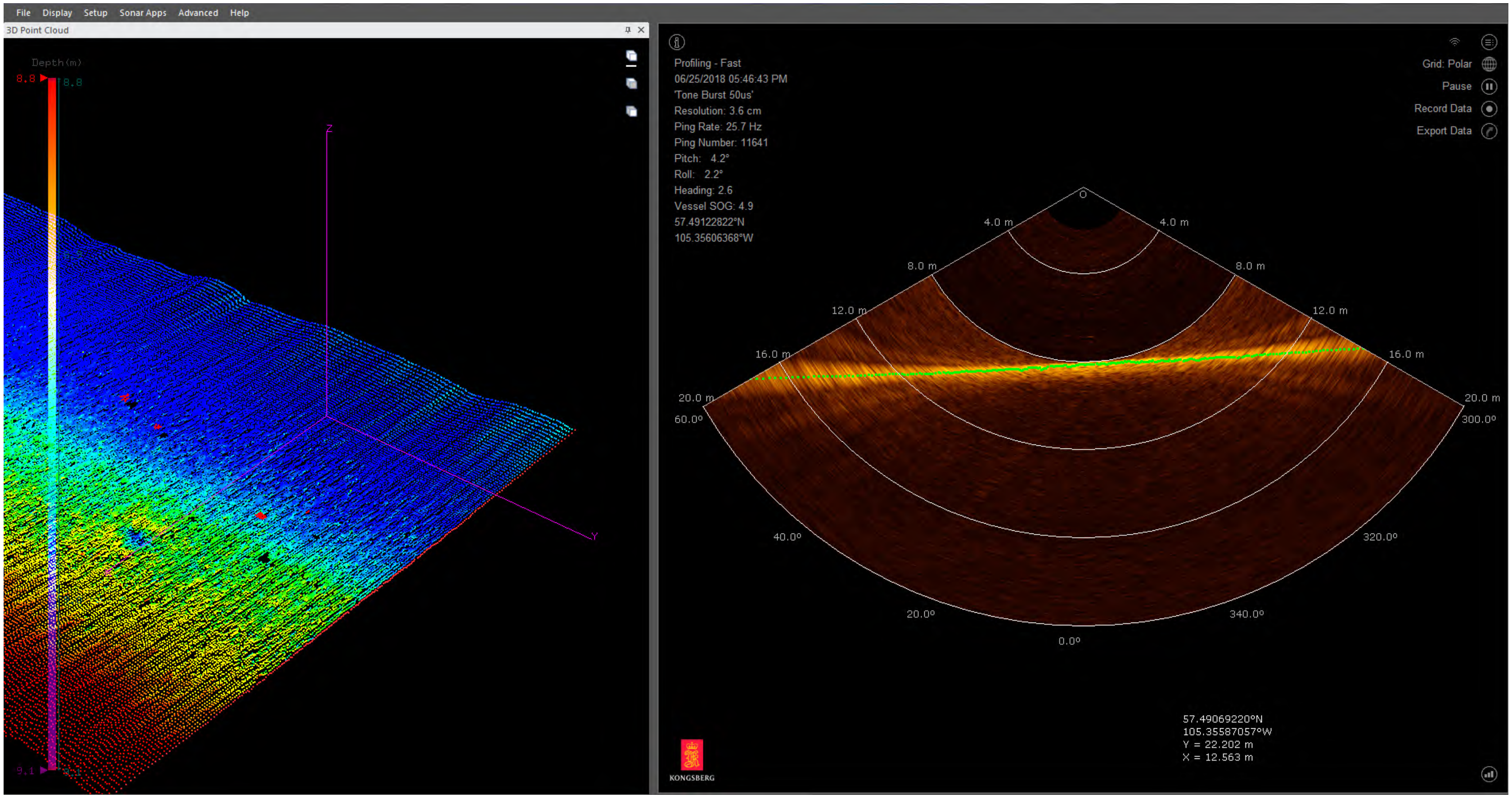

Figure 1. Screen shot from the Kongsberg M^3 data collection software. The real-time 3D point cloud (from Lake LA1) is shown in the left panel and a frame from the M3 multibeam sonar echogram is shown in the right panel. The bottom detection points are shown as green dots.

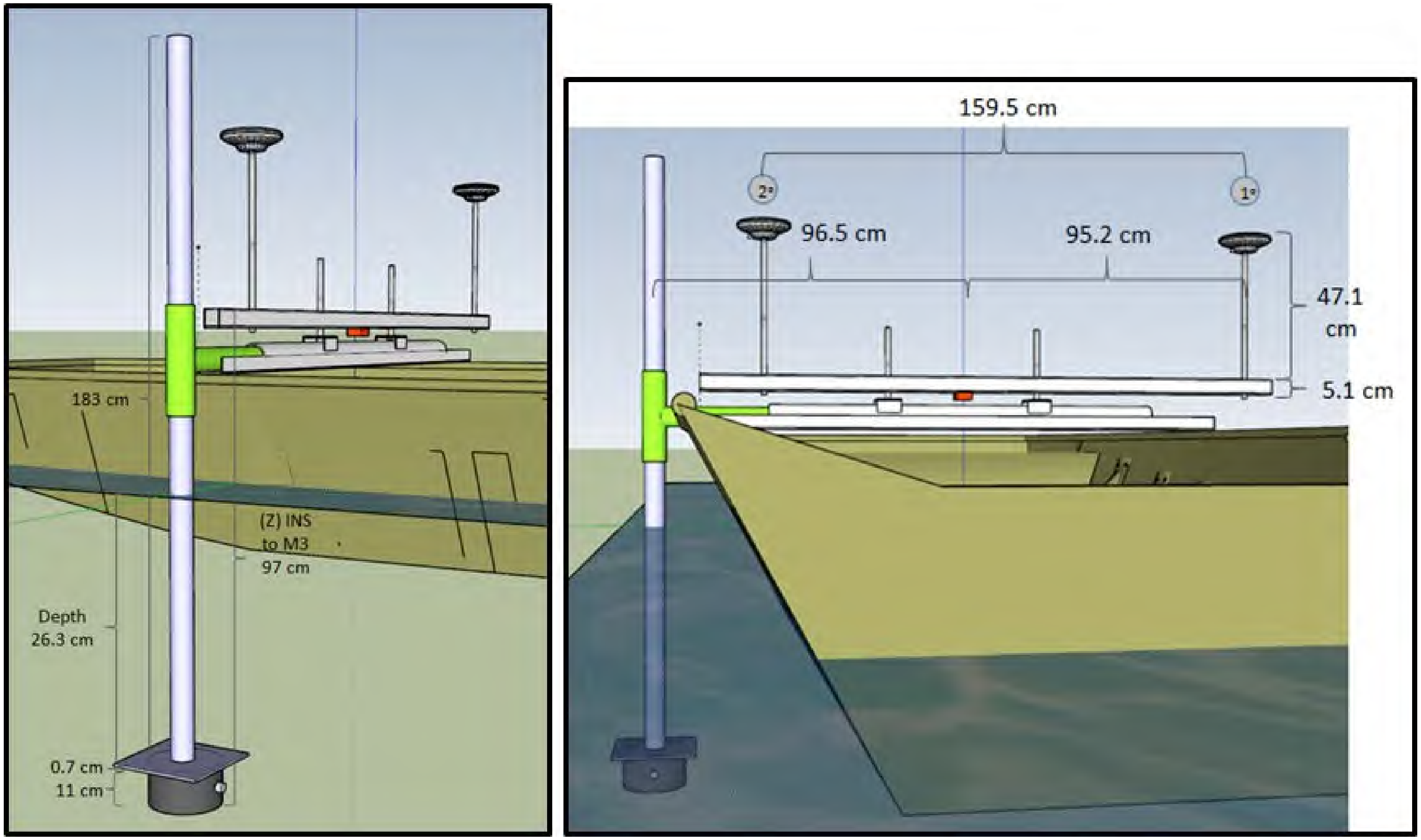

Figure 2. The Kongsberg M³ sonar system set up on the aluminum boat.

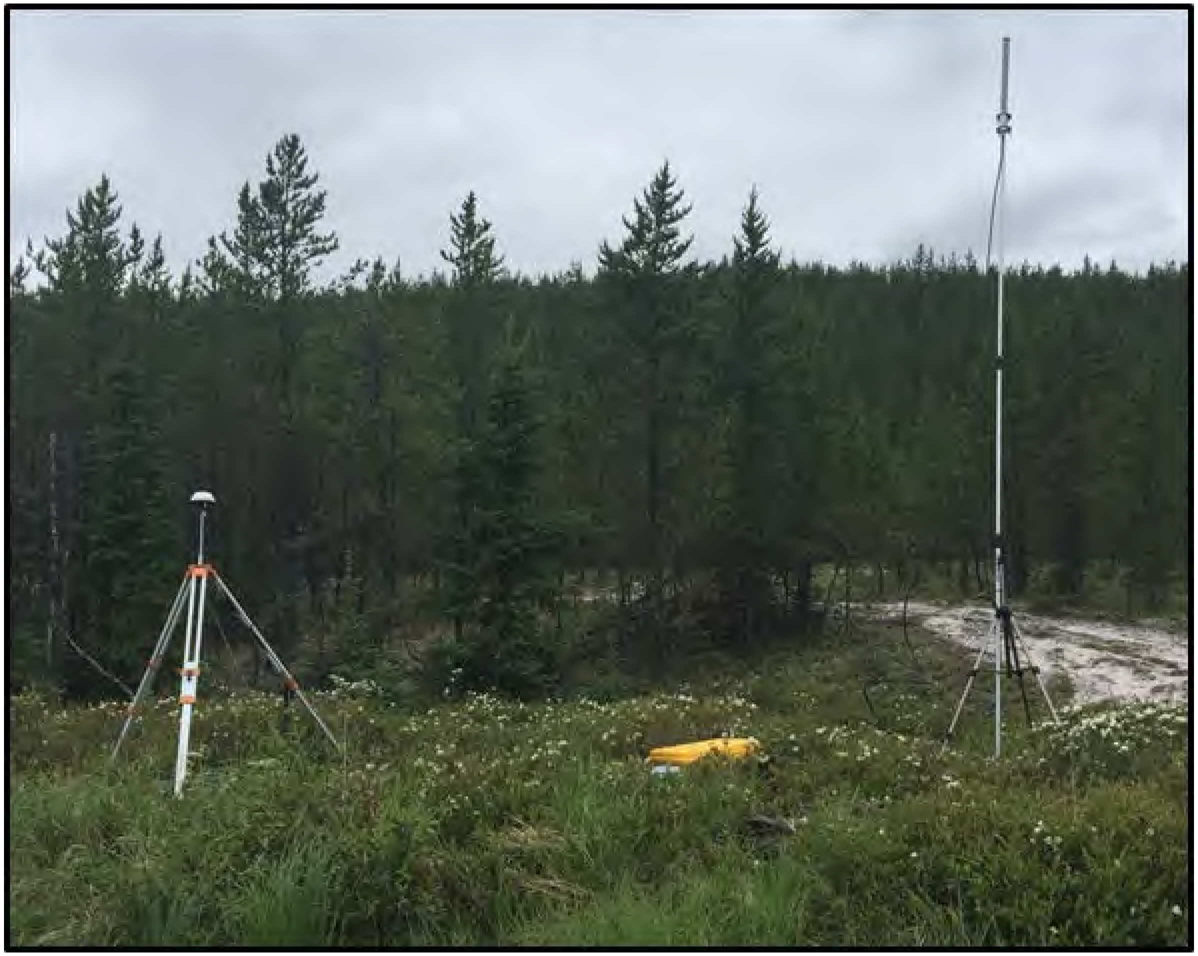

Figure 3. Shown is the Real-time Kinematic (RTK) GPS base-station and radio modem set-up on Lake LA6. A similar setup was deployed at Lake LA1.

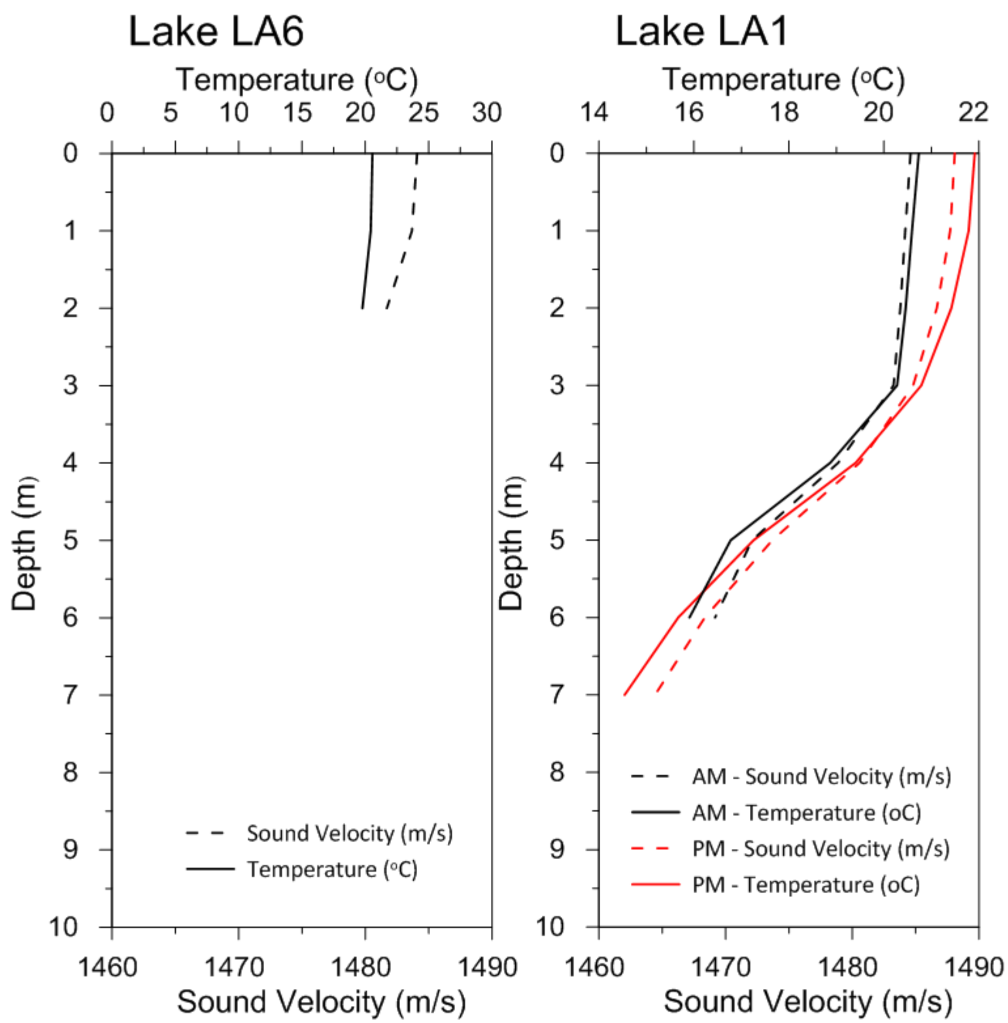

Figure 4. Observed Sontek CastAway "Conductivity-Temperature-Depth" (CTD) sonde water temperature (oC) and sound velocity (m/s) profiles for Lakes LA6 and LA1 recorded on the bathymetry survey day. Profiles recorded before commencing surveys are shown as black lines and post-survey are shown as red lines.

2.6 MULTIBEAM SONAR BATHYMETRY PROFILING

Kongsberg M^3 sonar echograms for all surveys were logged to the laptop in the native *.mmb format. All files were replayed in the M^3 host software and the 3D point cloud was exported to the Kongsberg *.all data format and imported into Hypack HySWEEP hydrographic software (HYPACK, Inc., Middletown CT.). Within Hypack hydrographic software, *.hsx multibeam data files were generated and imported into the HySWEEP Editor - 64 multibeam processing module within Hypack. Within HySWEEP, wiggle plots of the bathymetry files were generated to identify and remove outliers, fish detections, side-lobe and sub-bottom detections. File segments where GPS problems were observed were removed. Patch test data were processed to determine roll, pitch, yaw and sensor latency offsets. Scrubbed *.hs2x files (\\..\EcoMetrix\DenisonMine\Data\Hypack2018\Projects\DenisonMines\Edit) were then compiled onto a 0.1 m x 0.1 m grid and the average (AVG) depths were assigned to each cell from all observed bathymetry points that fell within the grid cell. To keep file sizes manageable, grid cells were then resampled to a 0.3 m x 0.3 m cell size and were exported as an *.xyz text file ("LA1_AVGZ_030cm_XYZ.txt" and "LA6_AVGZ_030cm_XYZ.txt") for importing into ESRI ArcGIS (ESRI). XYZ files are available in "\\..\EcoMetrix\DenisonMine\Data\Hypack2018\Projects\DenisonMines\Sort\".

2.7 BATHYMETRY SURFACE CREATION IN ARCGIS

The lake outlines (provided by EcoMetrix Inc.) for each of the survey lakes were modified and/or redigitized to contain all the observed XYZ data points. The lake outlines were split into 1 m segments and converted to XYZ points where Z = 0 m.

The multibeam sonar bathymetry survey data was limited to a minimum depth of 48 cm over the shoals. Where the shoreline was > ~25 m from the survey transect or where the area was too shallow (< 1 m) to be safely surveyed, we estimated the nearshore depth as ~40 cm (LA1) or ~50 cm (LA6) to generate a more realistic littoral area slope between the shoreline and the closest bathymetry survey point. Maps of the modified shoreline and the estimated contour lines are shown in Figures 5a-b.

Within the GIS, we used the 3D Analyst ArcGIS extension to generate a triangulated irregular network (TIN) surface from the XYZ bathymetry grid points, the modified shoreline points and the estimated ~40 cm (LA1) or ~50 cm (LA6) contour points. The

TIN surface was clipped using the "Delineate TIN Data Area" tool to remove all TIN components with an edge > 50 m. We used the Convert TIN to Raster tool to present the bathymetry model as an ArcGIS GRID with a 0.3 m x 0.3 m cell size.

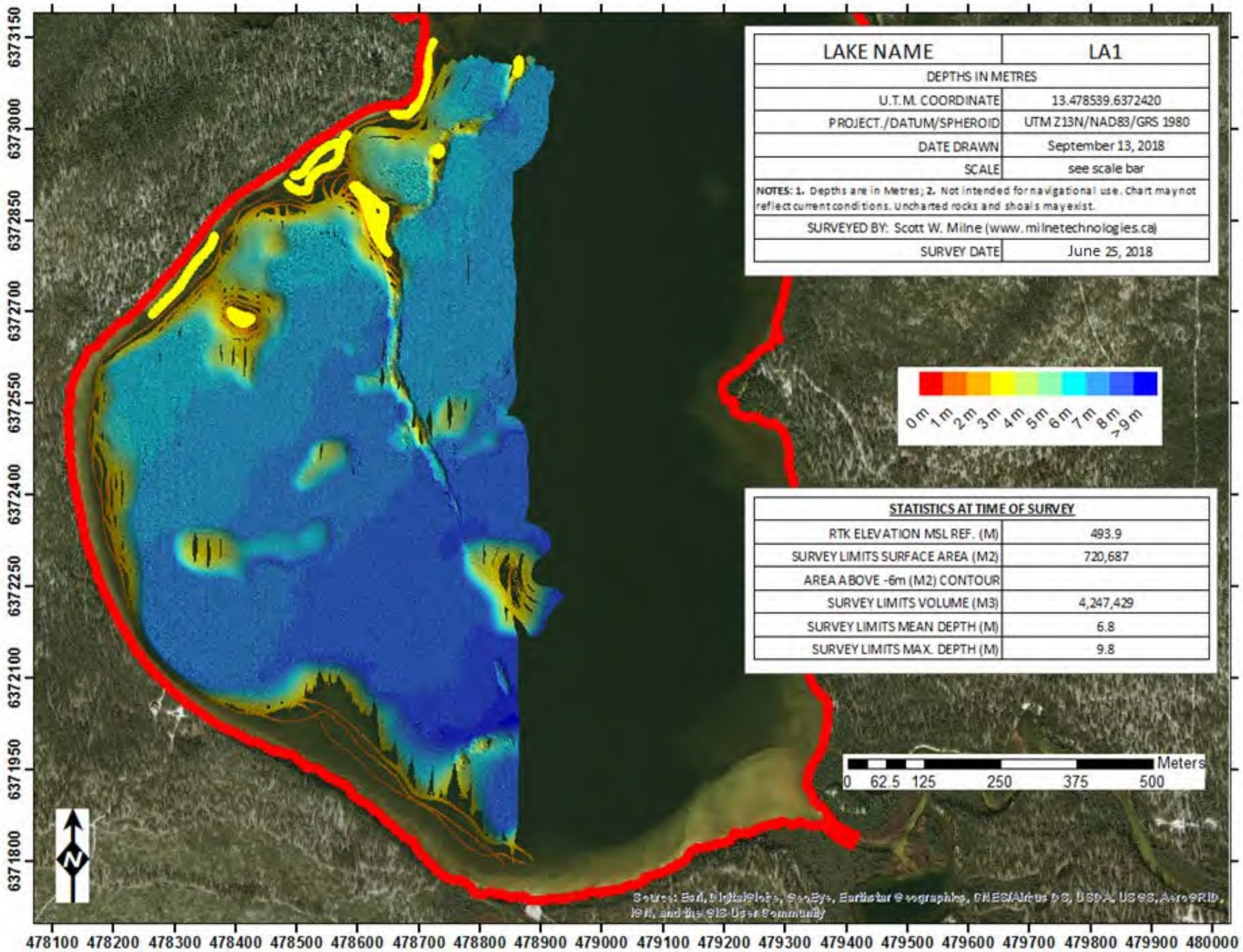

Figure 5a. Map of Lake LA1 showing the observed multibeam sonar bathymetry survey coverage (TIN model), the modified shoreline points (red points) and the estimated 40 cm depth contour points (yellow points).

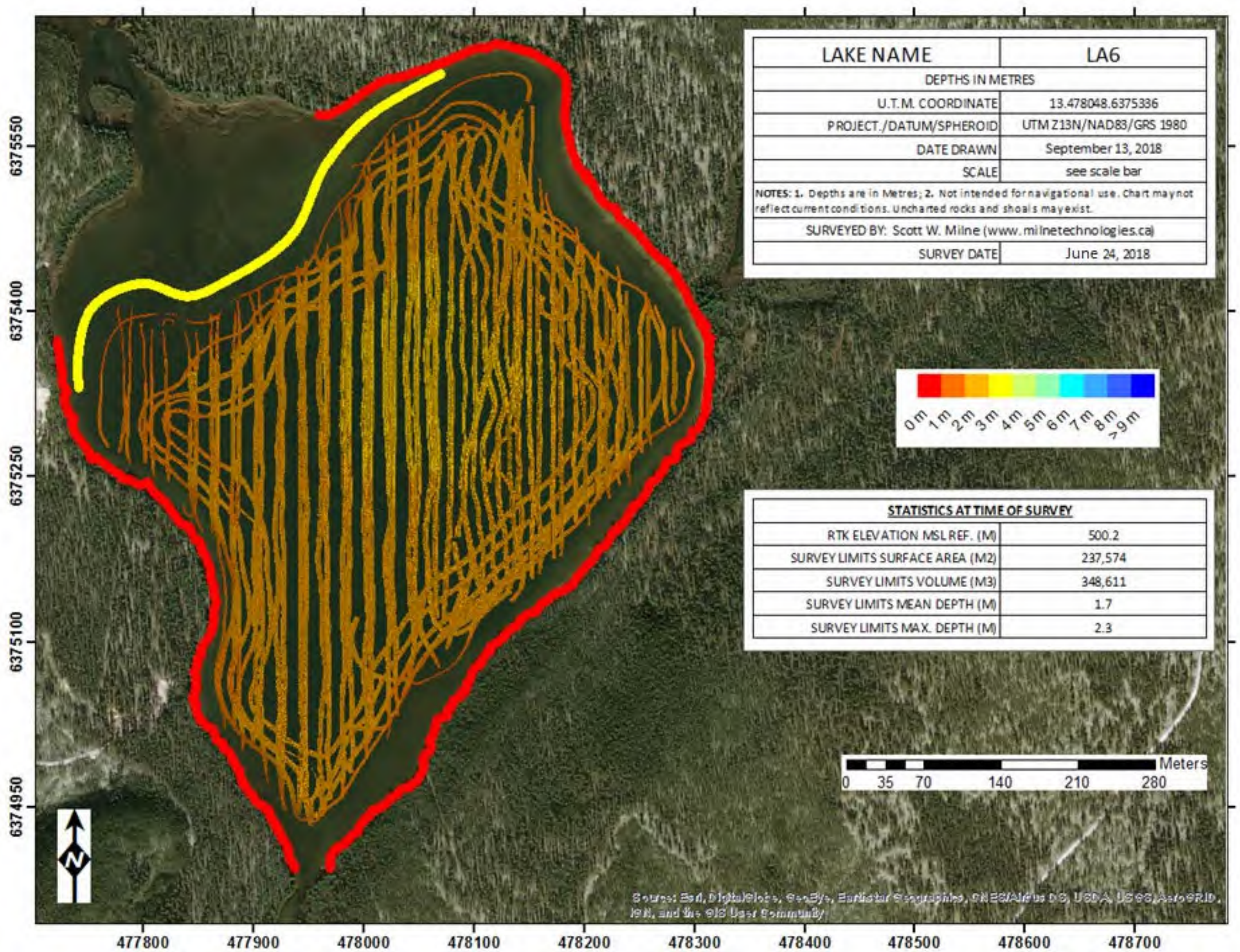

Figure 5b. Map of Lake LA6 showing the observed multibeam sonar bathymetry survey coverage (TIN model), the modified shoreline points (red points) and the estimated 50 cm depth contour points (yellow points).

2.8 MBES HABITAT MOSAICS (VEGETATION COVERAGE, COURSE WOODY DEBRIS AND BOTTOM SUBSTRATE COMPLEXITY)

Similar to the multibeam bathymetry surveys described above, we deployed the M^3 multibeam echosounder system from the Denison Mines aluminium boat. For this task the sonar head was oriented to look horizontally from the side of the survey vessel. The M^3 was operated in “eIQ imaging mode” to record high resolution images of the lake bottom features (course woody debris, boulders, submerged aquatic vegetation (SAV) etc.), relief (cobbles, rocks and gravel vs. mud, old tires etc.) and infrastructure (lost exploration gear, submerged pipes etc.). These images were “stitched” together on-the-fly using “Stand-Alone Mosaicking Module for Forward Looking Sonar” (SAMM-FLS, Oceanic Imaging Consultants, Honolulu, Hawaii, USA) sonar processing software. This software provided a geo-referenced “picture” (or mosaic of sonar images) of the nearshore (<8m) benthic habitat. In the sonar imaging mode, pulses were generated on 4 independent element arrays and received on a single transducer array, consisting of a 4 channel transmitter and a 64 element receiver. The associated signal processing software formed a 140^o swath image (in the horizontal plane), of the water column formed by 216 receive beams, each with a beam-width of 0.8^o x 30^o (at nadir).

All “Stand-Alone Mosaicking Module for Forward Looking Sonar” (SAMM-FLS) project files are available in the directory “\\..\EcoMetrix\DenisonMine\Data\SAMM_FLS\LA1\” and “..\LA6\”.

2.9 RELEVANT GIS LAYERS

.. \\EcoMetrix\DenisonMine\GIS\Bathy

*Note: "LA*x*" is the lake name (**1** or **6**)

LA*x*_AVGZ_030cm_XYZ_MODEL.lyr – Observed average depth calculated from all observed multibeam sonar profiling points within each 30 cm grid cell.

LA*x*_BathyContour_1m.lyr – 1 m depth contour polylines generated from the triangulated irregular network (TIN) bathymetry surface. Note that the layer includes a definition query expression "LENGTHM" >=50.

LA*x*_BATHY_MODEL.lyr – The triangulated irregular network (TIN) surface generated from the **average** XYZ bathymetry grid (0.3 m x 0.3 m) points. This layer combines all the high resolution bathymetry data, shoreline points and the estimated 40 cm or 50 cm contour points.

LA*x*_BATHY_RAW.lyr – The triangulated irregular network (TIN) surface generated from the **average** XYZ bathymetry grid (0.3 m x 0.3 m) points. This layer includes only the observed high resolution bathymetry data (no shoreline points and no estimated contour points).

.. \\EcoMetrix\DenisonMine\GIS

LA-*x* Shoreline.lyr –Lake outline polygon provided by EcoMetrix Inc.

.. \\EcoMetrix\DenisonMine\GIS\SAMM_FLS

SAMM_LA1.tif.lyr - The SAMM-FLS habitat imaging mosaic from LA1, shoreline and shoals.

SAMM_LA6_Shoreline.tif.lyr - The SAMM-FLS habitat imaging mosaic from LA6 shoreline area.

SAMM_LA6_CentreBasin_4cm.tif.lyr – The SAMM-FLS habitat imaging mosaic from LA6 centre basin area.

SAMM_LA*x*_HABITAT.lyr – Unsupervised substrate classification polygons traced from the SAMM_FLS mosaics. Unsupervised substrate classes include sand, gravel, submergent and emergent vegetation.

3.0 RESULTS

All map products (standard and high-resolution) are available in the folder "**..\\EcoMetrix\DenisonMine\GIS\Images**". High resolution (600 dpi) versions of the maps within this report are indicated with the "_HIRES.bmp" suffix.

Additional figures and maps are available in "**..\\EcoMetrix\DenisonMine\Data_Summary\2018_WheelerR_L1L6_MBES_Bathymetry_Mapping_Report-AppendixI.pptx**".

The bathymetry surface for the survey area within Lake LA1 is shown in figure 7a-d. Within the survey area, the observed mean and maximum depth is 6.8 m and 9.8 m, respectively. The nearshore area of Lake LA, within the survey area, is characterized by a shallow sand beach shelf that extends 15 m to 133 m out from shore. The edge of the beach shelf is steep, falling away quickly into a broad flat basin with a bottom depth of approximately 8 m. Within the basin, a number of shoal features and ridge-lines are apparent.

Although bottom sampling was not completed (i.e. underwater video, Ekman dredge sampling, etc.), horizontal sonar imaging reveals that these shoal features are significantly more acoustically reflective (i.e. harder substrates such as gravel, cobble and sand) than the flat basin that appears to be less reflective (indicating soft substrates, mud, detritus etc.)(figure 8). Both the bathymetry and horizontal sonar imaging surveys revealed very low densities of submerged vegetation stems within the main basin and on the shallow sand beach shelf. There was also no obvious accumulation of coarse woody debris or large rocks and boulders. Although backscatter intensity was relatively high over the mid-lake shoals, the absence of acoustic shadows and low bathymetry relief indicate the substrate in these areas are likely sand, gravel and small cobble with very few large rocks.

The bathymetry surface for the survey area within Lake LA6 is shown in figure 10a-d. This very shallow lake had an observed mean and maximum depth of only 1.7 m and 2.3 m, respectively. The lake morphology can be described as a "frying pan" shape with a very shallow and flat bottom and a relatively short slope up to the shoreline. Acoustic backscatter within the mid-basin indicates the substrate is very soft and suggests the acoustic detected bottom substrate has a high water content, almost flocculent-like. Although the M^3 MBES bottom detection algorithm is robust, in this case, the bottom point detections within ~ 15^o of the beam nadir varied in range (or depth) by approximately 10 to 15 cm. This is likely why the bathymetry models shows some "striping" in the north-south orientation.

Water depth within the region of the intake delta at the north-west corner of Lake LA6 was too shallow to safely survey. The relative acoustic backscattering strength at the outer edge of the intake delta and near the outflow was much higher than that of the main basin and may indicate harder substrate types such as sand (at outflow) and sand gravel mix (at edge of inflow delta).

Physical bottom sampling was not completed on Lake LA6, however the horizontal sonar imaging reveals some relevant habitat features such as stands of emergent and submergent vegetation, sand bars, probable gravel patches and some unknown features that may be lost exploration gear, tires and culverts (figure 11).

Dense patches of long-stemmed submergent vegetation were observed near the intake delta edge on the west side of the lake. Elsewhere, although sparse, some submergent vegetation stems were observed in the mid-basin, however the stem heights were only approximately 10 to 20 cm. Emergent vegetation was limited to the nearshore and shoreline areas.

A large nearshore horse-shoe shaped patch at the southern end of Lake LA6 showed a relatively strong acoustic reflection consistent with sand. Other small patches of relatively strong reflective material are consistent with gravel as these areas showed fine shadowing indicating substrate roughness. Overall, the dark colour of the sonar mosaics within the main basin indicates a relatively low acoustic backscattering strength that is consistent with a mud or detritus bottom with high water content.

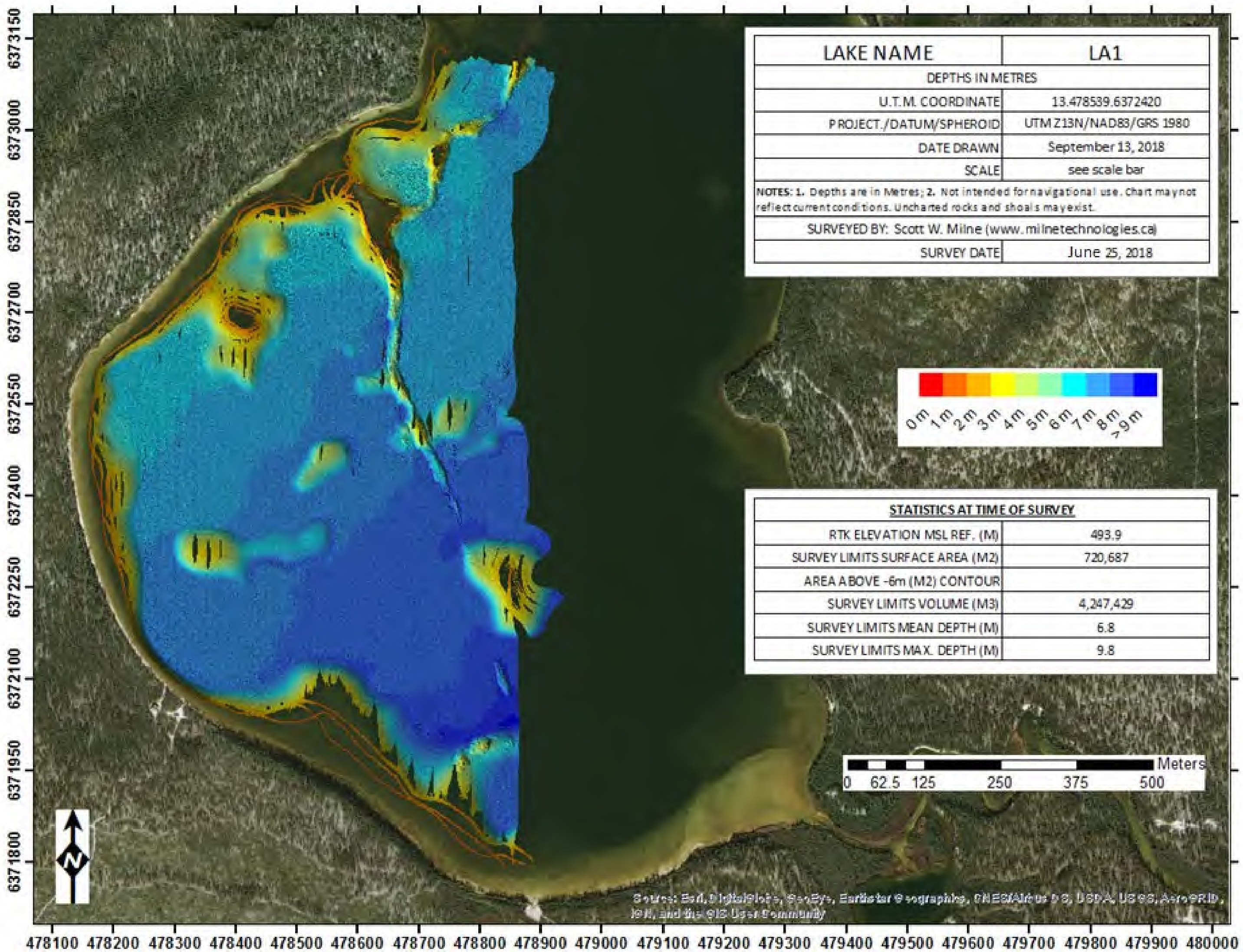

Figure 6. Observed multibeam sonar bathymetry survey coverage of Lake LA1.

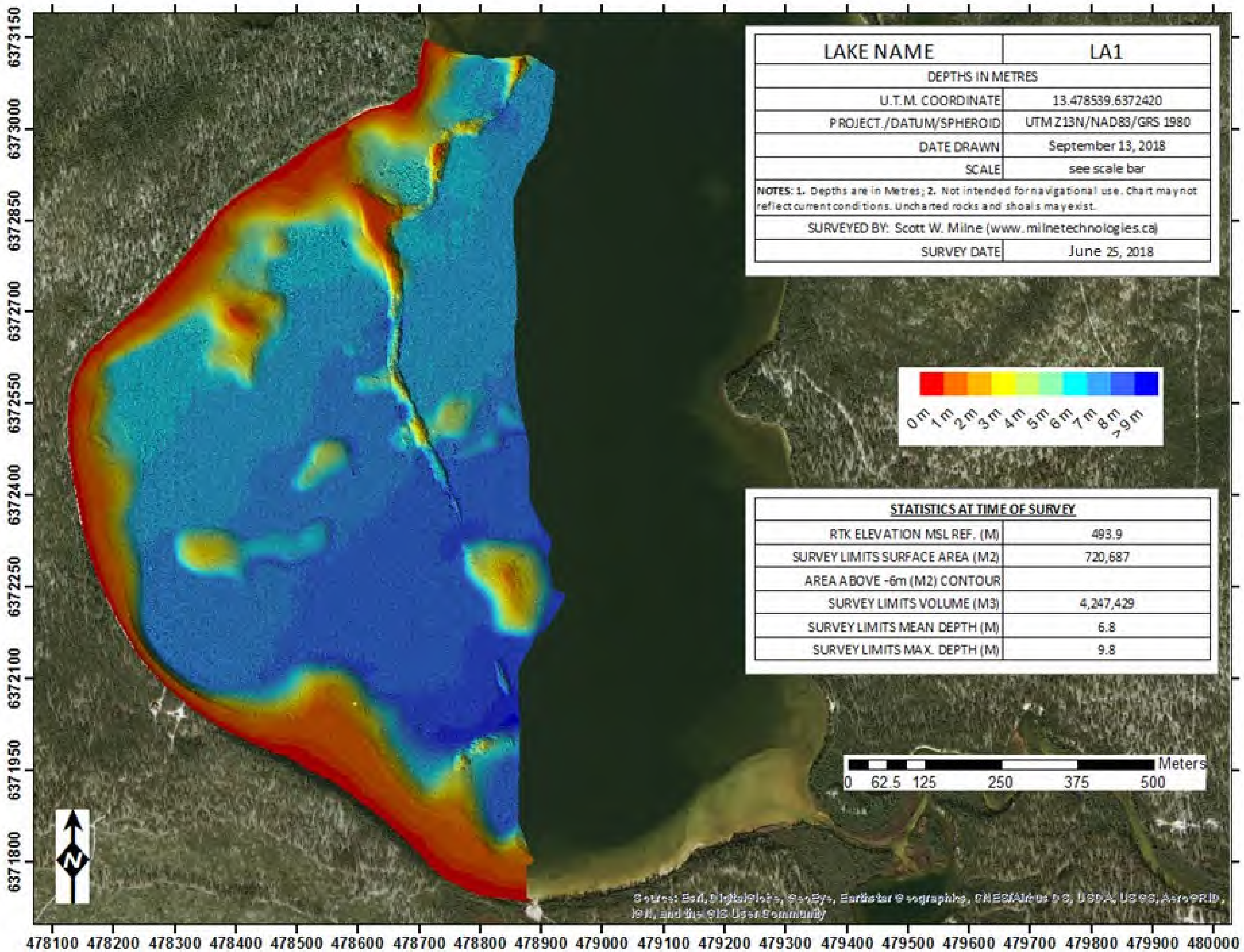

Figure 7a. Shown is the acoustic detected bottom bathymetry TIN (30 cm x 30 cm) model for Lake LA1. The bathymetry model includes the observed average multibeam sonar bathymetry points, the lake outline points (where z = 0 m) and the estimated 40 cm contours.

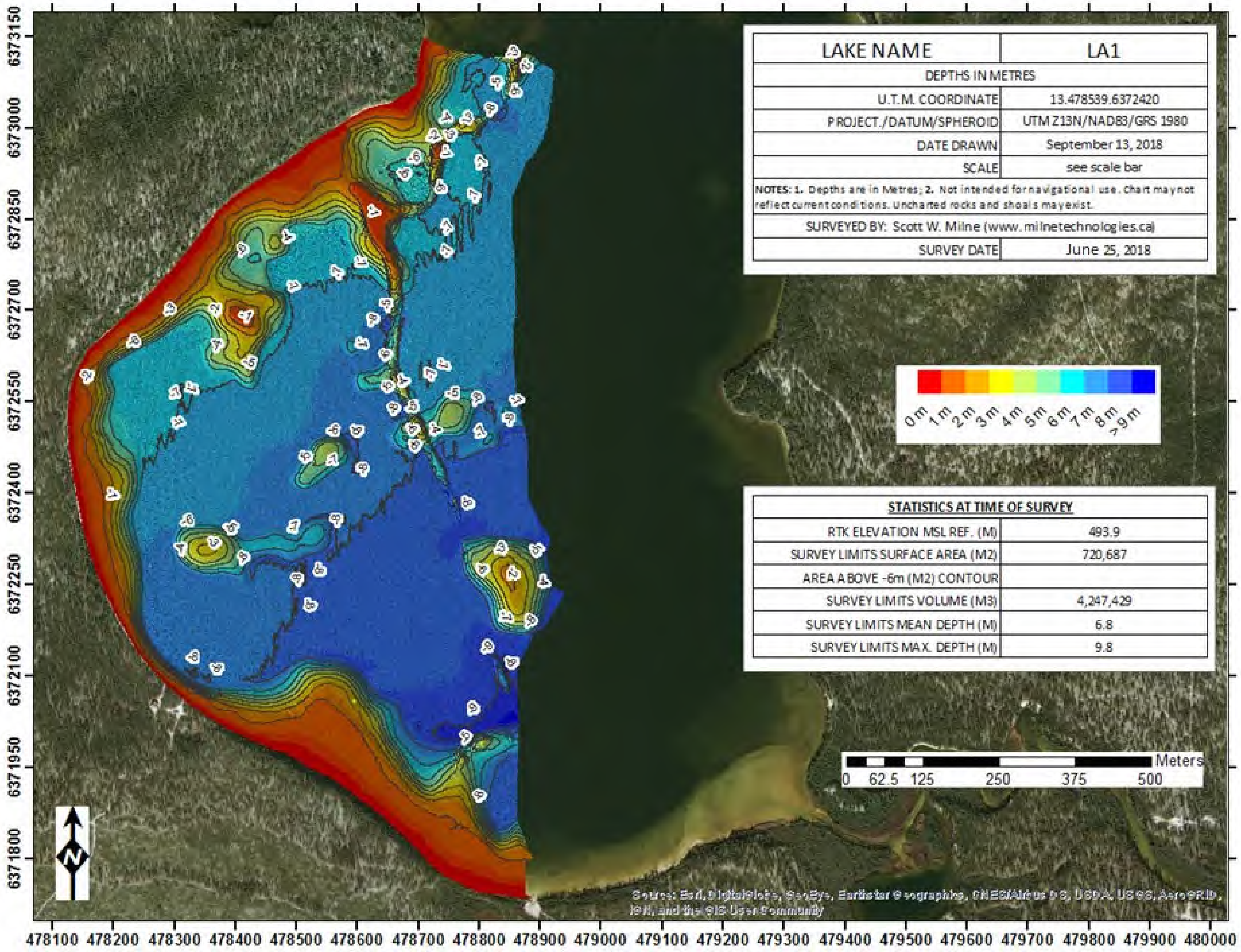

Figure 7b. Same as 7a and includes 1 m depth contour lines.

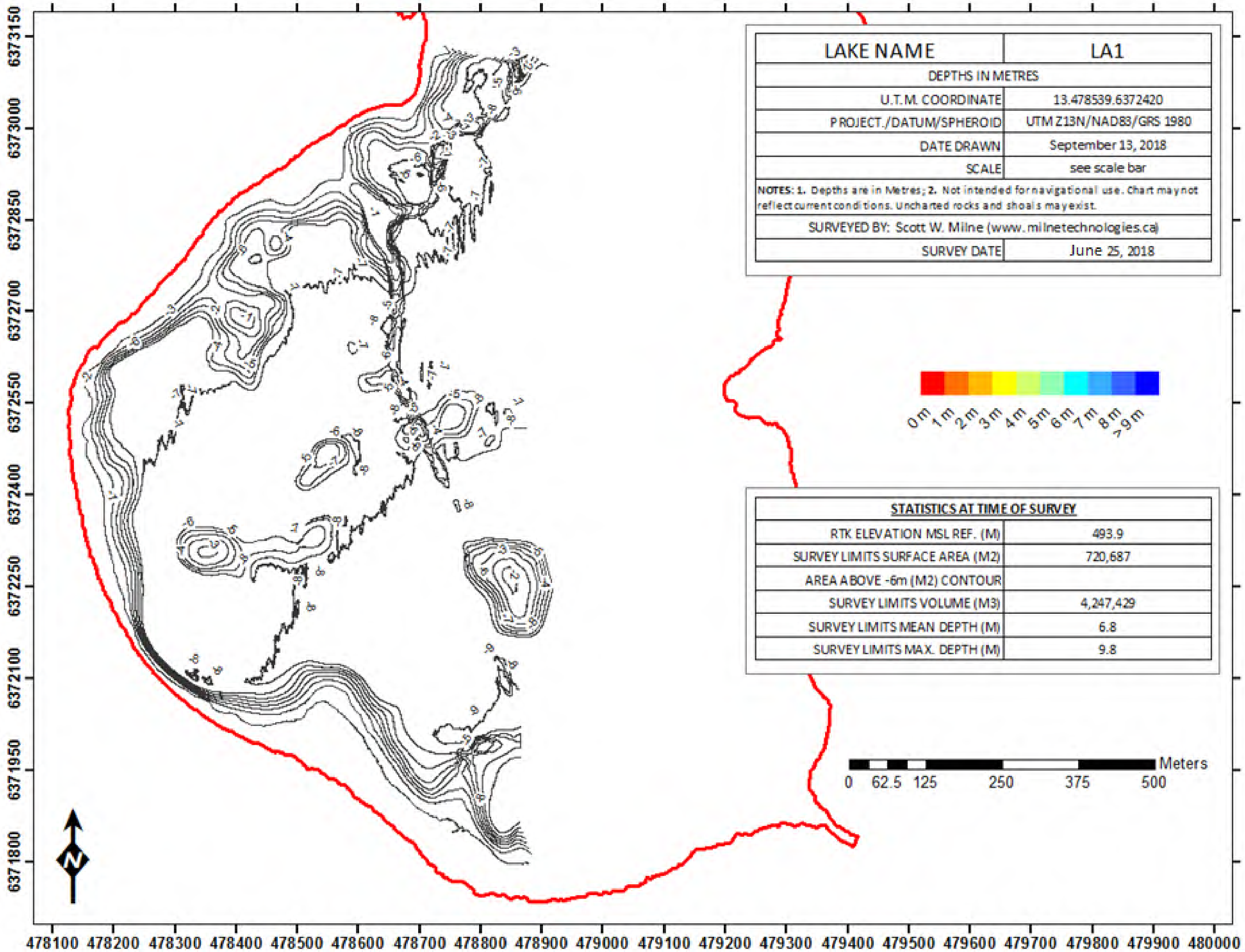

Figure 7c. 1m depth contours generated from the acoustic detected bottom bathymetry TIN (30 cm x 30 cm) model for Lake LA1.

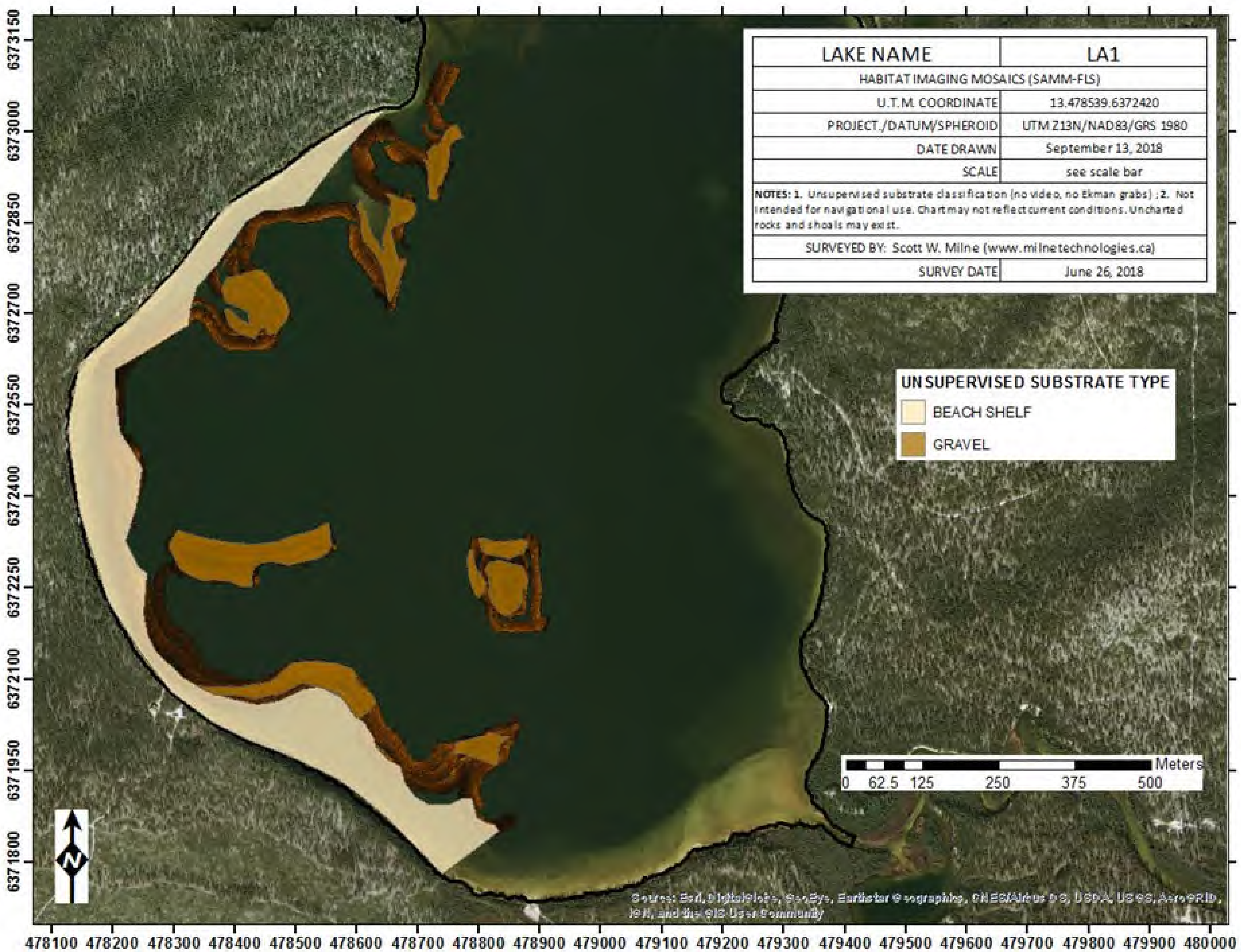

Figure 8. . Sonar imaging habitat mosaic for the Lake LA1 nearshore and shoals. Sand and gravel bars show up as bright patches whereas darker areas in away from shore indicate low acoustic reflection associated with mud, fines and detritus.

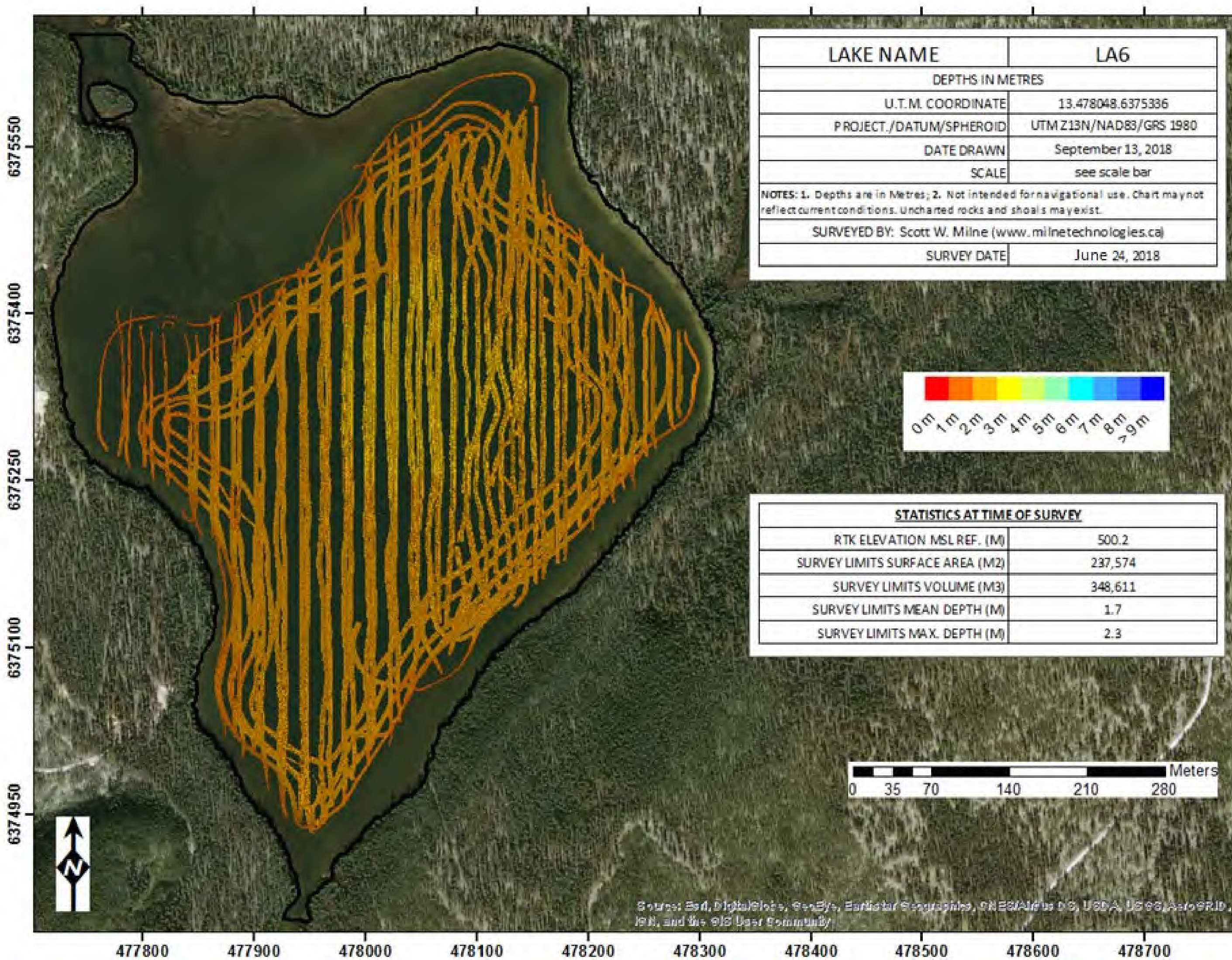

Figure 9. Observed multibeam sonar bathymetry survey coverage of Lake LA6.

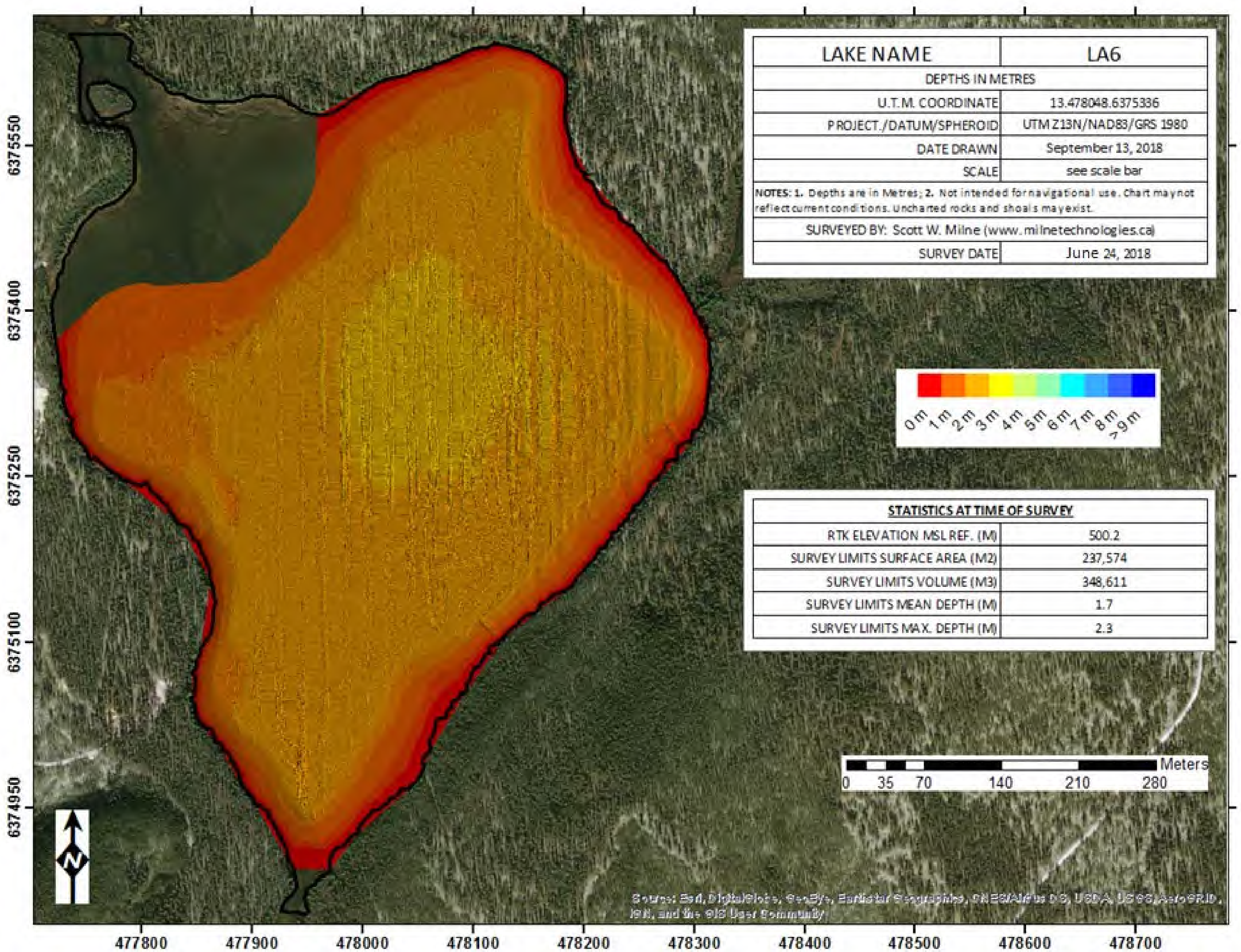

Figure 10a. Shown is the acoustic detected bottom bathymetry TIN (30 cm x 30 cm) model for Lake LA6. The bathymetry model includes the observed average multibeam sonar bathymetry points, the lake outline points (where z = 0 m) and the estimated 50 cm contours.

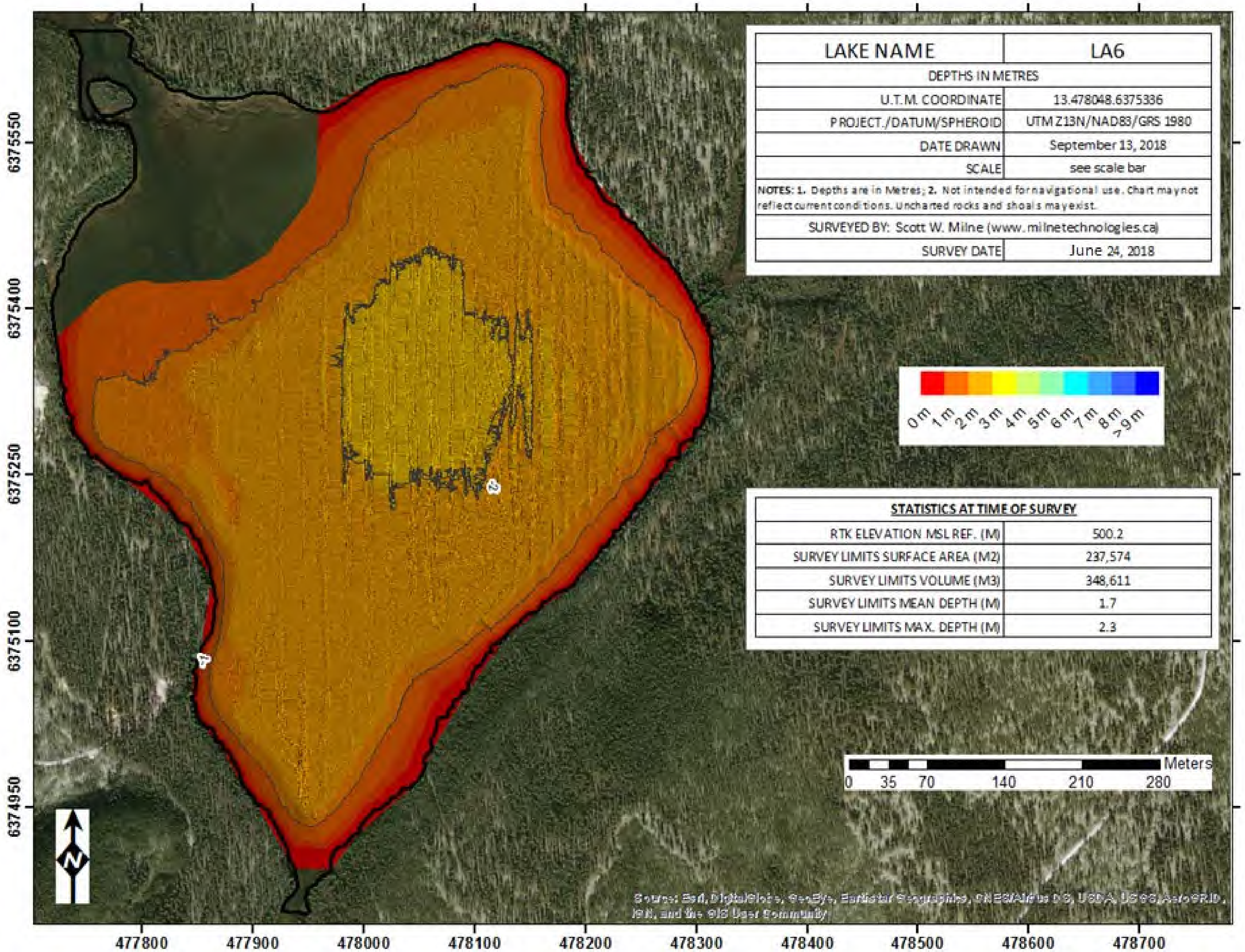

Figure 10b. Same as 9a and includes 1 m depth contour lines.

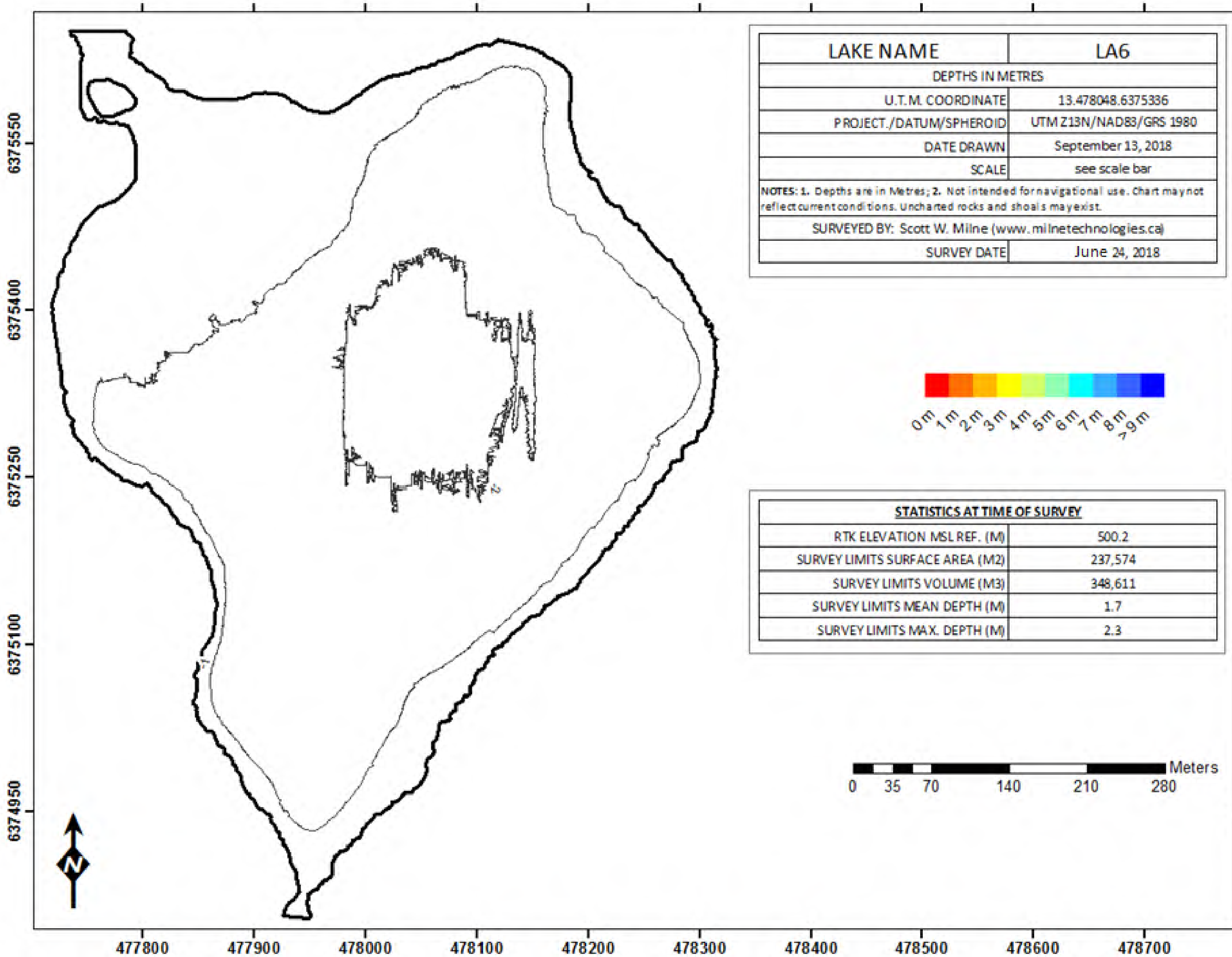

Figure 10c. 1m depth contours generated from the acoustic detected bottom bathymetry TIN (30 cm x 30 cm) model for Lake LA6.

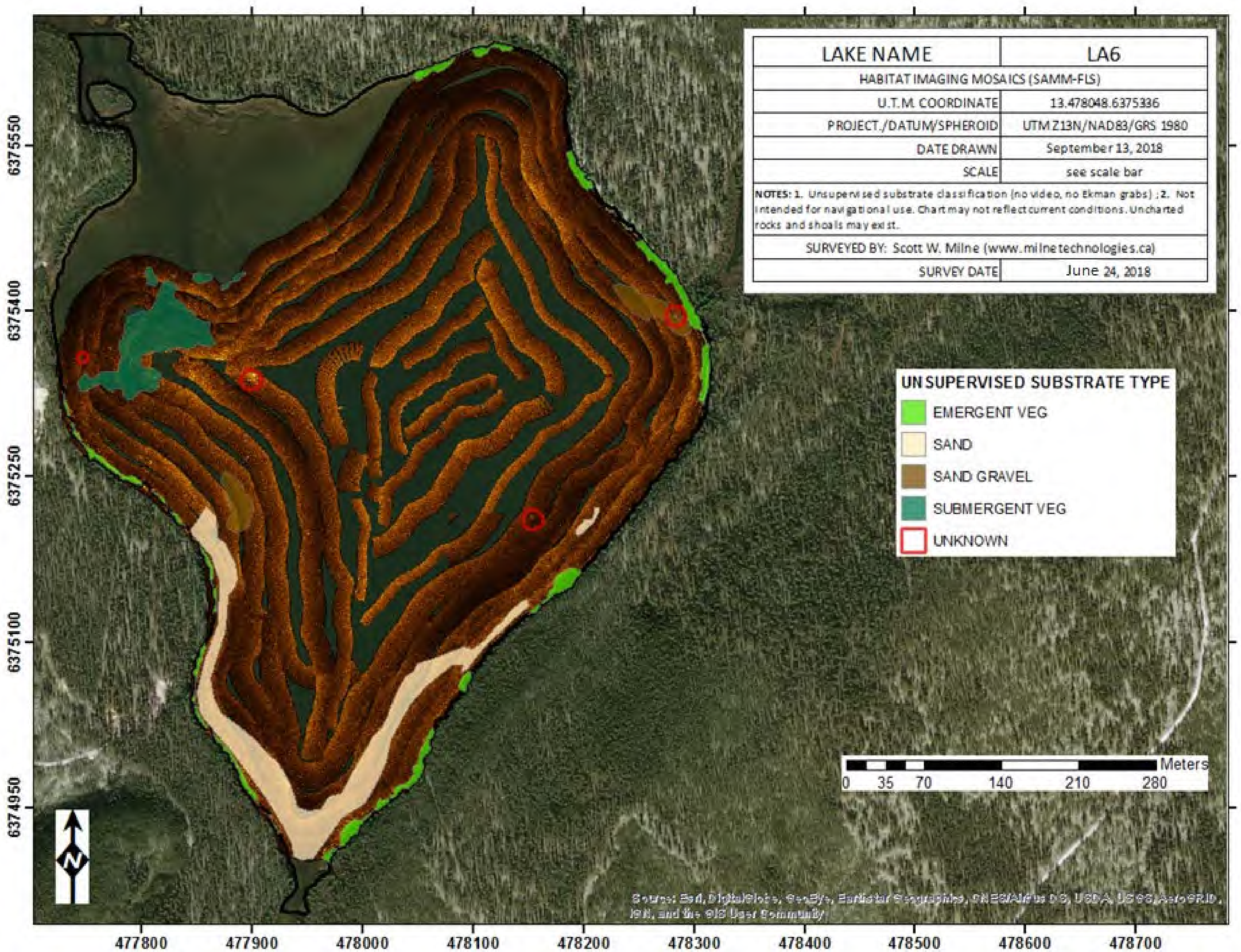

Figure 11. Sonar imaging habitat mosaic for Lake LA6. The bright speckling is acoustic scattering from macrophyte stems/leaves. Sand and gravel bars show up as bright patches whereas darker areas in away from shore indicate low acoustic reflection associated with mud, fines and detritus.

4.0 ACKNOWLEDGEMENTS

Special thanks to Jobie Daigneault for field assistance and support, as well as Elaine Mason and Goran Ivanis for project coordination and support.

5.0 REFERENCES

Smith, C. 2013. M3 Sonar: Collecting and processing bathymetry data. Kongsberg-Mesotech Ltd. Port Coquitlam, BC.

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Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

Powering
PEOPLE, PARTNERSHIPS
AND PASSION.

Ecometrix | Environmental INTELLIGENCE

TO:	FROM:
Xavier Lu Dac, Janna Switzer, Denison Mines	Harry Gaebler, Brian Fraser, Jason Dietrich, Ecometrix Incorporated

REF:	DATE:
LA-5 Discharge Concentration Assessment	21 November 2024

Denison Mines is currently assessing options for the discharge of process water from the Wheeler River Project to a nearby lake, Whitefish Lake North (also identified herein as LA-5).

The following memorandum provides an assessment of the effect of site discharge on constituent concentrations within the receiving waters, as well as preliminary results of the mixing zone for a conceptual offshore multi-port diffuser design. This assessment is in addition to an original assessment dated September 9, 2022, of the effect of site discharge on constituent concentrations within the receiving waters. The following assessment considers additional parameters, as specified by Schedule 4 of the MDMER and assesses the potential impact on assimilative capacity due to climate change.

1.0 Predicting Constituent Concentrations in LA-5

To determine the effects of site discharge on the downstream environment, it is important to characterize the water quantity and quality of both the site discharge and the background environment. A hydrological assessment of the study area was conducted by NewFields Canada (2021) and a water quality assessment, including identifying applicable screening concentrations representing constituent levels protective of aquatic life, was conducted by Ecometrix (2021). Key aspects of each report are presented below for reference.

1.1 Whitefish Lake North Water Quality Model

The effluent from the site would be discharged to Whitefish Lake North (LA-5) through an engineered, offshore, submerged, multiport diffuser, designed to maximize the mixing potential and reduce the spatial extent of the mixing zone. For further diffuser configuration information, see Section 0. Upon discharge, the effluent flows with the lake current, both downstream and offshore, and gradually mixes across lake until fully mixed. Key definitions of terms related to this section are provided below:

Mixing Zone: An area of water contiguous to a point source or definable non-point source where the water quality does not comply with one or more of the Water Quality Objectives (WQOs)

Edge of the Mixing Zone: The point within the constituent plume at which water quality objectives are met.

Well mixed: The point in which the water column is completely mixed, i.e., no vertical or horizontal concentrations gradients exist, and no further dilution occurs.

Equation 1 provides a basis to quantify the degree of mixing required to achieve the water quality objective (WQO) within the mixing zone.

$$D = \frac{C_E - C_L}{C_F - C_L}$$ **Equation 1**

where D is the required dilution, C_E is the concentration in the effluent, C_L is the concentration in LA-5, and C_F is the concentration in LA-5 at the edge of the mixing zone. For this assessment, C_F is assumed equal to the WQO (i.e., the concentration at the edge of the mixing zone is equal to the screening concentration).

However, unlike a river system, where water is instantly carried downstream, the north basin of LA-5 is more similar to a small lake, which may be subject to recirculation of effluent. As a result, the background concentration in LA-5 may increase over time due to site discharge. This potential increase in background concentration could influence the required dilution to meet WQOs at the edge of the mixing zone and therefore must be considered.

Constructing a mass balance for LA-5 by considering local inflows, outflows, and site discharge gives a steady-state (well mixed) condition for the concentration of a constituent in LA-5 as

$$C_L = \frac{C_B \cdot Q_B + C_E \cdot Q_E}{Q_L}$$ **Equation 2**

where C_B is the background concentration of an identified constituent in LA-5, Q_B is the background flow rate into LA-5, and Q_E is the flow rate for the effluent discharge.

Equation 2 provides an estimate of constituent concentrations within the well mixed portion of LA-5 (outside the influence of the mixing zone). Substituting Equation 2 into Equation 1 provides a basis to estimate the dilution required to meet WQOs at the edge of the mixing zone.

1.2 Model Inputs

To assess constituent concentrations within LA-5 using Equation 1 and Equation 2 information about local inflow rates, site discharge rates, background water quality and site discharge water quality is required. Each of these inputs are discussed below.

1.2.1 Hydrological Inputs

For the purpose of calculating water quality predictions within LA-5, the expected average effluent discharge rate of 0.0101 m^3/s (36.5 m^3/hr) was considered. Furthermore, to be conservative, it was assumed that discharge from the site remains constant throughout the year; however, this may not be the case and will be addressed through the permitting phase.

To assess the variability in inflow rates to LA-5, three flow scenarios were considered for the water quality evaluation. These flow scenarios are summarized below with monthly average flow rates summarized in Table 1-1 and model input flow rates summarized in Table 1-2:

1. **7Q10 Low Flow:** The 7Q10 low flow is defined as "*the lowest flow averaged over a period of seven consecutive days that can be statistically expected to occur once every 10 climatic years*." This flow condition was (0.616 m^3/s) used to assess concentrations under an extreme low flow event. The 7Q10 flow rate used in this assessment was provided to Ecometrix by NewFields Canada. The value was calculated by NewFields as the inflow from SA-6 to Whitefish Lake and therefore considered representative of the flow in the northern basin of LA-5. Please refer to Appendix 8-C (Table 3-3: 7Q10 Estimated Discharge).

2. **Monthly Low Flow:** The monthly low flow condition was calculated from historical data from the Water Survey of Canada (WSC) flow monitoring station on the Wheeler River (Station 06DA005, 57°28′40″N, 104°59′50″W) pro-rated for watershed size as the basis to estimate average monthly flows in the north basin of LA-5. The monthly low flow into LA-5 occurs in March and is given to be 1.04 m^3/s.

3. **Monthly Average Flow:** The monthly average flow condition was calculated from historical data from the Water Survey of Canada (WSC) flow monitoring station on the Wheeler River (Station 06DA005, 57°28′40″N, 104°59′50″W) pro-rated for watershed size as the basis to estimate annual average flows in the north basin of LA-5. The monthly average flow into LA-5 occurs is calculated as 1.40 m^3/s.

Table 1-1: Monthly Baseline Flows to LA-5

Month	Baseline (m^3/s)
Jan	1.14
Feb	1.08
Mar	1.04
Apr	1.21
May	1.94
Jun	1.94
Jul	1.63
Aug	1.43
Sep	1.38
Oct	1.45
Nov	1.36
Dec	1.19
Annual	**1.40**

Table 1-2: Estimated Flow Rates

Flow Parameters	Unit	Value
Discharge Rate	m^3/s	0.0101
LA-5 7Q10	m^3/s	0.616
LA-5 Monthly Low Flow	m^3/s	1.04
LA-5 Monthly Average Flow	m^3/s	1.40

For more detail related to site discharge rates and hydrology, see Ecometrix (2021) and Appendix 8-C of the EIS.

1.3 Water Quality Inputs

Water quality objectives for the receiving environment were obtained from existing federal and provincial guidelines. In general, the lowest of the federal or provincial (Saskatchewan) guidelines were used. In some instance, screening concentrations for select parameters are adjusted for hardness, DOC, and pH. For a complete description on water quality guidelines, see Ecometrix (2021).

Baseline surface water quality data for LA-5 were collected from 2016 to 2019 and are reported in the 2020 Wheeler River Project Baseline Aquatic Environment Study (Ecometrix, 2020; EIS Appendix 8-D). Baseline surface water quality data was also collected previously, starting in 2012 (Golder, 2014). Background water quality was defined by 95^{th} percentile concentrations for constituents in LA-5. The 95th percentile generates a conservative baseline for water quality.

A summary of background water quality is provided in Table 1-3 with select water quality objectives provided in Table 1-5.

Estimates of constituent concentrations in site effluent were communicated to Ecometrix from Denison Mines on 25 May 2022 with an update provided in December of 2023. The predicted concentrations for select constituents in effluent are summarized in Table 1-4.

A summary of background water quality and screening concentrations is provided in Table 1-3.

Table 1-3: Summary of Background Water Quality and Screening Concentrations

Constituent	Unit	Background Concentrations
General Chemistry, Nutrients and Anions		
Alkalinity	mg/L	12.4
Ammonia (as N)	mg/L	0.068
Un-Ionized Ammonia	mg/L	0.00019
Hardness	mg/L (as CaCO3)	5.26
Conductivity	µS/cm	21.7
Nitrate	mg/L	<0.249
pH	pH Unit	7.0
Phosphorus	mg/L	<0.01
Sulphate	mg/L	0.69
TDS	mg/L	28.3
Temperature	deg C	15
TSS	mg/L	3.9
Chloride	mg/L	0.39
Metals		
Aluminum	mg/L	0.00758

Constituent	Unit	Background Concentrations
Arsenic	mg/L	0.0001
Cadmium	mg/L	0.000019
Chromium	mg/L	<0.0005
Cobalt	mg/L	<0.0001
Copper	mg/L	<0.0002
Cyanide	mg/L	N/A
Iron	mg/L	0.181
Lead	mg/L	<0.0001
Manganese	mg/L	0.0198
Mercury	mg/L	<0.00001
Molybdenum	mg/L	<0.0001
Nickel	mg/L	<0.0001
Selenium	mg/L	<0.0001
Strontium	mg/L	0.015
Thallium	mg/L	<0.0002
Uranium	mg/L	<0.0001
Vanadium	mg/L	<0.0001
Zinc	mg/L	0.0011
Radiological		
Lead-210	Bq/L	<0.02
Polonium-210	Bq/L	<0.005
Radium-226	Bq/L	<0.0059
Thorium-230	Bq/L	<0.01
Uranium-238	Bq/L	<0.0012
Uranium-234	Bq/L	<0.0012

Table 1-4: Predicted Site Effluent Water Quality

Constituent	Unit	Predicted Discharge Concentrations (Max Expected)
General Chemistry, Nutrients and Anions		
Alkalinity	mg/L	12.4
Ammonia (as N)	mg/L	3.9
Un-Ionized Ammonia	mg/L	0.0129
Hardness	mg/L (as $CaCO_3$)	250 [1]
Conductivity	µS/cm	21.7
Nitrate	mg/L	0.249
pH	pH Unit	7.0
Phosphorus	mg/L	0.01
Sulphate	mg/L	2600
TDS	mg/L	6420
Temperature	deg C	16.5
TSS	mg/L	6
Chloride	mg/L	600
Metals		
Aluminum	mg/L	0.051
Arsenic	mg/L	0.006
Cadmium	mg/L	0.0018
Chromium	mg/L	0.025
Cobalt	mg/L	0.0027
Copper	mg/L	0.02
Cyanide	mg/L	NA
Iron	mg/L	0.0039
Lead	mg/L	0.0003
Manganese	mg/L	0.03
Mercury	mg/L	0.00001
Molybdenum	mg/L	2.5
Nickel	mg/L	0.0138
Selenium	mg/L	0.042
Strontium	mg/L	1.68
Thallium	mg/L	0.0006
Uranium	mg/L	0.057

Constituent	Unit	Predicted Discharge Concentrations (Max Expected)
Vanadium	mg/L	0.059
Zinc	mg/L	0.042
Radiological		
Lead-210	Bq/L	0.42
Polonium-210	Bq/L	0.15
Radium-226	Bq/L	0.15
Thorium-230	Bq/L	0.9
Uranium-238	Bq/L	0.7
Uranium-234	Bq/L	0.7

Notes

Bolded values are those that exceed the screening concentrations

* Hardness induced guideline, assuming hardness >250 mg/L

** Hardness induced guideline, assuming hardness >250 mg/L, pH=7.0, DOC = 5.26 mg/L

Un-ionized ammonia calculated

1) Hardness value provided here is not the expected hardness in effluent, but was selected as a concentration at which to evaluate a high hardness condition at the edge of the mixing zone for interpretation of modelled results against water quality guidelines.

DATE: 21 November 2024

TO: Xavier Lu Dac, Janna Switzer, Denison Mines

REF: LA-5 Discharge Concentration Assessment

Ecometrix | Environmental INTELLIGENCE

Table 1-5: Screening Concentrations

Parameter	Units	Short-term Screening Criteria (background hardness)	Short-term Screening Criteria (Hardness induced [>250 mg/L])	Source	Note	Long-term Screening Criteria (background hardness)	Long-term Screening Criteria (Hardness induced [>250 mg/L])	Source	Note
General Chemistry, Nutrients and Anions									
Alkalinity	mg/L	--	--	--	--	--	--	--	
Ammonia (as N)	mg/L	--	--	--	--	5.74	5.74	SEQG/CCME	(4)
Un-Ionized Ammonia	mg/L	--	--	--	--	0.019	6.98	SEQG/CCME	
Hardness	mg/L	--	--	--	--	--	--	--	--
Conductivity	µS/cm	--	--	--	--	--	--	--	--
Nitrate	mg/L	550	550	CCME		3.0	3.0	SEQG	--
pH	pH units	--	--	--	--	6.5-9.0	6.5-9.0	SEQG/CCME	--
Phosphorus	mg/L	--	--	--	--	0.004 - 0.01	0.004 - 0.01	CCME	(17)
Sulphate	mg/L	--	--	--	--	128	429	BC MOE	(12)
TDS	mg/L	--	--	--	--	500	500	SEQG	--
Temperature	°C	--	--	--	--	ambient temp	ambient temp	--	--
TSS	mg/L	--	--	--	--	background + 5 mg/L	background + 5 mg/L	CCME	--
Chloride	mg/L	640	640	SEQG/CCME	(6)	120	120	SEQG/CCME	(6)
Metals									
Aluminum	mg/L	--	--	--	--	0.1	0.1	SEQG/CCME	(5)
Arsenic	mg/L	--	--	--	--	0.005	0.005	SEQG/CCME	--
Cadmium	mg/L	0.00011	0.0053	SEQG/CCME	(18)	0.00004	0.00034	SEQG/CCME	--
Chromium	mg/L	--	--	--	--	0.001	0.001	SEQG/CCME	
Cobalt	mg/L	--	--	--	--	0.000295	0.00149	FEQG	(10)
Copper	mg/L	0.0009	0.004	SEQG	(19)	0.0002	0.0005	FEQG	(23)
Cyanide	mg/L	--	--	--	--	--	--	--	--

Parameter	Units	Short-term Screening Criteria (background hardness)	Short-term Screening Criteria (Hardness induced [>250 mg/L])	Source	Note	Long-term Screening Criteria (background hardness)	Long-term Screening Criteria (Hardness induced [>250 mg/L])	Source	Note
Iron	mg/L	--	--	--	--	0.3	0.3	SEQG/CCME	--
Lead	mg/L	--	--	--	--	0.001	0.007	SEQG/CCME	(8)
Manganese	mg/L	0.501	15	CCME	(3)	0.21	0.64	SEQG/CCME	(3)
Mercury	mg/L	--	--	--	--	0.000026	0.000026	CCME	--
Molybdenum	mg/L	--	--	--	--	0.073	0.07	CCME	(16)
Nickel	mg/L	--	--	--	--	0.025	0.07	CCME	(16)
Selenium	mg/L	--	--	--	--	0.001	0.001	CCME	--
Strontium	mg/L	--	--	--	--	2.5	2.5	FEQG	(11)
Thallium	mg/L	--	--	--	--	0.0008	0.0008	SEQG/CCME	--
Uranium	mg/L	0.033	0.033	CCME		0.015	0.015	SEQG/CCME	--
Vanadium	mg/L	--	--	--	--	0.12	0.12	FEQG	(13)
Zinc	mg/L	0.008	0.204	CCME	(9)(20)	0.007	0.058	CCME	(9)(22)
Radiological									
Lead-210	Bq/L	--	--	--	--	0.2	0.2	HC	--
Polonium-210	Bq/L	--	--	--	--	0.1	0.1	HC	--
Radium-226	Bq/L	--	--	--	--	0.11	0.11	SEQG	--
Thorium-230	Bq/L	--	--	--	--	0.6	0.6	HC	--
Uranium-238	Bq/L	--	--	--	--	3.0	3	HC	--
Uranium-234	Bq/L	--	--	--	--	3.0	3	HC	--

Notes:

All parameters listed as total concentrations unless otherwise specified.

Saskatchewan Water Quality Objectives, SEQG on-line (https://envrbrportal.crmp.saskatchewan.ca/seqg-search/), SEQG for the protection of aquatic life were selected, based on total concentrations.

Bold numbers indicate exceedance of long-term criteria.

Bold and italicized indicate exceedance of short-term criteria and long-term criteria.

SEQG – Saskatchewan Environmental Quality Guidelines – Water Quality Guidelines for Freshwater Aquatic Life.

CWQG – Canadian Council of Ministers of the Environment – Canadian Water Quality Guidelines for the Protection of Aquatic Life.

SSWQO – Saskatchewan Surface Water Quality Objectives.

DOC – Dissolved organic carbon.

TDS – Total dissolved solids.

TKN – Total Kjeldahl Nitrogen.

TOC – Total organic carbon.

TSS – Total suspended solids.

Narrative – Temperature - Maximum Weekly Average Temperature: Thermal additions to receiving waters should be such that the maximum weekly average temperature is not exceeded. Short-term Exposure to Extreme Temperature: Thermal additions to receiving waters should be such that the short-term exposures to maximum temperatures are not exceeded. Exposures should not be so lengthy or frequent as to adversely affect the important species.

(3) Scientific Criteria Document for the Development of the Canadian Water Quality Guidelines for the Protection of Aquatic Life - Manganese, Appendix B - Canadian Water Quality Guidelines Calculator (pH = 7.5, hardness = 15 mg/L). Guideline is based on dissolved manganese. Benchmark = exp(0.878[ln(hardness)] + 4.76) where the benchmark is expressed in dissolved manganese concentration (µg/L), and hardness is measured as CaCO3 equivalents in mg/L.

(4) Total ammonia-N calculated from the total ammonia guideline for a temperature of 15°C and a pH of 7.0, Un-ionized Ammonia from Table 1 of temperature and pH Canadian Water Quality Guidelines for the Protection of Aquatic Life - Ammonia (https://ccme.ca/en/res/ammonia-en-canadian-water-quality-guidelines-for-the-protection-of-aquatic-life.pdf).

(5) Based on a pH of >6.5.

(6) Based on water hardness >0 to <17 mg/L.

(7) Based on water hardness >0 to <82 mg/L.

(8) Based on water hardness >0 to ≤60 mg/L equation used at hardness of 5.26. At hardness >180 mg/L, the CWQG is 7 µg/L

(9) Guideline is based on dissolved zinc.

(10) Environment Canada 2017. Federal Environmental Quality Guidelines, Cobalt, May. Based on equation and site-specific baseline hardness of 15 mg/L.

(11) ECCC 2020. Federal Environmental Quality Guidelines Strontium. July.

(12) BC MECCS 2021. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf

(13) Environment Canada 2016. Federal Environmental Quality Guidelines, Vanadium. May.

(14) Health Canada 2020. Guidelines for Canadian Drinking Water Quality Summary Table. September. https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/ewh-semt/alt_formats/pdf/pubs/water-eau/sum_guide-res_recom/summary-table-EN-2020-02-11.pdf

(15) BC MECCS 2020. Source Drinking Water Quality Guidelines, Guideline Summary Ministry of Environment & Climate Change Strategy Water Protection & Sustainability Branch.

(17) Framework - guideline for oligotrophic waterbody 4-10 µg/L.

(18) Based on water hardness of >0 to <5.3 mg/L.

(19) Based on hardness of 5 mg/L (Short-term equation is (e{0.979123[ln(hardness)]-8.64497})*1000 (SEGQ via AEP 1996b).

(20) Based on benchmark = exp(0.833[ln(hardness mg·L-1)] + 0.240[ln(DOC mg·L-1)] + 0.526). Site-specific background hardness is 5.26 mg/L (95th percentile of LA-5 and LA-6). Site-specific DOC is 2.2 (arithmetic mean for LA-5 and LA-6), induced hardness of 250.5 mg/L used as upper limit of extrapolation available.

(21) based on water hardness of > 250 mg/L ($CaCO_3$) (251 mg/L).(22) based on CWQG = exp(0.947[ln(hardness mg·L-1)] - 0.815[pH] + 0.398[ln(DOC mg·L-1)] + 4.625). Where background hardness is 5.26 mg/L, pH = 6.61, DOC = 2.24 mg/L.

(23) based on FEQG BLM with pH=6.61 (pH= 7 under induced conditions), DOC =2.24 mg/L, background hardness of 5.26 mg/L (or induced hardness of 9 mg/L).

1.4 Water Quality Results

Water quality predictions for each of the three flow scenarios (described in Section1.2.1) are provided in Table 1-6. Parameters with well mixed concentrations above the screening criteria where background water quality was used when considering toxicity modifying factors include cadmium.

All parameters are below the induced screening criteria in the well mixed portion of LA-5.

1.4.1 Maximum Predicted Discharge Concentrations

Furthermore, an investigation into site discharge water quality predictions was completed to identify any parameters that require more than 30% of the available assimilative capacity of the receiver (Saskatchewan, 2015). Based on the three flow scenarios (described in Section 1.2.1), it was determined using CORMIX (Cornell Mixing Zone Expert System) that the dilution at 100 m (maximum mixing zone distance as specified by Saskatchewan surface water quality objectives (2015)) was 350:1, effluent to lake water. Based on this prediction, the maximum allowable effluent concentrations, such that parameter concentrations comply with selected sets of WQOs (background and induced toxicity modifiers) at 100 m, were calculated by substituting Equation 1 into Equation 2 and re-arranging as

$$C_E = \frac{C_B \cdot Q_B(1 - D) + D \cdot C_F \cdot Q_L}{Q_L + Q_E \cdot (D - 1)} \qquad \textbf{Equation 3}$$

As per Saskatchewan water quality objectives the maximum allowable discharge was calculated by considering 30% of the difference between the predicted value in Equation 3 and the background concentration. The maximum allowable predicted effluent concentrations for each of the flow scenarios and for two sets of screening criteria are presented in Table 1-7 and Table 1-8.

Parameters where the available assimilative capacity is less than the max predicted discharge concentration (highlighted in blue), indicating the potential need for treatment. For the screening criteria subject to background water quality (Table 1-7), these parameters include sulphate, chromium (influence by DLs in background), molybdenum, selenium (influence by DLs in background). For the screening criteria subject to induced (by effluent) water quality (Table 1-8), these parameters include chromium (influence by DLs in background), molybdenum, selenium (influence by DLs in background).

Parameters whose available assimilative capacity exceed short term criteria listed in Table 1-5 (Table 1-7 and Table 1-8, highlighted in yellow) for both sets of screening criteria include chloride, cadmium, copper, manganese, uranium, and zinc.

Note that although cyanide is a parameter identified in Schedule 4 of the MDMER, it was not considered in the above assessment due to the lack of background cyanide concentration in the receiver. Furthermore, cyanide will not be present in the effluent as not part of the mining process.

Table 1-6: Well Mixed Water Quality Results

Constituent	Unit	Screening Concentration - Background Modifiers	Screening Concentration - Induced Modifiers	Discharge Concentration (max predicted)	LA-5 Well Mixed (7Q10)	LA-5 Well Mixed (Monthly Low)	LA-5 Well Mixed (Average)
General Chemistry, Nutrients and Anions							
Alkalinity	mg/L	N/A	N/A	12.4	12.4	12.4	12.4
Ammonia (as N)	mg/L	5.74	5.74	3.9	0.13	0.11	0.10
Un-Ionized Ammonia	mg/L	0.019	0.019	0.0129	0.08	0.05	0.03
Hardness	mg/L (as CaCO3)	N/A	N/A	250	9	8	7
Conductivity	µS/cm	N/A	N/A	21.7	21.7	21.7	21.7
Nitrate	mg/L	3	3.0	0.249	0.249	0.249	0.249
pH	pH Unit	6.5 - 9.0	6.5 - 9.0	7.0	7.0	7.0	7.0
Phosphorus	mg/L	0.01	0.01	0.01	0.005	0.005	0.005
Sulphate	mg/L	128	429	2600	43	26	19
TDS	mg/L	500	500	6420	131	90	74
Temperature	deg C	16.5	17	16.5	15.0	15.0	15.0
TSS	mg/L	8.9	9	6	4	4	4
Chloride	mg/L	120	120	600	10	6	5
Metals							
Aluminum	mg/L	0.1	0.1	0.051	0.01	0.01	0.01
Arsenic	mg/L	0.005	0.005	0.006	0.0002	0.0002	0.0001
Cadmium	mg/L	0.00004	0.00034	0.0018	0.00005	0.00004	0.00003
Chromium	mg/L	0.001	0.001	0.025	0.001	0.001	0.001
Cobalt	mg/L	0.000295	0.001493	0.0027	0.000142	0.000125	0.000119
Copper	mg/L	0.0002	0.0005	0.02	0.00046	0.00031	0.00026
Cyanide	mg/L	N/A	N/A	N/A	0.0	0.0	0.0

Constituent	Unit	Screening Concentration - Background Modifiers	Screening Concentration - Induced Modifiers	Discharge Concentration (max predicted)	LA-5 Well Mixed (7Q10)	LA-5 Well Mixed (Monthly Low)	LA-5 Well Mixed (Average)
Iron	mg/L	0.3	0.3	0.0039	0.178	0.179	0.180
Lead	mg/L	0.001	0.007	0.0003	0.00005	0.00005	0.00005
Manganese	mg/L	0.21	0.640	0.03	0.020	0.020	0.020
Mercury	mg/L	0.000026	0.000026	0.00001	0.000010	0.000010	0.000010
Molybdenum	mg/L	0.073	0.073	2.5	0.04	0.02	0.02
Nickel	mg/L	0.025	0.025	0.0138	0.0003	0.0002	0.0001
Selenium	mg/L	0.001	0.001	0.042	0.001	0.001	0.000
Strontium	mg/L	2.5	2.5	1.68	0.04	0.03	0.03
Thallium	mg/L	0.0008	0.001	0.0006	0.0002	0.0002	0.0002
Uranium	mg/L	0.015	0.015	0.057	0.001	0.001	0.001
Vanadium	mg/L	0.12	0.12	0.059	0.0011	0.0007	0.00
Zinc	mg/L	0.013	0.058	0.042	0.002	0.001	0.001
Radiological							
Lead-210	mg/L	0.2	0.2	0.42	0.026	0.024	0.023
Polonium-210	mg/L	0.1	0.1	0.15	0.007	0.006	0.006
Radium-226	mg/L	0.11	0.11	0.15	0.008	0.007	0.007
Thorium-230	mg/L	0.6	0.6	0.9	0.024	0.019	0.016
Uranium-238	mg/L	3	3	0.7	0.013	0.008	0.006
Uranium-234	mg/L	3	3	0.7	0.013	0.008	0.006

Table 1-7: Predicted Maximum Allowable Effluent Concentrations (Background Toxicity Modifiers)

Constituent	Unit	Screening Concentration (Background WQ)	Discharge Concentration (max predicted)	Maximum Allowable Effluent Concentration (7Q10)	Maximum Allowable Effluent Concentration (Monthly Low Flow)	Maximum Allowable Effluent Concentration (Monthly Average Flow)
General Chemistry, Nutrients and Anions						
Alkalinity	mg/L	N/A	12.4	No Applicable WQO		
Ammonia (as N)	mg/L	5.74	3.9	89.9	136.3	170.1
Un-Ionized Ammonia	mg/L	0.019	0.0129	0.30	0.45	0.56
Hardness	mg/L (as CaCO3)	N/A	250	No Applicable WQO		
Conductivity	µS/cm	N/A	21.7	No Applicable WQO		
Nitrate	mg/L	3.0	0.249	45.8	70.5	88.5
pH	pH Unit	6.5 - 9.0	7.0	6.5 - 9.0	6.5 - 9.0	6.5 - 9.0
Phosphorus	mg/L	0.007	0.01	0.040	0.057	0.107
Sulphate	mg/L	128	**2600**	2017	3058	3817
TDS	mg/L	500	**6420**	7499	11356	14169
Temperature	deg C	17	16.5	38.8	51.0	60.0
TSS	mg/L	9	6	83	124	154
Chloride	mg/L	120	**600**	1895	2873	3586
Metals						
Aluminum	mg/L	0.1	0.051	1	2	3
Arsenic	mg/L	0.005	**0.006**	0.078	0.118	0.147
Cadmium	mg/L	0.00004	**0.0018**	0.0004	0.0005	0.0006
Chromium	mg/L	0.001	**0.025**	0.012	0.021	0.027
Cobalt	mg/L	0.000295	**0.0027**	0.0040	0.0064	0.0083
Copper	mg/L	0.0002	**0.02**	0.002	0.003	0.004
Cyanide	mg/L	N/A	N/A	No Predicted Discharge Concentration		
Iron	mg/L	0.3	0.0039	2.1	3.0	3.7
Lead	mg/L	0.001	0.0003	0.02	0.02	0.03
Manganese	mg/L	0.21	0.03	3.82	5.79	7.22
Mercury	mg/L	0.000026	0.00001	0.00034	0.00056	0.00072

Constituent	Unit	Screening Concentration (Background WQ)	Discharge Concentration (max predicted)	Maximum Allowable Effluent Concentration (7Q10)	Maximum Allowable Effluent Concentration (Monthly Low Flow)	Maximum Allowable Effluent Concentration (Monthly Average Flow)
Molybdenum	mg/L	0.073	**2.5**	1.1	1.7	2.1
Nickel	mg/L	0.025	0.0138	1.11	1.68	2.10
Selenium	mg/L	0.001	**0.042**	0.015	0.023	0.029
Strontium	mg/L	2.5	1.68	39.4	59.7	74.5
Thallium	mg/L	0.001	0.0006	0.011	0.018	0.023
Uranium	mg/L	0.015	**0.057**	0.24	0.36	0.45
Vanadium	mg/L	0.12	0.059	1.9	2.9	3.6
Zinc	mg/L	0.013	**0.042**	0.19	0.29	0.36
Radiological						
Lead-210	Bq/L	0.2	**0.42**	3.0	4.7	5.9
Polonium-210	Bq/L	0.1	**0.15**	1.5	2.4	3.0
Radium-226	Bq/L	0.11	**0.15**	1.7	2.6	3.3
Thorium-230	Bq/L	0.6	**0.9**	9	14	18
Uranium-238	Bq/L	3	0.7	47.5	72.0	89.9
Uranium-234	Bq/L	3	0.7	47.5	72.0	89.9

Notes

(1) Bolded values are those that exceed the Screening concentrations.

(2) Highlighted blue values indicate predicted discharge concentrations above maximum allowable effluent concentrations (as per Saskatchewan requirements) for different background flow conditions.

(3) Highlighted yellow values indicate predicted discharge concentrations above short-term values.

Table 1-8: Predicted Maximum Allowable Effluent Concentrations (Induced Toxicity Modifiers)

Constituent	Unit	Screening Concentration (Induced WQ)	Discharge Concentration (max predicted)	Maximum Allowable Effluent Concentration (7Q10)	Maximum Allowable Effluent Concentration (Monthly Low Flow)	Maximum Allowable Effluent Concentration (Monthly Average Flow)
General Chemistry, Nutrients and Anions						
Alkalinity	mg/L	N/A	12.4	No Applicable WQO		
Ammonia (as N)	mg/L	5.74	3.9	89.9	136.3	170.1
Un-Ionized Ammonia	mg/L	0.019	0.0129	0.30	0.45	0.56
Hardness	mg/L (as CaCO3)	N/A	250	No Applicable WQO		
Conductivity	µS/cm	N/A	21.7	No Applicable WQO		
Nitrate	mg/L	3.0	0.249	45.8	70.5	88.5
pH	pH Unit	6.5 - 9.0	7.0	6.5 - 9.0	6.5 - 9.0	6.5 - 9.0
Phosphorus	mg/L	0.007	0.01	0.040	0.057	0.107
Sulphate	mg/L	429	**2600**	6784	10286	12841
TDS	mg/L	500	**6420**	7499	11356	14169
Temperature	deg C	16.5	16.5	38.8	51.0	60.0
TSS	mg/L	9	6	83	124	154
Chloride	mg/L	120	**600**	1895	2873	3586
Metals						
Aluminum	mg/L	0.1	0.051	1	2	3
Arsenic	mg/L	0.005	**0.006**	0.078	0.118	0.147
Cadmium	mg/L	0.00034	**0.0018**	0.0051	0.0077	0.0096
Chromium	mg/L	0.001	**0.025**	0.012	0.021	0.027
Cobalt	mg/L	0.0015	**0.0027**	0.0229	0.0352	0.0442
Copper	mg/L	0.0005	**0.02**	0.007	0.010	0.013
Cyanide	mg/L	N/A	N/A	No Predicted Discharge Concentration		
Iron	mg/L	0.3	0.0039	2.1	3.0	3.7
Lead	mg/L	0.007	0.0003	0.11	0.17	0.21
Manganese	mg/L	0.640	0.03	9.84	14.91	18.61
Mercury	mg/L	0.000026	0.00001	0.00034	0.00056	0.00072

Constituent	Unit	Screening Concentration (Induced WQ)	Discharge Concentration (max predicted)	Maximum Allowable Effluent Concentration (7Q10)	Maximum Allowable Effluent Concentration (Monthly Low Flow)	Maximum Allowable Effluent Concentration (Monthly Average Flow)
Molybdenum	mg/L	0.07	**2.5**	1.1	1.7	2.1
Nickel	mg/L	0.15	0.0138	2.37	3.60	4.50
Selenium	mg/L	0.001	**0.042**	0.015	0.023	0.029
Strontium	mg/L	2.5	1.68	39	60	75
Thallium	mg/L	0.001	0.0006	0.011	0.018	0.023
Uranium	mg/L	0.015	**0.057**	0.24	0.36	0.45
Vanadium	mg/L	0.12	0.059	1.9	2.9	3.6
Zinc	mg/L	0.058	0.042	0.9	1.4	1.7
Radiological						
Lead-210	Bq/L	0.2	**0.42**	3.0	4.7	5.9
Polonium-210	Bq/L	0.1	**0.15**	1.5	2.4	3.0
Radium-226	Bq/L	0.11	**0.15**	1.7	2.6	3.3
Thorium-230	Bq/L	0.6	**0.9**	9	14	18
Uranium-238	Bq/L	3	0.7	47.5	72.0	89.9
Uranium-234	Bq/L	3	0.7	47.5	72.0	89.9

Notes
(1) Bolded values are those that exceed the Screening concentrations.

(2) Highlighted blue values indicate predicted discharge concentrations above maximum allowable effluent concentrations (as per Saskatchewan requirements) for different background flow conditions.

(3) Highlighted yellow values indicate predicted discharge concentrations above short-term values.

2.0 Preliminary Mixing Zone Assessment

In addition to concentration predictions, a preliminary mixing zone assessment was conducted for the discharge of water from the site to LA-5. This assessment was conducted assuming induced water quality criteria in the receiving environment. This preliminary mixing zone assessment furthers the discussion and determines the extent/size of the area of WQO exceedance within LA-5.

The proposed discharge from the site to LA-5 will be through an engineered, offshore, submerged, multiport diffuser, designed to maximize the mixing potential and minimize the spatial extent of the mixing zone. A mathematical model referred to as CORMIX (Cornell Mixing Zone Expert System) was used to predict the rate of mixing of the discharge with distance from the diffuser (hence, the spatial extent of the mixing zone). CORMIX was developed by Cornell University (Jirka and Akar, 1991), is supported by the United States Environmental Protection Agency, and is a widely recognized model for the analysis of mixing characteristics.

The conceptual design for the diffuser used in the assessment consisted of a diffuser line with 3 evenly spaced nozzles with each nozzle approximately 0.07 m in diameter. The diffuser line is located approximately 115 m offshore from the north shoreline and 440 m from the west shoreline, in approximately 3 m of water. The diffuser extends from the north shoreline from a single pipe which reaches a "T" that extends parallel to the north shoreline (Figure 2-1). The exact design configuration will be optimized as required during the engineering design and permitting phase to ensure optimal performance of the diffuser specific to site conditions.

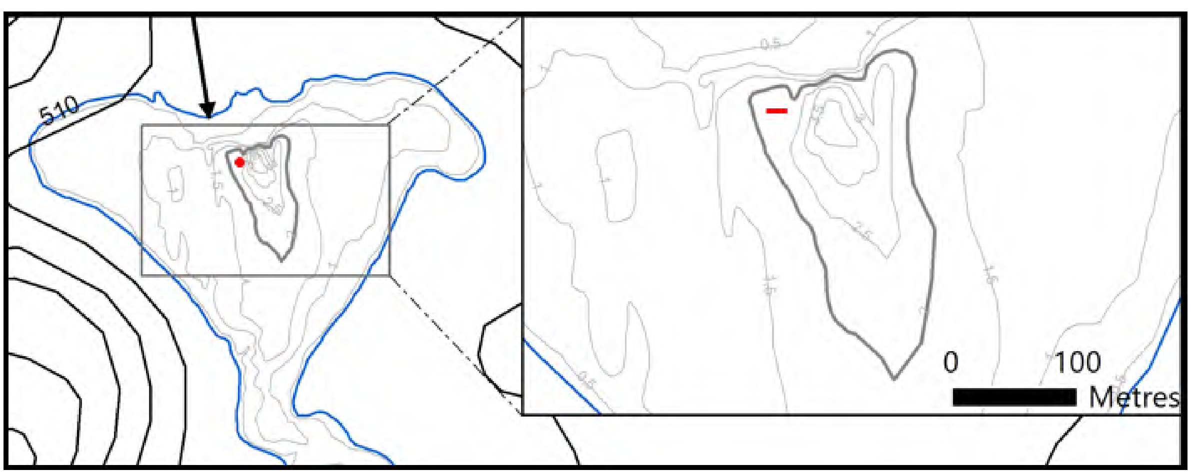

Figure 2-1: Approximate Diffuser Location

Simulations were carried out to assess the size of the mixing zone under different flow scenarios. To assess the size of a mixing zone within a lake, CORMIX uses local current velocities around the diffuser rather than volumetric flow rates. For this investigation, current velocities near the diffuser were estimated by converting river (from LA-6 to LA-5) volumetric flow rates to current speeds using the cross-sectional area of the river. This characterization of current speed near the diffuser is appropriate since the current diffuser design is placed near the mouth of the river. Estimates of current velocities were provided to Ecometrix from NewFields Canada (please refer to Appendix 8-C [Table 3-3: 7Q10 Estimated Discharge]). To assess variability in river flow rates, current velocity estimates were made by considering the minimum, average, and maximum flow rates through the mouth of the river. Current velocities used in the mixing zone assessment are summarized in 2-1.

Table 2-1: Estimated Current Velocities near the Diffuser

Flow Condition	Current Velocity (m/s)
Minimum	0.1
Average	0.23
Maximum	0.297

The extent of the mixing zone for concentrations predicted in Section 1.4 with different current velocities is given in Table 2-2. Under all flow scenarios, the size of the mixing zone for all constituents remains less than 5 m[1].

Table 2-2: Mixing Zone Size under Various Flow Conditions

Mixing Zone Distance (m)			
Current Velocity (m/s)	7Q10	Monthly Low Flow	Monthly Average Flow
0.1	4.2	0.7	0.5
0.23	0.8	0.1	0.05
0.297	0.5	0.1	0.05

[1] We note that in response to the EIS review process and comment Round 4 IR-114, the hardness induced guideline for Cu (hardness 9 mg/L, pH 7, DOC 2.24, temperature 13C), and this was in relation to interpreting the well mixed results, which are downstream of the mixing zone. Using the expected parameters at the edge of the mixing zone (hardness 250 mg/L, pH 7, DOC 2.24, temperature 13C), the size of the mixing zone for copper remains less than 5 m.

(1) Under all flow conditions, all constituents meet screening concentrations within the mixing zone.

3.0 Potential Thermal Effects

The site is expected to discharge to LA-5 year-round. Since effluent is stored in on-site ponds, it is anticipated that during the summer months, effluent temperatures and lake temperatures are both subject to the same ambient conditions, resulting in similar water temperatures. However, in the winter, the ponds may have a slight increase in temperature (compared to lake temperature) to prevent freezing of the ponds.

It is assumed that the effluent temperature in the winter would be approximately 5°C, while the ice-covered lake would have a temperature of 3-4°C. This results in a temperature differential of 1-2°C at end of pipe, leading to a slight temperature increase of the well-mixed (beyond the extend of the mixing zone) portion of LA-5 by approximately 0.2°C. Qualitatively, this suggests that there is a low thermal impact in the well-mixed portion of LA-5, a low thermal impact within the small mixing zone, and a low temporal occurrence (the largest temperature difference occurring under ice).

4.0 Closure

The information provided and statements made herein are to the best of our knowledge, information, and belief as of the date of this document. With respect to the information contained in this report, any errors or omissions made are not reflected and may be adjusted for accordingly.

Respectively Submitted,

Harry Gaebler, Ph.D.
Applied Mathematician/Environmental Modeller

Brian Fraser, M.Sc.
Principal Consultant

Jason Dietrich, M.Sc.
Project Manager

5.0

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Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

Powering
PEOPLE, PARTNERSHIPS AND PASSION.

Ecometrix | Environmental INTELLIGENCE

TO:

Denison Mines – Janna Switzer

FROM:

Ecometrix

REF:

Wheeler River Project EIS – Appendix 8-F: Wetland Effects Assessment Report

DATE:

3 October 2024

1.0 Introduction

On October 21, 2022, Denison Mines Corp. (Denison) submitted a draft Environmental Impact Statement (EIS) for the proposed Wheeler River Project (the Project). Based on their initial review, the Canadian Nuclear Safety Commission indicated that the submission contained the required information to proceed with the Federal-Indigenous Review Team (FIRT) technical review of the draft EIS. On March 20, 2023, the FIRT provided Denison with a list of information requests (IRs) for Denison to respond to and eventually submit a final EIS document. Responses to these IRs were provided in July and August of 2023. Additional FIRT IRs were provided to Denison on December 5, 2024. Of these IR-101 was not adequately answered and additional information was requested. This appendix was initially included in the January 2024 revised draft EIS and has been updated in October 2024 in response to Round 4 IR-101.

This appendix provides additional information to address IR-101 provided by Environment Canada and Climate Change (ECCC) as part of the second and fourth round of FIRT comments. The comment included a request for a further summary of wetland characterization information from available sources, baseline information pertaining to water quality and sediment quality, and assessment of potential effects to wetlands within the LSA for all phases of the Project and provide further information on mitigation measures and monitoring that would be applied for the protection of wetlands.

2.0 Scope of the Assessment

This section addresses the potential effects of the Project on the Fish and Fish Habitat VC for which wetland habitats are considered a component. The purpose of this assessment is to assess potential changes to wetlands (as represented by the Fish and Fish Habitat VC) in consideration of all phases of the Project at the Project Area, local, and regional study area scales. Pathways affecting wetlands are directly associated with potential changes to the Surface Water Quantity (hydrology), Surface Water Quality, Sediment Quality, and Benthic Invertebrates VCs. Changes to hydrology, water quality, sediment quality, and benthic invertebrate communities may directly affect wetlands as both fish and wildlife habitat and food resources. The assessment approach reflects these connections within the environment, as the significance determination for the Surface Water Quantity and Surface Water Quality VCs was conducted at the receptor VC level.

The Vegetation and Ecosystems, Listed Plant Species, and Wetlands VCs are interrelated, to varying extents, and are linked to other VCs, including:

Surface Water Quality – surface water contributes to local moisture regimes, and surface water quality can influence the persistence of Vegetation and Ecosystems, Listed Plant Species, and Wetlands.

Surface Water Quantity – surface water contributes to local moisture regimes, and surface water quantity contributes to site drainage and discharge, which can influence the persistence of Vegetation and Ecosystems, Listed Plant Species, and Wetlands.

Sediment Quality – Vegetation and Ecosystems, Listed Plant Species, and Wetlands contribute to ecosystem form and function that stabilize riparian areas and influence quality of surface water runoff to aquatic systems.

This appendix will focus on the interrelations between these VCs as they apply to Wetland function.

Pathways that are of interest include those associated with site clearing and the potential for erosion-driven mobilization of suspended sediment into local surface waters; groundwater interactions with surface water features including wetlands; the establishment of new subwatershed boundaries and the resulting effects of effluent discharge to the receiving environment; and the potential overprinting of wetland habitat by Project infrastructure.

2.1 Key indicators and Measurable Parameters

The KIs for the wetland component of the Fish and Fish Habitat VC include potential changes in surface water quantity, surface water quality, and available wetland habitat from baseline conditions. The rationale for each KI and associated MPs is summarized in Table 1.

Table 1: Key Indicators and Measurable Parameters for the Wetlands Valued Component

Key Indicator	Rationale for Key Indicator	Measurable Parameter
Change in available wetland habitat from baseline conditions	• Project activities may result in a change in the extent of Wetlands. • Of provincial and federal management concern • Contributes to biodiversity and habitat for wildlife species and listed plant species. • Cultural importance. • Contributes to biodiversity, maintenance of hydrologic cycles, nutrient cycling, water quality, and carbon storage. • Sensitive to disturbance. • Historically addressed for other mining projects in northern Saskatchewan.	Aerial extent (m^2 or ha) of overprinted wetland habitat.
Change to water levels or flows from baseline conditions	Project activities are expected to result in changes to local hydrology. A reduction or increase in flows may result due to the elimination or redirection of subwatershed area and through Project water management (i.e., water taking, storage, and effluent discharge). These changes in flow to the environment may alter stream flows, lake levels and such feature interactions (inundation) with wetland features required for fish and wildlife during all life stages.	Changes in water levels (m) or percent changes to flow conditions (%).
Change in surface water quality from baseline conditions	Changes in water quality are regulated (subsection 36(1) of the *Fisheries Act* and the MDMER). Changes that may occur as a result of the Project include: • mobilization of solids into local watersheds; and • deposition of deleterious substances into the receiving environment as a result of mine effluent and/or surface runoff.	Change in the concentration of constituents that are directly related to Project activities, measured as a mass of a chemical per unit volume in water (e.g., mg/L).

2.2 Spatial and Temporal Boundaries

The areas used to assess the effects of the Project on the Vegetation and Ecosystems, Listed Plant Species, and Wetlands VCs are (Figure 1):

Project Area: the area within which the Project and all components/activities are located (i.e., the area of maximum physical disturbance). The Project Area is considered to be a conservative estimate of the area of direct disturbance effects on VCs in this assessment.

Vegetation LSA: the area that surrounds the Project Area where all direct effects and most indirect effects are likely to occur on the Vegetation and Ecosystems, Listed Plant Species, and

Wetlands VCs. The Vegetation LSA is defined as the Project Area plus a 250 m buffer along roads and a 500 m buffer around all other infrastructure (1,161.8 ha).

Terrestrial RSA: the area that surrounds and includes the Vegetation LSA, established to assess the potential, largely indirect effects of the Project on Vegetation and Ecosystems, Listed Plant Species, and Wetlands VCs in a regional context. The Terrestrial RSA (40,173.6 ha) is defined as a minimum 8 km buffer around the Vegetation LSA and has been delineated to capture all indirect effects of the Project on the Vegetation and Ecosystems, Listed Plant Species, and Wetlands VCs and provide context for the type, distribution, extent, and prevalence of plant species and ecosystems in the region. The Terrestrial RSA also defines the area within which cumulative effects are likely to occur (i.e., CEA boundary).

Temporal boundaries identify when an effect is expected to occur in relation to specific Project phases and activities. The temporal boundaries are based on the timing and duration of Project activities, with the associated interactions with each VC and KI (where applicable). In the EA, the temporal boundaries are described as appropriate for each activity and cumulatively for the life of the Project.

The temporal boundaries for the EA represent the timeframes that the Project is expected to interact with and potentially affect Vegetation and Ecosystems, Listed Plant Species, and Wetlands VCs. The temporal boundaries are aligned with the Project development schedule as described in the EIS: Construction; Operation; Decommissioning; and Post-Decommissioning.

3.0 Existing Conditions

Wetlands are defined as "land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation and various kinds of biological activity which are adapted to a wet environment" (National Wetlands Working Group 1997). As such, ecosites have been determined to be wetland ecosystems where these conditions are expected to occur. This includes both wetland ecosites and sparsely vegetated ecosites where the water table is within 50 cm of the ground surface (McLaughlan et al. 2010). No wetlands within the Terrestrial RSA have been designated as Ramsar Wetlands of International Importance (The RAMSAR Convention Secretariat 2022).

Project-specific investigations pertaining to the Terrestrial Environment were conducted by Omnia Ecological Consulting (Omnia; Calgary, AB) from 2017 to 2019. Details on the methods, survey parameters and assumptions, and comprehensive data summaries/findings are presented in the Project-specific baseline report (Omnia 2020; see Appendix 9-B of the EIS) and a supplementary baseline annex report completed in 2021 (EDI 2021; see Appendix 9-C of the EIS).

Project baseline studies for vegetation presented a description of the ecosystems/habitat types (i.e., ecosite classifications) within the Terrestrial RSA. Vegetation communities and ecosystems are represented by provincial ecosite classifications for the Boreal Shield Ecozone in accordance with the Field Guide to the Ecosites of Saskatchewan's Provincial Forests (McLaughlan et al. 2010). These ecosite classifications were summarized within a 1:20,000 interpreted ecosite mapping product compiled within the Terrestrial RSA with the use of the following inputs:

- 1:5,000 anthropogenic features mapping;
- historical fires data;
- provincial Predicted Ecosite Mapping;
- current and historical imagery; and
- field sampling/ground truthing sites (EIS Appendix 9-B).

As the Boreal Shield Ecozone experiences a largely natural fire regime, much of the vegetation within the Terrestrial RSA (70.6%) is comprised of post-fire regeneration (i.e., shrubby structural stages). Twenty (20) upland ecosites were identified within the RSA with relative percentages by area estimated for each ecosite code.

The assessment also identified fourteen (14) wetland ecosite types within the RSA which included swamps, bogs, fens and shallow open water ecosite codes. The area of these wetlands was also estimated to provide a relative percent area of representation within the RSA.

This cataloguing of ecosite presence and relative area composition across the RSA provides the basis for understanding landscape change and succession over the course of the construction and operation of the Wheeler River Operation.

Waterbodies were conservatively included as wetlands, as they have the potential to be classified as shallow open water wetlands (i.e., water bodies 2 m deep or less; Warner et al. 1997). Waterbodies represent the most common wetland ecosystem within the Vegetation LSA and the Terrestrial RSA, comprising 3.9% (44.9 ha) and 10.7% (4,101.9 ha), respectively. The black spruce treed bog is the second most common wetland ecosystem within the Vegetation LSA (18.2 ha, 1.6%) and the Terrestrial RSA (1,157.1 ha; 2.9%). The Labrador tea shrubby bog is the most common wetland ecosystem in the Vegetation LSA, comprising 2.0% (23.3 ha), and the second most common wetland ecosystem in the Terrestrial RSA (989.9 ha, 2.5%). All other wetland ecosites are relatively uncommon, each comprising less than 0.5% of the Vegetation LSA and Terrestrial RSA. The location, size and relative area composition of the wetland features is provided in Table 2 and Figure 1). The initial classification and subsequent assessment of wetlands in the Terrestrial Environment (EIS Section 9) took a conservative approach in that the area of wetlands within the terrestrial study areas was likely overestimated to assess potential changes in areal extend of wetlands.

Table 2: Summary of Wetlands

Ecosite Code[1]	Ecosite Description[1]	Structure Code[2]	Vegetation LSA (ha)	Vegetation LSA (%)	Terrestrial RSA (ha)	Terrestrial RSA (%)
Swamps						
BS16	Black spruce / balsam poplar / river alder swamp	6	--	--	8.8	<0.1
Swamps Subtotal			**--**	**--**	**8.8**	**<0.1**
Bogs						
BS17	Black spruce treed bog	5	18.2	1.6	1,157.1	2.9
BS18	Labrador tea shrubby bog	3	23.3	2.0	967.6	2.4
		3a	--	--	20.3	0.1
		3b	--	--	2.0	<0.1
		Total	23.3	2.0	989.9	2.5
BS19	Graminoid bog	2	2.8	0.2	160.5	0.4
BS19/24[3]	Graminoid bog or graminoid fen	2	0.8	0.1	1.2	<0.1
BS20	Open bog	1	0.6	<0.1	65.5	0.2
Bogs Subtotal			**45.6**	**3.9**	**2,374.2**	**5.9**
Fens						
BS19/24[3]	Graminoid bog or graminoid fen	2	0.8	0.1	1.2	<0.1
BS21	Tamarack treed fen	5	1.9	0.2	66.5	0.2
BS22	Leatherleaf shrubby poor fen	3a	-	-	28.5	0.1
BS23	Willow shrubby rich fen	3b	0.6	<0.1	20.9	0.1
BS24	Graminoid fen	2	-	-	9.0	<0.1
BS25	Open fen	1	0.4	<0.1	5.7	<0.1

Ecosite Code[1]	Ecosite Description[1]	Structure Code[2]	Vegetation LSA (ha)	Vegetation LSA (%)	Terrestrial RSA (ha)	Terrestrial RSA (%)
Fens Subtotal			**3.6**	**0.3**	**131.8**	**0.3**
Shallow Open Water						
BS26	Rush sandy shore	2	-	-	15.1	<0.1
BS27	Sedge rocky shore	2	4.2	0.4	29.3	0.1
Waterbody[4]	--	0	44.9	3.9	4,101.9	10.7
Shallow Open Water Subtotal			**49.0**	**4.2**	**4,146.3**	**10.3**
Total Wetlands[5]			**98.3**	**8.5**	**6,661.1**	**16.6**

Notes:

1 Ecosystems are described in detail in the Guide to the Ecosites of Saskatchewan's Provincial Forests (McLaughlan et al. 2010).

2 Modified from the Field Manual for Describing Terrestrial Ecosystems (BC Ministry of Environment, Lands, and Parks, and BC Ministry of Forests 1998). 0 = unvegetated; 1 = sparse / bryophyte / lichen; 2 = herb/graminoid; 3a = low shrub; 3b = tall shrub; 5 = young forest, 6 = mature forest.

3 This ecosite type is an artifact of mapping uncertainty, as baseline mappers were unable to distinguish between these ecosites due to a lack of available information (e.g., soil information, vegetation field plots, water quality data). As such, this ecosite has conservatively been split between bog and fen classifications.

4 Areas of open water <2 m deep are defined as shallow open water wetland ecosystems (National Wetlands Working Group 1997); as such, unnamed waterbodies and areas of open water observed to exhibit an average depth of <2 m (Ecometrix Incorporated 2020) have been conservatively included as wetland ecosystems.

5 Some numbers are rounded for presentation purposes. Therefore, the totals may not equal the sum of the individual values.

DATE: 3 October 2024

TO: Denison Mines – Janna Switzer

REF: Wheeler River Project EIS – Appendix 8-F: Wetland Effects Assessment Report

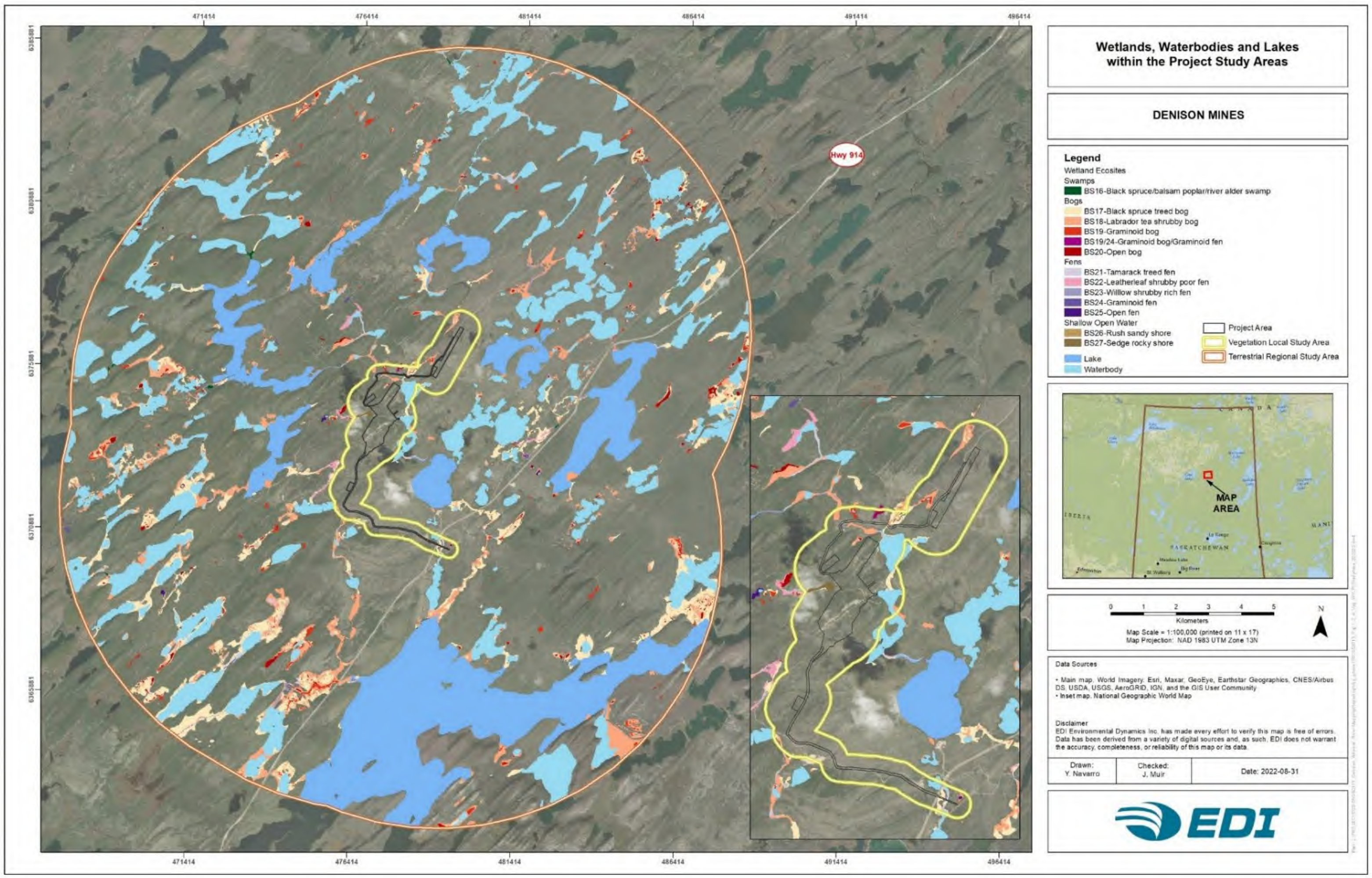

Figure 1: Wetlands, Waterbodies and Lakes within the Project Study Areas

Surface elevations for the wetland have been assessed and the information is summarized below and in the Figure 1.

- Wetlands 1.5 km west of the Project Area range from 526-524 masl.
- Waterbodies and their surrounding wetlands directly to the east of the SSA are at an elevation of between 506 and 500 masl.
- Waterbodies and surrounding wetlands 2 km east of site are approximately between 499 and 497 masl.
- Wetlands north of the Project Area and in the vicinity of the proposed air strip range from 514-508 masl.
- Wetlands situated further north of the Project Area in the LSA were at an elevation of approximately 526 masl.
- Southern wetlands that will interact with the proposed hydro corridor extension for the mine have an elevation of 491masl.
- Most wetland evaluated south of the Project Area had elevations ranging from 491-488 masl.

Wetland depth, presence of fish or fish habitat, water quality and sediment quality are not currently available for the non-waterbody wetlands (i.e. those not identified as a lake or watercourse in Section 8 of the EIS). However, Denison is committed to conducting field surveys to collect this data prior to the initiation of construction of the Operation. This will allow for baseline information to be available to compare future changes and assess the success of mitigation measures and the predicted effects or lack thereof.

For the purposes of this assessment the bogs and fens within the area can be assumed to provide supporting fish habitat to the adjacent lake and river water bodies in the vicinity of the LSA. Refer to Appendix A below for additional information on the in-lake wetlands.

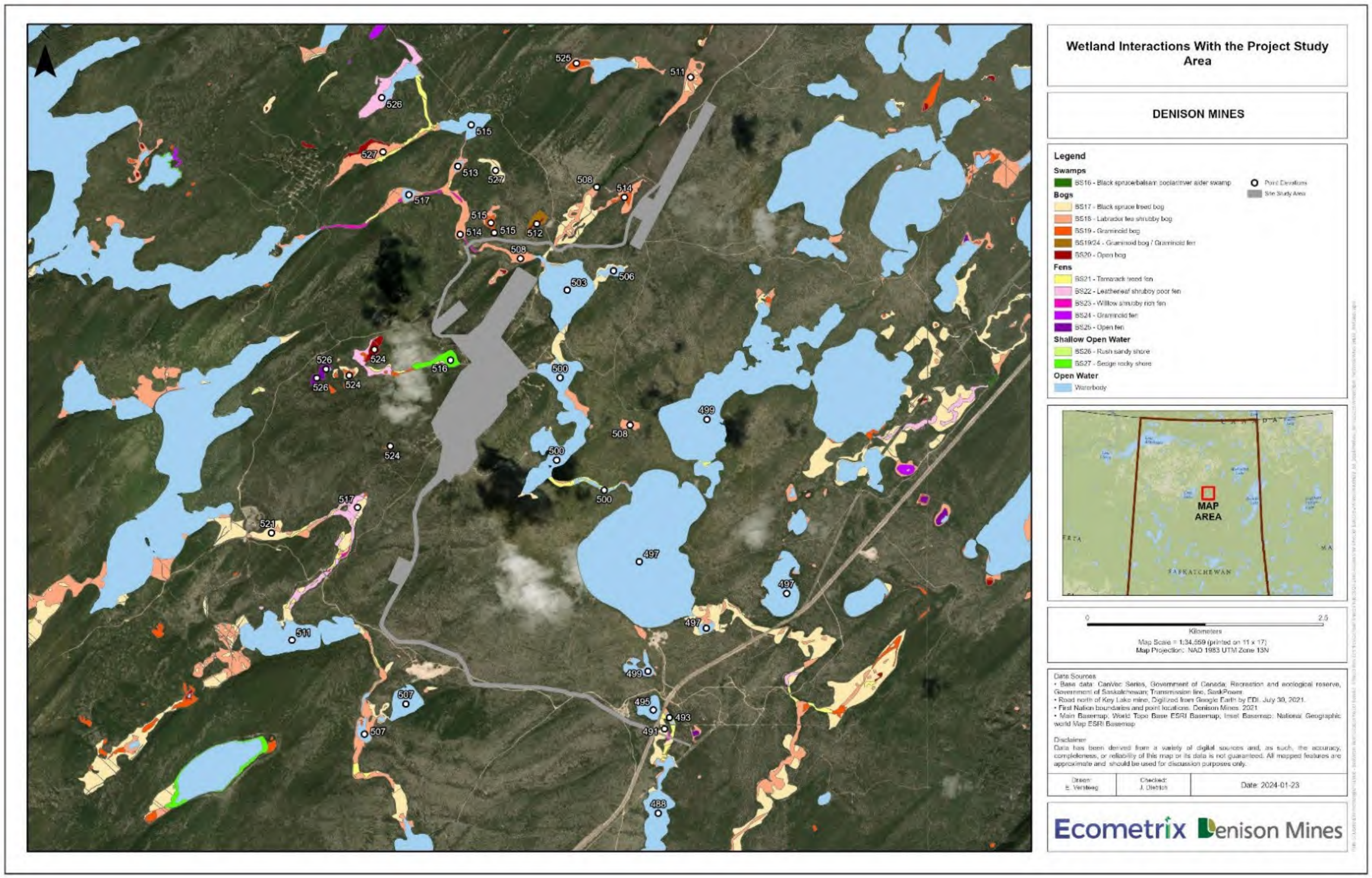

Figure 2: Elevations of wetland features in the LSA

4.0 Assessment of Project Related Effects

4.1 Potential Interactions Between the Project and Valued Component/Key Indicators

The Project will require the Construction, Operation, and Decommissioning of several components (as described in Section 2 of the EIS). Potential interactions between these Project components and activities and Fish and Fish Habitat in the form of Wetlands and their associated KIs are summarized by Project phase and activity in Table.

Potential interactions in Table are ranked as:

Primary Interaction (✓): Project activity is expected to interact with the VC / KI which may result in an adverse effect on the VC (i.e., a measurable or detectable change in the MP) and is further considered in the effects assessment as the primary contributor to potential adverse effects.

Other Interaction (✓): Project activity is expected to interact with the VC / KI. While the interaction is further considered in the effects assessment, it is not expected to be a primary contributor to potential adverse effects.

No Interaction: Project activity is not expected to interact with the VC or the KI, no adverse effects are expected, and rationale is provided for not considering this potential interaction further.

Table 4: Potential Project Interactions for Wetlands Valued Component

Project Phase/Activity	Wetlands Valued Component and Key Indicator
Development of access roads and air strip	✓
Site preparation and earthworks; clearing, leveling and grading of the Project Area	✓
Power generation - generators	✓
Installation of main substation and distribution of power around site	✓
Wellfield and freeze hole drilling; ground freezing	✓
Batch plant operation (concrete); crusher at borrow area	✓
Development of surface infrastructure (camp, operations centre, plants, ponds, pads and support facilities)	✓
Waste management (composting, domestic and industrial landfill operation, recycling)	
Water management (including treatment and site runoff)	✓
Groundwater supply	✓

Project Phase/Activity	Wetlands Valued Component and Key Indicator
Surface water withdrawal	✓
Fuel management (e.g., propane for comfort heating; vehicle and aircraft fuel)	✓
On-site and off-site operation of vehicles and transportation of materials	✓
Air transportation for workers	✓
Regulatory site inspections	✓
Engagement – site visit from Interested Parties	✓
Operation of the ISR wellfield	
Wellfield and freeze wall drilling	✓
Operation and expansion of freeze wall	✓
Batch plant operation (grout and cement); crusher in borrow area	✓
Expansion of pond and pads	✓
Operation of the processing plant and production of uranium concentrate	
Water withdrawal from groundwater or surface water body	✓
Management of surface water (including seepage and site runoff)	✓
Water treatment, both domestic and industrial	
Water release to surface water body	✓
Waste management (composting, domestic and industrial landfill operation, recycling)	
Hazardous waste management (temporary storage, handling, and off-site transportation)	✓
Storage and disposal of drill waste rock, process precipitates and industrial wastewater treatment plant precipitates	✓
On-site and off-site operation of vehicles and transport of materials	✓
Power supply – primarily power from the grid, also generators and back-up generators	✓
Package and transport of nuclear substances	✓
Fuel management (e.g., propane for comfort heating; vehicle and aircraft fuel)	✓
Air transportation for workers	✓
Progressive decommissioning and reclamation	✓
Regulatory site inspections	✓

Project Phase/Activity	Wetlands Valued Component and Key Indicator
Engagement – site visit from Interested Parties	✓
Site water management, treatment, and release	✓
Mining horizon remediation and thawing of freeze wall	✓
Process water treatment and release	✓
Closure of ISR and freeze wells and related infrastructure	✓
Decontamination of surface facilities and injection, recovery and monitoring wells	
Asset removal (including site power transmission lines and electrical infrastructure)	✓
Demolition and disposal of non-salvageable surface infrastructure and materials	✓
Remediation of contaminated areas (wellfield, pads, ponds, domestic wastewater treatment location, and process plant area)	✓
Generators	✓
Waste management (composting and landfill operation)	
Decommissioning of landfills; hazardous materials management (temporary storage and off-site disposal)	✓
On-site and off-site operation of vehicles and transportation of materials	✓
Reclamation of disturbed areas	✓
Regulatory site inspections	✓
Engagement – site visit from Interested Parties	✓
Environmental monitoring	✓
Regulatory site inspections	✓
Engagement - Site visit from Interested Parties	✓

1 Operational activities include maintenance.

4.2 Potential Project-related Effects

Based on the timing and nature of the interactions identified in Table 4, the following adverse effects have a potential to occur on the Wetland VC (Table 5). The key indicator of effects to wetlands is the change in areal extent of wetlands in the study area.

Table 5: Potential Project-related Effects on Wetlands Valued Component During all Project Phases

Project Phase/Potential Effect	Wetlands Valued Component and Key Indicator
Construction	
Direct disturbance / Overprinting	✓
Mobilization of suspended materials	✓
Introduction and/or Proliferation of Invasive Plants	✓
Changes in Water Quantity (water levels or flow)	✓
Edge Effects	✓
Changes to Water Quantity and Quality	✓
Dust Deposition	✓
Operation	
Direct disturbance / Overprinting	✓
Mobilization of suspended materials	✓
Edge Effects	✓
Introduction and/or Proliferation of Invasive Plants	✓
Controlled Discharge	✓
Changes in Water Quantity (water levels or flow)	✓
Controlled Discharge / Water Quality	✓
Dust Deposition	✓
Decommissioning	
Direct disturbance / Overprinting	✓
Mobilization of suspended materials	✓
Edge Effects	✓
Introduction and/or Proliferation of Invasive Plants	✓
Controlled Discharge	✓
Changes in Water Quantity (water levels or flow)	✓
Controlled Discharge / Water Quality	✓
Dust Deposition	✓
Post-Decommissioning	

Project Phase/Potential Effect	Wetlands Valued Component and Key Indicator
Direct disturbance	✓
Introduction and/or Proliferation of Invasive Plants	✓
Edge Effects	✓
Changes to Water Quantity and Quality	✓
Dust Deposition	✓

4.3 Mobilization of Suspended Materials

Construction

The primary effect pathway during Construction relates to the mobilization of suspended material into natural surface water features including wetlands as a result of land disturbance and clearing. The mobilization of suspended material into natural surface water features is readily mitigatable by virtue of the mine development plan and through the implementation of standard water management and sediment control practices. Water management infrastructure (e.g., collection ditches, ponds, pumping stations) and various aspects of the water management and sediment control management systems will be put into place coincident with the initiation of construction activities. Waters (e.g., runoff) associated with areas under development will be collected and stored within management infrastructure (e.g., clean waste rock pond, see Figure 2.2-14 in Section 2 of the EIS). In the event that releases to the natural environment are necessary, they would only occur once it is safe to do so (i.e., suspended solid levels in the water would be at acceptable levels). No downstream effects on surface waters, natural sediments, fish and fish habitat including wetlands are expected.

Operation

During Operation, mobilization of suspended materials will be managed through the development and operation of water management infrastructure and implementation of surface water management through the Surface Water Management Program. Releases of contact water to the natural environment will be directed through applicable collection ponds, the IWWTP, and the Effluent Monitoring and Release Ponds. No specific discharge is expected to wetland features in the Project Area. Discharge will only occur once it is safe to do so (i.e., suspended solids levels in the water would be at acceptable levels). Denison may employ active means (e.g., filtering), if required, to achieve low TSS levels in discharge, in addition to passive means, such as settling and clarification in the IWWTP to manage TSS in the effluent stream to low levels. No downstream effects on surface waters, natural sediments, or fish and fish habitat including wetlands are expected.

Decommissioning and Post-Decommissioning

During Decommissioning and Post-Decommissioning, the site-wide water management system will continue to operate such that Denison will maintain control of the site aspect affected water through the IWWTP. Surface drainage during Decommissioning activities will continue to be directed to the system of collection ponds, the IWWTP, and the Effluent Monitoring and Release Ponds to facilitate the control of suspended solids and achieve low TSS levels in the discharge, thereby minimizing any potential for adverse changes to water quality, sediment quality, and fish and fish habitat including wetland features.

4.4 Overprinting of Wetlands as Fish Habitat

For the purposes of this assessment the bogs and fens within the area can be assumed to provide supporting fish habitat to the adjacent lake and river water bodies in the vicinity of the LSA.

Bogs are predicted to be the wetland class most affected by the Project, with 0.4 ha (less than 0.1%) of mapped bog ecosystems within the Terrestrial RSA expected to be disturbed within the Project Area during Construction. Fens are the next most affected, with 0.1 ha (0.1%) anticipated to be disturbed during Construction (Figure 3). Less than 0.1 ha (less than 0.1%) of shallow open water wetlands within the Terrestrial RSA are also anticipated to be affected by the Project.

Within these wetland classes, the wetland ecosite expected to be most affected is the willow shrubby rich fen (ecosite BS23) with direct disturbance to 0.1 ha predicted to occur within the Project Area (0.5% of the BS23 ecosite within the Terrestrial RSA). The remaining ecosites anticipated to be directly affected by the Project are locally abundant, with direct disturbance expected to affect <0.1% of these ecosites within the Terrestrial RSA (Table 2).

Investigation of the potential overprinting of wetland features as a result of the Project it is evident that wetland loss is avoidable. The interaction of the Project with wetlands is isolated to those areas where stream crossings for access roads and hydro-line connections are proposed (Figure 3). With the use of single span bridges and implementation of best management practices, direct wetland disturbance associated with the crossings of Kratchkowsky Creek and Hart Creek is expected to be avoided. It should be noted that SaskPower proposes to tap the existing I3P 138 kV line near Highway 914 and build approximately 4.5 km of new 138 kV line from the I3P tap to the Project site. SaskPower will be responsible for conducting activities such as line routing, environmental studies, and permitting, public consultation, and engineering design work as applicable to the load interconnection. As such, wetland disturbance related to the SaskPower Hydro Corridor is expected to be addressed through the SaskPower permitting process.

DATE: 3 October 2024

TO: Denison Mines – Janna Switzer

REF: Wheeler River Project EIS – Appendix 8-F: Wetland Effects Assessment Report

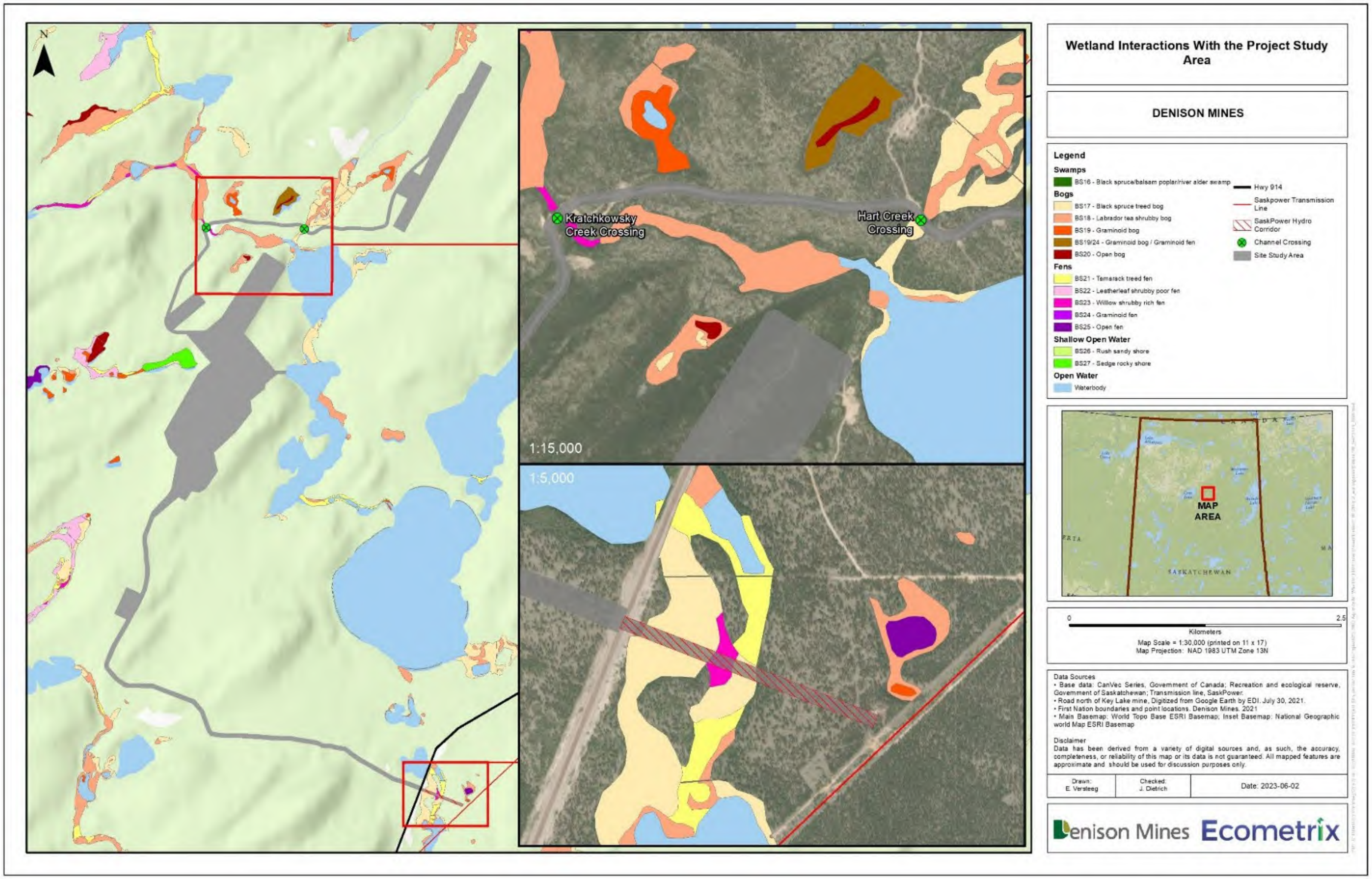

Figure 3: Denison Wheeler River Project Area and Wetland Feature Distribution

4.5 Controlled Discharge to Receiving Environments

According to the site water balance (Figure 2.2-14 in Section 2 of the EIS), there is no planned discharge to Whitefish Lake during Construction. Other than LA-5 (Whitefish Lake) no other controlled discharge will occur to the natural environment and no wetlands will be impacted as a result.

4.6 Change in Water Levels and Flow

As detailed in Section 8.1 of the EIS, the projected withdrawal and discharge rates proposed for the Project are the largest influence on the hydrological effects of the Project. The largest predicted change in streamflow rate is -3.1% at the LA-5 and SA-2 nodes (immediately downstream of the Project) during Operation and Decommissioning, as projected against the 5th percentile low flow dataset in March. Lake levels and wetlands are expected to deviate less than ±0.01 m due to all Project influences. All Project influences on the environment are expected to return to baseline conditions during Post-Decommissioning. These changes are within the range of fluctuation of environmental flows and water levels and are unlikely to affect fish passage or life history environmental cues.

4.7 Introduction and/or Proliferation of Invasive Plants

Vegetation clearing and soil disturbance during Construction are expected to create conditions suitable for the introduction and proliferation of invasive plants. Vehicles and construction equipment can inadvertently transport seeds and other invasive plant propagules in tires or the undercarriage to previously unaffected areas. The effects of invasive plants on native vegetation diversity are well documented and recognized as the second greatest threat to listed species after habitat loss (Enserink 1999). Competition with native species can lead to a reduction in the growth and vigour of native species (including Wetlands), as well as changes in the diversity, structure and function of ecosystems and habitats.

The potential for the introduction and proliferation of invasive plants by transport on vehicles and equipment is expected to continue throughout Operation during wellfield and freeze wall drilling, expansion of ponds and pads, drill waste rock, process precipitates and industrial wastewater treatment plant precipitates, on-site and off-site operation of vehicles and transport of materials, package and transport of nuclear substances, and air transportation for workers (i.e., landing and taking off of airplanes). Progressive decommissioning and reclamation has the potential to introduce invasive plants on vehicles and equipment and if seed used for revegetation is not supplied from a native seed source (Polster 2003) with a certificate of analysis indicating an absence of invasive plant seeds.

The potential for the introduction and proliferation of invasive plants is expected to continue throughout Decommissioning (e.g., during closure of the ISR and freeze wells and infrastructure, asset removal, demolition and disposal of non-salvageable surface infrastructure and materials, remediation of contaminated areas, reclamation of disturbed areas, and operation of vehicles and transportation of materials). The potential for the introduction and proliferation of invasive plants is expected to continue throughout Post-Decommissioning, but at lower levels due to reduced vehicle traffic.

4.8 Edge Effects

Edge habitat refers to an area on either side of a border between vegetation communities. Edges between vegetation communities often result in altered microclimatic conditions that can influence environmental conditions further away from the edge (Bannerman 1998). Edge effects are expected to extend into areas of native vegetation and habitats at the interface of disturbed areas and undisturbed native ecosystems, and could include altered microclimatic conditions that can influence quality in habitat away from the edge (Bannerman 1998). Where edge effects occur, Wetlands may experience changes in light intensity, temperature, wind, moisture, relative humidity, and patterns of snow accumulation and melt relative to undisturbed conditions. This can, in turn, affect plant health and alter natural disturbance regimes (e.g., blowdown), plant population persistence, and the structure and function of ecosystems and habitats. If changes to microclimatic conditions or vegetative structure at an edge exceed a species habitat preference or physiological tolerance, then edge habitat may result in lower occupancy or use, reduced survival, or lowered reproductive success.

Edge effects at the interface of disturbed areas and native ecosystems are expected to occur along the edges of the Project Area resulting from vegetation clearing during site preparation and earthworks during Construction. Edge effects are expected to continue throughout Operation, Decommissioning, and Post-Decommissioning, decreasing over time as revegetation and tree growth within reclaimed areas of the Project create a gradual structural transition at forest edges, aided by natural encroachment.

4.9 Long-Term Transport of Groundwater Solutes to Whitefish Lake in Future Centuries

During the 'future centuries' scenario as described in Section 8.3.1.3 of the EIS, remediation works will be completed and the site naturalized, thereby restoring drainage patterns to report to surface waterbodies. As indicated in Section 7 of the EIS, groundwater plumes may develop from residual mass remaining post-mining based on bench-scale lab tests of core flushing, and numerical modelling of reactive fate and transport. The results of this was described in Section 8.3.4.2.5 with respect to Fish and Fish Habitat and therefore wetlands.

The results of the numerical modelling (as provided in Section 7 and Appendix 10-A in Section 10 of the EIS) support the conclusion that with the implementation of appropriate mitigation during the decommissioning and restoration phases of the Project, the residual effects of the

Project on the intermediate Groundwater VC will not result in an adverse effect on surface water. Dissolved constituent concentrations emanating over hundreds to thousands of years in the future from the deep Ore Zone to Whitefish Lake are expected to remain below fresh water environmental quality criteria in Whitefish Lake.

Although the precise location of the groundwater discharge to the surface is somewhat uncertain, the groundwater transport scenarios that have been evaluated (Appendix 7-C of the EIS) to date suggest groundwater discharge impacted from mining will most likely be relegated to Whitefish Lake. The discharge to Whitefish Lake is generally predicted to occur along the eastern shore of the lake, as this is interpreted to be the eastern edge of the underlying desilicified zone. The Laborador Tea Shrubby Bog habitat located on the eastern shore of Whitefish Lake may be in the zone of influence of groundwater discharge, yet chemically will remain below freshwater environmental quality criteria. Groundwater impacts to other surrounding wetlands will be negligible as groundwater is not predicted to discharge within any area beyond the central portion of Whitefish Lake.

4.10 Indirect Effects

Indirect disturbance associated with the potential to adversely affect BS19/24 includes the introduction and/or proliferation of invasive plants, edge effects, changes to water quantity and quality, and dust deposition during all Project phases (as described in Section 9.2.4.2.1). Wetland ecosites BS19/24 (graminoid bog/fen) and BS25 (open fen) are peatland ecosystems typically characterized by high water tables (i.e., a very moist or very wet moisture regime), while ecosite BS27 (sedge rocky shore) is a sparsely vegetated ecosystem predominated by rocky substrates, typically occurring adjacent to lakes and ponds (McLaughlan et al. 2010). Because these ecosystems rely on high water tables and existing waterbodies, alteration of water quantity would be expected to have the highest potential to cause an adverse effect. Therefore, maintenance of wetland hydrology is expected to be the most effective mitigation to sustain these wetland ecosites within the Terrestrial LSA throughout the Project lifespan.

5.0 Mitigation Measures

Mitigation measures specific to the wetlands, discussed in the following subsection are applicable during all Operation phases and expected to be effective immediately following implementation and managed through the EMP.

Disturbance Reduction

- Wherever possible, wetlands will be avoided through Project design and instituting proper buffers.

- Disturbance to vegetation and soils will be avoided by clearly delineating Project Area boundaries (e.g., with the use of fencing, staking, or flagging), adhering to construction plans and schedules, and by restricting off-site machine use.
- Wetland boundaries in the proximity of planned disturbances will be clearly delineated (e.g., with the use of fencing, staking, or flagging) to facilitate avoidance to the extent practicable.
- Should they occur, areas prone to potential instability and areas in proximity to water bodies and drainage features will be identified and appropriate setbacks will be established and maintained.
- Temporary workspaces or laydown areas will be sited and constructed within existing disturbance or on previously compacted soils, where practicable. In areas requiring clearing only, grubbing will be avoided, and roots and groundcover will be retained to the extent feasible.
- Pre-construction listed plant surveys will be completed within the Project Area.
- Listed plants located adjacent to planned disturbances will be clearly delineated (e.g., with the use of fencing, staking, or flagging) to facilitate avoidance to the extent practicable and reduce the potential for accidental encroachment outside of the Project footprint.
- Should Listed Plants be identified within the Vegetation LSA prior to Construction, site- and species-specific mitigation measures to avoid and/or limit Project effects will be determined by a Qualified Vegetation Ecologist. Specific mitigation measures will depend on the species, its life history characteristics, time of year, and the location of the occurrence in relation to Project activities.
- Herbicide use will be avoided within 100 m of any known listed plant occurrences. Where herbicide use is unavoidable, use will be restricted to direct application instead of broadcast spraying and completed by qualified personnel.

Soil Handling and Reclamation

- Construction activities will be sequenced (i.e., site clearing, grading preparations, major earthworks and construction of infrastructure/facilities) so that surface vegetation, mineral soil and organic matter can be salvaged for later use in Project Decommissioning.
- Soil resources within the Project Area will be stripped/salvaged and stockpiled within the Project Area in accordance with relevant soil management BMPs, i.e., providing guidance on ground-truthing soil conditions, flagging potential hazards and sensitivities, and

modifying practices in relation to environmental conditions and avoiding or minimizing inadvertent/incidental disturbance.

- A soil monitoring program/protocol (or equivalent) will be undertaken to verify soil salvage volumes and reclamation suitability (Section 9.1.8.2).
- Soil stockpiling locations will be sited to reduce soil handling and travel distances and designed to minimize the potential for soil degradation and downgradient effects, e.g., having defined height and width that optimize soil storage and stockpile stability, and having integrated erosion control measures and surface water management features (if/where necessary). Sediment and erosion control measures will be implemented in accordance with BMPs and commensurate to site conditions and sensitivities.
- Sediment and erosion control measures and surface water management features will be installed and maintained at the Project. Erosion controls (e.g., sediment fencing, check-damns and/or sediment ponds) will be installed as necessary and at the discretion of construction personnel commensurate to site conditions and sensitivities to manage/mitigate erosion and sedimentation.
- Progressive reclamation and ecosystem-based revegetation will be conducted on disturbed areas as soon as practicable with the use of suitable native species and in accordance with the Reclamation and Closure Plan.

Surface Water Management

- Snow melt and runoff will be controlled within the Project Area to prevent the potential release of contaminated runoff from affecting vegetation in adjacent areas.
- Sediment and erosion control measures will be implemented in accordance with the EMS.
- Surface water management features (e.g., culverts and ditches) will constructed and maintained (as per Project design specification) along access roads and facility sites to facilitate surface drainage continuity and hydrologic connectivity—especially in proximity to wetlands, water crossings, and waterbodies.
- Hydrologic connectivity is expected to be maintained across the Project Area with the engineering, construction, and maintenance of surface water management features (e.g., culverts and ditches) as appropriate and as per Project design specifications along access roads and at facility sites.

Invasive Plant Management

- Equipment and vehicles will arrive at the Project Area clean, and will be inspected for soil, plant material, and seeds, and cleaned as appropriate, to limit the potential for the introduction of invasive plants and noxious weeds.
- Areas with a high risk for the potential spread of invasive plants and noxious weeds (i.e., within or adjacent to existing infestations) will be avoided to the extent practicable; if work must occur in these areas, invasive plant management will be implemented before starting work.
- Gravel, fill, straw matting, or similar materials to be used for erosion control will be inspected to minimize the potential for seeds or propagules of invasive plants being brought to site.
- All employees and contractors on the Project will receive an employee orientation appropriate to the work they are undertaking, including instruction on the definition of invasive plants and their potential effects, mitigation measures to avoid the introduction and spread of invasive plants, and training on the presence and identification of common invasive plant species and those known to occur within the Project Area.
- Invasive plant monitoring will be conducted periodically by personnel skilled in invasive plant identification during all Project phases to assess, evaluate, and document invasive plant occurrences within the Project Area. Invasive plant surveys will be completed during a biologically appropriate time of year (e.g., when invasive plants can be identified) within areas identified as most susceptible to invasive plant introduction and spread, including roads, ROW, debris and vegetation management areas (e.g., slash piles, timber decks, exposed soil or stockpiles) and other regularly disturbed habitats.
- Three general treatment options may be used alone or in combination to control of invasive plants in the Project Area:
    - mechanical control – involves the physical removal of the plants;
    - chemical control – involves application of synthetic and/or natural herbicides; and,
    - biological control measures – involves use of living organisms (e.g., rusts, insects) to control selected invasive plant species.
- The type of treatment option selected for an invasive plant occurrence will be based on a combination of specific information including the identity of the invasive plant species and its provincial designation, the size and extent of the occurrence, time of year, the proximity of the occurrence to other susceptible areas (e.g., rare plant occurrences, wetlands, waterbodies), and the available control options. Where possible, control of

invasive plants will be completed in consultation with a qualified professional to minimize potential effects on native vegetation, ecosystems and wetlands.

- Seed used during re-vegetation will be certified weed free, with a valid "Certificate of Seed Analysis".

6.0 Residual Effects Evaluation

6.1 Residual Effects Characterization

Residual effects on the Vegetation and Ecosystems, Listed Plant Species, and Wetlands VCs have been assessed in relation to the RSA, and characterized in terms of direction, magnitude, geographic extent, frequency, duration, reversibility, context, and likelihood (Table 6). Residual effect evaluation of residual effects are provided in Tables 7, 8 and 9.

Table 6: Definitions of Effect Characteristics Considered When Determining the Significance of Residual Effects

Residual Effect Characteristic	Definition	Rating
Direction	Identifies whether the residual effect will be adverse or positive.	**Adverse** – Negative effect or effect is not desirable. *Water Quantity* – Effect moves MPs (flow or water level) in a direction detrimental to water quantity relative to baseline conditions. A Project-related increase in surface water flows and levels during flooding, or a decrease in surface water flow below environmental flow requirements. *Water Quality* – An increase in constituent concentrations attributable to the Project in comparison to baseline conditions and trends. *Wetlands / Fish Habitat* – A physical loss of available fish habitat (extent of area) in comparison to baseline conditions. **Positive** – Beneficial effect or effect is desirable.
Magnitude	The amount of change in a measurable parameter relative to baseline conditions.	**Low** ▪ measurable decrease in the spatial extent of Wetlands, but less than a 10% loss; all original wetland classes are present. ▪ A measurable change that is not within the variability of baseline conditions but below relevant water quality objectives and criteria. A Project-related change in hydrology (flows or levels) compared to baseline conditions, but where the change is <5% from baseline conditions

Residual Effect Characteristic	Definition	Rating
		Moderate ▪ measurable decrease in the spatial extent of Wetlands between 10% and 30% loss; measurable changes in the diversity of wetland classes; some original wetland classes may be absent. ▪ A measurable change in water quality that is not within the variability of baseline conditions and not within applicable guidelines, legislated requirements, and/or federal and provincial management objectives. A Project-related change in hydrology (flows or levels) compared to baseline conditions, but where the change is >5% from baseline conditions, and could, therefore, have an adverse effect on Fish and Fish Habitat within the LSA. **High** ▪ measurable decrease in the spatial extent of Wetlands greater than 30% loss; some original wetland classes are absent. ▪ monthly flows (>10%), or lake surface elevation (m) in a waterbody or watercourse that is greater than the range of natural variability and large enough that fish can no longer rely on this habitat to carry out one or more of their life processes. A measurable change in water quality that is not within the variability of baseline conditions and not within applicable guidelines, legislated requirements, and/or federal and provincial management objectives and is likely to have an adverse effect on Wetlands (Fish and Fish Habitat) within the LSA, with the effect extending beyond the LSA.
Geographic Extent	The geographic area within which the residual effect is expected to occur.	**Project Area** – Effect is limited to the Project Area. **Local** – Effect is limited to the Vegetation LSA. **Regional** – Effect extends beyond the Vegetation LSA into the Terrestrial RSA. **Beyond Regional** – Effect extends beyond the Terrestrial RSA.
Duration	Length of time over which the residual effect is expected to persist.	**Short-term** – Less than 3 years (i.e., effect happens during Construction only). **Medium-term** – 3 years to 38 years (i.e., effect happens from Construction through to the end of Post-Decommissioning). **Long-term** – More than 38 years (i.e., effect extends beyond Post-Decommissioning).
Frequency	How often the residual effect is expected to occur.	**Infrequent** – Effect occurs several times at sporadic intervals. **Frequent** – Effect occurs many times on a regular basis. **Continuous** – Effect occurs continuously.

Residual Effect Characteristic	Definition	Rating
Reversibility	Whether or not the residual effect can be reversed once the activity causing the residual effect ceases.	**Fully Reversible** – A residual effect that diminishes to baseline conditions. **Partially Reversible** – A residual effect that partially diminishes to baseline conditions. **Irreversible** – A residual effect that will not diminish to baseline conditions.
Context	The extent to which the VC or KI has been affected by past and present environmental and socio-economic processes and conditions, its potential sensitivity to the Project-related residual effect, and its ability to recover from that effect (i.e., resilience)	**Low** – VC/KI has high resilience to stress or ecological change. This resilience can be a result of the ecological characteristics of the species or ecosystem, and/or a lack of historic and ongoing anthropogenic or natural disturbance. No listed species present. **Moderate** – VC/KI has moderate resilience to stress or ecological change. This resilience can be a result of the ecological characteristics of the species or ecosystem, and/or an intermediate level of historic or ongoing anthropogenic or natural disturbance with the capacity to assimilate more change. Presence of listed species **High** – VC/KI has weak resilience to stress or ecological change. This resilience can be a result of the ecological characteristics of the species or ecosystem, and/or a high level of historic or ongoing anthropogenic or natural disturbance. Presence of *SARA*-listed species
Likelihood	Likelihood that the residual effect will occur including consideration of the likelihood that the mitigation will be successful.	**Likely** – A moderate to high probability that the residual effect will occur. **Unlikely** – A low probability that the residual effect will occur.

Table 7: Wetland Fish and Fish Habitat – Summary of the Residual Effect Characteristics for Surface Water Quality

Residual Effect Characteristic	Rating	Summary Rationale for Rating
Direction	Adverse	The Project (specifically the discharge of effluent to the natural environment) will cause a change in the concentration of constituents, as measured as a mass of a chemical per unit volume in water (e.g., mg/L). Surface water quality in the local receiving environment will be adversely affected by effluent discharge to the aquatic environment, thereby providing a pathway to adversely affect surface waters. However, no discharge is planned to wetlands outside of Whitefish Lake.
Magnitude	Low	The magnitude of the residual effect is predicted to be low as constituents that may be introduced as part of Project activities are expected to remain below criteria for the protection of aquatic life and human health.
Geographic Extent	Local	The geographic extent of the residual effect is predicted to be confined to the immediate waterbody adjacent to the Project (i.e., Whitefish Lake). The estimated mixing zone is less than 5 m, implementing an effluent discharge configuration that promotes mixing.
Duration	Long-term	The residual effect is expected to last between 3 to 38 years (i.e., effect expected during Construction through to the end of Post-Decommissioning).
Frequency	Continuous	For the purposes of this EIS, a conservative scenario was identified, with effluent discharge being considered as continuous during Operation and Decommissioning.
Reversibility	Fully reversible	Surface water quality is expected to return to pre-development levels following Post-Decommissioning as Project-related sources will cease to operate.
Context	Low	Wetland health is expected to be resilient to changes in surface water quality in the context of this assessment, as COPC meet protective criteria even at the extreme low water scenario. Therefore, under applicable mitigative measures and average flow conditions, the contextual resilience of the aquatic system to respond to change is considered to be great.
Likelihood	Likely	A high probability exists that a change in water quality from background conditions will occur, but be restricted to Whitefish Lake and not other surrounding wetland features.

Table 8: Wetland Fish and Fish Habitat – Summary of the Residual Effect Characteristics for Change in Area Extent

Residual Effect Characteristic	Rating	Summary Rationale for Rating
Direction	Adverse	Impacts to wetlands in the LSA from physical disturbance or overprinting are expected to be minor in nature and relegated to wetlands located at stream crossings for access roads and the hydro-line corridor. In both cases the approach to design will be one of avoidance and minimal disturbance with clear span bridges and minimal clearing required for hydro-line installation where avoidance of open water areas can be met.
Magnitude	Low	The magnitude of the residual effect is predicted to be low. Less than 0.1% of Wetlands within the Terrestrial RSA are predicted to be directly affected as a result of Project Construction, and up to 1.5% may be indirectly affected during all Project phases.
Geographic Extent	Local	The residual effect is expected to be limited to the LSA, specifically to wetlands located at stream crossings for access roads and the hydro-line corridor
Duration	Long-term	Once natural drainage patterns are re-established following Operation, the structure and function of Wetlands altered as a result of indirect Project effects are expected to re-establish after Post-Decommissioning (more than 38 years).
Frequency	Frequent	While direct affects to specific Wetlands will occur over a short time period during Construction, Wetland alteration by indirect effects is anticipated to occur frequently throughout Construction, Operation, and Decommissioning, and infrequently during Post-Decommissioning.
Reversibility	Partially Reversible	Wetland effects are predicted to be partially reversible during Decommissioning once natural hydrologic conditions are reinstated. Alterations to wetland extent, structure and/or function as a result of indirect Project effects during all Project phases are predicted to be reversible over time once natural hydrologic conditions are reinstated and edge effects, dust, water quality changes, and invasive plant propagule pressure are reduced at the end of Decommissioning.
Context	Moderate	Wetlands can exhibit low resilience and high susceptibility to disturbance; however, disturbance is common within the Terrestrial RSA, and existing Wetlands have been historically disturbed by access roads and exploration activities.
Likelihood	Likely	The infrastructure associated with the bridges and the hydro-line are likely to affect the localized area for which they span in a limited way.

Table 9: Wetland Fish and Fish Habitat – Summary of the Residual Effect Characteristics for Change in Surface Water Quantity (Hydrology)

Residual Effect Characteristic	Rating	Summary Rationale for Rating
Direction	Adverse	Water quantity (flow and level) will be reduced in LA-5 as a result of the overprinting of its reporting drainage area by mine infrastructure and through site water balance. Water taking has an additional potential to reduce water levels in LA-5 and associated wetlands.
Magnitude	Low	The magnitude of the residual effect is predicted to be low. Under all scenarios, the Project-related change in hydrology (flows or levels) compared to baseline conditions is less than 5% of baseline conditions, and generally less than 3%.
Geographic Extent	Local	The residual effect is expected to be limited to the LSA, specifically the lakes and wetlands within proximity to the Project site (i.e., LA-5, LA-6, and LA-1).
Duration	Moderate	The residual effect is expected to last between 3 to 38 years (i.e., effect expected during Construction through to the end of Post-Decommissioning).
Frequency	Continuously	Although the mine is unlikely to require water taking on a continuous basis, this has been assessed as a bounding scenario and, as such, must be considered as a continuous effect.
Reversibility	Fully reversible	Surface water hydrology is expected to return to pre-development levels following Post-Decommissioning.
Context	Moderate	Surface water flow regimes are variable, and it is this variability that provides for morphological form to be maintained and for ecological reliance (i.e., wetlands, fish habitat). Some change to environmental flows is tolerated by wetland biota.
Likelihood	Low	Due to the localized nature and low magnitude of the effect on surface water hydrology, the likelihood of an effect is considered to be very low; therefore, the likelihood of an effect on Wetlands is expected to be low.

6.2 Significance and Confidence

The residual effect of change in the areal extent of the Wetlands VC as a result of the Project is not expected to result in a change to the wetlands KI that will alter its integrity within the Terrestrial RSA to the point where it is not sustainable or unavailable to contribute to ecological functions.

The threshold for significance for the Wetlands VC relates to predicted changes in the concentrations of water quality parameters, where changes could result in exceedances of relevant water quality benchmarks that are protective of aquatic biota in waterbodies that receive mine-affected drainage. The threshold for significance for Wetlands also includes predicted changes in surface water flows greater than baseline environmental flows and direct habitat loss.

The significance of the residual effects on the Wetlands VC has been deemed **not significant**. Following mitigation, the residual effects are not expected to cause a change in Wetland habitat (or associated KIs) to the extent that they might alter the ecological integrity of the VC in the LSA beyond an acceptable level.

The predicted confidence with respect to the Wetlands VC is high as the mobilization of suspended materials can be readily mitigated, making the effects prediction relative to this effect pathway easily understood.

Confidence in the assessment of predicted effects on water levels or flow is quite high due to available hydrological data for the LSA. Uncertainty is minimal with the assumptions that the water withdrawal and discharge scenarios presented herein represent the bounding case, and hydrogeological modelling projections are not changed (Section 8.1 of the EIS).

Potential effects on water quality as a result of Project discharges to local receiving environments were assessed by way of numerical modeling. The in-lake wetlands will be subject to the same processes by which constituents are expected to accumulate in all lake sediments. That is sediments are in dynamic equilibrium with the water, with the relationship between the two defined by the Kd (partition coefficient). The Kds used in the EIS are not habitat specific; they are derived from years of water and sediment data collected in the Athabasca Basin. The Kds would include a variety of habitats (e.g., nearshore vegetated littoral zones, depositional habitats) from which water and sediment quality data have been collected. These predictions are generally considered conservative in nature because the assumptions on which they are based are conservative. For example:

- The assessment is based on a continuous (year-round) discharge at an expected average effluent rate of 0.0101 m^3/s (36.5 m^3/hr) throughout Construction, Operation, and Decommissioning, despite the likelihood that effluent discharge will not be continuous and will only discharge when site water balance requires, based on water storage capabilities.

- The constituents in effluent discharge have been estimated conservatively. Presented discharge concentrations provided herein include contingency factors of one to three times.

- Baseline water quality is defined by the 95th percentile concentrations of individual constituents. Such an assumption is conservative as it constrains the assimilative capacity associated with the receiving environment. By definition, the assimilative capacity of a receiving environment is equal to the incremental difference between the existing baseline condition and the assessment benchmark (i.e., water quality criterion) on which the evaluation is based. Use of the 95th percentile concentration, rather than a measure of central tendency (i.e., 50th percentile, geomean), means that the incremental change in a given constituent concentration that can be assimilated by the receiving environment (whereby use of the receiving environment is protected) is relatively small in magnitude.

Due to the conservative nature of the assumptions on which the numerical assumptions are based, a high degree of confidence can be assumed.

6.3 Summary of Project Related Residual Adverse Effects

The results of the characterizations for these residual effects are summarized in Table 10. The residual effects of the Project on the Wetland KIs were predicted to be **not significant**. Thus, the residual effects of the Project on the Wetlands VC are predicted to be **not significant**.

Table 10: Summary of Project-related Residual Effects

Valued Component	Residual Effect	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context	Likelihood	Significance
Wetlands	Change in Water Quality	C, O, D	A	L	L	LT	C	FR	L	L	NS
	Change in Water Level or Flow	C, O, D	A	L	L	MT	C	FR	L	L	NS
	Change in the Areal Extent of Wetlands	C, O, D	A	L	L	LT	F	PR	M	L	NS

[1] Direction: Adverse (A), Positive (P)
Magnitude: Low (L), Moderate (M), High (H)
Geographic Extent: Local (L), Regional (R), Beyond Regional (BR)
Duration: Short-term (ST), Medium-term (MT), Long-term (LT)

Frequency:	Infrequent (IF), Frequent (F), Continuous (C)
Reversibility:	Fully Reversible (FR), Partially Reversible (PR), Irreversible (IR)
Context:	Low (L), Moderate (M), High (H)
Likelihood:	Unlikely (U), Likely (L)
Significance:	Not-Significant (NS), Significant (S)
Level of Confidence:	High (H), Moderate (M), Low (L)

7.0 Cumulative Effects

The cumulative effects are discussed in detail in Section 9.2.7 of the EIS and are not re-examined herein.

8.0 Summary

Bogs are predicted to be the wetland class most affected by the Project, with 0.4 ha (less than 0.1%) of mapped bog ecosystems within the Terrestrial RSA expected to be disturbed within the Project Area during Construction. Fens are the next most affected, with 0.1 ha (0.1%) anticipated to be disturbed during Construction. Less than 0.1 ha (less than 0.1%) of shallow open water wetlands within the Terrestrial RSA are also anticipated to be affected by the Project.

Within these wetland classes, the wetland ecosite expected to be most affected is the willow shrubby rich fen (ecosite BS23) with direct disturbance to 0.1 ha predicted to occur within the Project Area (0.5% of the BS23 ecosite within the Terrestrial RSA). The remaining ecosites anticipated to be directly affected by the Project are locally abundant, with direct disturbance expected to affect <0.1% of these ecosites within the Terrestrial RSA.

Investigation of the potential overprinting of wetland features as a result of the Project it is evident that wetland loss is avoidable. The interaction of the Project with wetlands is relegated to those areas where stream crossings for access roads and hydro-line connections are proposed.

Avoidance through design as well as mitigation measures to control sedimentation to wetland features during construction, operation and decommissioning phases. Water quantity and quality are not expected to cause impacts to wetlands as the change in surface water feature levels and flow are nearly negligible and water will not be discharged to wetlands save for Whitefish Lake, for which effluent will not be released unless meeting criteria for the protection of aquatic life.

Residual effects on the Wetlands VC resulting from the Project were identified and assessed as **not significant**. Existing provincial legislation (Environmental Management and Protection Act [Government of Saskatchewan 2010] and the Water Security Agency Act [Government of Saskatchewan 2019b]) requires written approval (i.e., Aquatic Habitat Protection Permits) prior to any works within a wetland.

To further supplement existing information that exists for the LSA wetlands, Denison is committed to undertaking wetland surveys including the collection of water quality, sediment quality, benthic invertebrates and fish and fish habitat surveys prior to the construction of the operation to provide an updated baseline for assessing the success of mitigation measures and to assess potential effects of the project on wetlands. These locations will then be further considered as part of the EMP for continued monitoring for these media and biota.

9.0 References

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Appendix A Orientation for CNSC Round 4 IR reviewers: Whitefish Lake (middle basin) inflow to McGowan Lake inflow

DATE: 3 October 2024

TO: Denison Mines – Janna Switzer

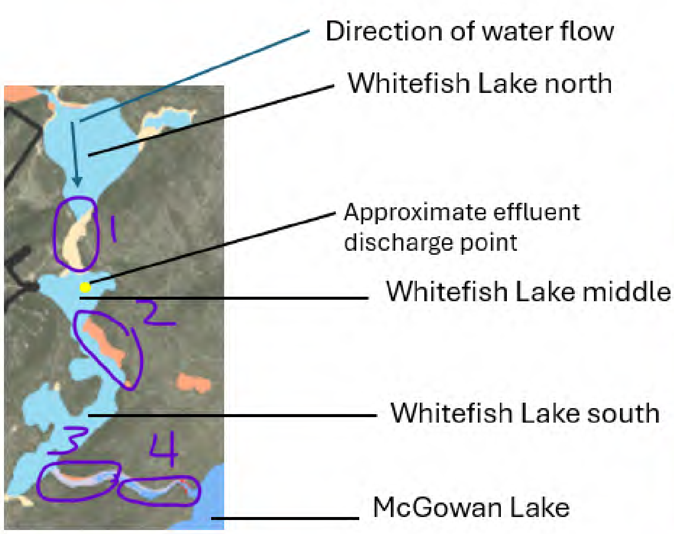
REF: Wheeler River Project EIS – Appendix 8-F: Wetland Effects Assessment Report

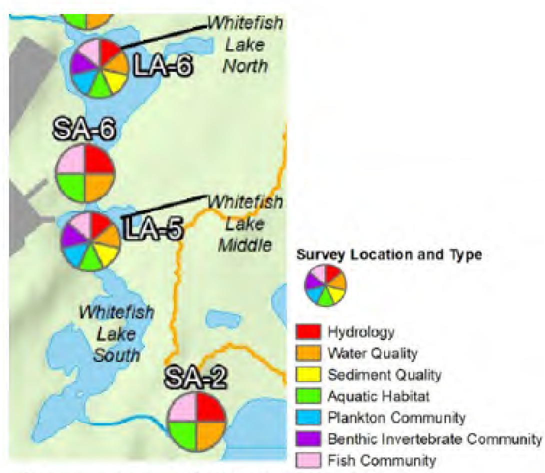
During the June 14, 2024, meeting to discuss Round 3 IR-101, the federal review team indicated that the wetlands of interest are those located within the nearshore environments of Whitefish Lake (Upper, Mid and Lower) as these lakes will directly receive treated effluent during operation.

The purpose of this appendix is to facilitate the CNSC's review of Denison's Round 4 response to IR-101 by summarizing information on the in-lake wetlands of interest.

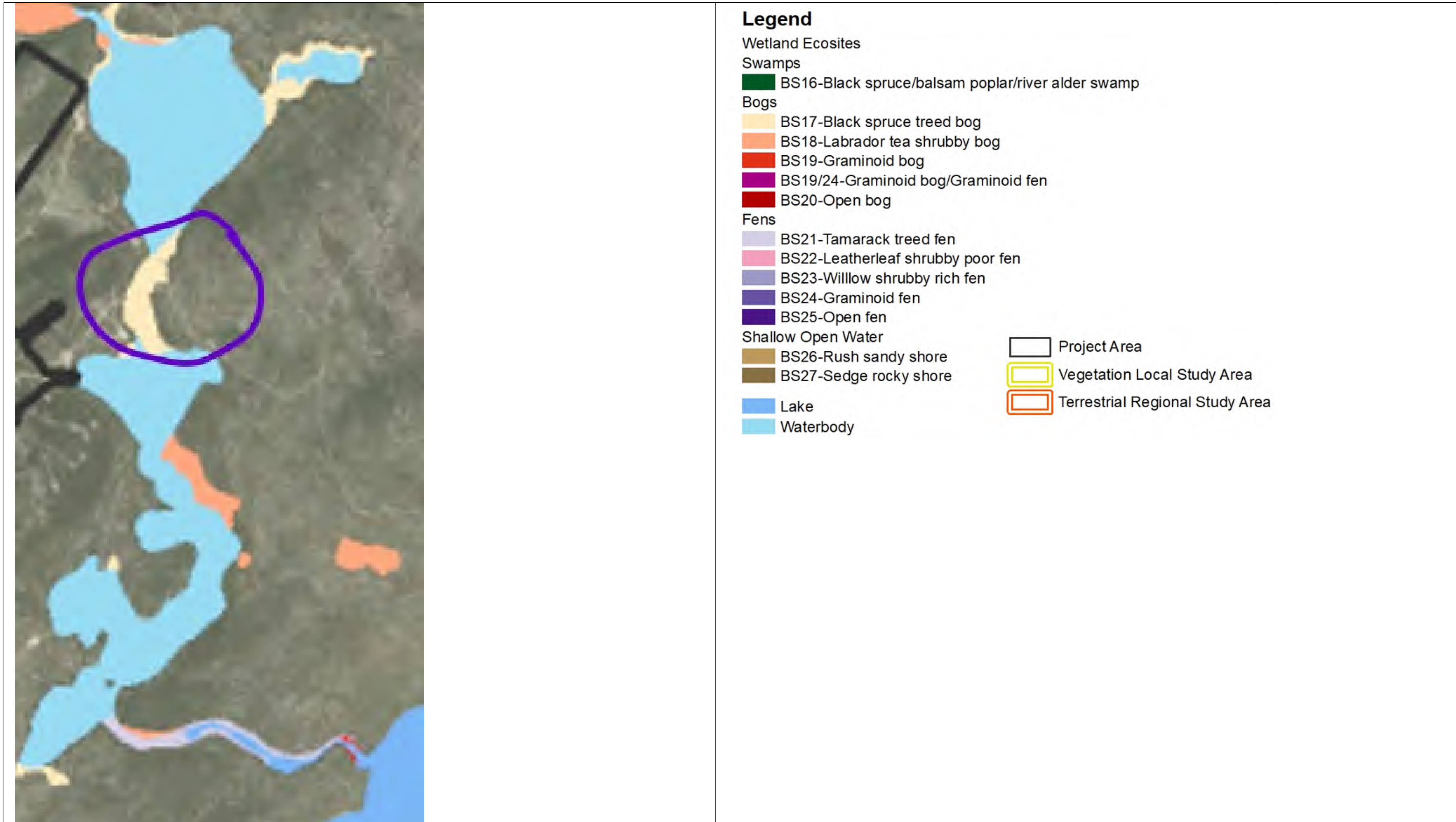
While some of these in-lake areas were conservatively classified as wetlands in the terrestrial assessment (EIS Section 9), from an aquatic perspective, these in-lake wetlands of interest are littoral / nearshore zones in the lake and connecting channels. These in-lake wetland areas of interest are not cut-off from or isolated from the main basin of the lake. As such, it can be assumed that the lake environment is likely to be as depositional as the nearshore environment. The lakes of interests are very shallow (on average 1.5 m in depth) and therefore deposition may be as likely in the "offshore" environment as the nearshore.

This appendix provides a summary of four general areas (see marked up wetland map image below with areas circled and numbered in purple) from the inflow to Whitefish Lake (middle basin) to the inflow to McGowan Lake. An excerpt from Section 8's Figure 8.2-4 is also provided to orient the reviewer to the water quality, biota, and sediment sampling locations (refer to EIS Section 8 for details). The four areas shown in the wetland image are reviewed in the balance of this appendix with photographs and text/descriptive excerpts from the EIS to provide a general site orientation to the reviewers.





(Excerpt from EIS Figure 8.2-4)


Legend
Wetland Ecosites
Swamps
BS16-Black spruce/balsam poplar/river alder swamp
Bogs
BS17-Black spruce treed bog
BS18-Labrador tea shrubby bog
BS19-Graminoid bog
BS19/24-Graminoid bog/Graminoid fen
BS20-Open bog
Fens
BS21-Tamarack treed fen
BS22-Leatherleaf shrubby poor fen
BS23-Willow shrubby rich fen
BS24-Graminoid fen
BS25-Open fen
Shallow Open Water
BS26-Rush sandy shore
BS27-Sedge rocky shore
Lake
Waterbody
Project Area
Vegetation Local Study Area
Terrestrial Regional Study Area

Notes from Appendix 8-B, Appendix F (2019):

SA-6 (Outflow from LA-6)
SA-6 is the outflow from LA-6 and is equipped with a stage recording datalogger. The sensor and sensor housing at this location were replaced in August. Stage and discharge data for SA-6 are presented in Table 6 and the rating curve is shown as Figure 6. The cross-section is shown in Photo 11 for the July field program and Photo 12 is from the August field program.

Photo 11: SA-6 - July Field Program

Photo 12: SA-6 - August Field Program

Notes from Appendix 8-D (2016)

4.6 SA-6
Station SA-6 is situated on the connecting channel between the north and south basins of Whitefish Lake, LA-6 (upstream) and LA-5 (downstream), respectively (see Figure 1-8). At this location the watercourse is 3rd order.

4.6.3 Aquatic Habitat
The surveyed reach (390 m) included the entire length of stream between the two lake basins. Mean wetted channel width, water depth and water velocity were 14 m, 0.7 m and 0.2 m/s, respectively. The banks were stable, and the channel was meandering (see Appendix C, Photo 11). The stream gradient was low, and stream morphology was primarily runs (75%) and pools (20%), with some flats (5%). The canopy was partly open. Instream cover was diverse, afforded by deep pools, aquatic macrophytes, boulders, logs and trees, and undercut banks. Substrates were comprised of 85% sand, 10% boulder and 2% silt. Observed aquatic vegetation included sedges, pondweed and horsetail (see Appendix C, Photo 12). Moderate algae growth and slight sediment were observed overlying the substrate and no barriers to fish migration were observed. The surrounding terrain was 50% upland and 50% lowland forest, and observed riparian vegetation included jack pine, black spruce, sweet gale, and Labrador tea. Snails (Gastropoda), mayfly nymphs (Hexagenia sp.) and dragonfly nymphs were observed. Stream habitat characteristics are detailed in Appendix A, Table A-15.

4.6.4 Fish Community
A summary of the fish community is presented in Table 4-4. Detailed fish catch data including fishing effort and numbers of each species collected are presented in Appendix A, Tables A-13, A-16. Within a 150-m stretch of the reach, 1,531 seconds of electrofishing effort was expended during the fall 2016 survey, resulting in the capture of 24 fish from 4 species. Twelve YOY and 3 adult Spottail Shiner, 4 YOY and 2 juvenile Burbot, 2 adult Ninespine Stickleback and 1 YOY Longnose Sucker were captured. The CPUE was 0.94 fish/minute of electrofishing. Three adult White Sucker, 1 adult Walleye, and 3 juvenile and 3 adult Northern Pike were captured by gillnet during the spring 2017 survey. In addition, 6 adult Northern Pike and 2 adult White Sucker were observed. The list of fish species identified during baseline surveys was reviewed by Bobby John, and is considered inclusive and comprehensive (Denison, 2020).

Photo 11: Stream station SA-6 looking downstream (12 September 2016). This drainage area station is situated on the connecting channel between lakes LA-6 (upstream) and LA (downstream).

Photo 12: Stream station SA-6 looking downstream (12 September 2016). Suitable spawning habitat for Northern Pike occurred near the inlet to lake LA-5, and adult pike were observed in the vicinity during the May 2017 spawning survey.

SA-6 facing upstream, March 2018.

Notes from Appendix 8-B, Appendix D (2011):

SA-6
Streamflow monitoring Station SA-6 drains from LA-6 and is upstream of SA-2. The stream section at this monitoring site is characterized by a sandy substrate, slow, deep, and laminar flow, and vertical banks. Although the right bank is well defined, high, and vegetated with trees, sand, and moss, the left bank is low lying with muskeg, shrubs and black spruce. The cross-section has a width of approximately 14 m. SA-6 produces a very good stage-discharge relationship and hydrograph.

Photo 6: SA-6 looking upstream. Photo taken May 13, 2011.

Legend

Wetland Ecosites

Swamps

- BS16-Black spruce/balsam poplar/river alder swamp

Bogs

- BS17-Black spruce treed bog
- BS18-Labrador tea shrubby bog
- BS19-Graminoid bog
- BS19/24-Graminoid bog/Graminoid fen
- BS20-Open bog

Fens

- BS21-Tamarack treed fen
- BS22-Leatherleaf shrubby poor fen
- BS23-Willlow shrubby rich fen
- BS24-Graminoid fen
- BS25-Open fen

Shallow Open Water

- BS26-Rush sandy shore
- BS27-Sedge rocky shore

- Lake
- Waterbody

- Project Area
- Vegetation Local Study Area
- Terrestrial Regional Study Area

Area of interest in Whitefish Lake, August 16, 2024		

Appendix 8-D:

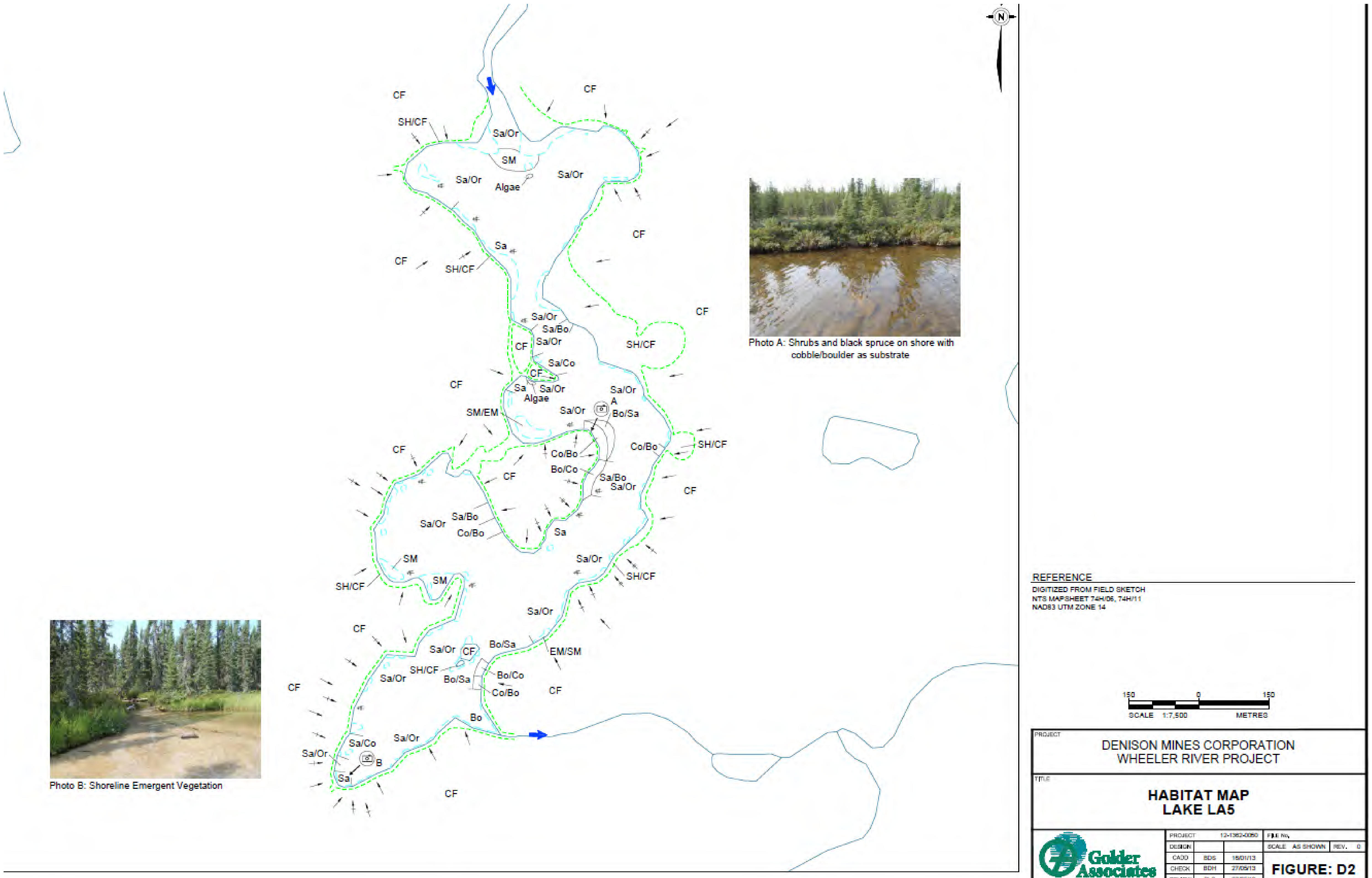
LA-5: 3.5.4 Aquatic Habitat

An aquatic habitat assessment was undertaken by Golder in August 2012 (Appendix F). Shoreline vegetation at LA-5 consisted mainly of shrubs and black spruce with upland jack pine forest. The typical substrate observed for LA-5 was sand and organic matter. Shoreline slopes ranged from shallow to steep. Cover types for aquatic biota included emergent and submergent vegetation, interstitial spaces in coarse substrate, overhanging vegetation and woody debris. Observations made during the 2016-19 baseline studies were similar, confirming the earlier survey data.

DATE: 3 October 2024

TO: Denison Mines – Janna Switzer

REF: Wheeler River Project EIS – Appendix 8-F: Wetland Effects Assessment Report



Legend - Lakes, Wetlands, Ponds

Substrate Types	
Cl	Clay
Si	Silt
Sa	Sand
Gr	Gravel
Co	Cobble
Bo	Boulder
Bd	Bedrock
Or	Organic

Habitat Features		
XXXX	BD	Beaver Dam
	MD	Man-Made Dam
	BL	Beaver Lodge
	BG	Boulder Garden
		Bridge
		Culvert
	DP	Debris Pile
	EM	Emergent Vegetation
		Flow Direction
	ISC	Instream Cover
	IV	Instream Vegetation
	INV	Inundated Vegetation
	LWD	Large Woody Debris
	LE	Ledge
	LJ	Log Jam
	LS	Landslide
	MIL	Multiple Island
	OHV	Overhanging Vegetation
	OHC	Overhead Cover
	RW	Root Wad
		Sand Bar
	SIL	Singular Island
	SWD	Small Woody Debris
	SM	Submergent Vegetation
	UCB	Undercut Bank
	USB	Unstable Bank

Sample Type Symbols		
		Water
		Sediment
		Benthic
		Fish

Notes:
ha = hectares
m = metres
mg/L = milligrams per litre
µS/cm = microseimens per centimetre
Max depth was the depth recorded at sampling locations.

Bank/Upland Vegetation Types		
	BA	Bare Ground
	OT	Open Tundra
	MU	Muskeg/Bog
	DF	Deciduous Forest
	CF	Coniferous Forest
	MW	Mixedwood Forest
	GS	Grassland
	GF	Grass/Forbs
	GF/SH	Grass/Forbs/Shrubs
	SE	Sedge
	SH	Shrubs
	EM	Emergent Vegetation
	MO	Moss
	OR	Organic

Bank Slope	
	Shallow Slope (0-5%)
	Intermediate Slope (6-30%)
	Steep Slope (31-70%)
	Very Steep Slope (>70%)

Bank Instability Ratings	
A	Aggrading
E	Eroding
S	Slumping
G	Gullying

Capture Methods		
	BP	Electrofishing - Backpack
	EF	Electrofishing - Boat
	GN	Gill Net
	SN	Seine
	FF	Fish Fence
	MT	Minnow Trap
	AN	Angling
	HN/TN	Hoop Net/Trap Net

General	
C	Photo Location/Direction
/	Habitat Type Divider
	Fish Bearing/Potential Bearing Watercourse
	Width
	Depth

Legend

Wetland Ecosites

Swamps

- BS16-Black spruce/balsam poplar/river alder swamp

Bogs

- BS17-Black spruce treed bog
- BS18-Labrador tea shrubby bog
- BS19-Graminoid bog
- BS19/24-Graminoid bog/Graminoid fen
- BS20-Open bog

Fens

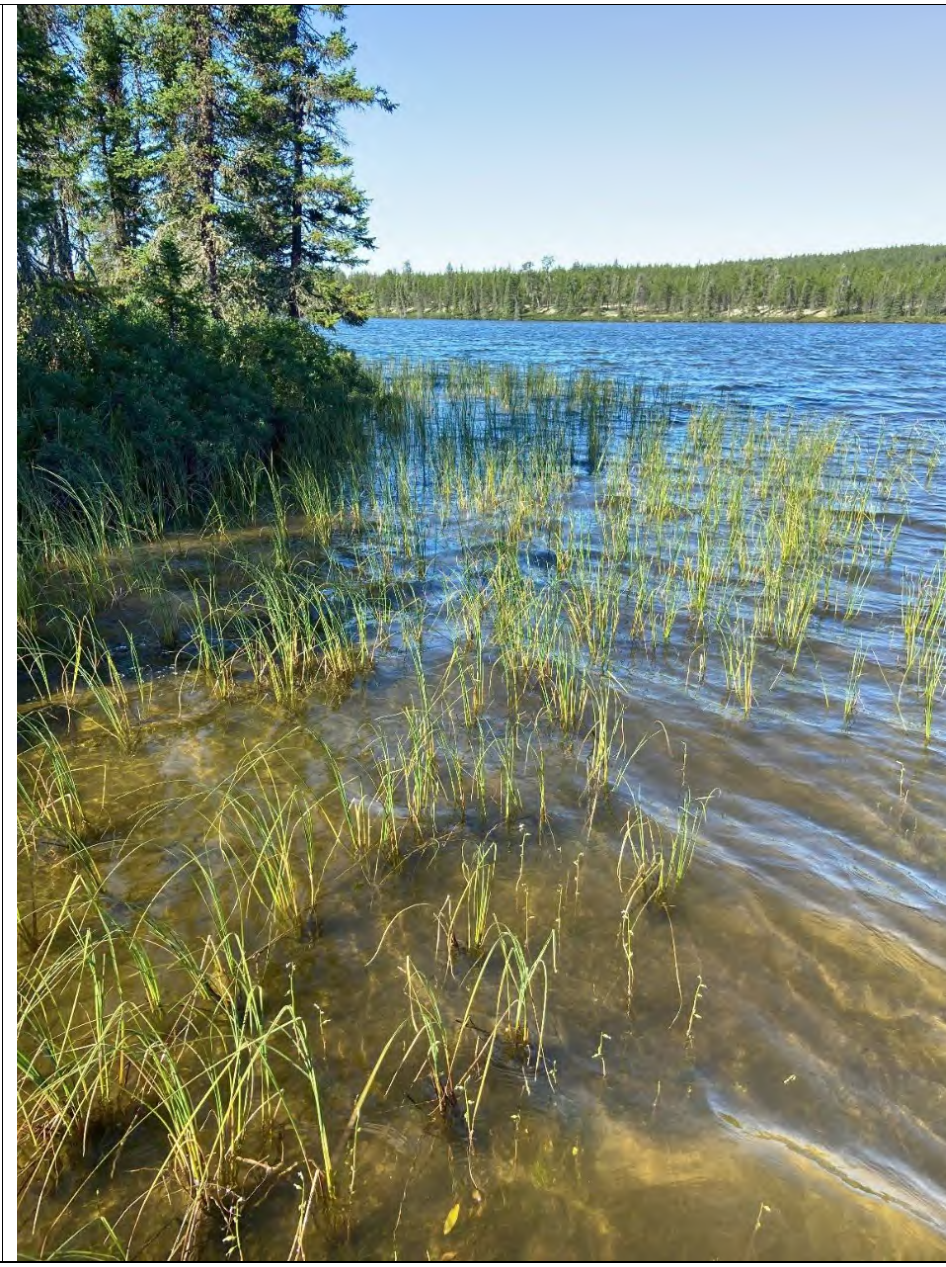
- BS21-Tamarack treed fen
- BS22-Leatherleaf shrubby poor fen
- BS23-Willlow shrubby rich fen
- BS24-Graminoid fen
- BS25-Open fen

Shallow Open Water

- BS26-Rush sandy shore
- BS27-Sedge rocky shore

- Lake
- Waterbody

- Project Area
- Vegetation Local Study Area
- Terrestrial Regional Study Area

Area of interest at outlet of Whitefish Lake, August 16, 2024: This area has stable banks and the substrate primarily composed of sand and detritus. The surrounding terrestrial vegetation was Black Spruce, Blue Spruce, and Jack Pine. The aquatic vegetation was Bur-reed and Potamogeton.		

DATE: 3 October 2024

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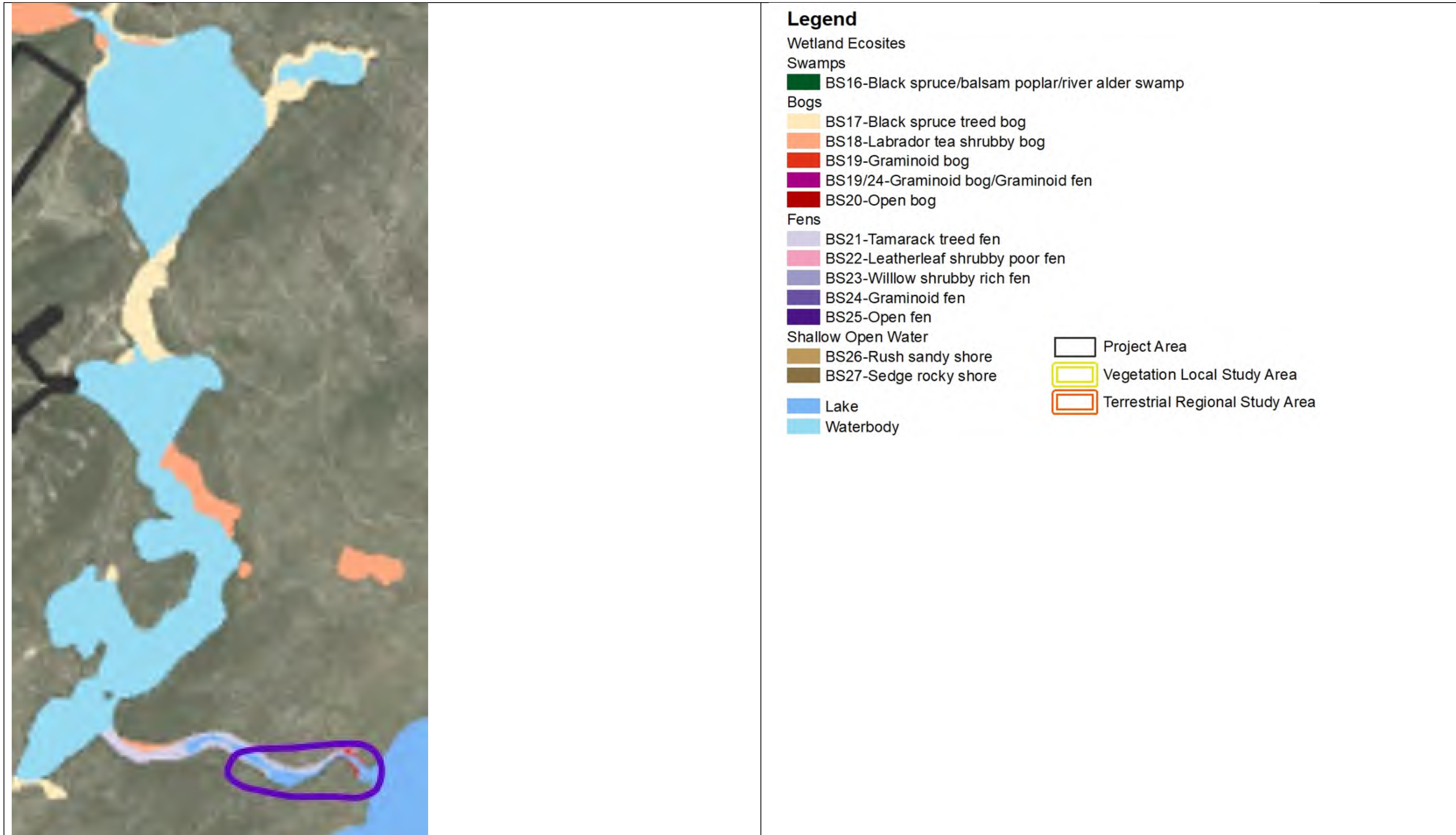

Notes from Appendix 8-B, Appendix F (2019):

SA-2 (Northwest Flow into McGowan Lake) Station SA-2 is located to the northwest of McGowan Lake. A datalogger is not installed at this location. During the 2019 monitoring program it was learned that the cross-section had been moved in 2016 creating a discrepancy in water levels. The old cross-section was identified during the August field program and sufficient data are available to correct the July 2019 measurement (Table 2 and Figure 2). The original cross-section will be used for measurements in future field monitoring programs. Photo 3 is taken of the cross-section used during the July field program while Photo 4 is the original cross-section used in August.

Photo 3: SA-2 - July Field Program

Photo 4: SA-2 - August Field Program

Notes from Appendix 8-D (2016):

4.2 SA-2
Stream station SA-2 is situated within the Icelander River watershed, on the northwest tributary of McGowan Lake (LA-1), immediately upstream of the lake, approximately 800 m downstream of Whitefish Lake (LA-6) (see Figure 1-8). At this location the stream is 3rd order.

Aquatic Habitat
Mean wetted channel width, water depth and water velocity for the 285 m long surveyed reach were 9 m, 0.35 m and 1 m/s, respectively. The stream banks were stable, and the channel was meandering with some braiding (see Appendix C, Photo 3). Within the surveyed reach, the stream gradient was mainly high to moderate. The stream morphology was mostly riffles (90%), with minor runs (5%) and pools (5%). The canopy was dense to partly open. Instream cover was primarily afforded by boulders and undercut banks, with minor contributions from logs and trees, deep pools and aquatic macrophytes. Substrates were comprised of 45% boulder, 40% cobble and 5% gravel, with trace amounts of sand and silt. Aquatic vegetation included sedges and horsetail (Equisetum sp.). Algal growth was moderate, and no sediment was observed overlying the substrate. No barriers to fish migration were observed in the reach. The surrounding terrain was 90% upland and 10% lowland forest, and observed riparian vegetation included jack pine, black spruce, alder (Alnus sp.), sweet gale, Labrador tea (Ledum groenlandicum) and willow. Stonefly nymphs and caddisfly larvae (Trichoptera) were observed. Stream habitat characteristics are detailed in Appendix A, Table A-15.

4.2.4 Fish Community
A summary of the fish community is presented in Table 4-4. Detailed fish catch data including fishing effort and numbers of each species collected are presented in Appendix A, Tables A-13, A-16. During the fall 2016 survey, 1,271 seconds of electrofishing effort was expended within a 285-m reach, resulting in the capture of 97 fish from 6 species. Slimy Sculpin were the most abundant species encountered, with 16 YOY, 19 juveniles and 35 adults collected. One YOY, 7 juvenile and 5 adult Lake Chub; 2 YOY and 5 juvenile Burbot; 2 YOY and 1 juvenile Northern Pike; 1 juvenile and 1 adult Arctic Grayling; and 2 juvenile White Sucker

<table>
<tr><td colspan="3">were also captured. In addition, Walleye was observed but not captured. CPUE was 4.58 fish/minute of electrofishing. Eighteen adult White Suckers were captured by gillnet at this location during the spring 2017 survey. The list of fish species identified was reviewed by Bobby John and is considered inclusive and comprehensive.</td></tr>
<tr><td>
Photo 3: Stream station SA-2 looking upstream (16 September 2016). This drainage area A station is situated on the northwest tributary of lake LA-1, immediately upstream of the lake, approximately 800 m downstream of lake LA-6.</td><td>
Photo 4: Stream station SA-2 looking downstream (16 September 2016). Use of the reach by White Sucker and Walleye for spawning was observed during the May 2017 spawning survey.</td><td>
SA-2 facing upstream, March 2018.</td></tr>
</table>

Notes from Appendix 8-B, Appendix D (2011): SA-2 Streamflow monitoring station SA-2 flows into the northwest end of LA-1. The monitoring station at SA-2 is located several meters downstream of the transition between an upstream meandering channel and a downstream riffle section. The monitoring site has a cross-section width of approximately 11 m, is relatively shallow with high velocity flow. The substrate is primarily composed of boulders and cobble, with well-defined and stable vertical banks vegetated with shrubs and trees. SA-2 produces a fair stage-discharge relationship; however, the slope is nearly linear, so it may overestimate low and high flows. Further measurements at extreme flows would help verify the accuracy of this rating curve.	 Photo 2: SA-2 looking downstream. Photo taken July 30, 2011.

Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

Powering PEOPLE, PARTNERSHIPS AND PASSION.

Section 9: Engagement Database Summary Table – Terrain, Soil, Organic Matter/Peat

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
18-EN-VB-4.50	4	Workshop	2018-01-18	As part of the engagement program for the Wheeler River Project, Denison organized a workshop in Beauval for community members to attend. The workshop gathered community input in relation to road alignment options, treated effluent discharge locations, and mining methods.	Village of Beauval	What is the rock type? Will the ground settle after mining?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Terrestrial of the EIS serves as a local perspective, documented as coming from an individual who attended workshop in the Village of Beauval in the year 2018. The ore zone has complex mineralogy, including uraninite (Fe, Pb, Cu, Zn) sulfides, nickel arsenides, aluminum phosphate sulphate minerals, oxide, carbonate, and clay minerals and quartz. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to terrain. While project-related effects may include minimal surface subsidence, Denison has determined that there will be no significant impacts as a result of Project activities.
20-LK-LEASESUR-267.20, 20-LK-LEASESUR-267.21, 20-LK-LEASESUR-267.22, 20-LK-LODGESUR-267.23, 20-LK-LEASESUR-267.24, 20-LK-LEASESUR-267.25	267	Survey	2020-02-01	Denison sent all known local cabin and lodge leaseholders a survey in the mail to be completed regarding their interests in Wheeler River. Denison received 6 responses from the survey, which has informed it's understanding of leaseholder uses in the area and interests regarding elements to be assessed as part of the environmental assessment.	Leaseholder, Wheeler River Lodge	Denison Question: What do you use your cabin or land for mostly? Response: Enjoying nature; family time.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a local cabin or lodge leaseholder who completed a survey in the year 2020.
20-LK-LEASESUR-267.40, 20-LK-LEASESUR-267.41	267	Survey	2020-02-01	Same as above	Leaseholder, Wheeler River Lodge	Denison Question: What do you use your cabin or land for mostly? Response: Plant harvesting / collecting.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a local cabin or lodge leaseholder who completed a survey in the year 2020.
20-LK-LEASESUR-267.44, 20-LK-LEASESUR-267.45, 20-LK-LEASESUR-267.46, 20-LK-LODGESUR-267.47 20-LK-LEASESUR-267.48, 20-LK-LEASESUR-267.49, 20-LK-LEASESUR-267.50, 20-LK-LODGESUR-267.51, 20-LK-LEASESUR-267.52, 20-LK-LEASESUR-267.53 20-LK-LEASESUR-267.54,	267	Survey	2020-02-01	Same as above	Leaseholder, Wheeler River Lodge	Denison Question: What do you use your cabin or land for mostly? Response: ATVing / boating.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a local cabin or lodge leaseholder who completed a survey in the year 2020.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
20-LK-LODGESUR-267.55								
20-LK-LEASESUR-267.56, 20-LK-LEASESUR-267.60	267	Survey	2020-02-01	Same as above	Leaseholder, Wheeler River Lodge	I Have been using This area for 20 years and roads are being used very hard and not maintained. We would drive trucks to the edge of Kratchkowsky lake 4 years ago, now we cannot due to skidder travel. It has made getting to our cabin much more difficult.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a local cabin or lodge leaseholder who completed a survey in the year 2020.
20-LK-LEASESUR-267.57, 20-LK-LEASESUR-267.61	267	Survey	2020-02-01	Same as above	Leaseholder, Wheeler River Lodge	Protection of our asset.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a local cabin or lodge leaseholder who completed a survey in the year 2020.
20-LK-LEASESUR-267.58, 20-LK-LEASESUR-267.62	267	Survey	2020-02-01	Same as above	Leaseholder, Wheeler River Lodge	I am concerned with how Denison will access their mine on the same road as Cameco uses from the Key Lake mine to McArthur. Presently, Cameco has gates which restrict access to that section of road. If these gates are to be removed or altered by Denison so that everyone has access to the section of road between Key Lake and McArthur that would be disastrous to the region. The theft, vandalism and crime would increase astronomically, and the region would lose its remoteness, tranquility and quality of fishing and a lot more.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a local cabin or lodge leaseholder who completed a survey in the year 2020. Access restrictions north of the Key Lake gate mean that use is restricted to lease holders (e.g., cabin owners) and select Indigenous communities. The Project does not propose any changes to the current access to Highway 914 north of Cameco's Key Lake Operation gate. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to traditional and other land use activities, including fishing. Denison has determined that there will be no significant impacts as a result of Project activities.
20-LK-LEASE / LODGESUR-267.59, 20-LK-LEASE / LODGESUR-267.63	267	Survey	2020-02-01	Same as above	Leaseholder, Wheeler River Lodge	Denison Question: What issues or concerns are of particular interest to you? Response: Increased accessibility to the area.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a local cabin or lodge leaseholder who completed a survey in the year 2020. The Project does not propose any changes to the current access to Highway 914 north of Cameco's Key Lake Operation gate.
20-LK-LEASESUR-267.64, 20-LK-LEASESUR-267.65	267	Survey	2020-02-01	Same as above	Leaseholder, Wheeler River Lodge	Denison Question: What issues or concerns are of particular interest to you? What do you feel should be considered in the Project Environmental Impact Assessment? Response: Wildlife viewing; hiking	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a local cabin or lodge leaseholder who completed a survey in the year 2020. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to traditional and other land use activities. Denison has determined that there will be no significant impacts as a result of Project activities.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
20-LK-LEASESUR-267.66, 20-LK-LEASESUR-267.67, 20-LK-LEASESUR-267.68	267	Survey	2020-02-01	Same as above	Leaseholder, Wheeler River Lodge	Concerns over fishing and hunting pressure [from the mine and people accessing the area].	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a local cabin or lodge leaseholder who completed a survey in the year 2020. Denison understands the importance of maintaining access to greatest degree possible for Indigenous people, while respecting the need for safety for all in the area. Access restrictions north of the Key Lake gate mean that use is restricted to lease holders (e.g., cabin owners) and select Indigenous communities. The Project does not propose any changes to the current access to Highway 914 north of Cameco's Key Lake Operation gate. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to traditional and other land use activities, including hunting and fishing. Denison has determined that there will be no significant impacts as a result of Project activities.
20-LK-LEASESUR-267.69, 20-LK-LEASESUR-267.70, 20-LK-LEASESUR-267.71, 20-LK-LODGESUR-267.72, 20-LK-LEASESUR-267.73, 20-LK-LEASESUR-267.74, 20-LK-LEASESUR-267.75, 20-LK-LEASESUR-267.76, 20-LK-LODGESUR-267.77, 20-LK-LEASESUR-267.78, 20-LK-LEASESUR-267.79, 20-LK-LEASESUR-267.80, 20-LK-LEASESUR-267.81, 20-LK-LODGESUR-267.82, 20-LK-LEASESUR-267.83	267	Survey	2020-02-01	Same as above	Leaseholder, Wheeler River Lodge	Denison Question: What issues or concerns are of particular interest to you? What do you feel should be considered in the Project Environmental Impact Assessment? Response: Access to fish resources.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a local cabin or lodge leaseholder who completed a survey in the year 2020. Denison understands the importance of maintaining access to greatest degree possible for Indigenous people, while respecting the need for safety for all in the area. Access restrictions north of the Key Lake gate mean that use is restricted to lease holders (e.g., cabin owners) and select Indigenous communities. The Project does not propose any changes to the current access to Highway 914 north of Cameco's Key Lake Operation gate. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to traditional and other land use activities, including fishing. Denison has determined that there will be no significant impacts as a result of Project activities.
20-LK-LEASESUR-267.84, 20-LK-LEASESUR-267.85, 20-LK-LEASESUR-267.86, 20-LK-LODGESUR-267.87, 20-LK-LEASESUR-267.88, 20-LK-LEASESUR-267.89, 20-LK-LEASESUR-267.90, 20-LK-LEASESUR-267.91, 20-LK-LODGESUR-267.92, 20-LK-LEASESUR-267.93,	267	Survey	2020-02-01	Same as above	Leaseholder, Wheeler River Lodge	Denison Question: What issues or concerns are of particular interest to you? What do you feel should be considered in the Project Environmental Impact Assessment? Response: Access to hunting resources.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a local cabin or lodge leaseholder who completed a survey in the year 2020. Denison understands the importance of maintaining access to greatest degree possible for Indigenous people, while respecting the need for safety for all in the area. Access restrictions north of the Key Lake gate mean that use is restricted to lease holders (e.g., cabin owners) and select Indigenous communities. The Project does not propose any changes to the current access to Highway 914 north of Cameco's Key Lake Operation gate. Denison has completed an environment assessment to understand Project impacts on the environment. The

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
20-LK-LEASESUR-267.94, 20-LK-LEASESUR-267.95, 20-LK-LEASESUR-267.96, 20-LK-LODGESUR-267.97, 20-LK-LEASESUR-267.98								assessment considers potential impacts to traditional and other land use activities, including hunting. Denison has determined that there will be no significant impacts as a result of Project activities.
20-LK-LEASESUR-267.109, 20-LK-LEASESUR-267.110, 20-LK-LEASESUR-267.111, 20-LK-LODGESUR-267.112, 20-LK-LEASESUR-267.113, 20-LK-LEASESUR-267.114, 20-LK-LEASESUR-267.115, 20-LK-LODGESUR-267.116	267	Survey	2020-02-01	Same as above	Leaseholder, Wheeler River Lodge	Denison Question: What issues or concerns are of particular interest to you? What do you feel should be considered in the Project Environmental Impact Assessment? Response: ATVing/snowmobiling.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a local cabin or lodge leaseholder who completed a survey in the year 2020. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to traditional and other land use activities. Denison has determined that there will be no significant impacts as a result of Project activities.
20-LK-LEASESUR-267.117, 20-LK-LEASESUR-267.118, 20-LK-LEASESUR-267.119, 20-LK-LODGESUR-267.120, 20-LK-LEASESUR-267.121, 20-LK-LEASESUR-267.122, 20-LK-LEASESUR-267.123, 20-LK-LEASESUR-267.124, 20-LK-LODGESUR-267.125, 20-LK-LEASESUR-267.126	267	Survey	2020-02-01	Same as above	Leaseholder, Wheeler River Lodge	Denison Question: What issues or concerns are of particular interest to you? What do you feel should be considered in the Project Environmental Impact Assessment? Response: Boating	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a local cabin or lodge leaseholder who completed a survey in the year 2020. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to traditional and other land use activities. Denison has determined that there will be no significant impacts as a result of Project activities.
21-EN-ERFN-473.8	473	Advisory Committee Meeting	2021-06-17	Denison and the Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee) of English River First Nation held a meeting. During the meeting topics discussed were: concluding discussions related to the geotechnical permit for the Wheeler River Project for 2021, site access considerations (related to ERFN usage of the Fox Lake road), a report on a subsidence assessment report undertaken by Denison and requested by ERFN, and an overview of a pilot project being undertaken by Denison related to reclamation of linear features	Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee)	Denison Comment: Denison wanted to make sure they responded to the concerns about surface disturbance due to activities. Subsidence occurs when ground shifts due to activity underground. We've worked with third-party experts to help determine what is happening because what we are doing underground is quite different with our mining method. What we are taking out is quite minimal. Max amount of subsidence is 7.5 cms – shorter than a pencil. The third-party also found that the risk of mining cavity collapse is minimal. A	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment And in section: Assessment of Project Related Effects, Potential Project Related Effects, Soil	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation and participant in the Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee) who attended an advisory committee meeting in the year 2021.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
				in and around the Wheeler River Project area.		graphic was shown as part of the presentation to illustrate what it would look like underground. Participant: Thank you for that. It is a lot less of anthill maze than what we had envisioned.		
22-EN-ERFN-618.16, 22-EN-ERFN-618.25	618	Open House	2022-05-30	In collaboration with the Chief and Council of English River First Nation, Denison hosted an open house event at ERFN Patuanak Reserve, sharing information about the Wheeler River Project, the preliminary effects assessment of the Project, and proposed mitigation and monitoring. Denison advertised the event on the local radio, with posters around the community, on the local cable network, and through social media. Denison had a Dene translator available for attendees. Residents of the Hamlet of Patuanak were also advised about the open house and invited to attend. 31 attendees signed the sign in sheet. Information boards and area models were displayed, and staff Denison staff were available to answer questions. A survey was available for community members to complete, and remaining available online for 2 weeks following the open house.	English River First Nation	Will the ground collapse from the voids?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from an individual who an open house in English River First Nation in the year 2022. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to terrain. While project-related effects may include minimal surface subsidence, Denison has determined that there will be no significant impacts as a result of Project activities.
22-EN-ERFN-618.23	618	Open House	2022-05-30	Same as above	English River First Nation	Do you need to backfill the ore zone after it is mined to prevent ground subsidence?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from an individual who an open house in English River First Nation in the year 2022. Backfilling the ore zone after mining is not required to prevent significant ground subsidence. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to terrain. While project-related effects may include minimal surface subsidence, Denison has determined that there will be no significant impacts as a result of Project activities.
22-EN-ERFN-618.24	618	Open House	2022-05-30	Same as above	English River First Nation	After uranium is removed, how do you fill the voids?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from an individual who an open house in English River First Nation in the year 2022.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
								Backfilling the ore zone after mining is not required to prevent significant ground subsidence. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to terrain. While project-related effects may include minimal surface subsidence, Denison has determined that there will be no significant impacts as a result of Project activities.
22-EN-ERFN-618.25	618	Open House	2022-05-30	Same as above	English River First Nation	Will the ground collapse from the voids?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from an individual who an open house in English River First Nation in the year 2022. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to terrain. While project-related effects may include minimal surface subsidence, Denison has determined that there will be no significant impacts as a result of Project activities.

Section 9: Engagement Database Summary Table – Vegetation and Ecosystems

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
18-EN-ERFN-5.67	5	Workshop	2018-05-03	As part of the engagement program for the Wheeler River Project, Denison organized a workshop for English River First Nation at their Patuanak Reserve location for ERFN and Patuanak members to attend. The workshop aimed to gather community input in relation to road alignment options, treated effluent discharge locations, and mining methods. The meeting had been delayed many times and was held in the Health Clinic because there was a regional power outage.	English River First Nation	There's a lot of natural filtration in that area because of the muskegs etc. I don't know if there's beaver habitat; those things have to be taken into consideration. Another mine in the area will impact Russell Lake, the river and the ecosystem. The water from Key Lake flows into the Wheeler River; will there be a double impact if you discharge to Russell? There's a lot of iron in the groundwater in that area; how will that react with discharge water when it eventually comes up? Some of the lakes on the north side have good pickerel; some small lakes have trout; Russell Lake has a good fishery. ERFN Trappers use that area quite a bit – you could connect with those particular ERFN Trappers. Those are some of the considerations.	Denison considered this in section: Scope of the Assessment, Key Indicators and Measurable Parameters In section: Existing Environment, Wetlands Valued Component In section: Assessment of Project Related Effects, Potential Project Related Effects, Change in Areal Extent of Habitat Types, Number of Listed Plants, and Areal Extent of Wetlands And in section: Assessment of Project Related Effects, Potential Project Related Effects, Change in the Concentrations of Constituents of Potential Concern in Vegetation	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from an individual who attended workshop in English River First Nation in the year 2018. The record reference serves as rationale for the inclusion of wetlands as a key indicator and to describe the existing environment in terms of wetlands. This reference is then used in relation to potential project related effects in terms of concentrations of COPCs in vegetation and areal extent of wetlands and habitat types as well as number of listed plant species in relation to changes to surface water quality. Water quality in Whitefish Lake and, by extension, downstream of Whitefish Lake will meet appropriate benchmarks for the protection of aquatic life in consideration of a small mixing zone in the lake. Following Decommissioning and the restoration of drainage patterns that are similar to pre-mining conditions, water quality is expected to meet appropriate benchmarks for the protection of aquatic life in Whitefish Lake and downstream. This includes Russell Lake of which the Icelander River system is associated. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to traditional and other land use activities, fishing and water quality. Denison additionally completed a human health risk assessment. Denison has determined that there will be no significant impacts as a result of Project activities.
18-EN-VILX-3.32	3	Workshop	2018-01-17	As part of the engagement program for the Wheeler River Project, Denison organized a workshop in Ile a la Crosse for community and A La Baie Métis members to attend. The workshop gathered community and student input in relation to road alignment options, treated effluent discharge locations, and mining methods.	Village of Ile a la Crosse	Need to understand impact on groundwater and lakes.	Denison considered this in section: Assessment of Project Related Effects, Potential Project Related Effects, Change in Areal Extent of Habitat Types, Number of Listed Plants, and Areal Extent of Wetlands And in section: Assessment of Project Related Effects, Potential Project Related Effects, Change in the Concentrations of Constituents of Potential Concern in Vegetation	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from an individual who attended workshop in Ile a la Crosse in the year 2018. The record reference serves to reiterate the importance of groundwater and lakes, thereby providing further validity to the inclusion of water quality and water quantity as a potential pathway of influence in terms of areal extent of habitat types, number of listed plants, the areal extent of wetlands, and changes in the concentrations of constituents of potential concern in vegetation. Denison has completed an environmental assessment to understand Project impacts on the environment. The assessment considers potential impacts to the groundwater and lakes. Denison has determined that there will be no significant impacts as a result of Project activities.
18-EN-VILX-3.80	3	Workshop	2018-01-17	As part of the engagement program for the Wheeler River Project, Denison organized a workshop in Ile a la Crosse for community and A La Baie Métis members to attend. The workshop gathered community and student input in relation to road alignment options, treated	Village of Ile a la Crosse	I go to climate change meetings in different provinces; I hear the science. But the cultural side of it is never talked about, the plant uses etc. I would like to see them both come together.	Denison considered this in section: Scope of the Assessment, Key Indicators and Measurable Parameters In section: Existing Environment, Vegetation and Ecosystems Valued Component, Vegetation Abundance And in section: Cumulative Effects, Potential Cumulative Effects.	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from an individual who attended workshop in Ile a la Crosse in the year 2018. The record reference serves as rational for the inclusion of vegetation abundance as a key indicator, as well as serves to describe the existing environment in terms of vegetation abundance. The reference is used in relation to potential cumulative effects in terms of Indigenous land use activities.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
				effluent discharge locations, and mining methods.				
18-EN-VILX-3.104	3	Workshop	2018-01-17	Same as above	Village of Ile a la Crosse	Have you identified any mercury?	Denison considered this in section: Assessment of Project Related Effects, Potential Project Related Effects, Change in Areal Extent of Habitat Types, Number of Listed Plants, and Areal Extent of Wetlands And in section: Assessment of Project Related Effects, Potential Project Related Effects, Change in the Concentrations of Constituents of Potential Concern in Vegetation	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from an individual who attended workshop in Ile a la Crosse in the year 2018. The record reference applies this local perspective to potential project related effects in relation to the change of constituents of potential concern in vegetation and the areal extent of wetlands. Sampling for mercury occurred as part of the baseline assessment with values subject to some variability, though generally falling below the detection limit. See the Aquatic Environment section of the EIS for detail on the existing environment in terms of surface water quality.
18-EN-VB-4.36	4	Workshop	2018-01-18	As part of the engagement program for the Wheeler River Project, Denison organized a workshop in Beauval for community members to attend. The workshop gathered community input in relation to road alignment options, treated effluent discharge locations, and mining methods.	Village of Beauval	All animals are affected by water quality.	Denison considered this in section: Assessment of Project Related Effects, Potential Project Related Effects, Change in Areal Extent of Habitat Types, Number of Listed Plants, and Areal Extent of Wetlands And in section: Assessment of Project Related Effects, Potential Project Related Effects, Change in the Concentrations of Constituents of Potential Concern in Vegetation	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from an individual who attended workshop in The Village of Beauval in the year 2018. The record reference applies this local perspective to potential project related effects in relation to the change of constituents of potential concern in vegetation and the areal extent of wetlands.
19-LK-ERFNTrap-134.124	134	Site Visit	2019-10-29	Denison met with English River First Nation Trapper / local land user at the Wheeler River Project site location for a full-day to interview him regarding his knowledge of the area, including providing information and feedback on specifics pertaining to wildlife and wildlife movement patterns, fish and spawning areas, local lakes and lake names, recreational and commercial use, traditional food consumption, and specific aspects of the Wheeler River Project. ERFN Trapper provided his consent to Denison to use the information he provided in the environmental assessment. He reviewed	ERFN Trapper	Denison Question: Do you gather berries or any plants? If so, from what and from where. Response: I might eat some berries while I am walking around but I don't gather berries. I don't drink Labrador Tea.	Denison considered this in section: Scope of Assessment, Key Indicators and Measurable Parameters In section: Existing Environment, Vegetation and Ecosystems Valued Components, Vegetation Abundance And in section: Cumulative Effects, Potential Cumulative Effects	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from English River First Nation Trapper who attended a site visit in the year 2019. The record reference serves as rationale for the inclusion of vegetation abundance as a key indicator and serves to describe the existing environment in terms of vegetation abundance in relation to plant harvesting. This reference is additionally used in relation harvesting in terms of cumulative impacts.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
				the notes taken from the meeting and provided his revisions / modifications to Denison on January 2, 2020.				
19-LK-ERFNTrap-134.133	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Denison Question: Are there any current barriers that limit where people can go, where people can get to (i.e., how far people will venture off the readily accessible trails/paths). Response: I have noticed people (individuals with cabin leases) are cutting quad trails into further away lakes.	Denison considered this in section: Cumulative Effects, Potential Cumulative Effects	The context in which this comment was used within the terrestrial section of the EIS serves as a local perspective, documented as coming from English River First Nation Trapper who attended a site visit in the year 2019.The record reference served to highlight reasons for access, which is then used in relation to cumulative impacts in terms of lodges/outfitters and known tourist/recreational activities.
19-LK-ERFNTrap-134.262	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Is that acid going to stay in the ground?	Denison considered this in section: Assessment of Project Related Effects, Potential Project Related Effects, Change in Areal Extent of Habitat Types, Number of Listed Plants, and Areal Extent of Wetlands And in section: Assessment of Project Related Effects, Potential Project Related Effects, Change in the Concentrations of Constituents of Potential Concern in Vegetation	The context in which this comment was used within the terrestrial section of the EIS serves as a local perspective, documented as coming from English River First Nation Trapper who attended a site visit in the year 2019. The record reference serves to highlight dialogue in relation to potential project related effects in terms of concentrations of COPCs in vegetation and areal extent of wetlands and habitat types as well as number of listed plant species in relation to changes to surface water quality. The conceptual decommissioning plan highlights that remediation of the mining area will continue until water reaches and is demonstrated to be stabilized at acceptable mining area decommissioning objectives as set out in regulatory requirements. Additional detail will be provided in the preliminary decommissioning plan (PDP), which will be submitted to regulators as part of Project licensing and permitting. Prior to executing decommissioning activities, Denison shall prepare and submit a detailed decommissioning plan, that builds upon the PDP, to regulators for acceptance. A post-decommissioning monitoring program will be designed and conducted in accordance with the provincial and federal regulations and license conditions. The monitoring program will be conducted until the site-specific decommissioning and reclamation objectives for the Project are met.
19-EN-ERFN-140.25	140	Site Visit	2019-08-28	Denison provided a site tour of the Wheeler River Project to the Chief of English River First Nation, along with three ERFN Councillors. Also on the tour was the local ERFN land user who resides near to the Wheeler River Project site location.	English River First Nation, ERFN Trapper	What will be the impact to water from the operation? Those freeze plants could affect the groundwater.	Denison considered this in section: Assessment of Project Related Effects, Potential Project Related Effects, Change in Areal Extent of Habitat Types, Number of Listed Plants, and Areal Extent of Wetlands And in section: Assessment of Project Related Effects, Potential Project Related Effects, Change in the Concentrations of Constituents of Potential Concern in Vegetation	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation who attended a site visit in the year 2019. The record reference serves to highlight dialogue surrounding potential project related effects in terms of concentrations of COPCs in vegetation and areal extent of wetlands and habitat types as well as number of listed plant species in relation to changes to surface water quality. The freeze wall will prevent groundwater flow in the area surrounding the ore body. The removal of the freeze wall will allow groundwater to re-establish its original flow path through the area.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
20-LK-LEASESUR-267.40	267	Survey	2020-02-01	Denison sent all known local cabin and lodge leaseholders a survey in the mail to be completed regarding their interests in Wheeler River. Denison received 6 responses from the survey, which has informed it's understanding of leaseholder uses in the area and interests regarding elements to be assessed as part of the environmental assessment.	Leaseholder, Wheeler River Lodge	Denison Question: What do you use your cabin or land for mostly? Response: Plant harvesting / collecting.	Denison considered this in section: Scope of Assessment, Key Indicators and Measurable Parameters In section: Existing Environment, Vegetation and Ecosystems Valued Component, Vegetation Abundance And in section: Cumulative Effects, Potential Cumulative Effects	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a local Leaseholder who completed a survey in the year 2020. The record reference serves as rationale for the inclusion of vegetation abundance as a key indicator and serves to describe the existing environment in terms of vegetation abundance in relation to plant harvesting. This reference is additionally used to reiterate harvesting in relation to potential cumulative impacts.
20-LK-LEASESUR-267.109 20-LK-LEASESUR-267.110 20-LK-LEASESUR-267.111 20-LK-LODGESUR-267.112	267	Survey	2020-02-01	Denison sent all known local cabin and lodge leaseholders a survey in the mail to be completed regarding their interests in Wheeler River. Denison received 6 responses from the survey, which has informed it's understanding of leaseholder uses in the area and interests regarding elements to be assessed as part of the environmental assessment.	Leaseholder, Wheeler River Lodge	Denison Question: What issues or concerns are of particular interest to you? What do you feel should be considered in the Project Environmental Impact Assessment? Response: ATVing/snowmobiling.	Denison considered this in section: Cumulative Effects, Potential Cumulative Effects	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a local Leaseholder who completed a survey in the year 2020. The record reference provides an example of reasons for access, which is then used in relation to potential cumulative impacts.
20-LK-LEASESUR-267.44 20-LK-LEASESUR-267.45 20-LK-LEASESUR-267.46 20-LK-LODGESUR-267.47	267	Survey	2020-02-01	Same as above	Leaseholder, Wheeler River Lodge	Denison Question: What do you use your cabin or land for mostly? (Survey question) Response: ATVing / boating.	Denison considered this in section: Cumulative Effects, Potential Cumulative Effects	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a local Leaseholder who completed a survey in the year 2020. The record reference provides an example of reasons for access, which is then used in relation to potential cumulative impacts.
20-LK-LEASESUR-267.67	267	Survey	2020-02-01	Same as above	Leaseholder, Wheeler River Lodge	Concerns over fishing and hunting pressure [from the mine and people accessing the area].	Denison considered this in section: Cumulative Effects, Potential Cumulative Effects	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a local Leaseholder who completed a survey in the year 2020. The record reference provides an example of reasons for access, which is then used in relation to potential cumulative impacts. Denison understands the importance of maintaining access to greatest degree possible for Indigenous people, while respecting the need for safety for all in the area. Access restrictions north of the Key Lake gate mean that use is restricted to lease holders (e.g., cabin owners) and select Indigenous communities. The Project does not propose any changes to the current access to Highway 914 north of Cameco's Key Lake Operation gate. Denison has completed an environment

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
								assessment to understand Project impacts on the environment. The assessment considers potential impacts to traditional and other land use activities, including hunting and fishing. Denison has determined that there will be no significant impacts as a result of Project activities.
21-EN-LLRIB-392.14	392	Meeting	2021-02-13	As a result of their request, Denison provided a presentation on the Wheeler River Project to the Lac La Ronge Indian Band Lands and Resources Subcommittee.	Lac La Ronge Indian Band	How are you going to protect the water quality? We are concerned about mercury in fish, other animals, etc. Is there mercury or arsenic in the uranium solution?	Denison considered this in section: Assessment of Project Related Effects, Potential Project Related Effects, Change in Areal Extent of Habitat Types, Number of Listed Plants, and Areal Extent of Wetlands And in section: Assessment of Project Related Effects, Potential Project Related Effects, Change in the Concentrations of Constituents of Potential Concern in Vegetation	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a member of the Lac La Ronge Indian Band Lands and Resources Subcommittee who attended a meeting in the year 2021. The record reference serves to reiterate concern of potential project related effects in terms of concentrations of COPCs in vegetation and areal extent of wetlands and habitat types as well as number of listed plant species in relation to changes to surface water quality. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to surface and groundwater quality. Denison has determined that there will be no significant impacts as a result of Project activities. Water quality would be protected through various Project design measures, as well as mitigation and monitoring plans. As part of the licensing and permitting process, mitigation and monitoring will be detailed, including environmental monitoring, groundwater monitoring, and liquid effluent monitoring. The uranium at the Project is amenable to the same type of leach solution that is used to leach other Athabasca Basin uranium ore in mills: an acidic (i.e. low pH) solution. A clear understanding of constituents used in the mining solution is an important component of ongoing engagement work.
21-EN-VPL-444.26	444	Virtual Meeting	2021-02-11	Denison hosted a virtual meeting for the municipality of Pinehouse Lake. The public meetings were focused on the Project generally, and did not seek input or comments on the distinct interests of the Métis in respect of the Project or Métis land use. This was expressly stated at the outset of each of the public meetings. Included in the discussion was an overview on the Valued Components for the Wheeler River Project, with a request to provide feedback to Denison via an online survey with specific questions pertaining to Valued Components.	Village of Pinehouse Lake	Would transported chemicals possibly harm plants or animals?	Denison considered this in section: Assessment of Project Related Effects, Potential Project Related Effects, Change in the Concentrations of Constituents of Potential Concern in Vegetation	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a Village of Pinehouse Lake community member who attended a virtual meeting in the year 2021. The record reference serves to reiterate concern of potential project related effects in terms of concentrations of COPCs in vegetation. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers accident and malfunction scenarios as well as potential impact to plants and animals. Denison determined that there will be no significant impacts as a result of Project activities. In the event of an accident or malfunction, a detailed process outlined within the Emergency Preparedness and Response Program will be followed. The Emergency Preparedness and Response Program is being developed as a condition of licensing and is consistent with guidance provided by the CNSC in REGDOC-2.10.1, Nuclear Emergency Preparedness and Response (CNSC 2016).
21-EN-SUR-446.65	446	Survey	2021-02-16	As part of engagement activities for the municipalities of Beauval, Ile	Village of Beauval, Village of Ile	Denison Question: Based on what you know so far about the Wheeler Project, what aspects of the project	Denison considered this in section: Assessment of Project Related Effects, Potential Project Related Effects, Change in the	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a member of Beauval, Ile a La Crosse, or Pinehouse, who completed a survey in the year 2021. The record

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
				a la Crosse and Pinehouse Lake, Denison prepared and shared an online survey which included information about Denison, the Wheeler River Project, and posed validation questions about the Valued Components being assessed as part of the environmental assessment process. A total of 68 responses were received and 62 of the responses were considered complete, for a 91% completion rate. The information related to the Valued Components was incorporated into the assessment.	a la Crosse, Village of Pinehouse Lake	could be challenging or cause concern for your community? Response: Non transparency regarding spills	Concentrations of Constituents of Potential Concern in Vegetation.	reference serves to reiterate concern of potential project related effects in terms of concentrations of COPCs in vegetation as related to spills. Public Information and Disclosure (CNSC 2018) sets out requirements and guidance for public information and disclosure for licensees and applicants of Class I and Class II nuclear facilities, and uranium mines and mills, for all lifecycle phases. The primary goal of the public information program, as it relates to the licensed activities, is to ensure that information related to the health, safety and security of persons and the environment, and other issues associated with the lifecycle of nuclear facilities are effectively communicated to the public. Denison would meet all requirements set out in this REGDOC, including the development of an appropriate public information program and disclosure protocol.
21-EN-SUR-446.66	446	Survey	2021-02-16	Same as above	Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Denison Question: Based on what you know so far about the Wheeler Project, what aspects of the project could be challenging or cause concern for your community? Response: Just pollutions	Denison considered this in section: Assessment of Project Related Effects, Potential Project Related Effects, Change in the Concentrations of Constituents of Potential Concern in Vegetation.	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a member of Beauval, Ile a La Crosse, or Pinehouse, who completed a survey in the year 2021. The record reference serves to reiterate concern of potential project related effects in terms of concentrations of COPCs in vegetation as related to spills. Denison has completed an environment assessment to understand Project impacts on the environment. Denison has determined that there will be no significant impacts as a result of Project activities
21-EN-SUR-446.67	446	Survey	2021-02-16	Same as above	Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Denison Question: Based on what you know so far about the Wheeler Project, what aspects of the project could be challenging or cause concern for your community? Response: Contamination	Denison considered this in section: Assessment of Project Related Effects, Potential Project Related Effects, Change in the Concentrations of Constituents of Potential Concern in Vegetation.	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a member of Beauval, Ile a La Crosse, or Pinehouse, who completed a survey in the year 2021. The record reference serves to reiterate concern of potential project related effects in terms of concentrations of COPCs in vegetation as related to spills. Denison has completed an environment assessment to understand Project impacts on the environment. Denison has determined that there will be no significant impacts as a result of Project activities
21-EN-SUR-446.89	446	Survey	2021-02-16	Same as above	Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Denison Question: Based on what you know so far about the Wheeler Project, what aspects of the project could be challenging or cause concern for your community? Response: Water contamination	Denison considered this in section: Assessment of Project Related Effects, Potential Project Related Effects, Change in the Concentrations of Constituents of Potential Concern in Vegetation	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a member of Beauval, Ile a La Crosse, or Pinehouse, who completed a survey in the year 2021. The record reference serves to reiterate concern of potential project related effects in terms of concentrations of COPCs in vegetation as related to spills. Denison has completed an environment assessment to understand Project impacts on the environment Denison determined that there will be no significant impacts as a result of Project activities.
21-EN-YOUTH-448.1	448	Virtual Meeting	2021-03-31	Denison provided a virtual presentation to the high school in English River First Nation on the Patuanak	English River First Nation	Any chance of the wells blowing and contaminating the ground around it?	Denison considered this in section: Assessment of Project Related Effects, Potential Project Related Effects, Change in Areal Extent of	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a youth member of English River First Nation who attended a virtual meeting in the year 2021. The reference serves to emphasize dialogue related to potential project related effects in terms of

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
				Reserve about the Wheeler River Project. Included in the discussion was an overview on the Valued Components for the Wheeler River Project, with a request to provide feedback to Denison via an online survey with specific questions pertaining to Valued Components.			Habitat Types, Number of Listed Plants, and Areal Extent of Wetlands And in section: Assessment of Project Related Effects, Potential Project Related Effects, Change in the Concentrations of Constituents of Potential Concern in Vegetation	concentrations of COPCs in vegetation and areal extent of wetlands and habitat types as well as number of listed plant species in relation to changes to surface water quality. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers accident and malfunction scenarios as well as potential impact to terrain/soil/peat. Denison determined that there will be no significant impacts as a result of Project activities. Mitigation and monitoring will be implemented, thereby decreasing the likelihood of accidents and malfunctions, such as leaks. In the event of an accident or malfunction, a detailed process outline within the Emergency Preparedness and Response Program will be followed. The Emergency Preparedness and Response Program is being developed as a condition of licensing and is consistent with guidance provided by the CNSC in REGDOC-2.10.1, Nuclear Emergency Preparedness and Response (CNSC 2016).

Section 9: Engagement Database Summary Table – Ungulates, Furbearers, and Woodland Caribou

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
16-EN-ERFN-100.15	100	Community Meeting	2016-07-27	Denison hosted a community meeting in Patuanak for English River First Nation members, the purpose of which was to provide an overview of the Wheeler River Project.	English River First Nation	In that territory near the Wheeler River there are a lot of spawning and calving areas for moose, caribou; those creeks are for whitefish spawning. There's lots of heavy muskeg there. A lot of us have been there, and we'd like to know there'll still be access to the area.	Denison has considered this in section: Existing environment, Ungulates, Information from Indigenous Knowledge, Local Knowledge, and Engagement And in section Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from an individual who attended a community meeting in English River First Nation in the year 2016. The record reference serves to describe the existing environment in terms of moose and caribou.
18-EN-ERFN-5.76	5	Workshop	2018-05-03	As part of the engagement program for the Wheeler River Project, Denison organized a workshop for English River First Nation at their Patuanak Reserve location for ERFN and Patuanak members to attend. The workshop aimed to gather community input in relation to road alignment options, treated effluent discharge locations, and mining methods. The meeting had been delayed many times, and was held in the Health Clinic because there was a regional power outage.	English River First Nation	That would allow some natural filtration. We would have to see what the other members think of it. Because it's further away, there would be more filtration by the time it reached Russell Lake. What about spawning areas, caribou and moose calving areas? Caribou and moose eat low bush cranberries and lichen; lichen takes many years to grow and recover. There may be other things to consider, like medicinal areas - the elders will know.	Denison has considered this in section: Existing Environment, Ungulates, Information from Indigenous Knowledge, Local Knowledge, and Engagement And in section Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in English River First Nation in the year 2018. The record reference serves to describe the existing environment in terms of moose and caribou.
19-LK-ERFNTrap-134.24	134	Site Visit	2019-10-29	Denison met with local land user and English River First Nation member and trapper, referred to as ERFN Trapper, at the Wheeler River Project site location for a full-day to interview him regarding his knowledge of the area, including providing information and feedback on specifics pertaining to wildlife and wildlife movement patterns, fish and spawning areas, local lakes and lake names, recreational and commercial use, traditional food consumption, and specific aspects of the Wheeler River Project. ERFN Trapper provided his consent to Denison to use the information he provided in the environmental assessment. He reviewed the notes taken from the meeting and provided his revisions / modifications to Denison on January 2, 2020.	ERFN Trapper	This [more cabins in the area] has affected me because there are more boats on the lakes. More boats on the lakes leads to more overfishing, anglers also cut access trails to lakes, access trails impact caribou by increasing wolf traffic.	Denison considered this in section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement And in section: Residual Effects Evaluation, Residual Effects Evaluation for Woodland Caribou, Change in Mortality	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of caribou predation in relation to access trails. The reference is used to support the context of residual effects for caribou in terms of change in mortality.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
19-LK-ERFNTrap-134.64	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Denison Question: Does he eat anything off his trapline? Response: ERFN Trapper will consume small lynx, beaver and muskrat from his trapline but there are fewer around than in the past.	Denison considered this in section: Existing Environment, Furbearers, Information from Indigenous Knowledge, Local Knowledge, and Engagement In section: Residual Effects Evaluation, Residual Effects Evaluation for Furbearers, Change in Mortality And in Section: Cumulative Effects, Cumulative Effects Characterization and Determination of Significance, Furbearers	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of trapline harvest consumption. This reference is used to support the context of both residual and cumulative effects in terms of furbearers, specifically in relation to suspected muskrat population decline.
19-LK-ERFNTrap-134.133	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Denison Question: Are there any current barriers that limit where people can go, where people can get to (i.e., how far people will venture off the readily accessible trails/paths)? Response: I have noticed people (individuals with cabin leases) are cutting quad trails into further away lakes.	Denison considered this in section: Cumulative Effects, Ongoing and Future Projects and Activities	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference was used to highlight the potential cumulative effect of additional trail development.
19-LK-ERFNTrap-134.149	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Moose: The area to the north of the Wheeler River Project regional study area (from maps) has generally been better for moose than the local project area. He sees more caribou and less moose. He believes this is a natural change and moose are moving further south.	Denison has considered this in section: Existing Environment, Ungulates, Information from Indigenous Knowledge, Local Knowledge, and Engagement In section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement In section: Residual Effects Evaluation, Residual Effects Evaluation for Ungulates, Alteration and/or Loss of Habitat And in section: Cumulative Effects, Cumulative Effects Characterization and Determination of Significance, Ungulates	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of moose abundance relative to caribou abundance in the area. This reference is then used to support the context of both residual and cumulative effects in terms of ungulates.
19-LK-ERFNTrap-134.150	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Caribou: Woodland caribou use of the area has changed since highway 914 (Key-McArthur Road) was built. Caribou don't seem to be bothered by visual sightings of vehicles (smaller trucks) but seem to react to regular traffic of larger bigger vehicles and are sensitive to the vibrations	Denison considered this in section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement And in section:	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of caribou density in the area. This reference is used to support the context of residual effects in terms of caribou, specifically in relation caribou behaviour in relation to the previously development of Highway 914.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
							Residual Effects Evaluation, Residual Effects Evaluation for Woodland Caribou, Alteration and/or Loss of Habitat	
19-LK-ERFNTrap-134.151	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Caribou: He sees more caribou and less moose. When he goes out to check his traplines in the winter he sees caribou quite regularly. He also sees caribou in the summer.	Denison considered this in section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of woodland caribou.
19-LK-ERFNTrap-134.152	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Caribou: Caribou do travel through areas of younger forest and burns to get to areas that are more desired.	Denison considered this in section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of woodland caribou.
19-LK-ERFNTrap-134.153	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Caribou: Caribou travel on bush roads. Often see tracks on roads, trails and handcuts.	Denison considered this in section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement In section: Residual Effects Evaluation, Residual Effects Evaluation for Woodland Caribou, Alteration and/or Loss of Habitat And in section: Residual Effects Evaluation, Residual Effects Evaluation for Woodland Caribou, Change in Mortality	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of woodland caribou. This reference is used to support the context of both residual effects for woodland caribou in terms of both alteration and/or loss of habitat and change in mortality.
19-LK-ERFNTrap-134.154	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Caribou: Identified area east of Highway 914 and NE of Russell Lake, sort of between Russell Lake and McDougall Lake (corresponding with Omnia winter tracking transects #5 and #9 [see Omnia Terrestrial Baseline Report, Figure 2.5-1; and image included below]) as an area where caribou are commonly seen in the winter. There are tall trees here, some small hills with protected valley areas, and it seems sheltered. There is caribou moss in this area.	Denison considered this in section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. In this section, the record reference serves to describe the existing environment in terms of woodland caribou.
19-LK-ERFNTrap-134.155	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Caribou: Caribou will utilize areas of younger forest with pine regeneration and in tougher years, especially deep snow, will eat the tips of fresh growth off the younger pine trees; this is especially the case when there are years with a bad snow crust. ERFN Trapper discussed this with his uncle who is in his 80s and he confirmed he has seen caribou eat tips of branches. Moose will also do this.	Denison considered this in section: Existing Environment, Ungulates, Information from Indigenous Knowledge, Local Knowledge, and Engagement And in section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of ungulates and woodland caribou.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
19-LK-ERFNTrap-134.156	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Caribou: Overall, there are the same number of caribou in the area over the years but there is less moose	Denison considered this in section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement In section: Residual Effects Evaluation, Residual Effects Evaluation for Woodland Caribou, Alteration and/or Loss of Habitat And in section: Residual Effects Evaluation, Residual Effects Evaluation for Woodland Caribou, Change in Mortality	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of woodland caribou. This reference is used to support the context of both residual effects for woodland caribou in terms of both alteration and/or loss of habitat and change in mortality.
19-LK-ERFNTrap-134.157	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Caribou: Caribou will utilize lake ice in late winter when the snow is shallow/compacted, and it is sunnier.	Denison considered this in section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of woodland caribou.
19-LK-ERFNTrap-134.158	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Caribou: Barren ground caribou were last seen in the north Cree Lake area around 1983. ERFN Trapper believes they no longer come as far south because of the large fires that have burned across the north. He felt these fires may have created a barrier in search of food.	Denison considered this in section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of woodland caribou.
19-LK-E1 RFNTrap-134.159	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Wolves: Wolves travel on bush roads. Saw a pack of about 18 wolves recently.	Denison considered this in section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement And in section: Residual Effects Evaluation, Residual Effects Evaluation for Woodland Caribou, Change in Mortality	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of woodland caribou. This reference is used to support the context of residual effects for woodland caribou in terms of change in mortality.
19-LK-ERFNTrap-134.160	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Marten, Fisher and Wolverine: In recent memory, marten is much more commonly observed compared to fisher. Probably 9 or 10 out of 10 would be marten. In fact, last year ERFN Trapper caught 90 marten and no fisher	Denison considered this in section: Existing Environment, Furbearers, Information from Indigenous Knowledge, Local Knowledge, and Engagement In section: Residual Effects Evaluation, Residual Effects Evaluation for Furbearers, Alteration and/or Loss of Habitat And in section: Residual Effects Evaluation, Residual Effects Evaluation for Furbearers, Change in Mortality	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of furbearers. This reference is used to support the context of residual effects for furbearers in terms of both alteration and/or loss of habitat and change in mortality.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
19-LK-ERFNTrap-134.161	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Marten, Fisher and Wolverine: Marten are typically caught during the winter months (Nov to April) using a tree mounted box with bait and a snap trap (conibear?)	Denison considered this in section: Existing Environment, Furbearers, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of furbearers.
19-LK-ERFNTrap-134.162	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Marten, Fisher and Wolverine: Wolverines are observed in the area occasionally but are not around consistently. He has not observed a change in wolverine over the years.	Denison considered this in section: Existing Environment, Furbearers, Information from Indigenous Knowledge, Local Knowledge, and Engagement In section: Residual Effects Evaluation, Residual Effects Evaluation for Furbearers, Alteration and/or Loss of Habitat And in section: Residual Effect Evaluation, Residual Effects Evaluation for Furbearers, Change in Mortality	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of furbearers. This reference is used to support the context of residual effects for furbearers in terms of both alteration and/or loss of habitat and change in mortality.
19-LK-ERFNTrap-134.165	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Prey Species: In recent years, the number of squirrels has been high. Too many in fact.	Denison considered this in section: Existing Environment, Furbearers, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of furbearers.
19-LK-ERFNTrap-134.166	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Birds: There are fewer loons on Cree Lake even though the number of fish caught here remains unchanged. There are still loons at Russell Lake. Russell Lake also has a growing population of Red Throated Loons (Gavia Stellata)	Denison considered this in section: Existing Environment, Furbearers, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of furbearers.
19-LK-ERFNTrap-134.167	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Birds: There are fewer loons on Cree Lake even though the number of fish caught here remains unchanged. There are still loons at Russell Lake.	Denison considered this in section: Existing Environment, Furbearers, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of furbearers.
19-LK-ERFNTrap-134.237	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	I have noticed some changes in what animals are here and changes over time including: Some species are disappearing. In the past bear and moose were much more common than they are now. I think moose are moving further south.	Denison considered this in section: Existing Environment, Ungulates, Information from Indigenous Knowledge, Local Knowledge, and Engagement And in section: Cumulative Effects, Cumulative Effects Characterization and Determination of Significance, Ungulates	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of ungulates. This reference is used to support the context of cumulative effects for ungulates in terms of change in mortality.
20-LK-LEASESUR-267.67	267	Survey	2020-02-01	Denison sent all known local cabin and lodge leaseholders a survey in the mail to be completed regarding their interests in Wheeler River.	Leaseholder, Wheeler River Lodge	Concerns regarding overfishing and hunting pressure [from the mine and people accessing the area].	Denison considered this in section: Existing Environment, Ungulates, Information from Indigenous Knowledge, Local Knowledge, and Engagement.	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a Leaseholder who completed a survey in the year 2020. The record reference serves to describe the existing environment in terms of ungulates and woodland caribou. This reference is

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
				Denison received 6 responses from the survey, which has informed it's understanding of leaseholder uses in the area and interests regarding elements to be assessed as part of the environmental assessment.			In section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement In section: Residual Effects Evaluation, Residual Effects Evaluation for Ungulates, Change in Mortality In section: Residual Effects Evaluation, Residual Effects Evaluation for Furbearers, Change in Mortality And in section: Cumulative Effects, Ongoing and Future Projects and Activities	used to support both the context of residual effects for ungulates and furbearers in terms of both alteration and/or loss of habitat and change in mortality, and the context of cumulative effects in terms of ongoing and future projects and activities in relation to Indigenous and other land use activities. Denison understands the importance of maintaining access to greatest degree possible for Indigenous people, while respecting the need for safety for all in the area. Access restrictions north of the Key Lake gate mean that use is restricted to lease holders (e.g., cabin owners) and select Indigenous communities. The Project does not propose any changes to the current access to Highway 914 north of Cameco's Key Lake Operation gate. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to traditional and other land use activities, including hunting and fishing. Denison has determined that there will be no significant impacts as a result of Project activities.
21-EN-SUR-446.68	446	Survey	2021-02-16	As part of engagement activities for the municipalities of Beauval, Ile a la Crosse and Pinehouse Lake, Denison prepared and shared an online survey which included information about Denison, the Wheeler River Project, and posed validation questions about the Valued Components being assessed as part of the environmental assessment process. A total of 68 responses were received and 62 of the responses were considered complete, for a 91% completion rate. The information related to the Valued Components was incorporated into the assessment.	Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Denison Question: Based on what you know so far about the Wheeler Project, what aspects of the project could be challenging or cause concern for your community? Response: Traditional land users & wildlife interruption	Denison considered this in section: Existing Environment, Ungulates, Information from Indigenous Knowledge, Local Knowledge, and Engagement And in section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from an individual who completed a survey sent to residents of Beauval, Pinehouse, and Ile a la Crosse, in the year 2021. The record reference serves to describe the existing environment in terms of ungulates and woodland caribou. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to traditional land use activities and wildlife. Denison has determined that there will be no significant impacts as a result of Project activities.
21-EN-SUR-446.69	446	Survey	2021-02-16	As part of engagement activities for the municipalities of Beauval, Ile a la Crosse and Pinehouse Lake, Denison prepared and shared an online survey which included information about Denison, the Wheeler River Project, and posed validation questions about the Valued Components being assessed as part of the environmental assessment process. A total of 68 responses were received and 62 of the responses were considered complete, for a 91% completion rate. The information related to the Valued Components was incorporated into the assessment	Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Denison Question: Based on what you know so far about the Wheeler Project, what aspects of the project could be challenging or cause concern for your community? Response: The impact of mining on the natural habitat and the displacement of the animals that currently inhabit the proposed site.	Denison considered this in section: Existing Environment, Ungulates, Information from Indigenous Knowledge, Local Knowledge, and Engagement And in section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from an individual who completed a survey sent to residents of Beauval, Pinehouse, and Ile a la Crosse, in the year 2021. The record reference serves to describe the existing environment in terms of ungulates and woodland caribou. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to the terrestrial environment. Denison has determined that there will be no significant impacts as a result of Project activities.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
				and questions asked on the surveys was incorporated into the overall engagement database.				
21-EN-ERFN-473.10	473	Advisory Committee Meeting	2021-06-15	Denison and the Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee) of English River First Nation held a meeting. During the meeting topics discussed were: concluding discussions related to the geotechnical permit for the Wheeler River Project for 2021, site access considerations (related to ERFN usage of the Fox Lake road), a report on a subsidence assessment report undertaken by Denison and requested by ERFN, and an overview of a pilot project being undertaken by Denison related to reclamation of linear features in and around the Wheeler River Project area.	Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee)	That might be something we'd like to see added, we've done some of that work – there is a little pocket that is for (caribou) calving specifically. Even though you are following the guidelines, we'd like to see the pocket included – so, there's less disturbance in that particular area. Always better to go beyond the standard.	Denison considered this in section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation and participant in the Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee) who attended an advisory committee meeting in the year 2021. The record reference serves to describe the existing environment in terms of woodland caribou.
21-EN-ERFN-473.11	473	Advisory Committee Meeting	2021-06-15	Same as above	Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee)	I'd like to see something a little more tailored to the area and review the maps developed with MLTC, ERFN and the government. There is a calving pocket in there.	Denison considered this in section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation and participant in the Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee) who attended an advisory committee meeting in the year 2021. The record reference serves to describe the existing environment in terms of woodland caribou.
21-EN-ERFN-473.12	473	Advisory Committee Meeting	2021-06-15	Same as above	Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee)	We hunt around that Brown Lake area – we have seen wolf tracks but there is caribou there because of the green areas. We haven't been concerned about the wolves. Moose is more our mainstay.	Denison considered this in section: Existing Environment, Ungulates, Information from Indigenous Knowledge, Local Knowledge, and Engagement In section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement And in section: Residual Effects Evaluation, Residual Effects Evaluation for Ungulates, Change in Mortality	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation and participant in the Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee) who attended an advisory committee meeting in the year 2021. The record reference serves to describe the existing environment in terms of woodland caribou and ungulates. This reference is used to support the context of residual effects for ungulates in terms of change in mortality. Denison has completed an environment assessment to understand Project impacts on the environment. Moose have been assessed a key indicator as part of the assessment. Denison has determined that there will be no significant impacts as a result of Project activities.
21-EN-ERFN-473.13	473	Advisory Committee Meeting	2021-06-15	Same as above	Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee)	That's what we have in our freezer. Moose has the same concern and affect for ERFN – not just the government protected caribou. We want to know how moose would be impacted?	Denison considered this in section: Existing Environment, Ungulates, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation and participant in the Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee) who attended an advisory committee meeting in the year 2021. The record reference serves to describe the existing environment in terms of woodland caribou. Denison has completed an environment assessment to understand Project impacts on the environment. Moose have been assessed a key indicator as part of the

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
								assessment. Denison has determined that there will be no significant impacts as a result of Project activities.
21-EN-ERFN-473.24	473	Advisory Committee Meeting	2021-06-15	Same as above	Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee)	Elders said after natural disasters (i.e. forest fires) it could take 35 years. This land that Denison is on is pretty burnt except for some patches thar are areas for caribou. The moose are coming back slowly.	Denison considered this in section: Existing Environment, Ungulates, Information from Indigenous Knowledge, Local Knowledge, and Engagement In section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement In section: Residual Effects Evaluation, Residual Effects Evaluation for Ungulates, Alteration and/or Loss of Habitat In section: Cumulative Effects, Cumulative Effects Characterization and Determination of Significance, Ungulates In section: Cumulative Effects, Cumulative Effects Characterization and Determination of Significance, Furbearers In section: Cumulative Effects, Cumulative Effects Characterization and Determination of Significance, Woodland Caribou And in section: Climate Change Considerations	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation and participant in the Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee) who attended an advisory committee meeting in the year2021. The record reference serves to describe the existing environment in terms of both woodland caribou and ungulates. This reference is used in relation to climate change considerations, as well as to support both the context of residual effects for ungulates in terms of alternation and/or loss of habitat, and the context of cumulative effects for ungulates, woodland caribou, and furbearers in terms of alteration and/or loss of habitat.
21-LK-ERFNTrap-506.2	506	Phone call	2021-06-04	Denison received preliminary feedback from a local English River First Nation trapper on the Linear Feature Mitigation Program - a multi-year program to test options for the Wheeler River Project. The feedback was in relation to the planned approach to be taken later in the summer, 2021.	ERFN Trapper	They know the wolves like to use the lines to hunt caribou.	Denison considered this in section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who took part in a phone call in the year 2021. The record reference serves to describe the exiting environment in terms of woodland caribou.
21-LK-ERFNTrap-506.3	506	Phone call	2021-06-04	Same as above	ERFN Trapper	Wolves are becoming a problem and they would like to see the wolf numbers reduced.	Denison considered this in section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who took part in a phone call in 2021. The record reference serves to describe the exiting environment in terms of woodland caribou.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
21-LK-ERFNTrap-506.4	506	Phone call	2021-06-04	Same as above	ERFN Trapper	Any treatment would have to be fairly tall because "caribou can jump high".	Denison considered this in section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who took part in a phone call in the year 2021. The record reference serves to describe the exiting environment in terms of woodland caribou.
21-LK-ERFNTrap-506.5	506	Phone call	2021-06-04	Denison received preliminary feedback from a local English River First Nation trapper on the Linear Feature Mitigation Program - a multi year program to test options for the Wheeler River Project. The feedback was in relation to the planned approach to be taken later in the summer, 2021.	ERFN Trapper	The number of cutlines in the area, all the way to Cree Lake is extensive and they would like to see more reclaimed.	Denison considered this in section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who took part in a phone call in the year 2021. The record reference serves to describe the exiting environment in terms of woodland caribou.
21-LK-ERFNTrap-516.1	516	Meeting	2021-08-08	Denison met with the English River First Nation Local Trapper at Wheeler River to provide an opportunity to see the Linear Feature Mitigation Pilot Program designs in place. Denison received early feedback on the trials that were accessible from the Wheeler River camp.	English River First Nation, ERFN Trapper	ERFN Trapper thought the wolves and caribou will be able to get over [mounds from the mounding trial]. They suggested one or two big mounds at the entrances of the linear features along with the planting of trees.	Denison considered this in section: Existing Environment, Woodland Caribou, Information from Indigenous Knowledge, Local Knowledge, and Engagement	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation ERFN Trapper who took part in a meeting in the year 2021. The record reference serves to describe the exiting environment in terms of woodland caribou.

Section 9: Engagement Database Summary Table – Raptors, Migratory Breeding Birds, and Bird Species at Risk

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
19-LK-ERFNTrap-134.133	134	Site Visit	2019-10-29	Denison met with local land user and English River First Nation Trapper at the Wheeler River Project site location for a full-day to interview him regarding his knowledge of the area, including providing information and feedback on specifics pertaining to wildlife and wildlife movement patterns, fish and spawning areas, local lakes and lake names, recreational and commercial use, traditional food consumption, and specific aspects of the Wheeler River Project. ERFN Trapper provided his consent to Denison to use the information he provided in the environmental assessment. He reviewed the notes taken from the meeting and provided his revisions / modifications to Denison on January 2, 2020.	ERFN Trapper	Denison Question: Are there any current barriers that limit where people can go, where people can get to (i.e., how far people will venture off the readily accessible trails/paths). Response: I have noticed people (individuals with cabin leases) are cutting quad trails into further away lakes.	Denison has considered this in section: Cumulative Effects, Ongoing and Future Projects.	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference is used to support the context of cumulative effects in terms of lodges/outfitters and tourist/recreational activities.
19-LK-ERFNTrap-134.163	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Prey Species: In recent years, there are fewer rabbits (snowshoe hare) and bush chickens (grouse species)	Denison has considered this in section: Existing Environment, Migratory Breeding Birds, Information from Indigenous Knowledge, Local Knowledge, and Engagement In section: Residual Effects Evaluation for Migratory Breeding Birds, Alteration and / or Loss of Habitat In section: Residual Effects Evaluation for Migratory Breeding Birds, Change in Mortality In section: Summary of Project-related Residual Effects on Raptors, Migratory Breeding Birds, and Bird Species at Risk And in section: Cumulative Effects, Cumulative Effects Characterization and Determination of Significance, Migratory Breeding Birds	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of migratory breeding birds. This reference is used both to support the context of residual effects for migratory breeding birds and bird species at risk and to support the context of cumulative effects for migratory birds in relation to population decline.
19-LK-ERFNTrap-134.164	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Prey Species: Also, way less ptarmigan in winter. Less mallards and Canada geese, more surf Scoters (*Melanitta perspicillata*).	Denison has considered this in section: Existing Environment, Migratory Breeding Birds, Information from Indigenous Knowledge, Local Knowledge, and Engagement In section:	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of migratory breeding birds. This reference is used to support the context of residual effects characteristics for migratory breeding birds in terms of both alteration and/or loss of habitat and change in mortality. This record is referenced in the summary of project-related residual effects for migratory breeding

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
							Residual Effects Evaluation for Migratory Breeding Birds, Alteration and / or Loss of Habitat In section: Residual Effects Evaluation for Migratory Breeding Birds, Change in Mortality In section: Summary of Project-related Residual Effects on Raptors, Migratory Breeding Birds, and Bird Species at Risk And in section: Cumulative Effects, Cumulative Effects Characterization and Determination of Significance, Migratory Breeding Birds	birds and bird species at risk in relation to alteration and/or loss of habitat and change in mortality. This record reference is used in terms of cumulative effects for migratory breeding birds in relation to population decline.
19-LK-ERFNTrap-134.166	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Birds: There are fewer loons on Cree Lake even though the number of fish caught here remains unchanged. There are still loons at Russell Lake. Russell Lake also has a growing population of Red Throated Loons (*Gavia Stellata*)	Denison has considered this in section: Existing Environment, Migratory Breeding Birds, Information from Indigenous Knowledge, Local Knowledge, and Engagement In section: Residual Effects Evaluation for Migratory Breeding Birds, Alteration and / or Loss of Habitat In section: Residual Effects Evaluation for Migratory Breeding Birds, Change in Mortality In section: Summary of Project-related Residual Effects on Raptors, Migratory Breeding Birds, and Bird Species at Risk And in section: Cumulative Effects, Cumulative Effects Characterization and Determination of Significance, Migratory Breeding Birds	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of migratory breeding birds. This reference is used to support the context of residual effects characteristics for migratory breeding birds in terms of both alteration and/or loss of habitat and change in mortality. This record is referenced in the summary of project-related residual effects for migratory breeding birds and bird species at risk in relation to alteration and/or loss of habitat and change in mortality. This record reference is used in terms of cumulative effects for migratory breeding birds in relation to population decline.
19-LK-ERFNTrap-134.167	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Birds: There are fewer loons on Cree Lake even though the number of fish caught here remains unchanged. There are still loons at Russell Lake.	Denison considered this in section: Existing Environment, Migratory Breeding Birds, Information from Indigenous Knowledge, Local Knowledge, and Engagement.	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of migratory breeding birds.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
19-LK-ERFNTrap-134.168	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Birds: An increase in American pelican occurrence, in the Cree Lake area in particular, has been observed.	Denison considered this comment in section: Existing Environment, Migratory Breeding Birds, Information from Indigenous Knowledge, Local Knowledge, and Engagement.	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of migratory breeding birds.
19-LK-ERFNTrap-134.169	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Birds: Whooping cranes have been observed along the Wheeler River and probably nest along Moore Lake based on behaviour (nest defence / return to specific after being disturbed). Sandhill cranes along the Wheeler River.	Denison considered this comment in section: Existing Environment, Migratory Breeding Birds, Information from Indigenous Knowledge, Local Knowledge, and Engagement. And in section: Existing Environment, Birds Species at Risk Information from Indigenous Knowledge, Local Knowledge, and Engagement.	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of migratory breeding birds and bird species at risk.
19-LK-ERFNTrap-134.170	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Birds: There have also been some reports of whooping cranes along the Cree River too.	Denison considered this comment in section: Existing Environment, Bird Species at Risk, Information from Indigenous Knowledge, Local Knowledge, and Engagement.	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of bird species at risk.
19-LK-ERFNTrap-134.238	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	There are fewer loons on Cree Lake even though the number of fish caught here remains unchanged. There are still loons at Russell Lake.	Denison considered this comment in section: Existing Environment, Migratory Breeding Birds, Information from Indigenous Knowledge, Local Knowledge, and Engagement.	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of migratory breeding birds.
19-LK-ERFNTrap-134.239	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	There are American pelican at Cree Lake now. They were not here in the past.	Denison considered this comment in section: Existing Environment, Migratory Breeding Birds, Information from Indigenous Knowledge, Local Knowledge, and Engagement. And in section: Residual Effects Evaluation for Migratory Breeding Birds, Alteration and / or Loss of Habitat	The context in which this comment was used within the Terrestrial section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. The record reference serves to describe the existing environment in terms of migratory breeding birds. This reference is used to support the context of residual effects characteristics for migratory breeding birds in terms of alteration and/or loss of habitat.