

APPENDIX E.9.1
2018 CREMP MONITORING REPORT
(PART 3 OF 3)



**Mary River Project 2018
Core Receiving Environment Monitoring
Program Report**

**Part 3 of 3
(Appendices A to H)**

Prepared for:
Baffinland Iron Mines Corporation
Oakville, Ontario

Prepared by:
Minnow Environmental Inc.
Georgetown, Ontario

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APPENDIX A
DATA QUALITY REVIEW

APPENDIX A DATA QUALITY REVIEW

A1	INTRODUCTION	1
A2	RESULTS	3
A2.1	Water Quality	3
A2.1.1	Sample Blanks	3
A2.1.2	Precision – Field Duplicates	7
A2.2	Sediment Quality	7
A2.3	Benthic Invertebrate Community Samples.....	7
A2.3.1	Subsampling Accuracy	7
A2.3.2	Organism Recovery.....	15
A3	DATA QUALITY STATEMENT	17

LIST OF TABLES

Table A.1:	Water Sample Trip Blank Results with Reference to Data Quality Objectives, Mary River CREMP, 2018	4
Table A.2:	Water Sample Field Blank Results with Reference to Data Quality Objectives, Mary River CREMP, 2018	5
Table A.3:	Water Sample Equipment Blank Results with Reference to Data Quality Objectives, Mary River CREMP, 2018	6
Table A. 4:	Water Quality Field Duplicate Results with Reference to Relative Percent Differences, Mary River CREMP, 2018.....	8
Table A.5:	Sediment Sample Field Duplicate Comparisons Indicating, in Highlight, Values Not Meeting the DQO of $\leq 40\%$ Relative Percent Difference (RPD)	14
Table A.6:	Subsampling Error for Benthic Invertebrate Community Samples, 2018 CREMP	16
Table A.7:	Percent Recovery from Benthic Invertebrate Samples, Mary River Project CREMP, 2018	16
Table A.8:	Proportion of Benthic Invertebrates Samples Sorted for the 2018 CREMP	16



A1 INTRODUCTION

Data Quality Review (DQR) was conducted on data collected as part of the Mary River Project 2018 CREMP to define the overall quality of the data collected for the program, and by extension, the confidence with which the data can be used to derive conclusions. A variety of factors can influence the physical, chemical and biological measurements made in an environmental study and thus affect the accuracy and/or precision of the data. Depending on the magnitude of these influences, inaccuracy or imprecision have the potential to affect the reliability of conclusions drawn from the available data. Therefore, it is important to ensure that programs incorporate appropriate steps to control the non-natural sources of data variability (i.e., minimize the variability that does not reflect natural spatial and temporal variability in the environment) and thus assure the quality of the data.

The Mary River Project 2018 CREMP DQR involved comparison of field performance to generic environmental study data quality objectives (DQO) for the evaluation of sample blanks, data precision and data accuracy. DQO were established *a priori* to reflect reasonable and achievable performance expectations. Overall, the intent of comparing data to DQO was not to reject any measurement that did not meet the DQO, but rather to evaluate whether, based on the available data and using a weight-of-evidence approach, whether the field and/or analytical sample data adequately reflected actual conditions and thus could be used with confidence to derive study conclusions. Using this approach, questionable data received more scrutiny to determine what effect, if any, this had on interpretation of results within the context of this project. Quality Control (QC) samples assessed for the Mary River Project CREMP included water sample trip blanks, field blanks, equipment blanks, and field duplicates, sediment sample field duplicates, and the verification of the accuracy of sub-sampling and organism recovery for the benthic invertebrate component, defined as follows:

- Blanks (water quality samples) are samples of de-ionized water and/or appropriate reagent(s) that are handled and analyzed the same way as regular samples. These samples reflect contamination that occurred from the equipment (in the case of equipment blanks), in the field (in the case of trip or field blanks), or in the laboratory (in the case of laboratory or method blanks). Analyte concentrations should be non-detectable, although a data quality objective of five times the laboratory reportable detection limit (RDL) allows for slight “noise” around the detection limit.
- Trip Blanks are meant to detect any widespread contamination resulting from the container (including caps) and preservative during transport and storage. A trip blank is a bottle set full of de-ionized water that is prepared prior to the field sample



collections, is transported with the regular sample bottles in the field, and remains unopened throughout the trip.

- Field Blanks mimic the sampling and preservative process but do not come in contact with ambient water. Field blanks are exposed to the sampling environment at the sample site. Consequently, they provide information on contamination resulting from the handling technique and through exposure to the atmosphere. They are processed in the same manner as the associated field samples (i.e., they are exposed to all the same potential sources of contamination as the field sample), including handling and, in some cases, filtration, and/or preservation.
- Equipment Blanks are samples of de-ionized water collected from the sampling equipment following decontamination (i.e., rinsing of the sampling device using de-ionized water) in the field between sampling stations and/or events. These blanks are useful in identifying cross contamination of samples in the field as a result of the sampling device.
- Field Duplicates (water quality and sediment quality samples) are sub-sample pairs collected from randomly selected field stations using identical collection and handling methods that are then analyzed separately in the laboratory. The duplicate samples are handled and analyzed in an identical manner in the laboratory. The data from field duplicate samples reflect natural variability, as well as the variability associated with sample collection methods, and therefore provide a measure of field precision.
- Sub-Sampling Checks (benthic invertebrate community samples) are used when excessive sample volume and/or organism density results in only a fraction of the original sample being analyzed. By comparing the numbers of benthic invertebrates recovered between at least two sub-samples, this measure provides an evaluation of how effective the sub-sampling method was in evenly dividing the original sample. Therefore, sub-sampling error provides a measure of analytical precision. The processing of entire samples in representative sample fractions also allows an evaluation of sub-sampling accuracy.
- Organism Recovery Checks (benthic invertebrate community samples) involve the re-processing of previously sorted material from a randomly selected sample to determine the number of invertebrates that were not recovered during the original sample processing. The reprocessing is conducted by an analyst not involved during the original processing to reduce any bias. This check allows the determination of accuracy through assessment of recovery efficiency.



A2 RESULTS

A2.1 Water Quality

A2.1.1 Sample Blanks

Trip blank samples were taken on field sampling campaigns a total of six times during the 2018 CREMP, including two during the winter lake monitoring event (April to May), two during the summer lake/stream monitoring event (July), and two during the fall lake/stream monitoring event (August). Of the 519 total number of analyses conducted on the trip blank samples, only three (0.6%) resulted in analyte detection above the trip blank DQO of less than five-times the RDL (Appendix Table A.1). Barium was the only parameter that was observed at concentrations that were above the DQO in trip blanks, but only in the dissolved fraction. Contamination from the bottle or filtering process were the most likely sources of dissolved barium to the trip blank samples.

Field blank samples were assessed a total of seven times during the 2018 CREMP, including two during the winter lake monitoring event, one during the spring stream monitoring event, two during the summer lake monitoring event, and two during the fall lake/stream monitoring event. Of the 604 determinations made, three (0.5%) resulted in analyte detections above the DQO of less than five-times the laboratory RDL (Appendix Table A.2). Similar to the trip blanks, barium was observed most frequently at concentrations above DQO in the 2018 field blank samples, with turbidity also not achieving the DQO in one instance. A similar frequency of detected concentrations over respective RDL occurred between the trip and field blanks, which suggested that a similar source of contamination was common to both QC sample types.

Equipment blank samples were collected a total of seven times during the 2018 CREMP, including two during the winter lake monitoring event, three during the summer lake monitoring event, and two during the fall lake monitoring event. Of the 609 determinations conducted, five (0.8%) resulted in analyte detection above the DQO of less than five-times the laboratory RDL (Appendix Table A.3). Once again, barium was most frequently detected at concentrations above RDL in the equipment blank samples, suggesting that the sampling device may have been a source of this metal. In addition to barium, turbidity was detected at a concentration above the RDL at a magnitude greater than the DQO in a single equipment blank sample. Notably, a similar frequency of analyte detection above the DQO was observed in the equipment blank samples compared to the trip and field blank samples.



Table A.1: Water Sample Trip Blank Results with Reference to Data Quality Objectives, Mary River CREMP, 2018

	Client Sample ID Date Sampled ALS Sample ID	Lowest RDL ^a	BL0-05-A	DL0-01-1-S	L1-09	BL0-01-B-S	BL0-04-B	C0-10
			15-Apr-2018	22-Apr-2018	1-Jul-2018	3-Aug-2018	25-Aug-2018	27-Aug-2018
			L2081994-4	L2085166-3	L2122777-31	L2141395-2	L2153578-11	L2153983-5
	Units							
Physical Tests								
Conductivity	umhos/cm	3.00	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Hardness (as CaCO ₃)	mg/L	10.0	<10.0	<10.1	<10.2	<10.3	<10.4	<10.5
Total Suspended Solids	mg/L	2.00	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Dissolved Solids	mg/L	20.0	<10	<10	<10	<20	<20	<20
Turbidity	NTU	0.100	0.230	0.250	<0.10	<0.10	<0.10	<0.10
Anions and Nutrients (Water)								
Alkalinity, Total (as CaCO ₃)	mg/L	10.0	<10.0	<10.1	<10.2	<10.3	<10.4	<10.5
Ammonia, Total (as N)	mg/L	0.0200	<0.020	<0.020	<0.020	<0.020	<0.020	0.0620
Bromide (Br)	mg/L	0.100	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chloride (Cl)	mg/L	0.500	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Nitrate and Nitrite as N	mg/L	0.0210	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021
Nitrate (as N)	mg/L	0.0200	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Nitrite (as N)	mg/L	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Total Kjeldahl Nitrogen	mg/L	0.150	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
Phosphorus, Total	mg/L	0.0030	<0.0030	<0.0030	<0.0030	0.0037	<0.0030	0.0042
Sulfate (SO ₄)	mg/L	0.300	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Organic / Inorganic Carbon (Water)								
Dissolved Organic Carbon	mg/L	0.500	<1.0	<1.0	<0.50	<0.50	0.600	<0.50
Total Organic Carbon	mg/L	0.500	<1.0	<1.0	<0.50	<0.50	0.800	<0.50
Total Metals (Water)								
Aluminum (Al)	mg/L	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Antimony (Sb)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium (Ba)	mg/L	0.0000500	<0.000050	<0.000050	0.000195	<0.000050	0.000244	<0.000050
Beryllium (Be)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L	0.0500	<0.050	<0.050	0.0970	<0.050	0.0800	<0.050
Chromium (Cr)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium (Mg)	mg/L	0.0500	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Manganese (Mn)	mg/L	0.0000700	<0.000070	<0.000070	<0.000070	<0.000070	<0.000070	<0.000070
Mercury (Hg)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium (K)	mg/L	0.200	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Selenium (Se)	mg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Silicon (Si)	mg/L	0.100	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Silver (Ag)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L	0.0500	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Strontium (Sr)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Thallium (Tl)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)	mg/L	0.000100	0.000250	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals (Water)								
Aluminum (Al)	mg/L	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Antimony (Sb)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium (Ba)	mg/L	0.0000500	<0.000050	<0.000050	0.000315	0.000411	0.000294	<0.000050
Beryllium (Be)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L	0.0500	<0.050	<0.050	0.0890	0.192	0.134	<0.050
Chromium (Cr)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Lithium (Li)	mg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium (Mg)	mg/L	0.0500	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Manganese (Mn)	mg/L	0.0000700	<0.000070	<0.000070	<0.000070	<0.000070	<0.000070	<0.000070
Mercury (Hg)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium (K)	mg/L	0.200	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Selenium (Se)	mg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Silicon (Si)	mg/L	0.100	<0.10	<0.10	<0.10	0.270	<0.10	<0.10
Silver (Ag)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thallium (Tl)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Zinc (Zn)	mg/L	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Aggregate Organics (Water)								
Phenols (4AAP)	mg/L	0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	0.0046
Plant Pigments (Water)								
Chlorophyll a	µg/L	0.100	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phaeophytin a	µg/L	0.200	0.120	0.140	0.170	<0.20	0.110	<0.20

Notes: RDL = Reportable Detection Limit.

Parameter did not meet the data quality objective of ≤ 5x the RDL

^a For some analytes, a range of RDLs were achieved in different laboratory reports. Each blank was compared to the RDL applicable to that sample.

Table A.2: Water Sample Field Blank Results with Reference to Data Quality Objectives, Mary River CREMP, 2018

Parameter		Lowest RDL ^a	BL0-01-A	DL0-02-06-S	MRY-REF-2	D1-05	BL0-05A-B	BL0-04-B	L1-09
			4/14/2018	4/17/2018	30-Jun-2018	1-Aug-2018	8/2/2018	8/25/2018	25-Aug-2018
			L2081999-1	L2082600-6	L2122777-11	L2140029-11	L2140864-10	L2153578-12	L2153585-3
Physical Tests									
Conductivity	umhos/cm	3.00	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Hardness (as CaCO3)	mg/L	10.0	<10	<10	<10	<10	<10	<10	<10
Total Suspended Solids	mg/L	2.00	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Dissolved Solids	mg/L	20.0	<10	<10	<10	20.0	<20	<20	<20
Turbidity	NTU	0.100	0.410	0.600	0.150	<0.10	<0.10	<0.10	<0.10
Anions and Nutrients (Water)									
Alkalinity, Total (as CaCO3)	mg/L	10.0	<10	<10	<10	<10	<10	<10	<10
Ammonia, Total (as N)	mg/L	0.0200	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Bromide (Br)	mg/L	0.100	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chloride (Cl)	mg/L	0.500	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Nitrate and Nitrite as N	mg/L	0.0210	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021
Nitrate (as N)	mg/L	0.0200	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Nitrite (as N)	mg/L	0.00500	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Total Kjeldahl Nitrogen	mg/L	0.150	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
Phosphorus, Total	mg/L	0.00300	0.00910	<0.0030	<0.0030	<0.0030	0.00380	<0.0030	<0.0030
Sulfate (SO4)	mg/L	0.300	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Organic / Inorganic Carbon (Water)									
Dissolved Organic Carbon	mg/L	0.500	<1.0	<1.0	<0.50	<0.50	<0.50	0.580	0.650
Total Organic Carbon	mg/L	0.500	<1.0	<1.0	<0.50	0.770	<0.50	1.10	0.950
Total Metals (Water)									
Aluminum (Al)	mg/L	0.00300	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Antimony (Sb)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium (Ba)	mg/L	0.0000500	<0.000050	0.000291	0.000202	<0.000050	<0.000050	0.000210	<0.000050
Beryllium (Be)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L	0.0500	<0.050	0.109	0.103	<0.050	<0.050	0.0940	<0.050
Chromium (Cr)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L	0.00100	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium (Mg)	mg/L	0.0500	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Manganese (Mn)	mg/L	0.0000700	<0.000070	<0.000070	<0.000070	<0.000070	<0.000070	<0.000070	<0.000070
Mercury (Hg)	mg/L	0.0000100	<0.000010	<0.0000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium (K)	mg/L	0.200	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Silicon (Si)	mg/L	0.100	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Silver (Ag)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L	0.0500	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Strontium (Sr)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Thallium (Tl)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.00420	<0.0030
Dissolved Metals (Water)									
Aluminum (Al)	mg/L	0.00300	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Antimony (Sb)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium (Ba)	mg/L	0.0000500	0.0000600	<0.000050	0.000181	<0.000050	0.0000950	0.000269	<0.000050
Beryllium (Be)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L	0.0500	0.116	<0.050	0.103	<0.050	0.0870	0.132	<0.050
Chromium (Cr)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000830	<0.00050
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L	0.00100	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium (Mg)	mg/L	0.0500	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Manganese (Mn)	mg/L	0.0000700	<0.000070	<0.000070	<0.000070	<0.000070	<0.000070	<0.000070	<0.000070
Mercury (Hg)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium (K)	mg/L	0.200	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Silicon (Si)	mg/L	0.100	<0.10	<0.10	<0.10	<0.10	0.270	<0.10	<0.10
Silver (Ag)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L	0.0500	<0.050	<0.050	<0.050	<0.050	0.0870	<0.050	<0.050
Strontium (Sr)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	0.000120	<0.00010	<0.00010
Thallium (Tl)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Aggregate Organics (Water)									
Phenols (4AAP)	mg/L	0.00100	0.00150	<0.0010	<0.0010	<0.0010	0.00230	<0.0010	<0.0010
Plant Pigments (Water)									
Chlorophyll a	ug/L	0.100	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phaeophytin a	ug/L	0.200	0.160	0.150	0.150	<0.20	<0.20	0.110	<0.20

Notes: RDL = Reportable Detection Limit.

Parameter did not meet the data quality objective of ≤ 5x the RDL

^a For some analytes, a range of RDLs were achieved in different laboratory reports. Each blank was compared to the RDL applicable to that sample.

Table A.3: Water Sample Equipment Blank Results with Reference to Data Quality Objectives, Mary River CREMP, 2018

Client Sample ID Date Sampled ALS Sample ID		Lowest RDL ^a	DD-HAB9-STN- 1-B	JLO-02	REF3-02	KEMMERER-2	KEMMERER-1	KEMMERER-2	KEMMERER-2
			4/23/2018 L2085170-3	4/13/2018 L2082011-1	8/12/2018 L2145787-9	7/29/2018 L2137924-25	7/30/2018 L2137924-26	8/20/2018 L2150018-7	8/28/2018 L2154042-1
	Units								
Physical Tests									
Conductivity	umhos/cm	3.00	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Hardness (as CaCO ₃)	mg/L	10.0	<10	<10	<10	<10	<10	<10	<10
Total Suspended Solids	mg/L	2.00	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Dissolved Solids	mg/L	20.0	<10	<10	<20	<20	<20	<20	<20
Turbidity	NTU	0.100	0.45	0.79	0.12	<0.10	0.40	<0.10	<0.10
Anions and Nutrients (Water)									
Alkalinity, Total (as CaCO ₃)	mg/L	10.0	<10	<10	<10	<10	<10	<10	<10
Ammonia, Total (as N)	mg/L	0.0200	<0.020	<0.020	<0.020	<0.020	0.074	<0.020	0.022
Bromide (Br)	mg/L	0.100	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chloride (Cl)	mg/L	0.500	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Nitrate and Nitrite as N	mg/L	0.0210	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021
Nitrate (as N)	mg/L	0.0200	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Nitrite (as N)	mg/L	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Total Kjeldahl Nitrogen	mg/L	0.150	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
Phosphorus, Total	mg/L	0.0030	<0.0030	<0.0030	<0.0030	0.0061	0.0054	0.0093	<0.0030
Sulfate (SO ₄)	mg/L	0.300	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Organic / Inorganic Carbon (Water)									
Dissolved Organic Carbon	mg/L	0.500	<1.0	<1.0	0.54	<0.50	<0.50	0.63	0.51
Total Organic Carbon	mg/L	0.500	<1.0	<1.0	0.67	<0.50	<0.50	0.71	0.92
Total Metals (Water)									
Aluminum (Al)	mg/L	0.0030	<0.0030	<0.0030	0.0039	<0.0030	0.0034	<0.0030	<0.0030
Antimony (Sb)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium (Ba)	mg/L	0.0000500	0.000082	0.000384	0.000145	0.000418	0.000296	0.000062	<0.000050
Beryllium (Be)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L	0.0500	<0.050	0.134	0.056	0.127	0.112	<0.050	<0.050
Chromium (Cr)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium (Mg)	mg/L	0.0500	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Manganese (Mn)	mg/L	0.0000700	<0.000070	<0.000070	0.000274	<0.000070	0.000092	0.000096	<0.000070
Mercury (Hg)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium (K)	mg/L	0.200	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Selenium (Se)	mg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Silicon (Si)	mg/L	0.100	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Silver (Ag)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L	0.0500	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Strontium (Sr)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Thallium (Tl)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals (Water)									
Aluminum (Al)	mg/L	0.0030	<0.0030	<0.0030	0.007	<0.0030	0.004	<0.0030	<0.0030
Antimony (Sb)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium (Ba)	mg/L	0.0000500	<0.000050	0.000282	0.000257	0.00037	0.000351	0.000057	<0.000050
Beryllium (Be)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L	0.0500	<0.050	0.123	0.125	0.096	0.123	<0.050	<0.050
Chromium (Cr)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lithium (Li)	mg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium (Mg)	mg/L	0.0500	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Manganese (Mn)	mg/L	0.0000700	<0.000070	<0.000070	0.000291	<0.000070	0.000111	<0.000070	<0.000070
Mercury (Hg)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Rubidium (Rb)	mg/L	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Silicon (Si)	mg/L	0.100	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Silver (Ag)	mg/L	0.0000100	<0.10	<0.10	0.3	<0.10	<0.10	<0.10	<0.10
Strontium (Sr)	mg/L	0.000100	<0.050	<0.050	0.12000	<0.050	<0.050	<0.050	<0.050
Titanium (Ti)	mg/L	0.0100	<0.00010	<0.00010	0.00093	<0.00010	<0.00010	<0.00010	<0.00010
Vanadium (V)	mg/L	0.0010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Zinc (Zn)	mg/L	0.0030	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zirconium (Zr)	mg/L	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Aggregate Organics (Water)									
Phenols (4AAP)	mg/L	0.0010	<0.0010	0.0019	0.0012	<0.0010	<0.0010	<0.0010	0.0014
Plant Pigments (Water)									
Chlorophyll a	µg/L	0.100	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phaeophytin a	µg/L	0.200	0.16	0.14	0.12	<0.20	<0.20	0.16	<0.20

Notes: RDL = Reportable Detection Limit.

Parameter did not meet the data quality objective of≤ 5x the RDL

^a For some analytes, a range of RDLs were achieved in different laboratory reports. Each blank was compared to the RDL applicable to that sample

A2.1.2 Precision – Field Duplicates

In total, 18 field duplicates were collected over the course of the 2018 Mary River Project CREMP water sampling, including four during the winter lake monitoring event, one during the spring stream monitoring event, nine during the summer stream/lake monitoring event, and four during the fall stream/lake monitoring event. In general, close agreement in parameter concentrations was observed between duplicate samples, with 96% of field duplicate analyte pairs meeting the water quality field duplicate DQO of $\leq 25\%$ Relative Percent Difference (RPD) in parameter concentrations of the 1,521 duplicate analyses conducted (Appendix Table A.4). Total aluminum, total phosphorus, phenols, and turbidity were the key parameters that most frequently did not meet DQO between the duplicate samples (Appendix Table A.4). In some cases in which DQO were not met, measured concentrations in one or both duplicate samples were close to the RDL (i.e., two- to three-times the RDL) such that small differences in concentrations between duplicate samples resulted in relatively high RPD. In other cases, the relatively high RPD between duplicate samples likely reflected variability in actual concentrations in the field or field sampling related influences. Because metals can be associated with materials reflected by turbidity (e.g., suspended inorganic minerals), the relatively high frequency in which turbidity differed between replicate samples may often have accounted for various metals (e.g., aluminum) not meeting the field duplicate DQO between replicated samples. Nevertheless, in the majority of cases, and for key parameters of concern, the RPD in analyte concentrations was sufficiently low as to not affect interpretation of the data.

A2.2 Sediment Quality

Field duplicate sediment samples were collected at each of Reference Lake 3 (REF03-10), Camp Lake (Station JLO-01), Sheardown Lake NW (Station DLO-01-2), Sheardown Lake SE (Station DLO-02-4), and Mary Lake (BLO-04), which represented 12% of the total number of sediment quality monitoring stations sampled for the 2018 CREMP. Excellent agreement in parameter concentrations were observed between duplicate samples, with none of the duplicate samples exhibiting greater than 40% RPD in parameter concentrations between split samples collected in the field (Appendix Table A.5). Therefore, data precision was very high and considered acceptable for providing reliable interpretation of the sediment quality data.

A2.3 Benthic Invertebrate Community Samples

A2.3.1 Subsampling Accuracy

Sub-sampling of benthic invertebrate community samples was conducted on 15 of 63 stream samples (24%) and 9 of 50 lake samples (18%; total of 21% for 2018 project) with the sorted



Figure A.4: Water Sample Field Duplicate Results with Reference to the Data Quality Objective, Mary River CREMP, 2018

Sample ID	Units	LDL	CLT-REF3	CLT-REF3	RPD	E0-03	EO-03	RPD	I0-01	I0-01	RPD
Date Sampled			25-Aug-18	25-Aug-18		30-Jun-18	29-Jun-18		1-Aug-18	1-Aug-18	
ALS Sample ID			L2153585-5	L2153585-6		L2122777-27	L2122777-12		L2140029-1	L2140029-2	
Conductivity	umhos/cm	3.00	94.4	93.5	1.0	29.8	30.0	0.7	95.0	96.1	1.2
Hardness (as CaCO ₃)	mg/L	10.0	48.0	47.0	2.1	14.0	14.0	0	50.0	51.0	2.0
pH	pH units	0.100	7.87	7.88	0.1	7.44	7.45	0.1	7.84	7.90	0.8
Total Suspended Solids	mg/L	2.00	<2.0	<2.0	0	4.50	5.60	22	<2.0	<2.0	0
Total Dissolved Solids	mg/L	20.0	38.0	38.0	0	21.0	<10	71	30.0	40.0	29
Turbidity	NTU	0.100	0.520	0.540	3.8	3.31	3.35	1.2	1.69	1.73	2.3
Anions and Nutrients (Water)											
Alkalinity, Total (as CaCO ₃)	mg/L	10.0	44.0	43.0	2.3	14.0	12.0	15	48.0	11.0	125
Ammonia, Total (as N)	mg/L	0.0200	<0.020	<0.020	0	<0.020	0.0370	60	<0.020	<0.020	0
Bromide (Br)	mg/L	0.100	<0.10	<0.10	0	<0.10	<0.10	0	<0.10	<0.10	0
Chloride (Cl)	mg/L	0.500	<0.50	<0.50	0	0.590	0.590	0	1.02	1.03	1.0
Nitrate and Nitrite as N	mg/L	0.0210	<0.021	<0.021	0	<0.021	<0.021	0	<0.021	<0.021	0
Nitrate (as N)	mg/L	0.0200	<0.020	<0.020	0	<0.020	<0.020	0	<0.020	<0.020	0
Nitrite (as N)	mg/L	0.00500	<0.0050	<0.0050	0	<0.0050	<0.0050	0	<0.0050	<0.0050	0
Total Kjeldahl Nitrogen	mg/L	0.150	<0.15	<0.15	0	<0.15	<0.15	0	<0.15	<0.15	0
Phosphorus, Total	mg/L	0.00300	0.00330	<0.0030	9.5	0.00820	0.0214	89	0.00800	<0.0030	91
Sulfate (SO4)	mg/L	0.300	1.14	1.16	1.7	0.350	0.350	0	0.600	0.600	0
Organic / Inorganic Carbon (Water)											
Dissolved Organic Carbon	mg/L	0.500	1.91	1.98	3.6	0.970	0.880	9.7	1.51	1.36	10
Total Organic Carbon	mg/L	0.500	4.22	2.45	53	1.26	1.48	16	2.03	2.06	1.5
Total Metals (Water)											
Aluminum (Al)	mg/L	0.00300	0.0281	0.0282	0.4	0.102	0.0805	24	0.0818	0.144	55
Antimony (Sb)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Arsenic (As)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Barium (Ba)	mg/L	0.000050	0.00531	0.00524	1.3	0.00296	0.00573	64	0.00551	0.00477	14
Beryllium (Be)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00010	133
Bismuth (Bi)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.000050	164
Boron (B)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Cadmium (Cd)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000050	67
Calcium (Ca)	mg/L	0.0500	9.71	9.91	2.0	3.02	3.10	2.6	11.0	9.79	12
Chromium (Cr)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Cobalt (Co)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Copper (Cu)	mg/L	0.0005000	0.00113	0.00114	0.9	<0.00050	<0.00050	0	0.0007800	<0.0010	25
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	0	0.0820	0.0670	20	0.0950	0.160	51
Lead (Pb)	mg/L	0.000050	0.000066	0.000073	10	0.000094	0.000097	3.1	0.0001050	0.000097	7.9
Lithium (Li)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Magnesium (Mg)	mg/L	0.0500	5.58	5.47	2.0	1.67	1.68	0.6	5.97	6.10	2.2
Manganese (Mn)	mg/L	0.000070	0.0005010	0.0005210	3.9	0.00213	0.00196	8.3	0.00292	0.00230	24
Mercury (Hg)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Molybdenum (Mo)	mg/L	0.000050	0.0004650	0.0004730	1.7	<0.000050	<0.000050	0	0.000074	0.0001140	43
Nickel (Ni)	mg/L	0.0005000	0.0006200	0.0006200	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Potassium (K)	mg/L	0.200	0.600	0.590	1.7	0.350	0.340	2.9	0.570	0.526	8.0
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.000050	181
Silicon (Si)	mg/L	0.100	0.850	0.830	2.4	0.490	0.410	18	0.800	0.770	3.8
Silver (Ag)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000050	133
Sodium (Na)	mg/L	0.0500	0.643	0.654	1.7	0.334	0.336	0.6	0.877	0.841	4.2
Strontium (Sr)	mg/L	0.0001000	0.00613	0.00621	1.3	0.00247	0.00253	2.4	0.00696	0.00640	8.4
Thallium (Tl)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.000010	164
Tin (Sn)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	0.00771	26
Uranium (U)	mg/L	0.000010	0.00188	0.00186	1.1	0.0001260	0.0001300	3.1	0.0007000	0.0006720	4.1
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.00050	67
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	0	<0.0030	<0.0030	0	<0.0030	<0.0030	0
Dissolved Metals (Water)											
Aluminum (Al)	mg/L	0.00300	0.0118	0.0120	1.7	0.0339	0.0310	8.9	0.0192	0.0158	19
Antimony (Sb)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Arsenic (As)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Barium (Ba)	mg/L	0.000050	0.00513	0.00538	4.8	0.00240	0.00228	5.1	0.00484	0.00501	3.5
Beryllium (Be)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Bismuth (Bi)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Boron (B)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Cadmium (Cd)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Calcium (Ca)	mg/L	0.0500	9.63	9.63	0	2.92	2.88	1.4	9.99	10.0	0.1
Chromium (Cr)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Cobalt (Co)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Copper (Cu)	mg/L	0.0005000	0.00108	0.00111	2.7	<0.00050	<0.00050	0	0.0006100	0.0006100	0
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	0	<0.030	<0.030	0	<0.030	<0.030	0
Lead (Pb)	mg/L	0.000050	<0.000050	<0.000050	0	<0.000050	<0.000050	0	<0.000050	<0.000050	0
Lithium (Li)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Magnesium (Mg)	mg/L	0.0500	5.76	5.59	3.0	1.61	1.60	0.6	6.11	6.20	1.5
Manganese (Mn)	mg/L	0.000070	0.0003990	0.0004150	3.9	0.0005870	0.0005810	1.0	0.0002070	0.0002140	3.3
Mercury (Hg)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Molybdenum (Mo)	mg/L	0.000050	0.0003840	0.0004420	14	<0.000050	<0.000050	0	0.000093	0.000087	6.7
Nickel (Ni)	mg/L	0.0005000	0.0005600	0.0005700	1.8	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Potassium (K)	mg/L	0.200	0.580	0.580	0	0.330	0.330	0	0.550	0.560	1.8
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Silicon (Si)	mg/L	0.100	0.790	0.780	1.3	0.340	0.350	2.9	0.700	0.710	1.4
Silver (Ag)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Sodium (Na)	mg/L	0.0500	0.644	0.642	0.3	0.338	0.341	0.9	0.900	0.928	3.1
Strontium (Sr)	mg/L	0.0001000	0.00633	0.00616	2.7	0.00234	0.00231	1.3	0.00617	0.00620	0.5
Thallium (Tl)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Tin (Sn)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Uranium (U)	mg/L	0.000010	0.00187	0.00181	3.3	0.000093	0.000099	6.3	0.0005980	0.0006030	0.8
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	0	<0.0030	<0.0030	0	<0.0030	<0.0030	0
Aggregate Organics (Water)											
Phenols (4AAP)	mg/L	0.00100	<0.0010	<0.0010	0	0.00110	0.0229	182	0.00110	<0.0010	9.5
Plant Pigments (Water)											
Chlorophyll a	µg/L	0.100	0.170	0.180	5.7	0.330	0.310	6.3	0.470	0.550	16
Phaeophytin a	µg/L	0.100	0.260	0.240	8.00	0.300	0.300	0	0.410	0.4200	2.4

Notes: LDL = Laboratory Detection Limit
RPD = Relative Percent Difference
DQO= = Data Quality Objective
Values exceeding the DQO of ≤ 25% RPD.

Figure A.4: Water Sample Field Duplicate Results with Reference to the Data Quality Objective, Mary River CREMP, 2018

Sample ID	Units	LDL	L0-01	L0-01	RPD	BL0-01-S	BL0-01-S	RPD	BL0-03-B	BL0-03-B	RPD
Date Sampled			1-Aug-18	1-Aug-18		8/3/2018	8/3/2018		4/15/2018	4/15/2018	
ALS Sample ID			L2140029-4	L2140029-5		L2141395-5	L2141395-8		L2081994-2	L2081994-3	
Conductivity	umhos/cm	3.00	178	176	1.1	107	110	2.76	78.8	85.4	8.04
Hardness (as CaCO ₃)	mg/L	10.0	88.0	88.0	0	55.0	55.0	0	37.0	42.0	13
pH	pH units	0.100	8.10	8.12	0.2	8.04	8.02	0.25	7.72	7.75	0.388
Total Suspended Solids	mg/L	2.00	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0
Total Dissolved Solids	mg/L	20.0	100	95.0	5.1	48.0	45.0	6.45	39.0	43.0	9.76
Turbidity	NTU	0.100	0.810	0.670	19	0.980	0.980	0	0.300	0.340	13
Anions and Nutrients (Water)											
Alkalinity, Total (as CaCO ₃)	mg/L	10.0	77.0	78.0	1.3	57.0	52.0	9.17	37.0	36.0	2.74
Ammonia, Total (as N)	mg/L	0.0200	<0.020	<0.020	0	<0.020	<0.020	0	<0.020	<0.020	0
Bromide (Br)	mg/L	0.100	<0.10	<0.10	0	<0.10	<0.10	0	<0.10	<0.10	0
Chloride (Cl)	mg/L	0.500	4.56	4.53	0.7	1.57	1.67	6.17	1.90	2.06	8.08
Nitrate and Nitrite as N	mg/L	0.0210	0.413	0.411	0.5	<0.021	0.581	186	0.0370	0.0340	8.45
Nitrate (as N)	mg/L	0.0200	0.413	0.411	0.5	<0.020	0.581	187	0.0370	0.0340	8.45
Nitrite (as N)	mg/L	0.00500	<0.0050	<0.0050	0	<0.0050	<0.0050	0	<0.0050	<0.0050	0
Total Kjeldahl Nitrogen	mg/L	0.150	<0.15	<0.15	0	<0.15	<0.15	0	<0.15	<0.15	0
Phosphorus, Total	mg/L	0.00300	0.00400	0.00330	19	0.00700	0.00600	15	0.00640	0.00310	69
Sulfate (SO4)	mg/L	0.300	5.36	5.34	0.4	1.01	2.71	91	1.30	1.38	5.97
Organic / Inorganic Carbon (Water)											
Dissolved Organic Carbon	mg/L	0.500	2.75	2.73	0.7	1.99	1.98	0.50	1.30	1.50	14
Total Organic Carbon	mg/L	0.500	3.24	3.26	0.6	2.38	1.97	19	1.60	1.70	6.06
Total Metals (Water)											
Aluminum (Al)	mg/L	0.00300	0.0233	0.0238	2.1	0.0314	0.0259	19	0.00460	0.00480	4.26
Antimony (Sb)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Arsenic (As)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Barium (Ba)	mg/L	0.000050	0.0102	0.0102	0	0.00571	0.00597	4.45	0.00428	0.00468	8.93
Beryllium (Be)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Bismuth (Bi)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Boron (B)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Cadmium (Cd)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Calcium (Ca)	mg/L	0.0500	17.8	17.0	4.6	11.6	11.9	2.55	7.91	8.17	3.23
Chromium (Cr)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Cobalt (Co)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Copper (Cu)	mg/L	0.0005000	0.00166	0.00165	0.6	0.0007500	0.0007200	4.08	0.0005700	0.0006200	8.40
Iron (Fe)	mg/L	0.0300	0.0420	0.0430	2.4	<0.030	<0.030	0	<0.030	<0.030	0
Lead (Pb)	mg/L	0.000050	<0.000050	<0.000050	0	<0.000050	<0.000050	0	<0.000050	<0.000050	0
Lithium (Li)	mg/L	0.00100	0.00160	0.00150	6.5	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Magnesium (Mg)	mg/L	0.0500	10.9	10.8	0.9	6.12	6.13	0.16	4.58	5.01	8.97
Manganese (Mn)	mg/L	0.000070	0.00360	0.00309	15	0.00122	0.00116	5.04	0.0004830	0.0004980	3.06
Mercury (Hg)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Molybdenum (Mo)	mg/L	0.000050	0.0007380	0.0007020	5.0	0.0001480	0.0001390	6.27	0.0001380	0.0001490	7.67
Nickel (Ni)	mg/L	0.0005000	0.0007100	0.0007200	1.4	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Potassium (K)	mg/L	0.200	1.75	1.74	0.6	0.640	0.630	1.57	0.560	0.600	6.90
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Silicon (Si)	mg/L	0.100	0.900	0.870	3.4	0.680	0.660	2.99	0.410	0.440	7.06
Silver (Ag)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Sodium (Na)	mg/L	0.0500	2.66	2.53	5.0	1.09	1.03	5.66	1.11	1.17	5.26
Strontium (Sr)	mg/L	0.0001000	0.0132	0.0128	3.1	0.00789	0.00809	2.50	0.00577	0.00614	6.21
Thallium (Tl)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Tin (Sn)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Uranium (U)	mg/L	0.000010	0.00271	0.00272	0.4	0.0007980	0.0007710	3.44	0.0004670	0.0005040	7.62
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Zinc (Zn)	mg/L	0.00300	0.00350	0.00440	23	<0.0030	<0.0030	0	<0.0030	<0.0030	0
Dissolved Metals (Water)											
Aluminum (Al)	mg/L	0.00300	0.00650	0.00650	0	0.0102	0.00850	18	<0.0030	0.00310	3.28
Antimony (Sb)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Arsenic (As)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Barium (Ba)	mg/L	0.000050	0.0100	0.00993	0.7	0.00580	0.00543	6.59	0.00413	0.00468	12
Beryllium (Be)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Bismuth (Bi)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Boron (B)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Cadmium (Cd)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Calcium (Ca)	mg/L	0.0500	17.4	17.2	1.2	11.7	11.8	0.85	7.40	8.33	12
Chromium (Cr)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Cobalt (Co)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Copper (Cu)	mg/L	0.0005000	0.00168	0.00165	1.8	0.0006700	0.0006900	2.94	0.0005700	0.0006300	10
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	0	<0.030	<0.030	0	<0.030	<0.030	0
Lead (Pb)	mg/L	0.000050	<0.000050	<0.000050	0	<0.000050	<0.000050	0	<0.000050	<0.000050	0
Lithium (Li)	mg/L	0.00100	0.00140	0.00140	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Magnesium (Mg)	mg/L	0.0500	10.7	11.0	2.8	6.25	6.11	2.27	4.53	5.23	14
Manganese (Mn)	mg/L	0.000070	0.00240	0.00240	0	0.0006680	0.0007240	8.05	0.0002450	0.0003370	32
Mercury (Hg)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Molybdenum (Mo)	mg/L	0.000050	0.0007260	0.0007240	0.3	0.0001320	0.0001480	11	0.0001320	0.0001670	23
Nickel (Ni)	mg/L	0.0005000	0.0007400	0.0007100	4.1	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Potassium (K)	mg/L	0.200	1.77	1.76	0.6	0.640	0.640	0	0.550	0.620	12
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Silicon (Si)	mg/L	0.100	0.860	0.850	1.2	0.630	0.640	1.57	0.390	0.440	12
Silver (Ag)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Sodium (Na)	mg/L	0.0500	2.62	2.61	0.4	1.07	1.04	2.84	1.13	1.24	9.28
Strontium (Sr)	mg/L	0.0001000	0.0129	0.0129	0	0.00786	0.00794	1.01	0.00549	0.00627	13
Thallium (Tl)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Tin (Sn)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Uranium (U)	mg/L	0.000010	0.00269	0.00268	0.4	0.0007520	0.0007760	3.14	0.0004210	0.0004970	17
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	0	<0.0030	<0.0030	0	<0.0030	<0.0030	0
Aggregate Organics (Water)											
Phenols (4AAP)	mg/L	0.00100	0.00130	0.00110	17	0.00160	<0.0010	46	0.00240	<0.0010	82
Plant Pigments (Water)											
Chlorophyll a	µg/L	0.100	0.330	0.340	3.0	0.420	0.470	11	<0.10	0.620	144
Phaeophytin a	µg/L	0.100	0.280	0.310	10	0.270	0.300	11	0.190	0.290	42

Notes: LDL = Laboratory Detection Limit
RPD = Relative Percent Difference
DQO= = Data Quality Objective
Values exceeding the DQO of ≤ 25% RPD.

Figure A.4: Water Sample Field Duplicate Results with Reference to the Data Quality Objective, Mary River CREMP, 2018

Sample ID	Units	LDL	BLO-05-B-S	BLO-05-B-S	RPD	BL0-09-B	BL0-09-B	RPD	BL0-09-S	BLO-09-S	RPD
Date Sampled			8/24/2018	8/24/2018		8/2/2018	8/2/2018		4/16/2018	4/16/2018	
ALS Sample ID			L2153235-4	L2153235-5		L2140864-4	L2140864-5		L2081979-4	L2081979-3	
Conductivity	umhos/cm	3.00	75.6	68.9	9.27	69.7	66.0	5.5	87.7	87.8	0.1
Hardness (as CaCO ₃)	mg/L	10.0	35.0	36.0	2.82	32.0	32.0	0	43.0	45.0	4.5
pH	pH units	0.100	7.88	7.85	0.381	7.74	7.69	0.6	7.74	7.76	0.3
Total Suspended Solids	mg/L	2.00	<2.0	<2.0	0	2.00	<2.0	0	<2.0	<2.0	0
Total Dissolved Solids	mg/L	20.0	40.0	43.0	7.23	35.0	40.0	13	44.0	51.0	15
Turbidity	NTU	0.100	1.37	1.54	12	3.13	2.94	6.3	0.420	0.590	34
Anions and Nutrients (Water)											
Alkalinity, Total (as CaCO ₃)	mg/L	10.0	32.0	34.0	6.06	27.0	28.0	3.6	37.0	35.0	5.6
Ammonia, Total (as N)	mg/L	0.0200	0.0220	<0.020	9.52	<0.020	<0.020	0	<0.020	<0.020	0
Bromide (Br)	mg/L	0.100	<0.10	<0.10	0	<0.10	<0.10	0	<0.10	<0.10	0
Chloride (Cl)	mg/L	0.500	1.65	1.65	0	1.51	1.52	0.7	2.12	2.13	0.5
Nitrate and Nitrite as N	mg/L	0.0210	<0.021	<0.021	0	<0.021	<0.021	0	0.0350	0.0350	0
Nitrate (as N)	mg/L	0.0200	<0.020	<0.020	0	<0.020	<0.020	0	0.0350	0.0350	0
Nitrite (as N)	mg/L	0.00500	<0.0050	<0.0050	0	<0.0050	<0.0050	0	<0.0050	<0.0050	0
Total Kjeldahl Nitrogen	mg/L	0.150	<0.15	<0.15	0	<0.15	<0.15	0	0.160	<0.15	6.5
Phosphorus, Total	mg/L	0.00300	0.00610	0.00400	42	0.00630	0.00750	17	0.00360	0.0102	96
Sulfate (SO ₄)	mg/L	0.300	2.61	2.62	0.382	1.88	1.85	1.6	1.48	1.49	0.7
Organic / Inorganic Carbon (Water)											
Dissolved Organic Carbon	mg/L	0.500	1.43	1.43	0	1.29	1.31	1.5	1.50	1.40	6.9
Total Organic Carbon	mg/L	0.500	1.72	0.530	106	1.54	1.43	7.4	1.60	1.70	6.1
Total Metals (Water)											
Aluminum (Al)	mg/L	0.00300	0.0394	0.0370	6.28	0.0388	0.0383	1.3	0.00580	0.00420	32
Antimony (Sb)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Arsenic (As)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Barium (Ba)	mg/L	0.000050	0.00438	0.00435	0.687	0.00448	0.00430	4.1	0.00473	0.00467	1.3
Beryllium (Be)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Bismuth (Bi)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Boron (B)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Cadmium (Cd)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Calcium (Ca)	mg/L	0.0500	7.12	7.21	1.26	6.93	6.82	1.6	8.56	7.80	9.3
Chromium (Cr)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Cobalt (Co)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Copper (Cu)	mg/L	0.0005000	0.0005600	0.0005900	5.22	0.0005500	<0.00050	9.5	0.0007300	0.0007100	2.8
Iron (Fe)	mg/L	0.0300	0.0370	0.0350	5.56	<0.030	<0.030	0	<0.030	<0.030	0
Lead (Pb)	mg/L	0.000050	<0.000050	0.000099	66	<0.000050	<0.000050	0	<0.000050	<0.000050	0
Lithium (Li)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Magnesium (Mg)	mg/L	0.0500	4.36	4.29	1.62	4.04	3.80	6.1	5.45	5.08	7.0
Manganese (Mn)	mg/L	0.000070	0.00271	0.00267	1.49	0.00118	0.00109	7.9	0.0004580	0.0004690	2.4
Mercury (Hg)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Molybdenum (Mo)	mg/L	0.000050	0.0001210	0.0001240	2.45	0.0001170	0.0001140	2.6	0.0001570	0.0001330	17
Nickel (Ni)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Potassium (K)	mg/L	0.200	0.550	0.530	3.70	0.570	0.550	3.6	0.650	0.630	3.1
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Silicon (Si)	mg/L	0.100	0.490	0.490	0	0.510	0.500	2.0	0.430	0.440	2.3
Silver (Ag)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Sodium (Na)	mg/L	0.0500	0.847	0.855	0.940	0.860	0.833	3.2	1.27	1.22	4.0
Strontium (Sr)	mg/L	0.0001000	0.00578	0.00601	3.90	0.00601	0.00578	3.9	0.00631	0.00589	6.9
Thallium (Tl)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Tin (Sn)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Uranium (U)	mg/L	0.000010	0.0004480	0.0004440	0.897	0.0002520	0.0001170	73	0.0005170	0.0005230	1.2
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	0	<0.0030	<0.0030	0	<0.0030	<0.0030	0
Dissolved Metals (Water)											
Aluminum (Al)	mg/L	0.00300	0.0150	0.0144	4.08	0.0187	0.0162	14	0.00330	0.00510	43
Antimony (Sb)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Arsenic (As)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Barium (Ba)	mg/L	0.000050	0.00415	0.00439	5.62	0.00440	0.00442	0.5	0.00482	0.00478	0.8
Beryllium (Be)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Bismuth (Bi)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Boron (B)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Cadmium (Cd)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Calcium (Ca)	mg/L	0.0500	7.21	7.30	1.24	6.78	6.68	1.5	8.33	8.87	6.3
Chromium (Cr)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Cobalt (Co)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Copper (Cu)	mg/L	0.0005000	0.0005300	0.0005400	1.87	0.0005400	0.0005400	0	0.0006200	0.00152	84
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	0	<0.030	<0.030	0	<0.030	<0.030	0
Lead (Pb)	mg/L	0.000050	<0.000050	<0.000050	0	<0.000050	<0.000050	0	<0.000050	<0.000050	0
Lithium (Li)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Magnesium (Mg)	mg/L	0.0500	4.25	4.26	0.235	3.56	3.71	4.1	5.31	5.45	2.6
Manganese (Mn)	mg/L	0.000070	0.0008440	0.0008000	5.35	0.00150	0.00143	4.8	0.0003300	0.000966	98
Mercury (Hg)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Molybdenum (Mo)	mg/L	0.000050	0.0001650	0.0001330	21	0.0001220	0.000098	22	0.0001590	0.0001620	1.9
Nickel (Ni)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Potassium (K)	mg/L	0.200	0.520	0.510	1.94	0.510	0.500	2.0	0.640	0.650	1.6
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Silicon (Si)	mg/L	0.100	0.440	0.440	0	0.460	0.450	2.2	0.440	0.450	2.2
Silver (Ag)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Sodium (Na)	mg/L	0.0500	0.849	0.862	1.52	0.786	0.787	0.1	1.25	1.32	5.4
Strontium (Sr)	mg/L	0.0001000	0.00588	0.00601	2.19	0.00581	0.00561	3.5	0.00648	0.00658	1.5
Thallium (Tl)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Tin (Sn)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	0.0005800	141
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Uranium (U)	mg/L	0.000010	0.0004550	0.0004460	2.00	0.0003930	0.0003930	0	0.0005270	0.0005480	3.9
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	0	<0.0030	<0.0030	0	<0.0030	<0.0030	0
Aggregate Organics (Water)											
Phenols (4AAP)	mg/L	0.00100	0.00110	<0.0010	9.52	0.00120	<0.0010	18	<0.0010	<0.0010	0
Plant Pigments (Water)											
Chlorophyll a	µg/L	0.100	0.930	0.980	5.24	0.790	0.800	1.26	0.440	0.430	2.3
Phaeophytin a	µg/L	0.100	1.010	1.000	0.995	0.630	0.660	4.651	<0.10	0.120	18

Notes: LDL = Laboratory Detection Limit
RPD = Relative Percent Difference
DQO= = Data Quality Objective
Values exceeding the DQO of ≤ 25% RPD.

Figure A.4: Water Sample Field Duplicate Results with Reference to the Data Quality Objective, Mary River CREMP, 2018

Sample ID	Units	LDL	DD-HAB9-STN-1-S	DD-HAB9-STN-1-S	RPD	DL0-02-3-B	DL0-02-3-B	RPD	DLO-02-7-B	DLO-02-7-B	RPD
Date Sampled			7/30/2018	7/30/2018		7/31/2018	7/31/2018		8/23/2018	8/23/2018	
ALS Sample ID			L2139231-10	L2139231-11		L2139231-22	L2139231-23		L2152558-2	L2152558-3	
Conductivity	umhos/cm	3.00	129	129	0	99.1	99.2	0.1	120	120	0
Hardness (as CaCO ₃)	mg/L	10.0	62.0	62.0	0	48.0	50.0	4.1	57.0	58.0	1.7
pH	pH units	0.100	8.10	8.08	0.2	7.89	7.86	0.4	7.94	7.95	0.1
Total Suspended Solids	mg/L	2.00	<2.0	<2.0	0	2.80	<2.0	33	<2.0	<2.0	0
Total Dissolved Solids	mg/L	20.0	60.0	55.0	8.7	62.0	50.0	21	60.0	50.0	18
Turbidity	NTU	0.100	1.22	0.920	28	3.20	2.58	21	2.29	2.18	4.9
Anions and Nutrients (Water)											
Alkalinity, Total (as CaCO ₃)	mg/L	10.0	46.0	53.0	14	40.0	43.0	7.2	45.0	46.0	2.2
Ammonia, Total (as N)	mg/L	0.0200	0.0390	0.0320	20	<0.020	<0.020	0	0.0240	0.0690	97
Bromide (Br)	mg/L	0.100	<0.10	<0.10	0	<0.10	<0.10	0	<0.10	<0.10	0
Chloride (Cl)	mg/L	0.500	3.45	3.44	0.3	2.48	2.57	3.6	2.79	2.81	0.7
Nitrate and Nitrite as N	mg/L	0.0210	0.0460	0.0460	0	<0.021	<0.021	0	0.0430	0.0420	2.4
Nitrate (as N)	mg/L	0.0200	0.0460	0.0460	0	<0.020	<0.020	0	0.0430	0.0420	2.4
Nitrite (as N)	mg/L	0.00500	<0.0050	<0.0050	0	<0.0050	<0.0050	0	<0.0050	<0.0050	0
Total Kjeldahl Nitrogen	mg/L	0.150	<0.15	<0.15	0	<0.15	<0.15	0	<0.15	<0.15	0
Phosphorus, Total	mg/L	0.00300	0.00400	0.00320	22	0.00740	0.00640	14	0.00370	0.00330	11
Sulfate (SO4)	mg/L	0.300	6.55	6.58	0.5	4.05	4.05	0	5.68	5.71	0.5
Organic / Inorganic Carbon (Water)											
Dissolved Organic Carbon	mg/L	0.500	1.82	1.71	6.2	1.55	1.58	1.9	1.65	1.68	1.8
Total Organic Carbon	mg/L	0.500	2.02	1.90	6.1	1.83	1.88	2.7	2.56	2.46	4.0
Total Metals (Water)											
Aluminum (Al)	mg/L	0.00300	0.0126	0.00370	109	0.0589	0.0600	1.9	0.0503	0.0654	26
Antimony (Sb)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Arsenic (As)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Barium (Ba)	mg/L	0.000050	0.00667	0.00686	2.8	0.00571	0.00583	2.1	0.00640	0.00647	1.1
Beryllium (Be)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Bismuth (Bi)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Boron (B)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Cadmium (Cd)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Calcium (Ca)	mg/L	0.0500	12.8	12.5	2.4	9.91	9.69	2.2	11.3	11.4	0.9
Chromium (Cr)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Cobalt (Co)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Copper (Cu)	mg/L	0.0005000	0.0007800	0.0006200	23	0.0006600	0.0007100	7.3	0.0008400	0.0008200	2.4
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	0	0.0770	0.0770	0	0.0520	0.0640	21
Lead (Pb)	mg/L	0.000050	<0.000050	<0.000050	0	0.000076	0.000092	19	0.000067	0.000076	13
Lithium (Li)	mg/L	0.00100	0.00110	0.00110	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Magnesium (Mg)	mg/L	0.0500	7.45	7.89	5.7	5.55	5.75	3.5	6.97	7.12	2.1
Manganese (Mn)	mg/L	0.000070	0.00281	0.0007100	119	0.00426	0.00449	5.3	0.00550	0.00545	0.9
Mercury (Hg)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Molybdenum (Mo)	mg/L	0.000050	0.0008630	0.0008590	0.5	0.0003720	0.0004130	10	0.0004650	0.0005070	8.6
Nickel (Ni)	mg/L	0.0005000	0.0005700	0.0005600	1.8	0.0005000	0.0005400	7.7	0.0006200	0.0006200	0
Potassium (K)	mg/L	0.200	1.14	1.29	12	0.840	0.880	4.7	1.04	1.04	0
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Silicon (Si)	mg/L	0.100	0.420	0.430	2.4	0.450	0.460	2.2	0.550	0.580	5.3
Silver (Ag)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Sodium (Na)	mg/L	0.0500	1.43	1.53	6.8	0.992	1.03	3.8	1.27	1.26	0.8
Strontium (Sr)	mg/L	0.0001000	0.00876	0.00869	0.8	0.00749	0.00735	1.9	0.00811	0.00817	0.7
Thallium (Tl)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Tin (Sn)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Uranium (U)	mg/L	0.000010	0.0009370	0.0006900	30	0.0006030	0.0006500	7.5	0.0006960	0.0006880	1.2
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	0	<0.0030	<0.0030	0	<0.0030	<0.0030	0
Dissolved Metals (Water)											
Aluminum (Al)	mg/L	0.00300	<0.0030	<0.0030	0	0.0107	0.0104	2.8	0.00500	0.0141	95
Antimony (Sb)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Arsenic (As)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Barium (Ba)	mg/L	0.000050	0.00663	0.00649	2.1	0.00547	0.00530	3.2	0.00605	0.00620	2.4
Beryllium (Be)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Bismuth (Bi)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Boron (B)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Cadmium (Cd)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Calcium (Ca)	mg/L	0.0500	11.5	12.0	4.3	9.22	9.54	3.4	11.4	11.4	0
Chromium (Cr)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Cobalt (Co)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Copper (Cu)	mg/L	0.0005000	0.0007900	0.0007500	5.2	0.0006000	0.0006200	3.3	0.0007100	0.0007400	4.1
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	0	<0.030	<0.030	0	<0.030	<0.030	0
Lead (Pb)	mg/L	0.000050	<0.000050	<0.000050	0	<0.000050	<0.000050	0	<0.000050	<0.000050	0
Lithium (Li)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Magnesium (Mg)	mg/L	0.0500	8.08	7.81	3.4	5.96	6.24	4.6	7.01	7.08	1.0
Manganese (Mn)	mg/L	0.000070	0.0004110	0.0003480	17	0.0005610	0.0005560	0.9	0.0006330	0.0006870	8.2
Mercury (Hg)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Molybdenum (Mo)	mg/L	0.000050	0.0007180	0.0007150	0.4	0.0003880	0.0004120	6.0	0.0004790	0.0004580	4.5
Nickel (Ni)	mg/L	0.0005000	0.0005700	0.0005700	0	<0.00050	<0.00050	0	0.0005200	0.0005400	3.8
Potassium (K)	mg/L	0.200	1.21	1.21	0	0.890	0.880	1.1	1.02	1.03	1.0
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Silicon (Si)	mg/L	0.100	0.410	0.410	0	0.390	0.390	0	0.480	0.500	4.1
Silver (Ag)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Sodium (Na)	mg/L	0.0500	1.49	1.48	0.7	1.07	1.06	0.9	1.26	1.27	0.8
Strontium (Sr)	mg/L	0.0001000	0.00762	0.00801	5.0	0.00654	0.00676	3.3	0.00824	0.00813	1.3
Thallium (Tl)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Tin (Sn)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Uranium (U)	mg/L	0.000010	0.0008530	0.0008890	4.1	0.0005560	0.0005600	0.7	0.0007330	0.0007330	0
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	0	<0.0030	<0.0030	0	<0.0030	<0.0030	0
Aggregate Organics (Water)											
Phenols (4AAP)	mg/L	0.00100	0.00840	0.00200	123	0.00480	0.00280	53	<0.0010	0.00180	57
Plant Pigments (Water)											
Chlorophyll a	µg/L	0.100	1.60	1.62	1.2	2.16	2.20	1.8	2.01	2.03	1.0
Phaeophytin a	µg/L	0.100	0.870	0.810	7.1	0.900	0.820	9.3	0.800	0.790	1.3

Notes: LDL = Laboratory Detection Limit
RPD = Relative Percent Difference
DQO= = Data Quality Objective
Values exceeding the DQO of ≤ 25% RPD.

Figure A.4: Water Sample Field Duplicate Results with Reference to the Data Quality Objective, Mary River CREMP, 2018

Sample ID	Units	LDL	DL0-02-07	DL0-02-07	RPD	JL0-02-B	JL0-02-B	RPD	JLO-09-B	JLO-09-B	RPD
Date Sampled			4/17/2018	4/17/2018		8/21/2018	8/21/2018		4/14/2018	4/14/2018	
ALS Sample ID			L2082600-5	L2082600-4		L2151700-2	L2151700-3		L2081999-9	L2081999-10	
Conductivity	umhos/cm	3.00	157	159	1.3	137	137	0	158	156	1.27
Hardness (as CaCO ₃)	mg/L	10.0	74.0	75.0	1.3	71.0	72.0	1.4	85.0	85.0	0
pH	pH units	0.100	7.87	7.88	0.1	8.03	8.08	0.6	8.00	8.01	0.125
Total Suspended Solids	mg/L	2.00	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0
Total Dissolved Solids	mg/L	20.0	90.0	85.0	5.7	55.0	60.0	8.7	79.0	76.0	3.87
Turbidity	NTU	0.100	0.650	0.530	20	0.650	0.500	26	0.590	0.360	48
Anions and Nutrients (Water)											
Alkalinity, Total (as CaCO ₃)	mg/L	10.0	69.0	71.0	2.9	61.0	61.0	0	69.0	68.0	1.46
Ammonia, Total (as N)	mg/L	0.0200	<0.020	0.0250	22	<0.020	<0.020	0	<0.020	<0.020	0
Bromide (Br)	mg/L	0.100	<0.10	<0.10	0	<0.10	<0.10	0	<0.10	<0.10	0
Chloride (Cl)	mg/L	0.500	3.48	3.51	0.9	3.85	3.82	0.8	4.38	4.37	0.229
Nitrate and Nitrite as N	mg/L	0.0210	0.0600	0.0590	1.7	0.0300	0.0260	14	<0.021	<0.021	0
Nitrate (as N)	mg/L	0.0200	0.0600	0.0590	1.7	0.0300	0.0260	14	<0.020	<0.020	0
Nitrite (as N)	mg/L	0.00500	<0.0050	<0.0050	0	<0.0050	<0.0050	0	<0.0050	<0.0050	0
Total Kjeldahl Nitrogen	mg/L	0.150	<0.15	<0.15	0	<0.15	<0.15	0	0.150	0.210	33
Phosphorus, Total	mg/L	0.00300	0.00710	0.00670	5.8	0.00330	0.00380	14	<0.0030	0.0251	157
Sulfate (SO ₄)	mg/L	0.300	4.63	4.67	0.9	3.90	3.89	0.3	3.65	3.64	0.274
Organic / Inorganic Carbon (Water)											
Dissolved Organic Carbon	mg/L	0.500	2.50	1.80	33	2.49	2.39	4.1	1.90	1.80	5.41
Total Organic Carbon	mg/L	0.500	2.00	2.00	0	2.77	2.82	1.8	2.10	2.30	9.09
Total Metals (Water)											
Aluminum (Al)	mg/L	0.00300	0.00390	0.00370	5.3	0.0140	0.0127	9.7	<0.0030	<0.0030	0
Antimony (Sb)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Arsenic (As)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Barium (Ba)	mg/L	0.000050	0.00891	0.00871	2.3	0.00667	0.00654	2.0	0.00778	0.00771	0.904
Beryllium (Be)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Bismuth (Bi)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Boron (B)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Cadmium (Cd)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Calcium (Ca)	mg/L	0.0500	15.0	14.9	0.7	13.9	13.9	0	15.0	15.1	0.664
Chromium (Cr)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Cobalt (Co)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Copper (Cu)	mg/L	0.0005000	0.0008600	0.0008700	1.2	0.0009500	0.0008900	6.5	0.00105	0.00118	12
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	0	<0.030	<0.030	0	<0.030	<0.030	0
Lead (Pb)	mg/L	0.000050	<0.000050	<0.000050	0	<0.000050	<0.000050	0	<0.000050	<0.000050	0
Lithium (Li)	mg/L	0.00100	<0.0010	<0.0010	0	0.00110	<0.0010	9.5	<0.0010	0.00110	9.52
Magnesium (Mg)	mg/L	0.0500	8.79	9.21	4.7	8.38	8.04	4.1	8.90	8.86	0.450
Manganese (Mn)	mg/L	0.000070	0.00168	0.00175	4.1	0.00187	0.00179	4.4	0.0004810	0.0004190	14
Mercury (Hg)	mg/L	0.000010	<0.000010	<0.0000050	67	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Molybdenum (Mo)	mg/L	0.000050	0.0006450	0.0006410	0.6	0.0002800	0.0002990	6.6	0.0003430	0.0003320	3.26
Nickel (Ni)	mg/L	0.0005000	0.0006800	0.0006600	3.0	0.0006200	0.0005900	5.0	0.0006300	0.0006500	3.12
Potassium (K)	mg/L	0.200	1.36	1.37	0.7	1.24	1.21	2.4	1.28	1.28	0
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Silicon (Si)	mg/L	0.100	0.610	0.600	1.7	0.330	0.320	3.1	0.330	0.330	0
Silver (Ag)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Sodium (Na)	mg/L	0.0500	1.56	1.53	1.9	1.70	1.62	4.8	1.64	1.61	1.85
Strontium (Sr)	mg/L	0.0001000	0.0104	0.0101	2.9	0.0105	0.0105	0	0.0112	0.0115	2.64
Thallium (Tl)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Tin (Sn)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Uranium (U)	mg/L	0.000010	0.0008460	0.0008410	0.6	0.0009400	0.0009020	4.1	0.0008790	0.0008750	0.456
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	0	<0.0030	<0.0030	0	<0.0030	<0.0030	0
Dissolved Metals (Water)											
Aluminum (Al)	mg/L	0.00300	<0.0030	<0.0030	0	<0.0030	0.00320	6.5	<0.0030	<0.0030	0
Antimony (Sb)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Arsenic (As)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Barium (Ba)	mg/L	0.000050	0.00791	0.00824	4.1	0.00692	0.00708	2.3	0.00715	0.00704	1.55
Beryllium (Be)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Bismuth (Bi)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Boron (B)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Cadmium (Cd)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Calcium (Ca)	mg/L	0.0500	15.1	15.1	0	14.3	14.4	0.7	17.1	17.0	0.587
Chromium (Cr)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Cobalt (Co)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Copper (Cu)	mg/L	0.0005000	0.0008200	0.0008300	1.2	0.0008900	0.000950	6.5	0.0009000	0.0008800	2.25
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	0	<0.030	<0.030	0	<0.030	<0.030	0
Lead (Pb)	mg/L	0.000050	<0.000050	<0.000050	0	<0.000050	<0.000050	0	<0.000050	<0.000050	0
Lithium (Li)	mg/L	0.00100	<0.0010	<0.0010	0	0.00110	0.00100	9.5	0.00140	0.00150	6.90
Magnesium (Mg)	mg/L	0.0500	8.77	9.07	3.4	8.56	8.80	2.8	10.2	10.3	0.976
Manganese (Mn)	mg/L	0.000070	0.0009110	0.0008910	2.2	0.0002430	0.0002710	11	0.0001320	0.0001270	3.86
Mercury (Hg)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Molybdenum (Mo)	mg/L	0.000050	0.0006460	0.0006560	1.5	0.0003370	0.0003610	6.9	0.0003700	0.0003780	2.14
Nickel (Ni)	mg/L	0.0005000	0.0006600	0.0006600	0	0.0006000	0.0006500	8.0	0.0007600	0.0006300	19
Potassium (K)	mg/L	0.200	1.37	1.37	0	1.27	1.29	1.6	1.26	1.27	0.791
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Silicon (Si)	mg/L	0.100	0.610	0.610	0	0.330	0.340	3.0	0.350	0.340	2.90
Silver (Ag)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Sodium (Na)	mg/L	0.0500	1.59	1.54	3.2	1.74	1.75	0.6	1.86	1.82	2.17
Strontium (Sr)	mg/L	0.0001000	0.0102	0.0103	1.0	0.0109	0.0108	0.9	0.0115	0.0115	0
Thallium (Tl)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Tin (Sn)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Uranium (U)	mg/L	0.000010	0.0008970	0.0008680	3.3	0.00102	0.00103	1.0	0.0008480	0.0008270	2.51
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	0	<0.0030	<0.0030	0	<0.0030	<0.0030	0
Aggregate Organics (Water)											
Phenols (4AAP)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	0.00120	0.00420	111
Plant Pigments (Water)											
Chlorophyll a	µg/L	0.100	1.65	2.07	23	2.02	2.41	18	0.160	0.170	6.06
Phaeophytin a	µg/L	0.100	0.890	0.760	16	0.940	0.990	5.2	0.200	0.190	5.128

Notes: LDL = Laboratory Detection Limit
RPD = Relative Percent Difference
DQO= = Data Quality Objective
Values exceeding the DQO of ≤ 25% RPD.

Figure A.4: Water Sample Field Duplicate Results with Reference to the Data Quality Objective, Mary River CREMP, 2018

Sample ID	Units	LDL	JL0-10-S	JL0-10-S	RPD	REF3-01-B	REF3-01-B	RPD	REF3-03-S	REF3-03-S	RPD
Date Sampled			7/29/2018	7/29/2018		8/12/2018	8/12/2018		8/12/2018	8/12/2018	
ALS Sample ID			L2137924-5	L2137924-6		L2145787-6	L2145787-8		L2145787-5	L2145787-4	
Conductivity	umhos/cm	3.00	136	136	0	70.2	70.3	0.142	70.9	70.6	0.424
Hardness (as CaCO ₃)	mg/L	10.0	66.0	67.0	1.50	36.0	36.0	0	37.0	37.0	0
pH	pH units	0.100	8.09	8.11	0.247	7.82	7.85	0.383	7.93	7.92	0.126
Total Suspended Solids	mg/L	2.00	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0
Total Dissolved Solids	mg/L	20.0	60.0	75.0	22	30.0	33.0	9.52	40.0	45.0	12
Turbidity	NTU	0.100	1.00	0.880	13	0.240	0.320	29	0.230	0.270	16
Anions and Nutrients (Water)											
Alkalinity, Total (as CaCO ₃)	mg/L	10.0	56.0	57.0	1.77	32.0	25.0	25	36.0	35.0	2.82
Ammonia, Total (as N)	mg/L	0.0200	<0.020	<0.020	0	<0.020	<0.020	0	<0.020	0.0240	18
Bromide (Br)	mg/L	0.100	<0.10	<0.10	0	<0.10	<0.10	0	<0.10	<0.10	0
Chloride (Cl)	mg/L	0.500	3.90	3.77	3.39	1.28	1.29	0.778	1.28	1.29	0.778
Nitrate and Nitrite as N	mg/L	0.0210	<0.021	<0.021	0	<0.021	<0.021	0	<0.021	<0.021	0
Nitrate (as N)	mg/L	0.0200	<0.020	<0.020	0	<0.020	<0.020	0	<0.020	<0.020	0
Nitrite (as N)	mg/L	0.00500	<0.0050	<0.0050	0	<0.0050	<0.0050	0	<0.0050	<0.0050	0
Total Kjeldahl Nitrogen	mg/L	0.150	<0.15	<0.15	0	0.150	<0.15	0	<0.15	<0.15	0
Phosphorus, Total	mg/L	0.00300	0.00470	0.00450	4.35	0.00420	0.00570	30	0.00710	0.00660	7.30
Sulfate (SO ₄)	mg/L	0.300	3.90	3.86	1.03	3.79	3.79	0	3.79	3.85	1.57
Organic / Inorganic Carbon (Water)											
Dissolved Organic Carbon	mg/L	0.500	1.76	1.77	0.567	3.21	3.19	0.625	3.23	3.27	1.23
Total Organic Carbon	mg/L	0.500	2.53	2.39	5.69	3.40	3.35	1.48	3.52	3.98	12
Total Metals (Water)											
Aluminum (Al)	mg/L	0.00300	0.0123	0.0171	33	<0.0030	<0.0030	0	0.00440	0.00350	23
Antimony (Sb)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Arsenic (As)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Barium (Ba)	mg/L	0.000050	0.00674	0.00698	3.50	0.00696	0.00667	4.26	0.00657	0.00640	2.62
Beryllium (Be)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Bismuth (Bi)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Boron (B)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Cadmium (Cd)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Calcium (Ca)	mg/L	0.0500	13.4	13.5	0.743	7.09	7.10	0.141	7.21	7.17	0.556
Chromium (Cr)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Cobalt (Co)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Copper (Cu)	mg/L	0.0005000	0.00113	0.00131	15	0.0007000	0.0006500	7.41	0.0008700	0.0008900	2.27
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	0	<0.030	<0.030	0	<0.030	<0.030	0
Lead (Pb)	mg/L	0.000050	<0.000050	<0.000050	0	<0.000050	<0.000050	0	<0.000050	<0.000050	0
Lithium (Li)	mg/L	0.00100	0.00120	0.00130	8.00	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Magnesium (Mg)	mg/L	0.0500	8.62	8.49	1.52	4.66	4.58	1.73	4.48	4.45	0.672
Manganese (Mn)	mg/L	0.000070	0.00241	0.00268	11	0.0001320	0.0007590	141	0.0006120	0.0006350	3.69
Mercury (Hg)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Molybdenum (Mo)	mg/L	0.000050	0.0002920	0.0003030	3.70	0.0001420	0.0001270	11	0.0001390	0.0001250	11
Nickel (Ni)	mg/L	0.0005000	0.0006000	0.0006000	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Potassium (K)	mg/L	0.200	1.20	1.21	0.830	1.01	0.980	3.02	0.920	0.940	2.15
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Silicon (Si)	mg/L	0.100	0.340	0.330	2.99	0.440	0.430	2.30	0.440	0.440	0
Silver (Ag)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Sodium (Na)	mg/L	0.0500	1.54	1.62	5.06	0.933	0.918	1.62	0.871	0.880	1.03
Strontium (Sr)	mg/L	0.0001000	0.0100	0.0101	0.995	0.00810	0.00801	1.12	0.00820	0.00812	0.980
Thallium (Tl)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Tin (Sn)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Uranium (U)	mg/L	0.000010	0.0007790	0.0007930	1.78	0.0002170	0.0001860	15	0.0002490	0.0002420	2.85
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	0	<0.0030	<0.0030	0	<0.0030	<0.0030	0
Dissolved Metals (Water)											
Aluminum (Al)	mg/L	0.00300	<0.0030	<0.0030	0	<0.0030	0.00310	3.28	<0.0030	<0.0030	0
Antimony (Sb)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Arsenic (As)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Barium (Ba)	mg/L	0.000050	0.00657	0.00667	1.51	0.00669	0.00696	3.96	0.00674	0.00704	4.35
Beryllium (Be)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Bismuth (Bi)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Boron (B)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Cadmium (Cd)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Calcium (Ca)	mg/L	0.0500	13.2	13.3	0.755	6.98	7.00	0.286	7.02	7.18	2.25
Chromium (Cr)	mg/L	0.0005000	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Cobalt (Co)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Copper (Cu)	mg/L	0.0005000	0.0008300	0.000970	16	0.0007800	0.0007800	0	0.0007800	0.0008100	3.77
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	0	<0.030	<0.030	0	<0.030	<0.030	0
Lead (Pb)	mg/L	0.000050	<0.000050	<0.000050	0	<0.000050	<0.000050	0	<0.000050	<0.000050	0
Lithium (Li)	mg/L	0.00100	0.00110	0.00110	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Magnesium (Mg)	mg/L	0.0500	8.02	8.32	3.67	4.55	4.52	0.662	4.65	4.60	1.08
Manganese (Mn)	mg/L	0.000070	0.0005420	0.0005730	5.56	0.0001080	0.0001760	48	0.0001780	0.0002680	40
Mercury (Hg)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Molybdenum (Mo)	mg/L	0.000050	0.0003150	0.0002890	8.61	0.0001250	0.0001130	10	0.0001260	0.0001230	2.41
Nickel (Ni)	mg/L	0.0005000	0.0005700	0.0005600	1.77	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Potassium (K)	mg/L	0.200	1.16	1.19	2.55	0.930	0.940	1.07	0.940	0.950	1.06
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Silicon (Si)	mg/L	0.100	0.300	0.300	0	0.420	0.430	2.35	0.420	0.420	0
Silver (Ag)	mg/L	0.000010	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Sodium (Na)	mg/L	0.0500	1.55	1.59	2.55	0.880	0.895	1.69	0.895	0.892	0.336
Strontium (Sr)	mg/L	0.0001000	0.00991	0.0100	0.904	0.00759	0.00765	0.787	0.00777	0.00795	2.29
Thallium (Tl)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Tin (Sn)	mg/L	0.0001000	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Uranium (U)	mg/L	0.000010	0.0008090	0.0007840	3.14	0.0002360	0.0002250	4.77	0.0002440	0.0002450	0.409
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	0	<0.0030	<0.0030	0	<0.0030	<0.0030	0
Aggregate Organics (Water)											
Phenols (4AAP)	mg/L	0.00100	0.00190	0.00180	5.41	<0.0010	<0.0010	0	0.00110	0.00390	112
Plant Pigments (Water)											
Chlorophyll a	µg/L	0.100	2.05	1.99	2.97	0.740	0.800	7.79	0.620	0.640	3.17
Phaeophytin a	µg/L	0.100	0.950	0.890	6.522	0.500	0.520	3.922	0.530	0.520	1.905

Notes: LDL = Laboratory Detection Limit
RPD = Relative Percent Difference
DQO= = Data Quality Objective
Values exceeding the DQO of ≤ 25% RPD.

Table A.5: Sediment Sample Field Duplicate Comparisons Indicating, in Highlight, Values Not Meeting the DQO of ≤ 40% Relative Percent Difference (RPD)

Parameter	Lowest Detection Limit	Units	REF-03-10	REF-03-DUP	% RPD	JLO-01	JLO-DUP	% RPD	DLO-01-02	DLO-01-DUP	% RPD	BLO-04	BLO-DUP	% RPD
			24-Aug-2018	24-Aug-2018		19-Aug-2018	19-Aug-2018		17-Aug-2018	17-Aug-2018		20-Aug-2018	20-Aug-2018	
Total Organic Carbon	0.10	%	4.20	4.39	4	1.28	1.41	10	1.23	1.29	4	0.67	0.64	5
Aluminum (Al)	50	µg/g	21,900	22,450	2	16,400	17,100	4	19,000	19,600	3	18,400	18,800	2
Antimony (Sb)	0.10	µg/g	<0.10	<0.10	0	<0.10	<0.10	0	<0.10	<0.10	0	<0.10	<0.10	0
Arsenic (As)	0.10	µg/g	4.56	4.69	3	4.6	4.8	5	3.95	4.25	7	2.47	2.50	1
Barium (Ba)	0.50	µg/g	137	140	2	72.0	75	5	127.0	139.0	9	78.3	79.5	1
Beryllium (Be)	0.10	µg/g	0.86	0.87	1	0.89	0.93	4	0.91	0.94	3	0.85	0.87	2
Bismuth (Bi)	0.20	µg/g	<0.20	<0.20	0	0.24	0.26	6	0.21	0.22	2	<0.20	<0.20	0
Boron (B)	5.0	µg/g	17.1	17.8	4	21.7	22.1	2	24.6	26.2	6	23.8	25.2	6
Cadmium (Cd)	0.020	µg/g	0.165	0.161	3	0.141	0.155	9	0.247	0.261	6	0.108	0.114	5
Calcium (Ca)	50	µg/g	5,470	5,555	2	3,820	4,005	5	4,880	4,950	1	4,130	4,165	1
Chromium (Cr)	0.50	µg/g	70.6	72.2	2	69.4	73.0	5	77.4	78.9	2	70.0	71.2	2
Cobalt (Co)	0.10	µg/g	16.0	16.2	1	17.7	18.3	3	15.9	16.6	4	13.0	13.2	1
Copper (Cu)	0.50	µg/g	88.7	89.5	1	44.1	45.5	3	41.0	42.4	3	25.3	25.7	2
Iron (Fe)	50	µg/g	46,600	47,100	1	31,900	33,200	4	39,300	41,950	7	32,300	33,000	2
Lead (Pb)	0.50	µg/g	16.9	17.3	2	19.4	20.1	3	19.2	19.6	2	16.7	16.9	1
Lithium (Li)	2.0	µg/g	34.5	35.4	2	29.8	30.9	4	32.4	33.3	3	32.9	33.8	3
Magnesium (Mg)	20	µg/g	14,700	14,900	1	12,700	13,350	5	13,300	13,550	2	12,900	13,200	2
Manganese (Mn)	1.0	µg/g	1,130	1,130	0	928	984	6	10,200	9,805	4	603	559	8
Mercury (Hg)	0.0050	µg/g	0.0562	0.0599	6	0.0302	0.0326	7	0.0319	0.0342	7	0.0362	0.0347	4
Molybdenum (Mo)	0.10	µg/g	2.37	2.41	1	0.73	0.78	6	7.53	8.67	14	0.63	0.62	2
Nickel (Ni)	0.50	µg/g	48.5	49.3	2	62.2	66	6	67.3	69.3	3	47.2	47.7	1
Phosphorus (P)	50	µg/g	1,020	1,060	4	944	972	3	873	934	7	746	759	2
Potassium (K)	100	µg/g	5,640	5,750	2	4,490	4,630	3	4,890	5,105	4	4,890	4,995	2
Selenium (Se)	0.20	µg/g	0.66	0.71	7	0.23	0.27	14	0.28	0.34	19	<0.20	<0.20	0
Silver (Ag)	0.10	µg/g	0.21	0.22	5	0.11	0.12	4	0.14	0.14	0	0.12	0.12	0
Sodium (Na)	50	µg/g	415	431	4	188	198	5	276	287	4	319	332	4
Strontium (Sr)	0.50	µg/g	12.6	13.1	4	11.1	11.2	1	10.8	11.1	3	11.4	11.7	2
Sulfur (S)	5000	µg/g	1,000	1,050	0	<1,000	<1,000	0	<1,000	<1,000	0	<1,000	<1,000	0
Thallium (Tl)	0.050	µg/g	0.665	0.676	2	0.462	0.490	6	0.553	0.581	5	0.406	0.412	1
Tin (Sn)	2.0	µg/g	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0
Titanium (Ti)	1.0	µg/g	1,220	1,265	4	829	868	5	1,170	1,220	4	1,390	1,405	1
Uranium (U)	0.050	µg/g	24.3	24.1	1	4.51	4.77	5	6.30	6.50	3	6.49	6.50	0
Vanadium (V)	0.20	µg/g	65.9	67.2	2	59.5	61.8	4	56.9	59.0	4	54.4	55.0	1
Zinc (Zn)	2.0	µg/g	90.6	92.1	2	54.3	56.4	4	65.9	67.6	3	60.7	61.4	1
Zirconium (Zr)	1.0	µg/g	3.2	3.2	2	4.9	5.0	2	7.0	6.8	4	19.8	20.1	1

fraction for these samples ranging between 12.5% (1/8) and 50% (1/2) of the sample material (average of 42%; Appendix Table A.8). Sub-sampling error estimates indicated that, on average, precision and accuracy of the sub-sampled benthic invertebrate community samples met the DQO of $\leq 20\%$ (Appendix Table A.6). Only two of the six sub-sample comparisons resulted in precision or accuracy outside of the DQO for the halved or quartered sample (Appendix Table A.6), but on average for this sample, and all others, precision and accuracy achieved the DQO of $\leq 20\%$. Overall, this indicated that precision and accuracy for sub-sampling of the benthic invertebrate community samples was acceptable.

A2.3.2 Organism Recovery

Sorting efficiency (i.e., percent recovery) of benthic invertebrate samples was high, averaging 95% for eight lotic samples evaluated and 97% for the five lentic samples evaluated (Appendix Table A.7a,b). Sorting efficiency for these samples achieved the DQO of $\geq 90\%$ recovery, and therefore the benthic invertebrate community sample recovery was considered acceptable.



Table A.6: Subsampling Error for Benthic Invertebrate Community Samples, 2018 CREMP**a) Lotic (creek and river) samples**

Station	Whole Organisms	No. of Organisms in Fraction 1	No. of Organisms in Fraction 2	No. of Organisms in Fraction 3	No. of Organisms in Fraction 4	Actual Density*	Precision		Accuracy	
							% range		min	max
CLT1-US-B2	-	97	115	-	-	212	15.7	-	8.5	-
CLT1-DS-B4	-	155	182	-	-	337	14.8	-	8.0	-
SDLT9-B1	-	67	77	89	90	323	1.1	25.6	4.6	17.0
CO-05-B2	-	91	120	-	-	211	24.2	-	13.7	-

b) Lentic (lake) samples

Station	Whole Organisms	Number of Organisms in Fraction 1	Number of Organisms in Fraction 2	Number of Organisms in Fraction 3	Number of Organisms in Fraction 4	Actual Density*	Precision		Accuracy	
							% range		min	max
DLO-02-13	-	89	89	-	-	178	0.0	-	0.0	-
DLO-01-04	-	235	246	-	-	481	4.5	-	2.3	-

* whole large organisms excluded in calculations.

min = minimum absolute % error. max = maximum absolute % error.

Table A.7: Percent Recovery from Benthic Invertebrate Samples, Mary River Project CREMP, 2018**(a) Lotic (creek and river) samples**

Station	Number of Organisms Recovered (initial sort)	Number of Organisms in Re-sort	Percent Recovery
CLT2-DS-B1	126	132	95.5%
CLT2-US-B2	32	33	97.0%
REF-CRK-B2	143	151	94.7%
SDLT1-B3	153	157	97.5%
SDLT9-B2	147	162	90.7%
CO-05-B3	136	147	92.5%
EO-01-B5	113	115	98.3%
GO-09-B4	96	100	96.0%
Average % Recovery			95.3%

b) Lentic (lake) samples

Station	Number of Organisms Recovered (initial sort)	Number of Organisms in Re-sort	Percent Recovery
REF-03-09	52	53	98.1%
BLO-05	137	143	95.8%
DLO-01-14	120	121	99.2%
DLO-02-04	292	309	94.5%
JLO-02	187	194	96.4%
Average % Recovery			96.8%

Table A.8: Proportion of Benthic Invertebrates Samples Sorted for the 2018 CREMP**(a) Lotic (creek and river) samples****b) Lentic (lake) samples**

Station	Fraction Sorted (500 um)	Station	Fraction Sorted (500 um)	Station	Fraction Sorted (500 um)	Station	Fraction Sorted (500 um)	Station	Fraction Sorted (500 um)
CLT1-US-B2	1/2	SDLT1-B2	1/8	SDLT9-B5	1/4	BLO-05	1/ 2	JLO-02	1/ 2
CLT1-US-B3	1/2	SDLT1-B3	1/2	SDLT12-B1	1/8	DLO-01-03	1/ 4	JLO-16	1/ 2
CLT1-US-B4	1/2	SDLT1-B4	1/2	SDLT12-B3	1/2	DLO-01-04	1/ 2	JLO-18	1/ 2
CLT1-DS-B5	1/2	SDLT9-B1	1/2	-	-	DLO-01-09	1/ 2	-	-
CO-05-B1	1/2	SDLT9-B2	1/2	-	-	DLO-02-03	1/ 4	-	-
CO-05-B4	1/2	SDLT9-B4	1/4	-	-	DLO-02-10	1/ 4	-	-

Notes: Any samples not listed were sorted in their entirety (total of 68 lotic samples and 50 lentic samples for the program)

QA/QC Notes: Pupae were not counted toward total number of taxa unless they were the sole representative of their taxa group. Immatures were not counted toward total number of taxa unless they were the sole representative of their taxa group.

A3 DATA QUALITY STATEMENT

The DQR results generally indicated that water, sediment, and benthic invertebrate community data were of acceptable quality. Few water quality and sediment quality parameters did not meet acceptable DQO. In general, most parameters that did not meet respective DQO typically showed very low margins of error relative to respective criteria and/or were observed at low concentrations often near RDL which led to relatively small incremental differences in concentrations between replicates resulting in failure to meet DQO. However, key exceptions to this occurred for total and/or dissolved barium concentrations and turbidity in water, which routinely did not meet DQO in trip, field, and equipment blank analyses suggesting that the results for these parameters should be interpreted with caution. Although it was unclear as to the source of these parameters in the various blank samples, because the parameters that did not meet DQO in trip, field, and equipment blanks were consistent, the water bottles/water bottle caps themselves were most likely sources of contamination in the blank samples. Notably, the deionized water used to create blanks was suggested as the most likely source of blank contamination in previous CREMP (KP 2015). The field duplicate samples for sediment indicated very high precision that consistently met DQO. The benthic invertebrate community data quality was also acceptable, meeting most precision, accuracy, and percent recovery benchmarks. Overall, the data associated with the 2018 CREMP were considered defensible and acceptable for interpretation and derivation of conclusions with a good level of confidence.



APPENDIX B
REFERENCE AREA DESCRIPTIVE OVERVIEW

APPENDIX B OVERVIEW OF REFERENCE CONDITIONS

B1	INTRODUCTION	1
B2	HABITAT	2
B2.1	Creek/Tributary Environments	2
B2.2	River Environments.....	2
B2.3	Lake Environments	3
B3	WATER QUALITY	5
B3.1	Creek/Tributary Environments	5
B3.2	River Environments.....	5
B3.3	Lake Environments (Reference Lake 3)	9
B4	SEDIMENT QUALITY.....	15
B4.1	Creek/Tributary Environments	15
B4.2	River Environments.....	15
B4.3	Lake Environments (Reference Lake 3)	15
B5	PHYTOPLANKTON (CHLOROPHYLL-A)	19
B5.1	Lotic Environments	19
B5.2	Lentic Environments (Reference Lake 3).....	19
B6	BENTHIC INVERTEBRATE COMMUNITY.....	25
B6.1	Creek/Tributary Environments	25
B6.2	River Environments.....	28
B6.3	Lentic Environments (Reference Lake 3).....	29
B7	FISH POPULATION	30
B7.1	Lotic Environments	30
B7.2	Lentic Environments (Reference Lake 3).....	30
B8	CREMP IMPLICATIONS	35
B9	REFERENCES	38

LIST OF FIGURES

Figure B.1:	Seasonal Variation in Water Chemistry at Stream/Tributary Reference Stations, Mary River Project CREMP, 2018.....	7
Figure B.2:	Seasonal Variation in Water Chemistry at Mary River GO-09 Reference Stations, Mary River Project CREMP, 2018.....	10
Figure B.3:	<i>In Situ</i> Water Quality with Depth from Surface at Reference Lake 3 during Summer and Fall Sampling Events, Mary River Project CREMP, 2018	11
Figure B.4:	Water Chemistry Comparison Between the Surface and the Bottom of the Water Column at Reference Lake 3 Routine Monitoring Stations during Summer and Fall, Mary River Project CREMP, 2018	14
Figure B.5:	Sediment Metal Concentrations (mean $\pm$ SE) at Littoral (<12m depth) and Profundal (>12m depth) Monitoring Stations of Reference Lake 3 (REF03), Mary River Project CREMP, 2015 to 2018.....	18



Figure B.6:	Chlorophyll-a Concentration Seasonal Comparison from 2015 to 2018 at Creek, River, and Lake Reference Phytoplankton Monitoring Stations, Mary River Project CREMP.....	21
Figure B.7:	Chlorophyll-a Concentrations at the Surface and Bottom of the Water Column at Reference Lake 3 Phytoplankton Monitoring Stations during Summer and Fall Sampling Events, Mary River Project CREMP, 2018	22
Figure B.8:	Length-frequency Distributions for Arctic Charr Captured by Backpack Electrofishing and Gill Netting at Reference Lake 3 (REF3) in August 2015 to 2018, Mary River Project CREMP.....	31
Figure B.9:	Comparison of Condition (Weight-at-fork-length Relationship) for Arctic Charr Collected at the Nearshore Area of Reference Lake 3 in August 2015 to 2018 using Log-transformed (a) and Untransformed (b) Data, Mary River Project CREMP.....	33

LIST OF TABLES

Table B.1:	Physical Characteristics for Mine-Exposed Lakes and Reference Lake 3.....	4
Table B.2:	Water Chemistry at Reference Creek Stations, Mary River Project CREMP, 2018	6
Table B.3:	Water Chemistry at Mary River GO-09 Series Reference Stations, Mary River Project CREMP, 2018.....	8
Table B.4:	Water Chemistry at Reference Lake 3, Mary River Project CREMP, 2018	12
Table B.5:	Sediment Particle Size, Total Organic Carbon, and Metal Concentrations at Reference Lake 3 (REF-03) Sediment Stations, Mary River Project CREMP, August 2018	17
Table B.6:	Phytoplankton Monitoring Data Collected at Lotic Reference Stations, Mary River Project CREMP 2018.....	20
Table B.7:	Statistical Comparisons of Chlorophyll-a Concentrations among Winter, Spring, Summer, and/or Fall Sampling Events at Reference Lotic and Lentic Study Areas, Mary River Project CREMP, 201	24
Table B.8:	Benthic Invertebrate Community Summary Statistics for Unnamed Reference Creek and Mary River (GO-09) Reference Areas, Mary River Project CREMP, August 2018.....	26
Table B.9:	Benthic Invertebrate Community Statistical Comparison Results between Littoral and Profundal Stations at Reference Lake 3, Mary River Project CREMP, August 2018	27
Table B.10:	Statistical Comparisons For Length, Weight, and Condition Endpoints For Arctic Charr, Mary River Project CREMP.....	32



B1 INTRODUCTION

The initial review of background (reference) data collected from lotic (i.e., creeks and rivers) and lentic (i.e., lakes) study areas as part of the 2015 Mary River Project CREMP revealed naturally elevated metal concentrations above guidelines and significant differences in benthic community endpoints between reference lake littoral and profundal stations (Minnow 2016a). Therefore, this overview of reference conditions is included to provide context and perspective regarding water quality, sediment quality, phytoplankton (chlorophyll-a), benthic invertebrate community, and fish population characteristics at the CREMP reference study areas. Key implications of reference area features towards the evaluation of potential mine-related effects at mine-exposed waterbodies as part of the CREMP were also identified as part of this reference area overview.



B2 HABITAT

B2.1 Creek/Tributary Environments

Four reference creek/tributary (reference creek) stations were established among two unnamed tributaries to Angajurjualuk Lake (Stations CLT-REF4, MRY-REF2 and MRY-REF3) and one unnamed tributary to the Mary River (Station CLT-REF3) during the Mary River Project CREMP in 2014 (see Figure 2.2). These stations were intended to provide reference information for the creek water quality and phytoplankton monitoring components of the CREMP, and have been used as such in the four studies conducted since commercial mine operations commenced at the Mary River Project (i.e., 2015 to 2018; see Table 2.1). From 2016 to 2018, habitat conditions at the western tributary to Angajurjualuk Lake that is used for Baffinland CREMP water quality monitoring (Stations CLT-REF4 and MRY-REF) were deemed comparable to habitat conditions at the Camp Lake and Sheardown Lake tributaries. Therefore, this tributary served as a benthic reference creek (REF-CRK) for comparisons involving the various mine-exposed tributaries as part of the 2016 to 2018 annual CREMP studies (see Figure 2.4), and herein has been referred to as Unnamed Reference Creek.

The reference creeks/tributaries are moderate gradient lotic systems characterized predominantly by riffle-run and riffle-rapid stream morphology, with pools occurring rarely based on localized topography and associated gradient. The wetted width and depth of the benthic reference tributary averaged 11.1 m and 0.09 m, respectively, during sampling conducted in August 2017 (Minnow 2018a). The corresponding water velocities across a representative riffle area of the benthic reference tributary ranged from 0.02 to 0.52 m/s in August 2017 (average of 0.28 m/s). As for most small lotic systems in the region, surface flow at all of the CREMP reference tributaries is limited to months in which average ambient air temperatures are near or above freezing (i.e., June to September). The substrate at the reference tributaries is composed mainly of cobble and large pebble (i.e., 50 to 256 mm diameter), with surficial areas of sand generally limited to less than 10% of stream area (Minnow 2018a). In-stream vegetation at the reference tributaries is sparse, and generally includes a relatively thin layer of surficial algae/periphyton attached to relatively stable substrate.

B2.2 River Environments

The area of Mary River located upstream of the mine lease property is only minimally influenced by Mary River Project mining activity (i.e., low amounts of dust deposition; see Baffinland 2015). Therefore, this area has been considered representative of background (reference) conditions for the mine-exposed stations/study areas situated farther downstream



on the Mary River under the CREMP (Baffinland 2015; KP 2014a,b, 2015; NSC 2014). Water quality, phytoplankton productivity, and benthic invertebrate community (benthic) data collected at the Mary River reference area, referred to as GO-09 (including water quality stations GO-09A, GO-09 and GO-09B), has been used to compare against areas of the Mary River that are potentially influenced by mine activity. Although area GO-03 can also currently serve as a reference area, potential advancement of the Mary River Project to include the Deposit 2 ore body would result in this area becoming a near-field mine-exposed area in the future.

The Mary River reference area is a moderate gradient erosional environment characterized mainly by riffle and run stream morphology. Depending on flow conditions, average wetted width and average depth of the Mary River reference area has ranged from 30 to 55 m and 0.20 to 0.36 m, respectively, in studies conducted by Minnow (2017, 2018a) during the month of August. On average, the corresponding water velocities across representative riffle areas of the GO-09 benthic study area have ranged from 0.20 to 0.47 m/s during these studies. The substrate at the GO-09 reference area is composed mainly of boulder and cobble, with roughly equal proportion of pebble, gravel, and sand composing the surficial substrate at much of the remaining area (Minnow 2018a). In-stream vegetation at the Mary River GO-09 reference area is sparse, and generally includes a relatively thin layer of periphyton and/or scarce bryophytes (moss) growth on the upper surface of physically stable substrate.

B2.3 Lake Environments

A geographically expansive reconnaissance survey of local study area (LSA) lakes was conducted in 2014 to identify a waterbody that could potentially serve as a suitable reference area for the mine-exposed lakes (i.e., Camp, Sheardown NW, Sheardown SE, and Mary lakes; NSC 2015b). The key criteria for the selection of the suitable reference lake included a waterbody with similar surface area, maximum water depth, substrate features, and fish species composition as the mine-exposed lakes, in addition to also being uninfluenced by current or past mining activity. Based on the results of this survey, Reference Lake 3 was selected to represent reference conditions for the mine-exposed lakes beginning in 2015 as part of the Mary River Project CREMP studies (Appendix Table B.1).

Reference Lake 3 is an unnamed lake located approximately 62 km south of the Mary Lake Project (see Figures 2.1 and 2.3), well outside the area of mine influence. Reference Lake 3 is a headwater lake that is characterized by a relatively complex morphology that includes three basins and connection to a separate lake by a short, shallow channel (see Figure 2.3). The three basins reach approximately 15 m, 30 m and 36 m in depth with progression from east to west, and the average depth of Reference Lake 3 is approximately 11.8 m (Appendix



Table B.1). The outlet of Reference Lake 3, located off the south-central portion of the lake, drains into a large boulder field through which flow can occur largely as sub-surface drainage. Substrate along the shoreline and shallow littoral areas of Reference Lake 3 is composed mainly of large boulder and cobble that is commonly interrupted by areas of bedrock. Substrate of the deeper littoral and profundal areas of Reference Lake 3 is almost exclusively represented by silt loam containing approximately 15 to 35% fine sand (by dry weight) and a moderate organic carbon content of approximately 5%. No substantial aquatic plant beds have been observed at Reference Lake 3, with fish cover provided predominantly by the rocky substrates along the shoreline and shallow littoral zone of the lake.

Table B.1: Physical Characteristics for Mine-Exposed Lakes and Reference Lake 3

Lake Feature	Mine-Exposed Lakes				Reference Lake
	Camp	Sheardown NW	Sheardown SE	Mary	Reference Lake 3
Drainage Basin Area (km ²)	26.5	6.6	8.9	663.4	23.2
Lake Area (km ²)	2.21	0.68	0.25	13.6	2.05
Drainage Basin: Lake Area Ratio	11.98	9.66	35.6	48.8	11.32
Mean Depth (m)	13.0	12.1	7.4	-	11.8
Maximum Depth (m)	35.1	30.1	14.8	40.0	38.3
Volume (1,000,000 m ³)	27.5	8.18	1.8	156.4	22.6
Hydraulic Retention Time (days)	416 ± 184	511 ± 213	83 ± 35	75 ± 29	-



B3 WATER QUALITY

B3.1 Creek/Tributary Environments

Water chemistry at the reference creek stations met all applicable WQG and AEMP benchmarks for lotic environments in 2018 with the exception of total aluminum concentrations (Appendix Table B.2). Concentrations of aluminum were elevated at reference creek station MRY-REF-3 in the spring and summer of 2018, appearing to be associated with relatively high turbidity at the time of sampling (Appendix Table B.2). Water chemistry at the reference creek stations showed distinct seasonal changes for some parameters (Appendix Figure B.1; Appendix Table B.2). In general, conductivity and concentrations of chloride, sulphate, and total metals were lowest in spring, intermediate in the summer, and highest during the fall in 2018 (Appendix Table B.2; Appendix Figure B.1). This pattern almost certainly reflected dilution from snow melt and precipitation-related sources, with the lowest parameter concentrations typically associated with the spring freshet conditions, and highest parameter concentrations generally associated with low precipitation/streamflow conditions later in the open water season. Previous baseline and 2015 to 2017 water quality monitoring conducted at reference creek stations showed similar seasonal patterns (KP 2014b; Minnow 2016a, 2017, 2018a). Temporal comparison of mean water chemistry for the reference creek stations showed no substantial changes in water quality from 2014 to 2018, suggesting that water chemistry at the reference creek stations was relatively consistent year-to-year taking seasonal sampling timing into account (Figure 3.2; Appendix Figure C.2). Therefore, the reference creek stations were deemed to provide a meaningful benchmark for the evaluation of potential mine-related influences on water chemistry at mine-exposed creek/tributary receiving environments taking seasonality into consideration.

B3.2 River Environments

Water chemistry at the Mary River reference stations (GO-09 series) often showed elevated concentrations of total aluminum, and on a single occasion, total phosphorus and phenol concentrations, compared to WQG and/or AEMP benchmarks in 2018 (Appendix Table B.3). As in previous CREMP studies, Mary River GO-09 reference station total aluminum appeared to be associated with naturally high turbidity and specifically, suspended particulate matter. Comparison of the ratio between dissolved and total concentrations of aluminum indicated that a high proportion of aluminum was in the total (particulate) fraction (i.e., 87%, on average; compare Appendix Tables B.3 and C.64), which can be expected for metals contained in particulate matter.



Table B.2: Water Chemistry at Reference Creek Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark	Spring Sampling Event				Summer Sampling Event				Fall Sampling Event			
					CLT-REF4	CLT-REF3	MRY-REF3	MRY-REF2	CLT-REF4	CLT-REF3	MRY-REF3	MRY-REF2	CLT-REF4	CLT-REF3	MRY-REF3	MRY-REF2
					30-Jun-2018	30-Jun-2018	30-Jun-2018	30-Jun-2018	12-Aug-2018	12-Aug-2018	12-Aug-2018	12-Aug-2018	24-Aug-2018	25-Aug-2018	24-Aug-2018	24-Aug-2018
Conventional ^b	Conductivity (lab)	umho/cm	-	-	32.3	38.4	19.5	38.3	84.2	75.2	49.7	90.2	107	94	78	110
	pH (lab)	pH	6.5 - 9.0	-	7.56	7.54	7.04	7.59	7.99	7.89	7.60	8.03	8.04	7.88	7.70	7.91
	Hardness (as CaCO ₃)	mg/L	-	-	16	19	<10	19	48	41	21	48	54	47.5	30	55
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	4.7	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	15	16	12	17	50	45	45	48	57	38	55	62
	Turbidity	NTU	-	-	0.7	0.6	5.9	0.9	1.4	0.9	9.4	1.2	1.1	0.5	6.9	1.2
	Alkalinity (as CaCO ₃)	mg/L	-	-	<10	18	<10	17	45	40	17	47	50	44	25	53
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.024
	Nitrate	mg/L	13	13	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Nitrate and Nitrite (as N)	mg/L	-	-	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021
	Dissolved Organic Carbon	mg/L	-	-	0.72	1.1	0.93	1.1	1.4	2.14	1.45	2.32	1.1	1.9	1.1	1.8
	Total Organic Carbon	mg/L	-	-	1.22	1.3	1.2	1.2	1.6	2.4	1.7	2.6	1.3	3.3	1.3	2.1
	Total Phosphorus	mg/L	0.020 ^d	-	0.0034	0.0034	0.0084	0.0041	0.0056	0.0032	0.0109	0.0035	<0.0030	0.0033	0.0047	<0.0030
Anions	Phenols	mg/L	0.004 ^d	-	0.0020	0.0038	<0.0010	0.0017	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	<0.50	<0.50	0.92	<0.50	<0.50	<0.50	2.19	0.80	<0.50	<0.50	4.23	1.30
Total Metals	Sulphate (SO ₄)	mg/L	218 ^β	218	<0.30	0.34	1.31	<0.30	0.46	0.87	4.04	0.73	0.82	1.15	7.5	1.33
	Aluminum (Al)	mg/L	0.100	0.179	0.0213	0.0147	0.1220	0.0155	0.0703	0.0457	0.237	0.0636	0.0516	0.0282	0.0816	0.056
	Antimony (Sb)	mg/L	0.020 ^d	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.00183	0.00271	0.00310	0.00248	0.00435	0.00516	0.00661	0.00509	0.00465	0.00528	0.0074	0.00631
	Beryllium (Be)	mg/L	0.011 ^d	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	3.39	3.88	1.64	3.84	9.49	8.06	4.66	9.50	10.8	9.8	6.86	11.8
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^d	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0022	<0.00050	0.00070	0.00065	<0.00050	0.00056	0.00135	0.00143	0.00071	<0.00050	0.00114	0.00114	0.00063
	Iron (Fe)	mg/L	0.30	0.326	<0.030	<0.030	0.106	<0.030	<0.030	0.037	0.199	0.042	<0.030	<0.030	0.087	0.037
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	0.000050	0.000148	<0.000050	<0.000050	0.000117	0.000266	<0.000050	<0.000050	0.000070	0.000164	<0.000050
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	-	-	1.80	2.20	0.831	2.12	5.52	4.92	2.29	5.60	6.04	5.53	3.36	6.30
	Manganese (Mn)	mg/L	0.935 ^β	-	0.000231	0.000283	0.00202	0.000401	0.000332	0.00067	0.00273	0.000620	0.000205	0.00051	0.001290	0.00060
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	<0.000050	0.000130	0.000070	<0.000050	0.000144	0.000375	0.000223	0.000141	0.000169	0.000469	0.000319	0.000191
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00066	<0.00050	<0.00050	<0.00050	0.00062	<0.00050	<0.00050
	Potassium (K)	mg/L	-	-	0.27	0.34	0.33	0.32	0.52	0.57	0.73	0.61	0.55	0.60	0.77	0.680
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.34	0.47	0.49	0.31	0.81	0.87	1.24	0.80	0.72	0.84	0.94	0.810
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	0.233	0.282	0.621	0.363	0.549	0.558	1.79	0.83	0.66	0.649	2.59	1.06
	Strontium (Sr)	mg/L	-	-	0.00230	0.00239	0.00327	0.00272	0.00675	0.00502	0.0096	0.00732	0.0080	0.00617	0.0141	0.0095
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.013	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.000123	0.000203	0.000267	0.000162	0.00190	0.001060	0.000592	0.000726	0.00339	0.00187	0.00093	0.00127
	Vanadium (V)	mg/L	0.006 ^d	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)	mg/L	-	-												

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above AEMP benchmark applicable to the mine lotic receiving environments.

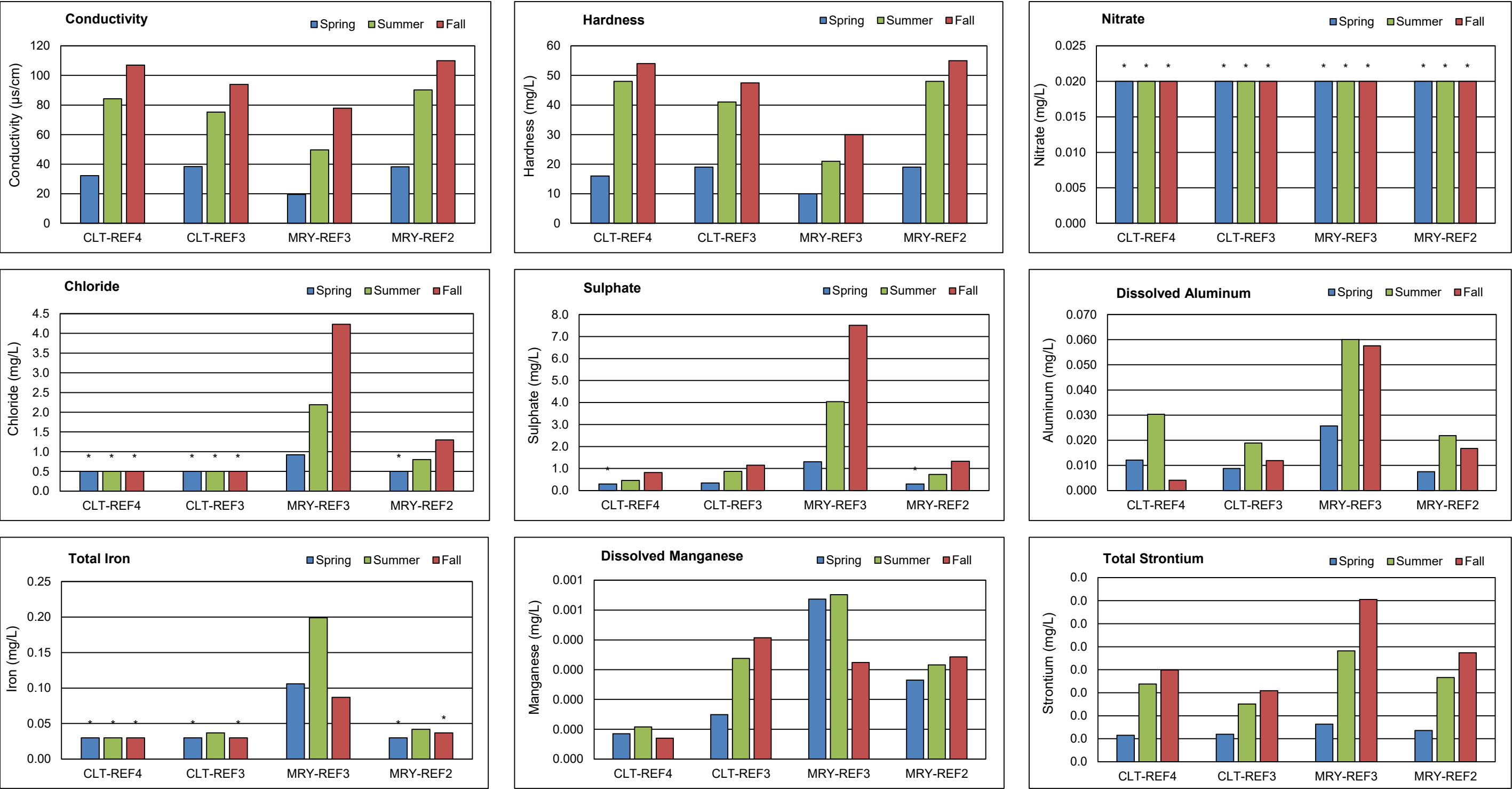


Figure B.1: Seasonal Variation in Water Chemistry at Stream/Tributary Reference Stations, Mary River Project CREMP, 2018

Note: Asterisk (*) indicates that the parameter concentration was below the laboratory reportable detection limit.

Table B.3: Water Chemistry at Mary River GO-09 Series Reference Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark	Spring Sampling Event			Summer Sampling Event			Fall Sampling Event		
					G0-09-A 1-Jul-2018	G0-09 1-Jul-2018	G0-09-B 1-Jul-2018	G0-09-A 12-Aug-2018	G0-09 12-Aug-2018	G0-09-B 12-Aug-2018	G0-09-A 27-Aug-2018	G0-09 25-Aug-2018	G0-09-B 25-Aug-2018
Conventional ^b	Conductivity (lab)	umho/cm	-	-	24.3	25.9	30.2	80.8	84.4	84.6	134	113	112
	pH (lab)	pH	6.5 - 9.0	-	7.3	7.4	7.4	8.16	8.03	8.13	7.99	8.07	8.14
	Hardness (as CaCO ₃)	mg/L	-	-	11	12	14	40	42	43	66	55	55
	Total Suspended Solids (TSS)	mg/L	-	-	16.9	6.2	3.7	<2.0	<2.0	<2.0	3.2	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	<10	13	11	40	50	50	55	70	70
	Turbidity	NTU	-	-	8.8	7.06	4.72	9.65	8.88	7.73	2.71	4.94	3.81
	Alkalinity (as CaCO ₃)	mg/L	-	-	11	15	17	46	39	40	65	50	52
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	<0.020	<0.020	<0.020	0.032	<0.020	<0.020	0.037	0.069	<0.020
	Nitrate	mg/L	13	13	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	0.88	0.92	1	1.2	1.29	1.48	1.33	1.96	1.91
	Total Organic Carbon	mg/L	-	-	1.31	1.2	1.25	1.6	1.57	1.67	2.1	2.05	1.95
	Total Phosphorus	mg/L	0.020 ^α	-	0.0277	0.0158	0.0074	0.0138	0.0075	0.009	0.0034	0.0073	0.0034
	Phenols	mg/L	0.004 ^α	-	0.0061	<0.0010	0.0015	0.0034	<0.0010	<0.0010	<0.0010	0.0027	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	0.53	0.53	0.58	1.89	1.81	1.59	2.83	2.87	2.8
	Sulphate (SO ₄)	mg/L	218 ^β	218	<0.30	<0.30	<0.30	1.2	1.1	0.9	1.61	1.79	1.74
Total Metals	Aluminum (Al)	mg/L	0.100	0.179	0.225	0.135	0.0864	0.1760	0.426	0.147	0.126	0.155	0.105
	Antimony (Sb)	mg/L	0.020 ^α	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.00395	0.00323	0.00309	0.0069	0.0073	0.0059	0.00845	0.00821	0.008
	Beryllium (Be)	mg/L	0.011 ^α	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	2.45	2.56	3.02	9	9	9	13.9	11.8	11.7
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	0.00072	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^α	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0022	0.00067	0.0006	0.00055	0.0010	0.0010	0.0008	0.00078	0.00087	0.00088
	Iron (Fe)	mg/L	0.30	0.326	0.181	0.125	0.096	0.138	0.140	0.112	0.071	0.102	0.082
	Lead (Pb)	mg/L	0.001	0.001	0.000219	0.000155	0.000103	0.00018	0.00016	0.00015	0.000076	0.000114	0.000092
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	-	-	1.37	1.46	1.63	4.85	5.04	4.44	7.44	6.06	6.48
	Manganese (Mn)	mg/L	0.935 ^β	-	0.00418	0.00317	0.00241	0.00176	0.00170	0.00139	0.0009	0.0012	0.0011
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	<0.000050	<0.000050	<0.000050	0.00021	0.00018	0.00015	0.00025	0.00029	0.00026
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Potassium (K)	mg/L	-	-	0.39	0.36	0.36	0.93	0.91	0.76	0.91	0.95	0.97
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.73	0.51	0.54	1.04	1.13	0.94	0.96	0.94	0.85
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	0.385	0.377	0.412	1.620	1.560	1.310	2.01	1.99	1.98
	Strontium (Sr)	mg/L	-	-	0.00267	0.00267	0.00279	0.010	0.009	0.009	0.0128	0.0127	0.0129
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.000204	0.000165	0.000152	0.0014	0.0014	0.0012	0.00263	0.00253	0.00269
	Vanadium (V)	mg/L	0.006 ^α	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

 Indicates parameter concentration above applicable Water Quality Guideline.

 Indicates parameter concentration above AEMP benchmark applicable to the mine lotic receiving environments.

Water chemistry at the Mary River reference stations showed distinct seasonal changes for conservative parameters including conductivity, hardness, chloride, sodium, and sulphate (Appendix Figure B.2; Appendix Table B.3). These seasonal changes in parameter concentrations were consistent with those observed at the reference creek stations in 2018, and in previous baseline (2005 to 2013), and 2015 to 2017 water quality monitoring data collected at the Mary River GO-09 series reference stations (KP 2014b; Minnow 2016a, 2017, 2018a). The seasonal changes in the Mary River reference station parameter concentrations likely reflected greater dilution during the spring snowmelt period, and consecutively lower surface runoff inputs during the summer and fall periods. Temporal comparison of the Mary River GO-09 series reference station water chemistry indicated that on average, parameter concentrations in 2018 were within respective ranges observed between the baseline period and previous operating mine conditions based on fall monitoring data (Figure 5.3; Appendix Figure C.22). Therefore, the Mary River reference stations were deemed to provide a meaningful benchmark for the evaluation of potential mine-related influences on water chemistry at the Mary River mine-exposed study areas.

B3.3 Lake Environments (Reference Lake 3)

In situ water temperature profiles conducted at Reference Lake 3 did not indicate thermal stratification of the water column in either summer or fall of 2018 (Appendix Figure B.3). No marked changes in dissolved oxygen concentration occurred with increased depth at any of the Reference Lake 3 basins, and dissolved oxygen saturation remained high (i.e., $\geq 95\%$) throughout the entire water column in both the summer and fall profiles (Appendix Figure B.3). The 2018 water quality profiles also showed only minor changes in pH and specific conductance among stations and with depth during each of the summer and fall sampling events (Appendix Figure B.3). Overall, the *in situ* water quality profiles suggested relatively thorough lateral mixing within Reference Lake 3 and no substantial changes in water temperature, dissolved oxygen, pH, or conductivity with changes in water depth.

The evaluation of water chemistry at Reference Lake 3 indicated that all monitored parameters were below WQG in summer and fall 2018 (Appendix Table B.4). In addition, no parameters were observed at concentrations above lentic AEMP benchmarks at Reference Lake 3 (Appendix Table B.4), suggesting that these water quality benchmarks were relevant for comparisons of water quality for the mine-exposed lakes. No substantial differences in water chemistry were observed between the summer and fall at Reference Lake 3 in 2018, which was similar to observations among winter, summer, and fall at local study area lakes during the mine baseline period and in summer and fall at Reference Lake 3 from 2015 to 2017 (KP 2014a,c; Minnow 2016a, 2017, 2018a). Temporal comparisons also showed no



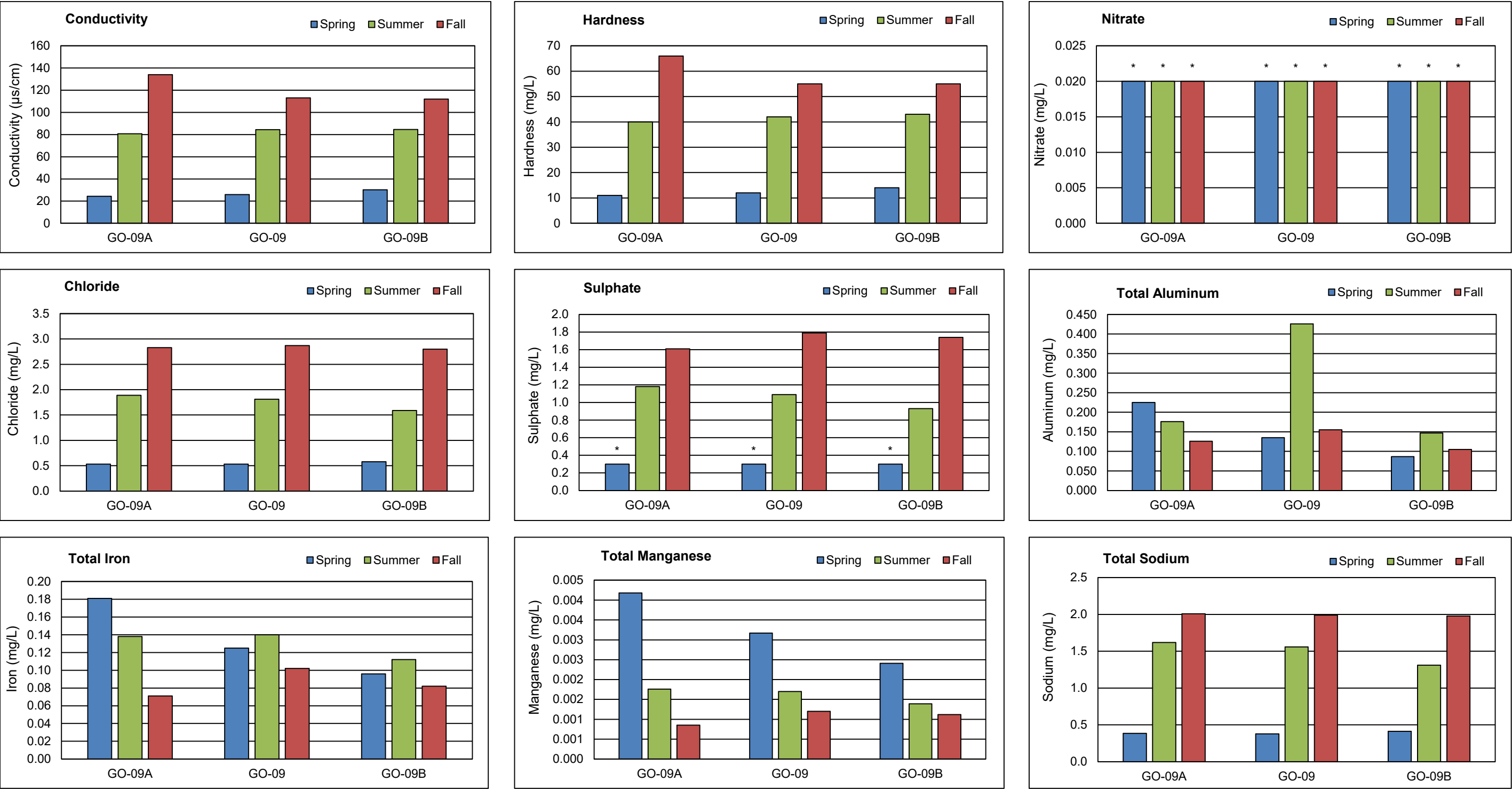


Figure B.2: Seasonal Variation in Water Chemistry at Mary River GO-09 Reference Stations, Mary River Project CREMP, 2018

Note: Asterisk (*) indicates that the parameter concentration was below the laboratory reportable detection limit.

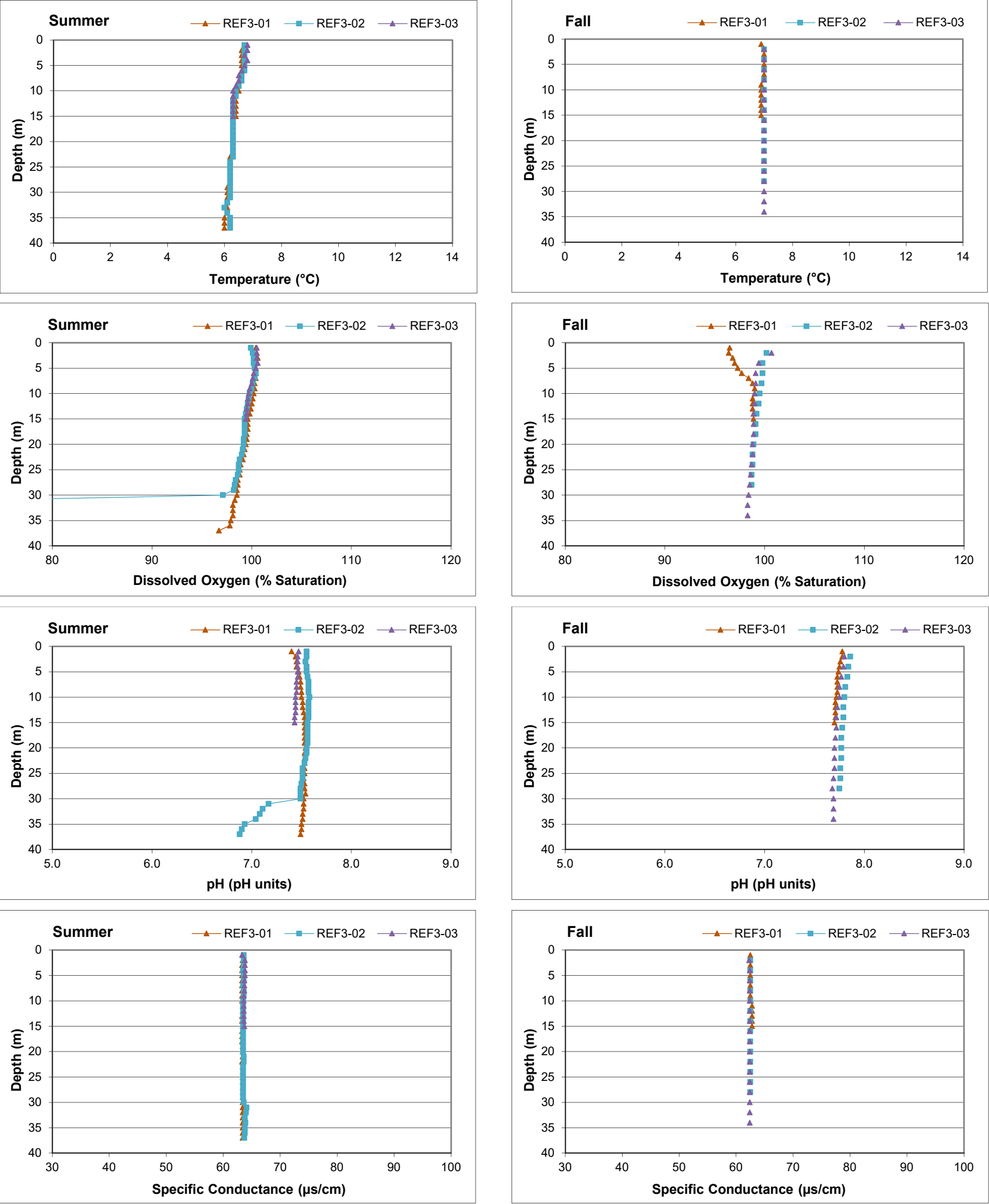


Figure B.3: *In Situ* Water Quality with Depth from Surface at Reference Lake 3 during Summer and Fall Sampling Events, Mary River Project CREMP, 2018

Table B.4: Water Chemistry at Reference Lake 3, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Summer Sampling Event						Fall Sampling Event					
					REF3-01 bottom 12-Aug-2018	REF3-01 surface 12-Aug-2018	REF3-02 bottom 12-Aug-2018	REF3-02 surface 12-Aug-2018	REF3-03 bottom 12-Aug-2018	REF3-03 surface 12-Aug-2018	REF3-01 bottom 27-Aug-2018	REF3-01 surface 27-Aug-2018	REF3-02 bottom 27-Aug-2018	REF3-02 surface 27-Aug-2018	REF3-03 bottom 27-Aug-2018	REF3-03 surface 27-Aug-2018
Conventional ^b	Conductivity (lab)	umho/cm	-	-	70.3	70.4	70.5	72.0	71.2	70.8	75.3	75.6	75.6	75.5	75.3	75.6
	pH (lab)	pH	6.5 - 9.0	-	7.84	7.86	7.91	7.98	7.90	7.93	7.61	7.67	7.64	7.64	7.66	7.68
	Hardness (as CaCO ₃)	mg/L	-	-	36	35	35	37	36	37	34	34	35	35	35	35
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	32	38	27	29	43	43	47	43	45	44	52	47
	Turbidity	NTU	-	-	0.28	0.23	0.22	0.22	0.25	0.25	0.52	0.48	0.45	0.48	0.41	0.70
	Alkalinity (as CaCO ₃)	mg/L	-	-	29	31	32	33	35	36	30	32	35	32	33	35
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	<0.020	<0.020	0.032	<0.020	<0.020	0.024	<0.020	<0.020	0.090	0.039	0.076	<0.020
	Nitrate	mg/L	13	13	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	0.17	0.18	<0.15	<0.15	<0.15
	Nitrate and Nitrite (as N)	mg/L	-	-	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021
	Dissolved Organic Carbon	mg/L	-	-	3.2	3.2	3.3	3.2	3.2	3.3	2.9	2.9	2.9	2.9	3.0	2.9
	Total Organic Carbon	mg/L	-	-	3.4	3.5	11.4	3.6	3.5	3.8	4.0	3.7	4.1	3.7	3.8	3.7
	Total Phosphorus	mg/L	0.030 ^d	-	0.0050	0.0046	0.0042	0.0038	0.0033	0.0069	<0.0030	<0.0030	0.0055	0.0114	0.0036	<0.0030
	Phenols	mg/L	0.004 ^d	-	<0.0010	<0.0010	<0.0010	0.0013	<0.0010	0.0025	<0.0010	0.0013	0.0010	<0.0010	<0.0010	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	1.29	1.27	1.27	1.31	1.27	1.29	1.27	1.27	1.26	1.27	1.26	1.27
	Sulphate (SO ₄)	mg/L	218 ^β	218	3.79	3.78	3.79	3.79	3.77	3.82	3.75	3.75	3.74	3.74	3.74	3.74
Total Metals	Aluminum (Al)	mg/L	0.100	0.179	<0.0030	0.0041	<0.0030	0.0033	<0.0030	0.0040	0.0069	<0.0030	0.0062	0.0036	0.0033	<0.0030
	Antimony (Sb)	mg/L	0.020 ^d	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.00682	0.00689	0.00660	0.00677	0.00667	1.00640	0.00657	0.00635	0.00662	0.00616	0.00649	0.00645
	Beryllium (Be)	mg/L	0.011 ^d	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	7.10	7.15	7.05	6.94	6.96	7.19	6.98	7.22	7.10	7.14	7.36	7.18
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^d	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0022	0.00068	0.00082	0.00088	0.00078	0.00085	0.00088	0.00077	0.00075	0.00079	0.00076	0.00075	0.00076
	Iron (Fe)	mg/L	0.30	0.326	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	-	-	4.62	4.46	4.56	4.27	4.47	4.47	4.34	4.14	4.19	4.21	4.29	4.36
	Manganese (Mn)	mg/L	0.935 ^β	-	0.000446	0.000648	0.000611	0.000576	0.000584	0.000624	0.000934	0.000583	0.000634	0.000573	0.000542	0.000558
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	0.000135	0.000135	0.000129	0.000134	0.000121	0.000132	0.000134	0.000141	0.000133	0.000145	0.000138	0.000138
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Potassium (K)	mg/L	-	-	1.00	0.93	0.93	0.92	0.93	0.93	0.88	0.85	0.85	0.86	0.85	0.88
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.44	0.47	0.45	0.43	0.44	0.44	0.42	0.41	0.42	0.42	0.41	0.42
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	0.926	0.903	0.879	0.872	0.879	0.876	0.884	0.821	0.874	0.863	0.842	0.886
	Strontium (Sr)	mg/L	-	-	0.00806	0.00796	0.00800	0.00784	0.00802	0.00816	0.00788	0.00822	0.00794	0.00804	0.00823	0.00814
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.000202	0.000246	0.000241	0.000236	0.000251	0.000246	0.000266	0.000273	0.000248	0.000258	0.000264	0.000246
	Vanadium (V)	mg/L	0.006 ^d	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG.

^b AEMP Water Quality Benchmarks developed by Intrinsik (2013) using background water quality data. The values are specific to the Camp Lake system.

 Indicates parameter concentration above applicable Water Quality Guideline.

substantial changes in water quality from 2015 to 2018 at Reference Lake 3 (Figure 3.10; Appendix Figure C.8).

Water chemistry data collected at Reference Lake 3 showed no consistent differences in parameter concentrations between the surface and the bottom of the water column at each individual station in 2018 (Appendix Figure B.4; Appendix Table B.4). The absence of any appreciable depth-related differences in parameter concentrations at each station was consistent with only minor differences in dissolved oxygen saturation, pH, and/or specific conductance with increased depth from the surface. Because anoxic conditions do not appear to develop in the summer or fall at Reference Lake 3, reducing conditions conducive to metal mobilization from sediment to the overlying water are less likely to occur near the lake bottom, resulting in relatively uniform water chemistry between surface and bottom waters of Reference Lake 3. Accordingly, metal concentrations can naturally be expected to be similar between surface and bottom of local study area lakes provided no substantial gradients in dissolved oxygen saturation, pH, and/or specific conductance occur within the water column.



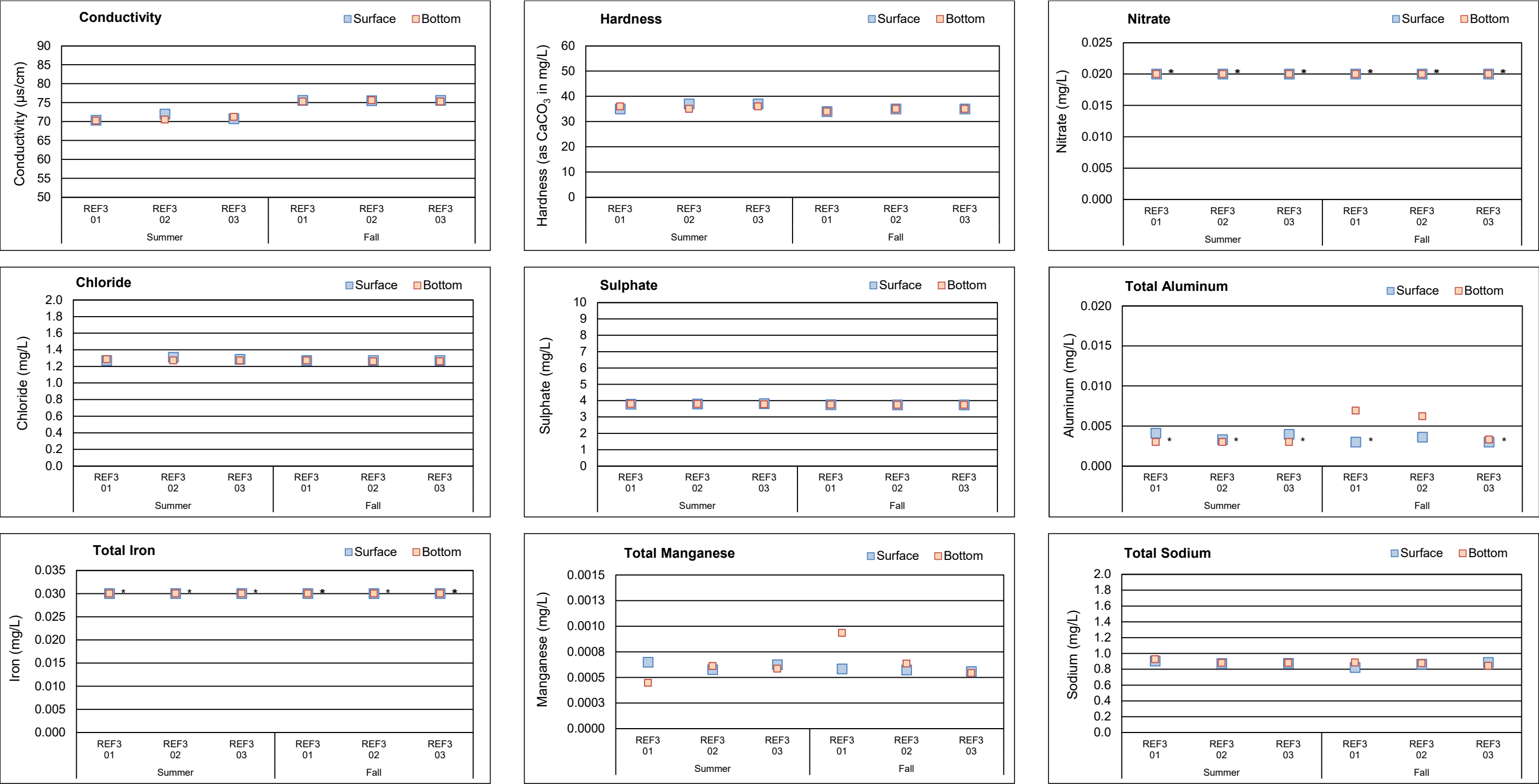


Figure B.4: Water Chemistry Comparison Between the Surface and the Bottom of the Water Column at Reference Lake 3 Routine Monitoring Stations during Summer and Fall, Mary River Project CREMP, 2018

Note: An asterisk (*) indicates that the parameter concentration was below the laboratory reportable detection limit.

B4 SEDIMENT QUALITY

B4.1 Creek/Tributary Environments

Deposited sediment at Unnamed Reference Creek (CLT-REF) was visually characterized as predominantly medium-sized sand by Minnow (2018a). In-stream substrate of the reference creek was described as mainly cobble and pebble material (i.e., substrate diameter 6 to 25 cm, and 2 to 6 cm, respectively), with sand constituting only a small amount (i.e., ~7%) of the material observed at the sediment surface (Minnow 2018a). Deposited sediment suitable for chemical characterization (i.e., sand and finer substrate sizes) was present primarily at shoreline/streambank areas, and not in the main channel. Sediment total organic carbon (TOC) content was very low (i.e., <0.1%) at the reference creek suggesting very limited deposition of fine organic materials (Minnow 2018a). Metal concentrations in deposited sediment at the reference creek were well below SQG during sampling conducted in 2017 (Minnow 2018a), and therefore the Unnamed Reference Creek data were deemed to provide a meaningful benchmark for the evaluation of potential mine-related influences on chemistry of deposited sediment at the mine-exposed creeks.

B4.2 River Environments

Deposited sediment at the Mary River (GO-09) upstream reference area was visually characterized as predominantly coarse sand in 2017 (Minnow 2018a). In-stream substrate of the reference creek was composed mainly of boulder and cobble material (i.e., substrate diameter >25 cm, and 6 to 25 cm, respectively), with sand constituting only a minor amount (i.e., ~10%) of the material observed at the sediment surface. Deposited sediment suitable for chemical characterization (i.e., sand and finer substrate sizes) was collected in-stream from quiescent zones immediately downstream of large boulders in 2017 (Minnow 2018a). Sediment total organic carbon (TOC) content was very low (i.e., <0.1%) at the GO-09 reference area, suggesting very limited deposition of fine organic materials. Metal concentrations in deposited sediment at the reference creek were shown to be well below SQG in 2017 (Minnow 2018a), and therefore the GO-09 data were deemed to provide a meaningful benchmark for the evaluation of potential mine-related influences on chemistry of deposited sediment at the Mary River mine-exposed study areas.

B4.3 Lake Environments (Reference Lake 3)

Sediment sampling was conducted at littoral and profundal (i.e., <12 m and >12 m depths, respectively) areas of Reference Lake 3 from 2015 to 2018 for the analysis of particle size, total organic carbon (TOC) content, and total metal concentrations (see Figure 2.3). Surficial



sediment at Reference Lake 3 littoral and profundal areas was composed of silty to sandy loam material with moderate TOC content. Substrate particle size differed significantly between the Reference Lake 3 littoral and profundal habitats in 2018, with significantly higher proportion of sand-sized material and significantly lower proportion of silt- and clay-sized material present at littoral stations compared to profundal stations (Appendix Table F.16). No significant differences in sediment TOC content occurred between the littoral and profundal habitats of the reference lake in 2018 (Appendix Table F.16). A surficial and/or sub-surface layer of oxidized material (likely iron hydroxide or oxy-hydroxides), visible as an orange-brown floc or distinct layer, was commonly observed in the surficial sediment of Reference Lake 3 (Appendix Tables D.1 and D.2). In addition, sub-surface sediment of Reference Lake 3 occasionally contained blackened/dark colouration, which suggested the occurrence of reducing (i.e., anoxic) sediment conditions (Appendix Tables D.1 and D.2). The physical properties of sediment observed at Reference Lake 3 in 2018 were consistent with those of the 2015 and 2016 studies (see Minnow 2016a, 2017).

Metal concentrations in sediment at Reference Lake 3 were generally lower at the littoral stations than at the profundal stations, although less than a two-fold difference in concentrations was typically shown for most parameters between the littoral and profundal station depths (Appendix Table B.5; Appendix Figure B.5). The differences in sediment metal concentrations between the littoral and profundal station depths likely reflected a naturally higher proportion of fine silt- and clay-sized particles at the latter, which is consistent with expected depositional patterns in lakes. Among metals with established SQG, mean concentrations of iron were elevated above SQG at littoral and profundal stations, and mean concentrations of manganese were elevated above SQG at profundal stations of Reference Lake 3 in 2018 (Appendix Table B.5). Phosphorus concentrations were also elevated above SQG in sediment at a single littoral station, and chromium concentrations were elevated above SQG in sediment at two profundal stations, at Reference Lake 3 in 2018 (Appendix Table B.5). Therefore, compared to SQG, high concentrations of iron and manganese, and chromium and phosphorus to a lesser extent, appear to occur naturally in sediments of Mary River Project local study area lakes. Mean copper and iron concentrations at littoral stations, and mean arsenic, copper, iron, and manganese concentrations at profundal stations, were above the most stringent (i.e., lowest) AEMP sediment quality benchmarks at Reference Lake 3 (Appendix Table B.5). This suggested that the AEMP sediment benchmarks for these metals were conservative. No substantial changes in concentrations of metals were indicated from 2015 to 2018 at littoral or profundal stations of Reference Lake 3 (Appendix Figure B.5; Figure 3.12).



Table B.5: Sediment Particle Size, Total Organic Carbon, and Metal Concentrations at Reference Lake 3 (REF-03) Sediment Stations, Mary River Project CREMP, August 2018

Analyte		Units	Sediment Quality Guideline (SQG) ^a	AEMP Benchmark ^b	Littoral Stations							Profundal Stations						
					REF-03-1	REF-03-2	REF-03-3	REF-03-4	REF-03-5	Mean	Standard Error	REF-03-6	REF-03-7	REF-03-8	REF-03-9	REF-03-10	Mean	Standard Error
Non-metals	Sand	%	-	-	59.4	56.6	60.7	66.4	54.9	59.6	2.0	49.9	50.9	44.5	47.0	45.1	47.5	0.90
	Silt	%	-	-	29.8	32.6	33.5	26.6	34.7	31.4	1.45	40.4	33.8	41.5	38.7	40.4	39.0	0.97
	Clay	%	-	-	10.80	10.8	5.80	7.00	10.40	9.0	1.06	9.7	15.3	14.0	14.3	14.5	13.6	0.70
	Moisture	%	-	-	90.7	94.0	84.7	72.6	90.3	86.5	3.77	76.7	87.2	87.0	86.8	87.6	85.1	1.48
	Total Organic Carbon	%	10 ^α	-	5.13	7.37	3.09	1.78	6.14	4.70	1.01	0.84	4.64	4.89	4.47	4.27	3.82	0.532
Metals	Aluminum (Al)	mg/kg	-	-	21,400	20,800	17,400	10,400	19,400	17,880	1,993	10,900	29,000	28,100	24,500	29,600	24,420	2,471
	Antimony (Sb)	mg/kg	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0
	Arsenic (As)	mg/kg	17	5.9 - 6.2 ^c	7.03	4.92	4.09	2.53	7.68	5.25	0.95	3.03	7.14	6.85	6.18	7.14	6.07	0.551
	Barium (Ba)	mg/kg	-	-	131	158	101.0	61.7	212.0	133	25	72	164	191	134	197	152	16.12
	Beryllium (Be)	mg/kg	-	-	0.83	0.82	0.66	0.39	0.70	0.68	0.08	0.41	1.04	0.99	0.83	1.07	0.87	0.086
	Bismuth (Bi)	mg/kg	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	0.00	<0.20	<0.20	0.21	<0.20	0.21	0.20	0.0017
	Boron (B)	mg/kg	-	-	13.9	17.3	14.1	8.1	16.2	13.9	1.6	7.8	16.8	18.9	14.1	20.3	15.6	1.56
	Cadmium (Cd)	mg/kg	3.5	1.5	0.238	0.217	0.099	0.095	0.324	0.195	0.044	0.184	0.201	0.204	0.186	0.210	0.197	0.004
	Calcium (Ca)	mg/kg	-	-	5,620	6,970	4,700	2,850	7,260	5,480	804	3,100	5,920	6,450	5,530	6,920	5,584	469.6
	Chromium (Cr)	mg/kg	90	79 - 98 ^c	74.0	65.5	54.5	30.9	69.8	58.9	7.7	34.6	89.9	90.5	77.4	93.9	77.3	7.80
	Cobalt (Co)	mg/kg	-	-	15.30	10.30	11.2	7.5	14.2	11.7	1.4	8.4	20.4	19.8	17.1	21.4	17.4	1.67
	Copper (Cu)	mg/kg	197	50 - 58 ^c	94	96	61	38	80	74	11	39	118	111	97	116	96	10.43
	Iron (Fe)	mg/kg	40,000 ^α	34,400 - 52,400 ^c	63,600	36,300	35,300	24,000	74,300	46,700	9,489	23,900	59,200	58,100	49,700	63,600	50,900	5,031
	Lead (Pb)	mg/kg	91.3	35	19.7	18.7	14.4	9.1	20.2	16.4	2.1	8.7	22.3	22.5	20.3	23.8	19.5	1.96
	Lithium (Li)	mg/kg	-	-	30.0	30.7	26.3	15.7	27.4	26.0	2.7	16.8	42.8	39.1	36.6	45.0	36.1	3.56
	Magnesium (Mg)	mg/kg	-	-	13,100	12,500	10,400	6,120	13,400	11,104	1,352	6,870	18,100	17,500	15,600	18,900	15,394	1,555
	Manganese (Mn)	mg/kg	1,100 ^{α,β}	657 - 4,370	803	454	703	563	678	640	60	914	1,410	1,320	1,160	1,590	1,279	81.1
	Mercury (Hg)	mg/kg	0.486	0.17	0.0512	0.0616	0.0228	0.0120	0.0688	0.0433	0.0111	0.0182	0.0819	0.0762	0.0831	0.0658	0.0650	0.00856
	Molybdenum (Mo)	mg/kg	-	-	6.75	3.48	2.57	1.83	4.56	3.84	0.86	1.59	2.97	2.77	2.39	3.13	2.57	0.194
	Nickel (Ni)	mg/kg	75 ^{α,β}	66 - 77 ^c	54.9	47.9	36.0	23.2	52.6	42.9	5.9	29.0	61.3	61.6	52.0	65.2	53.8	4.65
	Phosphorus (P)	mg/kg	2,000 ^α	1,278 - 1,958 ^c	1,420	1,130	986	698	2,290	1,305	272	769	1,240	1,350	1,130	1,450	1,188	83.1
	Potassium (K)	mg/kg	-	-	4,730	4,880	4,240	2,310	4,510	4,134	469	2,610	6,460	6,640	5,600	6,990	5,660	562.9
	Selenium (Se)	mg/kg	-	-	0.79	0.83	0.48	0.22	0.98	0.66	0.14	0.20	0.89	0.99	0.97	0.98	0.81	0.108
	Silver (Ag)	mg/kg	-	-	0.18	0.20	<0.10	<0.10	0.16	0.15	0.02	<0.10	0.34	0.30	0.27	0.30	0.26	0.030
	Sodium (Na)	mg/kg	-	-	332	401	301	165	400	320	43	199	471	530	421	542	433	44.1
	Strontium (Sr)	mg/kg	-	-	13.3	14.4	11.2	6.9	15.1	12.2	1.5	7.6	15.6	15.5	13.7	16.7	13.8	1.15
	Sulphur (S)	mg/kg	-	-	1800	2700	<1000	<1000	2400	1,780	350	<1000	1800	1400	1500	1300	1,400	92
	Thallium (Tl)	mg/kg	-	-	0.586	0.460	0.396	0.238	0.569	0.450	0.063	0.409	0.798	0.890	0.751	0.921	0.754	0.0647
	Tin (Sn)	mg/kg	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	0.0	<2.0	2.1	2.0	<2.0	2.2	2.1	0.028
	Titanium (Ti)	mg/kg	-	-	1,160	1,190	1,140	726	1,560	1,155	132	801	1,490	1,620	1,300	1,730	1,388	115.5
	Uranium (U)	mg/kg	-	-	19.70	12.1	9.9	7.47	17.7	13.4	2.3	9.7	29.8	28.2	23.6	31.1	24.5	2.76
	Vanadium (V)	mg/kg	-	-	73.8	66.4	52.5	34.3	64.3	58.3	6.9	37.2	84.2	83.4	70.7	88.2	72.7	6.62
	Zinc (Zn)	mg/kg	315	123 - 135 ^c	103.0	91.9	70.3	46.9	94.7	81.4	2.0	45	117.0	115.0	98.5	121.0	99.2	10.0
	Zirconium (Zr)	mg/kg	-	-	3.6	4.6	3.4	1.9	6.9	3.9	0.2	2.1	4.6	4.5	3.6	4.6	3.9	0.3

^a Canadian Sediment Quality Guideline, probable effects level (PEL; CCME 2017) except those indicated by α (Ontario Provincial Sediment Quality Objective [PSQO], severe effect level (SEL); OMOE 1993) and β (British Columbia Working Sediment Quality Guideline [BCSQG], probable effects level (PEL; BCMOE 2017)).

^b Baffinland Mary River Project Aquatic Effects Monitoring Program (AEMP) sediment quality benchmarks (Baffinland 2014, 2016; Intrinsik 2014, 2015).

^c The AEMP benchmarks were derived for individual mine-exposed lakes, and therefore a range of values is presented to reflect the AEMP benchmark variation among the mine-exposed lakes. Reference Lake 3 sediment chemistry was screened against the lowest AEMP benchmark for applicable parameters.

Indicates paramter concentration above Sediment Quality Guideline (SQG).

BOLD

 Indicates parameter concentration above the AEMP Benchmark.

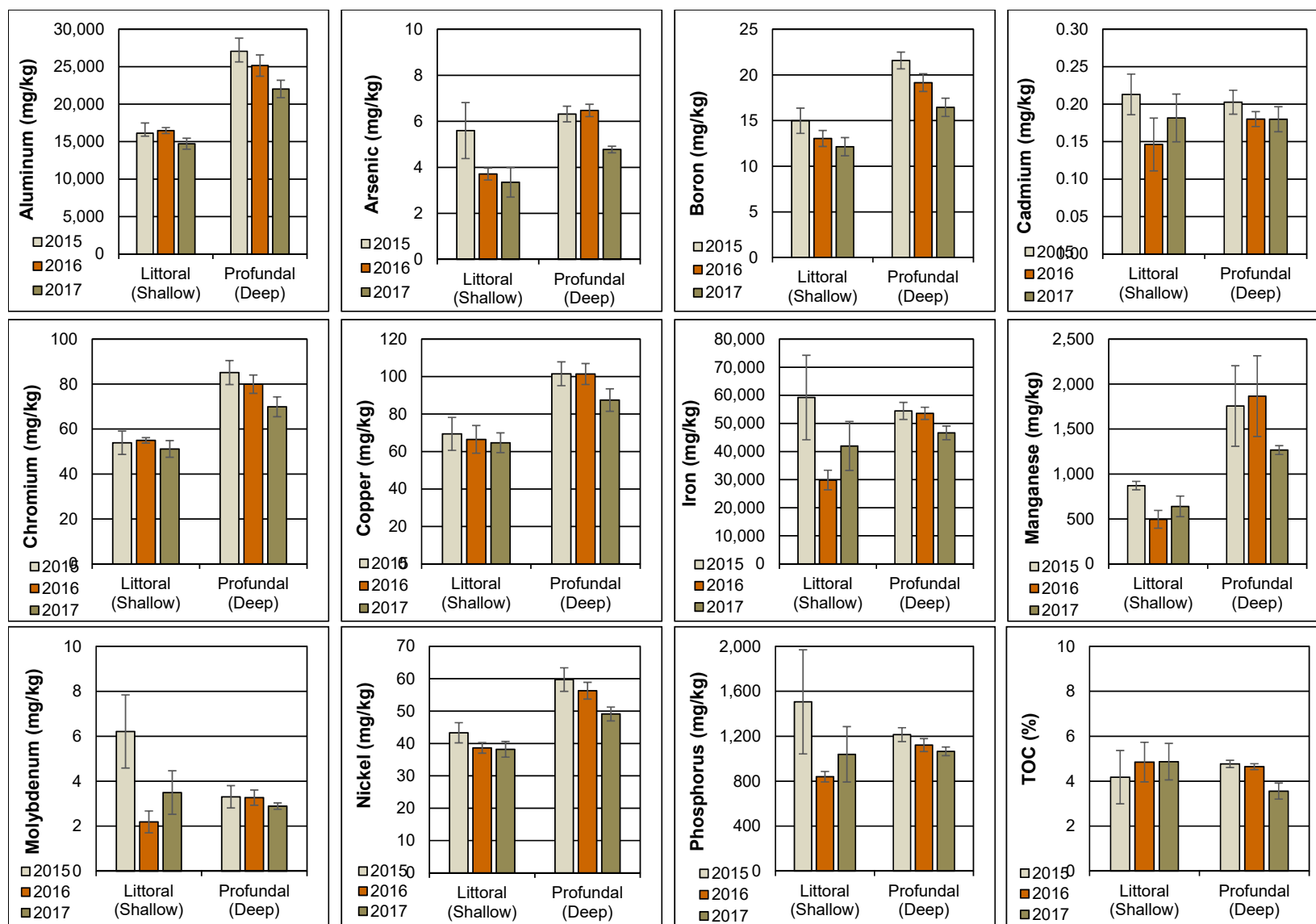


Figure B.5: Sediment Metal Concentrations (mean ± SE) at Littoral (<12m depth) and Profundal (>12m depth) Monitoring Stations of Reference Lake 3 (REF03), Mary River Project CREMP, 2015 to 2018

B5 PHYTOPLANKTON (CHLOROPHYLL-A)

B5.1 Lotic Environments

Chlorophyll-a concentrations, which were used as a surrogate for phytoplankton abundance, ranged from 0.13 to 0.48 µg/L at the reference creek and river stations among spring, summer, and fall sampling events in 2018 (Appendix Table B.6). Therefore, lotic reference station chlorophyll-a concentrations were consistently well below the AEMP benchmark of 3.7 µg/L, and reflected low (i.e., oligotrophic) phytoplankton productivity according to Dodds et al (1998) trophic status classification for stream environments. This trophic status classification was consistent with an oligotrophic CWQG categorization for the stream and river reference stations based on mean aqueous total phosphorus concentrations generally ranging between 4 to 10 µg/L during each respective spring, summer, and fall sampling event in 2018 (Appendix Tables B.2 and B.3). Seasonally, chlorophyll-a concentrations did not differ significantly among spring, summer, and fall at the reference creeks, but were significantly lower in the spring than during the summer and fall at the Mary River GO-09 series reference stations in 2018 (Appendix Tables B.6 and B.7).

Like-season chlorophyll-a concentrations from 2015 to 2018 showed no consistent significant differences among years over the spring, summer, and fall sampling events at either the reference creek or the Mary River reference area stations (Appendix Figure B.6). The variability in response shown among seasons and years at the lotic reference areas indicated that significant differences in chlorophyll-a concentrations occurs naturally among years and seasons in watercourses within the Mary River Project mine local study area.

B5.2 Lentic Environments (Reference Lake 3)

Chlorophyll-a concentrations at Reference Lake 3 showed no consistent differences between the surface and the bottom of the water column at each individual station during both the summer and fall sampling events in 2018 (Appendix Figure B.7). Chlorophyll-a concentrations were significantly lower near the surface of the water column than bottom in summer, but did not differ significantly between the surface and the bottom of the water column in fall, at Reference Lake 3. This suggested that phytoplankton abundance within the water column can vary from season to season.

Reference Lake 3 chlorophyll-a concentrations averaged 0.74 µg/L in summer and 0.91 µg/L in fall 2018, and were consistently well below the AEMP benchmark of 3.7 µg/L (Appendix Table E.3; Appendix Figure B.7). Similar to the lotic reference stations, mean chlorophyll-a concentrations observed at Reference Lake 3 in 2018 indicated low (i.e., oligotrophic)



Table B.6: Phytoplankton Monitoring Data Collected at Lotic Reference Stations, Mary River Project CREMP 2018

Station		Reference Creek Stations				Mary River Reference Stations		
		CLT-REF3	CLT-REF4	MRY-REF2	MRY-REF3	G0-09-A	G0-09	G0-09-B
Sample Collection Date	Spring	30-Jun-18	30-Jun-18	30-Jun-18	30-Jun-18	1-Jul-18	1-Jul-18	1-Jul-18
	Summer	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18
	Fall	25-Aug-18	24-Aug-18	24-Aug-18	24-Aug-18	27-Aug-18	25-Aug-18	25-Aug-18
Chlorophyll-a (µg/L)	Spring	0.24	0.28	0.36	0.19	0.38	0.32	0.25
	Summer	0.15	0.48	0.21	0.13	0.16	0.16	0.14
	Fall	0.18	0.47	0.44	0.18	0.17	0.24	0.19
	Average	0.19	0.41	0.34	0.17	0.24	0.24	0.19
	Standard Deviation	0.05	0.11	0.12	0.03	0.12	0.08	0.06
	Standard Error	0.03	0.07	0.07	0.02	0.07	0.05	0.03
Phaeophytin-a (µg/L)	Spring	0.26	0.30	0.35	0.26	0.34	0.28	0.27
	Summer	0.22	0.40	0.24	<0.3	0.31	0.28	0.27
	Fall	0.25	0.41	0.35	0.35	0.26	0.30	0.28
	Average	0.24	0.37	0.31	0.31	0.30	0.29	0.27
	Standard Deviation	0.02	0.06	0.06	0.05	0.04	0.01	0.01
	Standard Error	0.01	0.04	0.04	0.03	0.02	0.01	0.00

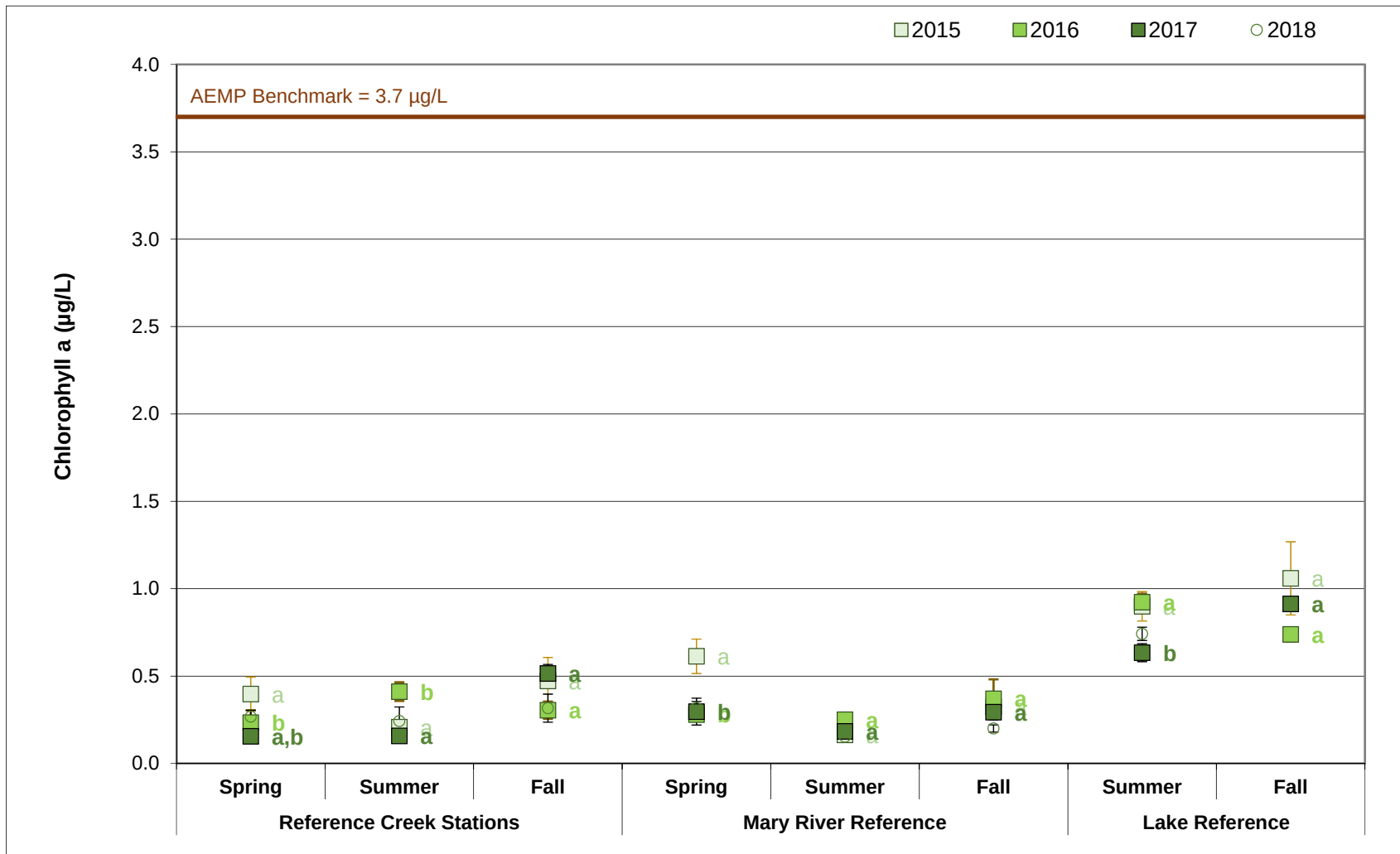


Figure B.6: Chlorophyll-a Concentration Seasonal Comparison from 2015 to 2018 at Creek, River, and Lake Reference Phytoplankton Monitoring Stations, Mary River Project CREMP

The same letters next to data points associated with each individual season/reference area indicates no significant difference between points .

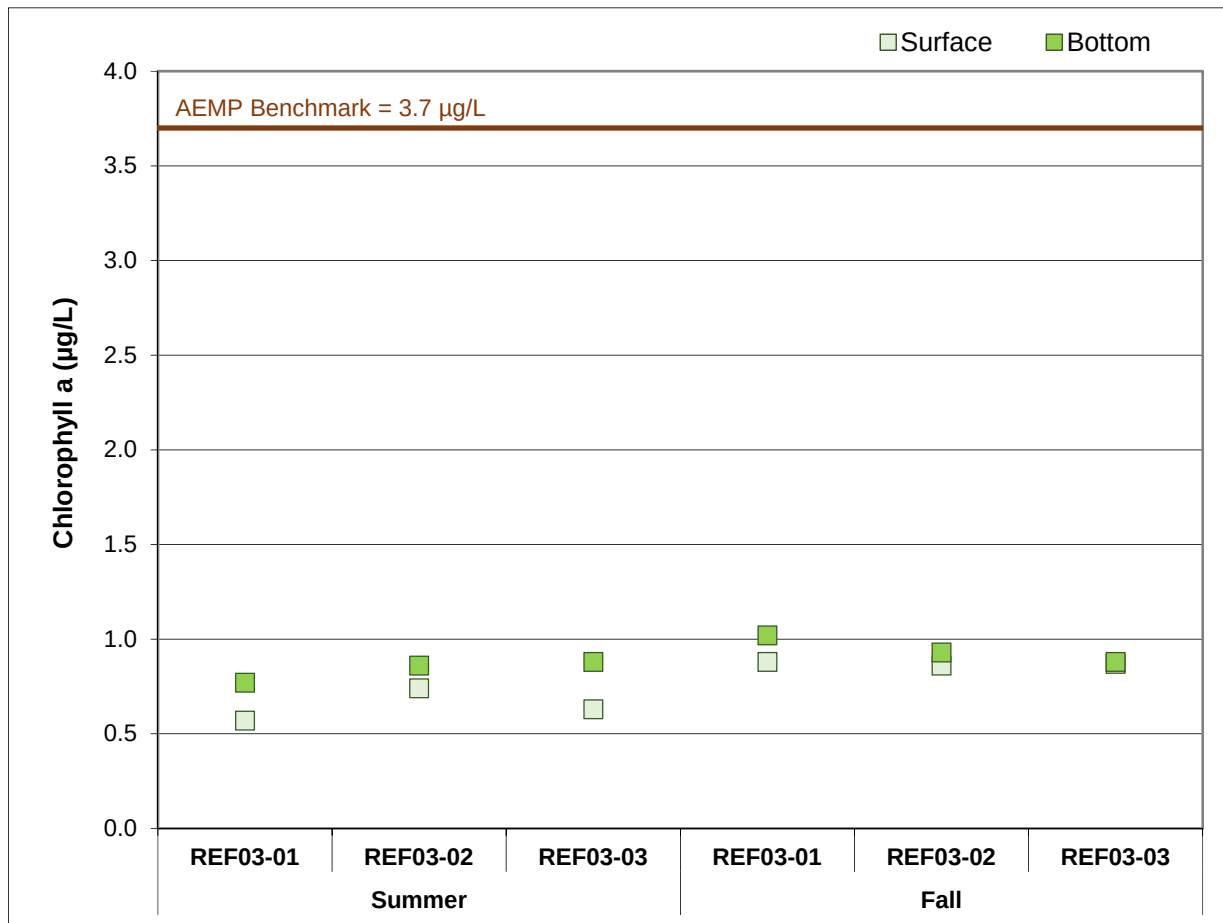


Figure B.7: Chlorophyll-a Concentrations at the Surface and Bottom of the Water Column at Reference Lake 3 Phytoplankton Monitoring Stations during Summer and Fall Sampling Events, Mary River Project CREMP, 2018

phytoplankton productivity based on the lake trophic status classification presented in Wetzel (2001). This trophic status classification was also consistent with an oligotrophic CWQG categorization for Reference Lake 3 based on mean aqueous total phosphorus concentrations typically ranging between 4 and 10 µg/L during the summer and fall sampling events in 2018 (Appendix Table B.4). Chlorophyll-a concentrations were significantly lower in the summer than in the fall at Reference Lake 3 in 2018 (Appendix Table B.7), which was similar to the seasonal differences shown in 2017, but differed from results of the 2015 study when chlorophyll-a concentrations did not differ between seasons, and from the results of the 2016 study when chlorophyll-a concentrations were significantly higher in the summer. Although chlorophyll-a concentrations were generally comparable from 2015 to 2018 for like-seasons at Reference Lake 3, the relative seasonal changes in chlorophyll-a concentrations among years suggested naturally variable temporal patterns in phytoplankton abundance can be expected at Mary River Project mine local study area lakes.



Table B.7: Statistical Comparisons of Chlorophyll-a Concentrations among Winter, Spring, Summer, and/or Fall Sampling Events at Reference Lotic and Lentic Study Areas, Mary River Project CREMP, 2018

Study Lake	Overall 3-group Comparison			Pair-wise, <i>post hoc</i> comparisons ^a				
	Significant Difference Among Areas?	p-value	Statistical Test ^b	(I) Area	(J) Area	Significant Difference Between 2 Areas?	p-value	Statistical Test
Stream Reference Stations	NO	0.75140	ANOVA ^c	Spring	Summer	NO	0.9646	Tamhane's
				Spring	Fall	NO	0.8735	
				Summer	Fall	NO	0.7381	
Mary River GO-09 Reference Stations	YES	0.00935	ANOVA ^c	Spring	Summer	YES	0.0088	Tukey's
				Spring	Fall	YES	0.0383	
				Summer	Fall	NO	0.4381	
Reference Lake 3	-	-	-	Winter	Summer	not applicable	-	ANOVA ^c
				Winter	Fall	not applicable	-	
				Summer	Fall	YES	0.0203	

^a *Post hoc* analysis of 1-way ANOVA among all areas protected for multiple comparisons.

^b Statistical tests include Analysis of Variance (ANOVA) and Kruskal Wallis H-test (KW H-test).

^c Untransformed data normally distributed.

^d Logged data non-normally distributed.

^e Kruskal-Wallis H-test used to validate results of ANOVA three-group comparison.

^f Mann-Whitney U-test used to validate results of post-hoc tests for all pair-wise comparisons.

B6 BENTHIC INVERTEBRATE COMMUNITY

B6.1 Creek/Tributary Environments

The original Mary River Project CREMP design had not included/identified a reference creek from which to evaluate potential mine-related effects on benthic invertebrate communities of creek/tributary environments, instead relying solely on a before-after approach to identify potential mine influences on benthic invertebrates over time (see NSC 2014). Stemming from recommendations from the 2015 CREMP (Minnow 2016b), a reference creek was incorporated into the 2016 to 2018 CREMP benthic invertebrate community studies to provide a stronger basis for evaluating potential within-year mine-related effects to biota residing in mine-exposed tributaries of Camp and Sheardown lakes. The benthic invertebrate community (benthic) study area selected for the CREMP was located within at the same unnamed tributary to Angajurjualuk Lake that is used for reference water quality sampling (Stations CLT-REF4 and MRY-REF2; Table 2.5; Figure 2.4). Criteria used for the selection of this creek as a reference area for the CREMP, which is herein referred to as Unnamed Reference Creek, included a watercourse exhibiting similar habitat characteristics (e.g., width, water velocity, substrate size) as the mine-exposed tributaries that is not/has not been influenced by mining or adverse anthropogenic disturbances. The acceptance of Unnamed Reference Creek as a reference area for the evaluation of mine-related influences on tributary water chemistry under the original CREMP (KP 2014a) was also considered an important criterion in the selection of this watercourse as a suitable reference area for the benthic invertebrate community survey.

Benthic invertebrate density at Unnamed Reference Creek ranged from 262 to 636 individuals/m² in 2018 (mean of 526 individuals/m²), which is considered moderate for Arctic streams (Craig and McCart 1975). Unnamed Reference Creek showed relatively high richness and Simpson's Evenness in 2018, which was unlike the low production that can naturally be expected in Arctic streams as the result of constraints associated with low nutrients and seasonal temperatures, as well as food limitation (Huryn and Wallace 2000). Chironomidae (non-biting midges) and Simuliidae (blackflies) were the dominant taxonomic groups observed at Unnamed Reference Creek benthic stations, collectively accounting for approximately 76% of the community (Appendix Table B.8). Collector-gatherers were the dominant benthic invertebrate functional feeding group (FFG) present at Unnamed Reference Creek (Appendix Table B.8), suggesting greatest reliance upon deposited fine particulate organic matter as a food source for benthic invertebrates. Shredders constituted a low proportion of the Unnamed Reference Creek benthic invertebrate community (Appendix Table B.9), suggesting that live and/or decomposing leaf material was a less important food source. In terms of benthic invertebrate habitat preference groups (HPG), sprawlers were the dominant group at Unnamed



Table B.8: Benthic Invertebrate Community Summary Statistics for Unnamed Reference Creek and Mary River (GO-09) Reference Areas, Mary River Project CREMP, August 2018

Metric	Area	Sample Size	Mean	Standard Deviation	Standard Error	95% Confidence Interval		Minimum	Maximum
						Lower Bound	Upper Bound		
Density (no. organisms / m ²)	Unnamed Reference Creek	5	526	152	68	337	714	262	636
	Mary River GO-09 Reference	5	194	112	50	55	332	77	361
Richness (Number of Taxa)	Unnamed Reference Creek	5	19.8	3.0	1.4	16.0	23.6	16.0	24.0
	Mary River GO-09 Reference	5	11.8	2.3	1.0	9.0	14.6	9.0	14.0
Simpson's Evenness	Unnamed Reference Creek	5	0.960	0.011	0.005	0.946	0.974	0.942	0.972
	Mary River GO-09 Reference	5	0.907	0.030	0.013	0.870	0.945	0.876	0.942
Bray-Curtis Index	Unnamed Reference Creek	5	0.208	0.093	0.042	0.092	0.324	0.114	0.342
	Mary River GO-09 Reference	5	0.345	0.137	0.061	0.175	0.515	0.120	0.471
Simuliidae (% of community)	Unnamed Reference Creek	5	15.9%	4.6%	2.0%	10.2%	21.6%	11.2%	22.2%
	Mary River GO-09 Reference	5	14.1%	9.9%	4.4%	1.8%	26.4%	2.9%	28.6%
Hydracarina (% of community)	Unnamed Reference Creek	5	3.3%	1.3%	0.6%	1.6%	4.9%	2.0%	5.3%
	Mary River GO-09 Reference	5	0.3%	0.7%	0.3%	-0.6%	1.2%	0.0%	1.6%
Chironomidae (% of community)	Unnamed Reference Creek	5	60.3%	4.5%	2.0%	54.8%	65.9%	55.0%	66.8%
	Mary River GO-09 Reference	5	78.7%	12.3%	5.5%	63.5%	94.0%	65.9%	91.3%
Metal Sensitive Chironomidae (% of community)	Unnamed Reference Creek	5	12.4%	4.2%	1.9%	7.1%	17.7%	6.9%	18.7%
	Mary River GO-09 Reference	5	31.0%	10.5%	4.7%	18.0%	44.0%	14.3%	41.4%
Tipulidae (% of community)	Unnamed Reference Creek	5	2.8%	1.5%	0.7%	1.0%	4.6%	1.5%	4.7%
	Mary River GO-09 Reference	5	3.1%	4.1%	1.8%	-1.9%	8.2%	0.0%	10.0%
Collector-Gatherer FFG (% of community)	Unnamed Reference Creek	5	71.5%	4.0%	1.8%	66.5%	76.5%	67.2%	76.0%
	Mary River GO-09 Reference	5	80.9%	11.4%	5.1%	66.7%	95.0%	66.8%	94.2%
Filterer FFG (% of community)	Unnamed Reference Creek	5	16.0%	4.5%	2.0%	10.4%	21.6%	11.2%	22.2%
	Mary River GO-09 Reference	5	14.1%	9.9%	4.4%	1.8%	26.4%	2.9%	28.6%
Shredder FFG (% of community)	Unnamed Reference Creek	5	4.8%	2.8%	1.2%	1.4%	8.2%	1.5%	8.3%
	Mary River GO-09 Reference	5	4.7%	6.3%	2.8%	-3.1%	12.6%	0.0%	15.2%
Clinger HPG (% of community)	Unnamed Reference Creek	5	22.6%	4.9%	2.2%	16.4%	28.7%	17.9%	29.2%
	Mary River GO-09 Reference	5	16.0%	10.2%	4.6%	3.4%	28.7%	2.9%	28.6%
Sprawler HPG (% of community)	Unnamed Reference Creek	5	66.2%	5.0%	2.2%	60.0%	72.5%	61.8%	72.0%
	Mary River GO-09 Reference	5	79.0%	12.7%	5.7%	63.1%	94.8%	61.8%	94.2%
Burrower HPG (% of community)	Unnamed Reference Creek	5	11.2%	1.9%	0.9%	8.8%	13.6%	9.0%	14.0%
	Mary River GO-09 Reference	5	5.0%	5.8%	2.6%	-2.2%	12.2%	0.0%	15.0%

Table B.9: Benthic Invertebrate Community Statistical Comparison Results between Littoral and Profundal Stations at Reference Lake 3, Mary River Project CREMP, August 2018

Metric	Statistical Test Results					Summary Statistics						
	Data Transformation	Significant Difference Between Habitats?	p-value	Statistical Analysis ^a	Magnitude of Difference ^a (No. of SD)	Habitat	Mean (n = 5)	Standard Deviation	Standard Error	Minimum	Median	Maximum
Density (Individuals/m ²)	none	YES	0.001	t-equal	-2.6	Lake Littoral	1,045	258	116	696	1,000	1,391
						Lake Profundal	377	155	69	104	452	470
Richness (Number of Taxa)	none	YES	0.002	t-equal	-2.4	Lake Littoral	10.8	2.3	1.0	7.0	11.0	13.0
						Lake Profundal	5.4	1.3	0.6	4.0	6.0	7.0
Simpson's Evenness (E)	log	YES	0.007	t-equal	-3.6	Lake Littoral	0.825	0.103	0.046	0.720	0.816	0.939
						Lake Profundal	0.455	0.296	0.132	0.218	0.296	0.933
Bray-Curtis Index	square root	YES	< 0.001	t-equal	-1.0	Lake Littoral	0.313	0.092	0.041	0.178	0.358	0.394
						Lake Profundal	0.224	0.304	0.136	0.051	0.109	0.763
Nemata (%)	fourth root	NO	0.268	t-equal	-0.5	Lake Littoral	7.1	8.8	3.9	0.0	3.4	21.3
						Lake Profundal	2.5	3.8	1.7	0.0	0.0	8.7
Hydracarina (%)	none	NO	0.447	t-equal	0.7	Lake Littoral	2.1	2.1	0.9	0.0	1.7	5.6
						Lake Profundal	3.7	3.8	1.7	0.0	3.9	8.7
Ostracoda (%)	square root	YES	0.015	t-equal	-1.1	Lake Littoral	23.9	18.3	8.2	3.4	20.6	53.3
						Lake Profundal	3.1	2.9	1.3	0.0	2.0	7.5
Chironomidae (%)	none	YES	0.048	t-equal	1.1	Lake Littoral	66.9	22.2	10.0	35.5	73.8	91.4
						Lake Profundal	90.8	4.9	2.2	82.7	92.2	95.7
Metal-Sensitive Chironomidae (%)	log	YES	0.017	t-equal	-1.3	Lake Littoral	36.5	19.6	8.8	17.8	27.5	60.1
						Lake Profundal	11.4	16.8	7.5	2.3	3.9	41.4
Collector-Gatherers (%)	log	YES	0.019	t-equal	1.8	Lake Littoral	55.6	19.0	8.5	33.0	57.5	79.2
						Lake Profundal	89.8	13.6	6.1	66.3	96.2	100.0
Filterers (%)	fourth root	YES	0.019	t-equal	-1.5	Lake Littoral	33.9	18.7	8.4	15.5	24.9	56.6
						Lake Profundal	6.5	10.5	4.7	0.0	3.7	25.0
Clingers (%)	square root	YES	0.023	t-equal	-1.4	Lake Littoral	36.1	18.4	8.2	17.1	26.9	58.3
						Lake Profundal	10.2	13.6	6.1	0.0	3.9	33.6
Sprawlers (%)	none	YES	0.093	t-equal	1.5	Lake Littoral	51.9	17.7	7.9	29.5	52.5	71.8
						Lake Profundal	79.3	26.8	12.0	32.7	90.4	100.0
Burrowers (%)	square root	NO	0.416	t-equal	-0.2	Lake Littoral	12.0	6.4	2.8	6.9	11.1	22.6
						Lake Profundal	10.6	14.1	6.3	0.0	5.6	33.6

^a Magnitude calculated by comparing the difference between the reference area and mine-exposed area means divided by the reference area standard deviation.

Grey shading indicates statistically significant difference between habitat types based on p-values ≤ 0.10.

Blue shaded values indicate significant difference (p-values ≤ 0.10) that was also outside of a CES of ±2 SD, indicating that the difference was ecologically meaningful.

Reference Creek (Appendix Table B.8) suggesting that most invertebrates were associated with substrate surfaces and were not deeply embedded in the substrate (i.e., non-burrowers).

B6.2 River Environments

The area of Mary River located upstream of the mine lease property has been considered representative of reference conditions for the mine-exposed stations/study areas situated farther downstream on the Mary River under the CREMP (Baffinland 2015; KP 2014a,b, 2015; NSC 2014). As in previous CREMP studies, the GO-09 area of Mary River (including water quality stations GO-09A, GO-09 and GO-09B) was used as the benthic reference area for mine-exposed areas of Mary River as part of the 2018 CREMP (see Table 2.5; Figure 2.4).

Benthic invertebrate density at the Mary River reference area in 2018 ranged from 77 to 361 individuals/m², which is considered low to moderate for Arctic lotic systems (Craig and McCart 1975). Moderate richness and Simpson's Evenness also characterized the benthic invertebrate community of the Mary River reference area, and reflected naturally low Arctic stream environment productivity as a result of low ambient temperatures and nutrient levels (Huryn and Wallace 2000). Midges of the family Chironomidae were the dominant taxonomic group observed at the Mary River reference area, with the relative abundance of this group ranging from 66 to 91% of individuals (mean of 79%) and chironomid taxa considered metal-sensitive constituting 14 to 41% of the community (Appendix Table B.8). Similar to the reference creek, collector-gatherers were the dominant FFG present at the Mary River reference area (Appendix Table B.8), suggesting that fine particulate organic matter was the predominant food source for benthic invertebrates at this area. Sprawlers composed the dominant HPG at the Mary River reference area (Appendix Table B.8), which suggested that most benthic invertebrates were associated with the surface of rocky substrates.

Comparison of the Mary River reference area benthic invertebrate communities among baseline (2006, 2007) and mine-operational (2015 to 2018) studies for key metrics indicated no consistent significant differences in density, richness, and relative abundance of metal-sensitive chironomids between the baseline and mine-operational periods (Figure 5.6; Appendix Table F.54). Although Simpson's Evenness was significantly higher, and relative abundance of chironomids and FFG collector-gatherers significantly lower, for the mine-operational studies compared to the baseline studies, the direction of these differences was not consistent with an adverse change but rather suggested greater diversity and/or more even distribution of invertebrate groups and FFG for the mine-operational period (Figure 5.6; Appendix Table F.54). These changes in benthic invertebrate community metrics between the mine baseline and operational studies at the Mary River reference area were thus attributable



to natural variability in community traits among years and/or to artifacts associated with CREMP sampling among studies.

B6.3 Lentic Environments (Reference Lake 3)

The benthic invertebrate community of Reference Lake 3 differed dramatically between littoral (<12 m depth) and profundal (>12 m depth) stations in 2018. As in previous monitoring conducted from 2015 to 2017, significantly higher benthic invertebrate density, richness, and Simpson's Evenness was observed at littoral stations compared to profundal stations in 2018, most at Critical Effect Sizes outside of ± 2 SD (Appendix Table B.9). In addition, differences in benthic invertebrate community structure occurred between sampling depths as indicated by significantly differing Bray Curtis Index and supported by higher and lower relative abundance of Ostracoda (seed shrimp) and Chironomidae (non-biting midges), respectively, at littoral stations compared to profundal stations (Appendix Table B.9). Significant differences in the relative abundance of FFG or HPG were also indicated between littoral and profundal habitats of Reference Lake 3, although these differences were not at effect sizes considered ecologically meaningful (Appendix Table B.9). The difference in benthic invertebrate community metrics and assemblage features between the littoral and profundal stations observed at Reference Lake 3 from 2015 to 2018 validated proposed changes to the CREMP benthic invertebrate community survey by Minnow (2016b). Specifically, benthic invertebrate community surveys can focus only on littoral habitat to reflect the fact that natural habitat factors that affect community assemblage at profundal areas limit the ability to interpret potential mine-related biological effects at profundal depths of the local study area lakes.

Comparison of littoral habitat benthic invertebrate communities at Reference Lake 3 among the 2015 to 2018 studies for key metrics indicated no consistent significant differences in density, richness, Simpson's Evenness, Bray Curtis Index, relative abundance of dominant FFG, and the relative abundance of all dominant taxonomic groups except Ostracoda (Appendix Table F.18). At profundal habitat, benthic invertebrate density, Simpson's Evenness, and relative abundance of the collector-gatherer FFG routinely differed significantly among years, but no consistent direction of differences has occurred over time (Appendix Table F.19). Overall, this suggested that the benthic invertebrate community at littoral habitat of Reference Lake 3 showed relatively minor changes from 2015 to 2018, whereas the benthic invertebrate community at profundal habitat can vary significantly from year-to-year for certain metrics (e.g., density, Simpson's Evenness).



B7 FISH POPULATION

B7.1 Lotic Environments

Fish population sampling of lotic habitats is not required as part of the Mary River Project CREMP (see NSC 2014). In part, this reflects the fact that fish can only inhabit local study area creeks/ivers for a short period each year (i.e., July to September) as a result of complete freezing/desiccation of these lotic habitats over much of the year. In addition, sampling of juvenile arctic charr within a representative lotic habitat is conducted for the federal Environmental Effects Monitoring (EEM) program to meet Metal and Diamond Mining Effluent Regulation requirements (Baffinland 2015; Minnow 2018b).

B7.2 Lentic Environments (Reference Lake 3)

The Reference Lake 3 fish community was composed of arctic charr and ninespine stickleback. The relative abundance of both species has been low at Reference Lake 3 based on low electrofishing and gill netting catches and catch-per-unit-effort (CPUE) for each species in 2018 (Appendix Tables G.1 and G.2) as well as in all previous studies from 2015 to 2017 (Minnow 2018a). Suitable numbers of arctic charr were captured at nearshore habitat of Reference Lake 3 (i.e., 100 individuals) to allow evaluation of mine-related effects on survival, growth, and condition of fish collected at the mine-exposed lake shorelines. For these fish, young-of-the-year (YOY) individuals were generally distinguishable from the 1+ to 6+ age classes at a fork length of 5.0 cm based on the evaluation of length-frequency distributions coupled with supporting age determinations (Appendix Figure B.8). In 2015, YOY arctic charr captured at nearshore habitat were not able to be distinguished from older age classes at Reference Lake 3 (Appendix Figure B.8). However, population comparisons of nearshore arctic charr captured between the mine-exposed and reference lakes from 2016 to 2018 were completed separately for YOY and non-YOY data sets. Temporal comparisons of the 2015 to 2018 nearshore arctic charr data indicated significantly larger sized fish were sampled in 2016 compared to 2015, 2017, and 2018 at the reference lake, the differences of which in fresh body weight were outside of the critical effect size for growth endpoints of $\pm 25\%$ (Appendix Table B.10). Similarly, condition of nearshore arctic charr differed significantly among the 2015 to 2018 studies at Reference Lake 3, the magnitude of which was outside of the critical effect size for condition of $\pm 10\%$ between the 2015 and 2018 studies, and between the 2017 and 2018 studies (Appendix Figure B.9). This indicated that some year-to-year differences in fish population endpoints can be expected naturally at local study area lakes, and these difference should be considered for the nearshore fish population surveys conducted as part of the Mary River Project CREMP.



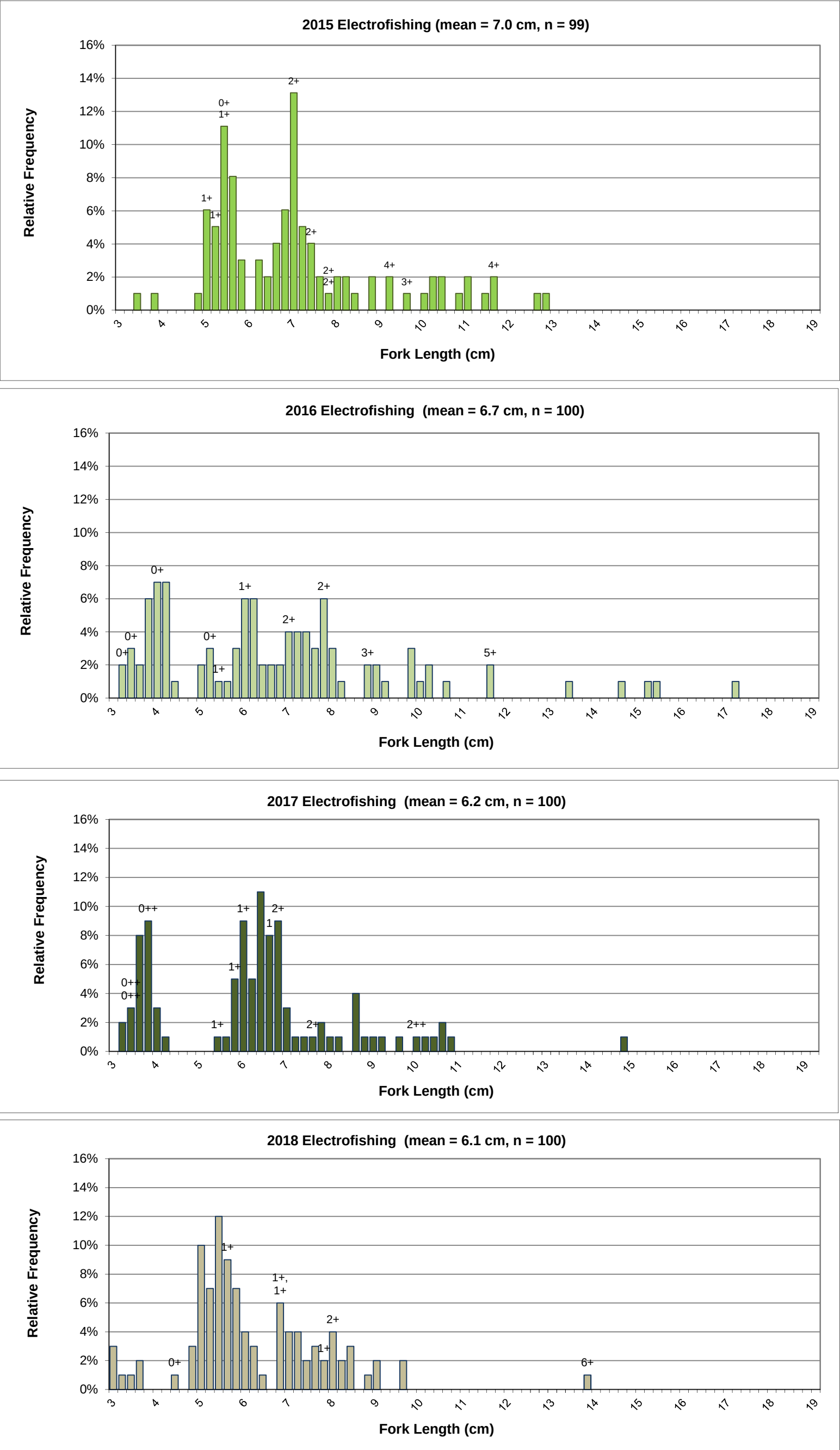


Figure B.8: Length-frequency Distributions for Arctic Charr Captured by Backpack Electrofishing and Gill Netting at Reference Lake 3 (REF3) in August 2015 to 2018, Mary River Project CREMP

Note: Fish ages are shown above the bars, where available.

Table B.10: Statistical Comparisons For Length, Weight, and Condition Endpoints For Arctic Charr, Mary River Project CREMP

Endpoint	Variables		Sample Size				Test	Model Statistics			Summary Statistics ^b					Test P-value (Year)	Post-hoc Contrasts P-value and Magnitude of Difference (%) ^c																	
	Response	Covariate	2015	2016	2017	2018		Interaction Model	Parallel Slope Model	Covariate Value for Comparison s ^a							2015 vs. 2016						2015 vs. 2017		2015 vs. 2018		2016 vs. 2017		2016 vs. 2018		2017 vs. 2018			
											Interaction P-value	Covariate P-value	Statistic	2015	2016		2017	2018	P-value		MOD (%)		P-value		MOD (%)		P-value		MOD (%)		P-value		MOD (%)	
																			P-value	MOD (%)	P-value	MOD (%)	P-value	MOD (%)	P-value	MOD (%)	P-value	MOD (%)	P-value	MOD (%)				
Length Frequency Distribution	Fork Length (cm)	-	97	99	100	100	K-S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0680	-	0.0220	-	0.0158	-							
Body Size	Fork Length (cm)	-	97	68	74	92	K-W	-	-	-	Median	6.8	7.3	6.6	5.8	<0.001	0.005	7	0.387	-3	0.005	-15	0.064	-10	<0.001	-21	<0.001	-12.1						
	Weight (g)	-	97	68	74	92	K-W	-	-	-	Median	2.68	3.34	2.49	1.83	<0.001	0.005	25	0.345	-7	0.104	-32	0.075	-25	<0.001	-45	0.014	-26.5						
Condition	log[Weight (g)]	log[Fork Length (cm)]	97	68	74	92	ANCOVA	0.051	<0.001	6.84	Adjusted Mean	3	3.05	3	3.35	<0.001	0.662	2	1	0	<0.001	12	0.721	-2	<0.001	10	<0.001	12						

Area P-value < 0.1 or Interaction P-value < 0.05

^a The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

^b The median and adjusted mean are reported for Kruskal-Wallis and ANCOVA, respectively, and the predicted means of the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction (i.e., different slopes) occurs.

^c The magnitude of difference calculated as: [(year mean - earlier year mean) /earlier year mean] x 100. When there is a significant interaction in the ANCOVA, the magnitude of difference is calculated at the minimum and maximum values of overlap in covariate values as : [(year predicted mean - earlier year predicted mean) / earlier year predicted mean] x 100.

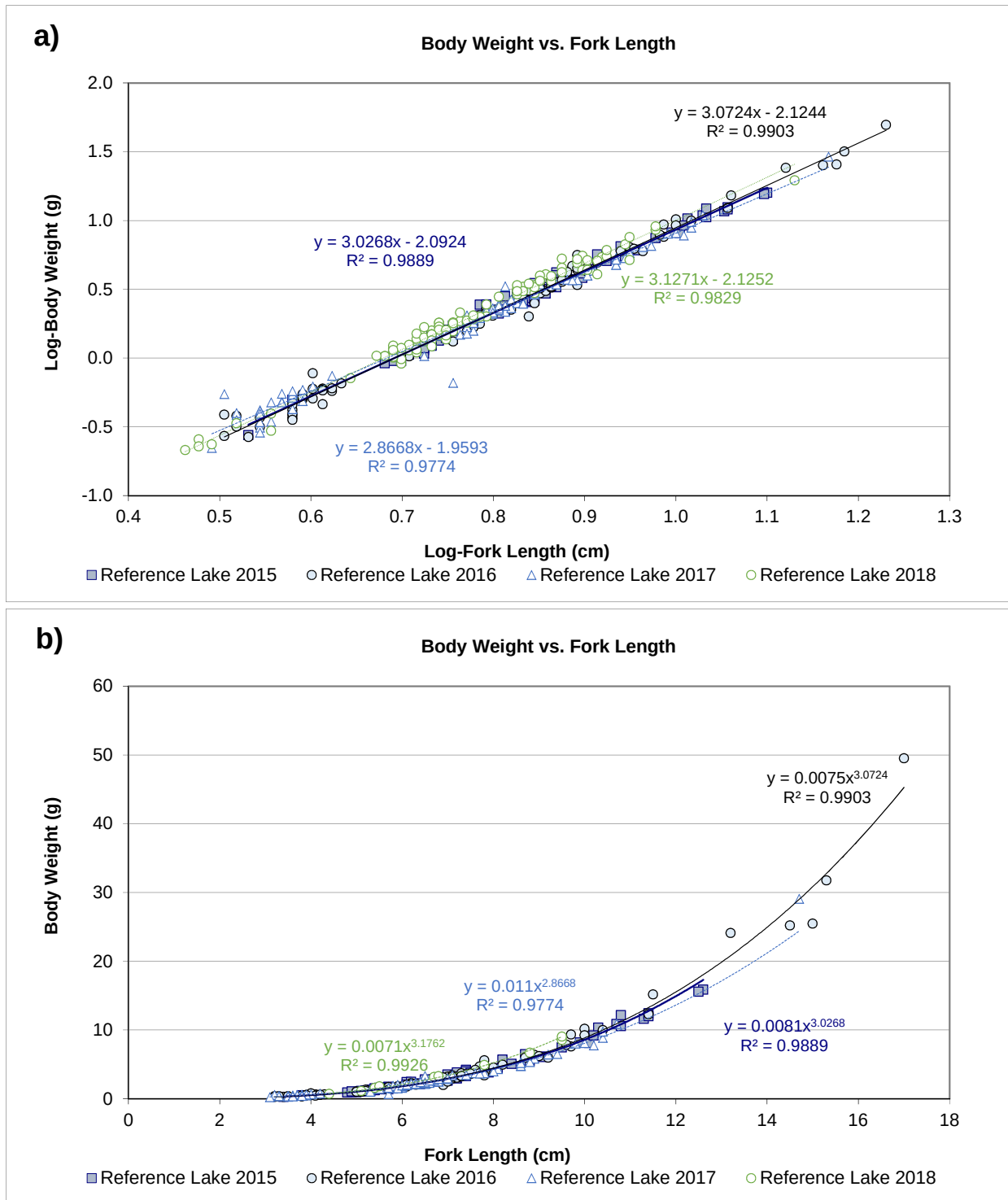


Figure B.9: Comparison of Condition (Weight-at-fork-length Relationship) for Arctic Charr Collected at the Nearshore Area of Reference Lake 3 in August 2015 to 2018 using Log-transformed (a) and Untransformed (b) Data, Mary River Project CREMP

Low numbers of arctic charr were captured at littoral/profundal areas of Reference Lake 3 in 2018 (i.e., 38 individuals) despite application of similar fishing effort to that used at the mine-exposed study lakes (Appendix Table G.2). However, unlike previous studies conducted from 2015 to 2017 that resulted in catches ranging from 1 to 14, the sample size in 2018 was sufficient as a basis for conducting meaningful statistical comparison with the mine-exposed lakes to evaluate mine-related effects on the population of reproductive-aged arctic charr. Notably, because arctic charr can show differential growth rates between the sexes (females grow faster; Jonsson et al. 1999; Skúlason et al. 1996; Gulseth and Nilssen 2001), natural differences in sex ratios between study areas could potentially result in falsely attributing differences in growth and/or condition between mine-exposed and reference areas to mine-related influences. Thus, the inability to definitively determine arctic charr sex using external characteristics when applying a non-lethal sampling approach could confound data interpretation. To determine whether differences in sex ratios could potentially confound the interpretation of the CREMP arctic charr health assessment, growth and condition were compared between male and female Arctic charr collected at Camp, Sheardown and Mary lakes during the baseline period as part of the 2015 CREMP (Minnow 2016a). No significant differences in growth and condition were indicated between males and females based on this analysis, suggesting that a non-lethal study approach is unlikely to bias the evaluation of mine-related effects on fish health as part of the CREMP. Contrary to the published literature, the absence of differences in arctic charr growth and condition between males and females at Mary River Project local study area lakes may be explained by naturally slow growth rates and low spawning frequency (i.e., once every 2 to 4 years) at high Arctic areas, and also by low gonadosomatic index (GSI) at the time that sampling is normally conducted for the Mary River Project CREMP (i.e., August).



B8 CREMP IMPLICATIONS

This overview of reference conditions was included in the CREMP to provide context and perspective regarding key chemical, physical, and biological features of the CREMP reference study areas. Key implications of reference area features that could affect the ability of the CREMP to evaluate mine-related effects at mine-exposed waterbodies that were identified through the 2016 to 2018 reference area overviews include the following:

- **Federal Water Quality Guidelines (WQG) are not applicable for aqueous phenol concentrations.** Aqueous concentrations of phenols were routinely elevated above WQG at the CREMP creek, river and lake reference stations in 2015 and 2016. Correlation analysis indicated a significant, positive relationship between phenol and both nitrate and DOC concentrations in the 2015 and 2016 CREMP, suggesting that high phenol concentrations in waterbodies near the Mary River Project mine were associated with influences from natural organic composition. Therefore, phenol concentration comparisons against applicable WQG did not serve as a focus for discussion as part of the 2016 to 2018 CREMP.
- **Greater reliance on the use of dissolved metals concentrations for assessing mine-related influences on aqueous metal concentrations at waterbodies used for the CREMP.** Total aluminum concentrations were routinely elevated, and other metals including (total) iron and manganese periodically elevated, above WQG at creek, river and/or lake reference areas used for the CREMP from 2015 to 2018, and historically in baseline studies. Significant positive correlations between total concentrations of these metals and turbidity were identified using the 2015 to 2018 data sets which suggested that these metals were likely bound to and/or composed suspended particulate materials in water samples. This was supported by a low ratio of dissolved to total metal concentrations in reference water samples from 2015 to 2017. Accordingly, greater emphasis should be placed on comparison of dissolved metal concentrations for assessing potential mine-related influences on water quality as part of the CREMP studies.
- **Use of fall sampling event water quality data to allow the most conservative evaluation of potential mine-related influences on water chemistry.** Water chemistry at lotic reference stations showed distinct seasonal changes in parameter concentrations during the baseline, and 2015 to 2017 studies. In general, conventional parameters, anions, and total metals were observed at lowest concentrations in spring, with intermediate concentrations in the summer, and highest concentrations observed



during the fall in each year. Therefore, although water chemistry data from winter, spring, and summer sampling events were examined, the fall water chemistry data generally served as the focus for the evaluation of potential mine-related influences on water quality at the mine-exposed lakes in CREMP studies conducted from 2016 to 2018.

- **Use of average water chemistry and chlorophyll-a data for lake water quality/phytoplankton monitoring stations.** No consistent differences in water chemistry or chlorophyll-a concentrations were observed between the surface and bottom of the water column at Reference Lake 3 stations from 2015 to 2018. Therefore, the evaluation of water chemistry and phytoplankton productivity among stations and study areas for the 2016 to 2018 Mary River Project CREMP studies was based on average water chemistry and chlorophyll-a values from the water column surface and bottom for each lake station.
- **Consider updating of the AEMP sediment quality benchmarks.** Arsenic, chromium, copper, iron, manganese, and phosphorus have been observed at concentrations above the AEMP sediment quality benchmarks in sediment at Reference Lake 3 in CREMP studies conducted from 2015 to 2018. This suggested that the AEMP benchmarks for these metals may be overly conservative and therefore, to improve the applicability of the AEMP benchmarks for these metals, consideration should be given to incorporating reference lake data into derivation of updated sediment quality AEMP benchmarks.
- **Focus lake benthic invertebrate community survey on littoral zone.** Benthic invertebrate community data collected at Reference Lake 3 from 2015 to 2018 consistently indicated that, similar to most lakes, benthic invertebrate community features can be expected to naturally change with depth. In general, as depth increases, lower benthic invertebrate density and richness typically occurs. The occurrence of naturally low density and/or richness can, in turn, limit the ability to distinguish adverse effects associated with a project. Therefore, in order to maximize the confidence in the benthic invertebrate community analysis results, the littoral zone should serve as the focus for the lake benthic invertebrate community survey analysis for the CREMP.
- **Adopting of standard CES for benthic invertebrate community and fish population endpoints into the CREMP.** Year-to-year evaluation of reference creek and lake habitat used for the CREMP has indicated that benthic invertebrate and fish



populations differences between years can be expected to vary within the CES set out for use under the federal EEM program (Munkittrick et al. 2009). Therefore, the use of established CES for defining effects appears to be applicable to the Mary River Project CREMP.



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APPENDIX C
WATER QUALITY DATA

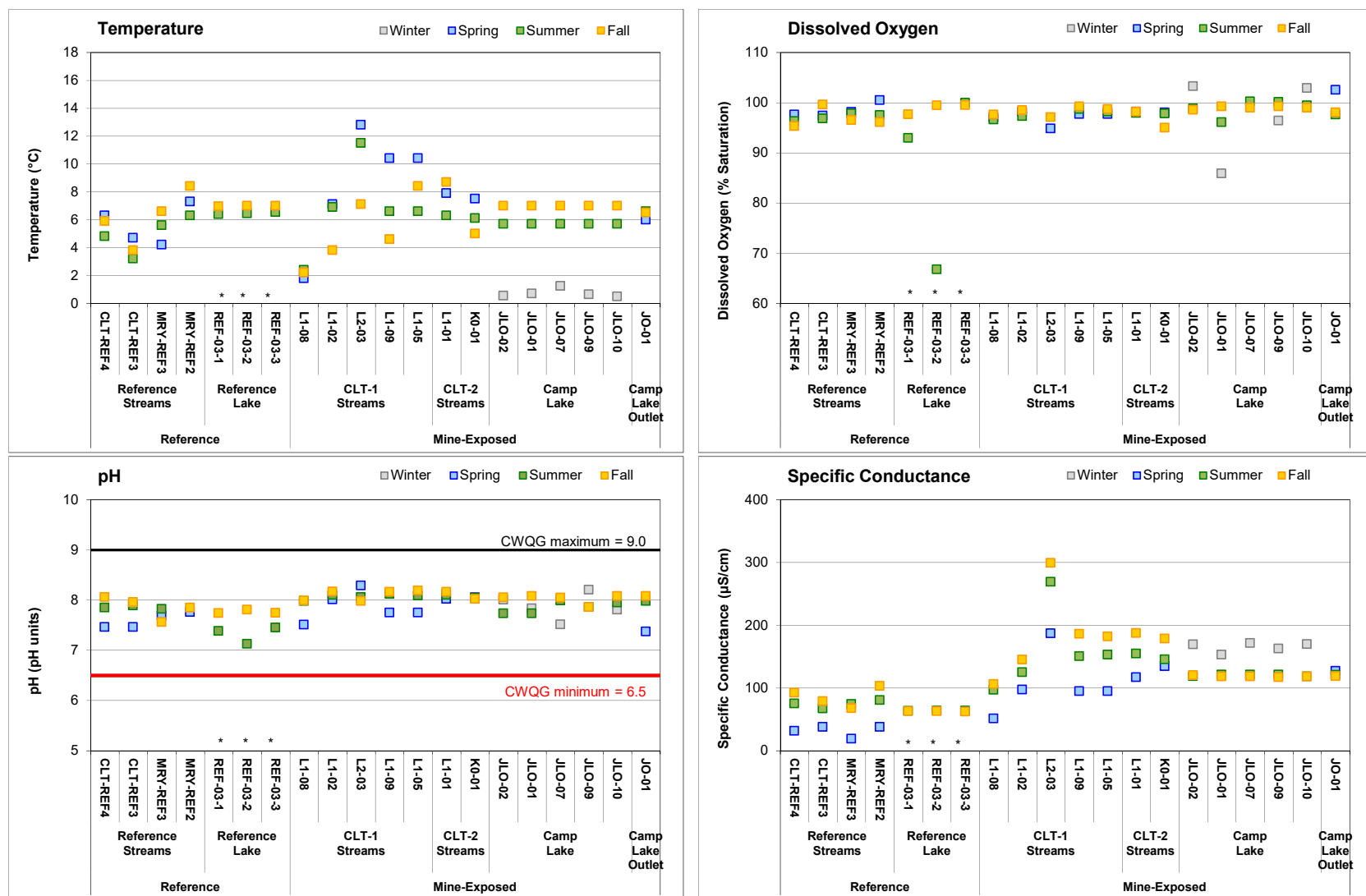


Figure C.1: Comparison of *In Situ* Water Quality Variables Measured at Camp Lake System Water Quality Monitoring Stations in Winter, Spring, Summer, and Fall 2018, Mary River Project CREMP

Notes: Lake values represent mean of surface and bottom *in situ* water quality measurements. Streams were not sampled in winter. Lakes were not sampled in spring.

* Reference Lake 3 (REF-03) was not sampled in winter.



Figure C.2: Temporal Comparison of Water Chemistry at Camp Lake Tributary 1 (CLT-1) and Tributary 2 (CLT-2) for Mine Baseline (2005 to 2013), Construction (2014) and Operational (2015 to 2018) Periods During Fall

Notes: Values represent mean $\pm$ SD. Lotic reference stations include the CLT-REF and MRY-REF series (mean $\pm$ SD; n = 4). Pound symbol (#) indicates parameter concentration is below the laboratory method detection limit. See Table 2.2 for information regarding Water Quality Guideline (WQG) criteria. AEMP Benchmarks are specific to the Camp Lake Tributaries.

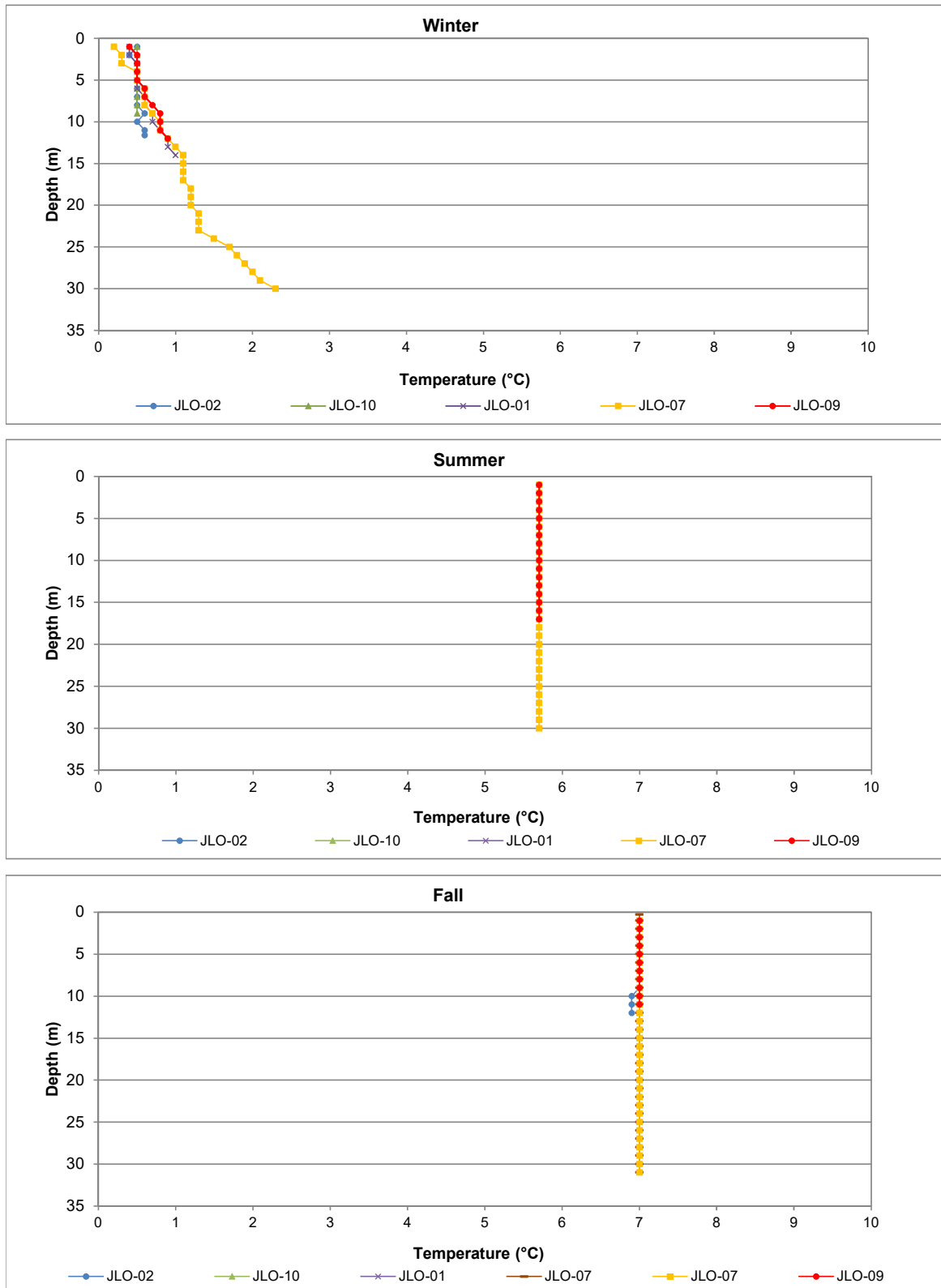


Figure C.3: Vertical Profiles of Temperature Measured at Camp Lake in Winter, Summer, and Fall, 2018

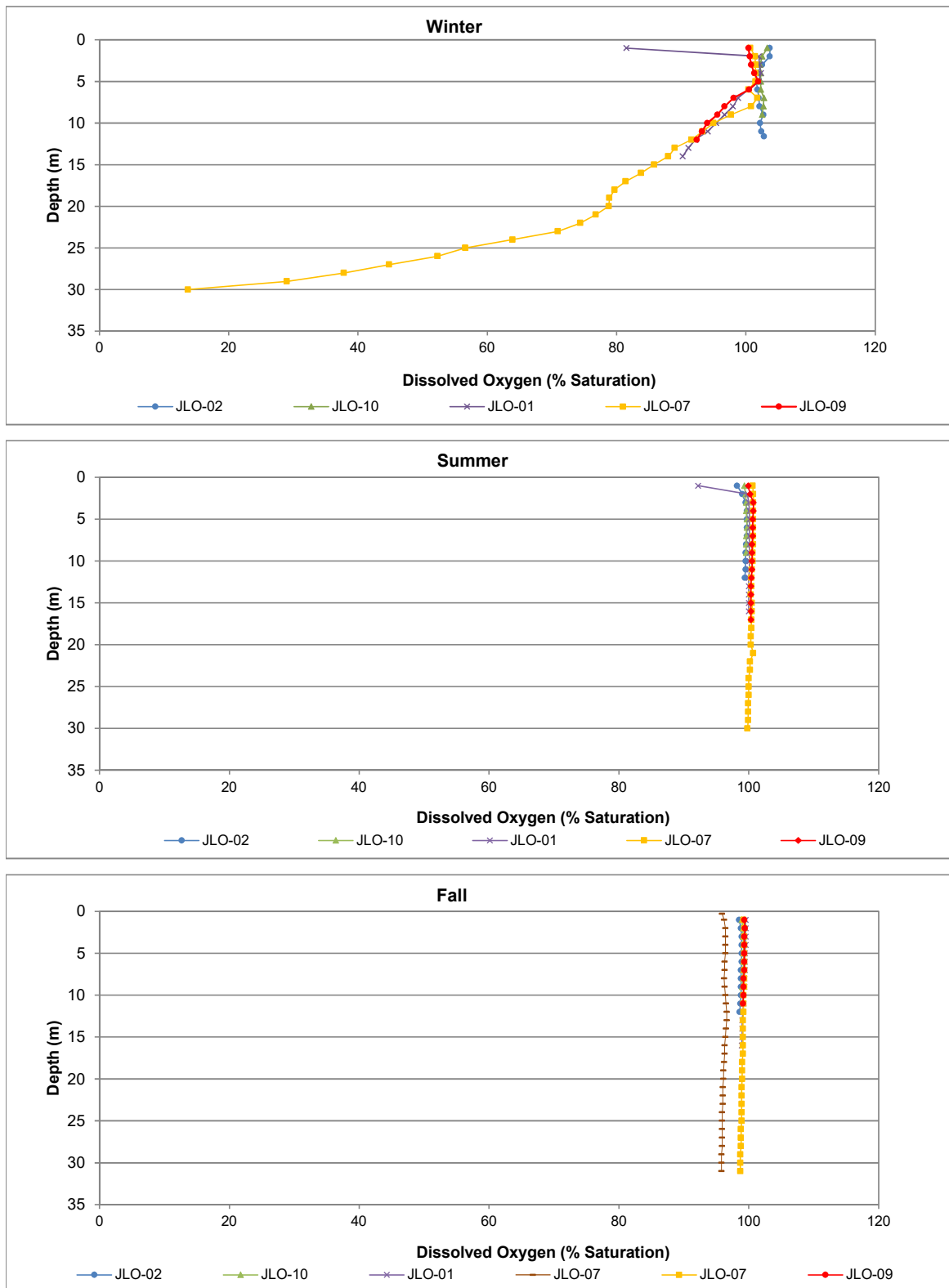


Figure C.4: Vertical Profiles of Dissolved Oxygen Measured at Camp Lake in Winter, Summer, and Fall, 2018

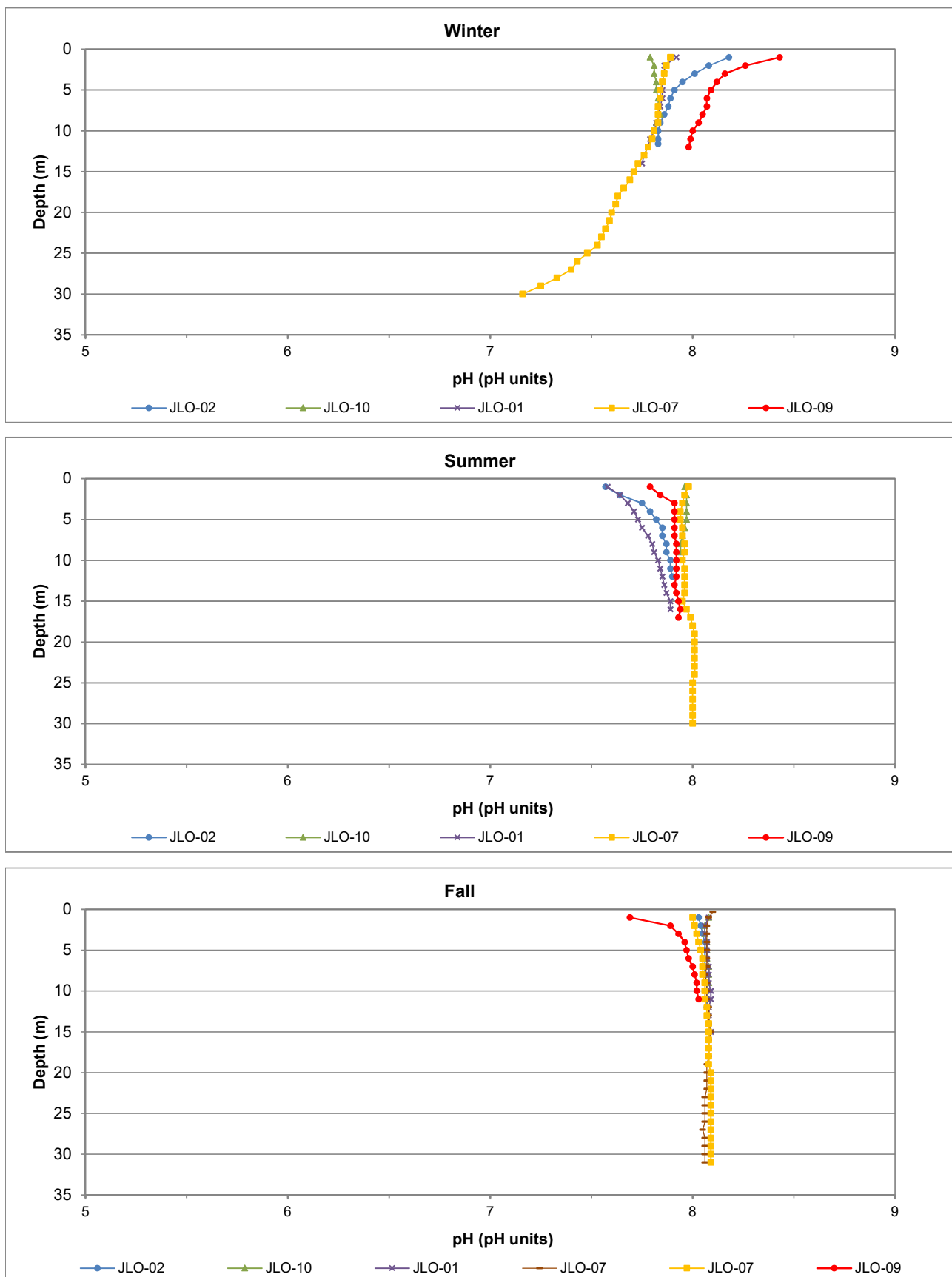


Figure C.5: Vertical Profiles of pH Measured at Camp Lake in Winter, Summer, and Fall, 2018

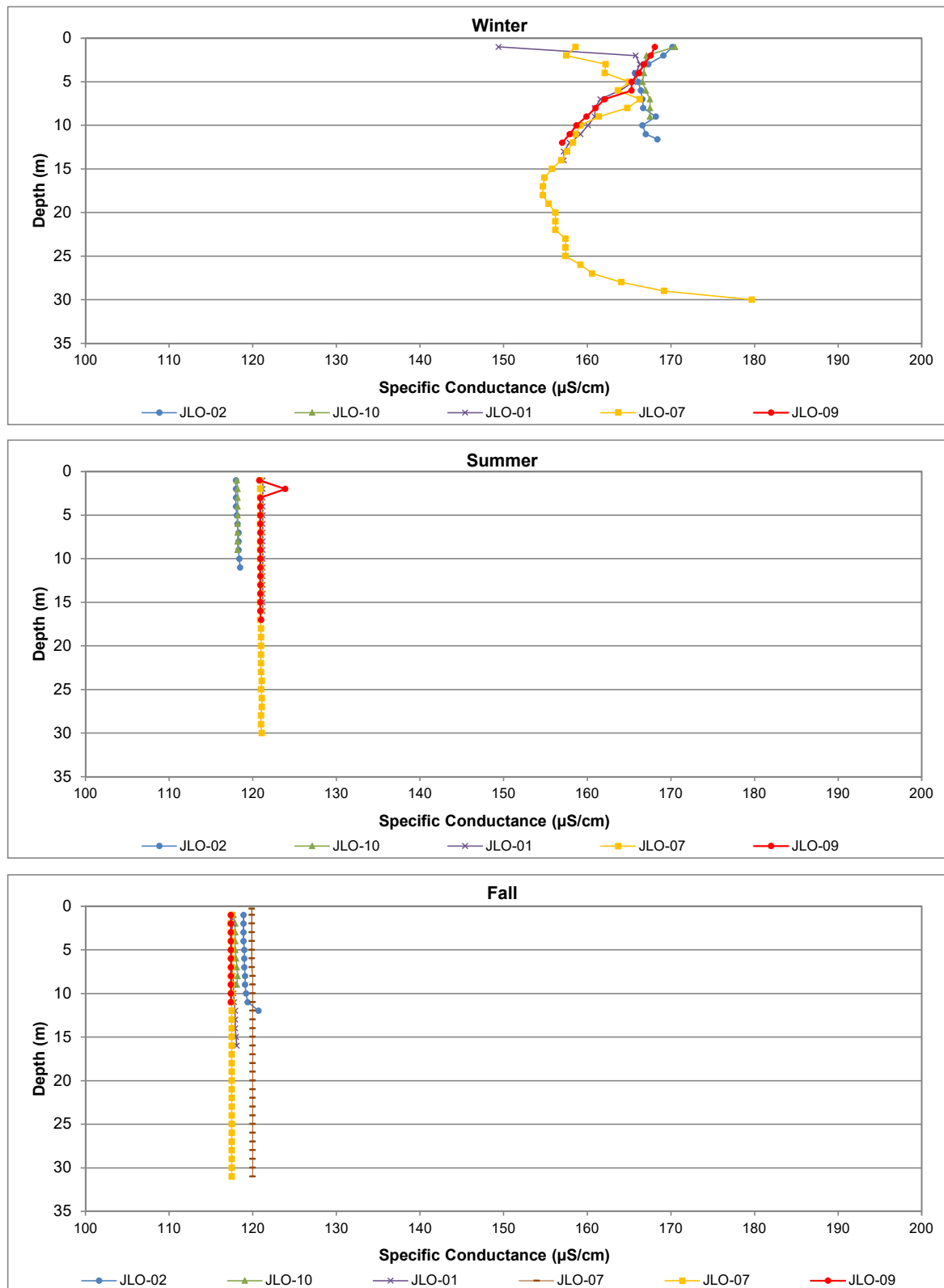


Figure C.6: Vertical Profiles of Specific Conductance Measured at Camp Lake in Winter, Summer, and Fall, 2018

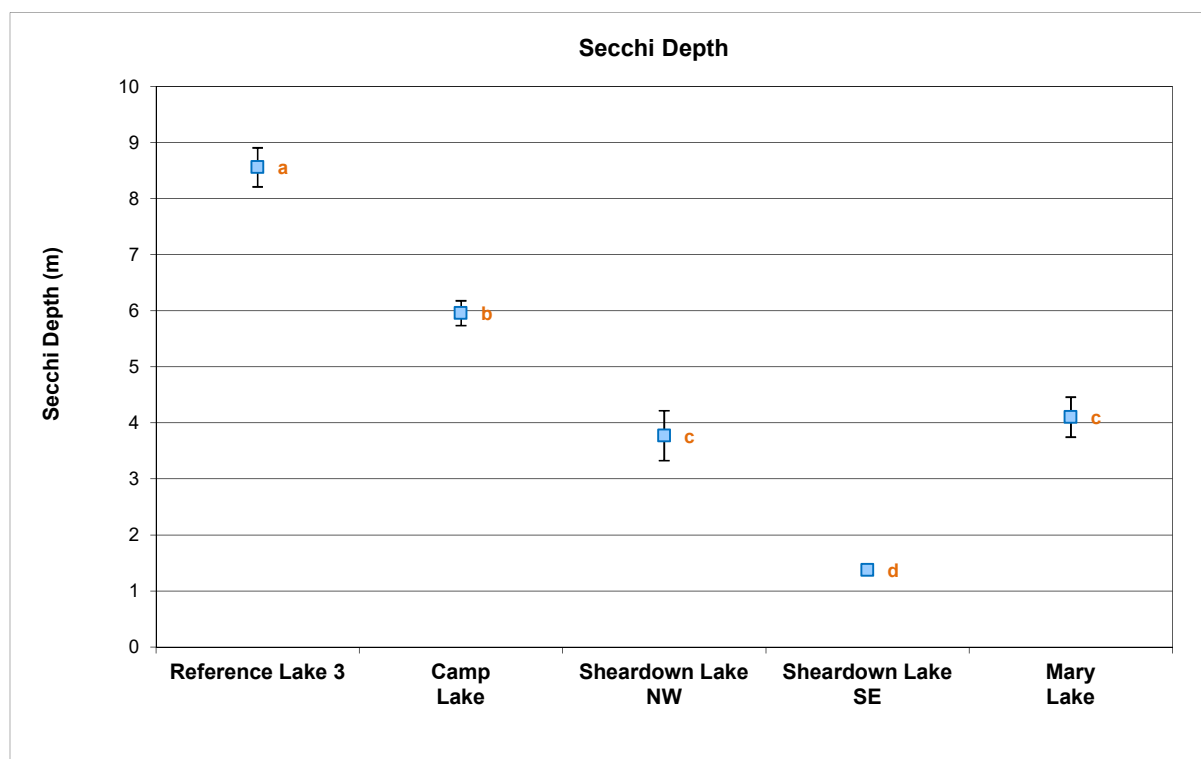


Figure C.7: Comparison of Secchi Depth (mean $\pm$ SD) Measured at the Mary River Project Lake Benthic Invertebrate Community Stations, August 2018

Notes: The same letter(s) next to study area data points indicate no significant difference between study areas. Sample size (n) was 10 for all lakes except Reference Lake 3, where n was 8.

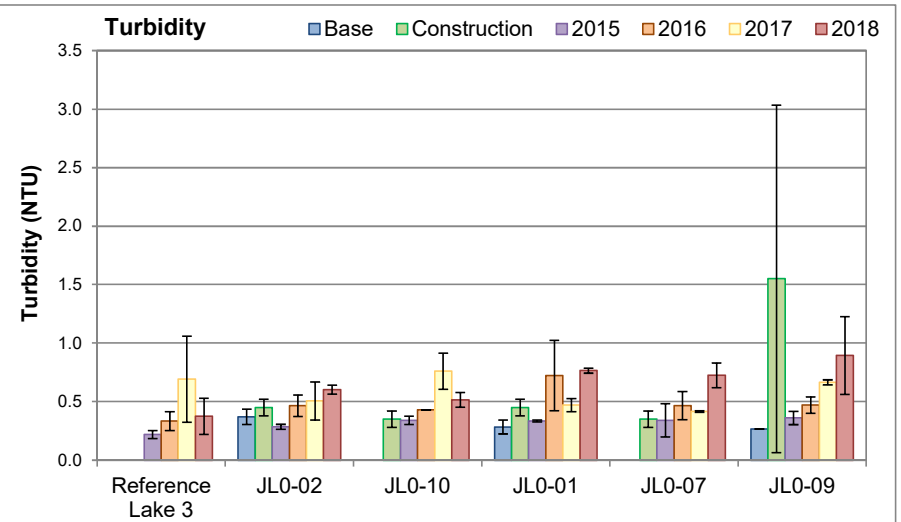
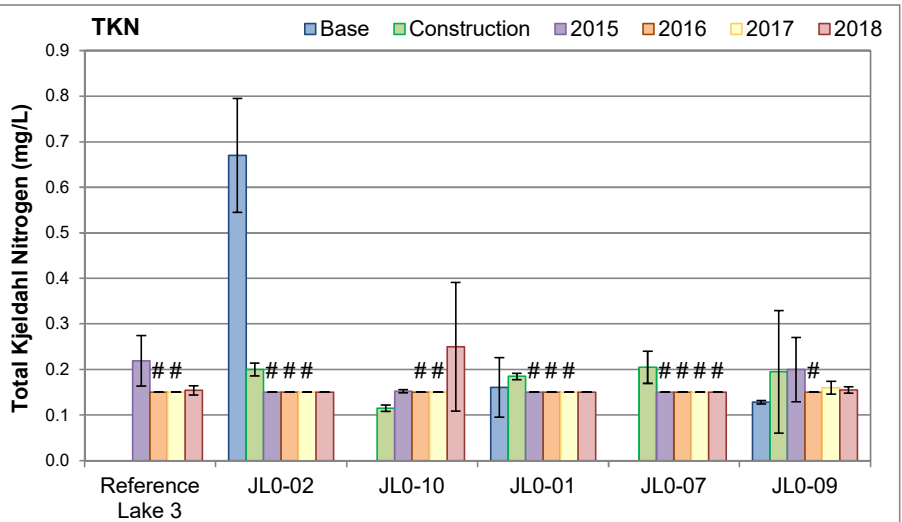
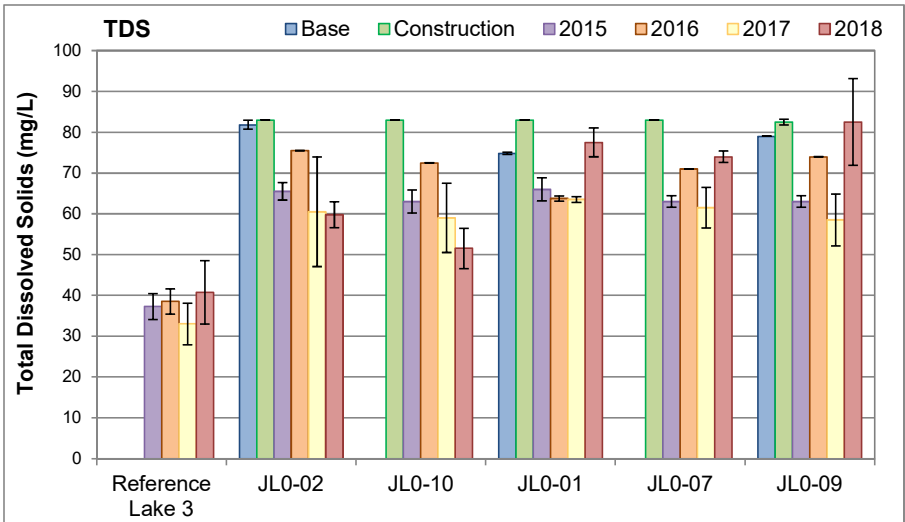
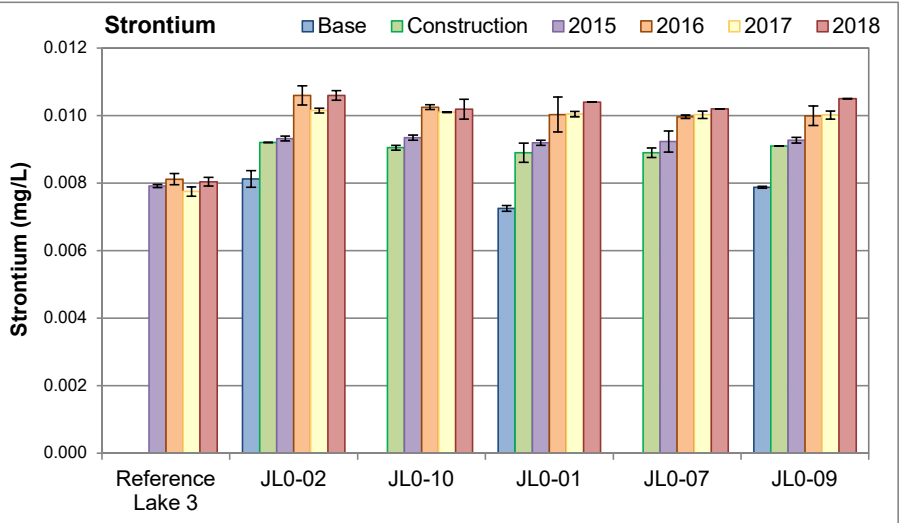
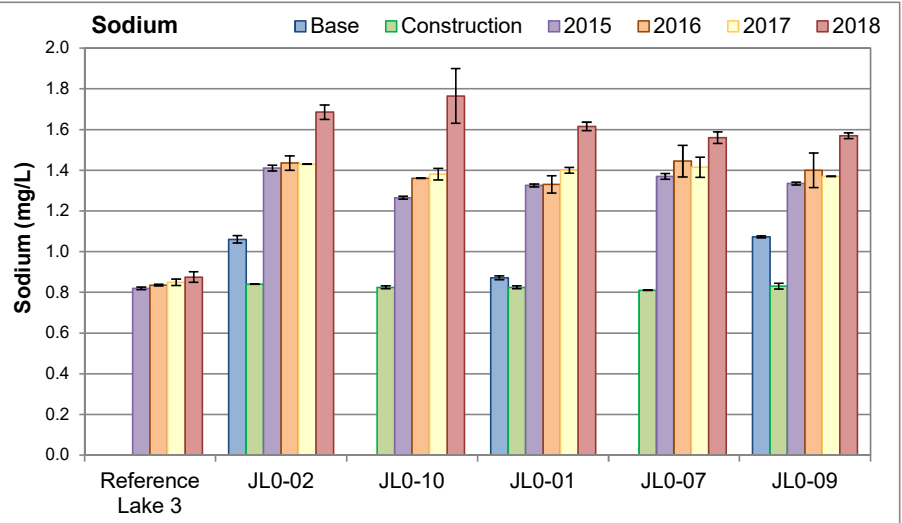
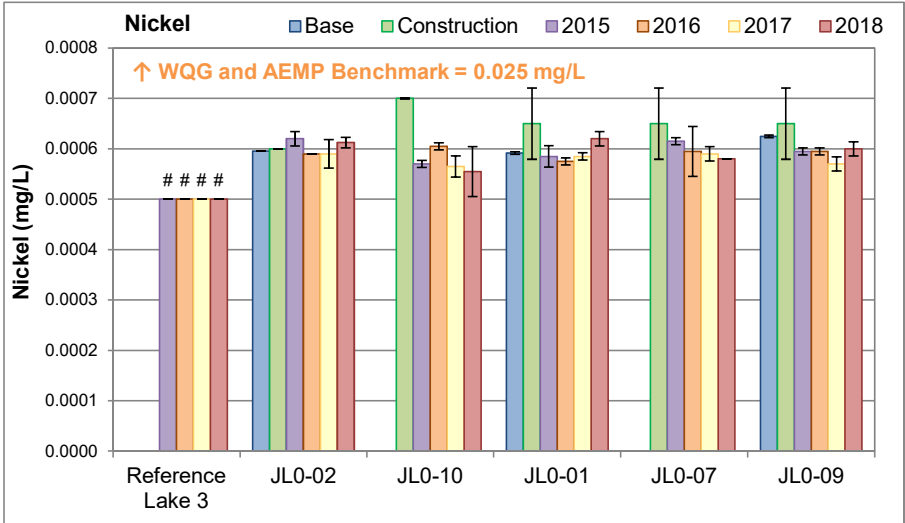
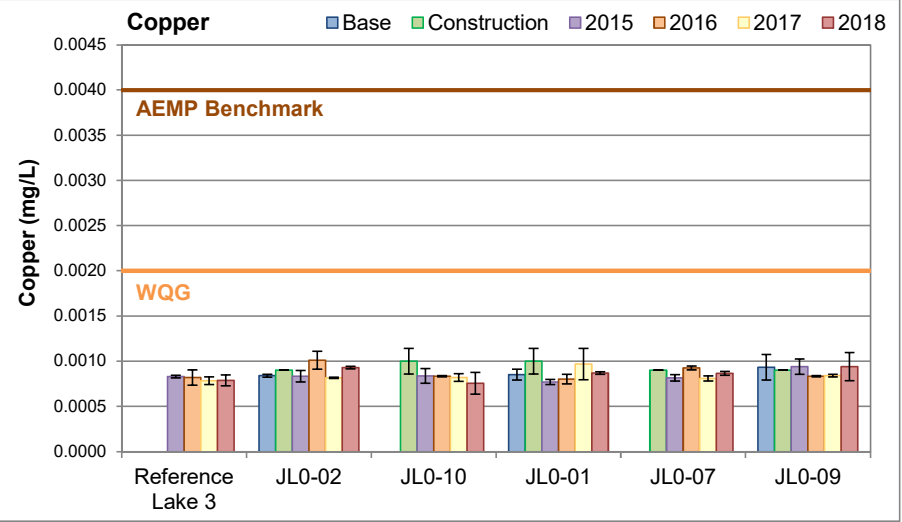
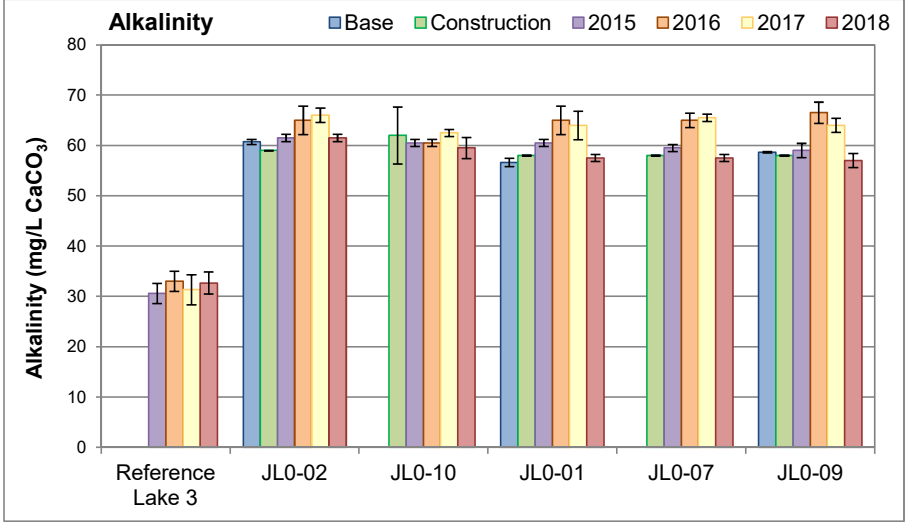


Figure C.8: Temporal Comparison of Water Chemistry at Camp Lake (JLO) for Mine Baseline (2005 to 2013), Construction (2014) and Operational (2015 to 2018) Periods during Fall

Notes: Values represent mean $\pm$ SD. Pound symbol (#) indicates parameter concentration is below the laboratory method detection limit. See Table 2.2 for information regarding Water Quality Guideline (WQG) criteria. AEMP Benchmarks are specific to Camp Lake.

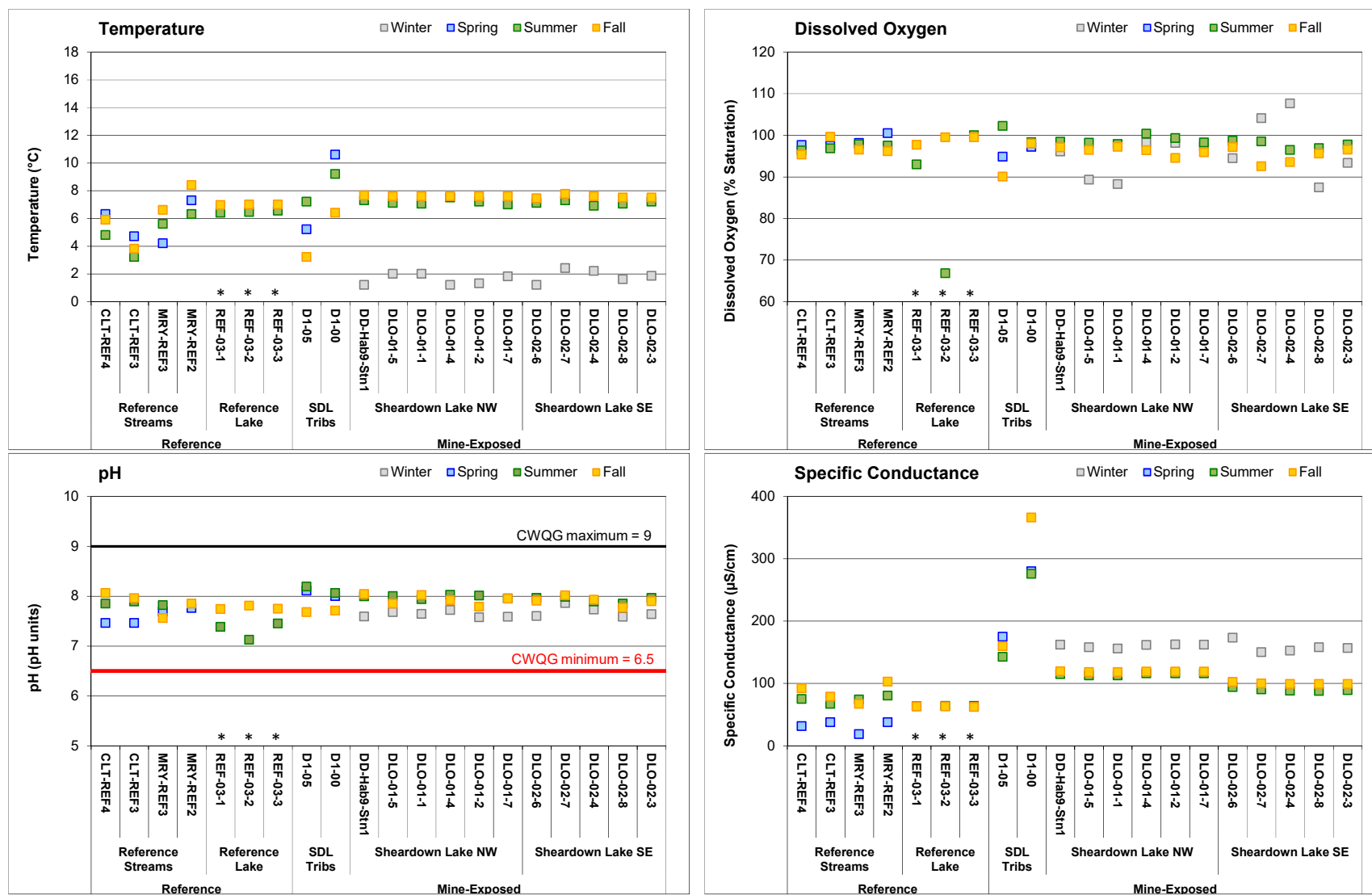


Figure C.9: Comparison of *In Situ* Water Quality Variables Measured at Sheardown Lake System Water Quality Monitoring Stations in Winter, Spring, Summer, and Fall 2018, Mary River Project CREMP

Notes: Lake values represent mean of surface and bottom *in situ* water quality measurements. Streams were not sampled in winter. Lakes were not sampled in spring.

* Reference Lake 3 (REF-03) was not sampled in winter.

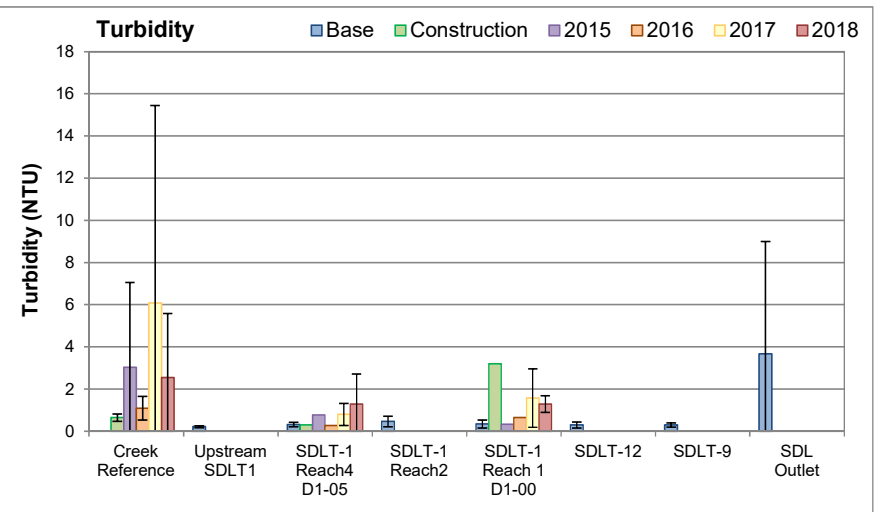
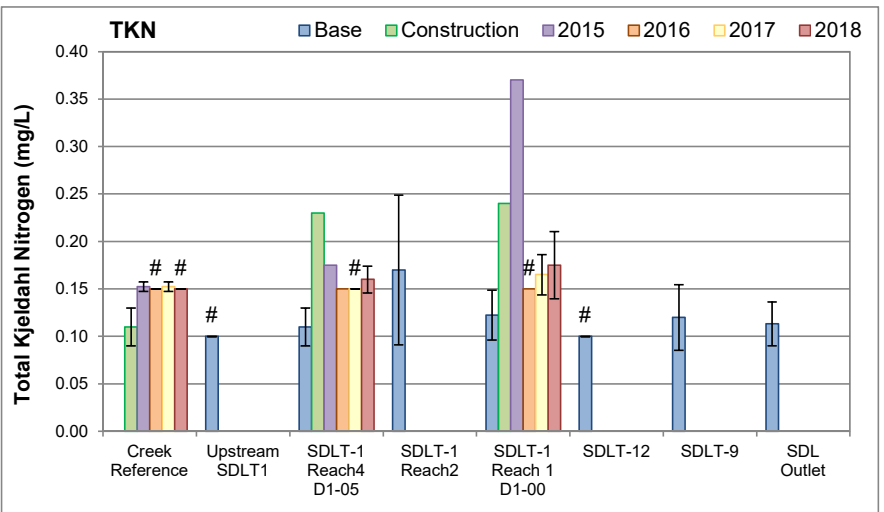
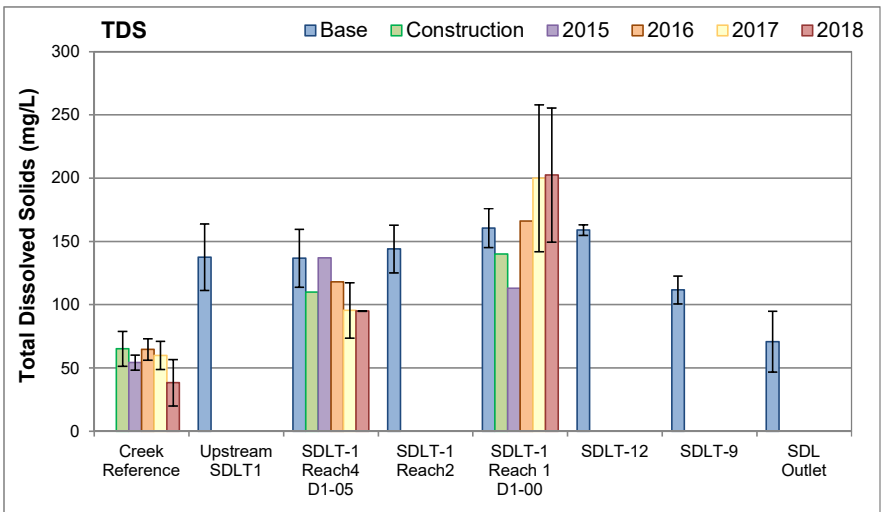
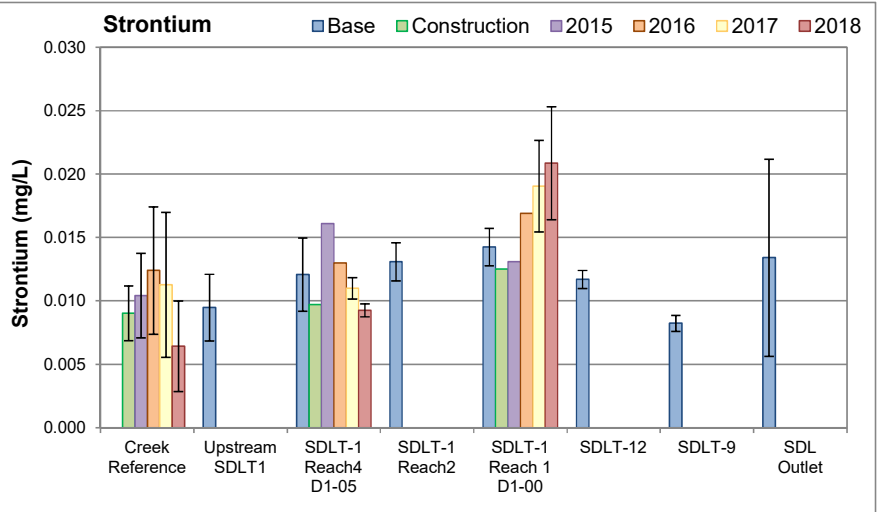
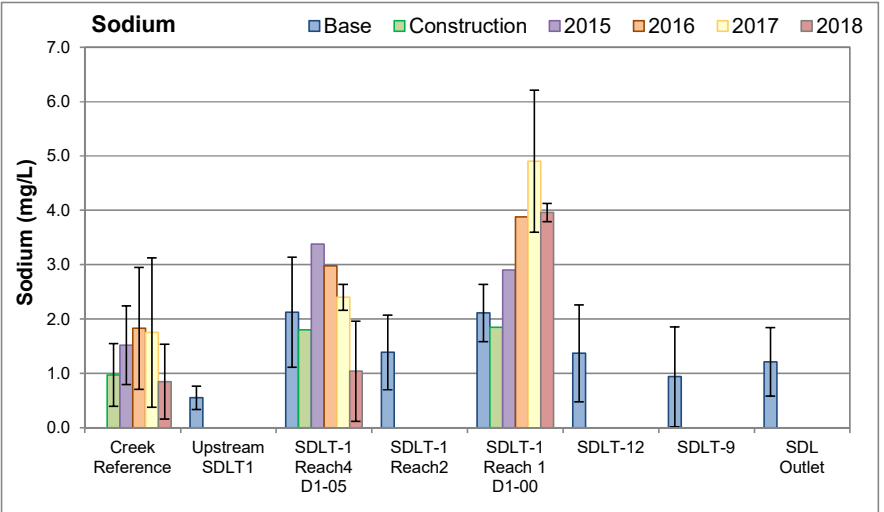
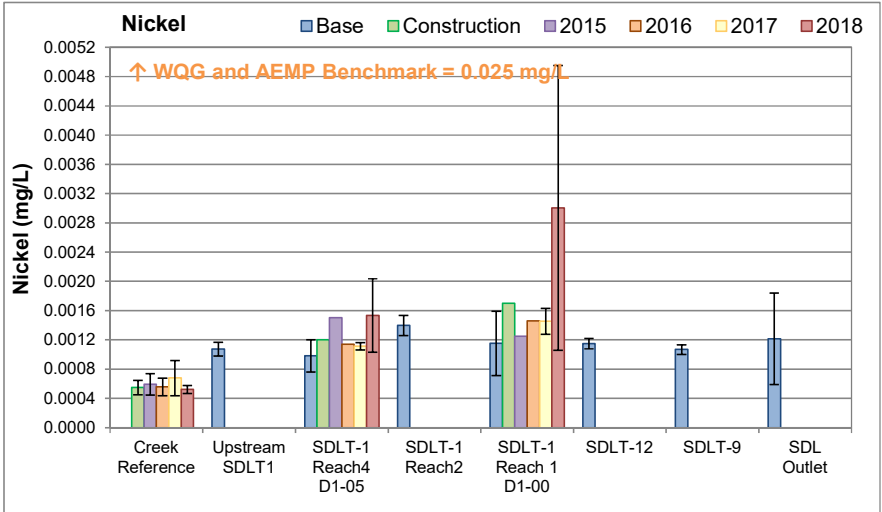
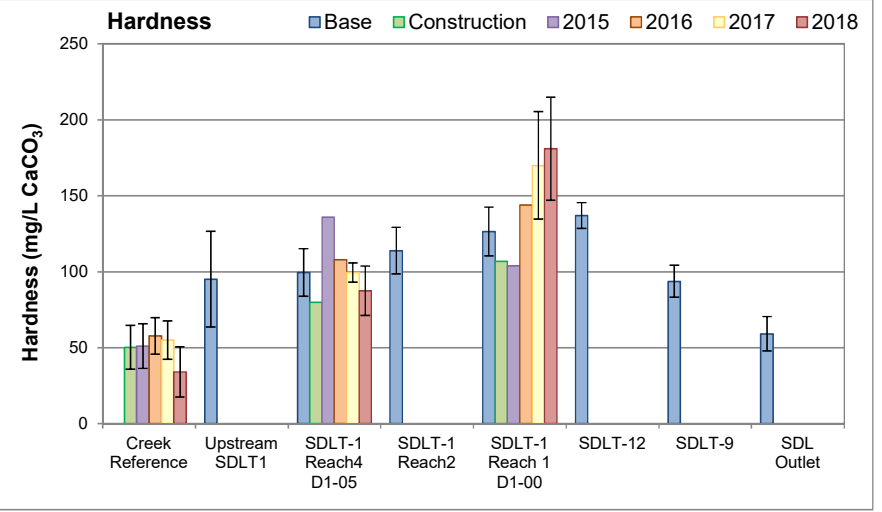
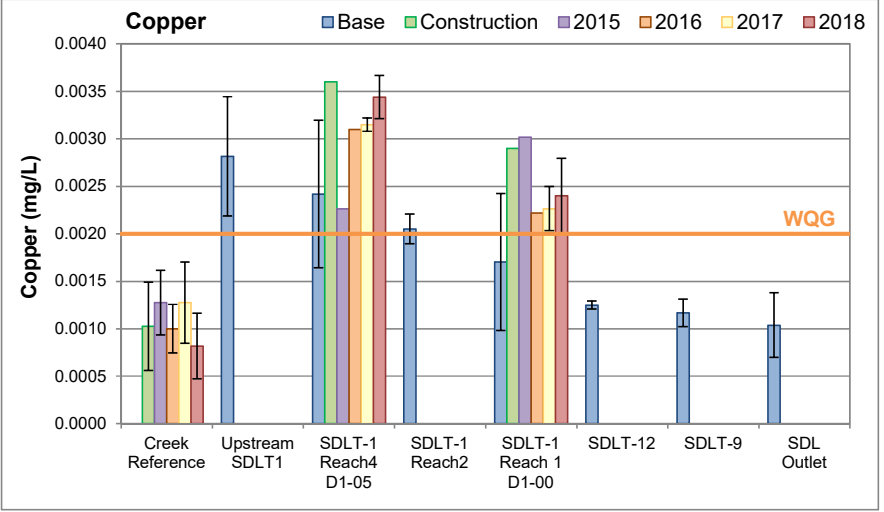
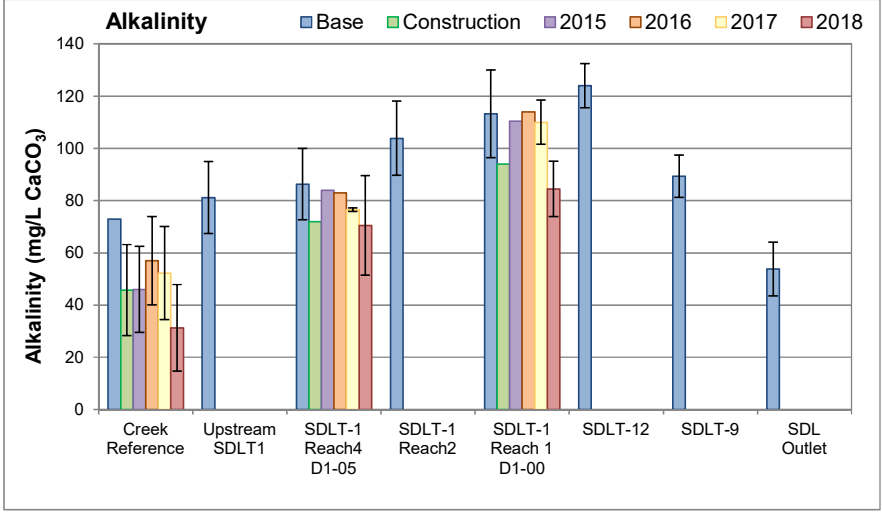


Figure C.10: Temporal Comparison of Water Chemistry at Sheardown Lake Tributaries (SDLT) for Mine Baseline (2005 to 2013), Construction (2014) and Operational (2015 to 2018) Periods during Fall

Notes: Values represent mean $\pm$ SD. Creek reference includes the CLT-REF and MRY-REF series stations (mean $\pm$ SD; n = 4). Pound symbol (#) indicates parameter concentration is below the laboratory method detection limit. See Table 2.2 for information regarding Water Quality Guideline (WQG) criteria. AEMP Benchmarks are specific to the Sheardown Lake Tributaries.

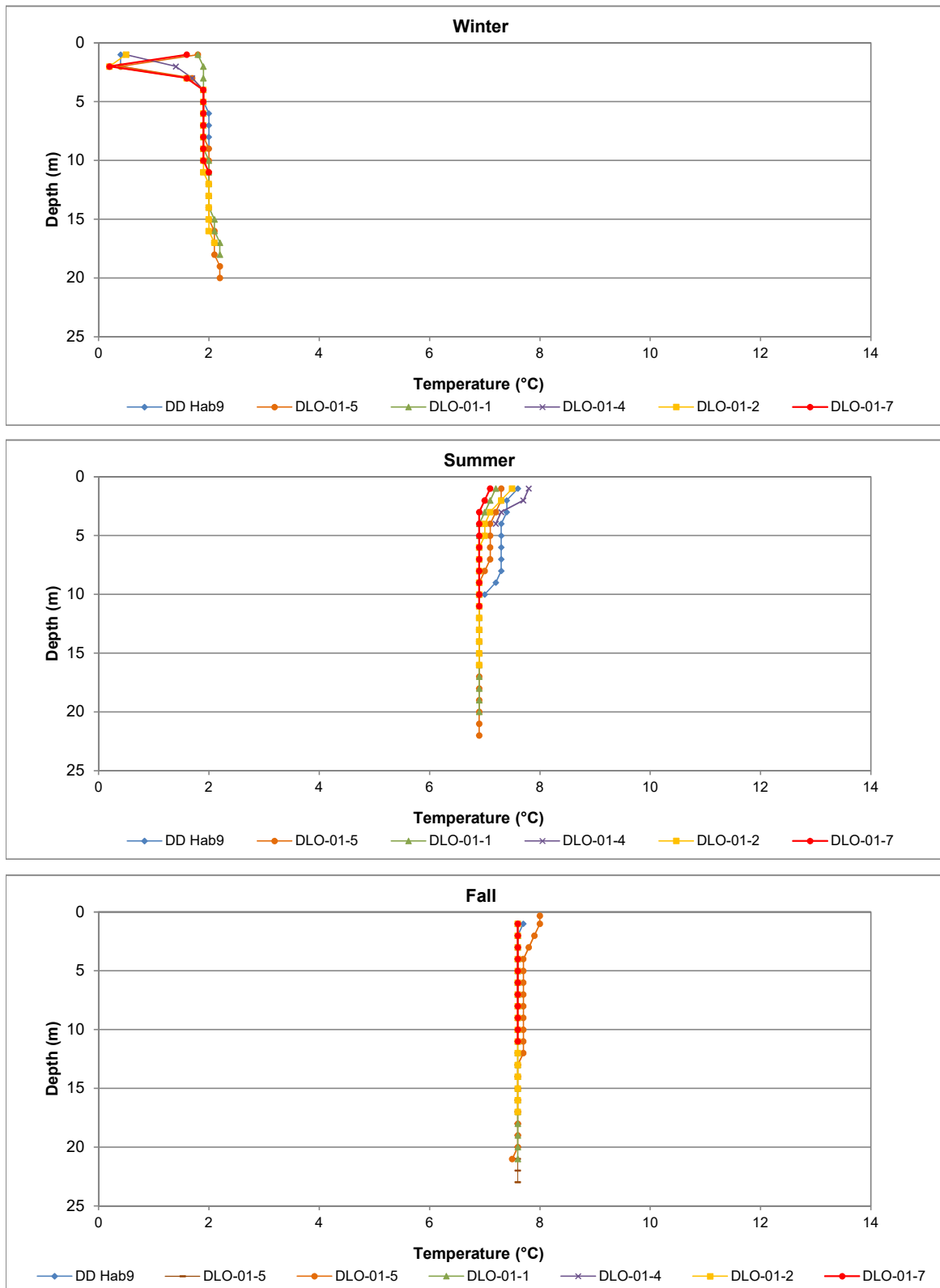


Figure C.11: Vertical Profiles of Temperature Measured at Sheardown Lake NW in Winter, Summer, and Fall, 2018

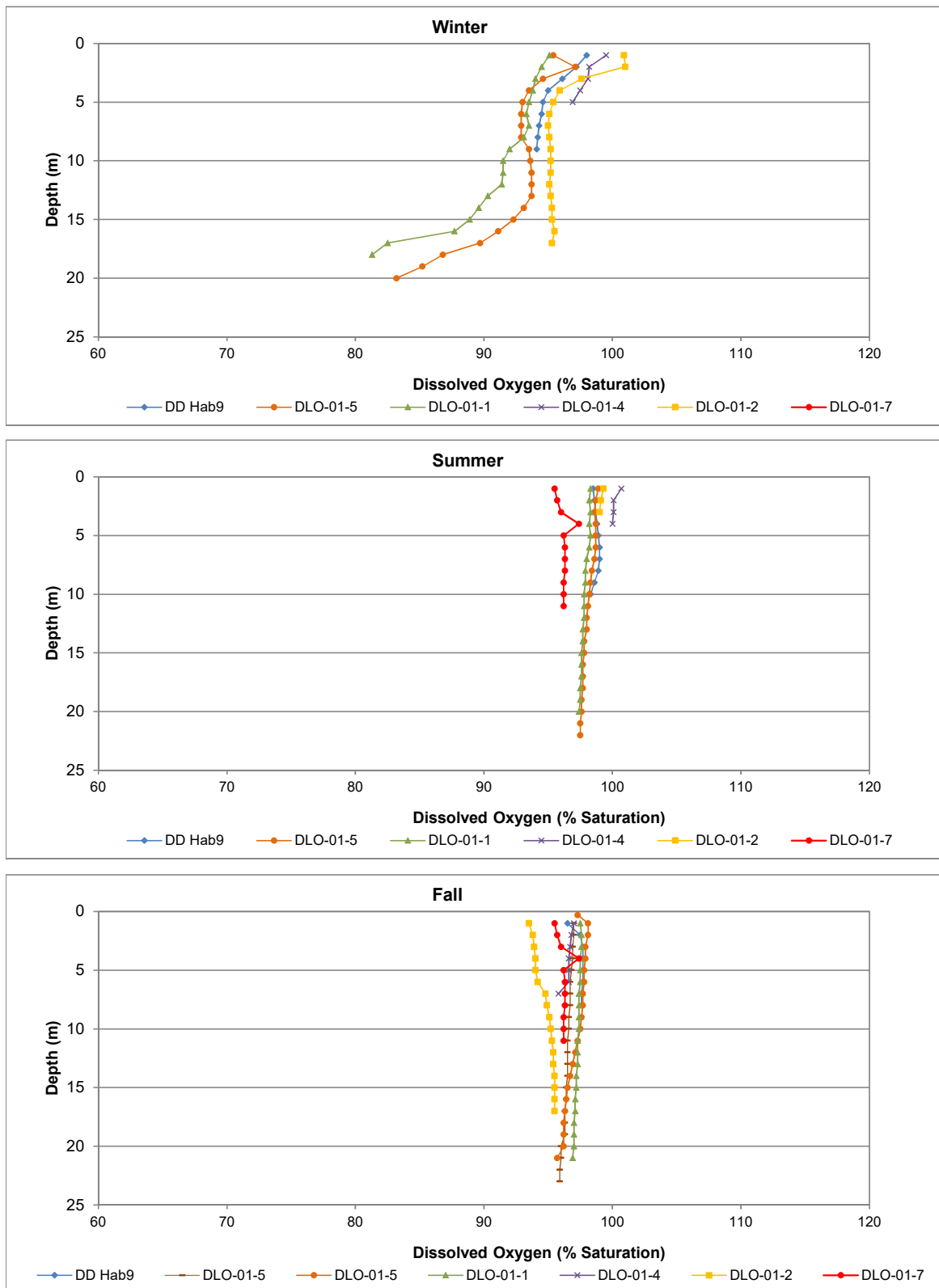


Figure C.12: Vertical Profiles of Dissolved Oxygen Measured at Sheardown Lake NW in Winter, Summer, and Fall, 2018

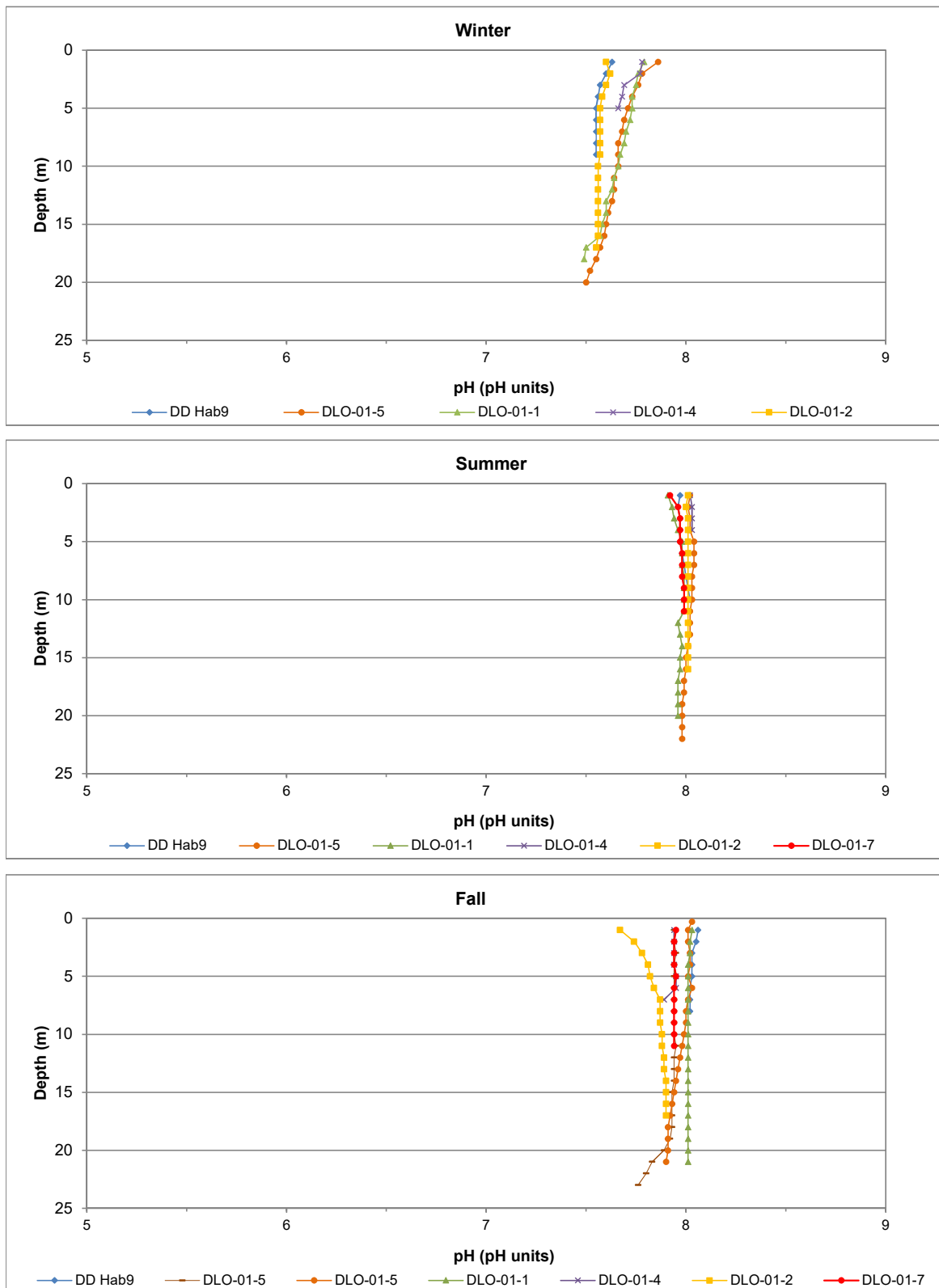


Figure C.13: Vertical Profiles of pH Measured at Sheardown Lake NW in Winter, Summer, and Fall, 2018

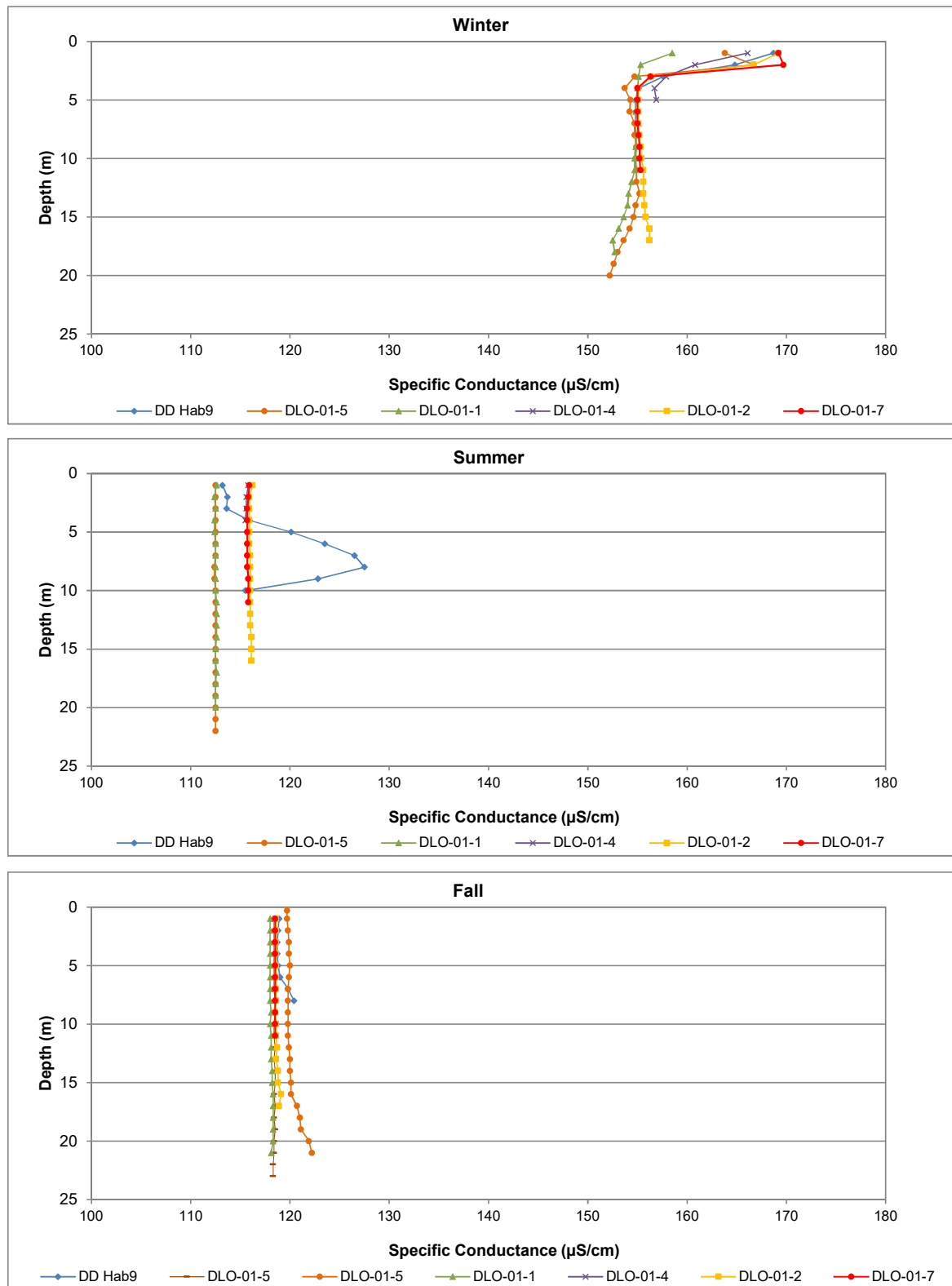


Figure C.14: Vertical Profiles of Specific Conductance Measured at Sheardown Lake NW in Winter, Summer, and Fall, 2018

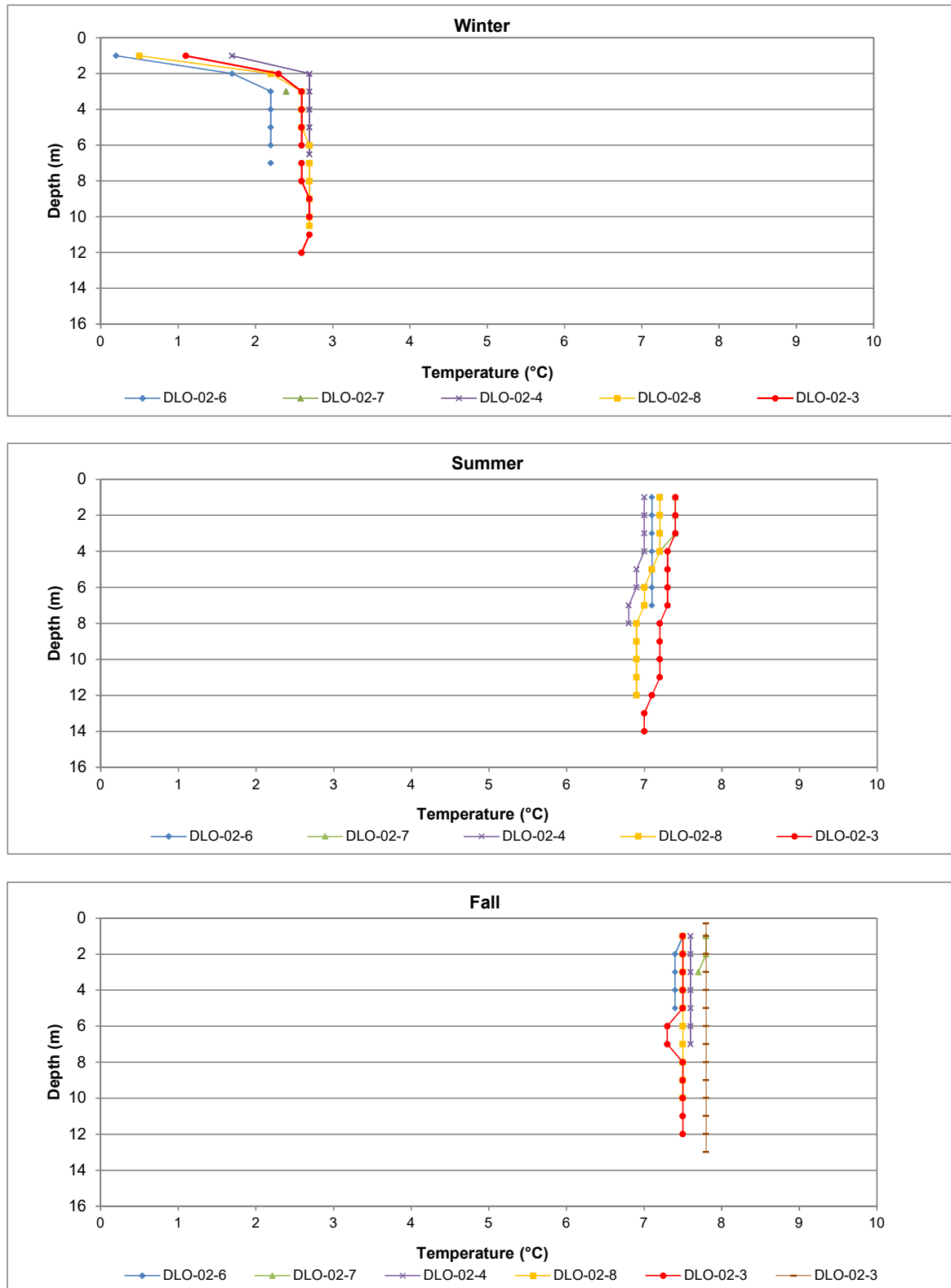


Figure C.15: Vertical Profiles of Temperature Measured at Sheardown Lake SE in Winter, Summer, and Fall, 2018

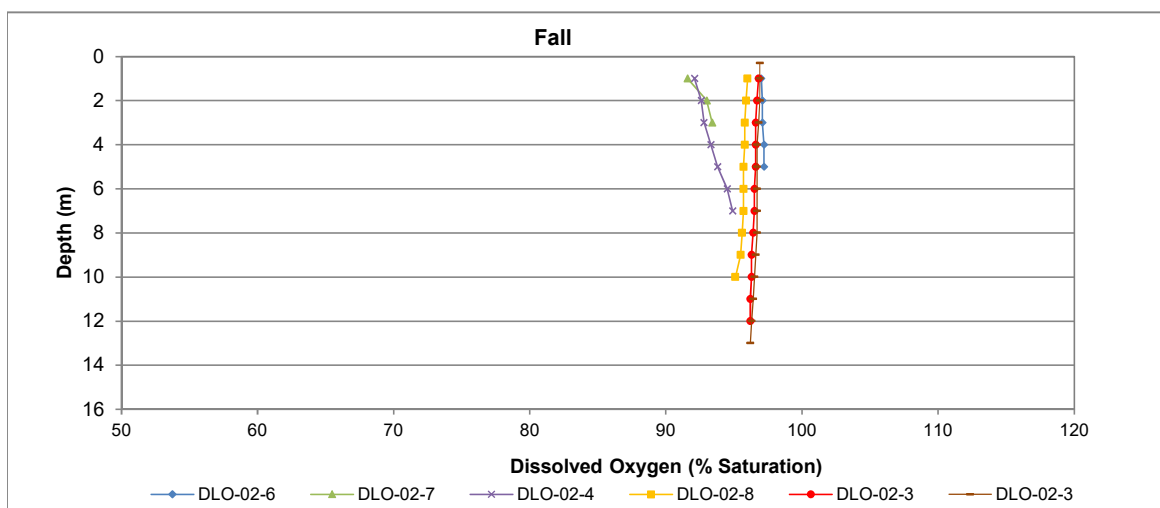
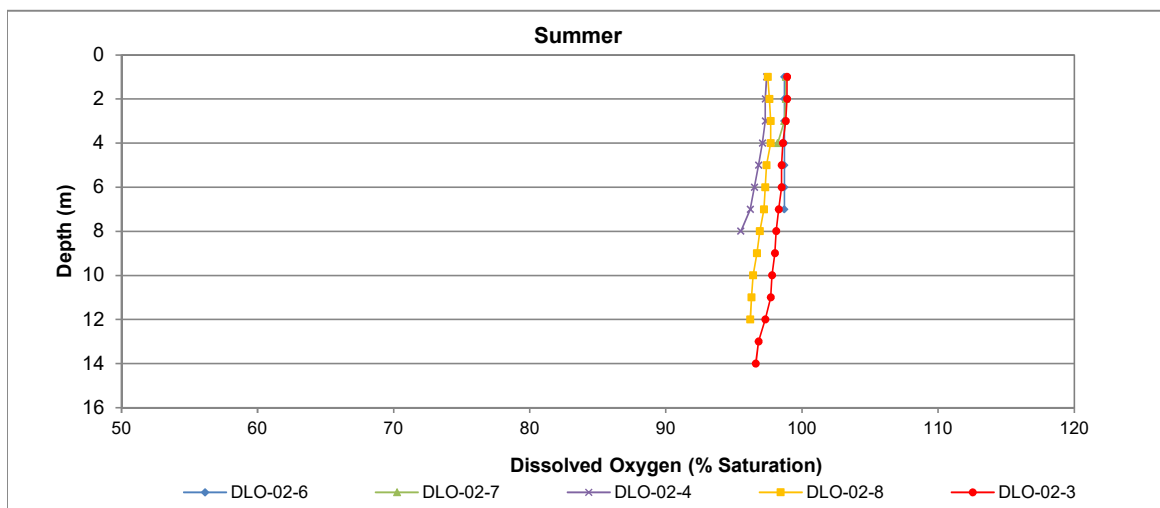
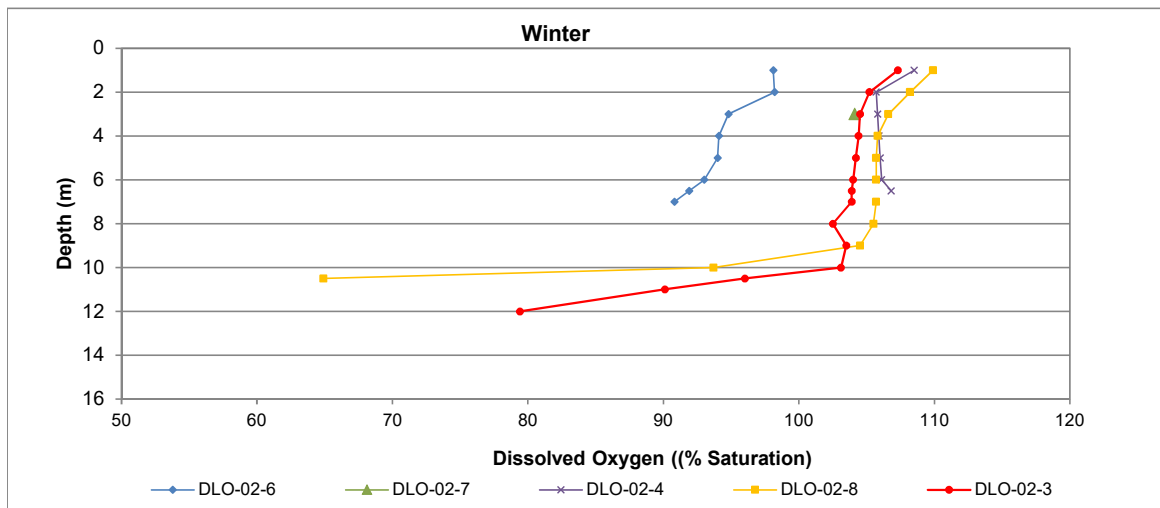


Figure C.16: Vertical Profiles of Dissolved Oxygen Measured at Sheardown Lake SE in Winter, Summer, and Fall, 2018

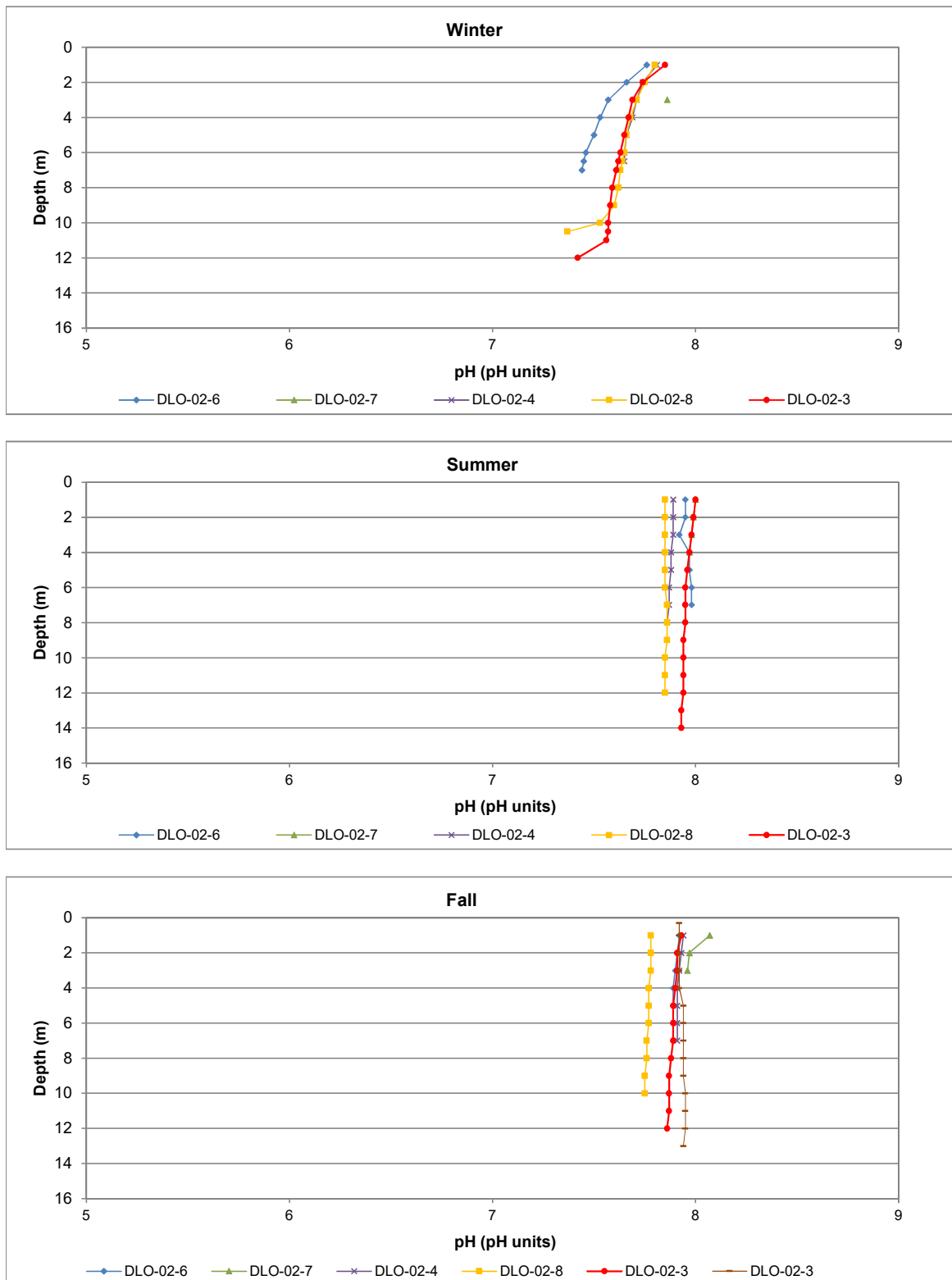


Figure C.17: Vertical Profiles of pH Measured at Sheardown Lake SE in Winter, Summer, and Fall 2018

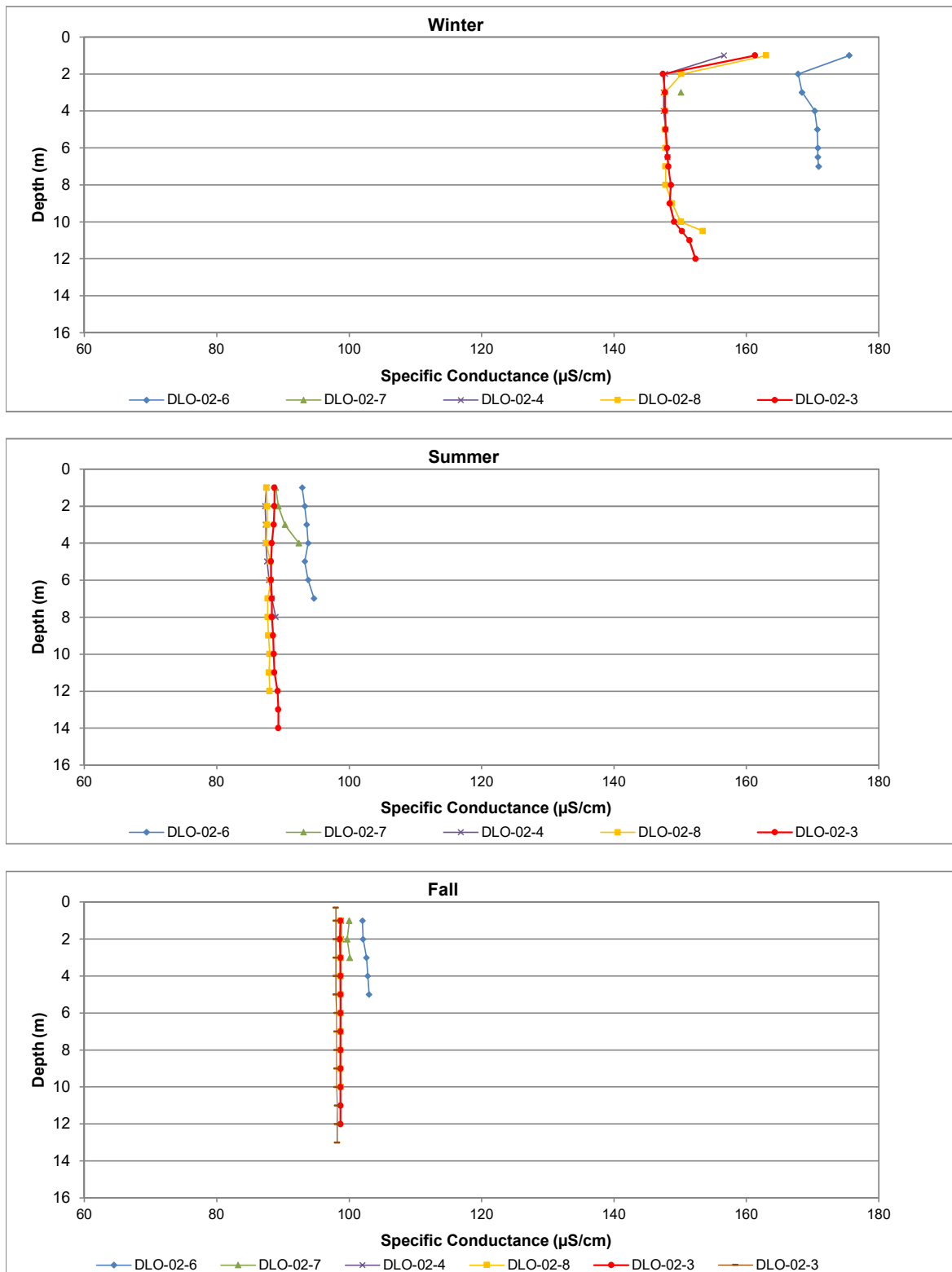


Figure C.18: Vertical Profiles of Conductivity Measured at Sheardown Lake SE in Winter, Summer, and Fall 2018



Figure C.19: Temporal Comparison of Water Chemistry at Sheardown Lake Northwest (DLO-01) and Sheardown Lake Southeast (DLO-02) for Mine Baseline (2005 to 2013), Construction (2014), and Operational (2015 to 2018) Periods during Fall

Notes: Values represent mean $\pm$ SD. Pound symbol (#) indicates parameter concentration is below the laboratory method detection limit. See Table 2.2 for information regarding Water Quality Guideline (WQG) criteria. AEMP Benchmarks are specific to Sheardown Lake (northwest and southeast).

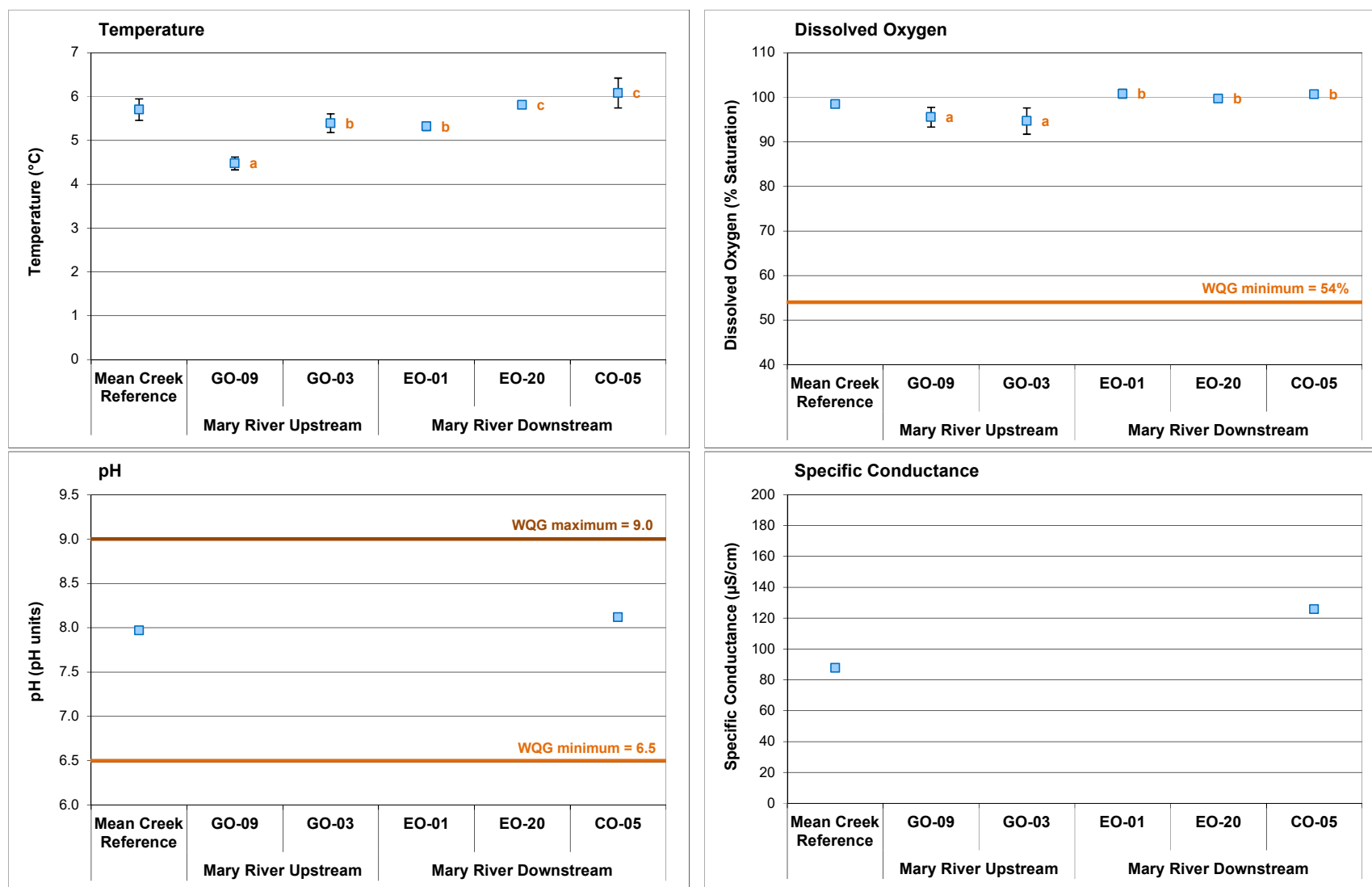


Figure C.20: Comparison of *In Situ* Water Quality Variables (mean $\pm$ SD; n = 5) Measured at Mary River Mine-Exposed and Reference (GO-09) Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2018

Note: The same letters next to Mary River study area data points indicates no significant difference between areas.

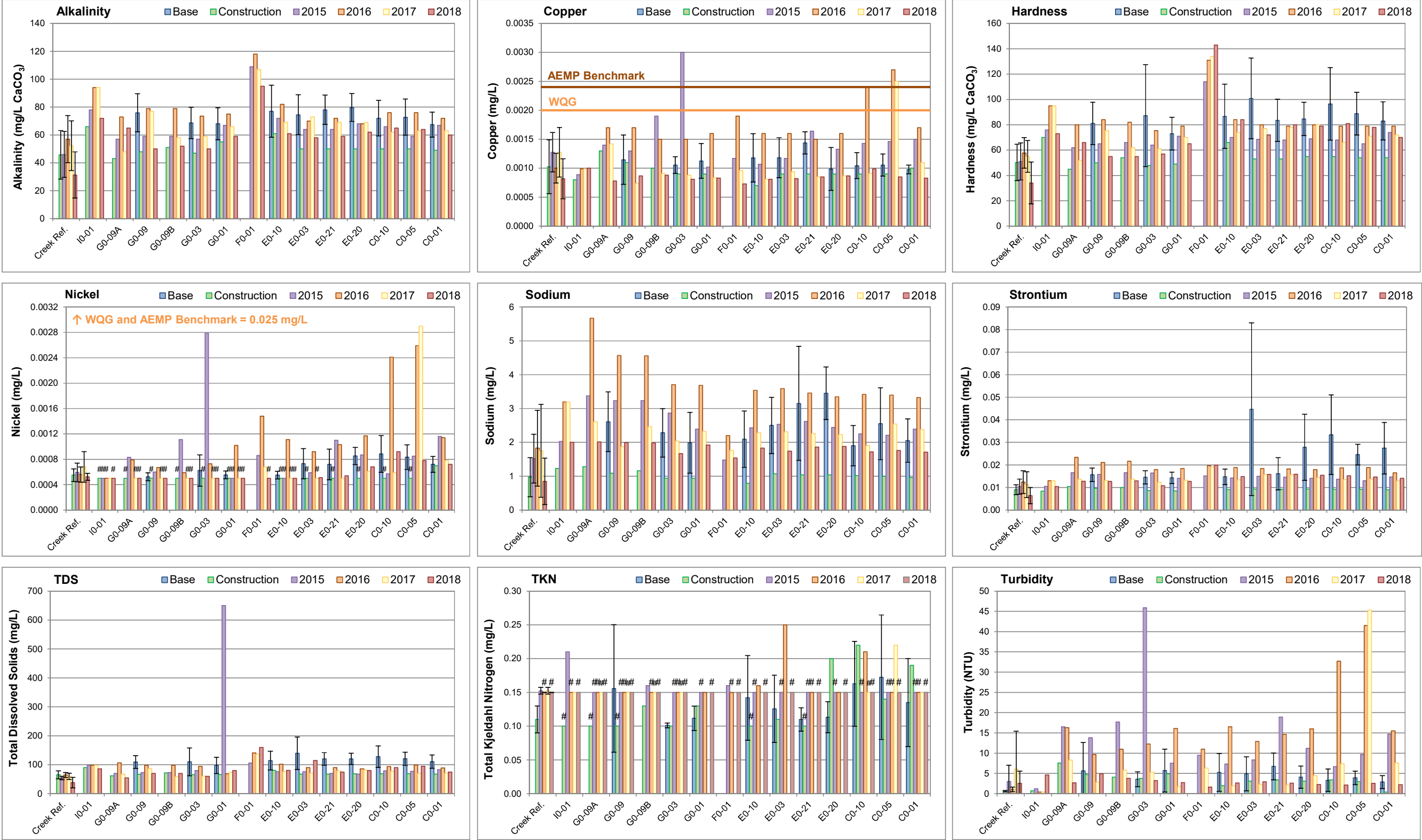


Figure C.22: Temporal Comparison of Water Chemistry at Mary River Stations for Mine Baseline (2005 to 2013), Construction (2014) and Operational (2015 to 2018) Periods in the Fall

Notes: Values represent mean $\pm$ SD. Creek reference includes the CLT-REF and MRY-REF series stations (mean $\pm$ SD; n = 4). Pound symbol (#) indicates parameter concentration is below the laboratory method detection limit. See Table 2.2 for information regarding Water Quality Guidelines (WQG) AEMP Benchmarks are specific to Mary River.

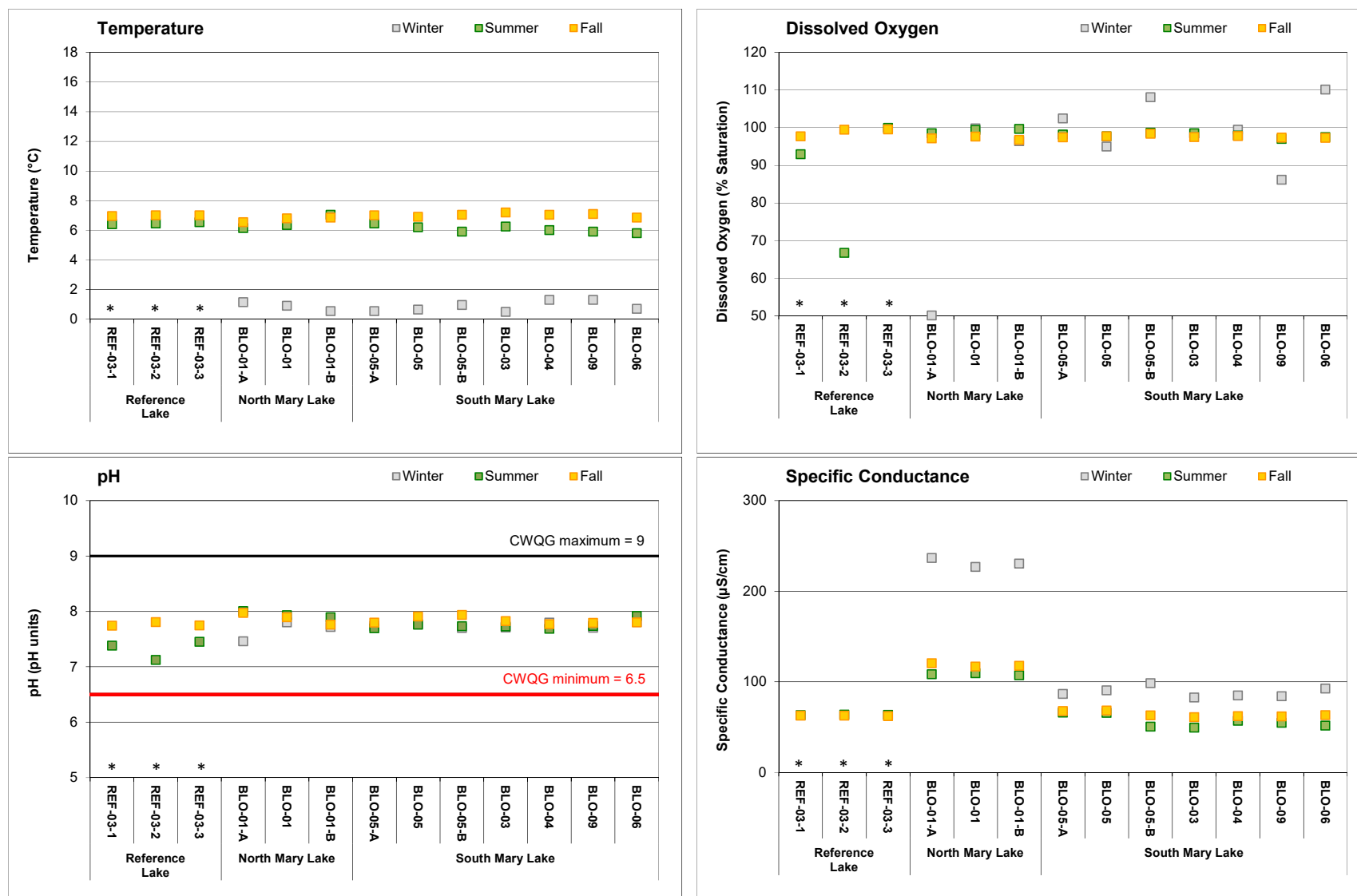


Figure C.23: Comparison of *In Situ* Water Quality Variables Measured at Mary Lake Water Quality Monitoring Stations in Winter, Summer, and Fall 2018, Mary River Project CREMP

Notes: Lake values represent mean of surface and bottom *in situ* water quality measurements. * Reference Lake 3 (REF-03) was not sampled in winter.

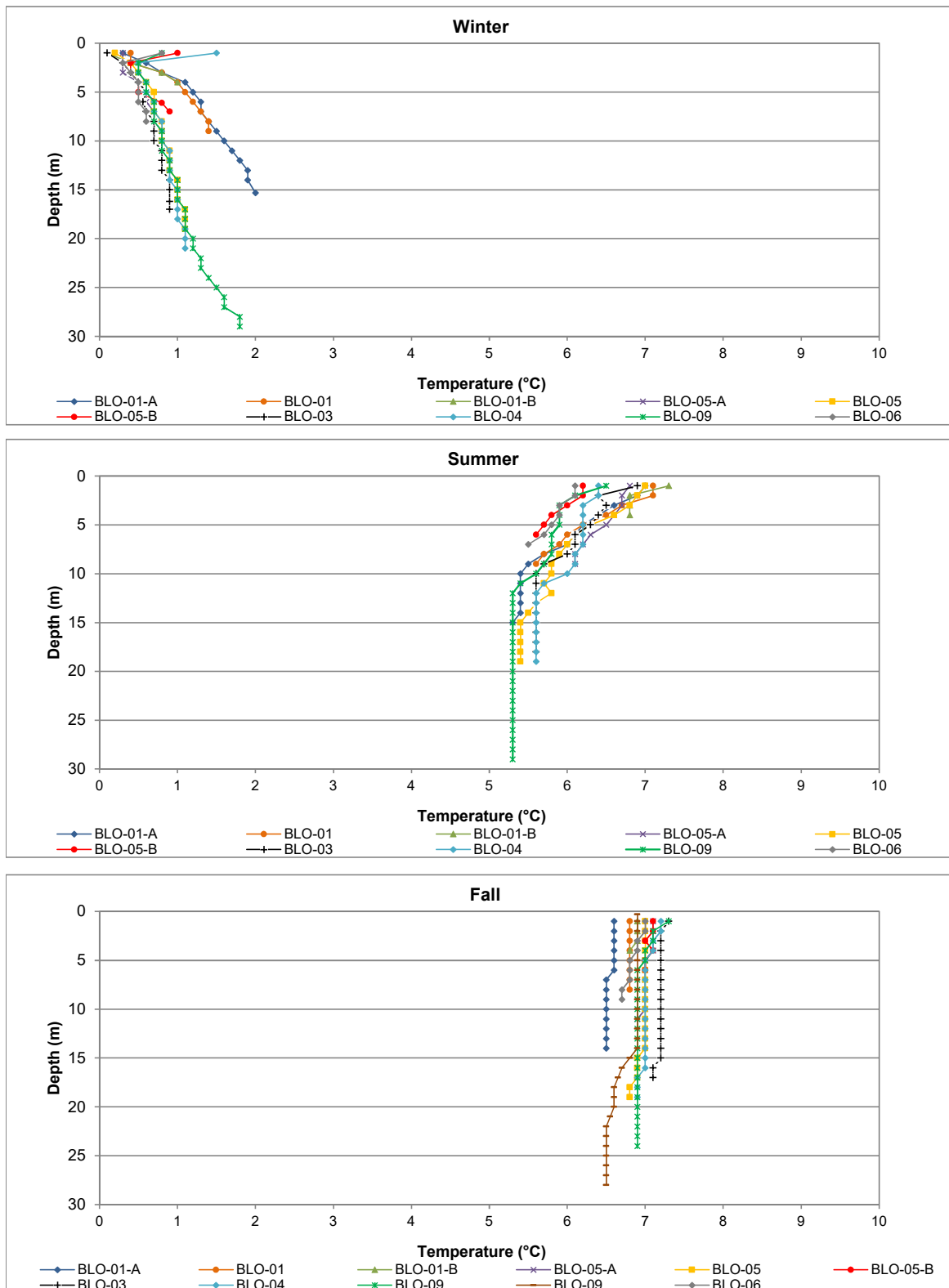


Figure C.24: Vertical Profiles of Temperature Measured at Mary Lake in Winter, Summer, and Fall, 2018

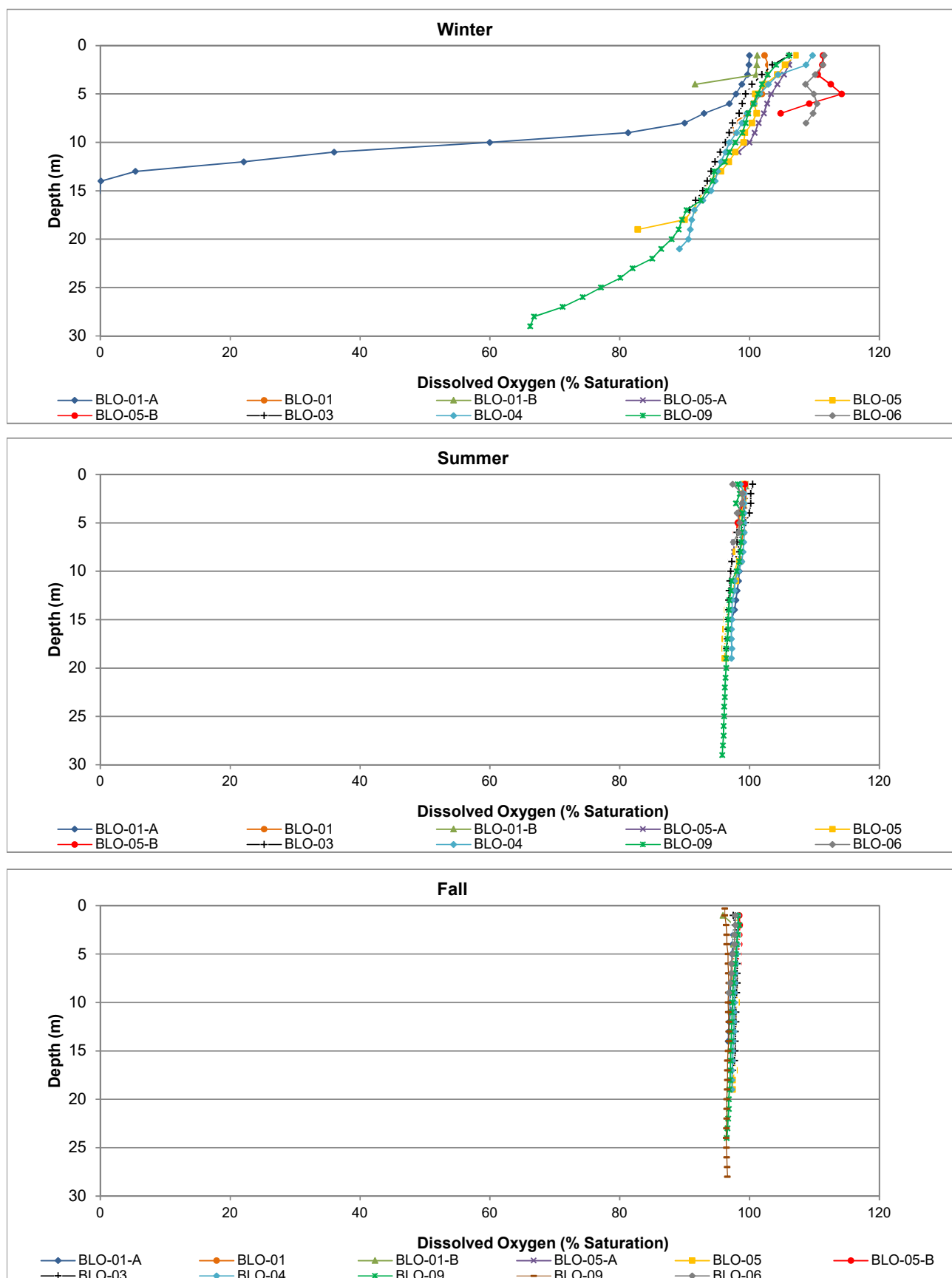


Figure C.25: Vertical Profiles of Dissolved Oxygen Measured at Mary Lake in Winter, Summer, and Fall, 2018

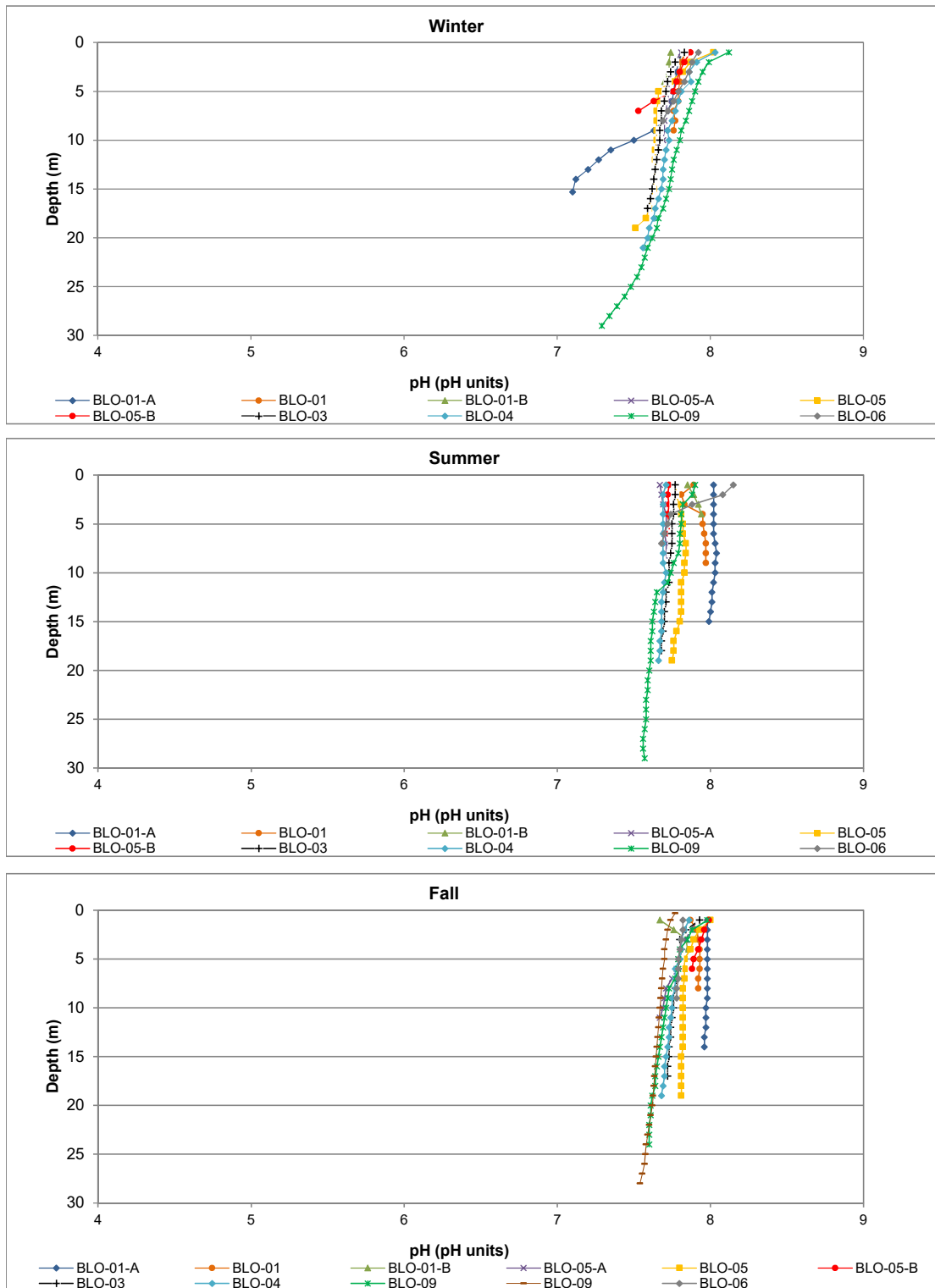


Figure C.26: Vertical Profiles of pH Measured at Mary Lake in Winter, Summer, and Fall, 2018

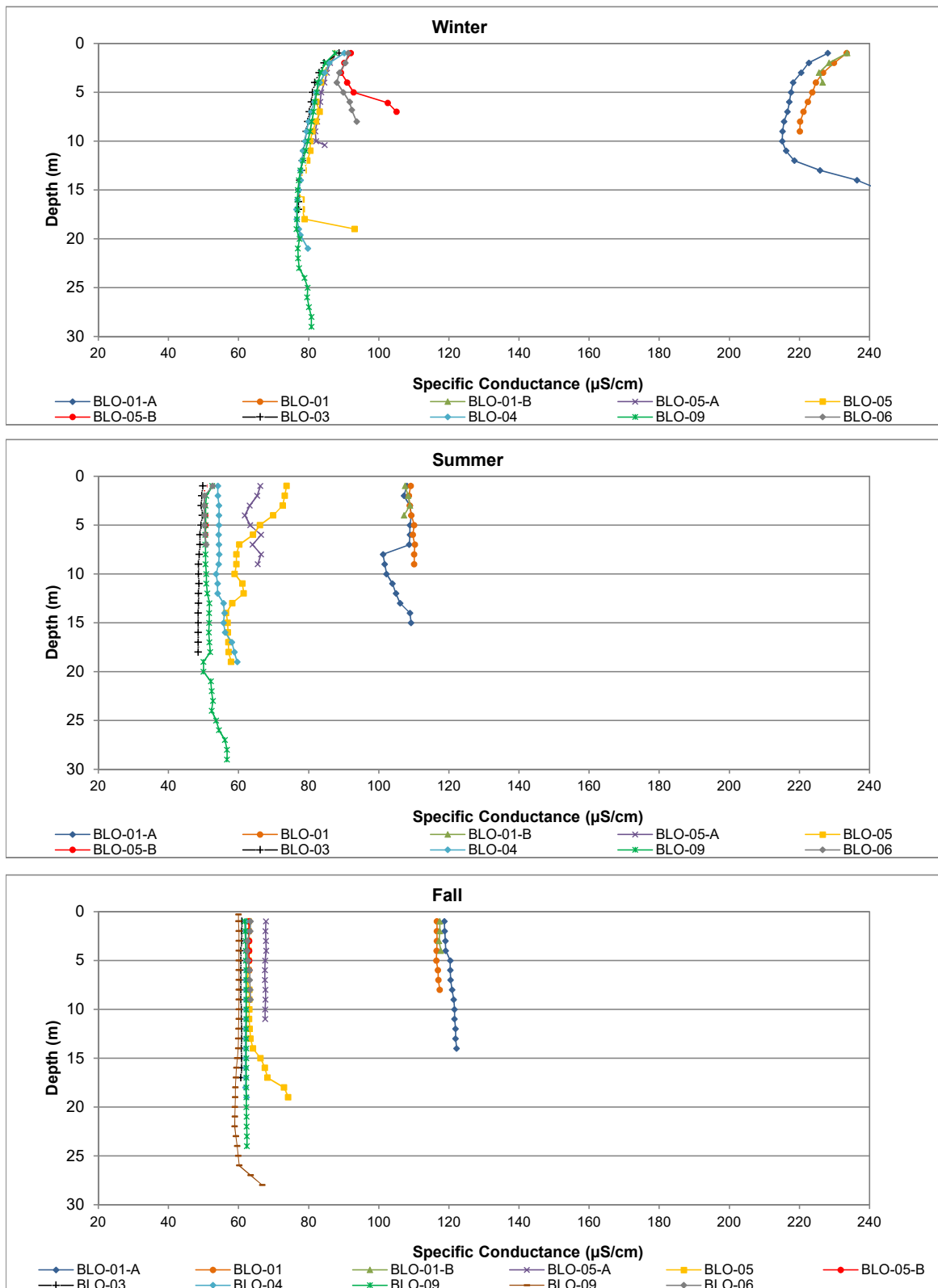


Figure C.27: Vertical Profiles of Specific Conductance Measured at Mary Lake in Winter, Summer, and Fall, 2018

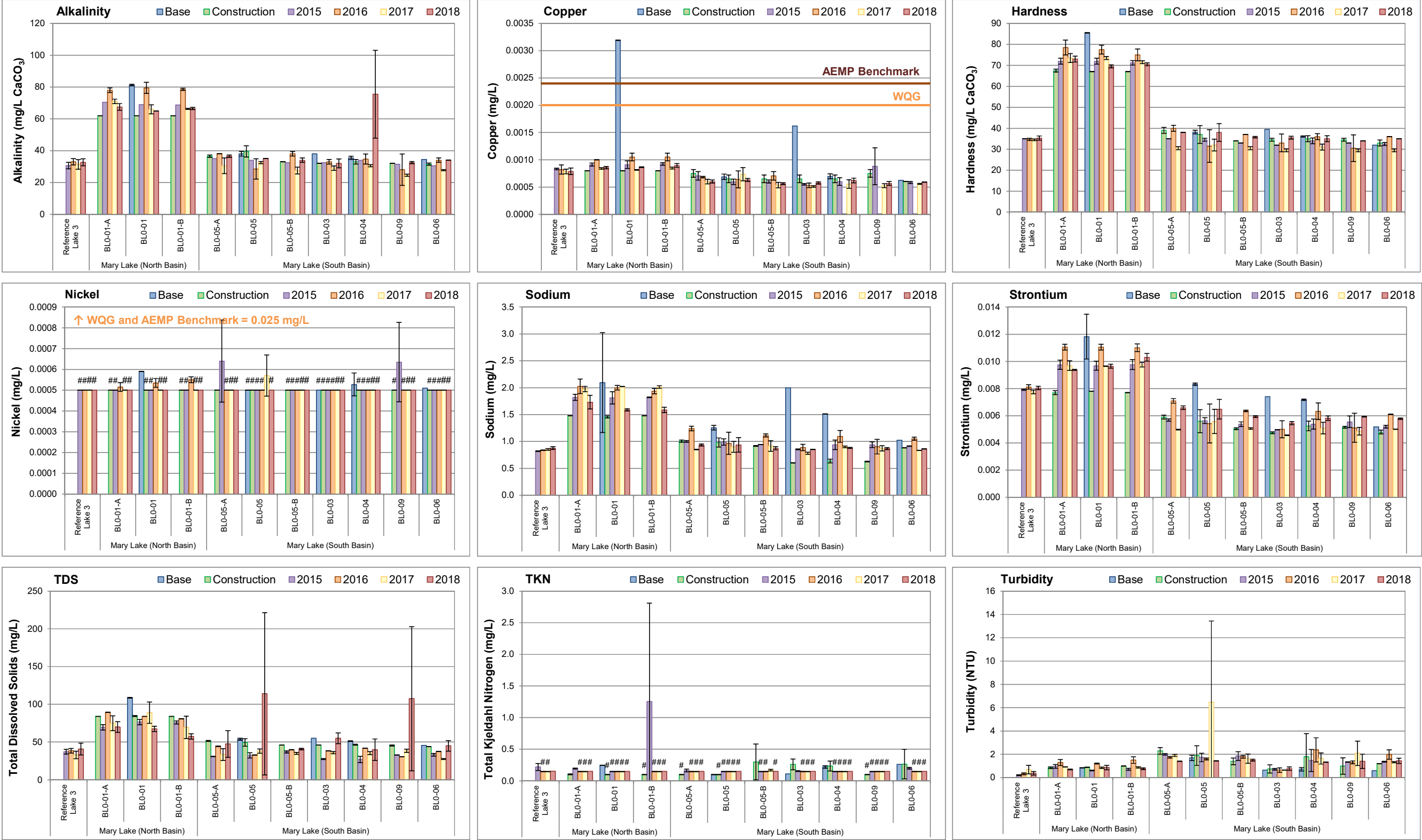


Figure C.28: Temporal Comparison of Water Chemistry at Mary Lake (BLO) for Mine Baseline (2005 to 2013), Construction (2014), and Operational (2015 to 2018) Periods during Fall

Notes: Values represent mean ± SD. Pound symbol (#) indicates parameter concentration is below the laboratory method detection limit. See Table 2.2 for information regarding Water Quality Guideline (WQG) criteria. AEMP Benchmarks are specific to Mary Lake.

Table C.1: *In Situ* Water Quality Data Collected from Lotic Environments for the Mary River Project CREMP, Spring 2018

Study Area		Station	Sampling Date	<i>In Situ</i> Water Quality Parameter				
				Temperature (°C)	Dissolved Oxygen (% saturation)	pH	Specific Conductance (µS/cm)	Turbidity (NTU)
Camp Lake System	Reference Creek Stations	CLT-REF4	30-Jun-18	6.3	97.6	7.46	31.3	0.79
		CLT-REF3	30-Jun-18	4.7	97.4	7.46	37.5	0.42
		MRY-REF3	30-Jun-18	4.2	98.1	7.69	18.7	5.38
		MRY-REF2	30-Jun-18	7.3	100.5	7.76	37.7	0.61
	CLT-1	L1-08	30-Jun-18	1.8	97.0	7.51	51.0	2.88
		L1-02	1-Jul-18	7.1	98.2	8.01	97.2	0.46
		L2-03	1-Jul-18	12.8	94.8	8.29	187.0	7.69
		L1-09	3-Jul-18	10.4	97.7	7.75	94.5	2.66
		L1-05	3-Jul-18	10.4	97.7	7.75	94.5	2.66
		L0-01	3-Jul-18	7.9	98.2	8.02	116.9	1.02
	CLT-2	K0-01	3-Jul-18	7.5	98.0	8.05	134.4	0.41
	Camp Lake	J0-01	30-Jun-18	6.0	102.5	7.37	126.9	1.42
Sheardown Lake System	SDL Tribs	D1-05	3-Jul-18	5.2	94.8	8.11	174.8	0.63
		D1-00	3-Jul-18	10.6	97.2	8.00	279.6	1.02
Mary River/Lake System	Tom River	I0-01	3-Jul-18	5.3	100.7	8.25	44.7	0.80
	Mary River	G0-09-A	1-Jul-18	4.4	93.7	7.07	21.3	15.45
		G0-09	1-Jul-18	5.4	94.8	7.23	23.4	7.37
		G0-09-B	1-Jul-18	5.9	16.2	7.17	27.7	4.63
		G0-03	1-Jul-18	6.8	97.0	7.19	30.3	4.67
		G0-01	30-Jun-18	3.4	98.7	7.90	25.1	3.26
		F0-01	30-Jun-18	4.8	97.0	7.56	62.2	1.55
		E0-10	1-Jul-18	6.0	98.5	7.50	29.7	8.24
		E0-03	30-Jun-18	8.0	99.2	7.34	29.0	4.05
		E0-20	30-Jun-18	8.2	98.7	7.42	30.2	3.63
		E0-21	30-Jun-18	8.2	98.5	7.46	29.0	3.81
		C0-10	30-Jun-18	8.3	101.3	7.38	29.2	2.89
		C0-05	30-Jun-18	5.7	101.1	7.40	39.0	3.07
		C0-01	30-Jun-18	6.0	102.0	7.42	35.6	3.56

Table C.2: *In Situ* Water Quality Data Collected from Lotic Environments for the Mary River Project CREMP, Summer 2018

Study Area		Station	Sampling Date	In Situ Water Quality Parameter					
				Temperature (°C)	Dissolved Oxygen (% saturation)	pH	Specific Conductance (µS/cm)	Turbidity (NTU)	
Camp Lake System	Reference Creek Stations	CLT-REF4	11-Aug-18	4.8	96.3	7.85	75.0	1.20	
		CLT-REF3	11-Aug-18	3.2	96.8	7.89	67.1	0.80	
		MRY-REF3	11-Aug-18	5.6	97.8	7.82	74.3	8.84	
		MRY-REF2	11-Aug-18	6.3	97.5	7.80	80.4	0.98	
	CLT-1	L1-08	10-Aug-18	2.4	96.6	7.98	96.9	0.80	
		L1-02	1-Aug-18	6.9	97.3	8.10	125.0	0.02	
		L2-03	1-Aug-18	11.5	not recorded	8.06	268.7	3.20	
		L1-09	1-Aug-18	6.6	98.7	8.12	150.5	0.37	
		L1-05	1-Aug-18	6.6	98.2	8.09	152.7	0.37	
		L0-01	1-Aug-18	6.3	97.9	8.10	154.5	0.28	
		CLT-2	K0-01	1-Aug-18	6.1	97.8	8.04	145.2	0.01
		Camp Lake	J0-01	10-Aug-18	6.6	97.6	7.98	120.7	1.07
Sheardown Lake System	SDL Tribs	D1-05	1-Aug-18	7.2	102.2	8.19	142.4	2.57	
		D1-00	1-Aug-18	9.2	98.3	8.06	275.6	0.82	
Mary River/Lake System	Tom River	I0-01	1-Aug-18	4.8	99.2	7.69	85.0	1.71	
	Mary River	G0-09-A	12-Aug-18	8.5	95.6	7.80	72.2	8.91	
		G0-09	12-Aug-18	8.4	96.1	7.71	75.3	8.11	
		G0-09-B	11-Aug-18	8.0	95.4	7.98	76.7	7.10	
		G0-03	11-Aug-18	8.2	96.1	7.85	78.9	5.53	
		G0-01	11-Aug-18	7.8	97.7	8.06	78.8	5.53	
		F0-01	11-Aug-18	6.1	96.8	8.09	247.2	2.37	
		E0-10	11-Aug-18	7.5	97.6	7.84	85.4	5.71	
		E0-03	11-Aug-18	6.9	97.8	7.88	93.9	6.68	
		E0-20	11-Aug-18	6.9	98.2	7.88	96.2	5.73	
		E0-21	11-Aug-18	6.7	98.3	7.88	93.3	6.31	
		C0-10	11-Aug-18	8.2	99.5	7.76	95.6	5.16	
		C0-05	11-Aug-18	7.9	100.8	7.83	95.8	5.26	
		C0-01	10-Aug-18	7.1	98.4	7.97	87.1	6.38	

Table C.3: *In Situ* Water Quality Data Collected From Lotic Environments for the Mary River Project CREMP, Fall 2018

Study Area		Station	Sampling Date	<i>In Situ</i> Water Quality Parameter				
				Temperature (°C)	Dissolved Oxygen (% saturation)	pH	Specific Conductance (µS/cm)	Turbidity (NTU)
Camp Lake System	Reference Creek Stations	CLT-REF4	24-Aug-18	5.9	95.3	8.06	92.0	0.4
		CLT-REF3	25-Aug-18	3.8	99.6	7.96	78.6	0.3
		MRY-REF3	24-Aug-18	6.6	96.5	7.56	67.2	5.8
		MRY-REF2	24-Aug-18	8.4	96.1	7.85	102.9	0.2
	CLT-1	L1-08	25-Aug-18	2.2	97.6	7.99	106.0	0.3
		L1-02	25-Aug-18	3.8	98.5	8.17	144.9	0.0
		L2-03	26-Aug-18	7.1	97.1	7.98	299.2	0.2
		L1-09	25-Aug-18	4.6	99.2	8.16	185.8	1.1
		L1-05	23-Aug-18	8.4	98.7	8.19	181.9	1.6
		L0-01	23-Aug-18	8.7	98.2	8.16	187.3	1.5
	CLT-2	K0-01	19-Aug-18	5.0	95.0	8.02	178.5	0.9
	Camp Lake	J0-01	27-Aug-18	6.5	98.0	8.08	118.6	0.4
Sheardown Lake System	SDL Tribs	D1-05	26-Aug-18	3.2	90.0	7.68	159.6	-4.4
		D1-00	26-Aug-18	6.4	98.0	7.71	365.8	-3.6
Mary River/Lake System	Tom River	I0-01	19-Aug-18	5.1	95.7	8.01	124.4	2.9
	Mary River	G0-09-A	27-Aug-18	4.8	96.2	8.20	106.6	3.2
		G0-09	25-Aug-18	7.8	96.0	8.13	95.4	4.2
		G0-09-B	25-Aug-18	8.4	96.9	8.17	99.4	4.0
		G0-03	25-Aug-18	8.0	96.9	8.08	101.6	3.2
		G0-01	27-Aug-18	3.2	98.9	8.14	113.2	2.7
		F0-01	25-Aug-18	6.4	97.7	8.39	243.7	3.1
		E0-10	27-Aug-18	3.6	99.8	8.16	155.7	2.5
		E0-03	26-Aug-18	5.3	96.1	8.01	127.4	-1.4
		E0-20	27-Aug-18	3.8	99.8	8.15	137.5	2.2
		E0-21	27-Aug-18	3.4	99.9	8.15	137.7	2.5
		C0-10	27-Aug-18	4.5	99.8	8.16	138.0	2.1
		C0-05	27-Aug-18	4.0	99.7	8.09	133.9	2.7
		C0-01	27-Aug-18	3.8	94.4	8.12	126.1	2.2

Table C.4: Dissolved Metal Concentrations at Reference Creek Monitoring Stations, Mary River Project CREMP, 2018

[illegible]

Table C.5: *In Situ* Water Quality Profile Data Collected at Reference Lake 3 Water Quality Monitoring Stations in Summer, Mary River Project CREMP, 2018

Depth (m)	Temperature (°C)			Dissolved Oxygen (mg/L)			Dissolved Oxygen (% Saturation)			pH (pH units)			Specific Conductance (µS/cm)		
	REF3-03	REF3-02	REF3-01	REF3-03	REF3-02	REF3-01	REF3-03	REF3-02	REF3-01	REF3-03	REF3-02	REF3-01	REF3-03	REF3-02	REF3-01
Date Collected	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18
1.0	6.8	6.7	6.8	12.3	12.2	12.3	100.4	99.9	100.5	7.40	7.55	7.47	63	64	63
2.0	6.6	6.7	6.8	12.3	12.2	12.3	100.5	100.1	100.5	7.44	7.55	7.46	63	64	64
3.0	6.6	6.7	6.7	12.3	12.3	12.3	100.6	100.2	100.5	7.45	7.54	7.46	63	64	64
4.0	6.6	6.7	6.8	12.3	12.3	12.3	100.5	100.2	100.6	7.45	7.55	7.46	63	64	64
5.0	6.6	6.7	6.7	12.3	12.3	12.3	100.4	100.3	100.4	7.47	7.55	7.46	63	64	64
6.0	6.6	6.7	6.6	12.3	12.3	12.3	100.4	100.4	100.2	7.48	7.56	7.46	63	64	64
7.0	6.6	6.6	6.5	12.3	12.3	12.3	100.4	100.3	100.1	7.49	7.57	7.45	63	64	64
8.0	6.5	6.6	6.5	12.3	12.3	12.3	100.3	100.1	100.0	7.49	7.57	7.45	63	64	64
9.0	6.5	6.5	6.4	12.3	12.3	12.3	100.3	100.0	99.8	7.50	7.57	7.45	63	64	64
10.0	6.5	6.4	6.3	12.3	12.3	12.3	100.2	99.8	99.7	7.50	7.58	7.44	63	64	64
11.0	6.4	6.4	6.3	12.3	12.3	12.3	100.1	99.7	99.6	7.51	7.57	7.44	63	64	64
12.0	6.4	6.3	6.3	12.3	12.3	12.3	100.0	99.6	99.6	7.51	7.57	7.44	63	64	64
13.0	6.4	6.3	6.3	12.3	12.3	12.3	99.9	9.5	99.5	7.52	7.57	7.44	63	64	64
14.0	6.4	6.3	6.3	12.3	12.3	12.3	99.8	99.4	99.5	7.53	7.57	7.43	63	64	64
15.0	6.4	6.3	6.3	12.3	12.3	12.3	99.6	99.3	99.4	7.53	7.56	7.43	63	64	64
16.0	6.3	6.3		12.3	12.3		99.6	99.3		7.53	7.56		63	64	
17.0	6.3	6.3		12.3	12.3		99.6	99.3		7.53	7.56		63	64	
18.0	6.3	6.3		12.3	12.3		99.5	99.3		7.53	7.56		63	64	
19.0	6.3	6.3		12.3	12.3		99.5	99.2		7.53	7.56		63	64	
20.0	6.3	6.3		12.3	12.3		99.4	99.2		7.54	7.55		63	64	
21.0	6.3	6.3		12.3	12.2		99.3	99.1		7.53	7.55		63	64	
22.0	6.3	6.3		12.3	12.2		99.2	99.0		7.53	7.54		63	64	
23.0	6.2	6.3		12.3	12.2		99.1	98.8		7.53	7.53		63	64	
24.0	6.2	6.2		12.3	12.2		98.9	98.7		7.53	7.51		63	64	
25.0	6.2	6.2		12.2	12.2		98.8	98.7		7.53	7.51		63	64	
26.0	6.2*	6.2		12.2*	12.2		98.8*	98.6		7.52*	7.51		63	64	
27.0	6.2	6.2		12.23	12.2		98.6	98.4		7.53	7.50		63	64	
28.0	6.2	6.2		12.22	12.2		98.6	98.3		7.53	7.49		63	64	
29.0	6.1	6.2		12.22	12.2		98.5	98.2		7.54	7.49		63	64	
30.0	6.1	6.2		12.21	12.0		98.5	97.1		7.52	7.49		63	64	
31.0	6.1	6.2		12.20	9.0		98.3	73.0		7.52	7.17		63	64	
32.0	6.1	6.1		12.19	8.2		98.1	67.1		7.52	7.11		63	64	
33.0	6.1	6.0		12.19	7.8		98.1	63.1		7.51	7.08		63	64	
34.0	6.1	6.1		12.18	7.6		98.1	61.2		7.51	7.04		63	64	
35.0	6.0	6.2		12.17	6.6		97.9	53.1		7.50	6.93		63	64	
36.0	6.0	6.2		12.18	6.3		97.8	50.6		7.50	6.90		63	64	
37.0	6.0	6.2		12.05	5.9		96.7	48.1		7.49	6.88		63	64	
38.0	6.0	6.2		11.64	5.8		94.3	46.6		7.50	6.86		63	64	
39.0	6.0	6.2		11.05	5.5		88.9	44.7		7.41	6.83		63	64	
40.0	6.0	6.2		10.81	5.1		87.2	41.6		7.38	6.80		63	64	
41.0	6.0	6.2		10.58	4.18		85.5	33.6		7.36	6.70*		63	64	

Note: Total depth at stations REF3-03, REF3-02, and REF3-01 was >41, >41, and 15.7 m, respectively, at the time of summer sampling.

Table C.6: In Situ Water Quality Profile Data Collected at Reference Lake 3 Water Quality Monitoring Stations in Fall, Mary River Project CREMP, 2018

Depth (m)	Temperature (°C)				Dissolved Oxygen (mg/L)				Dissolved Oxygen (% Saturation)				pH (pH units)				Specific Conductance (µS/cm)			
	REF3-01	REF3-02	REF3-03	REF3-03	REF3-01	REF3-02	REF3-03	REF3-03	REF3-01	REF3-02	REF3-03	REF3-03	REF3-01	REF3-02	REF3-03	REF3-03	REF3-01	REF3-02	REF3-03	REF3-03
Date Collected	27-Aug-18	27-Aug-18	27-Aug-18	24-Aug-18	27-Aug-18	27-Aug-18	27-Aug-18	24-Aug-18	27-Aug-18	27-Aug-18	27-Aug-18	24-Aug-18	27-Aug-18	27-Aug-18	27-Aug-18	24-Aug-18	27-Aug-18	27-Aug-18	27-Aug-18	24-Aug-18
surface				7.1				11.89				98.20				7.70				62
1.0	6.9			7.1	11.72			11.91	96.5			98.30	7.78			7.65	62.5			62
2.0	7.0	7.0	7.0	7.1	11.72	12.16	12.20	11.92	96.4	100.2	100.7	98.40	7.78	7.86	7.80	7.62	62.5	63	62	62
3.0	7.0				11.76				96.8				7.76				62.5			
4.0	7.0	7.0	7.0	7.1	11.79	12.12	12.06	11.90	97.0	99.8	99.4	98.30	7.75	7.84	7.79	7.61	62.5	63	62	62
5.0	7.0				11.82				97.3				7.74				62.5			
6.0	7.0	7.0	7.0	7.1	11.87	12.11	12.03	11.90	97.7	99.8	99.1	98.20	7.73	7.83	7.77	7.61	62.5	63	62	62
7.0	7.0				11.96				98.4				7.73				62.5			
8.0	7.0	7.0	7.0	7.1	12.01	12.11	12.02	11.89	98.8	99.7	99.1	98.20	7.73	7.81	7.75	7.61	62.5	63	62	62
9.0	6.9				12.04				99.0				7.73				62.5			
10.0	6.9	7.0	7.0	7.1	12.04	12.09	12.02	11.84	99.0	99.5	99.0	98.10	7.72	7.80	7.75	7.61	63	63	62	62
11.0	6.9				12.04				98.8				7.71				63			
12.0	6.9	7.0	7.0	7.1	12.04	12.07	12.01	11.87	98.8	99.4	99.0	98.00	7.71	7.79	7.73	7.59	63	63	62	62
13.0	6.9								98.8				7.71				63			
14.0	6.9	7.0	7.0	7.1	12.05	12.06	12.01	11.86	98.9	99.2	98.9	98.00	7.71	7.79	7.72	7.59	63	63	62	62
15.0	6.9				12.06				98.9				7.70				63			
16.0		7.0	7.0	7.1		12.05	12.00	11.86		99.1	98.9	97.90		7.78	7.72	7.59		63	62	62
17.0																				
18.0		7.0	7.0	7.1		12.03	12.00	11.85		99.1	98.9	97.80		7.77	7.71	7.59		63	62	62
19.0																				
20.0		7.0	7.0	7.1		12.02	11.99	11.84		98.9	98.8	97.80		7.77	7.70	7.58		63	62	62
21.0																				
22.0		7.0	7.0	7.1		12.00	11.99	11.83		98.8	98.8	97.70		7.77	7.70	7.58		63	62	62
23.0																				
24.0		7.0	7.0	7.1		12.00	11.98	11.82		98.8	98.7	97.60		7.76	7.70	7.58		63	62	62
25.0																				
26.0		7.0	7.0	7.1		11.99	11.97	11.82		98.7	98.6	97.60		7.76	7.69	7.57		63	62	62
27.0																				
28.0		7.0	7.0	7.1		11.98	11.96	11.80		98.7	98.5	97.50		7.75	7.68	7.58		63	62	62
29.0																				
30.0			7.0	7.1			11.96	11.80			98.4	97.40			7.69	7.57			62	62
31.0																				
32.0			7.0				11.95				98.3				7.69				62	
33.0																				
34.0			7.0				11.94				98.3				7.69				62	

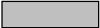
Notes: 27-Aug-18 sampling was conducted by Baffinland. 24-Aug-18 sampling was conducted by Minnow. Total depths at stations REF3-01, REF3-02, and REF3-03 were 16.1, 30, and 35 m, respectively, at the time of fall sampling.

Table C.7: Sampling Depth, Water Clarity Measures, and Surface and Bottom *In Situ* Water Quality Measures Collected at Reference Lake 3 Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2018

Replicate ID	Date Sampled	Station Depth (m)	Secchi Depth (m)	Colour/ Clarity	Depth sampled	Temperature (°C)	Dissolved Oxygen		pH (pH units)	Specific Conductance (µS/cm)
							(mg/L)	(% sat.)		
REF 03-1	24-Aug-18	10.5	9.1	clear/colorless	surface	7.00	11.26	92.7	7.57	62.4
					bottom	6.90	11.21	92.4	7.48	64.3
REF 03-2	24-Aug-18	9.1	8.1	clear/colorless	surface	7.10	11.74	96.8	7.77	62.4
					bottom	7.10	11.78	97.1	7.65	62.4
REF 03-3	23-Aug-18	9.8	-	clear/colorless	surface	-	-	-	-	-
					bottom	-	-	-	-	-
REF 03-4	24-Aug-18	8.4	8.5	clear/colorless	surface	7.10	11.52	95.1	7.64	62.3
					bottom	7.10	11.75	96.9	7.60	62.3
REF 03-5	24-Aug-18	11.2	8.3	clear/colorless	surface	7.10	12.12	100.3	7.70	62.3
					bottom	7.10	11.68	96.4	7.41	62.3
REF 03-6	24-Aug-18	22.5	8.8	clear/colorless	surface	7.00	11.60	95.5	7.74	62.4
					bottom	7.00	11.68	96.1	7.58	62.4
REF 03-7	23-Aug-18	25.0	-	clear/colorless	surface	-	-	-	-	-
					bottom	-	-	-	-	-
REF 03-8	24-Aug-18	18.5	8.3	clear/colorless	surface	7.10	11.39	93.9	7.72	62.7
					bottom	7.10	10.85	90.4	7.63	62.8
REF 03-9	24-Aug-18	21.1	8.6	clear/colorless	surface	7.10	11.45	94.5	7.71	62.3
					bottom	7.10	11.63	96.1	7.62	62.3
REF 03-10	24-Aug-18	19.2	8.9	clear/colorless	surface	7.10	11.54	95.2	7.66	62.3
					bottom	7.10	11.64	95.9	7.67	62.3

Table C.8: Statistical Comparison of Bottom *In Situ* Water Quality Between Littoral and Profundal Stations of Reference Lake 3, Mary River Project CREMP, August 2018

Lake	Habitat Variable	Statistical Test Results			Summary Statistics						
		Significant Difference Between Areas?	P-value	Statistical Analysis ^a	Station Type	n	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Reference Lake 3	Secchi Depth (m)	NO	0.616	α	Littoral	4	8.5	0.5	0.2	8.1	9.1
					Profundal	4	8.6	0.3	0.1	8.3	8.9
	Temperature (°C)	NO	0.886	γ	Littoral	4	7.1	0.1	0.0	6.9	7.1
					Profundal	4	7.1	0.0	0.0	7.0	7.1
	Dissolved Oxygen (mg/L)	NO	0.200	γ	Littoral	4	11.6	0.3	0.1	11.2	11.8
					Profundal	4	11.5	0.4	0.2	10.9	11.7
	Dissolved Oxygen (% saturation)	NO	0.200	γ	Littoral	4	95.7	2.2	1.1	92.4	97.1
					Profundal	4	94.6	2.8	1.4	90.4	96.1
	pH (units)	NO	0.201	η	Littoral	4	7.54	0.11	0.05	7.41	7.65
					Profundal	4	7.63	0.04	0.02	7.58	7.67
	Specific Conductance (umho/cm)	NO	0.886	γ	Littoral	4	62.8	1.0	0.5	62.3	64.3
					Profundal	4	62.5	0.2	0.1	62.3	62.8

 Highlighted values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log-transformed, single factor ANOVA test conducted; γ - data untransformed, Mann-Whitney U-test conducted; η - data untransformed, t-test assuming unequal variance conducted; δ - data log-transformed, t-test assuming unequal variance conducted.

Table C.9: Dissolved Metal Concentrations at Reference Lake 3 Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Summer Sampling Event						Fall Sampling Event					
			REF3-01	REF3-01	REF3-02	REF3-02	REF3-03	REF3-03	REF3-01	REF3-01	REF3-02	REF3-02	REF3-03	REF3-03
			bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
			12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	27-Aug-18	27-Aug-18	27-Aug-18	27-Aug-18	27-Aug-18	27-Aug-18
Dissolved Metals	Aluminum (Al)	mg/L	0.00305	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0121	<0.0030	0.0035	0.0056
	Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.00683	0.00685	0.00654	0.00685	0.00644	0.00689	0.00649	0.00635	0.00661	0.00641	0.0066	0.0068
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	6.99	6.97	6.91	7.27	6.80	7.10	6.99	6.9	7.04	7.24	7.16	7.16
	Chromium (Cr)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.00078	0.00075	0.00077	0.00078	0.00081	0.00080	0.00072	0.00073	0.00081	0.00071	0.00072	0.00074
	Iron (Fe)	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	4.54	4.37	4.34	4.46	4.51	4.63	4.08	4.12	4.12	4.15	4.08	4.17
	Manganese (Mn)	mg/L	0.000142	0.000164	0.000126	0.000163	0.000103	0.000223	0.000125	0.000142	0.0004	0.000135	0.00016	0.000297
	Mercury (Hg)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.000119	0.000129	0.000129	0.000123	0.000120	0.000125	0.000139	0.000133	0.000138	0.000133	0.000151	0.00013
	Nickel (Ni)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Potassium (K)	mg/L	0.94	0.94	0.94	0.94	0.94	0.95	0.84	0.84	0.85	0.84	0.84	0.86
	Selenium (Se)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	0.43	0.43	0.44	0.42	0.43	0.42	0.4	0.4	0.43	0.4	0.41	0.41
	Silver (Ag)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	0.888	0.867	0.874	0.887	0.877	0.894	0.873	0.862	0.891	0.872	0.84	0.906
	Strontium (Sr)	mg/L	0.00762	0.00767	0.00768	0.00802	0.00746	0.00786	0.00787	0.00783	0.00783	0.00815	0.00824	0.00816
	Thallium (Tl)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.000231	0.000238	0.000232	0.000247	0.000232	0.000245	0.00025	0.000264	0.00027	0.000249	0.000251	0.000262
Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	

Table C.10: Average Relative Percent Difference (RPD) Values between Water Chemistry Samples Taken at the Top and Bottom of the Water Column at Lake Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Reference Lake		Camp Lake			Sheardown Lake Northwest			Sheardown Lake Southeast			Mary Lake North Basin			Mary Lake South Basin		
		Summer	Fall	Winter	Summer	Fall	Winter	Summer	Fall	Winter	Summer	Fall	Winter	Summer	Fall	Winter	Summer	Fall
Conventional ^b	Conductivity (lab)	1.0	0.3	4.5	0.3	0.6	6	2	1	2.9	1.3	0.8	1.8	0.5	4.1	6.6	7.7	1.1
	pH (lab)	0.5	0.3	0.7	1.2	0.2	1.5	1.0	0.4	0.3	0.3	0.3	1.2	1.4	0.3	0.6	0.7	0.4
	Hardness (as CaCO ₃)	3.7	0	7.1	0.8	2.2	5.7	3.0	1.2	5.2	2.4	0.9	3.1	0.6	1.9	7.8	7.8	3.7
	Total Suspended Solids (TSS)	0	0	0	0	0	0	0	3.0	0	3.6	0	0	0	0	0	2.6	0
	Total Dissolved Solids (TDS)	9.0	7.1	19	11	9.7	7.3	16	9.7	9.2	14	27	5.0	23	10	10	17	58
	Turbidity	6.5	22	26	40	21	20	16	4.6	16	18	7.7	41	4.1	17	36	23	17
	Alkalinity (as CaCO ₃)	4.3	7.1	8.7	15	2.7	6.1	4.2	1.6	5.9	20	4.7	2.7	2.8	2.0	7.9	6.8	11
Nutrients and Organics	Total Ammonia	21	65	56	20	11	27	9.3	35	55	9.2	31	0	0	3.2	5.7	0	42
	Nitrate	0	0	21	0	5.7	9.1	34	1.4	5.8	0	1.6	29	58	0	16	2.0	20
	Nitrite	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0
	Total Kjeldahl Nitrogen (TKN)	0	10	26	0	17	32	0	1.1	5.6	0	0	0	0	0	0.9	8.2	0
	Dissolved Organic Carbon	1.2	0.6	4.6	3.4	7.1	10	4.1	3.4	8.1	3.1	2.5	1.5	9.0	1.6	4.7	2.4	1.6
	Total Organic Carbon	38	6.3	9.2	4.9	2.4	11	9.3	3.7	10	7.2	9.4	11	9.7	2.7	7.0	5.5	12
	Total Phosphorus	29	29	65	42	11	19	16	31	43	19	32	95	38	33	35	12	31
	Phenols	37	8.7	49	44	12	1.6	65	20	0	45	15	46	41	3.2	11	36	16
Anions	Bromide (Br)	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0
	Chloride (Cl)	1.8	0.5	4.0	1.1	0.6	5.7	32	0.5	4.1	4.4	0.4	3.5	8.1	1.9	7.0	5.0	1.0
	Sulphate (SO ₄)	0.5	0	4.3	2.3	0.8	5.5	17	0.6	6.0	2.5	0.5	12	23	1.2	7.7	17	2.5
Total Metals	Aluminum (Al)	23	47	0.7	28	34	0	19	30	58	8.0	40	0	15	13	32	21	20
	Antimony (Sb)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Arsenic (As)	0	0	0	0	0	0	0	0	0	0	1.9	13	0	0	0	0	0
	Barium (Ba)	67	3.7	5.4	2.2	5.1	7.0	5.9	8.1	4.1	2.9	12	6.9	1.6	2.3	7.7	10	4.9
	Cadmium (Cd)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Calcium (Ca)	1.9	2.1	6.0	1.0	2.5	4.3	4.0	2.1	7.0	1.3	2.8	2.3	0.7	2.5	7.6	9.6	4.1
	Chromium (Cr)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cobalt (Co)	0	0	0	0	0	0	0	4.3	0	0	13	0	0	0	0	0	0
	Copper (Cu)	12	2.6	10	18	11	10	11	20	6.8	7.6	16	9.6	6.5	3.4	9.3	24	5.9
	Iron (Fe)	0	0	0	0	0	0	0	20	1.6	9.2	49	35	0	0	0	24	14
	Lead (Pb)	0	0	0	0	0	0	0	18	0	8.9	35	0	0	0	4.8	19	9.1
	Magnesium (Mg)	3.4	2.3	8.4	1.4	3.0	6.9	3.5	4.8	4.9	1.3	6.7	3.1	4.5	2.8	8.2	7.6	4.9
	Manganese (Mn)	16	20	37	5.3	29	44	16	15	52	15	61	73	30	6.8	55	20	14
	Mercury (Hg)	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0
	Molybdenum (Mo)	4.3	4.6	8.0	2.0	12	5.2	9.4	6.6	8.6	6.0	7.4	11	3.4	7.5	8.8	16	12
	Nickel (Ni)	0	0	6.5	4.0	4.3	7.6	6.5	14	6.7	4.2	17	6.0	0	0	0	0	0
	Potassium (K)	2.6	2.7	7.6	0.6	3.6	7.8	3.0	5.0	5.4	0.9	8.2	4.1	0.8	1.2	9.0	6.5	3.0
	Selenium (Se)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Silicon (Si)	4.1	1.6	19	3.3	3.3	9.6	5.8	3.8	7.2	3.6	6.6	20	1.0	5.9	9.9	12	5.8
	Silver (Ag)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Sodium (Na)	1.2	4.6	9.3	1.1	3.9	8.3	5.3	2.4	5.9	0.9	6.5	3.9	4.0	5.6	7.5	6.6	4.9
	Strontium (Sr)	1.6	2.2	4.6	1.4	1.2	5.3	3.9	1.5	6.2	2.5	2.4	3.0	0.8	2.2	6.8	11	4.1
	Thallium (Tl)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Titanium (Ti)	0	0	0	0	0	0	0	0	0	0	1.9	0	0	0	0	0	0
	Uranium (U)	8.1	4.5	11	1.8	9.2	5.8	11	2.7	4.1	2.2	12	12	3.4	4.6	9.3	19	6.4
	Vanadium (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Zinc (Zn)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: Shaded values indicate RDP >30%

Table C.11: *In Situ* Water Quality Measurements Collected at Camp Lake Tributary 1 and Tributary 2 Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2018

Study Area	Station	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)	pH (pH units)	Specific Conductance (µS/cm)
Unnamed Reference Creek	REF-CRK-B1	6.0	12.27	98.5	7.98	88
	REF-CRK-B2	5.8	12.32	98.6	7.89	85
	REF-CRK-B3	5.8	12.34	98.6	7.98	89
	REF-CRK-B4	5.5	12.39	98.3	7.99	89
	REF-CRK-B5	5.4	12.42	98.3	7.92	88
Camp Lake Tributary 1 Upstream	CLT-1-US-B1	5.0	13.11	101.8	6.92	182
	CLT-1-US-B2	5.1	13.20	102.0	6.94	179
	CLT-1-US-B3	5.2	13.08	101.4	6.88	178
	CLT-1-US-B4	5.0	13.56	106.8	6.99	177
	CLT-1-US-B5	5.1	13.49	105.4	6.91	176
Camp Lake Tributary 1 Downstream	CLT-1-DS-B1	5.1	13.36	104.9	7.02	249
	CLT-1-DS-B2	10.4	12.07	108.6	6.80	243
	CLT-1-DS-B3	10.6	11.91	107.0	6.98	241
	CLT-1-DS-B4	10.6	11.91	107.1	7.25	231
	CLT-1-DS-B5	10.5	11.64	104.5	6.99	244
Camp Lake Tributary 2 Upstream	CLT-2-US-B1	5.0	14.14	111.0	6.34	132
	CLT-2-US-B2	5.1	13.97	109.7	6.30	137
	CLT-2-US-B3	4.7	-	-	-	136
	CLT-2-US-B4	5.9	10.68	107.0	6.64	194
	CLT-2-US-B5	5.9	12.52	100.6	6.70	193
Camp Lake Tributary 2 Downstream	CLT-2-DS-B1	5.8	14.01	112.0	6.23	187
	CLT-2-DS-B2	5.9	13.96	112.2	6.44	208
	CLT-2-DS-B3	5.8	13.96	111.9	6.39	210
	CLT-2-DS-B4	6.0	13.63	109.6	6.40	197
	CLT-2-DS-B5	6.3	13.87	112.4	6.49	220

Table C.12: *In Situ* Water Quality Summary Statistics for the Camp Lake Tributary Benthic Stations, Mary River Project CREMP, August 2018

Metric	Study Area	Mean	Standard Deviation	Standard Error	95% Confidence Interval		Minimum	Maximum
					Lower Bound	Upper Bound		
Water Temperature (°C)	Unnamed Reference Creek	5.7	0.2	0.1	5.4	6.0	5.4	6.0
	CLT1-US North Branch	5.1	0.1	0.0	5.0	5.2	5.0	5.2
	CLT1-DS Lower Main Stem	9.4	2.4	1.1	6.4	12.5	5.1	10.6
	CLT2-US Upstream	5.3	0.5	0.2	4.6	6.0	4.7	5.9
	CLT2-DS Downstream	6.0	0.2	0.1	5.7	6.2	5.8	6.3
Dissolved Oxygen (mg/L)	Unnamed Reference Creek	12.35	0.06	0.03	12.27	12.42	12.27	12.42
	CLT1-US North Branch	13.29	0.22	0.10	13.01	13.56	13.08	13.56
	CLT1-DS Lower Main Stem	12.18	0.68	0.30	11.34	13.02	11.64	13.36
	CLT2-US Upstream	12.83	1.61	0.80	10.27	15.38	10.68	14.14
	CLT2-DS Downstream	13.89	0.15	0.07	13.70	14.07	13.63	14.01
Dissolved Oxygen (% Saturation)	Unnamed Reference Creek	98.5	0.2	0.1	98.3	98.6	98.3	98.6
	CLT1-US North Branch	103.5	2.5	1.1	100.4	106.5	101.4	106.8
	CLT1-DS Lower Main Stem	106.4	1.7	0.8	104.3	108.5	104.5	108.6
	CLT2-US Upstream	107.1	4.6	2.3	99.7	114.4	100.6	111.0
	CLT2-DS Downstream	111.6	1.1	0.5	110.2	113.0	109.6	112.4
pH (units)	Unnamed Reference Creek	7.95	0.04	0.02	7.90	8.01	7.89	7.99
	CLT1-US North Branch	6.93	0.04	0.02	6.88	6.98	6.88	6.99
	CLT1-DS Lower Main Stem	7.01	0.16	0.07	6.81	7.21	6.80	7.25
	CLT2-US Upstream	6.50	0.20	0.10	6.17	6.82	6.30	6.70
	CLT2-DS Downstream	6.39	0.10	0.04	6.27	6.51	6.23	6.49
Specific Conductance (µS/cm)	Unnamed Reference Creek	88	1.6	0.7	86	90	85	89
	CLT1-US North Branch	178	2.3	1.0	176	181	176	182
	CLT1-DS Lower Main Stem	242	6.6	3.0	233	250	231	249
	CLT2-US Upstream	158	32.1	14.4	119	198	132	194
	CLT2-DS Downstream	204	12.7	5.7	189	220	187	220

Note: Five stations were sampled at each study area.

Table C.13: *In Situ* Water Quality Statistical Comparisons among Camp Lake Tributary 1 and Unnamed Reference Creek Study Areas, Mary River Project CREMP, August 2018

Metric	Overall 3-group Comparison ^a			Pair-wise, <i>post hoc</i> comparisons ^a				
	Significant Difference Among Areas?	P-value	Statistical Test ^b	(I) Area	(J) Area	Significant Difference Between 2 Areas?	P-value	Statistical Test
Water Temperature (°C)	YES	0.0117	γ	Unnamed Reference Creek	CLT1 North Branch	YES	0.0079	Mann-Whitney U-test
				Unnamed Reference Creek	CLT1 Lower Main Stem	NO	0.1508	
				CLT1 North Branch	CLT1 Lower Main Stem	YES	0.0317	
Dissolved Oxygen (mg/L)	YES	0.0184	γ	Unnamed Reference Creek	CLT1 North Branch	YES	0.0079	Mann-Whitney U-test
				Unnamed Reference Creek	CLT1 Lower Main Stem	NO	0.1508	
				CLT1 North Branch	CLT1 Lower Main Stem	YES	0.0556	
Dissolved Oxygen (% saturation)	YES	< 0.0001	α	Unnamed Reference Creek	CLT1 North Branch	YES	0.0299	Tamhane's
				Unnamed Reference Creek	CLT1 Lower Main Stem	YES	0.0013	
				CLT1 North Branch	CLT1 Lower Main Stem	NO	0.1766	
pH (units)	YES	< 0.0001	α	Unnamed Reference Creek	CLT1 North Branch	YES	0.0000	Tukey's HSD
				Unnamed Reference Creek	CLT1 Lower Main Stem	YES	0.0000	
				CLT1 North Branch	CLT1 Lower Main Stem	NO	0.4336	
Specific Conductance (µS/cm)	YES	< 0.0001	α	Unnamed Reference Creek	CLT1 North Branch	YES	0.0000	Tukey's HSD
				Unnamed Reference Creek	CLT1 Lower Main Stem	YES	0.0000	
				CLT1 North Branch	CLT1 Lower Main Stem	YES	0.0000	

Note: Shading indicates a significant difference for respective comparison (p-value ≤ 0.1).

^a *Post hoc* analysis of 1-way ANOVA among all areas protected for multiple comparisons.

^b Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log transformed, single factor ANOVA test conducted; γ - data untransformed, Kruskal Wallis H-test or Mann-Whitney U-test, as appropriate.

Table C.14: Water Chemistry at Lotic Camp Lake Tributary (CLT) Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Spring Sampling Event						
					L1-08	L1-02	L2-03	L1-09	L1-05	L0-01	K0-01
					30-Jun-18	03-Jul-18	01-Jul-18	01-Jul-18	03-Jul-18	03-Jul-18	03-Jul-18
Conventional	Conductivity (lab)	umho/cm	-	-	52	105	198	102	116	121	138
	pH (lab)	pH	6.5 - 9.0	-	7.65	7.95	8.06	8	7.97	8	8.01
	Hardness (as CaCO ₃)	mg/L	-	-	24	51	85	49	55	59	69
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	22.8	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	28	49	98	42	60	58	71
	Turbidity	NTU	-	-	2.8	0.7	8.5	2.3	2.2	2.4	0.9
	Alkalinity (as CaCO ₃)	mg/L	-	-	20	48	69	47	53	54	53
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	<0.020	<0.020	0.14	<0.020	<0.020	<0.020	<0.020
	Nitrate	mg/L	13	13	0.074	0.022	0.849	0.04	0.099	0.091	<0.020
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	0.0172	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	0.31	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	1.0	1.9	2.7	1.6	2.2	2.1	1.7
	Total Organic Carbon	mg/L	-	-	1.1	2.2	3.5	1.8	2.4	2.4	1.9
	Total Phosphorus	mg/L	0.030 ^α	-	0.0048	0.0036	0.0138	0.0043	0.0031	0.0062	0.0031
	Phenols	mg/L	0.004 ^α	-	0.0015	0.0016	0.0022	0.0036	<0.0010	0.0022	0.0014
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	0.6	0.9	11.1	2.2	2.3	2.4	1.0
	Sulphate (SO ₄)	mg/L	218 ^β	218	1.4	5.5	9.3	2.1	3.2	3.6	13.5
Total Metals	Aluminum (Al)	mg/L	0.100	0.179	0.023	0.011	0.280	0.021	0.043	0.040	0.012
	Antimony (Sb)	mg/L	0.020 ^α	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	0.00012	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0044	0.0072	0.011	0.0066	0.0072	0.0077	0.0077
	Beryllium (Be)	mg/L	0.011 ^α	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	0.016	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	5	11	18	10	11	12	13
	Chromium (Cr)	mg/L	0.0089	0.000856	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^α	0.004	<0.00010	<0.00010	0.00027	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0022	0.0013	0.0017	0.0017	0.0014	0.0016	0.0016	0.0009
	Iron (Fe)	mg/L	0.30	0.326	<0.030	<0.030	0.439	0.038	0.057	0.051	<0.030
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	0.000544	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	0.0022	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	-	-	2.9	6.4	10.2	5.8	6.7	7.2	8.6
	Manganesee (Mn)	mg/L	0.935 ^β	-	0.0008	0.0003	0.0327	0.0013	0.0026	0.0024	0.0005
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	0.00023	0.00027	0.00119	0.00035	0.00037	0.00040	0.00016
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	0.00053	0.00128	<0.00050	0.00062	0.00066	<0.00050
	Potassium (K)	mg/L	-	-	0.98	1.19	2.59	1.28	1.31	1.32	1.00
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.45	0.58	0.88	0.38	0.66	0.65	0.52
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	0.2	0.6	5.7	1.0	1.2	1.2	0.9
	Strontium (Sr)	mg/L	-	-	0.003	0.005	0.016	0.010	0.008	0.009	0.008
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.0002	0.0005	0.0042	0.0006	0.0009	0.0008	0.0005
	Vanadium (V)	mg/L	0.006 ^α	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	0.0031	<0.0030	<0.0030	<0.0030	<0.0030

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

^b AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to the Camp Lake Tributaries.

Indicates parameter concentration above applicable Water Quality Guideline.

BOLD

 Indicates parameter concentration above the AEMP benchmark.

Table C.14: Water Chemistry at Lotic Camp Lake Tributary (CLT) Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Summer Sampling Event						
					L1-08	L1-02	L2-03	L1-09	L1-05	L0-01	K0-01
					10-Aug-18	01-Aug-18	01-Aug-18	01-Aug-18	01-Aug-18	01-Aug-18	01-Aug-18
Conventional	Conductivity (lab)	umho/cm	-	-	109	130	301	171	175	177	161
	pH (lab)	pH	6.5 - 9.0	-	8.05	8.09	8.06	8.07	8.08	8.11	8.08
	Hardness (as CaCO ₃)	mg/L	-	-	58	75	127	85	85	88	87
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	2.4	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	54	75	170	80	90	97.5	90
	Turbidity	NTU	-	-	0.7	0.3	3.3	0.9	0.8	0.7	<0.10
	Alkalinity (as CaCO ₃)	mg/L	-	-	49	69	98	71	75	77.5	77
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	<0.020	<0.020	0.218	<0.020	<0.020	<0.020	<0.020
	Nitrate	mg/L	13	13	<0.020	0.021	3.500	0.468	0.468	0.412	<0.020
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	< 0.042	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	0.74	0.16000	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	2.2	2.2	3.9	2.7	3.3	2.7	2.9
	Total Organic Carbon	mg/L	-	-	2.5	2.8	4.7	3.3	3.4	3.3	2.8
	Total Phosphorus	mg/L	0.030 ^α	-	0.0057	<0.0030	0.0067	0.0031	0.0031	0.0037	0.0032
	Phenols	mg/L	0.004 ^α	-	0.0025	<0.0010	<0.0010	<0.0010	0.0016	0.0012	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	1.0	1.1	20.5	4.5	4.7	4.5	1.1
	Sulphate (SO ₄)	mg/L	218 ^β	218	3.9	4.3	11.3	5.2	5.3	5.4	11.1
Total Metals	Aluminum (Al)	mg/L	0.100	0.179	0.023	0.009	0.094	0.022	0.029	0.024	0.011
	Antimony (Sb)	mg/L	0.020 ^α	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	0.000	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0076	0.0097	0.0130	0.0096	0.0105	0.0102	0.0096
	Beryllium (Be)	mg/L	0.011 ^α	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	0.026	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	11	16	26	17	18	17	18
	Chromium (Cr)	mg/L	0.0089	0.000856	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^α	0.004	<0.00010	<0.00010	0.00026	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0022	0.0021	0.0018	0.0012	0.0017	0.0018	0.0017	0.0011
	Iron (Fe)	mg/L	0.30	0.326	<0.030	<0.030	0.233	0.043	0.058	0.043	<0.030
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	0.000118	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	0.0033	0.00150	0.00150	0.00155	0.00120
	Magnesium (Mg)	mg/L	-	-	6.4	8.5	16.3	10.1	10.6	10.9	10.1
	Manganesese (Mn)	mg/L	0.935 ^β	-	0.0005	0.0004	0.0278	0.0039	0.0046	0.0033	0.0005
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	0.00036	0.00029	0.00292	0.00077	0.00061	0.00072	0.00020
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	0.0005	0.00115	0.00066	0.00072	0.00072	<0.00050
	Potassium (K)	mg/L	-	-	1.54	1.47	3.56	1.73	1.77	1.75	1.17
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.74	0.79	1.06	0.84	0.89	0.89	0.73
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	0.4	0.8	12.8	2.6	2.8	2.6	1.0
	Strontium (Sr)	mg/L	-	-	0.007	0.008	0.025	0.013	0.015	0.013	0.011
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.0015	0.0012	0.0154	0.0030	0.0032	0.0027	0.0011
	Vanadium (V)	mg/L	0.006 ^α	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0040	<0.0030

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

^b AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to the Camp Lake Tributaries.

Indicates parameter concentration above applicable Water Quality Guideline.

BOLD

 Indicates parameter concentration above the AEMP benchmark.

Table C.14: Water Chemistry at Lotic Camp Lake Tributary (CLT) Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Fall Sampling Event						
					LI-08	L1-02	L2-03	L1-09	L0-05	L0-01	K0-01
					25-Aug-18	25-Aug-18	26-Aug-18	25-Aug-18	18-Aug-18	18-Aug-18	19-Aug-18
Conventional	Conductivity (lab)	umho/cm	-	-	107	171	350	218	204	218	195
	pH (lab)	pH	6.5 - 9.0	-	8.06	8.07	8.03	8.26	8.2	8.19	8.23
	Hardness (as CaCO ₃)	mg/L	-	-	62	89	146	103	104	108	108
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	3.2	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	60	76	195	110	90	105	124
	Turbidity	NTU	-	-	0.3	0.2	5.6	1.1	1.4	1.3	1.8
	Alkalinity (as CaCO ₃)	mg/L	-	-	58	83	122	92	92	90	104
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	0.045	<0.020	0.508	0.059	0.106	0.147	<0.020
	Nitrate	mg/L	13	13	0.025	0.022	3.53	0.625	0.629	0.571	<0.020
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	0.0224	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	0.66	<0.15	0.21	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	3.0	2.6	5.5	3.4	2.9	2.8	3.6
	Total Organic Carbon	mg/L	-	-	2.9	3.3	5.9	4.0	4.4	4.1	2.4
	Total Phosphorus	mg/L	0.030 ^α	-	<0.0030	<0.0030	0.0067	<0.0030	<0.0030	<0.0030	<0.0030
	Phenols	mg/L	0.004 ^α	-	<0.0010	0.0012	0.0045	<0.0010	<0.0010	<0.0010	0.0011
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	1.2	1.3	21.7	7.2	7.6	8.1	2.2
	Sulphate (SO ₄)	mg/L	218 ^β	218	4.0	3.8	13.8	5.6	6.2	6.2	4.5
Total Metals	Aluminum (Al)	mg/L	0.100	0.179	0.013	0.007	0.108	0.031	0.033	0.035	0.052
	Antimony (Sb)	mg/L	0.020 ^α	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	0.00012	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.00862	0.0103	0.0144	0.012	0.0118	0.01	0.0113
	Beryllium (Be)	mg/L	0.011 ^α	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	0.027	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00008	<0.000010	<0.000010	0.000035	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	12	19	29	23	21	21	22
	Chromium (Cr)	mg/L	0.0089	0.000856	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^α	0.004	<0.00010	<0.00010	0.00031	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0022	0.0022	0.0021	0.0014	0.0019	0.0019	0.0016	0.0015
	Iron (Fe)	mg/L	0.30	0.326	<0.030	<0.030	0.314	0.077	0.077	0.073	0.054
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	0.00021	<0.000050	0.000051	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	0.003	0.0015	0.0018	0.0017	0.0014
	Magnesium (Mg)	mg/L	-	-	7.5	10.8	18	12.3	12.3	11.1	13.2
	Manganese (Mn)	mg/L	0.935 ^β	-	0.0004	0.0004	0.0250	0.0053	0.0041	0.0032	0.0016
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	0.00078	0.00065	0.00300	0.00109	0.00089	0.00082	0.00032
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	0.00064	0.00139	0.00088	0.00087	0.00079	0.00063
	Potassium (K)	mg/L	-	-	1.81	1.71	3.26	2.04	2.20	1.89	1.54
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.79	0.79	1.23	0.91	0.92	0.9	0.95
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	0.5	1.2	13.8	4.0	4.1	3.4	1.7
	Strontium (Sr)	mg/L	-	-	0.008	0.009	0.029	0.020	0.019	0.018	0.013
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.0023	0.0018	0.0201	0.0052	0.0051	0.0042	0.0014
	Vanadium (V)	mg/L	0.006 ^α	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

^b AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to the Camp Lake Tributaries.

Indicates parameter concentration above applicable Water Quality Guideline.

BOLD

 Indicates parameter concentration above the AEMP benchmark.

Table C.15: Magnitude of Elevation in Seasonal Average Water Chemistry (Total Metal Concentration Data Provided) Between the Camp Lake Tributaries and Average Reference Creek Stations, Mary River Project CREMP, 2018

Variable	Spring				Summer				Fall			
	CLT1			CLT2	CLT1			CLT2	CLT1			CLT2
	North Branch	Upper Main Stem L2-03	Lower Main Stem	Station KO-01	North Branch	Upper Main Stem L2-03	Lower Main Stem	Station KO-01	North Branch	Upper Main Stem L2-03	Lower Main Stem	Station KO-01
Conductivity (lab)	2.4	6.2	3.5	4.3	1.6	4.0	2.3	2.2	1.4	3.6	2.2	2.0
Hardness (as CaCO ₃)	2.3	5.3	3.4	4.3	1.7	3.2	2.2	2.2	1.6	3.1	2.3	2.3
Total Suspended Solids (TSS)	0.7	8.5	0.7	0.7	1.0	1.2	1.0	1.0	1.0	1.6	1.0	1.0
Total Dissolved Solids (TDS)	2.6	6.5	3.6	4.7	1.4	3.6	1.9	1.9	1.3	3.7	1.9	2.3
Turbidity	0.9	4.2	1.1	0.4	0.2	1.0	0.2	0.0	0.1	2.3	0.5	0.7
Alkalinity (as CaCO ₃)	2.5	5.0	3.7	3.9	1.6	2.6	2.0	2.1	1.6	2.8	2.1	2.4
Total Ammonia	1.0	7.0	1.0	1.0	1.0	11	1.0	1.0	1.5	24	5.0	1.0
Nitrate	2.4	42	3.8	1.0	1.0	175	22	1.0	1.2	177	30	1.0
Nitrite	1.0	3.4	1.0	1.0	1.0	8.5	1.0	1.0	1.0	4.5	1.0	1.0
Total Kjeldahl Nitrogen (TKN)	1.0	2.1	1.0	1.0	1.0	4.9	1.0	1.0	1.0	4.4	1.1	1.0
Dissolved Organic Carbon	1.5	2.8	2.0	1.7	1.2	2.1	1.6	1.6	1.9	3.8	2.1	2.5
Total Organic Carbon	1.3	2.9	1.8	1.6	1.3	2.3	1.6	1.4	1.5	3.0	2.1	1.2
Total Phosphorus	0.9	2.9	0.9	0.6	0.8	1.2	0.6	0.6	0.9	1.9	0.9	0.9
Phenols	0.7	1.0	1.1	0.7	1.8	1.0	1.3	1.0	1.1	4.5	1.0	1.1
Bromide (Br)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Chloride (Cl)	1.2	18	3.8	1.7	1.0	21	4.6	1.1	0.8	13	4.7	1.3
Sulphate (SO ₄)	6.1	16	5.3	24	2.7	7.4	3.5	7.3	1.4	5.1	2.2	1.7
Aluminum (Al)	0.4	6.5	0.8	0.3	0.2	0.9	0.2	0.1	0.2	2.0	0.6	1.0
Antimony (Sb)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Arsenic (As)	1.0	1.2	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.2	1.0	1.0
Barium (Ba)	2.3	4.3	2.8	3.0	1.6	2.5	1.9	1.8	1.6	2.4	1.9	1.9
Beryllium (Be)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Bismuth (Bi)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Boron (B)	1.0	1.6	1.0	1.0	1.0	2.6	1.0	1.0	1.0	2.7	1.0	1.0
Cadmium (Cd)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.5	1.0	1.0
Calcium (Ca)	2.4	5.5	3.5	4.2	1.7	3.2	2.2	2.3	1.6	3.0	2.2	2.2
Chromium (Cr)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cobalt (Co)	1.0	2.7	1.0	1.0	1.0	2.6	1.0	1.0	1.0	3.1	1.0	1.0
Copper (Cu)	2.5	2.8	2.6	1.6	2.0	1.2	1.7	1.0	2.5	1.6	2.1	1.7
Iron (Fe)	0.6	9.0	1.0	0.6	0.4	3.0	0.6	0.4	0.7	6.8	1.6	1.2
Lead (Pb)	0.7	7.3	0.7	0.7	0.4	1.0	0.4	0.4	0.6	2.5	0.6	0.6
Lithium (Li)	1.0	2.2	1.0	1.0	1.0	3.3	1.5	1.2	1.0	3.0	1.7	1.4
Magnesium (Mg)	2.7	5.9	3.8	4.9	1.6	3.6	2.3	2.2	1.7	3.4	2.2	2.5
Manganese (Mn)	0.8	45	2.8	0.7	0.4	26	3.6	0.5	0.6	38	6.4	2.4
Mercury (Hg)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Molybdenum (Mo)	3.4	16	4.9	2.2	1.5	13	3.2	0.9	2.5	10	3.2	1.1
Nickel (Ni)	1.0	2.6	1.2	1.0	0.9	2.1	1.3	0.9	1.1	2.6	1.6	1.2
Potassium (K)	3.4	8.2	4.1	3.2	2.5	5.9	2.9	1.9	2.7	5.0	3.1	2.4
Selenium (Se)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Silicon (Si)	1.3	2.2	1.4	1.3	0.8	1.1	0.9	0.8	1.0	1.5	1.1	1.1
Silver (Ag)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sodium (Na)	1.1	15	3.0	2.3	0.6	14	2.8	1.1	0.7	11	3.1	1.4
Strontium (Sr)	1.5	6.0	3.4	2.8	1.0	3.5	1.9	1.5	0.9	3.1	2.0	1.3
Thallium (Tl)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Titanium (Ti)	1.0	1.2	1.0	1.0	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0
Uranium (U)	1.8	22	4.1	2.7	1.2	14	2.8	1.0	1.1	11	2.6	0.8
Vanadium (V)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Zinc (Zn)	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference value).

Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference value).

Denotes highly elevated concentration (mean concentration greater than 10 times higher than respective mean reference value).

Table C.16: Dissolved Metal Concentrations at Camp Lake Tributary Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Spring Sampling Event							Summer Sampling Event							Fall Sampling Event						
			L1-08	L1-02	L2-03	L1-09	L1-05	L0-01	K0-01	L1-08	L1-02	L2-03	L1-09	L1-05	L0-01	K0-01	LI-08	L1-02	L2-03	L1-09	L0-05	L0-01	K0-01
			30-Jun-18	03-Jul-18	01-Jul-18	01-Jul-18	03-Jul-18	03-Jul-18	03-Jul-18	10-Aug-18	01-Aug-18	01-Aug-18	01-Aug-18	01-Aug-18	01-Aug-18	01-Aug-18	01-Aug-18	25-Aug-18	25-Aug-18	26-Aug-18	25-Aug-18	18-Aug-18	18-Aug-18
Dissolved Metals	Aluminum (Al)	mg/L	0.0059	0.0062	0.0198	0.0065	0.0100	0.0094	0.0043	0.0082	0.0052	0.0067	0.0055	0.0079	0.0065	0.0044	0.0060	0.0046	0.0115	0.0051	0.0074	0.0071	0.0050
	Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.0043	0.0072	0.0088	0.0064	0.0072	0.0073	0.0078	0.0082	0.0094	0.0123	0.0096	0.0101	0.0100	0.0089	0.0091	0.0107	0.0137	0.0115	0.0118	0.0115	0.0100
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	<0.010	<0.010	0.016	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.025	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.026	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	4.73	10.20	17.8	9.93	11.10	11.90	13.80	11.20	14.70	25.00	17.00	16.70	17.30	17.50	12.50	18.00	29.00	21.10	21.00	21.60	21.70
	Chromium (Cr)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00021	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00023	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.00126	0.00159	0.00100	0.00129	0.00160	0.00154	0.00088	0.00227	0.00179	0.00102	0.00168	0.00170	0.00167	0.00106	0.00219	0.00207	0.00121	0.00186	0.00184	0.00183	0.00126
	Iron (Fe)	mg/L	<0.030	<0.030	0.053	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.077	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.085	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000151	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	<0.0010	<0.0010	0.0018	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0033	0.0014	0.0014	0.0014	0.0011	<0.0010	<0.0010	0.0027	0.0011	0.0018	0.0019	0.0015
	Magnesium (Mg)	mg/L	3.06	6.29	9.93	5.79	6.68	7.04	8.41	7.25	9.21	15.70	10.30	10.50	10.85	10.50	7.40	10.80	17.90	12.30	12.50	13.30	13.20
	Manganese (Mn)	mg/L	0.00025	0.00017	0.01720	0.00087	0.00170	0.00136	0.00030	0.00020	0.00022	0.02230	0.00339	0.00314	0.00240	0.00035	0.00030	0.00033	0.02150	0.00442	0.00322	0.00252	0.00071
	Mercury (Hg)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.00023	0.00029	0.00150	0.00034	0.00035	0.00036	0.00018	0.00037	0.00021	0.00315	0.00076	0.00074	0.00073	0.00024	0.00073	0.00066	0.00315	0.00109	0.00075	0.00082	0.00030
	Nickel (Ni)	mg/L	<0.00050	<0.00050	0.00077	<0.00050	0.00059	0.00063	<0.00050	<0.00050	0.00053	0.00095	0.00065	0.00068	0.00073	<0.00050	<0.00050	0.00063	0.0012	0.0008	0.0008	0.0009	0.00059
	Potassium (K)	mg/L	0.990	1.210	2.450	1.300	1.300	1.340	0.990	1.710	1.530	3.490	1.790	1.780	1.765	1.210	1.820	1.690	3.370	2.020	2.230	2.200	1.520
	Selenium (Se)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	0.43	0.55	0.44	0.36	0.57	0.58	0.49	0.77	0.78	0.88	0.81	0.86	0.86	0.74	0.75	0.78	0.97	0.86	0.89	0.93	0.87
	Silver (Ag)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	0.24	0.61	5.54	1.00	1.17	1.21	0.86	0.46	0.81	12.60	2.76	2.78	2.62	1.05	0.49	1.09	13.70	4.00	4.24	4.01	1.81
	Strontium (Sr)	mg/L	0.0026	0.0052	0.0156	0.0095	0.0082	0.0088	0.0076	0.0065	0.0074	0.0254	0.0130	0.0131	0.0129	0.0094	0.0083	0.0092	0.0289	0.0194	0.0185	0.0188	0.0125
	Thallium (Tl)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Uranium (U)	mg/L	0.00019	0.00046	0.00395	0.00055	0.00083	0.00080	0.00051	0.00142	0.00109	0.01520	0.00293	0.00287	0.00269	0.00099	0.00237	0.00175	0.01980	0.00505	0.00496	0.00450	0.00135	
Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	

Table C.17: Magnitude of Elevation in Seasonal Average Dissolved Metal Concentrations Between the Camp Lake Tributaries and Average Reference Creek Stations, Mary River Project CREMP, 2018

Variable	Spring				Summer				Fall			
	CLT1			CLT2	CLT1			CLT2	CLT1			CLT2
	North Branch	Upper Main Stem L2-03	Lower Main Stem	Station KO-01	North Branch	Upper Main Stem L2-03	Lower Main Stem	Station KO-01	North Branch	Upper Main Stem L2-03	Lower Main Stem	Station KO-01
Aluminum (Al)	0.4	0.6	0.7	0.3	0.2	0.2	0.2	0.1	0.2	0.5	0.3	0.2
Antimony (Sb)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Arsenic (As)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0
Barium (Ba)	2.6	1.8	3.2	3.5	1.8	2.6	2.1	1.8	1.8	2.5	2.1	1.8
Beryllium (Be)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Bismuth (Bi)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Boron (B)	1.0	1.6	1.0	1.0	1.0	2.5	1.0	1.0	1.0	2.6	1.0	1.0
Cadmium (Cd)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Calcium (Ca)	2.3	2.2	3.6	4.3	1.6	3.1	2.2	2.2	1.5	2.9	2.2	2.2
Chromium (Cr)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cobalt (Co)	1.0	1.0	1.0	1.0	1.0	2.1	1.0	1.0	1.0	2.3	1.0	1.0
Copper (Cu)	2.6	1.1	2.8	1.6	2.2	1.1	1.8	1.1	2.7	1.5	2.3	1.6
Iron (Fe)	1.0	1.6	1.0	1.0	0.9	2.4	0.9	0.9	1.0	2.8	1.0	1.0
Lead (Pb)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	1.0	1.0
Lithium (Li)	1.0	1.8	1.0	1.0	1.0	3.3	1.4	1.1	1.0	2.7	1.8	1.5
Magnesium (Mg)	2.7	2.1	3.9	4.9	1.7	3.3	2.3	2.2	1.7	3.4	2.5	2.5
Manganese (Mn)	0.8	52	5.2	1.2	0.6	68	8.2	1.1	1.1	75	10	2.5
Mercury (Hg)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Molybdenum (Mo)	3.4	6.2	4.6	2.3	1.2	13	3.1	1.0	2.4	11	2.9	1.0
Nickel (Ni)	1.0	1.5	1.2	1.0	1.0	1.8	1.3	1.0	1.1	2.3	1.7	1.1
Potassium (K)	3.6	4.1	4.4	3.3	2.7	5.8	2.9	2.0	2.8	5.4	3.5	2.4
Selenium (Se)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Silicon (Si)	1.4	0.5	1.5	1.4	1.0	1.1	1.1	0.9	1.0	1.3	1.2	1.2
Silver (Ag)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sodium (Na)	1.1	5.7	3.1	2.3	0.7	13	2.7	1.1	0.7	11	3.4	1.5
Strontium (Sr)	1.5	2.2	3.3	2.9	1.0	3.6	1.8	1.3	0.9	3.0	2.0	1.3
Thallium (Tl)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Titanium (Ti)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Uranium (U)	2.0	4.0	4.8	3.2	1.3	15	2.8	1.0	1.1	11	2.5	0.7
Vanadium (V)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Zinc (Zn)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference value).

Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference value).

Denotes highly elevated concentration (mean concentration greater than 10 times higher than respective mean reference value).

Table C.18: Magnitude of Elevation in Seasonal Average Dissolved Metal Concentrations at the Camp Lake Tributaries between 2018 and Mine Baseline (2005 to 2013) Periods

Variable	Spring				Summer				Fall			
	CLT1			CLT2	CLT1			CLT2	CLT1			CLT2
	North Branch	Upper Main Stem L2-03	Lower Main Stem	Station KO-01	North Branch	Upper Main Stem L2-03	Lower Main Stem	Station KO-01	North Branch	Upper Main Stem L2-03	Lower Main Stem	Station KO-01
Aluminum (Al)	0.8	6.3	1.2	0.8	1.4	1.0	1.6	0.9	1.3	4.3	2.5	1.4
Antimony (Sb)	0.5	1.0	1.0	0.6	0.7	1.0	1.0	0.6	0.7	1.0	1.0	0.6
Arsenic (As)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0
Barium (Ba)	1.8	1.9	1.8	1.4	1.3	1.4	1.1	1.1	1.0	0.8	0.8	0.9
Beryllium (Be)	0.3	5.0	5.0	0.4	0.5	2.1	2.1	0.4	0.5	2.1	2.1	0.4
Bismuth (Bi)	1.1	1.0	1.0	1.1	1.1	1.0	1.0	1.1	1.1	1.0	1.0	1.1
Boron (B)	0.5	1.6	1.0	0.6	0.6	2.5	1.0	1.0	1.0	2.6	1.0	1.0
Cadmium (Cd)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9
Calcium (Ca)	1.7	1.5	1.6	1.9	1.3	1.2	1.2	1.3	0.9	0.7	0.8	1.0
Chromium (Cr)	RDL	RDL	RDL	RDL	RDL	RDL	RDL	0.5	RDL	RDL	RDL	RDL
Cobalt (Co)	0.6	1.0	1.0	0.6	0.8	2.0	1.0	0.6	0.8	2.2	1.0	0.6
Copper (Cu)	1.5	1.6	1.5	1.1	1.2	1.2	1.1	1.1	1.3	1.7	1.1	0.5
Iron (Fe)	1.2	1.5	1.2	1.1	1.6	0.4	1.0	1.4	1.8	0.8	0.7	1.4
Lead (Pb)	0.5	1.0	1.0	0.6	0.7	1.0	1.0	0.6	0.7	3.0	1.0	0.6
Lithium (Li)	0.7	1.8	1.9	0.5	0.4	1.0	0.6	0.4	0.4	0.4	0.4	0.5
Magnesium (Mg)	1.7	1.5	1.6	1.9	1.3	1.3	1.3	1.3	0.9	0.9	0.9	1.0
Manganese (Mn)	0.2	6.1	0.5	0.1	0.7	1.8	1.4	0.5	0.8	1.5	0.8	0.6
Mercury (Hg)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0
Molybdenum (Mo)	1.5	10	2.4	1.2	0.7	15	1.7	0.8	1.0	12	1.4	0.7
Nickel (Ni)	0.8	1.0	0.8	0.2	0.9	0.9	1.2	0.2	0.9	1.0	1.0	0.3
Potassium (K)	1.8	3.1	1.9	1.7	1.3	3.6	1.4	1.2	1.0	2.2	1.2	1.1
Selenium (Se)	RDL	RDL	RDL	RDL	RDL	RDL	RDL	RDL	RDL	RDL	RDL	RDL
Silicon (Si)	1.3	0.7	1.2	1.1	1.4	1.0	1.3	1.2	1.0	0.8	0.9	1.4
Silver (Ag)	0.3	10.0	10.0	0.2	0.5	10.0	10.0	0.2	0.6	10.0	10.0	0.2
Sodium (Na)	1.2	5.4	1.9	2.2	1.0	7.1	2.5	0.9	0.8	4.1	1.8	1.0
Strontium (Sr)	1.8	1.2	1.5	2.2	1.3	0.8	1.0	1.2	1.1	0.3	0.3	1.0
Thallium (Tl)	1.3	10.0	10.0	1.3	1.4	2.5	2.4	1.2	1.6	2.5	2.5	0.2
Titanium (Ti)	1.3	1.0	1.0	1.2	1.1	1.0	1.0	1.2	1.1	1.0	1.0	1.5
Uranium (U)	2.0	18	4.1	3.4	2.1	27	3.8	1.4	0.8	12	1.8	0.8
Vanadium (V)	1.0	1.0	1.0	1.0	0.8	1.0	1.0	0.9	0.9	1.0	1.0	0.6
Zinc (Zn)	2.1	2.1	1.5	1.9	2.2	1.7	1.2	1.2	2.2	1.6	2.1	2.4

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference value).

Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference value).

Denotes highly elevated concentration (mean concentration greater than 10 times higher than respective mean reference value).

Note: RDL = Laboratory Reportable Detection Limit

Table C.19: In Situ Water Quality Statistical Comparisons among Camp Lake Tributary 2 and Unnamed Reference Creek Study Areas, Mary River Project CREMP, August 2018

Metric	Overall 3-group Comparison ^a			Pair-wise, <i>post hoc</i> comparisons ^a				
	Significant Difference Among Areas?	P-value	Statistical Test ^b	(I) Area	(J) Area	Significant Difference Between 2 Areas?	P-value	Statistical Test
Water Temperature (°C)	YES	0.0515	α	Unnamed Reference Creek	CLT2 Upstream	NO	0.5100	Tamhane's
				Unnamed Reference Creek	CLT2 Downstream	NO	0.2918	
				CLT2 Upstream	CLT2 Downstream	NO	0.1635	
Dissolved Oxygen (mg/L)	YES	0.0413	α	Unnamed Reference Creek	CLT2 Upstream	NO	0.9323	Tamhane's
				Unnamed Reference Creek	CLT2 Downstream	YES	0.0000	
				CLT2 Upstream	CLT2 Downstream	NO	0.6255	
Dissolved Oxygen (% saturation)	YES	0.0048	γ	Unnamed Reference Creek	CLT2 Upstream	YES	0.0159	Mann-Whitney U-test
				Unnamed Reference Creek	CLT2 Downstream	YES	0.0079	
				CLT2 Upstream	CLT2 Downstream	YES	0.0635	
pH (units)	YES	< 0.0001	α	Unnamed Reference Creek	CLT2 Upstream	YES	0.0016	Tamhane's
				Unnamed Reference Creek	CLT2 Downstream	YES	0.0000	
				CLT2 Upstream	CLT2 Downstream	NO	0.7805	
Specific Conductance ($\mu\text{S}/\text{cm}$)	YES	< 0.0001	α	Unnamed Reference Creek	CLT2 Upstream	YES	0.0234	Tamhane's
				Unnamed Reference Creek	CLT2 Downstream	YES	0.0001	
				CLT2 Upstream	CLT2 Downstream	YES	0.0851	

Note: Shading indicates a significant difference for respective comparison ($p\text{-value} \leq 0.1$).

^a *Post hoc* analysis of 1-way ANOVA among all areas protected for multiple comparisons.

^b Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log transformed, single factor ANOVA test conducted; γ - data untransformed, Kruskal Wallis H-test or Mann-Whitney U-test, as appropriate.

Table C.20: In Situ Water Quality Profile Data Collected at Camp Lake Water Quality Monitoring Stations in Winter, Mary River Project CREMP, 2018

Depth (m)	Temperature (°C)					Dissolved Oxygen (% Saturation)					pH (pH units)					Specific Conductance (µS/cm)				
	JLO-02	JLO-10	JLO-01	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-09
Date Collected	13-Apr-18	13-Apr-18	13-Apr-18	13-Apr-18	14-Apr-18	13-Apr-18	13-Apr-18	13-Apr-18	13-Apr-18	14-Apr-18	13-Apr-18	13-Apr-18	13-Apr-18	13-Apr-18	14-Apr-18	13-Apr-18	13-Apr-18	13-Apr-18	13-Apr-18	14-Apr-18
1.0	0.5	0.5	0.4	0.2	0.4	103.7	103.3	81.5	100.7	100.4	8.18	7.79	7.92	7.89	8.43	170	171	149	159	168
2.0	0.4	0.5	0.4	0.3	0.5	103.7	102.5	102.0	101.4	100.6	8.08	7.81	7.86	7.87	8.26	169	167	166	158	168
3.0	0.5	0.5	0.5	0.3	0.5	102.5	102.2	102.1	101.5	100.8	8.01	7.81	7.86	7.86	8.16	167	167	166	162	167
4.0	0.5	0.5	0.5	0.5	0.5	101.7	102.3	102.3	101.5	101.3	7.95	7.82	7.85	7.85	8.12	166	167	166	162	166
5.0	0.5	0.5	0.5	0.5	0.5	101.6	102.3	102.0	101.5	101.9	7.91	7.82	7.85	7.84	8.09	166	167	166	165	165
6.0	0.5	0.5	0.5	0.6	0.6	101.8	102.3	100.4	100.4	100.5	7.89	7.83	7.85	7.84	8.07	166	167	164	164	165
7.0	0.5	0.5	0.6	0.6	0.6	102.0	102.8	98.8	101.8	98.1	7.88	7.83	7.84	7.83	8.07	167	168	162	166	162
8.0	0.5	0.5	0.6	0.6	0.7	102.1	102.7	98.0	100.8	96.7	7.86	7.84	7.83	7.83	8.05	167	168	161	165	161
9.0	0.6	0.5	0.7	0.7	0.8	102.7	102.5	96.7	97.7	95.6	7.84	7.82	7.82	7.83	8.03	168	168	161	161	160
10.0	0.5		0.7	0.8	0.8	102.2		95.4	95.0	94.0	7.83		7.81	7.81	8.00	167		160	159	159
11.0	0.6		0.8	0.8	0.8	102.4		94.1	93.3	93.2	7.83		7.79	7.80	7.99	167		159	159	158
12.0	0.6		0.9	0.9	0.9	102.8		92.2	91.6	92.4	7.83		7.78	7.78	7.98	168		158	158	157
13.0			0.9	1.0				91.1	89.0				7.76	7.76				157	158	
14.0			1.0	1.1				90.2	88.0				7.75	7.73				157	157	
15.0				1.1					85.8					7.71					156	
16.0				1.1					83.8					7.69					155	
17.0				1.1					81.4					7.66					155	
18.0				1.2					79.7					7.63					155	
19.0				1.2					78.9					7.62					155	
20.0				1.2					78.8					7.60					156	
21.0				1.3					76.8					7.59					156	
22.0				1.3					74.4					7.57					156	
23.0				1.3					70.9					7.55					157	
24.0				1.5					63.9					7.53					157	
25.0				1.7					56.6					7.48					157	
26.0				1.8					52.3					7.43					159	
27.0				1.9					44.8					7.40					161	
28.0				2.0					37.8					7.33					164	
29.0				2.1					29.0					7.25					169	
30.0				2.3					13.7					7.16					180	
31.0				2.3					12.0					7.14					184	

Notes: Total depth at stations JLO-02, JLO-10, JLO-01, JLO-07, and JLO-09 was 12.2, 10.0, 15.9, 32.4, and 15.8 m, respectively, at the time of winter sampling. Ice thickness at stations JLO-02, JLO-10, JLO-01, JLO-07, and JLO-09 was 2.02, 2.09, 1.82, 2.07, and 2.01 m, respectively, at the time of winter sampling. Deepest measurement at stations JLO-02, JLO-10, JLO-01, JLO-07, and JLO-09 was 12.0, 9.0, 14.0, 31.0, and 12.0 m, respectively, at the time of winter sampling.

Table C.21: In Situ Water Quality Profile Data Collected at Camp Lake Water Quality Monitoring Stations in Summer, Mary River Project CREMP, 2018

Depth (m)	Temperature (°C)					Dissolved Oxygen (mg/L)					Dissolved Oxygen (% Saturation)					pH (pH units)					Specific Conductance (µS/cm)				
	JLO-02	JLO-10	JLO-01	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-09
Date Collected	30-Jul-18	29-Jul-18	30-Jul-18	29-Jul-18	29-Jul-18	30-Jul-18	29-Jul-18	30-Jul-18	29-Jul-18	29-Jul-18	30-Jul-18	29-Jul-18	30-Jul-18	29-Jul-18	29-Jul-18	30-Jul-18	29-Jul-18	30-Jul-18	29-Jul-18	29-Jul-18	30-Jul-18	29-Jul-18	30-Jul-18	29-Jul-18	29-Jul-18
1.0	5.7	5.7	5.7	5.7	5.7	12.31	12.47	12.44	12.61	12.52	98.2	99.3	92.2	100.6	99.9	7.57	7.96	7.58	7.98	7.79	118	118	121	121	121
2.0	5.7	5.7	5.7	5.7	5.7	12.41	12.49	12.53	12.63	12.57	99.0	99.5	99.8	100.7	100.2	7.64	7.97	7.64	7.96	7.84	118	118	121	121	124
3.0	5.7	5.7	5.7	5.7	5.7	12.47	12.50	12.54	12.63	12.62	99.5	99.6	100.0	100.7	100.7	7.75	7.97	7.68	7.95	7.91	118	118	121	121	121
4.0	5.7	5.7	5.7	5.7	5.7	12.49	12.50	12.56	12.63	12.61	99.7	99.6	100.1	100.7	100.7	7.79	7.97	7.71	7.94	7.91	118	118	121	121	121
5.0	5.7	5.7	5.7	5.7	5.7	12.49	12.51	12.56	12.63	12.62	99.7	99.7	100.1	100.7	100.6	7.82	7.97	7.73	7.94	7.91	118	118	121	121	121
6.0	5.7	5.7	5.7	5.7	5.7	12.50	12.50	12.56	12.62	12.62	99.7	99.7	100.1	100.7	100.6	7.85	7.96	7.75	7.95	7.91	118	118	121	121	121
7.0	5.7	5.7	5.7	5.7	5.7	12.50	12.50	12.56	12.63	12.62	99.7	99.6	100.1	100.7	100.6	7.85	7.95	7.78	7.95	7.91	118	118	121	121	121
8.0	5.7	5.7	5.7	5.7	5.7	12.49	12.50	12.56	12.63	12.61	99.6	99.6	100.1	100.7	100.5	7.87	7.94	7.80	7.96	7.92	118	118	121	121	121
9.0	5.7	5.7	5.7	5.7	5.7	12.49	12.50	12.56	12.62	12.61	99.5	99.6	100.1	100.6	100.5	7.87	7.94	7.81	7.96	7.92	118	118	121	121	121
10.0	5.7		5.7	5.7	5.7	12.49		12.56	12.61	12.61	99.5		100.1	100.6	100.5	7.89		7.83	7.95	7.92	118		121	121	121
11.0	5.7		5.7	5.7	5.7	12.48		12.56	12.60	12.60	99.5		100.1	100.5	100.5	7.89		7.84	7.96	7.92	118		121	121	121
12.0	5.7		5.7	5.7	5.7	12.47		12.55	12.60	12.60	99.4		100.0	100.4	100.4	7.90		7.85	7.96	7.92	119		121	121	121
13.0			5.7	5.7	5.7			12.55	12.59	12.58			100.0	100.4	100.3			7.86	7.96	7.91			121	121	121
14.0			5.7	5.7	5.7			12.54	12.58	12.59			100.0	100.3	100.3			7.87	7.96	7.92			121	121	121
15.0			5.7	5.7	5.7			12.54	12.60	12.59			100.0	100.5	100.3			7.89	7.95	7.93			121	121	121
16.0			5.7	5.7	5.7			12.54	12.59	12.58			100.0	100.5	100.3			7.89	7.97	7.94			121	121	121
17.0				5.7	5.7				12.59	12.58				100.4	100.3				7.99	7.93				121	121
18.0				5.7					12.58					100.4					8.00					121	
19.0				5.7					12.58					100.3					8.01					121	
20.0				5.7					12.58					100.3					8.01					121	
21.0				5.7					12.57					100.7					8.01					121	
22.0				5.7					12.57					100.2					8.01					121	
23.0				5.7					12.56					100.2					8.01					121	
24.0				5.7					12.55					100.0					8.01					121	
25.0				5.7					12.54					100.0					8.00					121	
26.0				5.7					12.54					100.0					8.00					121	
27.0				5.7					12.54					99.9					8.00					121	
28.0				5.7					12.53					99.9					8.00					121	
29.0				5.7					12.53					99.9					8.00					121	
30.0				5.7					12.56					99.8					8.00					121	

Note: Total depth at stations JLO-02, JLO-10, JLO-01, JLO-07, and JLO-09 was 13.0, 10.0, 17.4, 32.7, and 17.0 m, respectively, at the time of summer sampling.

Table C.22: In Situ Water Quality Profile Data Collected at Camp Lake Water Quality Monitoring Stations in Fall, Mary River Project CREMP, 2018

Depth (m)	Temperature (°C)						Dissolved Oxygen (mg/L)						Dissolved Oxygen (% Saturation)					
	JLO-02	JLO-10	JLO-01	JLO-07	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-07	JLO-09
Date Collected	20-Aug-18	20-Aug-18	19-Aug-18	19-Aug-18	18-Aug-18	19-Aug-18	20-Aug-18	20-Aug-18	19-Aug-18	19-Aug-18	18-Aug-18	19-Aug-18	20-Aug-18	20-Aug-18	19-Aug-18	18-Aug-18	19-Aug-18	19-Aug-18
surface				7.0							11.60					95.9		
1.0	7.0	7.0	7.0	7.0	7.0	7.0	11.98	12.00	12.07	12.04	11.68	12.1	98.5	98.9	99.5	96.2	99.2	99.3
2.0	7.0	7.0	7.0	7.0	7.0	7.0	11.99	12.02	12.07	12.05	11.70	12.1	98.8	99.1	99.5	96.4	99.3	99.4
3.0	7.0	7.0	7.0	7.0	7.0	7.0	12.01	12.03	12.06	12.05	11.70	12.1	98.9	99.1	99.5	96.4	99.3	99.3
4.0	7.0	7.0	7.0	7.0	7.0	7.0	12.01	12.04	12.06	12.05	11.70	12.1	98.9	99.2	99.5	96.4	99.3	99.3
5.0	7.0	7.0	7.0	7.0	7.0	7.0	12.01	12.04	12.06	12.05	11.70	12.1	98.9	99.2	99.4	96.4	99.3	99.3
6.0	7.0	7.0	7.0	7.0	7.0	7.0	12.01	12.04	12.06	12.05	11.69	12.0	98.9	99.2	99.4	96.3	99.3	99.3
7.0	7.0	7.0	7.0	7.0	7.0	7.0	12.01	12.03	12.05	12.04	11.69	12.0	98.8	99.1	99.4	96.3	99.3	99.3
8.0	7.0	7.0	7.0	7.0	7.0	7.0	12.01	12.03	12.05	12.05	11.68	12.0	98.8	99.1	99.3	96.2	99.3	99.2
9.0	7.0	7.0	7.0	7.0	7.0	7.0	12.00	12.03	12.04	12.04	11.69	12.0	98.8	99.0	99.3	96.3	99.3	99.2
10.0	6.9		7.0	7.0	7.0	7.0	12.00		12.03	12.04	11.70	12.0	98.8		99.1	96.4	99.2	99.2
11.0	6.9		7.0	7.0	7.0	7.0	12.00		12.03	12.03	11.71	12.0	98.7		99.2	96.5	99.2	99.1
12.0	6.9		7.0	7.0	7.0		12.00		12.03	12.03	11.73		98.6		99.1	96.6	99.2	
13.0			7.0	7.0	7.0				12.02	12.03	11.72				99.0	96.6	99.1	
14.0			7.0	7.0	7.0				12.01	12.03	11.71				99.0	96.5	99.1	
15.0			7.0	7.0	7.0				12.01	12.03	11.70				99.0	96.4	99.1	
16.0			7.0	7.0	7.0				12.01	12.03	11.69				98.9	96.3	99.1	
17.0				7.0	7.0					12.02	11.69					96.3	99.1	
18.0				7.0	7.0					12.02	11.68					96.2	99.0	
19.0				7.0	7.0					12.01	11.67					96.1	99.0	
20.0				7.0	7.0					12.01	11.66					96.1	99.0	
21.0				7.0	7.0					12.01	11.66					96.0	98.9	
22.0				7.0	7.0					12.00	11.65					96.0	98.9	
23.0				7.0	7.0					12.00	11.65					96.0	98.9	
24.0				7.0	7.0					12.00	11.64					95.9	98.9	
25.0				7.0	7.0					12.00	11.64					95.9	98.9	
26.0				7.0	7.0					11.99	11.64					95.9	98.8	
27.0				7.0	7.0					11.99	11.64					95.9	98.8	
28.0				7.0	7.0					11.98	11.64					95.9	98.8	
29.0				7.0	7.0					11.98	11.64					95.8	98.7	
30.0				7.0	7.0					11.98	11.64					95.8	98.7	
31.0				7.0	7.0					11.97	11.63					95.8	98.7	

Notes: 19-Aug-18 and 20-Aug-18 sampling was conducted by Baffinland. 18-Aug-18 sampling was conducted by Minnow. Total depth at Stations JLO-02, JLO-10, JLO-01, JLO-07, and JLO-09 was 12.1, 9.8, 16.2, 31, and 12 m, respectively, at the time of fall sampling.

Table C.22: In Situ Water Quality Profile Data Collected at Camp Lake Water Quality Monitoring Stations in Fall, Mary River Project CREMP, 2018

Depth (m)	pH (pH units)						Specific Conductance (µS/cm)					
	JLO-02	JLO-10	JLO-01	JLO-07	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-07	JLO-09
Date Collected	20-Aug-18	20-Aug-18	19-Aug-18	19-Aug-18	18-Aug-18	19-Aug-18	20-Aug-18	20-Aug-18	19-Aug-18	19-Aug-18	18-Aug-18	19-Aug-18
surface					8.10						120	
1.0	8.03	8.08	8.08	8.00	8.08	7.69	119	118	118	118	120	117
2.0	8.04	8.06	8.06	8.01	8.07	7.89	119	118	118	117	120	117
3.0	8.05	8.06	8.06	8.02	8.07	7.93	119	118	118	118	120	117
4.0	8.06	8.07	8.07	8.03	8.07	7.96	119	118	118	118	120	117
5.0	8.06	8.07	8.07	8.04	8.07	7.97	119	118	118	118	120	117
6.0	8.06	8.07	8.07	8.05	8.07	7.98	119	118	118	118	120	117
7.0	8.06	8.08	8.08	8.05	8.07	8.00	119	118	118	118	120	117
8.0	8.06	8.08	8.08	8.05	8.06	8.01	119	118	118	118	120	117
9.0	8.07	8.08	8.08	8.06	8.07	8.02	119	118	118	118	120	117
10.0	8.07		8.09	8.06	8.07	8.02	119		118	118	120	117
11.0	8.07		8.09	8.06	8.07	8.03	119		118	118	120	117
12.0	8.07		8.08	8.07	8.08		121		118	118	120	
13.0			8.08	8.07	8.08				118	118	120	
14.0			8.08	8.08	8.08				118	118	120	
15.0			8.09	8.08	8.09				118	118	120	
16.0			8.08	8.08	8.08				118	118	120	
17.0				8.08	8.08					118	120	
18.0				8.08	8.08					118	120	
19.0				8.08	8.07					118	120	
20.0				8.09	8.07					118	120	
21.0				8.09	8.07					118	120	
22.0				8.09	8.07					118	120	
23.0				8.09	8.06					118	120	
24.0				8.09	8.06					118	120	
25.0				8.09	8.06					118	120	
26.0				8.09	8.06					118	120	
27.0				8.09	8.05					118	120	
28.0				8.09	8.06					118	120	
29.0				8.09	8.06					118	120	
30.0				8.09	8.06					118	120	
31.0				8.09	8.06					118	120	

Notes: 19-Aug-18 and 20-Aug-18 sampling was conducted by Baffinland. 18-Aug-18 sampling was conducted by Minnow. Total depth at Stations JLO-02, JLO-10, JLO-01, JLO-07, and JLO-09 was 12.1, 9.8, 16.2, 31, and 12 m, respectively, at the time of fall sampling.

Table C.23: Sampling Depth, Water Clarity Measures, and Surface and Bottom *In Situ* Water Quality Measures Collected at Camp Lake Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2018

Categorization & Replicate ID		Date Sampled	Station Depth (m)	Secchi Depth (m)	Depth sampled	Temperature (°C)	Dissolved Oxygen		pH (units)	Specific Conductance (µS/cm)
							(mg/L)	(% sat.)		
Littoral (Shallow) Stations	JLO-02	18-Aug-18	11.6	6.1	surface	7.30	11.71	97.2	8.02	121
					bottom	7.20	11.37	94.5	7.98	121
	JLO-21	19-Aug-18	10.0	6.2	surface	7.16	12.04	99.7	6.77	139
					bottom	7.39	11.61	96.8	-	146
	JLO-20	19-Aug-18	6.6	5.5	surface	7.10	12.05	99.6	6.89	128
					bottom	7.09	11.96	98.8	6.83	128
	JLO-19	19-Aug-18	7.0	6.1	surface	7.30	12.20	101.3	-	-
					bottom	7.17	11.99	99.3	-	-
	JLO-18	18-Aug-18	12.1	6.1	surface	7.40	11.62	96.7	8.11	121
					bottom	7.20	11.63	96.3	8.11	120
Profundal (Deep) Stations	JLO-01	19-Aug-18	18.0	5.7	surface	7.10	11.59	95.8	8.08	120
					bottom	7.10	11.61	95.9	8.02	120
	JLO-07	19-Aug-18	32.9	6.1	surface	7.00	11.60	95.7	8.10	120
					bottom	7.00	11.63	95.8	8.06	120
	JLO-16	19-Aug-18	16.8	6.0	surface	7.30	11.64	96.7	8.11	121
					bottom	7.00	11.65	96.0	8.07	120
	JLO-11	18-Aug-18	29.6	5.9	surface	7.00	11.58	95.3	8.03	120
					bottom	6.90	11.64	95.7	8.01	120
	JLO-12	18-Aug-18	16.5	5.8	surface	7.00	11.60	95.5	8.09	120
					bottom	6.90	11.60	95.4	8.06	120

Table C.24: Statistical Comparison of Bottom *In Situ* Water Quality Between Camp Lake Littoral and Profundal Stations, Mary River Project CREMP, August 2018

Habitat Variable	Statistical Test Results			Summary Statistics					
	Significant Difference Between Areas?	P-value	Statistical Analysis ^a	Lake Zone	Mean (n = 5)	Standard Deviation	Standard Error	Minimum	Maximum
Secchi Depth (m)	NO	0.454	α	Littoral	6.01	0.29	0.13	5.50	6.20
				Profundal	5.90	0.14	0.06	5.71	6.07
Temperature (°C)	YES	0.006	α	Littoral	7.21	0.11	0.05	7.09	7.39
				Profundal	6.98	0.08	0.04	6.90	7.10
Dissolved Oxygen (mg/L)	NO	0.503	η	Littoral	11.7	0.3	0.1	11.4	12.0
				Profundal	11.6	0.0	0.0	11.6	11.7
Dissolved Oxygen (% saturation)	NO	0.189	η	Littoral	97.1	2.0	0.9	94.5	99.3
				Profundal	95.8	0.2	0.1	95.4	96.0
pH (units)	NO	0.425	η	Littoral	7.64	0.70	0.41	6.83	8.11
				Profundal	8.04	0.03	0.01	8.01	8.07
Specific Conductance (umho/cm)	NO	0.229	η	Littoral	129.0	11.9	5.9	120.4	146.0
				Profundal	120.0	0.2	0.1	119.8	120.3

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log-transformed, single factor ANOVA test conducted; γ - data untransformed, Mann-Whitney U-test conducted; η - data untransformed, t-test assuming unequal variance conducted; δ - data log-transformed, t-test assuming unequal variance conducted.



Highlighted values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

Table C.25: Statistical Comparison of Bottom *In Situ* Water Quality Between Camp Lake and Reference Lake 3 Stations Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2018

Lake Zone	Habitat Variable	Statistical Test Results			Summary Statistics						
		Significant Difference Between Areas?	P-value	Statistical Analysis ^a	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Littoral (Shallow) Stations	Station Depth (m)	NO	0.795	η	Reference	5	9.46	2.55	1.14	6.60	12.10
					Camp	5	9.80	1.11	0.49	8.40	11.20
	Secchi Depth (m)	YES	< 0.001	α	Reference	5	6.01	0.29	0.13	5.50	6.20
					Camp	4	8.49	0.45	0.23	8.05	9.10
	Temperature (°C)	NO	0.111	γ	Reference	5	7.21	0.11	0.05	7.09	7.39
					Camp	4	7.05	0.10	0.05	6.90	7.10
	Dissolved Oxygen (mg/L)	NO	0.564	α	Reference	5	11.7	0.3	0.1	11.4	12.0
					Camp	4	11.6	0.3	0.1	11.2	11.8
	Dissolved Oxygen (% saturation)	NO	0.730	γ	Reference	5	97.1	2.0	0.9	94.5	99.3
					Camp	4	95.7	2.2	1.1	92.4	97.1
Profundal (Deep) Stations	Station Depth (m)	NO	0.703	η	Reference	5	22.76	7.86	3.51	16.50	32.90
					Camp	5	21.26	2.62	1.17	18.50	25.00
	Secchi Depth (m)	YES	< 0.001	α	Reference	5	5.90	0.14	0.06	5.71	6.07
					Camp	4	8.63	0.26	0.13	8.30	8.90
	Temperature (°C)	NO	0.111	γ	Reference	5	6.98	0.08	0.04	6.90	7.10
					Camp	4	7.08	0.05	0.02	7.00	7.10
	Dissolved Oxygen (mg/L)	NO	0.905	γ	Reference	5	11.6	0.0	0.0	11.6	11.7
					Camp	4	11.5	0.4	0.2	10.9	11.7
	Dissolved Oxygen (% saturation)	NO	0.413	γ	Reference	5	95.8	0.2	0.1	95.4	96.0
					Camp	4	94.6	2.8	1.4	90.4	96.1
	pH (units)	YES	< 0.001	α	Reference	5	8.04	0.03	0.01	8.01	8.07
					Camp	4	7.63	0.04	0.02	7.58	7.67
	Specific Conductance (umho/cm)	YES	< 0.001	α	Reference	5	120.0	0.2	0.1	119.8	120.3
					Camp	4	62.5	0.2	0.1	62.3	62.8

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log-transformed, single factor ANOVA test conducted; γ - data untransformed, Mann-Whitney U-test conducted; η - data untransformed, t-test assuming unequal variance conducted; δ - data log-transformed, t-test assuming unequal variance conducted.

Highlighted values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

Table C.26: Water Chemistry at Camp Lake (JLO) Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Summer Sampling Event				J0-01 outlet 10-Aug-18	Fall Sampling Event										
					JL0-07 bottom 29-Jul-18	JL0-07 surface 29-Jul-18	JL0-09 bottom 29-Jul-18	JL0-09 surface 29-Jul-18		JL0-02 bottom 21-Aug-18	JL0-02 surface 21-Aug-18	JL0-10 bottom 21-Aug-18	JL0-10 surface 21-Aug-18	JL0-01 bottom 20-Aug-18	JL0-01 surface 20-Aug-18	JL0-07 bottom 20-Aug-18	JL0-07 surface 20-Aug-18	JL0-09 bottom 20-Aug-18	JL0-09 surface 20-Aug-18	J0-01 outlet 27-Aug-18
Conventional	Conductivity (lab)	umho/cm	-	-	135	134	135	135	136	137	137	138	135	137	136	136	136	137	137	141
	pH (lab)	pH	6.5 - 9.0	-	8.13	8.19	8.11	8.07	7.99	8.06	8.05	8.02	8.05	8.04	8.06	8.06	8.05	8.04	8.03	8.1
	Hardness (as CaCO ₃)	mg/L	-	-	67	66	66	67	72	72	69	70	69	68	68	68	71	68	69	70
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	60	80	65	71	60	58	62	48	55	80	75	73	75	75	90	90
	Turbidity	NTU	-	-	0.7	1.2	0.6	0.7	7.4	0.6	0.6	0.5	0.6	0.8	0.8	0.8	0.7	1.1	0.7	0.5
	Alkalinity (as CaCO ₃)	mg/L	-	-	60	58	58	57	61	61	62	58	61	58	57	58	57	56	58	63
Nutrients and Organics	Total Ammonia	mg/L	variable	0.855	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.035	<0.020	<0.020	<0.020	<0.020	0.044
	Nitrate	mg/L	13	13	<0.020	<0.020	<0.020	<0.020	<0.020	0.028	0.021	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	0.15	0.35	<0.15	<0.15	0.15	<0.15	<0.15	<0.15	0.16	<0.15
	Nitrate and Nitrite (as N)	mg/L	-	-	<0.021	<0.021	<0.021	<0.021	<0.021	0.028	0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021	<0.021
	Dissolved Organic Carbon	mg/L	-	-	1.8	1.8	1.7	1.9	2.4	2.4	2.8	2.4	2.4	2.4	2.5	2.5	2.4	2.4	2.6	2.2
	Total Organic Carbon	mg/L	-	-	2.5	2.4	2.4	2.3	2.7	2.8	2.6	2.6	2.6	2.5	2.6	2.5	2.5	2.5	2.6	2.8
	Total Phosphorus	mg/L	0.020 ^d	-	0.0039	<0.0030	0.0031	0.0095	0.0055	0.0036	0.0046	0.0040	0.0042	0.0056	0.0049	0.0037	0.0035	0.0042	0.0040	<0.0030
	Phenols	mg/L	0.001 ^d	-	0.0011	0.0019	0.0013	0.0011	0.0018	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0019	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	3.8	3.8	3.8	3.8	3.7	3.8	3.8	3.7	3.7	3.7	3.7	3.7	3.8	3.7	3.7	3.8
	Sulphate (SO ₄)	mg/L	218 ^β	218	3.7	3.7	3.7	4.0	3.8	3.9	3.9	3.8	3.8	3.8	3.7	3.8	3.8	3.8	3.8	3.9
Total Metals	Aluminum (Al)	mg/L	0.100	0.1	0.009	0.007	0.007	0.007	0.019	0.013	0.013	0.010	0.004	0.015	0.011	0.008	0.011	0.011	0.009	0.008
	Antimony (Sb)	mg/L	0.020 ^d	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0066	0.0067	0.0068	0.0066	0.0070	0.0066	0.0069	0.0067	0.0073	0.0064	0.0069	0.0067	0.0069	0.0068	0.0068	0.0071
	Beryllium (Be)	mg/L	0.011 ^d	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	13	14	13	13	14	14	14	14	13	14	13	13	13	14	13	14
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^d	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.004	0.0012	0.0008	0.0009	0.0009	0.0010	0.0009	0.0009	0.0008	0.0007	0.0009	0.0009	0.0009	0.0009	0.0011	0.0008	0.0008
	Iron (Fe)	mg/L	0.30	0.300	<0.030	<0.030	<0.030	<0.030	0.034	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	0.0011	0.0013	0.0013	0.0012	<0.0010	0.0011	0.0010	<0.0010	0.0010	0.0011	0.0011	<0.0010	<0.0010	<0.0010	0.0011	0.0015
	Magnesium (Mg)	mg/L	-	-	8.6	8.4	8.2	8.3	8.8	8.2	8.4	8.3	9.3	8.4	8.4	8.2	8.3	8.3	8.3	8.3
	Manganese (Mn)	mg/L	0.935 ^β	-	0.0024	0.0024	0.0023	0.0024	0.0028	0.0018	0.0018	0.0018	0.0018	0.0006	0.0018	0.0017	0.0016	0.0018	0.0020	0.0017
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	0.00029	0.00028	0.00030	0.00030	0.00027	0.00029	0.00035	0.00028	0.00036	0.00033	0.00030	0.00030	0.00030	0.00030	0.00032	0.00038
	Nickel (Ni)	mg/L	0.025	0.025	0.00060	0.00059	0.00058	0.00060	0.00075	0.000605	0.00062	0.00059	0.00052	0.00061	0.00063	0.00058	0.00058	0.00061	0.00059	0.00067
	Potassium (K)	mg/L	-	-	1.18	1.18	1.16	1.16	1.22	1.225	1.24	1.22	1.41	1.21	1.2	1.16	1.17	1.17	1.18	1.13
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.31	0.30	0.30	0.30	0.39	0.325	0.35	0.32	0.32	0.33	0.31	0.33				

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

Table C.27: Magnitude of Elevation in Seasonal Average Parameter Concentrations (Total Metal Concentration Data Provided) Between Camp Lake and Reference Lake 3 in 2018, and Between Camp Lake 2018 and Baseline (2005 to 2013), Mary River Project CREMP

Parameter	Camp Lake vs Reference Lake 3 in 2018		Camp Lake 2018 vs Baseline		
	Summer	Fall	Winter	Summer	Fall
Conductivity (lab)	1.9	1.8	1.3	1.2	1.1
Hardness (as CaCO ₃)	1.9	2.0	1.4	1.2	1.2
Total Suspended Solids (TSS)	1.0	1.0	1.0	1.0	1.0
Total Dissolved Solids (TDS)	1.9	1.5	1.0	0.9	0.9
Turbidity	3.2	1.4	1.9	1.5	2.3
Alkalinity (as CaCO ₃)	1.8	1.8	1.1	1.0	1.0
Total Ammonia	1.1	0.5	1.2	0.3	0.8
Nitrate	1.0	1.0	0.2	0.2	0.2
Nitrite	1.0	1.0	1.9	0.2	1.0
Total Kjeldahl Nitrogen (TKN)	1.0	1.1	1.2	0.7	0.5
Dissolved Organic Carbon	0.6	0.8	1.0	1.0	1.4
Total Organic Carbon	0.5	0.7	1.1	1.2	1.4
Total Phosphorus	1.0	0.9	1.5	1.1	0.8
Phenols	1.4	1.0	1.9	1.3	1.1
Bromide (Br)	1.0	1.0	1.1	0.4	0.4
Chloride (Cl)	3.0	3.0	3.3	1.9	1.7
Sulphate (SO ₄)	1.0	1.0	2.8	2.6	1.3
Aluminum (Al)	3.2	2.4	1.9	0.8	1.7
Antimony (Sb)	1.0	1.0	1.0	1.0	1.0
Arsenic (As)	1.0	1.0	1.0	1.0	1.0
Barium (Ba)	0.0	1.1	1.4	1.2	1.2
Beryllium (Be)	1.0	1.0	1.1	1.3	2.8
Cadmium (Cd)	1.0	1.0	0.6	0.8	0.9
Calcium (Ca)	1.9	1.9	1.2	1.1	1.1
Chromium (Cr)	1.0	1.0	RDL	1.0	1.0
Cobalt (Co)	1.0	1.0	1.0	1.0	0.9
Copper (Cu)	1.2	1.1	1.0	0.3	1.0
Iron (Fe)	1.0	1.0	1.1	1.1	1.7
Lead (Pb)	1.0	1.0	0.7	0.6	1.0
Lithium (Li)	1.2	1.1	0.2	0.3	
Magnesium (Mg)	1.9	2.0	1.2	1.2	1.2
Manganese (Mn)	4.1	2.6	0.8	1.2	1.1
Mercury (Hg)	1.0	1.0	1.0	1.0	1.0
Molybdenum (Mo)	2.2	2.3	1.7	1.5	1.5
Nickel (Ni)	1.2	1.2	1.0	0.8	1.0
Potassium (K)	1.3	1.4		1.4	1.4
Selenium (Se)	1.0	1.0	RDL	RDL	RDL
Silicon (Si)	0.7	0.8	0.8	0.7	0.8
Silver (Ag)	1.0	1.0	1.1	1.6	2.7
Sodium (Na)	1.8	1.9		1.7	1.6
Strontium (Sr)	1.3	1.3	1.7	1.4	1.3
Thallium (Tl)	1.0	1.0	1.1	1.3	3.2
Tin (Sn)	1.0	1.0	0.1	0.2	0.1
Titanium (Ti)	1.0	1.0	1.0	1.0	1.0
Uranium (U)	3.3	3.3	2.0	1.7	1.7
Vanadium (V)	1.0	1.0	1.0	1.0	1.0
Zinc (Zn)	1.0	1.0	2.4	1.3	1.3

 Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).
 Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).
 Denotes highly elevated concentration (mean concentration greater than 10 times higher than respective mean reference or baseline period value).

Note: RDL = Reportable Detection Limit

Table C.28: Spearman's Rank Correlation Coefficients for Camp Lake (JLO) Water Quality Data Collected in Winter, Summer, and Fall 2016^a

Parameters	Conventional Parameters							Total Metals													
	Total Dissolved Solids	Turbidity	Alkalinity	Ammonia (total)	Phosphorus (total)	Chloride	Sulphate	Aluminum	Barium	Calcium	Copper	Lithium	Magnesium	Manganese	Molybdenum	Nickel	Potassium	Silicon	Sodium	Strontium	Uranium
Total Dissolved Solids	1	-0.050	0.483	0.352	0.091	0.345	0.209	-0.330	0.324	0.434	0.139	-0.133	0.310	-0.496	0.428	0.434	0.186	-0.008	0.083	0.541	0.486
Turbidity	-0.050	1	-0.677	-0.477	0.030	-0.550	-0.196	0.671	-0.602	-0.637	-0.324	0.636	-0.546	0.485	-0.484	-0.486	-0.670	-0.262	-0.644	-0.596	-0.371
Alkalinity	0.483	-0.677	1	0.599	0.010	0.748	0.288	-0.668	0.716	0.739	0.399	-0.522	0.713	-0.602	0.558	0.688	0.823	0.349	0.714	0.723	0.539
Ammonia (total)	0.352	-0.477	0.599	1	0.107	0.579	0.066	-0.541	0.549	0.491	0.328	-0.490	0.516	-0.309	0.239	0.437	0.472	0.380	0.499	0.472	0.193
Phosphorus (total)	0.091	0.030	0.010	0.107	1	0.107	0.159	0.012	0.003	0.050	0.117	0.203	0.247	-0.109	0.086	0.115	0.103	0.214	-0.048	-0.092	0.052
Chloride	0.345	-0.550	0.748	0.579	0.107	1	0.416	-0.607	0.750	0.754	0.665	-0.233	0.725	-0.367	0.383	0.809	0.690	0.454	0.549	0.623	0.409
Sulphate	0.209	-0.196	0.288	0.066	0.159	0.416	1	-0.030	0.224	0.341	0.172	-0.134	0.230	-0.343	0.304	0.397	0.302	-0.013	0.228	0.275	0.533
Aluminum (total)	-0.330	0.671	-0.668	-0.541	0.012	-0.607	-0.030	1	-0.665	-0.551	-0.291	0.588	-0.654	0.610	-0.616	-0.462	-0.570	-0.057	-0.523	-0.606	-0.227
Barium (total)	0.324	-0.602	0.716	0.549	0.003	0.750	0.224	-0.665	1	0.613	0.595	-0.527	0.859	-0.565	0.673	0.672	0.770	0.474	0.613	0.615	0.376
Calcium (total)	0.434	-0.637	0.739	0.491	0.050	0.754	0.341	-0.551	0.613	1	0.670	-0.400	0.557	-0.525	0.464	0.839	0.695	0.261	0.552	0.902	0.695
Copper (total)	0.139	-0.324	0.399	0.328	0.117	0.665	0.172	-0.291	0.595	0.670	1	-0.139	0.481	-0.124	0.372	0.772	0.419	0.539	0.278	0.570	0.374
Lithium (total)	-0.133	0.636	-0.522	-0.490	0.203	-0.233	-0.134	0.588	-0.527	-0.400	-0.139	1	-0.337	0.711	-0.629	-0.234	-0.511	-0.032	-0.599	-0.598	-0.479
Magnesium (total)	0.310	-0.546	0.713	0.516	0.247	0.725	0.230	-0.654	0.859	0.557	0.481	-0.337	1	-0.468	0.641	0.634	0.825	0.463	0.646	0.457	0.212
Manganese (total)	-0.496	0.485	-0.602	-0.309	-0.109	-0.367	-0.343	0.610	-0.565	-0.525	-0.124	0.711	-0.468	1	-0.798	-0.386	-0.601	0.061	-0.443	-0.704	-0.741
Molybdenum (total)	0.428	-0.484	0.558	0.239	0.086	0.383	0.304	-0.616	0.673	0.464	0.372	-0.629	0.641	-0.798	1	0.509	0.615	0.080	0.486	0.649	0.527
Nickel (total)	0.434	-0.486	0.688	0.437	0.115	0.809	0.397	-0.462	0.672	0.839	0.772	-0.234	0.634	-0.386	0.509	1	0.648	0.496	0.501	0.748	0.616
Potassium (total)	0.186	-0.670	0.823	0.472	0.103	0.690	0.302	-0.570	0.770	0.695	0.419	-0.511	0.825	-0.601	0.615	0.648	1	0.408	0.878	0.627	0.464
Silicon (total)	-0.008	-0.262	0.349	0.380	0.214	0.454	-0.013	-0.057	0.474	0.261	0.539	-0.032	0.463	0.061	0.080	0.496	0.408	1	0.312	0.153	0.134
Sodium (total)	0.083	-0.644	0.714	0.499	-0.048	0.549	0.228	-0.523	0.613	0.552	0.278	-0.599	0.646	-0.443	0.486	0.501	0.878	0.312	1	0.503	0.329
Strontium (total)	0.541	-0.596	0.723	0.472	-0.092	0.623	0.275	-0.606	0.615	0.902	0.570	-0.598	0.457	-0.704	0.649	0.748	0.627	0.153	0.503	1	0.760
Uranium (total)	0.486	-0.371	0.539	0.193	0.052	0.409	0.533	-0.227	0.376	0.695	0.374	-0.479	0.212	-0.741	0.527	0.616	0.464	0.134	0.329	0.760	1

^a Correlation matrix included only those parameters with ≥75% of values above laboratory reportable detection limits (RDL). Sample size (n) totalled 33.

Indicates strong positive correlation (i.e., Spearman's rho ≥ 0.7) between parameter pairings.

Indicates strong negative correlation (i.e., Spearman's rho ≤ -0.7) between parameter pairings.

Table C.29: Dissolved Metal Concentrations at Camp Lake Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Winter Sampling Event											Summer Sampling Event					
			JL0-02 bottom	JL0-02 surface	JL0-10 bottom	JL0-10 surface	JL0-01 bottom	JL0-01 surface	JL0-07 bottom	JL0-07 surface	JL0-09 bottom	JL0-09 surface	J0-01 outlet	JL0-02 bottom	JL0-02 surface	JL0-10 bottom	JL0-10 surface	JL0-01 bottom	JL0-01 surface
			13-Apr-18	13-Apr-18	13-Apr-18	13-Apr-18	13-Apr-18	13-Apr-18	13-Apr-18	13-Apr-18	14-Apr-18	14-Apr-18	30-Jun-18	30-Jul-18	30-Jul-18	29-Jul-18	29-Jul-18	30-Jul-18	30-Jul-18
Dissolved Metals	Aluminum (Al)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.003	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.00733	0.00769	0.00740	0.00755	0.00710	0.00746	0.00724	0.00779	0.00710	0.00748	0.00651	0.00672	0.00670	0.00654	0.00662	0.00672	0.00655
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	16.7	18.7	18.2	18.6	16.8	18.1	16.4	18.6	17.1	18.3	12.3	13.5	13.7	13.2	13.3	13.1	13.3
	Chromium (Cr)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.00100	0.00110	0.00093	0.00095	0.00088	0.00096	0.00084	0.00097	0.00089	0.00093	0.00072	0.00082	0.00081	0.00095	0.00090	0.00081	0.00079
	Iron (Fe)	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	0.0013	0.0016	0.0016	0.0016	0.0015	0.0016	0.0013	0.0015	0.00145	0.0014	<0.0010	0.0012	0.0013	0.0011	0.0011	0.0011	0.0012
	Magnesium (Mg)	mg/L	10.50	10.90	10.50	11.20	10.00	11.00	10.10	11.00	10.25	10.50	7.40	8.21	8.27	8.19	8.17	8.39	8.15
	Manganese (Mn)	mg/L	0.00022	0.00019	0.000111	0.000152	0.000095	0.000142	0.000946	0.000102	0.000130	0.000175	0.000967	0.000522	0.00046	0.000533	0.000558	0.000467	0.000454
	Mercury (Hg)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.000366	0.000393	0.000383	0.000393	0.000363	0.000382	0.000293	0.000378	0.000374	0.000365	0.000271	0.000303	0.000297	0.000313	0.000302	0.000290	0.000276
	Nickel (Ni)	mg/L	0.00067	0.00072	0.00071	0.00073	0.00065	0.00071	0.00066	0.00072	0.00070	0.00066	0.00053	0.00058	0.00057	0.00056	0.00057	0.00055	0.00052
	Potassium (K)	mg/L	1.29	1.34	1.32	1.33	1.23	1.34	1.23	1.38	1.27	1.31	1.09	1.19	1.20	1.18	1.18	1.19	1.17
	Selenium (Se)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	0.34	0.35	0.34	0.36	0.34	0.36	0.93	0.36	0.35	0.34	0.28	0.31	0.31	0.31	0.30	0.29	0.30
	Silver (Ag)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	1.90	1.96	1.91	2.08	1.88	2.00	2.37	2.00	1.84	1.98	1.42	1.61	1.61	1.57	1.57	1.54	1.52
	Strontium (Sr)	mg/L	0.0114	0.0124	0.0119	0.0126	0.0116	0.0124	0.0116	0.0127	0.0115	0.0120	0.0092	0.01020	0.01030	0.00997	0.00996	0.00992	0.01000
	Thallium (Tl)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.000887	0.000924	0.000873	0.000927	0.000832	0.000906	0.000664	0.000924	0.000838	0.000914	0.000730	0.000788	0.000778	0.000775	0.000797	0.000772	0.000754
	Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table C.29: Dissolved Metal Concentrations at Camp Lake Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Summer Sampling Event					Fall Sampling Event										
			JL0-07 bottom	JL0-07 surface	JL0-09 bottom	JL0-09 surface	J0-01 outlet	JL0-02 bottom	JL0-02 surface	JL0-10 bottom	JL0-10 surface	JL0-01 bottom	JL0-01 surface	JL0-07 bottom	JL0-07 surface	JL0-09 bottom	JL0-09 surface	J0-01 outlet
			29-Jul-18	29-Jul-18	29-Jul-18	29-Jul-18	10-Aug-18	21-Aug-18	21-Aug-18	21-Aug-18	21-Aug-18	20-Aug-18	20-Aug-18	20-Aug-18	20-Aug-18	20-Aug-18	20-Aug-18	20-Aug-18
Dissolved Metals	Aluminum (Al)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	0.0039	0.0032	0.0046	0.0034	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0047
	Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.00662	0.00667	0.00650	0.00661	0.00707	0.00700	0.00693	0.00706	0.00700	0.00692	0.00646	0.00696	0.00662	0.00620	0.00644	0.00684
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	13.2	13.1	13.4	13.4	14.2	14.4	14.1	14.3	14.1	13.4	13.2	13.4	13.9	13.4	13.6	14.4
	Chromium (Cr)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.00081	0.00076	0.00086	0.00085	0.00089	0.00092	0.00087	0.00085	0.00090	0.00086	0.00090	0.00090	0.00084	0.00084	0.00080	0.00078
	Iron (Fe)	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	0.0011	0.0011	0.0012	0.0012	0.0010	0.0011	0.0010	0.0011	0.0011	0.0011	0.0010	0.0011	0.0013	0.0012	0.0012	<0.0010
	Magnesium (Mg)	mg/L	8.20	8.13	7.98	8.18	8.84	8.68	8.17	8.31	8.30	8.49	8.43	8.44	8.72	8.36	8.51	8.18
	Manganese (Mn)	mg/L	0.000454	0.000385	0.000418	0.000407	0.00088	0.000257	0.000246	0.000203	0.000159	0.000128	0.000147	0.000138	0.000157	0.000127	0.000141	0.000711
	Mercury (Hg)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.000284	0.000287	0.000305	0.000298	0.000276	0.000349	0.000285	0.000261	0.000282	0.000309	0.000313	0.000308	0.000333	0.000324	0.000294	0.000341
	Nickel (Ni)	mg/L	0.00057	0.00053	0.00057	0.00055	0.00071	0.00063	0.00058	0.00058	0.00057	0.00056	0.00059	0.00059	0.00061	0.00055	0.00057	0.00060
	Potassium (K)	mg/L	1.18	1.16	1.18	1.17	1.22	1.28	1.24	1.23	1.24	1.21	1.19	1.21	1.21	1.17	1.17	1.11
	Selenium (Se)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	0.30	0.29	0.29	0.29	0.36	0.34	0.32	0.32	0.31	0.31	0.31	0.30	0.31	0.30	0.31	0.32
	Silver (Ag)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	1.55	1.56	1.58	1.57	1.59	1.75	1.62	1.63	1.68	1.62	1.71	1.61	1.64	1.55	1.69	1.47
	Strontium (Sr)	mg/L	0.0100	0.01000	0.01010	0.01010	0.01040	0.01085	0.0106	0.0106	0.0105	0.0103	0.01010	0.0104	0.01070	0.0105	0.0105	0.0109
	Thallium (Tl)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.000770	0.000779	0.000745	0.000776	0.000782	0.001025	0.000960	0.000921	0.000922	0.000856	0.000839	0.000838	0.000886	0.000894	0.000839	0.000922
	Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table C.30: Magnitude of Elevation in Seasonal Average Dissolved Metal Concentrations Between Camp Lake and Reference Lake 3 in 2018, and Between Camp Lake 2018 and Baseline (2005 to 2013), Mary River Project CREMP

Parameter	Camp Lake vs Reference Lake 3 in 2018		Camp Lake 2018 vs Baseline		
	Summer	Fall	Winter	Summer	Fall
Aluminum (Al)	1.0	0.6	0.0	0.6	1.1
Antimony (Sb)	1.0	1.0	0.0	0.0	1.0
Arsenic (As)	1.0	1.0	1.0	0.8	1.0
Barium (Ba)	1.0	1.0	0.0	1.3	1.2
Beryllium (Be)	1.0	1.0	1.2	1.2	2.1
Cadmium (Cd)	1.0	1.0	0.4	0.0	0.8
Calcium (Ca)	1.9	1.9	1.3	1.2	1.2
Chromium (Cr)	1.0	1.0	RDL	RDL	RDL
Cobalt (Co)	1.0	1.0	1.0	1.0	0.9
Copper (Cu)	1.1	1.2	0.8	0.6	1.1
Iron (Fe)	1.0	1.0	1.2	1.2	1.7
Lead (Pb)	1.0	1.0	0.6	1.0	1.0
Lithium (Li)	1.2	1.1	0.3	0.0	0.5
Magnesium (Mg)	1.8	2.0	1.3	1.2	1.2
Manganese (Mn)	3.0	0.8	0.5	0.0	0.3
Mercury (Hg)	1.0	1.0	1.0	1.0	1.0
Molybdenum (Mo)	2.4	2.2	1.6	0.0	1.5
Nickel (Ni)	1.1	1.2	1.0	0.6	1.0
Potassium (K)	1.3	1.4	0.8	1.1	1.0
Selenium (Se)	1.0	1.0	RDL	RDL	RDL
Silicon (Si)	0.7	0.8	0.8	0.7	0.8
Silver (Ag)	1.0	1.0	1.2	1.8	2.7
Sodium (Na)	1.8	1.9	1.2	1.2	1.3
Strontium (Sr)	1.3	1.3	1.5	1.4	1.4
Thallium (Tl)	1.0	1.0	1.2	1.3	2.6
Tin (Sn)	1.0	1.0	0.1	0.2	0.1
Titanium (Ti)	1.0	1.0	1.0	1.0	1.0
Uranium (U)	3.3	3.5	1.7	1.7	1.8
Vanadium (V)	1.0	1.0	1.0	1.0	1.0
Zinc (Zn)	1.0	1.0	1.5	1.0	1.9

 Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).
 Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).
 Denotes highly elevated concentration (mean concentration greater than 10 times higher than respective mean reference or baseline period value).

Note: RDL = Reportable Detection Limit

Table C.31: *In Situ* Water Quality Measurements Collected at Sheardown Lake Tributary 1, Tributary 12, and Tributary 9 Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2018

Study Area	Station	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)	pH (pH units)	Specific Conductance (µS/cm)
Unnamed Reference Creek	REF-CRK-B1	6.00	12.27	98.5	7.98	87.6
	REF-CRK-B2	5.80	12.32	98.6	7.98	85.9
	REF-CRK-B3	5.80	12.34	98.6	7.98	88.5
	REF-CRK-B4	5.50	12.39	98.3	7.99	88.5
	REF-CRK-B5	5.40	12.42	98.3	1.00	88.3
Sheardown Lake Tributary 1 Reach 1	SDLT-1-R1-B1	9.51	12.22	107.2	7.43	359
	SDLT-1-R1-B2	9.50	12.03	105.5	7.57	371
	SDLT-1-R1-B3	9.44	12.12	106.2	7.59	391
	SDLT-1-R1-B4	8.90	12.46	107.8	7.55	-
	SDLT-1-R1-B5	8.65	12.66	109.0	7.51	379
Sheardown Lake Tributary 12 Downstream	SDLT-12-DS-B1	5.90	12.80	99.8	7.45	268
	SDLT-12-DS-B2	6.86	12.30	101.0	7.41	271
	SDLT-12-DS-B3	7.83	12.10	101.9	7.30	267
Sheardown Lake Tributary 9 Upstream	SDLT-9-DS-B1	5.30	11.26	88.8	7.93	180.9
	SDLT-9-DS-B2	5.30	11.55	91.1	7.96	180.3
	SDLT-9-DS-B3	5.40	11.75	93.3	8.00	180.1
	SDLT-9-DS-B4	5.50	11.95	94.8	8.03	180.3
	SDLT-9-DS-B5	5.40	12.12	96.0	8.07	179.1

Table C.32: *In Situ* Water Quality Summary Statistics for the Sheardown Lake Tributary Benthic Stations, Mary River Project CREMP, August 2018

Metric	Study Area	Mean	Standard Deviation	Standard Error	95% Confidence Interval		Minimum	Maximum
					Lower Bound	Upper Bound		
Water Temperature (°C)	Unnamed Reference Creek	5.7	0.2	0.1	5.4	6.0	5.4	6.0
	Sheardown Lake Tributary 1 (SDLT1)	9.2	0.4	0.2	8.7	9.7	8.7	9.5
	Sheardown Lake Tributary 12 (SDLT12)	6.9	1.0	0.6	4.5	9.3	5.9	7.8
	Sheardown Lake Tributary 9 (SDLT9)	5.4	0.1	0.0	5.3	5.5	5.3	5.5
Dissolved Oxygen (mg/L)	Unnamed Reference Creek	12.35	0.06	0.03	12.27	12.42	12.27	12.42
	Sheardown Lake Tributary 1 (SDLT1)	12.30	0.26	0.12	11.98	12.62	12.03	12.66
	Sheardown Lake Tributary 12 (SDLT12)	12.40	0.36	0.21	11.50	13.30	12.10	12.80
	Sheardown Lake Tributary 9 (SDLT9)	11.73	0.34	0.15	11.31	12.14	11.26	12.12
Dissolved Oxygen (% Saturation)	Unnamed Reference Creek	98.5	0.2	0.1	98.3	98.6	98.3	98.6
	Sheardown Lake Tributary 1 (SDLT1)	107.1	1.4	0.6	105.4	108.8	105.5	109.0
	Sheardown Lake Tributary 12 (SDLT12)	100.9	1.1	0.6	98.3	103.5	99.8	101.9
	Sheardown Lake Tributary 9 (SDLT9)	92.8	2.9	1.3	89.2	96.4	88.8	96.0
pH (units)	Unnamed Reference Creek	7.97	0.03	0.01	7.93	8.01	7.92	7.99
	Sheardown Lake Tributary 1 (SDLT1)	7.53	0.06	0.03	7.45	7.61	7.43	7.59
	Sheardown Lake Tributary 12 (SDLT12)	7.39	0.08	0.04	7.19	7.58	7.30	7.45
	Sheardown Lake Tributary 9 (SDLT9)	8.00	0.06	0.02	7.93	8.07	7.93	8.07
Specific Conductance (µS/cm)	Unnamed Reference Creek	88	1.1	0.5	86.4	89.1	85.9	88.5
	Sheardown Lake Tributary 1 (SDLT1)	375	13	7	354	396	359	391
	Sheardown Lake Tributary 12 (SDLT12)	269	2	1	263	274	267	271
	Sheardown Lake Tributary 9 (SDLT9)	180	1	0	179	181	179	181

Note: Five stations were sampled at each study area except Tributary 9, where three stations were sampled.

Table C.33: In Situ Water Quality Statistical Comparisons Among the Sheardown Lake Tributaries and Unnamed Reference Creek Study Areas, Mary River Project CREMP, August 2018

Metric	Overall 4-group Comparison			Pair-wise, <i>post hoc</i> comparisons ^a				
	Significant Difference Among Areas?	P-value	Statistical Test ^b	(I) Area	(J) Area	Significant Difference Between Areas?	P-value	Statistical Test
Water Temperature (°C)	YES	0.0019	γ	Unnamed Reference Creek	Sheardown Tributary 1	YES	0.0079	Mann-Whitney U-test
				Unnamed Reference Creek	Sheardown Tributary 12	YES	0.0714	
				Unnamed Reference Creek	Sheardown Tributary 9	YES	0.0317	
				Sheardown Tributary 1	Sheardown Tributary 12	YES	0.0357	
				Sheardown Tributary 1	Sheardown Tributary 9	YES	0.0079	
				Sheardown Tributary 12	Sheardown Tributary 9	YES	0.0357	
Dissolved Oxygen (% saturation)	YES	< 0.0001	α	Unnamed Reference Creek	Sheardown Tributary 1	YES	0.0008	Tamhane's
				Unnamed Reference Creek	Sheardown Tributary 12	NO	0.2889	
				Unnamed Reference Creek	Sheardown Tributary 9	YES	0.0686	
				Sheardown Tributary 1	Sheardown Tributary 12	YES	0.0035	
				Sheardown Tributary 1	Sheardown Tributary 9	YES	0.0005	
				Sheardown Tributary 12	Sheardown Tributary 9	YES	0.0108	
pH (units)	YES	0.0032	γ	Unnamed Reference Creek	Sheardown Tributary 1	YES	0.0079	Mann-Whitney U-test
				Unnamed Reference Creek	Sheardown Tributary 12	YES	0.0357	
				Unnamed Reference Creek	Sheardown Tributary 9	NO	0.4206	
				Sheardown Tributary 1	Sheardown Tributary 12	YES	0.0714	
				Sheardown Tributary 1	Sheardown Tributary 9	YES	0.0079	
				Sheardown Tributary 12	Sheardown Tributary 9	YES	0.0357	
Specific Conductance (µS/cm)	YES	< 0.0001	α	Unnamed Reference Creek	Sheardown Tributary 1	YES	0.0002	Tamhane's
				Unnamed Reference Creek	Sheardown Tributary 12	YES	0.0000	
				Unnamed Reference Creek	Sheardown Tributary 9	YES	0.0000	
				Sheardown Tributary 1	Sheardown Tributary 12	YES	0.0025	
				Sheardown Tributary 1	Sheardown Tributary 9	YES	0.0005	
				Sheardown Tributary 12	Sheardown Tributary 9	YES	0.0005	

Note: Shading indicates a significant difference for respective comparison (p-value ≤ 0.1).

^a *Post hoc* analysis of 1-way ANOVA among all areas protected for multiple comparisons

^b Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log transformed, single factor ANOVA test conducted; γ - data untransformed, Kruskal Wallis H-test or Mann-Whitney U-test conducted, as appropriate.

Table C.34: Water Chemistry at Sheardown Lake Tributary 1 (SDLT1) Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Spring Sampling Event		Summer Sampling Event		Fall Sampling Event	
					D1-05	D1-00	D1-05	D1-00	DI-05	DI-00
					03-Jul-18	03-Jul-18	01-Aug-18	01-Aug-18	26-Aug-18	26-Aug-18
Conventionals	Conductivity (lab)	umho/cm	-	-	179	282	132	307	190	441
	pH (lab)	pH	6.5 - 9.0	-	7.90	8.10	7.87	8.05	7.72	8.05
	Hardness (as CaCO ₃)	mg/L	-	-	84	136	76	157	99	205
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	95	159	95	165	95	240
	Turbidity	NTU	-	-	1.07	1.37	2.30	1.57	0.28	1.01
	Alkalinity (as CaCO ₃)	mg/L	-	-	56	83	57	77	84	92
Nutrients and Organics	Total Ammonia	mg/L	variable	0.855	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Nitrate	mg/L	13	13	0.164	0.357	0.236	0.881	<0.020	1.280
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	0.0058	<0.0050	0.0057
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	0.17	<0.15	<0.15	0.2
	Dissolved Organic Carbon	mg/L	-	-	2.5	2.0	3.2	3.2	3.4	4.1
	Total Organic Carbon	mg/L	-	-	2.7	3.3	3.7	3.8	3.8	4.3
	Total Phosphorus	mg/L	0.030 ^α	-	0.0053	0.0052	0.0042	0.0036	<0.0030	<0.0030
Anions	Phenols	mg/L	0.004 ^α	-	0.0016	<0.0010	0.0016	0.0012	0.0011	0.0011
	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	6.4	10.4	4.5	7.9	0.6	8.8
	Sulphate (SO ₄)	mg/L	218 ^β	218	20.7	42.9	12.3	63.5	7.8	110.0
Total Metals	Aluminum (Al)	mg/L	0.100	0.179	0.024	0.028	0.069	0.041	0.012	0.026
	Antimony (Sb)	mg/L	0.020 ^α	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0099	0.0167	0.0088	0.0161	0.0093	0.0174
	Beryllium (Be)	mg/L	0.011 ^α	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	0.012	<0.010	0.011	<0.010	0.012
	Cadmium (Cd)	mg/L	0.00012	0.00008	0.00003	0.00001	0.00003	0.00002	<0.000010	0.00002
	Calcium (Ca)	mg/L	-	-	16	26	14	27	20	38
	Chromium (Cr)	mg/L	0.0089	0.00856	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^α	0.004	<0.00010	<0.00010	<0.00010	0.00024	0.00057	0.00064
	Copper (Cu)	mg/L	0.002	0.0022	0.0028	0.0021	0.0033	0.0027	0.0036	0.0021
	Iron (Fe)	mg/L	0.30	0.326	<0.030	0.084	0.071	0.067	<0.030	0.072
	Lead (Pb)	mg/L	0.001	0.001	0.000107	0.000055	0.000158	0.000085	0.000061	0.000053
	Lithium (Li)	mg/L	-	-	<0.0010	0.0019	0.0013	0.0020	<0.0010	0.0021
	Magnesium (Mg)	mg/L	-	-	11.1	17.3	9.9	21.7	12.7	29.2
	Manganese (Mn)	mg/L	0.935 ^β	-	0.0010	0.0050	0.001220	0.0399	0.0002	0.1000
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	0.00311	0.00261	0.00575	0.00403	0.00091	0.00322
	Nickel (Ni)	mg/L	0.025	0.025	0.00115	0.00132	0.00118	0.00163	0.00189	0.00438
	Potassium (K)	mg/L	-	-	2.25	2.78	2.30	2.70	1.49	2.81
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	1.10	0.99	1.46	1.50	1.43	1.38
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	1.6	4.1	1.7	3.8	0.4	4.1
	Strontium (Sr)	mg/L	-	-	0.011	0.016	0.010	0.018	0.009	0.024
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.0028	0.0038	0.0026	0.0041	0.0034	0.0049
	Vanadium (V)	mg/L	0.006 ^α	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	0.0117	<0.0030	0.0055	<0.0030	0.0075

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for WQG information.

^b AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data and adopted from the Camp Lake Tributaries.

Indicates parameter concentration above applicable Water Quality Guideline.

BOLD

 Indicates parameter concentration above the AEMP benchmark.

Table C.35: Magnitude of Elevation in Seasonal Average Parameter Concentrations (Total Metal Concentration Data Provided) Between SDLT1 and Reference Creek Stations in 2018, and at SDLT1 Between 2018 and the Baseline Period, Mary River Project CREMP

Parameter	SDLT1 Station D1-05 (Reach 4)						SDLT1 Station D1-00 (Reach 1)					
	2018 vs Reference Creek			2018 vs Baseline			2018 vs Reference Creek			2018 vs Baseline		
	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall
Conductivity (lab)	5.6	1.8	2.0	2.6	0.9	0.9	8.8	4.1	4.5	3.4	1.6	1.8
Hardness (as CaCO ₃)	5.3	1.9	2.1	2.4	1.1	1.0	8.5	4.0	4.4	3.2	1.5	1.6
Total Suspended Solids (TSS)	0.7	1.0	1.0	1.0	1.0	1.0	0.7	1.0	1.0	1.0	1.0	1.0
Total Dissolved Solids (TDS)	6.3	2.0	1.8	2.2	1.0	0.7	11	3.5	4.5	3.0	1.3	1.5
Turbidity	0.5	0.7	0.1	1.5	6.5	0.9	0.7	0.5	0.4	0.3	2.4	2.9
Alkalinity (as CaCO ₃)	4.1	1.5	2.0	1.9	0.9	1.0	6.0	2.1	2.1	2.2	0.8	0.8
Total Ammonia	1.0	1.0	1.0	0.1	0.2	0.3	1.0	1.0	1.0	0.1	0.4	0.7
Nitrate	8.2	12	1.0	1.9	2.5	0.1	18	44	64	3.6	8.8	12
Nitrite	1.0	1.0	1.0	1.0		0.7	1.0	1.2	1.1	1.0		1.0
Total Kjeldahl Nitrogen (TKN)	1.0	1.1	1.0	1.1	1.5	1.4	1.0	1.0	1.3	0.7	0.8	1.6
Dissolved Organic Carbon	2.6	1.7	2.3	0.7	1.3	1.5	2.0	1.7	2.8	0.5	1.1	1.7
Total Organic Carbon	2.3	1.8	1.9	0.8	1.5	1.6	2.7	1.8	2.1	0.7	1.2	1.7
Total Phosphorus	1.1	0.7	0.9	0.4	0.9	1.0	1.1	0.6	0.9	0.5	0.8	0.4
Phenols	0.8	1.6	1.1				0.5	1.2	1.1			
Bromide (Br)	1.0	1.0	1.0	0.4			1.0	1.0	1.0	0.4		
Chloride (Cl)	11	4.5	0.4	1.5	1.3	0.1	17	7.9	5.4		1.7	1.2
Sulphate (SO ₄)	37	8.1	2.9	26	2.7	0.8	76	42	41	86	12	13
Aluminum (Al)	0.5	0.7	0.2	0.7	4.7	1.1	0.6	0.4	0.5	0.2	1.9	2.3
Antimony (Sb)	1.0	1.0	1.0	0.5	0.7	0.7	1.0	1.0	1.0	1.0	1.0	1.0
Arsenic (As)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Barium (Ba)	3.9	1.7	1.6	2.4	1.2	0.9	6.6	3.0	3.0	3.1	1.4	1.4
Boron (B)	1.0	1.0	1.0	1.0	0.6	0.6	1.2	1.1	1.2	1.1	0.6	0.9
Cadmium (Cd)	3.3	3.1	1.0	1.1	0.9	0.3	1.3	2.0	2.3	0.9	1.1	1.6
Calcium (Ca)	5.1	1.8	2.0	2.5	1.0	1.1	8.0	3.4	3.8	3.2	1.4	1.5
Chromium (Cr)	RDL	RDL	RDL	RDL	RDL	RDL	RDL	RDL	RDL	RDL	RDL	RDL
Cobalt (Co)	1.0	1.0	5.7	0.6	0.8	4.4	1.0	2.4	6.4	0.8	2.4	6.4
Copper (Cu)	4.8	3.2	4.2	0.9	1.1	1.5	3.5	2.6	2.5	0.7	1.1	1.2
Iron (Fe)	0.6	0.9	0.7	0.5	2.7	1.2	1.7	0.9	1.6	0.5	0.6	1.4
Lead (Pb)	1.4	1.3	0.7	0.4	1.5	0.8	0.7	0.7	0.6	0.2	1.5	1.0
Lithium (Li)	1.0	1.3	1.0	2.0	1.5	1.1	1.9	2.0	2.1	3.8	1.6	1.8
Magnesium (Mg)	6.4	2.2	2.4	2.6	1.1	1.0	10.0	4.7	5.5	3.3	1.7	2.1
Manganese (Mn)	1.3	1.1	0.3	1.1	1.7	0.4	6.8	37	153	1.2	15	67
Mercury (Hg)	1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0		
Molybdenum (Mo)	41	26	3.2	3.5	2.4	0.3	35	18	11	2.1	2.0	1.7
Nickel (Ni)	2.3	2.2	3.6	0.7	1.1	1.9	2.6	3.0	8.3	0.6	1.2	3.8
Potassium (K)	7.1	3.8	2.3	2.5	1.4	0.8	8.8	4.4	4.3	2.9	1.5	1.6
Silicon (Si)	2.7	1.6	1.7	1.3	1.2	1.1	2.5	1.6	1.7	0.9	1.1	1.1
Silver (Ag)	1.0	1.0	1.0	0.9			1.0	1.0	1.0			
Sodium (Na)	4.2	1.8	0.3	5.3	1.7	0.2	11	4.1	3.3	8.1	3.1	1.9
Strontium (Sr)	4.0	1.3	0.9	3.2	1.2	0.7	6.0	2.5	2.5	3.2	1.5	1.7
Thallium (Tl)	1.0	1.0	0.0	RDL	RDL	RDL	1.0	1.0	0.0	RDL	RDL	RDL
Titanium (Ti)	1.0	0.9	1.0	1.0			1.0	0.9	1.0	1.0		
Uranium (U)	15	2.4	1.8	4.4	1.0	0.5	20	3.9	2.6	6.1	1.7	1.1
Vanadium (V)	1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0		
Zinc (Zn)	1.0	1.0	1.0	2.2	1.2	1.4	3.9	1.8	2.5	12	1.2	2.7

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).

Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).

Denotes highly elevated concentration (mean concentration greater than 10 times higher than respective mean reference or baseline period value).

Note: RDL = Reportable Detection Limit

Table C.36: Dissolved Metal Concentrations at Sheardown Lake Tributary Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Spring Sampling Event		Summer Sampling Event		Fall Sampling Event	
			D1-05 3-Jul-18	D1-00 3-Jul-18	D1-05 1-Aug-18	D1-00 1-Aug-18	D1-05 26-Aug-18	D1-00 26-Aug-18
Dissolved Metals	Aluminum (Al)	mg/L	0.0084	0.0083	0.0141	0.0072	0.0036	0.0076
	Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.0094	0.0166	0.0086	0.0162	0.0096	0.0180
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	<0.010	0.012	<0.010	0.011	<0.010	0.012
	Cadmium (Cd)	mg/L	0.000036	0.000011	0.000038	0.000023	<0.000010	0.000021
	Calcium (Ca)	mg/L	15.8	25.8	14.1	27.0	19.3	35.5
	Chromium (Cr)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	<0.00010	<0.00010	<0.00010	0.00022	0.00058	0.00061
	Copper (Cu)	mg/L	0.00264	0.00197	0.00324	0.00259	0.00349	0.00207
	Iron (Fe)	mg/L	<0.030	0.041	<0.030	<0.030	<0.030	0.036
	Lead (Pb)	mg/L	<0.000050	<0.000050	0.000053	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	<0.0010	0.0017	0.0012	0.0021	<0.0010	0.0020
	Magnesium (Mg)	mg/L	10.9	17.4	9.8	21.8	12.3	28.4
	Manganese (Mn)	mg/L	0.00036	0.00427	0.00036	0.04100	0.00016	0.09740
	Mercury (Hg)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.00294	0.00265	0.00587	0.00409	0.00106	0.00319
	Nickel (Ni)	mg/L	0.00107	0.00131	0.00112	0.00154	0.00187	0.00439
	Potassium (K)	mg/L	2.26	2.80	2.26	2.70	1.45	2.60
	Selenium (Se)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	1.07	0.96	1.32	1.43	1.46	1.34
	Silver (Ag)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	1.51	4.19	1.69	3.86	0.38	3.94
	Strontium (Sr)	mg/L	0.0105	0.0163	0.0098	0.0189	0.0099	0.0231
	Thallium (Tl)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.0027	0.0037	0.0026	0.0041	0.0034	0.0050
	Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	<0.0030	0.011	<0.0030	0.0053	<0.0030	0.0077

Table C.37: In Situ Water Quality Profile Data Collected at Sheardown Lake NW Water Quality Monitoring Stations in Winter, Mary River Project CREMP, 2018

Depth (m)	Temperature (°C)						Dissolved Oxygen (mg/L)						Dissolved Oxygen (% Saturation)						pH (pH units)						Specific Conductance (µS/cm)					
	DD Hab9	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7	DD Hab9	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7	DD Hab9	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7	DD Hab9	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7	DD Hab9	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7
Date Collected	23-Apr-18	23-Apr-18	22-Apr-18	22-Apr-18	23-Apr-18	23-Apr-18	23-Apr-18	23-Apr-18	22-Apr-18	22-Apr-18	23-Apr-18	23-Apr-18	23-Apr-18	23-Apr-18	22-Apr-18	22-Apr-18	23-Apr-18	23-Apr-18	23-Apr-18	23-Apr-18	23-Apr-18	22-Apr-18	22-Apr-18	23-Apr-18	23-Apr-18	23-Apr-18	22-Apr-18	22-Apr-18	23-Apr-18	23-Apr-18
1.0	0.4	1.8	1.8	0.5	0.5	1.6	14.2	13.2	13.3	14.3	14.5	14.1	98.0	95.4	95.1	99.5	100.9	100.5	7.63	7.86	7.79	7.78	7.60	7.62	169	164	159	166	169	169
2.0	0.4	0.4	1.9	1.4	0.2	0.2	14.1	14.1	13.1	13.8	14.7	17.8	97.2	97.1	94.5	98.2	101.0	101.8	7.60	7.78	7.76	7.77	7.62	7.61	165	167	155	161	167	170
3.0	1.6	1.7	1.9	1.7	1.6	1.6	13.4	13.2	13.0	13.6	13.6	13.6	96.1	94.6	94.0	98.1	97.6	97.3	7.57	7.76	7.75	7.69	7.60	7.59	158	155	155	158	156	156
4.0	1.9	1.9	1.9	1.9	1.9	1.9	13.2	13.0	13.0	13.4	13.3	13.3	95.0	93.5	93.8	97.5	95.9	95.7	7.56	7.73	7.73	7.68	7.58	7.58	155	154	155	157	155	155
5.0	1.9	1.9	1.9	1.9	1.9	1.9	13.1	12.9	13.0	13.4	13.2	13.2	94.6	93.0	93.5	96.9	95.4	95.2	7.55	7.71	7.73	7.66	7.57	7.57	155	154	155	157	155	155
6.0	2.0	1.9	1.9		1.9	1.9	13.1	12.9	12.9		13.2	13.1	94.5	92.9	93.3		95.1	94.9	7.55	7.69	7.72		7.57	7.56	155	154	155		155	155
7.0	2.0	1.9	1.9		1.9	1.9	13.1	12.9	13.0		13.2	13.1	94.3	92.9	93.5		95.0	94.6	7.55	7.68	7.70		7.57	7.56	155	155	155		155	155
8.0	2.0	1.9	1.9		1.9	1.9	13.0	12.9	12.9		13.2	13.1	94.2	92.9	93.1		95.1	94.5	7.55	7.66	7.69		7.57	7.56	155	155	155		155	155
9.0	2.0	2.0	1.9		1.9	1.9	13.0	12.9	12.7		13.2	13.1	94.1	93.5	92.0		95.2	94.7	7.55	7.66	7.67		7.57	7.56	155	155	155		155	155
10.0		2.0	2.0		1.9	1.9		13.0	12.7		13.2	13.1		93.6	91.5		95.2	94.9		7.66	7.66		7.56	7.56		155	155		155	155
11.0		2.0	2.0		1.9	2.0		13.0	12.7		13.2	13.0		93.7	91.5		95.2	94.1		7.64	7.64		7.56	7.55		155	155		156	155
12.0		2.0	2.0		2.0			13.0	12.6		13.2			93.7	91.4		95.1			7.64	7.63		7.56			155	154		156	
13.0		2.0	2.0		2.0			13.0	12.5		13.2			93.7	90.3		95.2			7.63	7.60		7.56			155	154		156	
14.0		2.0	2.0		2.0			12.9	12.4		13.2			93.1	89.6		95.3			7.61	7.60		7.56			155	154		156	
15.0		2.0	2.1		2.0			12.7	12.2		13.2			92.3	88.9		95.3			7.60	7.58		7.56			155	154		156	
16.0		2.1	2.1		2.0			12.6	12.0		13.2			91.1	87.7		95.5			7.59	7.57		7.56			154	153		156	
17.0		2.1	2.2		2.1			12.3	11.4		13.1			89.7	82.5		95.3			7.57	7.50		7.55			154	153		156	
18.0		2.1	2.2					12.0	11.2					86.8	81.3					7.55	7.49					153	153			
19.0		2.2						11.7						85.2						7.52						153				
20.0		2.2						11.4						83.2						7.50						152				
21.0																														
21.7																														

Notes: Total depth at stations DD Hab9, DLO-01-5, DLO-01-1, DLO-01-4, DLO-01-2, and DLO-01-7 was 9, 20, 18, 5, 17 and 11 m, respectively, at the time of winter sampling. Ice thickness at stations DD Hab9, DLO-01-5, DLO-01-1, DLO-01-4, DLO-01-2, and DLO-01-7 was 2.2, 1.7, 2.7, 2.4, and 1.7 m, respectively, at the time of winter sampling. Deepest measurement at stations DD Hab9, DLO-01-5, DLO-01-1, DLO-01-4, DLO-01-2, and DLO-01-7 was 7.9, 21.7, 20, 5.0, 15.4, and 10.4 m, respectively, at the time of winter sampling.

Table C.38: In Situ Water Quality Profile Data Collected at Sheardown Lake NW Water Quality Monitoring Stations in Summer, Mary River Project CREMP, 2018

Depth (m)	Temperature (°C)						Dissolved Oxygen (mg/L)						Dissolved Oxygen (% Saturation)						pH (pH units)						Specific Conductance (µS/cm)					
	DD Hab9	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7	DD Hab9	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7	DD Hab9	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7	DD Hab9	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7	DD Hab9	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7
Date Collected	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18
1.0	7.6	7.3	7.2	7.8	7.5	7.1	11.80	11.90	11.86	11.98	11.95	11.93	98.5	98.9	98.3	100.7	99.3	98.3	7.97	8.02	7.91	8.02	8.01	7.92	113	113	113	116	116	116
2.0	7.4	7.3	7.1	7.7	7.3	7.0	11.86	11.89	11.89	12.05	11.96	11.99	98.6	98.7	98.2	100.1	99.1	98.7	7.96	8.01	7.93	8.03	8.00	7.96	114	113	112	116	116	116
3.0	7.4	7.2	7.0	7.3	7.1	6.9	11.88	11.92	11.93	12.06	11.99	12.00	98.7	98.6	98.3	100.1	99.0	98.6	7.97	8.02	7.94	8.03	8.01	7.97	114	113	113	116	116	116
4.0	7.3	7.1	6.9	7.2	7.0	6.9	11.89	11.96	11.94	12.08	12.00	12.00	98.8	98.7	98.2	100.0		98.7	7.97	8.02	7.96	8.03	8.01	7.97	116	113	112	116	116	116
5.0	7.3	7.1	6.9		7.0	6.9	11.90	11.96	11.94		12.00	11.99	98.9	98.7	98.3			98.6	7.97	8.04	7.98		8.01	7.97	120	113	112		116	116
6.0	7.3	7.1	6.9		6.9	6.9	11.93	11.96	11.93		12.00	11.99	99.0	98.7	98.2			98.5	7.98	8.04	7.98		8.01	7.98	124	113	113		116	116
7.0	7.3	7.1	6.9		6.9	6.9	11.93	11.95	11.92		11.99	11.98	99.0	98.6	98.0			98.5	7.99	8.04	7.98		8.01	7.98	127	113	113		116	116
8.0	7.3	7.0	6.9		6.9	6.9	11.92	11.95	11.91		11.99	11.97	98.9	98.4	97.9			98.9	8.00	8.03	7.99		8.01	7.98	128	112	113		116	116
9.0	7.2	6.9	6.9		6.9	6.9	11.91	11.94	11.90		11.99	11.97	98.6	98.3	97.9			98.3	8.01	8.03	7.99		8.01	7.99	123	112	113		116	116
10.0	7.0	6.9	6.9		6.9	6.9	11.93	11.94	11.90		11.98	11.96	98.3	98.2	97.8			98.3	8.02	8.03	7.99		8.01	7.99	116	113	113		116	116
11.0		6.9	6.9		6.9	6.9		11.93	11.89		11.97	11.95		98.1	97.8			98.2		8.02	7.99		8.01	7.99		113	113		116	116
12.0		6.9	6.9		6.9			11.92	11.89		11.96			98.0	97.8					8.02	7.96		8.01			113	113		116	
13.0		6.9	6.9		6.9			11.91	11.89		11.95			98.0	97.7					8.02	7.97		8.01			113	113		116	
14.0		6.9	6.9		6.9			11.90	11.88		11.94			97.8	97.7					8.01	7.98		8.01			113	113		116	
15.0		6.9	6.9		6.9			11.89	11.88		11.93			97.8	97.6					8.00	7.97		8.01			113	113		116	
16.0		6.9	6.9		6.9			11.89	11.88		11.93			97.7	97.6					8.00	7.97		8.01			113	113		116	
17.0		6.9	6.9					11.88	11.87					97.7	97.6					7.99	7.96					113	113			
18.0		6.9	6.9					11.88	11.87					97.7	97.5					7.99	7.96					113	113			
19.0		6.9	6.9					11.88	11.86					97.6	97.5					7.98	7.96					113	113			
20.0		6.9	6.9					11.87	11.86					97.6	97.4					7.98	7.96					113	113			
21.0		6.9						11.86						97.5						7.98						113				
22.0		6.9						11.86						97.5						7.98						113				

Note: Total depth at stations DD Hab9, DLO-01-5, DLO-01-1, DLO-01-4, DLO-01-2, and DLO-01-7 was 10.5, 23.4, 22, 5.4, 17.4, and 11.5 m, respectively, at the time of summer sampling.

Table C.39: In Situ Water Quality Profile Data Collected at Sheardown Lake NW Water Quality Monitoring Stations in Fall, Mary River Project CREMP, 2018

Depth (m)	Temperature (°C)							Dissolved Oxygen (mg/L)							Dissolved Oxygen (% Saturation)						
	DD Hab9	DLO-01-5	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7	DD Hab9	DLO-01-5	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7	DD Hab9	DLO-01-5	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7
Date Collected	20-Aug-18	21-Aug-18	17-Aug-18	20-Aug-18	21-Aug-18	21-Aug-18	21-Aug-18	20-Aug-18	21-Aug-18	17-Aug-18	20-Aug-18	21-Aug-18	21-Aug-18	21-Aug-18	20-Aug-18	21-Aug-18	17-Aug-18	20-Aug-18	21-Aug-18	21-Aug-18	21-Aug-18
surface			8.0							11.6							97.3				
1.0	7.7	7.6	8.0	7.6	7.6	7.6	7.6	11.5	11.6	11.6	11.7	11.6	11.2	11.4	96.5	97.0	98.1	97.5	97.0	93.5	95.5
2.0	7.6	7.6	7.9	7.6	7.6	7.6	7.6	11.7	11.6	11.7	11.7	11.6	11.2	11.4	97.5	97.0	98.1	97.6	96.8	93.8	95.7
3.0	7.6	7.6	7.8	7.6	7.6	7.6	7.6	11.7	11.6	11.7	11.7	11.6	11.2	11.5	97.7	96.9	97.9	97.6	96.7	93.9	96.0
4.0	7.6	7.6	7.7	7.6	7.6	7.6	7.6	11.7	11.6	11.7	11.7	11.6	11.2	11.5	97.7	96.9	97.9	97.5	96.6	94.0	97.4
5.0	7.6	7.6	7.7	7.6	7.6	7.6	7.6	11.7	11.6	11.7	11.7	11.6	11.2	11.5	97.7	96.8	97.8	97.5	96.6	94.0	96.2
6.0	7.6	7.6	7.7	7.6	7.6	7.6	7.6	11.7	11.6	11.7	11.7	11.6	11.25	11.5	97.7	96.7	97.8	97.5	96.6	94.2	96.3
7.0	7.6	7.6	7.7	7.6	7.6	7.6	7.6	11.7	11.6	11.7	11.6	11.5	11.3	11.5	97.6	96.7	97.7	97.4	95.8	94.8	96.3
8.0	7.6	7.6	7.7	7.6		7.6	7.6	11.7	11.6	11.6	11.6		11.4	11.5	97.6	96.7	97.7	97.4		94.9	96.3
9.0		7.6	7.7	7.6		7.6	7.6		11.6	11.6	11.6		11.4	11.5		96.6	97.6	97.4		95.1	96.2
10.0		7.6	7.7	7.6		7.6	7.6		11.5	11.6	11.6		11.4	11.5		96.6	97.5	97.4		95.2	96.2
11.0		7.6	7.7	7.6		7.6	7.6		11.5	11.6	11.6		11.4	11.5		96.5	97.3	97.3		95.3	96.2
12.0		7.6	7.7	7.6		7.6			11.5	11.6	11.6		11.4			96.5	97.1	97.3		95.4	
13.0		7.6	7.6	7.6		7.6			11.5	11.6	11.6		11.4			96.5	96.9	97.3		95.4	
14.0		7.6	7.6	7.6		7.6			11.5	11.6	11.6		11.4			96.5	96.7	97.2		95.5	
15.0		7.6	7.6	7.6		7.6			11.5	11.5	11.6		11.4			96.4	96.5	97.2		95.5	
16.0		7.6	7.6	7.6		7.6			11.5	11.5	11.6		11.4			96.4	96.4	97.1		95.5	
17.0		7.6	7.6	7.6		7.6			11.5	11.5	11.6		11.4			96.3	96.3	97.1		95.5	
18.0		7.6	7.6	7.6					11.5	11.5	11.6					96.3	96.2	97.0			
19.0		7.6	7.6	7.6					11.5	11.5	11.6					96.3	96.2	97.0			
20.0		7.6	7.6	7.6					11.5	11.5	11.6					96.0	96.2	97.0			
21.0		7.6	7.5	7.6					11.5	11.5	11.6					96.0	95.7	96.9			
22.0		7.6							11.5							95.9					
23.0		7.6							11.5							95.9					

Notes: 17-Aug-18 sampling was conducted by Minnow. Sheardown Lake NW water profile sampling on all other dates was conducted by Baffinland. Total depth at stations DD Hab9, DLO-01-5, DLO-01-1, DLO-01-4, DLO-01-2, and DLO-01-7 was 8.6, 23.5, 20.6, 7.0, 17.4, and 10.7 m, respectively, at the time of fall sampling.

Table C.39: In Situ Water Quality Profile Data Collected at Sheardown Lake NW Water Quality Monitoring Stations in Fall, Mary River Project CREMP, 2018

Depth (m)	pH (pH units)							Specific Conductance (µS/cm)						
	DD Hab9	DLO-01-5	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7	DD Hab9	DLO-01-5	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7
Date Collected	20-Aug-18	21-Aug-18	17-Aug-18	20-Aug-18	21-Aug-18	21-Aug-18	21-Aug-18	20-Aug-18	21-Aug-18	17-Aug-18	20-Aug-18	21-Aug-18	21-Aug-18	21-Aug-18
surface			8.03							120				
1.0	8.06	7.94	8.01	8.03	7.94	7.67	7.95	119	118	120	118	119	119	119
2.0	8.05	7.94	8.01	8.02	7.94	7.74	7.94	119	118	120	118	119	119	119
3.0	8.03	7.95	8.02	8.02	7.94	7.78	7.94	119	118	120	118	119	119	119
4.0	8.03	7.94	8.02	8.01	7.94	7.81	7.94	119	118	120	118	119	119	119
5.0	8.03	7.94	8.01	8.01	7.95	7.82	7.95	119	118	120	118	119	119	119
6.0	8.02	7.94	8.03	8.01	7.95	7.84	7.94	119	118	120	118	119	119	119
7.0	8.02	7.94	8.01	8.01	7.89	7.87	7.94	120	118	120	118	119	119	119
8.0	8.02	7.94	8.00	8.01		7.87	7.94	120	119	120	118		119	119
9.0		7.94	8.00	8.01		7.87	7.94		119	120	118		119	119
10.0		7.94	7.99	8.01		7.88	7.94		118	120	118		119	119
11.0		7.95	7.98	8.01		7.88	7.94		118	120	118		119	119
12.0		7.94	7.97	8.01		7.89			119	120	118		119	
13.0		7.94	7.96	8.01		7.89			118	120	118		119	
14.0		7.94	7.95	8.01		7.90			119	120	118		119	
15.0		7.93	7.94	8.01		7.90			119	120	118		119	
16.0		7.93	7.93	8.01		7.90			118	120	118		119	
17.0		7.93	7.92	8.01		7.90			119	121	118		119	
18.0		7.93	7.91	8.01					118	121	118			
19.0		7.92	7.91	8.01					119	121	118			
20.0		7.89	7.91	8.01					118	122	118			
21.0		7.83	7.90	8.01					118	122	118			
22.0		7.80							118					
23.0		7.76							118					

Notes: 17-Aug-18 sampling was conducted by Minnow. Sheardown Lake NW water profile sampling on all other dates was conducted by Baffinland. Total depth at stations DD Hab9, DLO-01-5, DLO-01-1, DLO-01-4, DLO-01-2, and DLO-01-7 was 8.6, 23.5, 20.6, 7.0, 17.4, and 10.7 m, respectively, at the time of fall sampling.

Table C.40: Sampling Depth, Water Clarity Measures, and Surface and Bottom *In Situ* Water Quality Measures Collected at Sheardown Lake NW Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2018

Categorization & Replicate ID		Date Sampled	Station Depth (m)	Secchi Depth (m)	Depth sampled	Temperature (°C)	Dissolved Oxygen		pH (units)	Specific Conductance (µS/cm)
							(mg/L)	(% sat.)		
Littoral (Shallow) Stations	DLO-01-9	17-Aug-2018	8.2	3.3	surface	7.80	11.65	97.9	7.96	120
					bottom	7.60	11.64	97.1	8.01	121
	DLO-01-4	17-Aug-2018	6.7	3.7	surface	7.80	11.68	98.3	8.01	120
					bottom	7.50	11.67	97.5	8.02	120
	DLO-01-3	17-Aug-2018	7.3	3.6	surface	8.10	11.65	98.6	7.99	120
					bottom	7.70	11.68	98.1	7.98	120
	DLO-01-11	17-Aug-2018	8.2	3.7	surface	7.90	11.63	98.0	8.02	120
					bottom	7.70	11.63	97.7	8.00	120
	DLO-01-10	17-Aug-2018	8.8	3.5	surface	7.90	11.65	98.7	8.00	120
					bottom	7.70	11.65	97.8	8.03	120
Profundal (Deep) Stations	DLO-01-5	17-Aug-2018	23.8	4.6	surface	7.80	11.61	97.6	7.81	120
					bottom	7.50	11.27	93.7	7.83	120
	DLO-01-14	17-Aug-2018	23.8	3.5	surface	7.80	11.65	98.0	8.04	119
					bottom	7.50	11.41	95.2	7.94	120
	DLO-01-15	17-Aug-2018	21.3	4.5	surface	7.80	11.68	98.2	7.99	120
					bottom	7.60	11.50	96.1	7.96	120
	DLO-01-2	17-Aug-2018	17.1	3.9	surface	7.90	11.67	98.3	7.99	120
					bottom	7.60	11.59	97.0	7.98	120
	DLO-01-12	17-Aug-2018	14.0	3.4	surface	8.00	11.66	98.4	7.98	120
					bottom	7.60	11.60	97.1	7.97	120

Table C.41: Statistical Comparison of Bottom *In Situ* Water Quality Between Sheardown Lake NW Littoral and Profundal Stations, Mary River Project CREMP, August 2018

Habitat Variable	Statistical Test Results			Summary Statistics						
	Significant Difference Between Areas?	P-value	Statistical Analysis ^a	Lake Zone	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Secchi Depth (m)	NO	0.169	α	Littoral	5	3.56	0.17	0.07	3.30	3.70
				Profundal	5	3.98	0.55	0.25	3.40	4.60
Temperature (°C)	NO	0.151	β, ζ	Littoral	5	7.64	0.09	0.04	7.50	7.70
				Profundal	5	7.56	0.05	0.02	7.50	7.60
Dissolved Oxygen (mg/L)	YES	0.042	β, ζ	Littoral	5	11.7	0.0	0.0	11.6	11.7
				Profundal	5	11.5	0.1	0.1	11.3	11.6
Dissolved Oxygen (% saturation)	YES	0.043	α	Littoral	5	97.6	0.4	0.2	97.1	98.1
				Profundal	5	95.8	1.4	0.6	93.7	97.1
pH (units)	YES	0.008	α	Littoral	5	8.01	0.02	0.01	7.98	8.03
				Profundal	5	7.94	0.06	0.03	7.83	7.98
Specific Conductance (umho/cm)	NO	0.829	α	Littoral	5	120.0	0.4	0.2	119.7	120.7
				Profundal	5	120.0	0.5	0.2	119.5	120.4

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log-transformed, single factor ANOVA test conducted; γ - data untransformed, Mann-Whitney U-test conducted; η - data untransformed, t-test assuming unequal variance conducted; δ - data log-transformed, t-test assuming unequal variance conducted.



Highlighted values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

Table C.42: Statistical Comparison of Bottom *In Situ* Water Quality Between Sheardown Lake NW and Reference Lake 3 Stations Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2018

Lake Zone	Habitat Variable	Statistical Test Results			Summary Statistics						
		Significant Difference Between Areas?	P-value	Statistical Analysis ^a	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Littoral (Shallow) Stations	Station Depth (m)	YES	0.013	α	Reference	5	9.80	1.11	0.49	8.40	11.20
					Sheardown NW	5	7.84	0.83	0.37	6.70	8.80
	Secchi Depth (m)	YES	< 0.001	α	Reference	4	8.49	0.45	0.23	8.05	9.10
					Sheardown NW	5	3.56	0.17	0.07	3.30	3.70
	Temperature (°C)	YES	0.016	γ	Reference	4	7.05	0.10	0.05	6.90	7.10
					Sheardown NW	5	7.64	0.09	0.04	7.50	7.70
	Dissolved Oxygen (mg/L)	NO	0.738	η	Reference	4	11.6	0.3	0.1	11.2	11.8
					Sheardown NW	5	11.7	0.0	0.0	11.6	11.7
	Dissolved Oxygen (% saturation)	YES	0.016	γ	Reference	4	95.7	2.2	1.1	92.4	97.1
					Sheardown NW	5	97.6	0.4	0.2	97.1	98.1
Profundal (Deep) Stations	pH (units)	YES	0.003	η	Reference	4	7.54	0.11	0.05	7.41	7.65
					Sheardown NW	5	8.01	0.02	0.01	7.98	8.03
	Specific Conductance (umho/cm)	YES	< 0.001	α	Reference	4	62.8	1.0	0.5	62.3	64.3
					Sheardown NW	5	120.0	0.4	0.2	119.7	120.7
	Station Depth (m)	NO	0.593	α	Reference	5	21.26	2.62	1.17	18.50	25.00
					Sheardown NW	5	20.00	4.33	1.94	14.00	23.80
	Secchi Depth (m)	YES	< 0.001	α	Reference	4	8.63	0.26	0.13	8.30	8.90
					Sheardown NW	5	3.98	0.55	0.25	3.40	4.60
	Temperature (°C)	YES	0.016	γ	Reference	4	7.08	0.05	0.02	7.00	7.10
					Sheardown NW	5	7.56	0.05	0.02	7.50	7.60
	Dissolved Oxygen (mg/L)	NO	0.286	γ	Reference	4	11.5	0.4	0.2	10.9	11.7
					Sheardown NW	5	11.5	0.1	0.1	11.3	11.6
	Dissolved Oxygen (% saturation)	NO	0.556	γ	Reference	4	94.6	2.8	1.4	90.4	96.1
					Sheardown NW	5	95.8	1.4	0.6	93.7	97.1
	pH (units)	YES	0.016	γ	Reference	4	7.63	0.04	0.02	7.58	7.67
					Sheardown NW	5	7.94	0.06	0.03	7.83	7.98
	Specific Conductance (umho/cm)	YES	< 0.001	α	Reference	4	62.5	0.2	0.1	62.3	62.8
					Sheardown NW	5	120.0	0.5	0.2	119.5	120.4

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log-transformed, single factor ANOVA test conducted; γ - data untransformed, Mann-Whitney U-test conducted; η - data untransformed, t-test assuming unequal variance conducted; δ - data log-transformed, t-test assuming unequal variance conducted.

Highlighted values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

Table C.43: Water Chemistry at Sheardown Lake NW (DLO-01) Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Winter Sampling Event											
					DD-HAB9-STN1 bottom 23-Apr-18	DD-HAB9-STN1 surface 23-Apr-18	DL0-01-5 bottom 23-Apr-18	DL0-01-5 surface 23-Apr-18	DL0-01-1 bottom 22-Apr-18	DL0-01-1 surface 22-Apr-18	DL0-01-4 bottom 22-Apr-18	DL0-01-4 surface 22-Apr-18	DL0-01-2 bottom 23-Apr-18	DL0-01-2 surface 23-Apr-18	DL0-01-7 bottom 23-Apr-18	DL0-01-7 surface 23-Apr-18
Conventional	Conductivity (lab)	umho/cm	-	-	154	160	148	171	152	158	156	161	155	159	156	166
	pH (lab)	pH	6.5 - 9.0	-	7.93	7.95	7.72	8.16	7.93	7.96	7.89	7.91	8.12	7.94	8.03	8.00
	Hardness (as CaCO ₃)	mg/L	-	-	66	69	68	75	68	70	68	72	69	72	69	74
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	71	76	73	78	68	73	76	85	73	76	74	80
	Turbidity	NTU	-	-	0.3	0.3	0.4	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.4	0.3
	Alkalinity (as CaCO ₃)	mg/L	-	-	64	70	63	69	60	64	63	67	66	68	69	71
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	<0.020	<0.020	0.023	<0.020	0.032	<0.020	<0.020	0.034	0.033	<0.020	<0.020	<0.020
	Nitrate	mg/L	13	13	0.083	0.085	0.120	0.097	0.104	0.083	0.082	0.083	0.079	0.081	0.081	0.085
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	0.28	<0.15	0.27	<0.15	<0.15	0.18	0.21	<0.15	<0.15	0.28	<0.15
	Dissolved Organic Carbon	mg/L	-	-	1.7	1.8	1.8	1.8	1.7	1.7	<1.0	1.8	1.8	1.8	1.8	1.8
	Total Organic Carbon	mg/L	-	-	1.9	2.0	1.9	2.3	1.9	2.2	2.0	2.1	2.1	2.1	1.8	2.2
	Total Phosphorus	mg/L	0.020 ^d	-	0.0031	0.0036	<0.0030	<0.0030	0.0050	0.0048	0.0034	0.0042	0.0039	0.0046	0.0055	<0.0030
	Phenols	mg/L	0.004 ^d	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	3.7	3.9	3.7	4.2	3.7	3.9	3.8	4.0	3.8	3.9	3.7	4.0
	Sulphate (SO ₄)	mg/L	218 ⁸	218	6.7	6.9	6.5	7.4	6.6	6.9	6.8	7.0	6.7	7.0	6.7	7.1
Total Metals	Aluminum (Al)	mg/L	0.100	0.179, 0.173 ^c	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Antimony (Sb)	mg/L	0.020 ^d	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0079	0.0079	0.0074	0.0083	0.0079	0.0084	0.0083	0.0081	0.0083	0.0079	0.0073	0.0086
	Beryllium (Be)	mg/L	0.011 ^d	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00009	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	14	14	14	15	14	14	14	14	13	14	14	15
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^d	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0024	0.0010	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0011	0.0009	0.0008	0.0008	0.0009
	Iron (Fe)	mg/L	0.30	0.300	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	-	-	8.6	8.7	8.1	8.8	8.2	9.1	8.4	8.9	8.4	8.5	7.9	9.1
	Manganese (Mn)	mg/L	0.935 ⁸	-	0.0006	0.0006	0.0011	0.0005	0.0009	0.0006	0.0002	0.0007	0.0007	0.0006	0.0006	0.0006
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	0.00090	0.00097	0.00084	0.00097	0.00090	0.00092	0.00096	0.00099	0.00092	0.00094	0.00096	0.00097
	Nickel (Ni)	mg/L	0.025	0.025	0.00064	0.00066	0.00062	0.00067	0.00062	0.00069	0.00066	0.00070	0.00065	0.00067	0.00060	0.00070
	Potassium (K)	mg/L	-	-	1.25	1.34	1.23	1.34	1.25	1.34	1.29	1.36	1.28	1.29	1.16	1.39
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.49	0.50	0.69	0.52	0.62	0.49	0.49	0.49	0.48	0.48	0.49	0.51
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	1.5	1.6	1.5	1.6	1.4	1.6	1.5	1.7	1.5	1.5	1.4	1.7
	Strontium (Sr)	mg/L	-	-	0.010	0.010	0.009	0.010	0.009	0.010	0.010	0.010	0.010	0.010	0.010	0.010
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00018	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.0011	0.0011	0.0009	0.0011	0.0010	0.0011	0.0011	0.0011	0.0010	0.0010	0.0010	0.0011
	Vanadium (V)	mg/L	0.006 ^d	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

^b AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to Sheardown Lake.

^c Benchmark is 0.179 mg/L and 0.173 mg/L for shallow and deep stations, respectively.

 Indicates parameter concentration above applicable Water Quality Guideline.

 Indicates parameter concentration above the AEMP benchmark.

Table C.43: Water Chemistry at Sheardown Lake NW (DLO-01) Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Summer Sampling Event											
					DD-HAB9-STN1 bottom 30-Jul-18	DD-HAB9-STN1 surface 30-Jul-18	DL0-01-5 bottom 30-Jul-18	DL0-01-5 surface 30-Jul-18	DL0-01-1 bottom 30-Jul-18	DL0-01-1 surface 30-Jul-18	DL0-01-4 bottom 30-Jul-18	DL0-01-4 surface 30-Jul-18	DL0-01-2 bottom 30-Jul-18	DL0-01-2 surface 30-Jul-18	DL0-01-7 bottom 30-Jul-18	DL0-01-7 surface 30-Jul-18
Conventionals	Conductivity (lab)	umho/cm	-	-	144	129	129	129	129	129	128	128	129	129	129	128
	pH (lab)	pH	6.5 - 9.0	-	8.07	8.09	8.13	8.10	8.04	7.85	8.11	8.12	8.11	8.25	8.19	8.11
	Hardness (as CaCO ₃)	mg/L	-	-	72	62	63	63	64	63	63	63	63	63	63	62
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	55	58	50	55	40	50	50	60	50	40	40	50
	Turbidity	NTU	-	-	0.9	1.1	1.0	1.0	1.0	1.0	1.3	0.9	1.0	1.0	1.3	0.9
	Alkalinity (as CaCO ₃)	mg/L	-	-	55	50	56	53	56	54	55	55	55	53	55	54
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	<0.020	0.0355	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Nitrate	mg/L	13	13	0.950	0.046	0.043	0.043	0.050	0.045	0.045	0.042	0.045	0.044	0.042	0.042
	Nitrite	mg/L	0.06	0.06	0.0972	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	1.9	1.8	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.9	2.1
	Total Organic Carbon	mg/L	-	-	2.1	2.0	2.0	2.5	2.0	1.9	2.1	1.9	1.8	2.0	1.9	2.0
	Total Phosphorus	mg/L	0.020 ^d	-	0.0035	0.0036	0.0037	0.0057	0.0041	0.0040	0.0051	0.0037	0.0049	0.0055	0.0050	0.0047
Anions	Phenols	mg/L	0.004 ^d	-	0.0027	0.0052	<0.0010	0.0044	0.0018	0.0039	0.0017	0.0015	0.0027	0.0013	0.0016	<0.0010
	Bromide (Br)	mg/L	-	-	0.23	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	65.8	3.4	3.4	3.5	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.5
Total Metals	Sulphate (SO ₄)	mg/L	218 ^β	218	19.0	6.6	6.5	6.5	6.5	6.6	6.4	6.5	6.6	6.5	6.5	6.5
	Aluminum (Al)	mg/L	0.100	0.179, 0.173 ^c	0.020	0.008	0.014	0.015	0.013	0.013	0.015	0.017	0.012	0.012	0.014	0.015
	Antimony (Sb)	mg/L	0.020 ^d	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0078	0.0068	0.0070	0.0072	0.0070	0.0067	0.0070	0.0076	0.0066	0.0068	0.0070	0.0068
	Beryllium (Be)	mg/L	0.011 ^d	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00009	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	14	13	13	13	13	13	13	12	13	13	13	13
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^d	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0024	0.00102	0.00070	0.0009	0.00084	0.0009	0.0009	0.0008	0.00084	0.0008	0.0008	0.0008	0.00080
	Iron (Fe)	mg/L	0.30	0.300	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	0.0011	0.0011	0.0012	0.0010	0.0012	<0.0010	<0.0010	<0.0010	0.001	<0.0010	0.001	<0.0010
	Magnesium (Mg)	mg/L	-	-	8.7	7.7	7.8	7.8	7.6	7.6	7.6	7.9	7.6	7.4	7.5	7.6
	Manganese (Mn)	mg/L	0.935 ^β	-	0.0035	0.0018	0.0034	0.0032	0.0031	0.0032	0.0031	0.0030	0.0032	0.0030	0.0033	0.0032
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	0.00123	0.00086	0.00076	0.00079	0.00081	0.00072	0.00075	0.00076	0.00075	0.00074	0.00080	0.00077
	Nickel (Ni)	mg/L	0.025	0.025	0.00068	0.00057	0.00062	0.00060	0.00062	0.00060	0.00059	0.00059	0.00062	0.00055	0.00058	0.00059
	Potassium (K)	mg/L	-	-	1.34	1.22	1.21	1.23	1.18	1.20	1.18	1.20	1.18	1.16	1.15	1.17
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.55	0.43	0.43	0.43	0.42	0.43	0.43	0.42	0.42	0.43	0.42	0.43
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	1.7	1.5	1.4	1.6	1.4	1.5	1.5	1.5	1.4	1.4	1.4	1.4
	Strontium (Sr)	mg/L	-	-	0.010	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.0014	0.0008	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0010	0.0009	0.0009	0.0009
	Vanadium (V)	mg/L	0.006 ^d	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

^b AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to Sheardown Lake.

^c Benchmark is 0.179 mg/L and 0.173 mg/L for shallow and deep stations, respectively.

 Indicates parameter concentration above applicable Water Quality Guideline.

 Indicates parameter concentration above the AEMP benchmark.

Table C.43: Water Chemistry at Sheardown Lake NW (DLO-01) Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Fall Sampling Event											
					DD-HAB9-STN1 bottom	DD-HAB9-STN1 surface	DL0-01-5 bottom	DL0-01-5 surface	DL0-01-1 bottom	DL0-01-1 surface	DL0-01-4 bottom	DL0-01-4 surface	DL0-01-2 bottom	DL0-01-2 surface	DL0-01-7 bottom	DL0-01-7 surface
					21-Aug-18	21-Aug-18	22-Aug-18	22-Aug-18	21-Aug-18	21-Aug-18	22-Aug-18	22-Aug-18	22-Aug-18	22-Aug-18	22-Aug-18	22-Aug-18
Conventional	Conductivity (lab)	umho/cm	-	-	141	136	138	135	131	134	140	140	140	140	141	140
	pH (lab)	pH	6.5 - 9.0	-	7.95	8.00	8.00	7.98	7.97	7.95	7.97	8.01	8.00	8.00	7.98	8.06
	Hardness (as CaCO ₃)	mg/L	-	-	69	69	68	67	69	70	67	66	69	68	68	67
	Total Suspended Solids (TSS)	mg/L	-	-	2	<2.0	<2.0	<2.0	<2.0	<2.0	2	2.4	2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	65	60	80	85	55	59	75	70	75	71	90	70
	Turbidity	NTU	-	-	1.0	1.0	0.9	0.9	0.9	1.0	0.9	1.0	1.0	0.9	0.9	1.0
	Alkalinity (as CaCO ₃)	mg/L	-	-	51	53	50	52	52	52	52	52	49	49	51	52
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	0.057	<0.020	0.026	<0.020	0.046	<0.020	<0.020	<0.020	0.022	<0.020	<0.020	<0.020
	Nitrate	mg/L	13	13	0.097	0.095	0.078	0.076	0.086	0.086	0.081	0.081	0.079	0.078	0.079	0.077
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	0.15	0.16	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	2.2	2.3	2.4	2.5	2.2	2.3	2.7	2.5	2.5	2.5	2.5	2.5
	Total Organic Carbon	mg/L	-	-	2.3	2.4	2.6	2.6	2.7	2.5	2.6	2.7	2.7	2.7	2.5	2.6
	Total Phosphorus	mg/L	0.020 ^d	-	0.0050	0.0050	0.0037	0.0034	0.0159	0.0052	0.0060	0.0049	<0.0030	0.0051	0.0042	0.0045
Anions	Phenols	mg/L	0.004 ^d	-	0.0011	0.0013	<0.0010	0.0010	0.0014	0.0030	<0.0010	0.0012	0.0010	0.0011	<0.0010	<0.0010
	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	3.5	3.5	3.4	3.5	3.5	3.5	3.5	3.5	3.5	3.4	3.5	3.4
Total Metals	Sulphate (SO ₄)	mg/L	218 ^β	218	9.5	9.5	9.3	9.3	9.2	9.3	9.3	9.3	9.5	9.4	9.4	9.4
	Aluminum (Al)	mg/L	0.100	0.179, 0.173 ^c	0.024	0.019	0.017	0.019	0.060	0.020	0.017	0.020	0.016	0.013	0.020	0.021
	Antimony (Sb)	mg/L	0.020 ^d	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0071	0.0067	0.0069	0.0070	0.0072	0.0068	0.0070	0.0072	0.0069	0.0050	0.0070	0.0069
	Beryllium (Be)	mg/L	0.011 ^d	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00009	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	13	13	13	14	13	13	13	13	13	13	13	13
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^d	0.004	<0.00010	<0.00010	<0.00010	<0.00010	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0024	0.0009	0.0009	0.00087	0.0016	0.0011	0.0009	0.0009	0.0009	0.0008	0.0007	0.0009	0.0009
	Iron (Fe)	mg/L	0.30	0.300	0.035	<0.030	<0.030	<0.030	0.099	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	<0.000050	<0.000050	0.000164	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	<0.0010	0.0011	0.0010	0.0011	0.0011	0.0010	0.0011	0.0011	0.0011	0.001	0.0010	<0.0010
	Magnesium (Mg)	mg/L	-	-	8.6	8.6	8.5	8.5	8.5	8.6	8.6	8.5	8.2	6.4	8.5	8.5
	Manganese (Mn)	mg/L	0.935 ^β	-	0.0117	0.0106	0.00988	0.0102	0.0166	0.0103	0.0097	0.0097	0.0102	0.0079	0.0102	0.0105
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	0.00083	0.00080	0.00077	0.00081	0.00074	0.00074	0.00079	0.00086	0.00082	0.00076	0.00086	0.00075
	Nickel (Ni)	mg/L	0.025	0.025	0.00077	0.00076	0.00073	0.00077	0.00090	0.00074	0.00076	0.00075	0.00072	0.00056	0.00085	0.00119
	Potassium (K)	mg/L	-	-	1.30	1.31	1.28	1.27	1.29	1.30	1.28	1.29	1.27	0.97	1.29	1.29
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.44	0.43	0.43	0.43	0.47	0.42	0.45	0.43	0.41	0.40	0.43	0.44
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	1.7	1.7	1.7	1.6	1.6	1.7	1.6	1.6	1.6	1.6	1.6	1.7
	Strontium (Sr)	mg/L	-	-	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0009	0.0010	0.0009	0.0010
	Vanadium (V)	mg/L	0.006 ^d	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

^b AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to Sheardown Lake.

^c Benchmark is 0.179 mg/L and 0.173 mg/L for shallow and deep stations, respectively.

 Indicates parameter concentration above applicable Water Quality Guideline.

 Indicates parameter concentration above the AEMP benchmark.

Table C.44: Summary of the Magnitude of Elevation in Seasonal Average Parameter Concentrations (Total Metal Concentration Data Provided) Between the Sheardown Lake Basins and Reference Lake 3 in 2018, and at the Sheardown Lake Basins Between 2018 and the Baseline Period

Variable	Sheardown Lake NW					Sheardown Lake SE				
	2018 vs Reference Lake 3		2018 vs Baseline			2018 vs Reference Lake 3		2018 vs Baseline		
	Summer	Fall	Winter	Summer	Fall	Summer	Fall	Winter	Summer	Fall
Conductivity (lab)	1.8	1.8	1.1	1.1	1.1	1.4	1.6	1.0	1.0	1.1
Hardness (as CaCO ₃)	1.8	2.0	1.0	1.1	1.1	1.4	1.7	1.0	1.0	1.1
Total Suspended Solids (TSS)	1.0	1.0	1.0	0.5	0.8	1.0	1.0	0.9	0.8	0.8
Total Dissolved Solids (TDS)	1.4	1.5	0.8	0.7	0.9	1.8	1.0	0.9	1.0	0.6
Turbidity	4.3	1.9	1.4	1.3	1.8	9.8	4.4	1.5	1.4	1.3
Alkalinity (as CaCO ₃)	1.7	1.6	1.0	1.0	0.9	1.2	1.4	0.9	0.8	0.9
Total Ammonia	0.9	0.6	0.1	0.5	0.6	0.9	0.8	0.4	0.8	1.1
Nitrate	6.0	4.1	0.9	1.2	0.8	1.0	2.1	0.6	0.2	0.4
Nitrite	2.5	1.0	1.3	0.4	1.1	1.0	1.0	1.4	0.4	1.1
Total Kjeldahl Nitrogen (TKN)	1.0	1.0	0.8	0.9	1.0	1.0	0.9	0.7	1.0	0.7
Dissolved Organic Carbon	0.6	0.8	1.0	1.0	1.4	0.5	0.6	1.0	1.0	1.1
Total Organic Carbon	0.4	0.7	1.1	1.1	1.4	0.4	0.7	1.1	1.1	1.6
Total Phosphorus	1.0	1.1	1.1	0.7	1.0	1.5	1.0	1.7	0.9	0.9
Phenols	1.8	1.2	1.0	2.4	1.3	1.5	1.1	1.0	2.1	1.1
Bromide (Br)	1.1	1.0	0.6	0.5	0.4	1.0	1.0	0.7	0.4	0.4
Chloride (Cl)	6.7	2.7	1.2	3.5	1.3	1.9	2.2	1.1	1.0	0.9
Sulphate (SO ₄)	2.0	2.5	2.1	2.8	3.1	1.1	1.5	1.6	1.8	2.3
Aluminum (Al)	4.1	5.1	1.0	1.0	1.1	18	15	0.8	0.8	1.0
Antimony (Sb)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Arsenic (As)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Barium (Ba)	0.0	1.1	1.3	1.4	1.3	0.0	1.0	1.2	1.1	1.1
Beryllium (Be)	1.0	1.0	2.0	1.4	1.5	1.0	1.0	1.5	1.2	1.3
Cadmium (Cd)	1.0	1.0	0.8	0.9	0.9	1.0	1.0	0.8	0.8	0.8
Calcium (Ca)	1.8	1.8	1.0	1.1	1.1	1.4	1.6	0.9	1.1	1.0
Chromium (Cr)	1.0	1.0	RDL	RDL	RDL	1.0	1.0	RDL	RDL	RDL
Cobalt (Co)	1.0	1.0	1.0	1.0	0.9	1.0	1.1	1.0	0.9	1.0
Copper (Cu)	1.0	1.4	0.9	0.8	0.7	0.9	1.1	0.8	0.6	0.8
Iron (Fe)	1.0	1.2	1.2	1.1	0.9	2.5	3.3	0.6	0.7	1.3
Lead (Pb)	1.0	1.2	0.9	0.9	0.1	1.6	1.8	0.5	0.7	1.0
Lithium (Li)	1.1	1.1	0.4	0.3	0.0	1.0	1.0	0.3	0.2	0.3
Magnesium (Mg)	1.7	2.0	1.0	1.1	1.2	1.3	1.7	0.9	1.1	1.1
Manganese (Mn)	5.3	17	1.0	1.7	4.8	7.5	13	0.2	0.7	2.6
Mercury (Hg)	1.0	1.0	1.0	0.9	0.3	1.0	1.0	0.6	1.0	1.0
Molybdenum (Mo)	6.2	5.7	1.2	1.3	1.2	3.1	3.4	1.2	1.2	1.1
Nickel (Ni)	1.2	1.6	0.8	0.9	1.1	1.1	1.3	0.8	0.8	1.0
Potassium (K)	1.3	1.5	1.2	1.5	1.5	0.9	1.2	1.3	1.4	1.4
Selenium (Se)	1.0	1.0	RDL	RDL	RDL	1.0	1.0	RDL	RDL	RDL
Silicon (Si)	1.0	1.0	0.7	0.7	0.7	1.1	1.4	0.7	0.7	0.8
Silver (Ag)	1.0	1.0	2.5	1.0	1.3	1.0	1.0	1.6	1.4	1.4
Sodium (Na)	1.7	1.9	1.1	1.3	1.4	1.2	1.5	1.1	1.6	1.4
Strontium (Sr)	1.1	1.1	1.1	1.2	1.1	0.9	1.0	0.8	0.9	0.8
Thallium (Tl)	1.0	1.0	2.3	1.6	0.4	1.0	1.0	1.6	1.2	1.3
Tin (Sn)	1.0	1.0	0.2	0.2	0.2	1.0	1.0	0.1	0.1	0.1
Titanium (Ti)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9
Uranium (U)	4.0	3.7	1.1	1.3	1.2	2.6	2.7	1.0	1.1	0.9
Vanadium (V)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Zinc (Zn)	1.0	1.0	1.2	1.5	1.2	1.0	1.0	1.0	1.8	1.9

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).

Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).

Denotes highly elevated concentration (mean concentration greater than 10 times higher than respective mean reference or baseline period value).

Note: RDL = Reportable Detection Limit

Table C.45: Dissolved Metal Concentrations at Sheardown Lake NW Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Winter Sampling Event												Summer Sampling Event					
			DD-HAB9-STN1	DD-HAB9-STN1	DL0-01-5	DL0-01-5	DL0-01-1	DL0-01-1	DL0-01-4	DL0-01-4	DL0-01-2	DL0-01-2	DL0-01-7	DL0-01-7	DD-HAB9-STN1	DD-HAB9-STN1	DL0-01-5	DL0-01-5	DL0-01-1	DL0-01-1
			bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
			23-Apr-18	23-Apr-18	23-Apr-18	23-Apr-18	22-Apr-18	22-Apr-18	22-Apr-18	22-Apr-18	23-Apr-18	23-Apr-18	23-Apr-18	23-Apr-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18
Dissolved Metals	Aluminum (Al)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0033	<0.0030	<0.0030	<0.0030	0.0031	<0.0030
	Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.00775	0.00778	0.00738	0.00812	0.00738	0.00798	0.00754	0.00794	0.00756	0.00795	0.00766	0.00849	0.00718	0.00656	0.00662	0.00682	0.00686	0.00645
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	13.4	13.7	13.1	15.0	13.8	14.1	13.5	13.9	14.1	14.6	13.4	14.8	13.7	11.8	12.2	12.3	12.3	12.3
	Chromium (Cr)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.00080	0.00084	0.00080	0.00086	0.00080	0.00080	0.00090	0.00084	0.00082	0.00087	0.00088	0.00092	0.00097	0.00077	0.00078	0.00079	0.00080	0.00083
	Iron (Fe)	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	<0.0010	<0.0010	<0.0010	0.0012	0.0011	<0.0010	<0.0010	0.0011	<0.0010	0.0011	<0.0010	<0.0010	0.0013	<0.0010	0.0012	0.0011	0.0011	0.0011
	Magnesium (Mg)	mg/L	7.97	8.53	8.58	9.07	8.14	8.55	8.44	9.06	8.25	8.56	8.64	9.08	9.05	7.95	7.86	7.89	7.96	7.97
	Manganese (Mn)	mg/L	0.000142	0.000272	0.000221	0.000180	0.000117	0.000123	0.000640	0.000301	0.000134	0.000150	0.000155	0.000221	0.000875	0.000380	0.000223	0.000328	0.000233	0.000342
	Mercury (Hg)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.000894	0.000913	0.000870	0.001010	0.000898	0.000934	0.000904	0.000968	0.000880	0.000957	0.000927	0.001000	0.001150	0.000717	0.000737	0.000768	0.000775	0.000759
	Nickel (Ni)	mg/L	0.000640	0.00067	0.00065	0.00069	0.00064	0.00065	0.00072	0.00067	0.00063	0.00068	0.00065	0.00070	0.00064	0.00057	0.00057	0.00056	0.00057	0.00056
	Potassium (K)	mg/L	1.22	1.27	1.21	1.36	1.20	1.28	1.25	1.35	1.24	1.28	1.24	1.37	1.36	1.21	1.23	1.22	1.20	1.20
	Selenium (Se)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	0.48	0.49	0.68	0.50	0.59	0.48	0.49	0.50	0.47	0.49	0.48	0.51	0.53	0.41	0.40	0.41	0.41	0.40
	Silver (Ag)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	1.51	1.59	1.46	1.64	1.44	1.50	1.46	1.68	1.56	1.58	1.52	1.62	1.73	1.49	1.49	1.45	1.49	1.53
	Strontium (Sr)	mg/L	0.00956	0.00942	0.00922	0.01050	0.00957	0.00986	0.00962	0.01030	0.00931	0.01010	0.00937	0.01030	0.00918	0.00782	0.00812	0.00818	0.00822	0.00828
	Thallium (Tl)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.00107	0.00108	0.00095	0.00109	0.00098	0.00106	0.00102	0.00109	0.00106	0.00106	0.00104	0.00110	0.00127	0.00087	0.00085	0.00090	0.00089	0.00088
	Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table C.45: Dissolved Metal Concentrations at Sheardown Lake NW Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Summer Sampling Event						Fall Sampling Event											
			DL0-01-04 bottom	DL0-01-04 surface	DL0-01-2 bottom	DL0-01-2 surface	DL0-01-7 bottom	DL0-01-7 surface	DD-HAB9-STN1 bottom	DD-HAB9-STN1 surface	DL0-01-1 bottom	DL0-01-1 surface	DL0-01-5 bottom	DL0-01-5 surface	DL0-01-4 bottom	DL0-01-4 surface	DL0-01-2 bottom	DL0-01-2 surface	DL0-01-7 bottom	DL0-01-7 surface
			30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	30-Jul-18	21-Aug-18	21-Aug-18	22-Aug-18	22-Aug-18	21-Aug-18	21-Aug-18	22-Aug-18	22-Aug-18	22-Aug-18	22-Aug-18	22-Aug-18	22-Aug-18
Dissolved Metals	Aluminum (Al)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.004	0.0033	0.0041	<0.0030	0.0045	<0.0030	<0.0030	<0.0030	<0.0030	0.0046	<0.0030	0.0034	<0.0030
	Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.00680	0.00687	0.00663	0.00702	0.00656	0.00676	0.00697	0.00674	0.00694	0.00670	0.00684	0.00682	0.00690	0.00643	0.00684	0.00646	0.00692	0.00699
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	12.2	12.6	12.2	12.4	12.2	12.2	13.5	13.5	13.2	13.2	13.4	13.8	13.1	13.2	13.1	13.3	13.2	13.2
	Chromium (Cr)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.00075	0.00078	0.00076	0.00074	0.00073	0.00080	0.00105	0.00084	0.00082	0.00089	0.00079	0.00079	0.00076	0.00078	0.00085	0.00078	0.00085	0.00079
	Iron (Fe)	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	0.0011	<0.0010	<0.0010	0.0011	0.001	0.0011	0.0011	0.0011	0.001	0.001	0.001	0.0012	<0.0010	0.0011	0.0011	0.0010	0.001	0.0011
	Magnesium (Mg)	mg/L	7.91	7.64	7.94	7.80	8.00	7.74	8.43	8.72	8.54	8.33	8.58	8.58	8.44	7.96	8.69	8.58	8.41	8.36
	Manganese (Mn)	mg/L	0.000350	0.000420	0.000204	0.000303	0.000194	0.000271	0.002970	0.002900	0.002280	0.002420	0.002280	0.002240	0.002030	0.001920	0.002640	0.002210	0.002190	0.002260
	Mercury (Hg)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.000784	0.000765	0.000753	0.000754	0.000780	0.000776	0.000845	0.000862	0.000778	0.000775	0.000861	0.000902	0.000766	0.000839	0.000796	0.000774	0.000788	0.000783
	Nickel (Ni)	mg/L	0.00062	0.00056	0.00061	0.00057	0.00057	0.00060	0.00071	0.00071	0.00069	0.00070	0.00074	0.00071	0.00067	0.00066	0.00074	0.00072	0.00071	0.00073
	Potassium (K)	mg/L	1.19	1.16	1.21	1.18	1.21	1.20	1.29	1.30	1.28	1.28	1.30	1.28	1.24	1.23	1.27	1.27	1.29	1.30
	Selenium (Se)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	0.40	0.41	0.40	0.40	0.41	0.40	0.42	0.42	0.41	0.41	0.42	0.40	0.40	0.39	0.41	0.41	0.40	0.40
	Silver (Ag)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	1.47	1.44	1.48	1.46	1.50	1.45	1.60	1.66	1.64	1.66	1.63	1.56	1.62	1.54	1.60	1.53	1.61	1.69
	Strontium (Sr)	mg/L	0.00816	0.00868	0.00817	0.00835	0.00826	0.00817	0.00897	0.00900	0.00882	0.00879	0.00888	0.00906	0.00880	0.00880	0.00883	0.00882	0.00880	0.00888
	Thallium (Tl)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.00085	0.00093	0.00087	0.00089	0.00091	0.00087	0.00098	0.00101	0.00098	0.00095	0.00099	0.00101	0.00099	0.00097	0.00098	0.00099	0.00099	0.00099
	Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table C.46: Magnitude of Elevation in Seasonal Average Dissolved Metal Concentrations Between Sheardown Lake Northwest and Reference Lake 3 in 2018, and at Sheardown Lake Northwest Between 2018 and the Baseline Period

Dissolved Metal	Sheardown Lake NW				
	2018 vs Reference Lake 3		2018 vs Baseline		
	Summer	Fall	Winter	Summer	Fall
Aluminum (Al)	1.0	0.7	0.0	0.7	1.1
Antimony (Sb)	1.0	1.0	0.0	0.0	1.0
Arsenic (As)	1.0	1.0	1.0	0.8	1.0
Barium (Ba)	1.0	1.0	0.0	1.3	1.2
Beryllium (Be)	1.0	1.0	1.2	1.2	2.1
Cadmium (Cd)	1.0	1.0	0.4	0.0	0.8
Calcium (Ca)	1.8	1.9	1.1	1.1	1.1
Chromium (Cr)	1.0	1.0	RDL	RDL	RDL
Cobalt (Co)	1.0	1.0	1.0	1.0	0.9
Copper (Cu)	1.0	1.1	0.7	0.5	1.0
Iron (Fe)	1.0	1.0	1.2	1.2	1.7
Lead (Pb)	1.0	1.0	0.6	1.0	1.0
Lithium (Li)	1.1	1.1	0.2	0.0	0.5
Magnesium (Mg)	1.8	2.1	1.1	1.2	1.2
Manganese (Mn)	2.2	11	0.4	0.0	3.6
Mercury (Hg)	1.0	1.0	1.0	1.0	1.0
Molybdenum (Mo)	6.4	5.9	4.0	0.0	4.0
Nickel (Ni)	1.2	1.4	0.9	0.6	1.2
Potassium (K)	1.3	1.5	0.8	1.1	1.1
Selenium (Se)	1.0	1.0	RDL	RDL	RDL
Silicon (Si)	1.0	1.0	1.1	1.0	1.0
Silver (Ag)	1.0	1.0	1.2	1.8	2.7
Sodium (Na)	1.7	1.8	0.9	1.2	1.2
Strontium (Sr)	1.1	1.1	1.3	1.2	1.2
Thallium (Tl)	1.0	1.0	1.2	1.3	2.6
Tin (Sn)	1.0	1.0	0.1	0.2	0.1
Titanium (Ti)	1.0	1.0	1.0	1.0	1.0
Uranium (U)	3.9	3.8	2.1	2.0	2.0
Vanadium (V)	1.0	1.0	1.0	1.0	1.0
Zinc (Zn)	1.0	1.0	1.5	1.0	1.9

 Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).

 Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).

 Denotes highly elevated concentration (mean concentration ≥ 10 times higher than respective mean reference or baseline period value).

Note: RDL = Reportable Detection Limit that confounds interpretation.

Table C.47: Spearman's Rank Correlation Coefficients for Sheardown Lake NW (DLO-1) Water Quality Data Collected in Winter, Summer, and Fall 2018^a

Parameters	Conventional Parameters										Total Metals										
	Conduct-ivity	Hardness	Total Dissolved Solids	Turbidity	Alkalinity	Nitrate	Total Organic Carbon	Total Phosphorus	Chloride	Sulphate	Aluminum	Barium	Copper	Manganese	Molybdenum	Nickel	Potassium	Silicon	Sodium	Strontium	Uranium
Conductivity	1	0.709	0.749	-0.745	0.444	0.675	0.016	-0.250	0.788	0.342	-0.482	0.644	0.328	-0.437	0.796	0.305	0.504	0.727	0.164	0.773	0.721
Hardness	0.709	1	0.551	-0.401	0.178	0.736	0.288	0.043	0.616	0.564	-0.079	0.338	0.363	0.023	0.367	0.506	0.662	0.396	0.489	0.619	0.654
Total Dissolved Solids	0.749	0.551	1	-0.602	0.074	0.370	0.305	-0.423	0.480	0.500	-0.187	0.427	0.366	-0.188	0.586	0.442	0.474	0.439	0.394	0.551	0.590
Turbidity	-0.745	-0.401	-0.602	1	-0.555	-0.487	0.169	0.253	-0.766	0.009	0.560	-0.692	-0.283	0.573	-0.613	-0.054	-0.208	-0.775	0.131	-0.647	-0.646
Alkalinity	0.444	0.178	0.074	-0.555	1	0.192	-0.659	-0.135	0.555	-0.546	-0.725	0.695	0.080	-0.795	0.532	-0.266	0.008	0.629	-0.481	0.638	0.399
Nitrate	0.675	0.736	0.370	-0.487	0.192	1	0.107	0.015	1	0.384	-0.097	0.398	0.484	-0.006	0.385	0.481	0.637	0.634	0.374	0.601	0.581
Total Organic Carbon	0.016	0.288	0.305	0.169	-0.659	0.107	1	0.189	-0.097	1	0.603	-0.239	0.304	0.652	-0.270	0.600	0.422	-0.231	0.771	-0.183	0.126
Total Phosphorus	-0.250	0.043	-0.423	0.253	-0.135	0.015	0.189	1	-0.114	0.054	0	-0.256	-0.224	0.330	-0.444	0.006	-0.081	-0.118	0.097	-0.326	-0.097
Chloride	0.788	0.616	0.480	-0.766	0.555	0.662	-0.097	-0.114	1	0.101	-0.501	1	0.311	-0.484	0.697	0.202	0.489	0.808	0.032	0.721	0.673
Sulphate	0.342	0.564	0.500	0.009	-0.546	0.384	0.726	0.054	0.101	1	0.484	-0.255	0	0.593	0.012	0.737	0.586	-0.096	0.752	0.097	0.341
Aluminum (total)	-0.482	-0.079	-0.187	0.560	-0.725	-0.097	0.603	0.334	-0.501	0.484	1	-0.472	0.250	1	-0.644	0.577	0.259	-0.455	0.586	-0.481	-0.248
Barium (total)	0.644	0.338	0.427	-0.692	0.695	0.398	-0.239	-0.256	0.687	-0.255	-0.472	1	0.397	-0.627	1	0.076	0.319	0.754	-0.121	0.682	0.576
Copper (total)	0.328	0.363	0.366	-0.283	0.080	0.484	0.304	-0.224	0.311	0.356	0.250	0.397	1	0.202	0.240	1	0.687	0.339	0.509	0.564	0.537
Manganese (total)	-0.437	0.023	-0.188	0.573	-0.795	-0.006	0.652	0.330	-0.484	0.593	0.916	-0.627	0.202	1	-0.662	0.567	0	-0.492	0.623	-0.455	-0.244
Molybdenum (total)	0.796	0.367	0.586	-0.613	0.532	0.385	-0.270	-0.444	0.697	0.012	-0.644	0.679	0.240	-0.662	1	-0.009	0.273	1	-0.145	0.722	0.442
Nickel (total)	0.305	0.506	0.442	-0.054	-0.266	0.481	0.600	0.006	0.202	0.737	0.577	0.076	0.717	0.567	-0.009	1	0.794	0.221	1	0.327	0.449
Potassium (total)	0.504	0.662	0.474	-0.208	0.008	0.637	0.422	-0.081	0.489	0.586	0.259	0.319	0.687	0.231	0.273	0.794	1	0.387	0.756	0	0.569
Silicon (total)	0.727	0.396	0.439	-0.775	0.629	0.634	-0.231	-0.118	0.808	-0.096	-0.455	0.754	0.339	-0.492	0.601	0.221	0.387	1	-0.045	0.730	0.601
Sodium (total)	0.164	0.489	0.394	0.131	-0.481	0.374	0.771	0.097	0.032	0.752	0.586	-0.121	0.509	0.623	-0.145	0.738	0.756	-0.045	1	0.068	0
Strontium (total)	0.773	0.619	0.551	-0.647	0.638	0.601	-0.183	-0.326	0.721	0.097	-0.481	0.682	0.564	-0.455	0.722	0.327	0.484	0.730	0.068	1	0.752
Uranium (total)	0.721	0.654	0.590	-0.646	0.399	0.581	0.126	-0.097	0.673	0.341	-0.248	0.576	0.537	-0.244	0.442	0.449	0.569	0.601	0.290	0.752	1
Aluminum (dissolved)	-0.178	0.039	0.057	0.214	-0.356	-0.052	0.224	-0.211	-0.114	0.399	0.386	-0.328	0.244	0.446	-0.024	0.310	0.082	-0.307	0.180	-0.073	-0.253
Barium (dissolved)	0.773	0.554	0.550	-0.739	0.635	0.487	-0.261	-0.282	0.714	0.001	-0.483	0.740	0.301	-0.544	0.608	0.210	0.400	0.778	-0.042	0.745	0.589
Copper (dissolved)	0.624	0.625	0.637	-0.469	0.201	0.446	0.070	-0.371	0.600	0.423	-0.144	0.412	0.436	-0.139	0.600	0.418	0.462	0.422	0.225	0.682	0.489
Manganese (dissolved)	-0.222	0.175	0.148	0.422	-0.774	0.093	0.721	0.074	-0.303	0.717	0.796	-0.448	0.256	0.804	-0.424	0.586	0.407	-0.379	0.778	-0.291	-0.046
Molybdenum (dissolved)	0.776	0.771	0.418	-0.565	0.585	0.729	-0.103	-0.071	0.775	0.133	-0.381	0.618	0.357	-0.378	0.597	0.265	0.541	0.686	0.146	0.784	0.702
Nickel (dissolved)	0.407	0.658	0.503	-0.089	-0.383	0.522	0.660	0.007	0.209	0.845	0.377	-0.098	0.351	0.473	-0.031	0.712	0.583	0.097	0.680	0.226	0.483
Potassium (dissolved)	0.449	0.722	0.533	-0.100	-0.249	0.461	0.616	0.075	0.311	0.829	0.361	-0.014	0.511	0.446	0.094	0.775	0.750	0.162	0.798	0.379	0.547
Silicon (dissolved)	0.659	0.521	0.342	-0.661	0.604	0.580	-0.353	-0.292	0.714	-0.132	-0.650	0.671	0.194	-0.567	0.651	-0.091	0.203	0.690	-0.152	0.741	0.527
Sodium (dissolved)	0.317	0.559	0.501	-0.005	-0.294	0.297	0.638	0.017	0.103	0.808	0.426	-0.122	0.513	0.513	0.021	0.789	0.640	0.061	0.756	0.295	0.426
Strontium (dissolved)	0.885	0.807	0.571	-0.721	0.503	0.785	-0.038	-0.160	0.802	0.277	-0.415	0.639	0.381	-0.367	0.602	0.322	0.564	0.713	0.209	0.802	0.820
Uranium (dissolved)	0.835	0.771	0.640	-0.634	0.376	0.623	0.142	-0.045	0.697	0.451	-0.288	0.490	0.396	-0.264	0.532	0.390	0.602	0.551	0.341	0.689	0.833

^a Correlation matrix included only those parameters with≥75% of values above laboratory reportable detection limits (RDL). Sample size (n) totalled 36.

Indicates strong positive correlation (i.e., Spearman's rho≥ 0.7) between parameter pairings.

Indicates strong negative correlation (i.e., Spearman's rho≤ -0.7) between parameter pairings.

Table C.47: Spearman's Rank Correlation Coefficients for Sheardown Lake NW (DLO-1) Water Quality Data Collected in Winter, Summer, and Fall 2018^a

Parameters	Dissolved Metals										
	Aluminum	Barium	Copper	Manganese	Molybdenum	Nickel	Potassium	Silicon	Sodium	Strontium	Uranium
Conductivity	-0.178	0.773	0.624	-0.222	0.776	0.407	0.449	0.659	0.317	0.885	0.835
Hardness	0.039	0.554	0.625	0.175	0.771	0.658	0.722	0.521	0.559	0.807	0.771
Total Dissolved Solids	0.057	0.550	0.637	0.148	0.418	0.503	0.533	0.342	0.501	0.571	0.640
Turbidity	0.214	-0.739	-0.469	0.422	-0.565	-0.089	-0.100	-0.661	-0.005	-0.721	-0.634
Alkalinity	-0.356	0.635	0.201	-0.774	0.585	-0.383	-0.249	0.604	-0.294	0.503	0.376
Nitrate	-0.052	0.487	0.446	0.093	0.729	0.522	0.461	0.580	0.297	0.785	0.623
Total Organic Carbon	0.224	-0.261	0.070	0.721	-0.103	0.660	0.616	-0.353	0.638	-0.038	0.142
Total Phosphorus	-0.211	-0.282	-0.371	0.074	-0.071	0.007	0.075	-0.292	0.017	-0.160	-0.045
Chloride	-0.114	0.714	0.600	-0.303	0.775	0.209	0.311	0.714	0.103	0.802	0.697
Sulphate	0.399	0.001	0.423	0.717	0.133	0.845	0.829	-0.132	0.808	0.277	0.451
Aluminum (total)	0.386	-0.483	-0.144	0.796	-0.381	0.377	0.361	-0.650	0.426	-0.415	-0.288
Barium (total)	-0.328	0.740	0.412	-0.448	0.618	-0.098	-0.014	0.671	-0.122	0.639	0.490
Copper (total)	0.244	0.301	0.436	0.256	0.357	0.351	0.511	0.194	0.513	0.381	0.396
Manganese (total)	0.446	-0.544	-0.139	0.804	-0.378	0.473	0.446	-0.567	0.513	-0.367	-0.264
Molybdenum (total)	-0.024	0.608	0.600	-0.424	0.597	-0.031	0.094	0.651	0.021	0.602	0.532
Nickel (total)	0.310	0.210	0.418	0.586	0.265	0.712	0.775	-0.091	0.789	0.322	0.390
Potassium (total)	0.082	0.400	0.462	0.407	0.541	0.583	0.750	0.203	0.640	0.564	0.602
Silicon (total)	-0.307	0.778	0.422	-0.379	0.686	0.097	0.162	0.690	0.061	0.713	0.551
Sodium (total)	0	0	0	1	0	1	1	0	1	0	0.341
Strontium (total)	-0.073	0.745	0.682	-0.291	0.784	0.226	0.379	0.741	0.295	0.802	0.689
Uranium (total)	-0.253	0.589	0.489	-0.046	0.702	0.483	0.547	0.527	0.426	0.820	0.833
Aluminum (dissolved)	1	-0.231	0.481	0.455	-0.147	0.245	0.202	-0.174	0.265	-0.213	-0.220
Barium (dissolved)	-0.231	1	0.567	-0.365	0.695	0.136	0.237	0.680	0.139	0.782	0.679
Copper (dissolved)	0.481	0.567	1	0.152	0.575	0.453	0.507	0.530	0.338	0.594	0.485
Manganese (dissolved)	0.455	-0.365	0.152	1	-0.244	0.666	0.585	-0.368	0.574	-0.180	-0.065
Molybdenum (dissolved)	-0.147	0.695	0.575	-0.244	1	0.355	0.388	0.651	0.198	0.893	0.738
Nickel (dissolved)	0.245	0.136	0.453	0.666	0.355	1	0.819	0.059	0.686	0.455	0.491
Potassium (dissolved)	0.202	0.237	0.507	0.585	0.388	0.819	1	0.127	0.881	0.472	0.608
Silicon (dissolved)	-0.174	0.680	0.530	-0.368	0.651	0.059	0.127	1	-0.058	0.752	0.514
Sodium (dissolved)	0.265	0.139	0.338	0.574	0.198	0.686	0.881	-0.058	1	0.272	0.488
Strontium (dissolved)	-0.213	0.782	0.594	-0.180	0.893	0.455	0.472	0.752	0.272	1	0.870
Uranium (dissolved)	-0.220	0.679	0.485	-0.065	0.738	0.491	0.608	0.514	0.488	0.870	1

^a Correlation matrix included only those parameters with≥75% of values above laboratory reportable detection limits (RDL). Sample size (n) totalled 36.

Indicates strong positive correlation (i.e., Spearman's rho≥ 0.7) between parameter pairings.

Indicates strong negative correlation (i.e., Spearman's rho≤ -0.7) between parameter pairings.

Table C.48: In Situ Water Quality Profile Data Collected at Sheardown Lake SE Water Quality Monitoring Stations in Winter, Mary River Project CREMP, 2018

Depth (m)	Temperature (°C)					Dissolved Oxygen (mg/L)					Dissolved Oxygen (% Saturation)					pH (pH units)					Specific Conductance (µS/cm)				
	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3
Date Collected	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18	17-Apr-18
1.0	0.2		1.7	0.5	1.1	14.25		15.10	15.82	15.20	98.1		108.5	109.9	107.3	7.76		7.81	7.80	7.85	176		157	163	161
2.0	1.7		2.7	2.2	2.3	13.66		14.35	14.88	14.38	98.2		105.7	108.2	105.2	7.66		7.74	7.75	7.74	168		148	150	147
3.0	2.2	2.4	2.7	2.6	2.6	13.02	14.23	14.36	14.50	14.22	94.8	104.1	105.8	106.6	104.5	7.57	7.86	7.71	7.71	7.69	168	150	148	148	148
4.0	2.2		2.7	2.6	2.6	12.93		14.37	14.38	14.20	94.1		105.9	105.8	104.4	7.53		7.69	7.68	7.67	170		148	148	148
5.0	2.2		2.7	2.6	2.6	12.91		14.39	14.36	14.17	94.0		106.0	105.7	104.2	7.50		7.66	7.66	7.65	171		148	148	148
6.0	2.2		2.7	2.7	2.6	12.77		14.40	14.36	14.14	93.0		106.1	105.7	104.0	7.46		7.65	7.65	7.63	171		148	148	148
6.5			2.7					14.49					106.8					7.65					148		
7.0	2.2			2.7	2.6	12.40			14.36	14.12	90.8			105.7	103.9	7.44			7.63	7.61	171			148	148
8.0				2.7	2.6				14.33	13.90				105.5	102.5				7.62	7.59				148	149
9.0				2.7	2.7				14.17	14.07				104.5	103.5				7.60	7.58				149	148
10.0				2.7	2.7				12.81	13.93				93.7	103.1				7.53	7.57				150	149
10.5				2.7					8.82					64.9					7.37					153	
11.0					2.7					12.23					90.1					7.56					151
12.0					2.6					10.75					79.4					7.42					152
13.0																									
14.0																									

Notes: Total depth at stations DLO-02-6, DLO-02-7, DLO-02-4, DLO-02-8, and DLO-02-3 was 7.1, 3.8, 8.5, 12.9, and 13.9 m, respectively, at the time of winter sampling. Ice thickness at stations DLO-02-6, DLO-02-7, DLO-02-4, DLO-02-8, and DLO-02-3 was 2.1, 2.1, 2.1, 2.1, and 1.9 m, respectively, at the time of winter sampling. Deepest measurement at stations DLO-02-6, DLO-02-7, DLO-02-4, DLO-02-8, and DLO-02-3 was 7, 2.9, 6.5, 10.5, and 12 m, respectively, at the time of winter sampling.

Table C.49: In Situ Water Quality Profile Data Collected at Sheardown Lake SE Water Quality Monitoring Stations in Summer, Mary River Project CREMP, 2018

Depth (m)	Temperature (°C)					Dissolved Oxygen (mg/L)					Dissolved Oxygen (% Saturation)					pH (pH units)					Specific Conductance (µS/cm)				
	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3
Date Collected	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18
1.0	7.1	7.4	7.0	7.2	7.4	11.94	11.86	11.81	11.78	11.88	98.7	98.8	97.4	97.5	98.9	7.95	8.00	7.89	7.85	8.00	93	89	88	88	89
2.0	7.1	7.4	7.0	7.2	7.4	11.94	11.87	11.81	11.80	11.88	98.7	98.8	97.3	97.6	98.9	7.95	7.99	7.89	7.85	7.99	93	89	87	88	89
3.0	7.1	7.4	7.0	7.2	7.4	11.95	11.87	11.80	11.81	11.87	98.7	98.7	97.3	97.7	98.8	7.92	7.98	7.89	7.85	7.98	94	90	87	88	89
4.0	7.1	7.2	7.0	7.2	7.3	11.95	11.86	11.80	11.81	11.87	98.7	98.2	97.1	97.7	98.6	7.97	7.97	7.88	7.85	7.97	94	92	87	88	88
5.0	7.1		6.9	7.1	7.3	11.94		11.78	11.80	11.87	98.7		96.8	97.4	98.5	7.97		7.88	7.85	7.96	93		88	88	88
6.0	7.1		6.9	7.0	7.3	11.93		11.75	11.81	11.86	98.7		96.5	97.3	98.5	7.98		7.87	7.85	7.95	94		88	88	88
7.0	7.1		6.8	7.0	7.3	11.94		11.72	11.80	11.85	98.7		96.2	97.2	98.3	7.98		7.87	7.86	7.95	95		88	88	88
8.0			6.8	6.9	7.2			11.65	11.78	11.84			95.5	96.9	98.1			7.86	7.86	7.95			89	88	88
9.0				6.9	7.2				11.76	11.83				96.7	98.0				7.86	7.94				88	89
10.0				6.9	7.2				11.74	11.81				96.4	97.8				7.85	7.94				88	89
11.0				6.9	7.2				11.73	11.80				96.3	97.7				7.85	7.94				88	89
12.0				6.9	7.1				11.72	11.78				96.2	97.3				7.85	7.94				88	89
13.0					7.0					11.76					96.8					7.93					89
14.0					7.0					11.73					96.6					7.93					89

Note: Total depth at stations DLO-02-6, DLO-02-7, DLO-02-4, DLO-02-8, and DLO-02-3 was 7.8, 4.9, 9.9, 13.8, and 15.5 m, respectively, at the time of summer sampling.

Table C.50: *In Situ* Water Quality Profile Data Collected at Sheardown Lake SE Water Quality Monitoring Stations in Fall, Mary River Project CREMP, 2018

Depth (m)	Temperature (°C)						Dissolved Oxygen (mg/L)						Dissolved Oxygen (% Saturation)					
	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-3
Date Collected	23-Aug-18	23-Aug-18	23-Aug-18	23-Aug-18	23-Aug-18	16-Aug-18	23-Aug-18	23-Aug-18	23-Aug-18	23-Aug-18	23-Aug-18	16-Aug-18	23-Aug-18	23-Aug-18	23-Aug-18	23-Aug-18	23-Aug-18	16-Aug-18
surface						7.8						11.53						96.9
1.0	7.5	7.8	7.6	7.5	7.5	7.8	11.6	10.9	11.0	11.5	11.6	11.52	97.0	91.6	92.1	96.0	96.8	96.9
2.0	7.4	7.8	7.6	7.5	7.5	7.8	11.7	11.1	11.1	11.5	11.6	11.53	97.1	93.0	92.6	95.9	96.7	96.9
3.0	7.4	7.7	7.6	7.5	7.5	7.8	11.7	11.2	11.1	11.5	11.6	11.51	97.1	93.4	92.8	95.8	96.6	96.8
4.0	7.4		7.6	7.5	7.5	7.8	11.7		11.2	11.5	11.6	11.51	97.2		93.3	95.8	96.6	96.7
5.0	7.4		7.6	7.5	7.5	7.8	11.7		11.2	11.5	11.6	11.50	97.2		93.8	95.7	96.6	96.7
6.0			7.6	7.5	7.3	7.8			11.3	11.5	11.6	11.50			94.5	95.7	96.5	96.7
7.0			7.6	7.5	7.3	7.8			11.4	11.5	11.6	11.50			94.9	95.7	96.5	96.7
8.0				7.5	7.5	7.8				11.5	11.5	11.50				95.6	96.4	96.7
9.0				7.5	7.5	7.8				11.4	11.5	11.49				95.5	96.3	96.6
10.0				7.5	7.5	7.8				11.4	11.5	11.48				95.1	96.3	96.5
11.0					7.5	7.8					11.5	11.47					96.2	96.4
12.0					7.5	7.8					11.5	11.46					96.2	96.3
13.0						7.8						11.44						96.2

Notes: 23-Aug-18 sampling was conducted by Baffinland. 16-Aug-18 sampling was conducted by Minnow. Total depth at stations DLO-02-6, DLO-02-7, DLO-02-4, DLO-02-8, and DLO-02-3 was 6.5, 3.4, 8.4, 12.7, and 13.7 m, respectively, at the time of fall sampling.

Table C.50: *In Situ* Water Quality Profile Data Collected at Sheardown Lake SE Water Quality Monitoring Stations in Fall, Mary River Project CREMP, 2018

Depth (m)	pH (pH units)						Specific Conductance (µS/cm)					
	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-3
Date Collected	23-Aug-18	23-Aug-18	23-Aug-18	23-Aug-18	23-Aug-18	16-Aug-18	23-Aug-18	23-Aug-18	23-Aug-18	23-Aug-18	23-Aug-18	16-Aug-18
surface						7.92						98
1.0	7.92	8.07	7.94	7.78	7.93	7.92	102	100	99	99	99	98
2.0	7.91	7.97	7.93	7.78	7.91	7.92	102	100	99	99	99	98
3.0	7.90	7.96	7.92	7.78	7.91	7.92	103	100	99	99	99	98
4.0	7.89		7.91	7.77	7.90	7.92	103		99	99	99	98
5.0	7.89		7.91	7.77	7.89	7.94	103		99	99	99	98
6.0			7.91	7.77	7.89	7.94			99	99	99	98
7.0			7.91	7.76	7.89	7.94			99	99	99	98
8.0				7.76	7.88	7.94				99	99	98
9.0				7.75	7.87	7.94				99	99	98
10.0				7.75	7.87	7.95				99	99	98
11.0					7.87	7.95					99	98
12.0					7.86	7.95					99	98
13.0						7.94						98

Notes: 23-Aug-18 sampling was conducted by Baffinland. 16-Aug-18 sampling was conducted by Minnow. Total depth at stations DLO-02-6, DLO-02-7, DLO-02-4, DLO-02-8, and DLO-02-3 was 6.5, 3.4, 8.4, 12.7, and 13.7 m, respectively, at the time of fall sampling.

Table C.51: Sampling Depth, Water Clarity Measures, and Surface and Bottom *In Situ* Water Quality Measures Collected at Sheardown Lake SE Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2018

Categorization & Replicate ID		Date Sampled	Station Depth (m)	Secchi Depth (m)	Depth sampled	Temperature (°C)	Dissolved Oxygen		pH (units)	Specific Conductance (µS/cm)
							(mg/L)	(% sat.)		
Littoral (Shallow) Stations	DLO-02-1	16-Aug-18	9.8	1.4	surface	7.70	11.56	96.9	7.92	100
					bottom	7.70	11.52	96.6	7.94	100
	DLO-02-11	16-Aug-18	8.2	1.3	surface	7.50	11.46	95.6	7.77	96
					bottom	7.50	11.38	95.0	7.76	96
	DLO-02-10	16-Aug-18	6.7	1.2	surface	7.50	11.43	95.4	7.67	96
					bottom	7.50	11.33	94.6	7.61	96
	DLO-02-4	16-Aug-18	7.6	1.4	surface	7.50	11.47	95.7	7.80	96
					bottom	7.60	11.41	95.2	7.80	96
	DLO-02-9	16-Aug-18	8.8	1.4	surface	7.60	11.51	96.3	7.84	96
					bottom	7.60	11.43	95.7	7.84	97
Profundal (Deep) Stations	DLO-02-12	16-Aug-18	10.7	1.4	surface	7.50	11.52	96.3	7.89	96
					bottom	7.60	11.41	95.3	7.85	96
	DLO-02-8	16-Aug-18	13.4	1.4	surface	7.70	11.52	96.6	7.90	97
					bottom	7.50	11.38	95.0	7.87	97
	DLO-02-13	16-Aug-18	7.0	1.5	surface	7.70	11.52	96.6	7.90	98
					bottom	7.80	11.49	96.5	7.90	98
	DLO-02-2	16-Aug-18	14.0	1.4	surface	7.70	11.52	96.6	7.92	98
					bottom	7.70	11.42	95.8	7.90	98
	DLO-02-3	16-Aug-18	13.4	1.5	surface	7.80	11.53	96.9	7.92	98
					bottom	7.80	11.44	96.2	7.94	98

Table C.52: Statistical Comparison of Bottom *In Situ* Water Quality Between Sheardown Lake SE Littoral and Profundal Stations, Mary River Project CREMP, August 2018

Habitat Variable	Statistical Test Results			Summary Statistics						
	Significant Difference Between Areas?	P-value	Statistical Analysis ^a	Lake Zone	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Secchi Depth (m)	YES	0.095	γ	Littoral	5	1.33	0.11	0.05	1.15	1.40
				Profundal	5	1.42	0.03	0.01	1.40	1.45
Temperature (°C)	NO	0.187	α	Littoral	5	7.58	0.08	0.04	7.50	7.70
				Profundal	5	7.68	0.13	0.06	7.50	7.80
Dissolved Oxygen (mg/L)	NO	0.710	α	Littoral	5	11.4	0.1	0.0	11.3	11.5
				Profundal	5	11.4	0.0	0.0	11.4	11.5
Dissolved Oxygen (% saturation)	NO	0.463	α	Littoral	5	95.4	0.8	0.3	94.6	96.6
				Profundal	5	95.8	0.6	0.3	95.0	96.5
pH (units)	NO	0.107	α	Littoral	5	7.79	0.12	0.05	7.61	7.94
				Profundal	5	7.89	0.03	0.02	7.85	7.94
Specific Conductance (umho/cm)	NO	0.310	γ	Littoral	5	97.0	1.9	0.8	96.0	100.3
				Profundal	5	97.4	1.0	0.4	96.2	98.2

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log-transformed, single factor ANOVA test conducted; γ - data untransformed, Mann-Whitney U-test conducted; η - data untransformed, t-test assuming unequal variance conducted; δ - data log-transformed, t-test assuming unequal variance conducted.



Highlighted values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

Table C.53: Statistical Comparison of Bottom *In Situ* Water Quality Between Sheardown Lake SE and Reference Lake 3 Stations Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2018

Lake Zone	Habitat Variable	Statistical Test Results			Summary Statistics						
		Significant Difference Between Areas?	P-value	Statistical Analysis ^a	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Littoral (Shallow) Stations	Station Depth (m)	YES	0.060	α	Reference	5	9.80	1.11	0.49	8.40	11.20
					Sheardown SE	5	8.22	1.18	0.53	6.70	9.80
	Secchi Depth (m)	YES	0.016	γ	Reference	4	8.49	0.45	0.23	8.05	9.10
					Sheardown SE	5	1.33	0.11	0.05	1.15	1.40
	Temperature (°C)	YES	0.016	γ	Reference	4	7.05	0.10	0.05	6.90	7.10
					Sheardown SE	5	7.58	0.08	0.04	7.50	7.70
	Dissolved Oxygen (mg/L)	NO	0.163	α	Reference	4	11.6	0.3	0.1	11.2	11.8
					Sheardown SE	5	11.4	0.1	0.0	11.3	11.5
	Dissolved Oxygen (% saturation)	NO	0.413	γ	Reference	4	95.7	2.2	1.1	92.4	97.1
					Sheardown SE	5	95.4	0.8	0.3	94.6	96.6
Profundal (Deep) Stations	Station Depth (m)	YES	< 0.001	α	Reference	4	7.54	0.11	0.05	7.41	7.65
					Sheardown SE	5	7.79	0.12	0.05	7.61	7.94
	Specific Conductance (umho/cm)	YES	0.016	γ	Reference	4	62.8	1.0	0.5	62.3	64.3
					Sheardown SE	5	97.0	1.9	0.8	96.0	100.3
	Station Depth (m)	YES	< 0.001	α	Reference	5	21.26	2.62	1.17	18.50	25.00
					Sheardown SE	5	11.70	2.92	1.31	7.00	14.00
	Secchi Depth (m)	YES	0.016	γ	Reference	4	8.63	0.26	0.13	8.30	8.90
					Sheardown SE	5	1.42	0.03	0.01	1.40	1.45
	Temperature (°C)	YES	0.016	γ	Reference	4	7.08	0.05	0.02	7.00	7.10
					Sheardown SE	5	7.68	0.13	0.06	7.50	7.80
	Dissolved Oxygen (mg/L)	NO	0.286	γ	Reference	4	11.5	0.4	0.2	10.9	11.7
					Sheardown SE	5	11.4	0.0	0.0	11.4	11.5
	Dissolved Oxygen (% saturation)	NO	0.905	γ	Reference	4	94.6	2.8	1.4	90.4	96.1
					Sheardown SE	5	95.8	0.6	0.3	95.0	96.5
	pH (units)	YES	< 0.001	α	Reference	4	7.63	0.04	0.02	7.58	7.67
					Sheardown SE	5	7.89	0.03	0.02	7.85	7.94
	Specific Conductance (umho/cm)	YES	< 0.001	η	Reference	4	62.5	0.2	0.1	62.3	62.8
					Sheardown SE	5	97.4	1.0	0.4	96.2	98.2

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log-transformed, single factor ANOVA test conducted; γ - data untransformed, Mann-Whitney U-test conducted; η - data untransformed, t-test assuming unequal variance conducted; δ - data log-transformed, t-test assuming unequal variance conducted.

Highlighted values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

Table C.54: Water Chemistry at Sheardown Lake SE (DLO-02) Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Winter Sampling Event								
					DL0-02-6 bottom 17-Apr-18	DL0-02-6 surface 17-Apr-18	DL0-02-7 surface 17-Apr-18	DL0-02-4 bottom 17-Apr-18	DL0-02-4 surface 17-Apr-18	DL0-02-8 bottom 17-Apr-18	DL0-02-8 surface 17-Apr-18	DL0-02-3 bottom 17-Apr-18	DL0-02-3 surface 17-Apr-18
Conventional	Conductivity (lab)	umho/cm	-	-	174	174	158	155	154	151	161	153	160
	pH (lab)	pH	6.5 - 9.0	-	7.82	7.81	7.88	7.93	7.91	7.93	7.91	7.85	7.91
	Hardness (as CaCO ₃)	mg/L	-	-	79	80	75	68	75	69	73	71	74
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	96	92	88	78	86	80	91	85	94
	Turbidity	NTU	-	-	0.6	0.6	0.6	0.7	0.5	0.8	0.6	0.7	0.8
	Alkalinity (as CaCO ₃)	mg/L	-	-	76	77	70	63	69	64	68	67	72
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	0.066	<0.020	0.025	<0.020	<0.020	<0.020	<0.020	0.044	0.163
	Nitrate	mg/L	13	13	0.087	0.089	0.060	0.049	0.051	0.047	0.053	0.061	0.058
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	0.15	0.16	0.2	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	1.7	2.0	2.2	1.8	1.9	1.8	1.9	1.8	1.9
	Total Organic Carbon	mg/L	-	-	2.3	2.1	2.0	1.9	2.0	2.0	2.2	2.1	2.5
	Total Phosphorus	mg/L	0.020 ^d	-	0.0033	0.0033	0.0069	0.0032	0.0036	0.0065	0.0071	0.0312	0.0044
Anions	Phenols	mg/L	0.004 ^d	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	3.8	3.9	3.5	3.3	3.4	3.3	3.6	3.4	3.6
Total Metals	Sulphate (SO ₄)	mg/L	218 ^β	218	4.9	5.1	4.7	4.5	4.5	4.4	4.8	4.3	4.8
	Aluminum (Al)	mg/L	0.100	0.179, 0.173 ^c	0.0032	0.0030	0.004	0.006	<0.0030	0.009	0.0033	0.007	0.0032
	Antimony (Sb)	mg/L	0.020 ^d	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0094	0.0097	0.0088	0.0081	0.0080	0.0078	0.0086	0.0081	0.0082
	Beryllium (Be)	mg/L	0.011 ^d	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00009	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	15	16	15	14	14	13	15	14	15
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^d	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0024	0.0009	0.0010	0.0009	0.0008	0.0009	0.0009	0.0009	0.0008	0.0009
	Iron (Fe)	mg/L	0.30	0.300	0.032	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	-	-	9.3	9.7	9.0	8.1	8.3	8.4	8.8	8.5	9.3
	Manganese (Mn)	mg/L	0.935 ^β	-	0.0049	0.0025	0.0017	0.0015	0.0013	0.0020	0.0010	0.0026	0.0013
	Mercury (Hg)	mg/L	0.000026	-	<0.0000050	<0.000010	<0.0000075	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)	mg/L	0.073	-	0.00062	0.00068	0.00064	0.00060	0.00066	0.00058	0.00062	0.00059	0.00064
	Nickel (Ni)	mg/L	0.025	0.025	0.00070	0.00075	0.00067	0.00061	0.00060	0.00062	0.00069	0.00065	0.00070
	Potassium (K)	mg/L	-	-	1.46	1.52	1.37	1.27	1.28	1.27	1.34	1.25	1.40
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.72	0.74	0.61	0.55	0.56	0.56	0.58	0.74	0.60
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	1.7	1.6	1.5	1.4	1.5	1.4	1.5	1.4	1.6
	Strontium (Sr)	mg/L	-	-	0.010	0.011	0.010	0.009	0.010	0.009	0.010	0.010	0.010
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.0008	0.0009	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008
	Vanadium (V)	mg/L	0.006 ^d	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

^b AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to Sheardown Lake.

^c Benchmark is 0.179 mg/L and 0.173 mg/L for shallow and deep stations, respectively.

 Indicates parameter concentration above applicable Water Quality Guideline.

 Indicates parameter concentration above the AEMP benchmark.

Table C.54: Water Chemistry at Sheardown Lake SE (DLO-02) Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Summer Sampling Event									
					DL0-02-6 bottom 31-Jul-18	DL0-02-6 surface 31-Jul-18	DL0-02-7 bottom 31-Jul-18	DL0-02-7 surface 31-Jul-18	DL0-02-4 bottom 31-Jul-18	DL0-02-4 surface 31-Jul-18	DL0-02-8 bottom 31-Jul-18	DL0-02-8 surface 31-Jul-18	DL0-02-3 bottom 31-Jul-18	DL0-02-3 surface 31-Jul-18
Conventional	Conductivity (lab)	umho/cm	-	-	104	103	100	99	99	97	98	100	99	98
	pH (lab)	pH	6.5 - 9.0	-	7.94	7.95	7.95	7.94	7.85	7.90	7.91	7.94	7.88	7.88
	Hardness (as CaCO ₃)	mg/L	-	-	52	50	49	49	50	47	48	48	49	48
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.4	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	70	60	75	70	52	55	55	67	56	70
	Turbidity	NTU	-	-	2.0	2.7	2.0	2.0	2.2	2.1	2.3	3.1	2.9	2.3
	Alkalinity (as CaCO ₃)	mg/L	-	-	42	19	41	42	47	39	42	41	42	41
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	<0.020	<0.020	0.032	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Nitrate	mg/L	13	13	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	1.7	1.6	1.6	1.6	1.6	1.5	1.6	1.6	1.6	1.6
	Total Organic Carbon	mg/L	-	-	2.0	1.8	1.6	1.7	1.5	1.8	1.8	1.8	1.9	1.8
	Total Phosphorus	mg/L	0.020 ^α	-	0.0062	0.0059	0.0110	0.0066	0.0082	0.0068	0.0056	0.0065	0.0069	0.0065
Anions	Phenols	mg/L	0.001 ^α	-	0.0017	0.0030	0.0023	<0.0010	0.0014	0.0016	0.0027	0.0024	0.0038	0.0019
	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	2.5	2.7	2.4	2.4	2.5	2.3	2.4	2.4	2.5	2.4
Total Metals	Sulphate (SO ₄)	mg/L	218 ^β	218	4.3	4.3	4.0	4.0	4.1	3.9	4.0	3.9	4.1	4.0
	Aluminum (Al)	mg/L	0.100	0.179, 0.173 ^c	0.054	0.053	0.058	0.055	0.073	0.057	0.072	0.068	0.059	0.059
	Antimony (Sb)	mg/L	0.020 ^α	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0060	0.0060	0.0058	0.0059	0.0062	0.0058	0.0060	0.0058	0.0058	0.0058
	Beryllium (Be)	mg/L	0.011 ^α	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00009	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	11	10	10	10	10	10	10	10	10	10
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^α	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0024	0.00079	0.00072	0.00071	0.00074	0.00070	0.00071	0.00071	0.0007	0.0007	0.00084
	Iron (Fe)	mg/L	0.30	0.300	0.065	0.067	0.066	0.067	0.090	0.072	0.086	0.077	0.077	0.071
	Lead (Pb)	mg/L	0.001	0.001	0.000071	0.000068	0.000068	0.000073	0.000092	0.000078	0.000091	0.000078	0.000084	0.000083
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	-	-	6.1	6.1	5.9	5.9	5.8	5.7	5.7	5.7	5.7	5.7
	Manganese (Mn)	mg/L	0.935 ^β	-	0.0038	0.0039	0.0037	0.0038	0.0060	0.0041	0.0049	0.0040	0.0044	0.0039
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	0.00047	0.00041	0.00038	0.00042	0.00038	0.00039	0.00041	0.00041	0.00039	0.00040
	Nickel (Ni)	mg/L	0.025	0.025	0.00055	0.00054	0.00051	<0.00050	0.00055	<0.00050	0.00055	0.00051	0.00052	0.00052
	Potassium (K)	mg/L	-	-	0.91	0.92	0.88	0.87	0.88	0.87	0.89	0.88	0.86	0.86
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.47	0.47	0.45	0.45	0.51	0.45	0.48	0.47	0.46	0.47
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	1.1	1.1	1.0	1.0	1.1	1.1	1.0	1.0	1.0	1.0
	Strontium (Sr)	mg/L	-	-	0.008	0.008	0.007	0.007	0.008	0.007	0.007	0.007	0.007	0.007
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
	Vanadium (V)	mg/L	0.006 ^α	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

^b AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to Sheardown Lake.

^c Benchmark is 0.179 mg/L and 0.173 mg/L for shallow and deep stations, respectively.

 Indicates parameter concentration above applicable Water Quality Guideline.

 **BOLD** Indicates parameter concentration above the AEMP benchmark.

Table C.54: Water Chemistry at Sheardown Lake SE (DLO-02) Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Fall Sampling Event									
					DL0-02-6 bottom 23-Aug-18	DL0-02-6 surface 23-Aug-18	DL0-02-7 bottom 23-Aug-18	DL0-02-7 surface 23-Aug-18	DL0-02-4 bottom 23-Aug-18	DL0-02-4 surface 23-Aug-18	DL0-02-8 bottom 23-Aug-18	DL0-02-8 surface 23-Aug-18	DL0-02-3 bottom 23-Aug-18	DL0-02-3 surface 23-Aug-18
Conventionals	Conductivity (lab)	umho/cm	-	-	120	122	120	120	118	121	118	118	117	117
	pH (lab)	pH	6.5 - 9.0	-	8.02	8.02	7.95	7.89	8.00	8.00	7.95	7.99	7.97	7.93
	Hardness (as CaCO ₃)	mg/L	-	-	60	60	58	57	57	57	58	57	57	58
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	30	55	55	60	35	38	33	45	45	60
	Turbidity	NTU	-	-	2.2	2.0	2.2	2.4	2.4	2.2	2.1	2.3	2.3	2.4
	Alkalinity (as CaCO ₃)	mg/L	-	-	49	47	46	47	46	44	47	46	41	45
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	<0.020	<0.020	0.0465	0.087	<0.020	0.049	0.026	0.027	<0.020	0.021
	Nitrate	mg/L	13	13	0.044	0.043	0.0425	0.042	0.044	0.043	0.041	0.041	0.042	0.041
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	1.6	1.7	1.7	1.7	1.7	1.7	1.8	2.0	1.6	1.6
	Total Organic Carbon	mg/L	-	-	2.7	2.5	2.5	2.7	2.7	2.4	2.5	3.1	2.5	2.5
	Total Phosphorus	mg/L	0.020 ^d	-	0.0104	0.0049	0.0035	0.0045	0.0032	0.0039	0.0058	0.0045	0.0054	0.0046
Anions	Phenols	mg/L	0.001 ^d	-	0.0011	0.0012	0.0018	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011
	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	2.9	2.9	2.8	2.8	2.7	2.7	2.8	2.8	2.8	2.7
Total Metals	Sulphate (SO ₄)	mg/L	218 ^β	218	6.0	6.0	5.7	5.7	5.6	5.6	5.6	5.6	5.6	5.6
	Aluminum (Al)	mg/L	0.100	0.179, 0.173 ^c	0.155	0.044	0.058	0.066	0.071	0.060	0.057	0.039	0.067	0.056
	Antimony (Sb)	mg/L	0.020 ^d	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0077	0.0064	0.0064	0.0064	0.0065	0.0054	0.0064	0.0070	0.0058	0.0065
	Beryllium (Be)	mg/L	0.011 ^d	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00009	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	12	12	11	11	11	11	11	11	11	11
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^d	0.004	0.0002	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0024	0.0011	0.0009	0.0008	0.0009	0.0008	0.0007	0.0008	0.0006	0.0007	0.0008
	Iron (Fe)	mg/L	0.30	0.300	0.463	0.053	0.058	0.063	0.066	0.061	0.061	<0.030	0.061	0.062
	Lead (Pb)	mg/L	0.001	0.001	0.000260	0.000065	0.0000715	0.000077	0.000073	0.000074	0.000075	<0.000050	0.000076	0.000072
	Lithium (Li)	mg/L	-	-	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	-	-	7.5	7.3	7.0	7.0	6.9	6.2	6.9	8.2	6.7	6.9
	Manganese (Mn)	mg/L	0.935 ^β	-	0.0401	0.0057	0.0055	0.0056	0.0053	0.0047	0.0054	0.0010	0.0049	0.0051
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	0.00042	0.00049	0.00049	0.00046	0.00046	0.00044	0.00050	0.00053	0.00047	0.00045
	Nickel (Ni)	mg/L	0.025	0.025	0.00101	0.00061	0.00062	0.00063	0.00065	0.00054	0.00062	0.00054	0.00058	0.00059
	Potassium (K)	mg/L	-	-	1.10	1.05	1.04	1.05	1.05	0.91	1.03	1.20	0.97	1.03
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.67	0.54	0.57	0.57	0.59	0.56	0.58	0.55	0.55	0.55
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	1.3	1.3	1.3	1.3	1.3	1.1	1.3	1.4	1.2	1.2
	Strontium (Sr)	mg/L	-	-	0.009	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	0.01100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.0008	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0005	0.0007	0.0007
	Vanadium (V)	mg/L	0.006 ^d	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

^b AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to Sheardown Lake.

^c Benchmark is 0.179 mg/L and 0.173 mg/L for shallow and deep stations, respectively.

 Indicates parameter concentration above applicable Water Quality Guideline.

 **BOLD** Indicates parameter concentration above the AEMP benchmark.

Table C.55: Dissolved Metal Concentrations at Sheardown Lake SE Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Winter Sampling Event									Summer Sampling Event					
			DL0-02-6 bottom 17-Apr-18	DL0-02-6 surface 17-Apr-18	DL0-02-7 surface 17-Apr-18	DL0-02-4 bottom 17-Apr-18	DL0-02-4 surface 17-Apr-18	DL0-02-8 bottom 17-Apr-18	DL0-02-8 surface 17-Apr-18	DL0-02-3 bottom 17-Apr-18	DL0-02-3 surface 17-Apr-18	DL0-02-6 bottom 31-Jul-18	DL0-02-6 surface 31-Jul-18	DL0-02-7 bottom 31-Jul-18	DL0-02-7 surface 31-Jul-18	DL0-02-4 bottom 31-Jul-18	DL0-02-4 surface 31-Jul-18
Dissolved Metals	Aluminum (Al)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0094	0.0086	0.0101	0.0098	0.0141	0.0097
	Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.00848	0.00880	0.00808	0.00747	0.00782	0.00711	0.00796	0.00760	0.00781	0.00536	0.00543	0.00531	0.00521	0.00542	0.00534
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	16.0	15.9	15.1	13.7	15.1	13.9	14.9	14.5	14.4	10.4	10.0	9.6	9.5	9.7	9.3
	Chromium (Cr)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.00080	0.00088	0.00083	0.00078	0.00086	0.00080	0.00093	0.00082	0.00083	0.00065	0.00064	0.00068	0.00061	0.00072	0.00062
	Iron (Fe)	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	<0.0010	0.00110	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	9.59	9.73	8.92	8.30	8.96	8.38	8.60	8.55	9.12	6.41	6.13	6.07	6.05	6.19	5.9
	Manganese (Mn)	mg/L	0.001110	0.000678	0.000901	0.000186	0.000682	0.000168	0.000720	0.000282	0.000255	0.000509	0.00037	0.000348	0.000386	0.000828	0.000265
	Mercury (Hg)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.0000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.000695	0.000701	0.000651	0.000622	0.000674	0.000617	0.000647	0.000622	0.000647	0.00044	0.000468	0.000425	0.000401	0.000345	0.000385
	Nickel (Ni)	mg/L	0.000670	0.000730	0.000660	0.000600	0.000680	0.000600	0.000640	0.000600	0.000660	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Potassium (K)	mg/L	1.46	1.52	1.37	1.26	1.40	1.29	1.38	1.30	1.39	0.92	0.91	0.88	0.86	0.87	0.85
	Selenium (Se)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	0.74	0.73	0.61	0.56	0.61	0.57	0.58	0.70	0.62	0.41	0.4	0.39	0.39	0.44	0.39
	Silver (Ag)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	1.66	1.75	1.57	1.48	1.65	1.50	1.57	1.54	1.63	1.12	1.1	1.08	1.06	1.08	1.05
	Strontium (Sr)	mg/L	0.01100	0.01120	0.01025	0.00963	0.01020	0.00964	0.01020	0.00986	0.01030	0.00729	0.00699	0.00679	0.00687	0.00712	0.00669
	Thallium (Tl)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.000914	0.000909	0.000883	0.000821	0.000885	0.000867	0.000868	0.000824	0.000870	0.000601	0.000614	0.00057	0.000547	0.000568	0.000542
	Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table C.55: Dissolved Metal Concentrations at Sheardown Lake SE Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Summer Sampling Event				Fall Sampling Event									
			DL0-02-8 bottom	DL0-02-8 surface	DL0-02-3 bottom	DL0-02-3 surface	DL0-02-6 bottom	DL0-02-6 surface	DL0-02-7 bottom	DL0-02-7 surface	DL0-02-4 bottom	DL0-02-4 surface	DL0-02-8 bottom	DL0-02-8 surface	DL0-02-3 bottom	DL0-02-3 surface
			31-Jul-18	31-Jul-18	31-Jul-18	31-Jul-18	23-Aug-18	23-Aug-18	23-Aug-18	23-Aug-18	23-Aug-18	23-Aug-18	23-Aug-18	23-Aug-18	23-Aug-18	23-Aug-18
Dissolved Metals	Aluminum (Al)	mg/L	0.0109	0.0101	0.01055	0.0078	0.0108	0.0111	0.0096	0.0139	0.0060	0.0052	0.0126	0.0163	0.0052	0.0054
	Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.00528	0.00506	0.005385	0.00537	0.00631	0.00640	0.00613	0.00613	0.00609	0.00616	0.00627	0.00611	0.00618	0.00622
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	9.3	9.3	9.4	9.4	12.0	12.0	11.4	11.4	11.4	11.3	11.3	11.3	11.5	11.5
	Chromium (Cr)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.00065	0.00083	0.00061	0.00056	0.00076	0.00131	0.00073	0.00075	0.00071	0.00070	0.00073	0.00075	0.00070	0.00072
	Iron (Fe)	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	5.94	5.99	6.1	6.01	7.27	7.27	7.05	7.01	6.87	7.07	7.16	7.06	6.96	7.08
	Manganese (Mn)	mg/L	0.000398	0.000346	0.0005585	0.000387	0.000883	0.000641	0.000660	0.000656	0.000411	0.000365	0.000410	0.000491	0.000305	0.000324
	Mercury (Hg)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.000396	0.000408	0.000400	0.000372	0.000513	0.000557	0.000469	0.000516	0.000469	0.000479	0.000493	0.000474	0.000432	0.000515
	Nickel (Ni)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	0.00058	0.00055	0.00053	0.00051	0.00053	0.00052	0.00054	0.0005	0.00055	0.00051
	Potassium (K)	mg/L	0.88	0.87	0.885	0.89	1.07	1.05	1.03	1.02	1.03	1.01	1.03	1.02	1.02	1.03
	Selenium (Se)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	0.4	0.39	0.39	0.38	0.49	0.48	0.49	0.49	0.48	0.48	0.50	0.49	0.48	0.47
	Silver (Ag)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	1.06	1.06	1.065	1.06	1.32	1.29	1.27	1.26	1.26	1.25	1.26	1.27	1.25	1.27
	Strontium (Sr)	mg/L	0.00670	0.00666	0.00665	0.00670	0.00857	0.00846	0.00819	0.00816	0.00808	0.00816	0.00807	0.00816	0.00824	0.00819
	Thallium (Tl)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.000546	0.000547	0.000558	0.000543	0.000759	0.000765	0.000733	0.000727	0.000710	0.000708	0.000700	0.000702	0.000697	0.000720
	Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table C.56: Magnitude of Elevation in Seasonal Average Dissolved Metal Concentrations Between Sheardown Lake Southeast and Reference Lake 3 in 2018, and at Sheardown Lake Southeast Between 2018 and the Baseline Period

Dissolved Metal	Sheardown Lake SE				
	2018 vs Reference Lake 3		2018 vs Baseline		
	Summer	Fall	Winter	Summer	Fall
Aluminum (Al)	3.4	1.9	0.0	2.2	3.2
Antimony (Sb)	1.0	1.0	0.0	0.0	1.0
Arsenic (As)	1.0	1.0	1.0	0.8	1.0
Barium (Ba)	0.8	0.9	0.0	1.0	1.1
Beryllium (Be)	1.0	1.0	1.2	1.2	2.1
Cadmium (Cd)	1.0	1.0	0.4	0.0	0.8
Calcium (Ca)	1.4	1.6	1.1	0.8	1.0
Chromium (Cr)	1.0	1.0	RDL	RDL	RDL
Cobalt (Co)	1.0	1.0	1.0	1.0	0.9
Copper (Cu)	0.8	1.1	0.7	0.4	1.0
Iron (Fe)	1.0	1.0	1.2	1.2	1.7
Lead (Pb)	1.0	1.0	0.6	1.0	1.0
Lithium (Li)	1.0	1.0	0.2	0.0	0.4
Magnesium (Mg)	1.4	1.7	1.1	0.9	1.0
Manganese (Mn)	2.9	2.5	1.0	0.0	0.8
Mercury (Hg)	1.0	1.0	0.9	1.0	1.0
Molybdenum (Mo)	3.3	3.6	2.8	0.0	2.4
Nickel (Ni)	1.0	1.1	0.9	0.5	0.9
Potassium (K)	0.9	1.2	0.9	0.8	0.9
Selenium (Se)	1.0	1.0	RDL	RDL	RDL
Silicon (Si)	0.9	1.2	1.3	1.0	1.2
Silver (Ag)	1.0	1.0	1.2	1.8	2.7
Sodium (Na)	1.2	1.5	1.0	0.8	1.0
Strontium (Sr)	0.9	1.0	1.3	1.0	1.1
Thallium (Tl)	1.0	1.0	1.2	1.3	2.6
Tin (Sn)	1.0	1.0	0.1	0.2	0.1
Titanium (Ti)	1.0	1.0	1.0	1.0	1.0
Uranium (U)	2.4	2.8	1.8	1.2	1.4
Vanadium (V)	1.0	1.0	1.0	1.0	1.0
Zinc (Zn)	1.0	1.0	1.5	1.0	1.9

 Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).
 Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).
 Denotes highly elevated concentration (mean concentration ≥ 10 times higher than respective mean reference or baseline period value).

Note: RDL = Reportable Detection Limit

Table C.57: Spearman's Rank Correlation Coefficients for Sheardown Lake SE (DLO-2) Water Quality Data Collected in Winter, Summer, and Fall 2018^a

Parameters	Conventional Parameters									Total Metals											
	Conduct-ivity	Hardness	Total Dissolved Solids	Turbidity	Alkalinity	Dissolved Organic Carbon	Total Phosphorus	Chloride	Sulphate	Aluminum	Barium	Copper	Iron	Manganese	Molybdenum	Nickel	Potassium	Silicon	Sodium	Strontium	Uranium
Conductivity	1	0.934	0.697	-0.726	0.897	0.810	-0.370	0.964	0.383	-0.750	0.872	0.705	-0.785	-0.440	0.914	0.787	0.943	0.808	0.928	0.945	0.843
Hardness	0.934	1	0.679	-0.774	0.942	0.786	-0.285	0.960	0.382	-0.777	0.923	0.779	-0.758	-0.388	0.933	0.816	0.945	0.827	0.944	0.975	0.893
Total Dissolved Solids	0.697	0.679	1	-0.676	0.669	0.539	-0.211	0.704	-0.213	-0.835	0.710	0.533	-0.633	-0.575	0.713	0.445	0.700	0.388	0.675	0.694	0.573
Turbidity	-0.726	-0.774	-0.676	1	-0.788	-0.604	0.156	-0.719	0.083	0.777	-0.711	-0.534	0.657	0.482	-0.752	-0.488	-0.679	-0.520	-0.718	-0.732	-0.698
Alkalinity	0.897	0.942	0.669	-0.788	1	0.783	-0.202	0.938	0.302	-0.696	0.926	0.755	-0.698	-0.354	0.876	0.842	0.921	0.828	0.931	0.930	0.835
Dissolved Organic Carbon	0.810	0.786	0.539	-0.604	0.783	1	-0.254	0.823	0.359	-0.736	0.773	0.515	-0.893	-0.680	0.913	0.575	0.848	0.652	0.841	0.750	0.618
Total Phosphorus	-0.370	-0.285	-0.211	0.156	-0.202	-0.254	1	-0.271	-0.362	0.357	-0.216	-0.220	0.353	0.127	-0.413	-0.081	-0.350	-0.093	-0.277	-0.298	-0.190
Chloride	0.964	0.960	0.704	-0.719	0.938	0.823	-0.271	1	0.397	-0.762	0.937	0.767	-0.772	-0.414	0.922	0.862	0.970	0.857	0.971	0.968	0.863
Sulphate	0.383	0.382	-0.213	0.083	0.302	0.359	-0.362	0.397	1.000	0.006	0.307	0.416	-0.203	0.229	0.350	0.521	0.393	0.557	0.404	0.395	0.368
Aluminum (total)	-0.750	-0.777	-0.835	0.777	-0.696	-0.736	0.357	-0.762	0.006	1.000	-0.756	-0.468	0.853	0.758	-0.867	-0.391	-0.787	-0.416	-0.796	-0.757	-0.576
Barium (total)	0.872	0.923	0.710	-0.711	0.926	0.773	-0.216	0.937	0.307	-0.756	1	0.719	-0.736	-0.440	0.881	0.826	0.954	0.763	0.942	0.938	0.829
Copper (total)	0.705	0.779	0.533	-0.534	0.755	0.515	-0.220	0.767	0.416	-0.468	0.719	1	-0.357	-0.051	0.681	0.828	0.740	0.709	0.709	0.774	0.889
Iron (total)	-0.785	-0.758	-0.633	0.657	-0.698	-0.893	0.353	-0.772	-0.203	0.853	-0.736	-0.357	1	0.768	-0.900	-0.423	-0.800	-0.512	-0.802	-0.743	-0.529
Manganese (total)	-0.440	-0.388	-0.575	0.482	-0.354	-0.680	0.127	-0.414	0.229	0.758	-0.440	-0.051	0.768	1	-0.595	-0.011	-0.493	-0.036	-0.470	-0.368	-0.192
Molybdenum (total)	0.914	0.933	0.713	-0.752	0.876	0.913	-0.413	0.922	0.350	-0.867	0.881	0.681	-0.900	-0.595	1	0.675	0.938	0.721	0.926	0.908	0.780
Nickel (total)	0.787	0.816	0.445	-0.488	0.842	0.575	-0.081	0.862	0.521	-0.391	0.826	0.828	-0.423	-0.011	0.675	1	0.816	0.925	0.809	0.860	0.851
Potassium (total)	0.943	0.945	0.700	-0.679	0.921	0.848	-0.350	0.970	0.393	-0.787	0.954	0.740	-0.800	-0.493	0.938	0.816	1	0.790	0.979	0.957	0.836
Silicon (total)	0.808	0.827	0.388	-0.520	0.828	0.652	-0.093	0.857	0.557	-0.416	0.763	0.709	-0.512	-0.036	0.721	0.925	0.790	1	0.817	0.838	0.780
Sodium (total)	0.928	0.944	0.675	-0.718	0.931	0.841	-0.277	0.971	0.404	-0.796	0.942	0.709	-0.802	-0.470	0.926	0.809	0.979	0.817	1	0.953	0.806
Strontium (total)	0.945	0.975	0.694	-0.732	0.930	0.750	-0.298	0.968	0.395	-0.757	0.938	0.774	-0.743	-0.368	0.908	0.860	0.957	0.838	0.953	1	0.900
Uranium (total)	0.843	0.893	0.573	-0.698	0.835	0.618	-0.190	0.863	0.368	-0.576	0.829	0.889	-0.529	-0.192	0.780	0.851	0.836	0.780	0.806	0.900	1
Aluminum (dissolved)	-0.777	-0.758	-0.808	0.760	-0.636	-0.528	0.229	-0.725	0.093	0.806	-0.669	-0.501	0.711	0.549	-0.734	-0.459	-0.700	-0.462	-0.680	-0.774	-0.706
Barium (dissolved)	0.942	0.978	0.651	-0.788	0.924	0.762	-0.250	0.946	0.368	-0.761	0.908	0.751	-0.741	-0.375	0.907	0.822	0.933	0.837	0.939	0.977	0.902
Copper (dissolved)	0.789	0.769	0.669	-0.548	0.793	0.771	-0.108	0.790	0.147	-0.610	0.761	0.642	-0.652	-0.511	0.777	0.658	0.800	0.646	0.752	0.742	0.663
Manganese (dissolved)	0.244	0.302	0.021	-0.214	0.354	0.189	0.053	0.294	0.367	-0.012	0.313	0.343	0.090	0.239	0.190	0.399	0.268	0.393	0.301	0.252	0.363
Molybdenum (dissolved)	0.941	0.958	0.737	-0.723	0.892	0.797	-0.353	0.934	0.361	-0.799	0.888	0.793	-0.771	-0.442	0.944	0.767	0.942	0.782	0.923	0.950	0.877
Nickel (dissolved)	0.934	0.970	0.683	-0.822	0.921	0.748	-0.314	0.933	0.314	-0.749	0.864	0.814	-0.723	-0.365	0.913	0.803	0.907	0.810	0.897	0.955	0.917
Potassium (dissolved)	0.931	0.987	0.685	-0.729	0.926	0.778	-0.319	0.959	0.383	-0.774	0.927	0.786	-0.757	-0.406	0.931	0.831	0.961	0.825	0.945	0.975	0.881
Silicon (dissolved)	0.928	0.954	0.651	-0.753	0.949	0.814	-0.287	0.962	0.356	-0.749	0.910	0.696	-0.794	-0.387	0.922	0.823	0.944	0.873	0.959	0.946	0.807
Sodium (dissolved)	0.935	0.983	0.693	-0.725	0.932	0.807	-0.312	0.967	0.394	-0.799	0.943	0.747	-0.786	-0.458	0.935	0.801	0.972	0.799	0.968	0.970	0.852
Strontium (dissolved)	0.945	0.978	0.700	-0.748	0.937	0.769	-0.292	0.967	0.395	-0.770	0.937	0.743	-0.762	-0.401	0.912	0.825	0.955	0.820	0.960	0.988	0.878
Uranium (dissolved)	0.957	0.976	0.710	-0.733	0.925	0.777	-0.329	0.968	0.397	-0.757	0.909	0.792	-0.750	-0.380	0.919	0.810	0.955	0.808	0.950	0.969	0.899

^a Correlation matrix included only those parameters with≥75% of values above laboratory reportable detection limits (RDL). Sample size (n) totalled 28.

Indicates strong positive correlation (i.e., Spearman's rho≥ 0.7) between parameter pairings.
 Indicates strong negative correlation (i.e., Spearman's rho≤ -0.7) between parameter pairings.

Table C.57: Spearman's Rank Correlation Coefficients for Sheardown Lake SE (DLO-2) Water Quality Data Collected in Winter, Summer, and Fall 2018^a

Parameters	Dissolved Metals										
	Aluminum	Barium	Copper	Manganese	Molybdenum	Nickel	Potassium	Silicon	Sodium	Strontium	Uranium
Conductivity	-0.777	0.942	0.789	0.244	0.941	0.934	0.931	0.928	0.935	0.945	0.957
Hardness	-0.758	0.978	0.769	0.302	0.958	0.970	0.987	0.954	0.983	0.978	0.976
Total Dissolved Solids	-0.808	0.651	0.669	0.021	0.737	0.683	0.685	0.651	0.693	0.700	0.710
Turbidity	0.760	-0.788	-0.548	-0.214	-0.723	-0.822	-0.729	-0.753	-0.725	-0.748	-0.733
Alkalinity	-0.636	0.924	0.793	0.354	0.892	0.921	0.926	0.949	0.932	0.937	0.925
Dissolved Organic Carbon	-0.528	0.762	0.771	0.189	0.797	0.748	0.778	0.814	0.807	0.769	0.777
Total Phosphorus	0.229	-0.250	-0.108	0.053	-0.353	-0.314	-0.319	-0.287	-0.312	-0.292	-0.329
Chloride	-0.725	0.946	0.790	0.294	0.934	0.933	0.959	0.962	0.967	0.967	0.968
Sulphate	0.093	0.368	0.147	0.367	0.361	0.314	0.383	0.356	0.394	0.395	0.397
Aluminum (total)	0.806	-0.761	-0.610	-0.012	-0.799	-0.749	-0.774	-0.749	-0.799	-0.770	-0.757
Barium (total)	-0.669	0.908	0.761	0.313	0.888	0.864	0.927	0.910	0.943	0.937	0.909
Copper (total)	-0.501	0.751	0.642	0.343	0.793	0.814	0.786	0.696	0.747	0.743	0.792
Iron (total)	0.711	-0.741	-0.652	0.090	-0.771	-0.723	-0.757	-0.794	-0.786	-0.762	-0.750
Manganese (total)	0.549	-0.375	-0.511	0.239	-0.442	-0.365	-0.406	-0.387	-0.458	-0.401	-0.380
Molybdenum (total)	-0.734	0.907	0.777	0.190	0.944	0.913	0.931	0.922	0.935	0.912	0.919
Nickel (total)	-0.459	0.822	0.658	0.399	0.767	0.803	0.831	0.823	0.801	0.825	0.810
Potassium (total)	-0.700	0.933	0.800	0.268	0.942	0.907	0.961	0.944	0.972	0.955	0.955
Silicon (total)	-0.462	0.837	0.646	0.393	0.782	0.810	0.825	0.873	0.799	0.820	0.808
Sodium (total)	-0.680	0.939	0.752	0.301	0.923	0.897	0.945	0.959	0.968	0.960	0.950
Strontium (total)	-0.774	0.977	0.742	0.252	0.950	0.955	0.975	0.946	0.970	0.988	0.969
Uranium (total)	-0.706	0.902	0.663	0.363	0.877	0.917	0.881	0.807	0.852	0.878	0.899
Aluminum (dissolved)	1	-0.770	-0.588	0.133	-0.771	-0.800	-0.750	-0.691	-0.738	-0.771	-0.770
Barium (dissolved)	-0.770	1	0.737	0.293	0.957	0.963	0.968	0.944	0.955	0.964	0.952
Copper (dissolved)	-0.588	0.737	1	0.211	0.792	0.776	0.799	0.758	0.798	0.738	0.778
Manganese (dissolved)	0.133	0.293	0.211	1	0.223	0.253	0.262	0.252	0.281	0.274	0.313
Molybdenum (dissolved)	-0.771	0.957	0.792	0.223	1	0.944	0.962	0.920	0.952	0.941	0.957
Nickel (dissolved)	-0.800	0.963	0.776	0.253	0.944	1	0.962	0.930	0.936	0.942	0.955
Potassium (dissolved)	-0.750	0.968	0.799	0.262	0.962	0.962	1	0.955	0.986	0.966	0.966
Silicon (dissolved)	-0.691	0.944	0.758	0.252	0.920	0.930	0.955	1	0.949	0.941	0.936
Sodium (dissolved)	-0.738	0.955	0.798	0.281	0.952	0.936	0.986	0.949	1	0.981	0.976
Strontium (dissolved)	-0.771	0.964	0.738	0.274	0.941	0.942	0.966	0.941	0.981	1	0.980
Uranium (dissolved)	-0.770	0.952	0.778	0.313	0.957	0.955	0.966	0.936	0.976	0.980	1

^a Correlation matrix included only those parameters with≥75% of values above laboratory reportable detection limits (RDL). Sample size (n) totalled 28.

Indicates strong positive correlation (i.e., Spearman's rho≥ 0.7) between parameter pairings.

Indicates strong negative correlation (i.e., Spearman's rho≤ -0.7) between parameter pairings.

Table C.59: *In Situ* Water Quality Measurements Collected at Mary River Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2018

Study Area	Station	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)	pH (pH units)	Specific Conductance (µS/cm)
Mary River Upstream (GO-09)	GO-09 B1	4.7	11.93	92.7	6.75*	93*
	GO-09 B2	4.5	12.26	94.7	5.48*	-
	GO-09 B3	4.5	12.44	96.1	5.40*	-
	GO-09 B4	4.4	12.37	95.3	5.36*	-
	GO-09 B5	4.4	12.82	98.8	5.57*	-
Mary River Upstream (GO-03)	GO-03 B1	5.6	11.63	92.5	2.75*	-
	GO-03 B2	5.6	11.52	91.6	2.87*	-
	GO-03 B3	5.4	11.85	93.8	2.66*	-
	GO-03 B4	5.3	12.48	98.5	2.60*	-
	GO-03 B5	5.1	12.33	96.9	5.68*	-
Mary River Downstream (EO-01)	EO-01 B1	5.3	12.86	101.5	6.48*	158*
	EO-01 B2	5.4	12.72	100.7	5.18*	85*
	EO-01 B3	5.4	12.66	100.2	5.20*	90*
	EO-01 B4	5.2	12.66	99.6	6.64*	156*
	EO-01 B5	5.4	12.89	102.0	5.48*	90*
Mary River Downstream (EO-20)	EO-20 B1	5.7	12.51	100.0	5.43*	91*
	EO-20 B2	5.8	12.50	99.8	5.55*	87*
	EO-20 B3	5.8	12.51	99.7	5.46*	88*
	EO-20 B4	5.9	12.40	99.5	5.86*	88*
	EO-20 B5	5.9	12.35	99.4	5.62*	92*
Mary River Downstream (CO-05)	CO-05 B1	6.4	12.45	101.0	8.13	126
	CO-05 B2	6.4	12.51	101.0	8.12	126
	CO-05 B3	6.1	12.51	100.8	8.14	126
	CO-05 B4	5.9	12.54	100.5	8.12	126
	CO-05 B5	5.6	12.49	100.0	8.08	125

Note: * Meter not functioning properly, and therefore readings of pH and specific conductance were not used for further evaluation.

Table C.60: *In Situ* Water Quality Summary for Mary River Benthic Invertebrate Community Study Areas, Mary River Project CREMP, August 2018

Metric	Station	Sample Size	Mean	Standard Deviation	Standard Error	95% Confidence Interval		Minimum	Maximum
						Lower Bound	Upper Bound		
Temperature (°C)	GO-09	5	4.47	0.15	0.07	4.29	4.66	4.35	4.72
	GO-03	5	5.39	0.21	0.10	5.13	5.66	5.11	5.61
	EO-01	5	5.32	0.09	0.04	5.20	5.43	5.18	5.42
	EO-20	5	5.81	0.08	0.03	5.71	5.91	5.74	5.92
	CO-05	5	6.08	0.34	0.15	5.66	6.50	5.60	6.40
Dissolved Oxygen (mg/L)	GO-09	5	12.4	0.3	0.1	12.0	12.8	11.9	12.8
	GO-03	5	12.0	0.4	0.2	11.4	12.5	11.5	12.5
	EO-01	5	12.8	0.1	0.0	12.6	12.9	12.7	12.9
	EO-20	5	12.5	0.1	0.0	12.4	12.5	12.4	12.5
	CO-05	5	12.5	0.0	0.0	12.5	12.5	12.5	12.5
Dissolved Oxygen (% saturation)	GO-09	5	95.5	2.2	1.0	92.8	98.3	92.7	98.8
	GO-03	5	94.7	2.9	1.3	91.0	98.3	91.6	98.5
	EO-01	5	100.8	1.0	0.4	99.6	102.0	99.6	102.0
	EO-20	5	99.7	0.2	0.1	99.4	100.0	99.4	100.0
	CO-05	5	100.7	0.4	0.2	100.1	101.2	100.0	101.0
pH (pH units)	GO-09	5	-	-	-	-	-	-	-
	GO-03	5	-	-	-	-	-	-	-
	EO-01	5	-	-	-	-	-	-	-
	EO-20	5	-	-	-	-	-	-	-
	CO-05	5	8.12	0.02	0.01	8.09	8.15	8.08	8.14
Specific Conductance (µS/cm)	GO-09	5	-	-	-	-	-	-	-
	GO-03	5	-	-	-	-	-	-	-
	EO-01	5	-	-	-	-	-	-	-
	EO-20	5	-	-	-	-	-	-	-
	CO-05	5	125.7	0.5	0.2	125.1	126.3	124.9	126.1

Note: Meter not functioning properly, and therefore readings of pH and specific conductance were not able to be calculated for GO-09, GO-03, EO-01, and EO-20.

Table C.61: Statistical Comparison of *In Situ* Water Quality Variables Among Mary River Benthic Invertebrate Community Study Areas, Mary River Project CREMP, August 2018

<i>In Situ</i> Variable	Overall 5-group Comparison			Pair-wise, <i>post hoc</i> comparisons ^a				
	Significant Difference Among Areas?	P-value	Statistical Test ^b	(I) Area	(J) Area	Significant Difference Between Areas?	P-value	Statistical Test
Temperature (°C)	YES	< 0.001	α	GO-09	GO-03	YES	0.000	Tukey's HSD
				GO-09	EO-01	YES	0.000	
				GO-09	EO-20	YES	0.000	
				GO-09	CO-05	YES	0.000	
				GO-03	EO-01	NO	0.975	
				GO-03	EO-20	YES	0.025	
				GO-03	CO-05	YES	0.000	
				EO-01	EO-20	YES	0.007	
				EO-01	CO-05	YES	0.000	
Dissolved Oxygen (mg/L)	YES	0.0017	α	EO-20	CO-05	NO	0.242	Tukey's HSD
				GO-09	GO-03	NO	0.112	
				GO-09	EO-01	NO	0.123	
				GO-09	EO-20	NO	0.977	
				GO-09	CO-05	NO	0.903	
				GO-03	EO-01	YES	0.000	
				GO-03	EO-20	YES	0.035	
				GO-03	CO-05	YES	0.019	
				EO-01	EO-20	NO	0.323	
Dissolved Oxygen (% Saturation)	YES	< 0.001	α	EO-01	CO-05	NO	0.480	Tukey's HSD
				EO-20	CO-05	NO	0.998	
				GO-09	GO-03	NO	0.929	
				GO-09	EO-01	YES	0.001	
				GO-09	EO-20	YES	0.008	
				GO-09	CO-05	YES	0.001	
				GO-03	EO-01	YES	0.000	
				GO-03	EO-20	YES	0.001	
				GO-03	CO-05	YES	0.000	
				EO-01	EO-20	NO	0.838	
				EO-01	CO-05	NO	1.000	
				EO-20	CO-05	NO	0.893	

^a *Post hoc* analysis of 1-way ANOVA among all areas protected for multiple comparisons.

^b Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log transformed, single factor ANOVA test conducted; γ - data untransformed, Kruskal Wallis H-test or Mann-Whitney U-test, as appropriate.

 Highlighted values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

Table C.62: Water Chemistry at Mary River Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Spring Sampling Event												
					G0-09-A	G0-09	G0-09-B	G0-03	G0-01	F0-01	E0-10	E0-03	E0-21	E0-20	C0-10	C0-05	C0-01
					01-Jul-18	01-Jul-18	01-Jul-18	01-Jul-18	30-Jun-18	30-Jun-18	01-Jul-18	30-Jun-18	30-Jun-18	30-Jun-18	30-Jun-18	30-Jun-18	30-Jun-18
Conventionals	Conductivity (lab)	umho/cm	-	-	24	26	30	33	26	65	33	30	30	31	30	39	36
	pH (lab)	pH	6.5 - 9.0	-	7.3	7.4	7.4	7.44	7.3	7.72	7.39	7.445	7.39	7.48	7.4	7.43	7.45
	Hardness (as CaCO ₃)	mg/L	-	-	11	12	14	15	12	31	15	14	14	15	14	18	17
	Total Suspended Solids (TSS)	mg/L	-	-	16.9	6.2	3.7	<2.0	2.1	<2.0	<2.0	5.1	3.7	3.7	<2.0	<2.0	2.8
	Total Dissolved Solids (TDS)	mg/L	-	-	<10	13	11	11	16	37	22	21	21	22	30	26	24
	Turbidity	NTU	-	-	8.8	7.1	4.7	3.5	3.7	1.2	3.3	3.3	3.6	3.2	3.3	3.8	3.3
	Alkalinity (as CaCO ₃)	mg/L	-	-	11	15	17	16	<10	29	15	13	13	13	<10	16	16
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.0285	0.043	<0.020	<0.020	<0.020	<0.020
	Nitrate	mg/L	13	13	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	0.9	0.9	1.0	1.0	1.0	0.6	0.9	0.9	1.0	1.0	1.0	1.1	1.1
	Total Organic Carbon	mg/L	-	-	1.3	1.2	1.3	1.2	1.4	1.0	1.1	1.4	1.2	1.3	1.3	1.4	1.3
	Total Phosphorus	mg/L	0.030 ^d	-	0.0277	0.0158	0.0074	0.0060	0.0069	0.0035	0.0063	0.0148	0.0076	0.0091	0.0059	0.0053	0.006
Anions	Phenols	mg/L	0.004 ^d	-	0.0061	<0.0010	0.0015	0.0025	0.0014	0.0038	0.0013	0.012	0.0026	0.0016	0.0016	0.0034	0.0079
	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	0.5	0.53	0.6	1.7	0.6	<0.50	0.6	0.6	0.58	0.6	0.6	0.8	0.8
Total Metals	Sulphate (SO ₄)	mg/L	218 ^β	218	<0.30	<0.30	<0.30	<0.30	<0.30	2.1	1.1	0.4	0.4	0.4	0.4	0.7	0.6
	Aluminum (Al)	mg/L	0.100	0.966	0.225	0.135	0.086	0.123	0.084	0.036	0.087	0.091	0.094	0.073	0.098	0.048	0.091
	Antimony (Sb)	mg/L	0.020 ^d	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0040	0.0032	0.0031	0.0033	0.0025	0.0034	0.0030	0.0043	0.0030	0.0027	0.0029	0.0031	0.0032
	Beryllium (Be)	mg/L	0.011 ^d	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cadmium (Cd)	mg/L	0.00012	0.00006	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	2	3	3	3	3	6	3	3	3	3	3	4	4
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	0.00072	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^d	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0024	0.00067	0.0006	0.0006	0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Iron (Fe)	mg/L	0.30	0.874	0.181	0.125	0.096	0.083	0.064	0.036	0.061	0.075	0.086	0.043	0.069	0.043	0.071
	Lead (Pb)	mg/L	0.001	0.001	0.000219	0.000155	0.000103	0.000090	0.000077	<0.000050	0.000071	0.000096	0.000093	<0.000050	0.000082	0.000066	0.000092
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	-	-	1.4	1.5	1.6	1.7	1.4	3.8	1.8	1.7	1.7	1.9	1.7	2.2	2.0
	Manganese (Mn)	mg/L	0.935 ^β	-	0.0042	0.0032	0.00241	0.0015	0.0014	0.0008	0.0013	0.0020	0.0025	0.0007	0.0015	0.0025	0.0024
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000052	<0.000050	0.00009	0.00007
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Potassium (K)	mg/L	-	-	0.39	0.36	0.36	0.37	0.32	0.43	0.35	0.345	0.36	0.39	0.36	0.42	0.4
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.73	0.51	0.54	0.55	0.44	0.38	0.47	0.45	0.46	0.47	0.49	0.36	0.48
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.414000
	Strontium (Sr)	mg/L	-	-	0.0027	0.0027	0.0028	0.0028	0.0023	0.0034	0.0026	0.0025	0.0025	0.0026	0.0025	0.0030	0.0029
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.0002	0.0002	0.0002	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002
	Vanadium (V)	mg/L	0.006 ^d	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

^b AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to the Mary River system.

 Indicates parameter concentration above applicable Water Quality Guideline.

 Indicates parameter concentration above the AEMP benchmark.

Table C.62: Water Chemistry at Mary River Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Summer Sampling Event												
					G0-09-A	G0-09	G0-09-B	G0-03	G0-01	F0-01	E0-10	E0-03	E0-21	E0-20	C0-10	C0-05	C0-01
					12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	10-Aug-18
Conventional	Conductivity (lab)	umho/cm	-	-	81	84	85	88	88	270	96	106	104	107	107	110	100
	pH (lab)	pH	6.5 - 9.0	-	8.16	8.03	8.13	8.12	8.08	8.29	8.10	8.09	8.14	8.13	8.03	8.09	8.13
	Hardness (as CaCO ₃)	mg/L	-	-	40	42	43	44	45	145	48	53	52	53	55	54	50
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	40	50	50	40	50	145	50	55	46	68	52	70	40
	Turbidity	NTU	-	-	9.7	8.9	7.7	6.1	6.3	1.6	6.0	6.6	6.4	5.4	3.5	5.4	1.0
	Alkalinity (as CaCO ₃)	mg/L	-	-	46	39	40	39	40	83	41	45	41	45	50	49	42
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	0.032	<0.020	<0.020	0.033	<0.020	<0.020	0.044	0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Nitrate	mg/L	13	13	<0.020	<0.020	<0.020	<0.020	<0.020	0.210	<0.020	0.021	<0.020	0.023	0.033	0.022	0.020
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	1.2	1.29	1.48	1.53	1.47	1.38	1.5	1.42	1.41	1.63	1.88	1.7	1.7
	Total Organic Carbon	mg/L	-	-	1.6	1.57	1.67	1.69	1.64	1.54	1.68	1.89	1.68	1.87	2.07	2.2	2.1
	Total Phosphorus	mg/L	0.020 ^d	-	0.0138	0.0075	0.0090	0.0066	0.0074	0.0048	0.0068	0.0080	0.0082	0.0067	0.0082	0.0089	0.0077
	Phenols	mg/L	0.004 ^d	-	0.0034	<0.0010	<0.0010	0.0014	<0.0010	0.0013	<0.0010	0.0013	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	1.9	1.8	1.6	4.0	2.7	1.9	2.6	2.7	2.6	2.4	2.6	2.3	2.0
	Sulphate (SO ₄)	mg/L	218 ^β	218	1.2	1.1	0.9	0.9	0.9	59.9	3.3	7.5	7.2	6.4	5.2	5.9	4.9
Total Metals	Aluminum (Al)	mg/L	0.100	0.966	0.176	0.426	0.147	0.166	0.163	0.042	0.099	0.146	0.112	0.113	0.107	0.153	0.141
	Antimony (Sb)	mg/L	0.020 ^d	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0069	0.0073	0.0059	0.0068	0.0073	0.0132	0.0069	0.0075	0.0074	0.0073	0.0069	0.0076	0.0070
	Beryllium (Be)	mg/L	0.011 ^d	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cadmium (Cd)	mg/L	0.00012	0.00006	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	9	9	9	9	9	26	10	10	10	11	10	11	10
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^d	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00022	< 0.00021	< 0.00017	<0.00010	< 0.00015	< 0.00013
	Copper (Cu)	mg/L	0.002	0.0024	0.0010	0.0010	0.0008	0.0009	0.0010	0.0007	0.0009	0.0010	0.0010	0.0010	0.0009	0.0010	0.0010
	Iron (Fe)	mg/L	0.30	0.874	0.138	0.140	0.112	0.110	0.109	0.049	0.083	0.122	0.105	0.103	0.115	0.128	0.134
	Lead (Pb)	mg/L	0.001	0.001	0.000177	0.000164	0.000146	0.000128	0.000129	<0.000050	0.000109	0.000139	0.000135	0.000119	0.000146	0.000137	0.000155
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00140	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	-	-	4.9	5.0	4.4	5.2	5.3	20.5	5.9	6.7	6.5	7.1	6.8	6.7	6.1
	Manganese (Mn)	mg/L	0.935 ^β	-	0.0018	0.0017	0.0014	0.0013	0.0013	0.0018	0.0012	0.0210	0.0184	0.0145	0.0060	0.0121	0.0081
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	0.00021	0.00018	0.00015	0.00015	0.00018	0.00021	0.00015	0.00024	0.00026	0.00024	0.00038	0.00029	0.00021
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.0006	0.0006	0.0007	0.0007	0.0008	0.0007
	Potassium (K)	mg/L	-	-	0.93	0.91	0.76	0.84	0.84	1.35	0.83	0.88	0.86	0.87	1.01	0.92	0.84
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	1.04	1.13	0.94	1.07	1.01	0.87	0.91	1.00	0.92	0.97	0.65	1.08	0.97
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	1.6	1.6	1.3	1.3	1.3	1.4	1.3	1.3	1.3	1.3	1.2	1.3	1.1
	Strontium (Sr)	mg/L	-	-	0.0098	0.0094	0.0088	0.0087	0.0087	0.018	0.0088	0.0110	0.0107	0.0105	0.0075	0.0104	0.0097
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.0014	0.0014	0.0012	0.0010	0.0010	0.0018	0.0010	0.0010	0.0010	0.0009	0.0007	0.0009	0.0008
	Vanadium (V)	mg/L	0.006 ^d	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

^b AEMP Water Quality Benchmarks developed by Intrinsic (2013) using baseline water quality data specific to the Mary River system.

 Indicates parameter concentration above applicable Water Quality Guideline.

 Indicates parameter concentration above the AEMP benchmark.

Table C.62: Water Chemistry at Mary River Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Fall Sampling Event												
					G0-09-A	G0-09	G0-09-B	G0-03	GO-01	F0-01	E0-10	EO-03	EO-21	EO-20	C0-10	C0-05	CO-01
					27-Aug-18	25-Aug-18	25-Aug-18	25-Aug-18	27-Aug-18	25-Aug-18	27-Aug-18	26-Aug-18	27-Aug-18	27-Aug-18	27-Aug-18	27-Aug-18	27-Aug-18
Conventional	Conductivity (lab)	umho/cm	-	-	134	113	112	121	134	283	177	153	164	163	165	160	149
	pH (lab)	pH	6.5 - 9.0	-	7.99	8.07	8.14	8.02	8.00	8.29	8.03	8.03	8.05	8.04	8.07	8.01	8.11
	Hardness (as CaCO ₃)	mg/L	-	-	66	55	55	57	65	143	84	72	80	79	81	78	70
	Total Suspended Solids (TSS)	mg/L	-	-	3.2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	55	70	70	60	80	160	81	115	75	80	90	95	75
	Turbidity	NTU	-	-	2.7	4.9	3.8	3.2	2.7	1.7	2.7	3.0	2.6	2.3	2.1	2.6	2.2
	Alkalinity (as CaCO ₃)	mg/L	-	-	65	50	52	50	59	95	61	58	59	62	65	64	60
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	0.037	0.069	<0.020	<0.020	<0.020	<0.020	0.022	<0.020	<0.020	<0.020	<0.020	0.032	<0.020
	Nitrate	mg/L	13	13	<0.020	<0.020	<0.020	<0.020	<0.020	0.13	0.049	0.021	0.034	0.047	0.044	0.041	0.026
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	1.3	2.0	1.9	1.4	1.4	2.23	1.3	2.0	1.4	1.5	1.5	1.7	1.7
	Total Organic Carbon	mg/L	-	-	2.1	2.1	2.0	1.9	1.9	2.3	1.8	2.1	1.9	2.0	2.3	2.4	2.6
	Total Phosphorus	mg/L	0.020 ^d	-	0.0034	0.0073	0.0034	<0.0030	<0.0030	0.0036	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0030	<0.0030
Anions	Phenols	mg/L	0.004 ^d	-	<0.0010	0.0027	<0.0010	0.0011	<0.0010	0.0011	<0.0010	0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010
	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	2.8	2.9	2.8	5.4	5.5	2.5	5.3	5.5	5.4	5.0	5.0	4.9	4.7
Total Metals	Sulphate (SO ₄)	mg/L	218 ^β	218	1.6	1.8	1.7	1.6	1.7	49.1	17.9	8.2	12.7	11.8	11.9	10.6	7.3
	Aluminum (Al)	mg/L	0.100	0.966	0.126	0.155	0.105	0.128	0.139	0.034	0.135	0.123	0.125	0.123	0.0927	0.102	0.0974
	Antimony (Sb)	mg/L	0.020 ^d	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0085	0.0082	0.0080	0.0086	0.0089	0.0132	0.0107	0.00963	0.0101	0.0105	0.0103	0.00985	0.00932
	Beryllium (Be)	mg/L	0.011 ^d	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cadmium (Cd)	mg/L	0.00012	0.00006	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	14	12	12	12	14	26	17	15	16	16	16	15	16
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^d	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0024	0.0008	0.0009	0.0009	0.0008	0.0008	0.0007	0.0008	0.0008	0.0009	0.0009	0.0010	0.0009	0.0008
	Iron (Fe)	mg/L	0.30	0.874	0.071	0.102	0.082	0.079	0.074	0.042	0.075	0.075	0.075	0.092	0.059	0.085	0.072
	Lead (Pb)	mg/L	0.001	0.001	0.000076	0.000114	0.000092	0.000086	0.000069	<0.000050	0.000068	0.000076	0.000076	0.000092	0.000061	0.000068	0.000060
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	-	-	7.4	6.1	6.5	6.3	7.2	20.4	10.4	8.3	9.2	9.5	9.7	9.3	8.4
	Manganese (Mn)	mg/L	0.935 ^β	-	0.0009	0.0012	0.0011	0.0010	0.0008	0.0011	0.0009	0.0094	0.0072	0.0074	0.0057	0.0064	0.0040
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	0.00025	0.00029	0.00026	0.00024	0.00030	0.00032	0.00029	0.00045	0.00046	0.00039	0.00044	0.00042	0.00045
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00051	0.00054	0.00068	0.00092	0.00078	0.00072
	Potassium (K)	mg/L	-	-	0.91	0.95	0.97	0.87	0.92	1.26	0.99	0.98	0.99	1	0.97	0.99	0.96
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.96	0.94	0.85	0.96	0.97	0.7	1.01	0.97	0.94	1	0.93	0.94	0.93
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	2.0	2.0	2.0	1.7	1.9	1.5	1.8	1.7	1.9	1.9	1.7	1.8	1.7
	Strontium (Sr)	mg/L	-	-	0.0128	0.0127	0.0129	0.0108	0.0127	0.020	0.0148	0.016	0.016	0.015	0.0152	0.0147	0.0141
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.0026	0.0025	0.0027	0.0020	0.0021	0.0023	0.0023	0.0020	0.0022	0.0019	0.0019	0.0017	0.0017
	Vanadium (V)	mg/L	0.006 ^d	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

^b AEMP Water Quality Benchmarks developed by Intrinsic (2013) using baseline water quality data specific to the Mary River system.

 Indicates parameter concentration above applicable Water Quality Guideline.

 Indicates parameter concentration above the AEMP benchmark.

Table C.63: Summary of the Magnitude of Elevation in Seasonal Average Parameter Concentrations (Total Metal Concentration Data Provided) Between Mary River Mine-Exposed and Reference (GO-09) Stations in 2018

Variable	Spring										Summer									
	G0-03	G0-01	FO-01	E0-10	E0-03	E0-21	E0-20	C0-10	CO-05	CO-01	G0-03	G0-01	FO-01	E0-10	E0-03	E0-21	E0-20	C0-10	CO-05	CO-01
Conductivity (lab)	1.2	1.0	2.4	1.2	1.1	1.1	1.2	1.1	1.5	1.4	1.1	1.1	3.2	1.2	1.3	1.2	1.3	1.3	1.3	1.2
Hardness (as CaCO ₃)	1.2	1.0	2.5	1.2	1.1	1.1	1.2	1.1	1.5	1.4	1.1	1.1	3.5	1.2	1.3	1.2	1.3	1.3	1.3	1.2
Total Suspended Solids (TSS)	0.2	0.2	0.2	0.2	0.6	0.4	0.4	0.2	0.2	0.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Total Dissolved Solids (TDS)	1.0	1.4	3.3	1.9	1.9	1.9	1.9	2.6	2.3	2.1	0.9	1.1	3.1	1.1	1.2	1.0	1.5	1.1	1.5	0.9
Turbidity	0.5	0.5	0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.7	0.2	0.7	0.8	0.7	0.6	0.4	0.6	0.1
Alkalinity (as CaCO ₃)	1.1	0.7	2.0	1.0	0.9	0.9	0.9	0.7	1.1	1.1	0.9	1.0	2.0	1.0	1.1	1.0	1.1	1.2	1.2	1.0
Total Ammonia	1.0	1.0	1.0	1.0	1.4	2.2	1.0	1.0	1.0	1.0	1.4	0.8	0.8	1.8	0.8	0.8	0.8	0.8	0.8	0.8
Nitrate	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	11	1.0	1.1	1.0	1.2	1.7	1.1	1.0
Nitrite	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Total Kjeldahl Nitrogen (TKN)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Dissolved Organic Carbon	1.0	1.1	0.6	1.0	1.0	1.0	1.1	1.0	1.2	1.2	1.2	1.1	1.0	1.1	1.1	1.1	1.2	1.4	1.3	1.3
Total Organic Carbon	0.9	1.1	0.8	0.9	1.1	0.9	1.0	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.2	1.0	1.2	1.3	1.3	1.3
Total Phosphorus	0.4	0.4	0.2	0.4	0.9	0.4	0.5	0.3	0.3	0.4	0.7	0.7	0.5	0.7	0.8	0.8	0.7	0.8	0.9	0.8
Phenols	0.9	0.5	1.3	0.5	4.2	0.9	0.6	0.6	1.2	2.8	0.8	0.6	0.7	0.6	0.7	0.6	0.6	0.6	0.6	0.6
Bromide (Br)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Chloride (Cl)	3.1	1.1	0.9	1.2	1.1	1.1	1.1	1.1	1.5	1.4	2.3	1.5	1.1	1.5	1.5	1.5	1.3	1.5	1.3	1.1
Sulphate (SO ₄)	1.0	1.0	6.9	3.7	1.2	1.2	1.3	1.2	2.3	2.0	0.8	0.9	56	3.1	7.0	6.7	6.0	4.9	5.5	4.6
Aluminum (Al)	0.8	0.6	0.2	0.6	0.6	0.6	0.5	0.7	0.3	0.6	0.7	0.7	0.2	0.4	0.6	0.4	0.5	0.4	0.6	0.6
Antimony (Sb)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Arsenic (As)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Barium (Ba)	1.0	0.7	1.0	0.9	1.3	0.9	0.8	0.9	0.9	0.9	1.0	1.1	2.0	1.0	1.1	1.1	1.1	1.0	1.1	1.0
Beryllium (Be)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cadmium (Cd)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Calcium (Ca)	1.2	0.9	2.4	1.2	1.1	1.1	1.2	1.1	1.4	1.3	1.1	1.1	3.0	1.1	1.2	1.2	1.3	1.2	1.3	1.2
Chromium (Cr)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cobalt (Co)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.2	2.1	1.7	1.0	1.5	1.3
Copper (Cu)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.0	1.0	0.8	0.9	1.0	1.0	1.0	1.0	1.0	1.0
Iron (Fe)	0.6	0.5	0.3	0.5	0.6	0.6	0.3	0.5	0.3	0.5	0.8	0.8	0.4	0.6	0.9	0.8	0.8	0.9	1.0	1.0
Lead (Pb)	0.6	0.5	0.3	0.4	0.6	0.6	0.3	0.5	0.4	0.6	0.8	0.8	0.3	0.7	0.9	0.8	0.7	0.9	0.8	1.0
Lithium (Li)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Magnesium (Mg)	1.2	0.9	2.6	1.2	1.1	1.2	1.2	1.1	1.5	1.3	1.1	1.1	4.3	1.2	1.4	1.4	1.5	1.4	1.4	1.3
Manganese (Mn)	0.5	0.4	0.2	0.4	0.6	0.8	0.2	0.5	0.8	0.7	0.8	0.8	1.1	0.7	13	11	9.0	3.7	7.5	5.0
Mercury (Hg)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Molybdenum (Mo)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.7	1.5	0.8	1.0	1.2	0.9	1.3	1.4	1.3	2.1	1.6	1.2
Nickel (Ni)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.2	1.1	1.4	1.5	1.5	1.4
Potassium (K)	1.0	0.9	1.2	0.9	0.9	1.0	1.1	1.0	1.1	1.1	1.0	1.0	1.6	1.0	1.0	1.0	1.0	1.2	1.1	1.0
Selenium (Se)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Silicon (Si)	0.9	0.7	0.6	0.8	0.8	0.8	0.8	0.8	0.6	0.8	1.0	1.0	0.8	0.9	1.0	0.9	0.9	0.6	1.0	0.9
Silver (Ag)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sodium (Na)	1.0	0.9	0.7	0.9	0.9	0.9	1.0	0.9	1.2	1.1	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.8	0.9	0.8
Strontium (Sr)	1.0	0.8	1.3	1.0	0.9	0.9	1.0	0.9	1.1	1.1	0.9	0.9	2.0	0.9	1.2	1.1	1.1	0.8	1.1	1.0
Thallium (Tl)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Tin (Sn)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Titanium (Ti)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Uranium (U)	0.7	0.6	1.0	0.8	0.7	0.7	0.3	0.7	1.0	0.9	0.8	0.8	1.4	0.7	0.8	0.7	0.7	0.5	0.7	0.6
Vanadium (V)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Zinc (Zn)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).

Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).

Denotes highly elevated concentration (mean concentration ≥ 10 times higher than respective mean reference or baseline period value).

Table C.63: Summary of the Magnitude of Elevation in Seasonal Average Parameter Concentrations (Total Metal Concentration Data Provided) Between Mary River Mine-Exposed and Reference (GO-09) Stations in 2018

Variable	Fall									
	G0-03	G0-01	FO-01	E0-10	E0-03	E0-21	E0-20	C0-10	CO-05	CO-01
Conductivity (lab)	1.0	1.1	2.4	1.5	1.3	1.4	1.4	1.4	1.3	1.2
Hardness (as CaCO ₃)	1.0	1.1	2.4	1.4	1.2	1.4	1.3	1.4	1.3	1.2
Total Suspended Solids (TSS)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Total Dissolved Solids (TDS)	0.9	1.2	2.5	1.2	1.8	1.2	1.2	1.4	1.5	1.2
Turbidity	0.8	0.7	0.4	0.7	0.8	0.7	0.6	0.6	0.7	0.6
Alkalinity (as CaCO ₃)	0.9	1.1	1.7	1.1	1.0	1.1	1.1	1.2	1.1	1.1
Total Ammonia	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.5
Nitrate	1.0	1.0	6.5	2.5	1.1	1.7	2.4	2.2	2.1	1.3
Nitrite	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Total Kjeldahl Nitrogen (TKN)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Dissolved Organic Carbon	0.8	0.8	1.3	0.8	1.2	0.8	0.9	0.9	1.0	1.0
Total Organic Carbon	0.9	0.9	1.1	0.9	1.0	0.9	1.0	1.1	1.2	1.3
Total Phosphorus	0.6	0.6	0.8	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Phenols	0.7	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.8	0.6
Bromide (Br)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Chloride (Cl)	1.9	1.9	0.9	1.9	1.9	1.9	1.8	1.8	1.7	1.7
Sulphate (SO ₄)	0.9	1.0	29	10	4.8	7.4	6.9	6.9	6.2	4.2
Aluminum (Al)	1.0	1.1	0.3	1.0	1.0	1.0	1.0	0.7	0.8	0.8
Antimony (Sb)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Arsenic (As)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Barium (Ba)	1.0	1.1	1.6	1.3	1.2	1.2	1.3	1.3	1.2	1.1
Beryllium (Be)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cadmium (Cd)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Calcium (Ca)	1.0	1.1	2.1	1.3	1.2	1.3	1.3	1.3	1.2	1.3
Chromium (Cr)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cobalt (Co)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Copper (Cu)	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.2	1.0	1.0
Iron (Fe)	0.9	0.9	0.5	0.9	0.9	0.9	1.1	0.7	1.0	0.8
Lead (Pb)	0.9	0.7	0.5	0.7	0.8	0.8	1.0	0.6	0.7	0.6
Lithium (Li)	1.0	1.0	1.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Magnesium (Mg)	0.9	1.1	3.1	1.6	1.2	1.4	1.4	1.5	1.4	1.3
Manganese (Mn)	0.9	0.8	1.1	0.9	8.9	6.8	7.0	5.4	6.1	3.8
Mercury (Hg)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Molybdenum (Mo)	0.9	1.1	1.2	1.1	1.7	1.7	1.5	1.6	1.5	1.7
Nickel (Ni)	1.0	1.0	1.0	1.0	1.0	1.1	1.4	1.8	1.6	1.4
Potassium (K)	0.9	1.0	1.3	1.0	1.0	1.0	1.1	1.0	1.0	1.0
Selenium (Se)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Silicon (Si)	1.0	1.1	0.8	1.1	1.1	1.0	1.1	1.0	1.0	1.0
Silver (Ag)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sodium (Na)	0.8	1.0	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Strontium (Sr)	0.8	1.0	1.6	1.2	1.2	1.2	1.2	1.2	1.1	1.1
Thallium (Tl)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Tin (Sn)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Titanium (Ti)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Uranium (U)	0.8	0.8	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.6
Vanadium (V)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Zinc (Zn)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Denotes slight elev

Denotes moderate

Denotes highly ele

Table C.64: Dissolved Metal Concentrations at Mary River Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Spring Sampling Event													Summer Sampling Event					
			G0-09-A	G0-09	G0-09-B	G0-03	G0-01	F0-01	E0-10	E0-03	E0-21	E0-20	C0-10	C0-05	C0-01	G0-09-A	G0-09	G0-09-B	G0-03	G0-01	F0-01
			1-Jul-18	1-Jul-18	1-Jul-18	1-Jul-18	30-Jun-18	30-Jun-18	1-Jul-18	30-Jun-18	30-Jun-18	30-Jun-18	30-Jun-18	30-Jun-18	30-Jun-18	30-Jun-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18
Dissolved Metals	Aluminum (Al)	mg/L	0.0594	0.0443	0.0344	0.0375	0.0258	0.0094	0.0366	0.0325	0.0291	0.0319	0.0320	0.0249	0.0268	0.0781	0.0535	0.0674	0.0283	0.0151	0.0056
	Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.00235	0.00226	0.00241	0.00275	0.00212	0.00312	0.00275	0.00234	0.00243	0.00283	0.00259	0.00282	0.00267	0.00572	0.00607	0.00592	0.00581	0.00621	0.01310
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	2.27	2.37	2.96	3.18	2.51	6.10	3.25	2.90	2.98	3.13	2.87	3.70	3.46	8.60	8.69	8.60	9.04	9.19	23.90
	Chromium (Cr)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00084	0.00083	0.00078	0.00081	0.0008	0.00065
	Iron (Fe)	mg/L	0.034	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.039	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	1.24	1.37	1.62	1.70	1.37	3.78	1.78	1.61	1.62	1.69	1.61	2.19	2.01	4.60	5.00	5.16	5.12	5.26	20.70
	Manganese (Mn)	mg/L	0.00117	0.00082	0.00075	0.00053	0.00046	0.00016	0.00046	0.00058	0.00048	0.00056	0.00060	0.00137	0.00100	0.00044	0.00030	0.00034	0.00020	0.00015	0.00057
	Mercury (Hg)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.000053	<0.000050	<0.000050	<0.000050	<0.000050	0.000052	<0.000050	<0.000050	<0.000050	<0.000050	0.000051	0.000087	0.00008	0.000298	0.000252	0.000203	0.000171	0.000204	0.000225
	Nickel (Ni)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Potassium (K)	mg/L	0.34	0.33	0.36	0.35	0.30	0.41	0.33	0.33	0.33	0.33	0.34	0.41	0.38	0.87	0.86	0.86	0.78	0.80	1.35
	Selenium (Se)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	0.40	0.38	0.38	0.39	0.32	0.32	0.36	0.35	0.35	0.34	0.34	0.34	0.34	0.85	0.82	0.73	0.78	0.76	0.82
	Silver (Ag)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	0.37	0.39	0.42	0.38	0.34	0.26	0.35	0.34	0.34	0.34	0.37	0.45	0.42	1.58	1.65	1.51	1.30	1.33	1.37
	Strontium (Sr)	mg/L	0.0024	0.0023	0.0026	0.0026	0.0022	0.0033	0.0026	0.0023	0.0024	0.0025	0.0024	0.0028	0.0027	0.0098	0.0094	0.0087	0.0083	0.0082	0.0177
	Thallium (Tl)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.000129	0.000115	0.000125	0.000097	0.000091	0.000161	0.000112	0.000096	0.000099	0.000103	0.000100	0.000161	0.000137	0.001430	0.001320	0.001160	0.000904	0.000856	0.001800
	Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table C.64: Dissolved Metal Concentrations at Mary River Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Summer Sampling Event							Fall Sampling Event												
			E0-10	E0-03	E0-21	E0-20	C0-10	C0-05	C0-01	G0-09-A	G0-09	G0-09-B	G0-03	GO-01	FO-01	EO-10	EO-03	EO-21	EO-20	C0-10	C0-05	CO-01
			12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	10-Aug-18	27-Aug-18	25-Aug-18	25-Aug-18	25-Aug-18	27-Aug-18	27-Aug-18	25-Aug-18	27-Aug-18	26-Aug-18	27-Aug-18	27-Aug-18	27-Aug-18	27-Aug-18
Dissolved Metals	Aluminum (Al)	mg/L	0.0507	0.0504	0.0325	0.0308	0.0177	0.0519	0.0437	0.0242	0.0376	0.0075	0.0067	0.0281	0.0053	0.0229	0.0223	0.0235	0.0044	0.0203	0.0138	0.0246
	Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.00639	0.00653	0.00687	0.00666	0.00596	0.00676	0.00604	0.00789	0.00702	0.00737	0.00743	0.00884	0.01350	0.00975	0.00888	0.00963	0.00893	0.00964	0.00925	0.00864
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	9.52	10.50	10.20	10.40	10.60	10.50	9.51	14.40	12.20	11.90	12.50	14.30	25.40	16.90	14.90	16.90	16.20	16.40	16.50	14.30
	Chromium (Cr)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	<0.00010	0.00017	0.00015	0.00012	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.00079	0.00076	0.00077	0.00083	0.00077	0.0009	0.00079	0.00068	0.00073	0.00074	0.00070	0.00079	0.00067	0.00073	0.00077	0.00077	0.00072	0.00079	0.00119	0.00083
	Iron (Fe)	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	0.034	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	5.99	6.49	6.35	6.65	6.93	6.85	6.27	7.19	5.83	6.26	6.13	7.06	19.40	10.00	8.47	9.16	9.40	9.75	9.02	8.40
	Manganese (Mn)	mg/L	0.00026	0.01880	0.01680	0.01340	0.00127	0.01030	0.00588	0.00012	0.00020	0.00010	0.00010	0.00015	0.00023	0.00016	0.00847	0.00630	0.00505	0.00477	0.00494	0.00299
	Mercury (Hg)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.000184	0.000270	0.000280	0.000267	0.000460	0.000320	0.000234	0.000280	0.000351	0.000297	0.000250	0.000283	0.000294	0.000287	0.000424	0.000435	0.000432	0.000443	0.000456	0.000376
	Nickel (Ni)	mg/L	<0.00050	<0.00050	<0.00050	0.00061	<0.00050	0.00065	0.00053	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00053	0.00061	0.00068	0.00062
	Potassium (K)	mg/L	0.81	0.82	0.82	0.84	0.99	0.89	0.82	0.86	0.90	0.91	0.82	0.89	1.24	0.92	0.93	0.95	0.94	0.96	0.94	0.98
	Selenium (Se)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	0.83	0.84	0.77	0.83	0.52	0.88	0.87	0.70	0.70	0.66	0.67	0.78	0.63	0.72	0.74	0.73	0.73	0.77	0.75	0.75
	Silver (Ag)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	1.29	1.23	1.31	1.30	1.24	1.32	1.18	1.97	2.00	2.06	1.74	1.79	1.44	1.79	1.82	1.83	1.70	1.78	1.70	1.64
	Strontium (Sr)	mg/L	0.0086	0.0110	0.0105	0.0100	0.0078	0.0098	0.0090	0.0131	0.0125	0.0123	0.0108	0.0129	0.0195	0.0146	0.0158	0.0162	0.0150	0.0154	0.0153	0.0145
	Thallium (Tl)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00018	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.000939	0.000915	0.000886	0.000844	0.000637	0.000813	0.000698	0.002650	0.002390	0.002380	0.001960	0.002050	0.002280	0.002210	0.002040	0.002140	0.002030	0.001890	0.001700	0.001720
	Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table C.65: Summary of the Magnitude of Elevation in Seasonal Average Dissolved Metal Concentrations Between Mary River Mine-Exposed and Reference (GO-09) Stations in 2018

Variable	Spring										Summer										Fall									
	G0-03	G0-01	FO-01	E0-10	E0-03	E0-21	E0-20	C0-10	CO-05	CO-01	G0-03	G0-01	FO-01	E0-10	E0-03	E0-21	E0-20	C0-10	CO-05	CO-01	G0-03	G0-01	FO-01	E0-10	E0-03	E0-21	E0-20	C0-10	CO-05	CO-01
Aluminum (Al)	0.8	0.6	0.2	0.8	0.7	0.6	0.7	0.7	0.5	0.6	0.4	0.2	0.1	0.8	0.8	0.5	0.5	0.3	0.8	0.7	0.3	1.2	0.2	1.0	1.0	1.0	0.2	0.9	0.6	1.1
Antimony (Sb)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Arsenic (As)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Barium (Ba)	1.2	0.9	1.3	1.2	1.0	1.0	1.2	1.1	1.2	1.1	1.0	1.1	2.2	1.1	1.1	1.2	1.1	1.0	1.1	1.0	1.0	1.2	1.8	1.3	1.2	1.3	1.2	1.3	1.2	1.2
Beryllium (Be)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cadmium (Cd)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Calcium (Ca)	1.3	1.0	2.4	1.3	1.1	1.2	1.2	1.1	1.5	1.4	1.0	1.1	2.8	1.1	1.2	1.2	1.2	1.2	1.2	1.1	1.0	1.1	2.0	1.3	1.2	1.3	1.3	1.3	1.3	1.1
Chromium (Cr)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cobalt (Co)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.7	1.5	1.2	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Copper (Cu)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.8	1.0	0.9	0.9	1.0	0.9	1.1	1.0	1.0	1.1	0.9	1.0	1.1	1.1	1.0	1.1	1.7	1.2
Iron (Fe)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead (Pb)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lithium (Li)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Magnesium (Mg)	1.2	1.0	2.7	1.3	1.1	1.1	1.2	1.1	1.6	1.4	1.0	1.1	4.2	1.2	1.3	1.3	1.4	1.4	1.4	1.3	1.0	1.1	3.0	1.6	1.3	1.4	1.5	1.5	1.4	1.3
Manganese (Mn)	0.6	0.5	0.2	0.5	0.6	0.5	0.6	0.7	1.5	1.1	0.5	0.4	1.6	0.7	53	47	38	3.6	29	17	0.7	1.1	1.6	1.1	61	45	36	34	36	22
Mercury (Hg)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Molybdenum (Mo)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.7	1.6	0.7	0.8	0.9	0.7	1.1	1.1	1.1	1.8	1.3	0.9	0.8	0.9	1.0	0.9	1.4	1.4	1.4	1.4	1.5	1.2
Nickel (Ni)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.2	1.0	1.3	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.2	1.4	1.2
Potassium (K)	1.0	0.9	1.2	1.0	1.0	1.0	1.0	1.0	1.2	1.1	0.9	0.9	1.6	0.9	0.9	0.9	1.0	1.1	1.0	0.9	0.9	1.0	1.4	1.0	1.0	1.1	1.1	1.1	1.1	1.1
Selenium (Se)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Silicon (Si)	1.0	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.1	1.0	1.0	0.7	1.1	1.1	1.0	1.1	0.9	1.0	1.1	1.1	1.1	1.1	1.1	1.1
Silver (Ag)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sodium (Na)	1.0	0.9	0.7	0.9	0.9	0.9	0.9	0.9	1.2	1.1	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.9	0.9	0.7	0.9	0.9	0.9	0.8	0.9	0.8	0.8
Strontium (Sr)	1.1	0.9	1.4	1.1	1.0	1.0	1.0	1.0	1.2	1.1	0.9	0.9	1.9	0.9	1.2	1.1	1.1	0.8	1.1	1.0	0.9	1.0	1.5	1.2	1.3	1.3	1.2	1.2	1.2	1.1
Thallium (Tl)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Tin (Sn)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.8	1.0	1.0	1.0	1.0	1.0	1.0
Titanium (Ti)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Uranium (U)	0.8	0.7	1.3	0.9	0.8	0.8	0.8	0.8	1.3	1.1	0.7	0.7	1.4	0.7	0.7	0.7	0.6	0.5	0.6	0.5	0.8	0.8	0.9	0.9	0.8	0.9	0.8	0.8	0.7	0.7
Vanadium (V)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Zinc (Zn)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).

Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).

Denotes highly elevated concentration (mean concentration ≥ 10 times higher than respective mean reference or baseline period value).

Note: RDL = Reportable Detection Limit

Table C.66: Spearman's Rank Correlation Coefficients for Mary River Water Quality Data Collected in Spring, Summer, and Fall 2018^a

Parameters	Conventional Parameters										Total Metals										
	Conduct-ivity	Hardness	Total Suspended Solids	Total Dissolved Solids	Turbidity	Alkalinity	Dissolved Organic Carbon	Total Phosphorus	Chloride	Sulphate	Aluminum	Barium	Copper	Iron	Manganese	Molybdenum	Potassium	Silicon	Sodium	Strontium	Uranium
Conductivity	1	0.992	-0.096	0.969	-0.102	0.986	-0.056	-0.430	0.867	0.928	0.043	0.957	0.523	-0.038	0.132	0.764	0.921	0.854	0.804	0.963	0.882
Hardness	0.992	1	-0.071	0.967	-0.108	0.985	-0.039	-0.429	0.854	0.922	0.021	0.952	0.527	-0.053	0.137	0.773	0.923	0.843	0.795	0.958	0.864
Total Suspended Solids	-0.096	-0.071	1	-0.072	0.174	-0.121	0.188	0.510	-0.093	-0.092	0.258	-0.030	-0.115	0.100	0.327	-0.138	-0.021	-0.135	-0.111	-0.078	-0.213
Total Dissolved Solids	0.969	0.967	-0.072	1	-0.030	0.967	-0.044	-0.424	0.847	0.902	0.086	0.936	0.498	-0.019	0.136	0.724	0.908	0.847	0.785	0.949	0.870
Turbidity	-0.102	-0.108	0.174	-0.030	1	-0.108	-0.171	0.258	0.109	0.049	0.714	0.052	0.357	0.744	0.353	-0.070	0.145	0.164	0.140	-0.011	0.030
Alkalinity	0.986	0.985	-0.121	0.967	-0.108	1	-0.044	-0.429	0.861	0.906	0.058	0.950	0.534	-0.010	0.120	0.777	0.920	0.859	0.802	0.956	0.888
Dissolved Organic Carbon	-0.056	-0.039	0.188	-0.044	-0.171	-0.044	1	0.127	0.009	-0.086	0.106	0.015	0.044	-0.031	0.052	0.170	0.043	0.114	0.072	-0.082	-0.033
Total Phosphorus	-0.430	-0.429	0.510	-0.424	0.258	-0.429	0.127	1	-0.261	-0.389	0.426	-0.326	0.061	0.443	0.451	-0.244	-0.255	-0.259	-0.247	-0.336	-0.352
Chloride	0.867	0.854	-0.093	0.847	0.109	0.861	0.009	-0.261	1	0.816	0.343	0.889	0.704	0.209	0.139	0.728	0.909	0.918	0.952	0.889	0.948
Sulphate	0.928	0.922	-0.092	0.902	0.049	0.906	-0.086	-0.389	0.816	1	0.095	0.941	0.551	0.068	0.307	0.783	0.898	0.792	0.734	0.927	0.773
Aluminum (total)	0.043	0.021	0.258	0.086	0.714	0.058	0.106	0.426	0.343	0.095	1	0.215	0.476	0.857	0.368	0.070	0.319	0.427	0.364	0.139	0.267
Barium (total)	0.957	0.952	-0.030	0.936	0.052	0.950	0.015	-0.326	0.889	0.941	0.215	1	0.644	0.138	0.279	0.810	0.968	0.890	0.853	0.968	0.858
Copper (total)	0.523	0.527	-0.115	0.498	0.357	0.534	0.044	0.061	0.704	0.551	0.476	0.644	1	0.622	0.544	0.769	0.694	0.697	0.725	0.624	0.605
Iron (total)	-0.038	-0.053	0.100	-0.019	0.744	-0.010	-0.031	0.443	0.209	0.068	0.857	0.138	0.622	1	0.540	0.199	0.216	0.297	0.209	0.080	0.136
Manganese (total)	0.132	0.137	0.327	0.136	0.353	0.120	0.052	0.451	0.139	0.307	0.368	0.279	0.544	0.540	1	0.444	0.258	0.161	0.130	0.265	-0.012
Molybdenum (total)	0.764	0.773	-0.138	0.724	-0.070	0.777	0.170	-0.244	0.728	0.783	0.070	0.810	0.769	0.199	0.444	1	0.781	0.735	0.714	0.825	0.672
Potassium (total)	0.921	0.923	-0.021	0.908	0.145	0.920	0.043	-0.255	0.909	0.898	0.319	0.968	0.694	0.216	0.258	0.781	1	0.922	0.877	0.937	0.869
Silicon (total)	0.854	0.843	-0.135	0.847	0.164	0.859	0.114	-0.259	0.918	0.792	0.427	0.890	0.697	0.297	0.161	0.735	0.922	1	0.905	0.874	0.899
Sodium (total)	0.804	0.795	-0.111	0.785	0.140	0.802	0.072	-0.247	0.952	0.734	0.364	0.853	0.725	0.209	0.130	0.714	0.877	0.905	1	0.835	0.920
Strontium (total)	0.963	0.958	-0.078	0.949	-0.011	0.956	-0.082	-0.336	0.889	0.927	0.139	0.968	0.624	0.080	0.265	0.825	0.937	0.874	0.835	1	0.869
Uranium (total)	0.882	0.864	-0.213	0.870	0.030	0.888	-0.033	-0.352	0.948	0.773	0.267	0.858	0.605	0.136	-0.012	0.672	0.869	0.899	0.920	0.869	1
Aluminum (dissolved)	-0.414	-0.413	-0.152	-0.364	0.363	-0.400	0.020	0.027	-0.146	-0.253	0.239	-0.308	0.119	0.279	0.179	-0.111	-0.247	-0.148	-0.087	-0.332	-0.272
Barium (dissolved)	0.978	0.979	-0.110	0.941	-0.115	0.970	-0.013	-0.419	0.869	0.923	0.032	0.954	0.601	-0.006	0.179	0.835	0.925	0.855	0.809	0.956	0.853
Copper (dissolved)	0.786	0.788	-0.207	0.723	0.049	0.774	-0.091	-0.411	0.737	0.803	0.019	0.814	0.569	0.039	0.127	0.694	0.781	0.694	0.737	0.758	0.692
Manganese (dissolved)	0.248	0.268	0.242	0.202	-0.010	0.221	0.002	0.090	0.103	0.415	-0.063	0.318	0.227	0.059	0.690	0.406	0.211	0.105	0.047	0.300	-0.060
Molybdenum (dissolved)	0.845	0.843	-0.107	0.825	0.103	0.821	-0.091	-0.316	0.805	0.923	0.128	0.882	0.656	0.111	0.427	0.818	0.852	0.773	0.783	0.895	0.723
Potassium (dissolved)	0.935	0.940	-0.055	0.909	-0.004	0.930	0.012	-0.346	0.883	0.908	0.176	0.964	0.638	0.082	0.210	0.794	0.959	0.880	0.846	0.939	0.825
Silicon (dissolved)	0.916	0.916	-0.162	0.901	-0.098	0.925	0.105	-0.402	0.857	0.814	0.120	0.895	0.615	0.029	0.098	0.780	0.892	0.910	0.834	0.903	0.847
Sodium (dissolved)	0.771	0.770	-0.111	0.769	0.203	0.770	0.071	-0.237	0.937	0.716	0.375	0.817	0.721	0.231	0.123	0.698	0.844	0.884	0.968	0.811	0.902
Strontium (dissolved)	0.972	0.970	-0.067	0.948	-0.034	0.967	-0.095	-0.363	0.890	0.941	0.128	0.965	0.598	0.054	0.245	0.804	0.939	0.869	0.840	0.978	0.876
Uranium (dissolved)	0.897	0.883	-0.215	0.888	-0.014	0.905	-0.043	-0.389	0.947	0.805	0.227	0.874	0.598	0.093	0.016	0.695	0.882	0.887	0.913	0.890	0.987

^a Correlation matrix included only those parameters with ≥75% of values above laboratory reportable detection limits (RDL). Sample size (n) totalled 36.

Indicates strong positive correlation (i.e., Spearman's rho ≥ 0.7) between parameter pairings.

Indicates strong negative correlation (i.e., Spearman's rho ≤ -0.7) between parameter pairings.

Table C.66: Spearman's Rank Correlation Coefficients for Mary River Water Quality Data Collected in Spring, Summer, and Fall 2016^a

Parameters	Dissolved Metals									
	Aluminum	Barium	Copper	Manganese	Molybdenum	Potassium	Silicon	Sodium	Strontium	Uranium
Conductivity	-0.414	0.978	0.786	0.248	0.845	0.935	0.916	0.771	0.972	0.897
Hardness	-0.413	0.979	0.788	0.268	0.843	0.940	0.916	0.770	0.970	0.883
Total Suspended Solids	-0.152	-0.110	-0.207	0.242	-0.107	-0.055	-0.162	-0.111	-0.067	-0.215
Total Dissolved Solids	-0.364	0.941	0.723	0.202	0.825	0.909	0.901	0.769	0.948	0.888
Turbidity	0.363	-0.115	0.049	-0.010	0.103	-0.004	-0.098	0.203	-0.034	-0.014
Alkalinity	-0.400	0.970	0.774	0.221	0.821	0.930	0.925	0.770	0.967	0.905
Dissolved Organic Carbon	0.020	-0.013	-0.091	0.002	-0.091	0.012	0.105	0.071	-0.095	-0.043
Total Phosphorus	0.027	-0.419	-0.411	0.090	-0.316	-0.346	-0.402	-0.237	-0.363	-0.389
Chloride	-0.146	0.869	0.737	0.103	0.805	0.883	0.857	0.937	0.890	0.947
Sulphate	-0.253	0.923	0.803	0.415	0.923	0.908	0.814	0.716	0.941	0.805
Aluminum (total)	0.239	0.032	0.019	-0.063	0.128	0.176	0.120	0.375	0.128	0.227
Barium (total)	-0.308	0.954	0.814	0.318	0.882	0.964	0.895	0.817	0.965	0.874
Copper (total)	0.119	0.601	0.569	0.227	0.656	0.638	0.615	0.721	0.598	0.598
Iron (total)	0.279	-0.006	0.039	0.059	0.111	0.082	0.029	0.231	0.054	0.093
Manganese (total)	0.179	0.179	0.127	0.690	0.427	0.210	0.098	0.123	0.245	0.016
Molybdenum (total)	-0.111	0.835	0.694	0.406	0.818	0.794	0.780	0.698	0.804	0.695
Potassium (total)	-0.247	0.925	0.781	0.211	0.852	0.959	0.892	0.844	0.939	0.882
Silicon (total)	-0.148	0.855	0.694	0.105	0.773	0.880	0.910	0.884	0.869	0.887
Sodium (total)	-0.087	0.809	0.737	0.047	0.783	0.846	0.834	0.968	0.840	0.913
Strontium (total)	-0.332	0.956	0.758	0.300	0.895	0.939	0.903	0.811	0.978	0.890
Uranium (total)	-0.272	0.853	0.692	-0.060	0.723	0.825	0.847	0.902	0.876	0.987
Aluminum (dissolved)	1	-0.330	-0.116	0.072	-0.063	-0.247	-0.329	-0.060	-0.304	-0.252
Barium (dissolved)	-0.330	1	0.808	0.302	0.867	0.955	0.924	0.783	0.969	0.873
Copper (dissolved)	-0.116	0.808	1	0.328	0.799	0.843	0.716	0.729	0.786	0.691
Manganese (dissolved)	0.072	0.302	0.328	1	0.494	0.300	0.160	0.067	0.309	-0.027
Molybdenum (dissolved)	-0.063	0.867	0.799	0.494	1	0.870	0.776	0.777	0.907	0.761
Potassium (dissolved)	-0.247	0.955	0.843	0.300	0.870	1	0.916	0.821	0.947	0.840
Silicon (dissolved)	-0.329	0.924	0.716	0.160	0.776	0.916	1	0.810	0.898	0.852
Sodium (dissolved)	-0.060	0.783	0.729	0.067	0.777	0.821	0.810	1	0.811	0.881
Strontium (dissolved)	-0.304	0.969	0.786	0.309	0.907	0.947	0.898	0.811	1	0.900
Uranium (dissolved)	-0.252	0.873	0.691	-0.027	0.761	0.840	0.852	0.881	0.900	1

^a Correlation matrix included only those parameters with ≥75% of values above laboratory reportable detection limits (RDL). Sample size (n) totalled 36.

Indicates strong positive correlation (i.e., Spearman's rho ≥ 0.7) between parameter pairings.

Indicates strong negative correlation (i.e., Spearman's rho ≤ -0.7) between parameter pairings.

Table C.67: In Situ Water Quality Profile Data Collected at Mary Lake Water Quality Monitoring Stations in Winter, Mary River Project CREMP, 2018

Depth (m)	Temperature (°C)										Dissolved Oxygen (mg/L)										Dissolved Oxygen (% Saturation)				
	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05
Date Collected	14-Apr-18	14-Apr-18	14-Apr-18	15-Apr-18	15-Apr-18	15-Apr-18	15-Apr-18	16-Apr-18	18-Apr-18	15-Apr-18	14-Apr-18	14-Apr-18	14-Apr-18	15-Apr-18	15-Apr-18	15-Apr-18	15-Apr-18	16-Apr-18	18-Apr-18	15-Apr-18	14-Apr-18	14-Apr-18	14-Apr-18	15-Apr-18	15-Apr-18
1.0	0.3	0.4	0.1	0.3	0.2	1.0	0.1	1.5	0.8	0.8	14.5	14.8	14.8	15.5	15.6	15.7	15.5	15.4	15.1	16.0	100.0	102.3	101.2	106.5	107.1
2.0	0.6	0.4	0.4	0.3	0.4	0.4	0.3	0.5	0.5	0.3	14.4	14.9	14.6	15.4	15.2	16.0	15.0	15.5	15.0	16.1	99.9	102.9	101.1	106.1	105.5
3.0	0.8	0.8	0.8	0.3	0.5	0.4	0.4	0.5	0.5	0.4	14.2	14.7	14.4	15.2	15.0	16.0	14.7	15.0	14.8	15.9	99.7	102.6	101.0	105.3	104.3
4.0	1.1	1.0	1.0	0.5	0.6	0.5	0.5	0.6	0.6	0.5	14.0	14.5	13.0	15.0	14.7	16.2	14.5	14.8	14.7	15.7	98.8	102.2	91.6	104.3	102.4
5.0	1.2	1.1		0.6	0.7	0.5	0.6	0.6	0.6	0.5	13.8	14.4		14.9	14.5	16.5	14.3	14.6	14.6	15.8	97.9	101.9		103.3	100.9
6.0	1.3	1.2		0.6	0.7	0.8	0.6	0.7	0.7	0.5	13.7	14.2		14.7	14.4	15.6	14.2	14.4	14.4	15.9	96.9	100.6		102.7	100.7
7.0	1.3	1.3		0.7	0.7	0.9	0.6	0.7	0.7	0.6	13.1	14.0		14.7	14.5	14.8	14.1	14.3	14.4	15.8	93.0	99.7		102.2	101.1
8.0	1.4	1.4		0.7	0.8		0.7	0.8	0.7	0.6	12.6	13.7		14.5	14.4		14.0	14.1	14.2	15.6	90.0	97.6		101.4	100.4
9.0	1.5	1.4		0.8	0.8		0.7	0.8	0.8		11.4	13.7		14.4	14.2		13.9	14.0	14.2		81.3	97.3		100.8	99.3
10.0	1.6			0.8	0.8		0.7	0.8	0.8		8.4			14.3	14.0		13.8	13.8	14.0		60.0			100.0	99.1
11.0	1.7			0.8	0.9		0.8	0.9	0.8		5.0			14.0	13.9		13.7	13.7	13.8		36.0			98.3	97.8
12.0	1.8				0.9		0.8	0.9	0.9		3.1				13.8		13.5	13.6	13.7		22.1				96.8
13.0	1.9				0.9		0.8	0.9	0.9		0.7				13.6		13.4	13.5	13.5		5.4				95.6
14.0	1.9				1.0		0.9	0.9	1.0		0.0				13.3		13.3	13.5	13.4		0.1				93.7
15.0	2.0				1.0		0.9	1.0	1.0		0.0				13.2		13.2	13.4	13.3		-0.1				92.9
16.0					1.0		0.9	1.0	1.0						13.1		13.1	13.2	13.1						92.1
17.0					1.1		0.9	1.0	1.1						12.9		12.9	13.0	12.8						91.3
18.0					1.1			1.0	1.1						12.7			12.9	12.7						90.0
19.0					1.1			1.1	1.1						11.5			12.9	12.6						82.8
20.0								1.1	1.2									12.8	12.4						
21.0								1.1	1.2									12.6	12.2						
22.0									1.3										11.9						
23.0									1.3										11.5						
24.0									1.4										11.2						
25.0									1.5										10.8						
26.0									1.6										10.4						
27.0									1.6										9.9						
28.0									1.8										9.3						
29.0									1.8										9.2						
30.0																									

Notes: Total depth at stations BLO-01-A, BLO-01, BLO-01-B, BLO-05-A, BLO-05, BLO-05-B, BLO-03, BLO-04, BLO-09, and BLO-06 was 15.5, 9.4, 5, 11.6, 20.7, 7.2, 17.5, 20.9, 29.4, and 8.9 m, respectively, at the time of winter sampling. Ice thickness at stations BLO-01-A, BLO-01, BLO-01-B, BLO-05-A, BLO-05, BLO-05-B, BLO-03, BLO-04, BLO-09, and BLO-06 was 1.9, 1.6, 2.1, 1.8, 1.9, 1.7, 1.9, 1.7, 1.7, and 2 m, respectively, at the time of winter sampling. Deepest measurement at stations BLO-01-A, BLO-01, BLO-01-B, BLO-05-A, BLO-05, BLO-05-B, BLO-03, BLO-04, BLO-09, and BLO-06 was 15, 9, 4, 11, 19, 7, 17, 21, 29, and 8 m, respectively, at the time of winter sampling.

Table C.67: In Situ Water Quality Profile Data Collected at Mary Lake Water Quality Monitoring Stations in Winter, Mary River Project CREMP, 2018

Depth (m)	Dissolved Oxygen (% Saturation)					pH (pH units)										Specific Conductance (µS/cm)									
	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-06
Date Collected	15-Apr-18	15-Apr-18	16-Apr-18	18-Apr-18	15-Apr-18	14-Apr-18	14-Apr-18	14-Apr-18	15-Apr-18	15-Apr-18	15-Apr-18	15-Apr-18	16-Apr-18	18-Apr-18	15-Apr-18	14-Apr-18	14-Apr-18	14-Apr-18	15-Apr-18	15-Apr-18	15-Apr-18	15-Apr-18	16-Apr-18	18-Apr-18	15-Apr-18
1.0	111.3	106.1	109.7	106.1	111.5	7.82	7.84	7.74	7.81	8.02	7.87	7.83	8.03	8.12	7.92	228	234	234	88	88	92	89	90	88	91
2.0	111.2	103.5	108.7	104.1	111.3	7.79	7.81	7.73	7.77	7.87	7.83	7.77	7.91	7.99	7.88	223	230	229	86	85	90	84	86	85	91
3.0	110.5	101.9	104.4	102.8	110.1	7.78	7.80	7.73	7.75	7.82	7.80	7.74	7.86	7.95	7.86	221	227	226	85	85	89	83	85	83	89
4.0	112.5	100.4	102.9	101.9	108.6	7.77	7.80	7.70	7.73	7.74	7.78	7.72	7.87	7.92	7.83	218	225	227	85	84	91	82	83	83	88
5.0	114.2	99.4	101.6	101.3	109.9	7.76	7.79		7.73	7.66	7.76	7.71	7.81	7.90	7.79	218	224		84	82	93	81	82	82	90
6.0	109.2	98.9	100.7	100.6	110.4	7.75	7.79		7.72	7.66	7.63	7.70	7.79	7.88	7.76	217	222		83	82	103	81	82	82	92
7.0	104.8	98.4	99.6	99.8	109.8	7.72	7.76		7.71	7.65	7.53	7.68	7.77	7.86	7.72	217	221		83	83	105	80	81	81	92
8.0		97.4	98.8	99.4	108.7	7.69	7.77		7.70	7.65		7.68	7.75	7.84	7.69	216	220		82	82		80	80	81	94
9.0		96.9	98.0	98.9		7.63	7.76		7.70	7.65		7.67	7.72	7.81		215	220		82	81		79	79	80	
10.0		96.3	96.9	97.8		7.50			7.69	7.65		7.67	7.73	7.80		215			82	80		79	79	80	
11.0		95.5	96.3	96.9		7.35			7.66	7.64		7.66	7.71	7.78		216			85	81		79	78	79	
12.0		94.7	95.6	96.2		7.27				7.64		7.65	7.70	7.76		219				80		78	78	78	
13.0		94.1	95.1	94.6		7.20				7.64		7.64	7.69	7.75		226				79		78	78	78	
14.0		93.5	94.7	94.3		7.12				7.63		7.63	7.69	7.74		236				78		78	78	77	
15.0		92.8	94.1	93.4		7.10				7.63		7.62	7.68	7.73		245				77		77	77	77	
16.0		91.7	92.8	92.5						7.61		7.61	7.66	7.71						78		77	77	77	
17.0		90.8	91.5	90.3						7.60		7.59	7.64	7.69						78		77	77	77	
18.0			91.1	89.6						7.58			7.63	7.66						79			77	77	
19.0			90.9	89.1						7.51			7.60	7.65						93			77	77	
20.0			90.6	88.0									7.59	7.62									78	77	
21.0			89.2	86.4									7.56	7.59									80	77	
22.0				85.0										7.57										77	
23.0				82.0										7.55										77	
24.0				80.1										7.52										79	
25.0				77.1										7.48										80	
26.0				74.3										7.44										80	
27.0				71.2										7.39										80	
28.0				66.8										7.34										81	
29.0				66.2										7.29										81	
30.0																									

Notes: Total depth at stations BLO-01-A, BLO-01, BLO-01-B, BLO-05-A, BLO-05, BLO-05-B, BLO-03, BLO-04, BLO-09, and BLO-06 was 15.5, 9.4, 5, 11.6, 20.7, 7.2, 17.5, 20.9, 29.4, and 8.9 m, respectively, at the time of winter sampling. Ice thickness at stations BLO-01-A, BLO-01, BLO-01-B, BLO-05-A, BLO-05, BLO-05-B, BLO-03, BLO-04, BLO-09, and BLO-06 was 1.9, 1.6, 2.1, 1.8, 1.9, 1.7, 1.9, 1.7, 1.7, and 2 m, respectively, at the time of winter sampling. Deepest measurement at stations BLO-01-A, BLO-01, BLO-01-B, BLO-05-A, BLO-05, BLO-05-B, BLO-03, BLO-04, BLO-09, and BLO-06 was 15, 9, 4, 11, 19, 7, 17, 21, 29, and 8 m, respectively, at the time of winter sampling.

Table C.68: In Situ Water Quality Profile Data Collected at Mary Lake Water Quality Monitoring Stations in Summer, Mary River Project CREMP, 2018

Depth (m)	Temperature (°C)										Dissolved Oxygen (mg/L)										Dissolved Oxygen (% Saturation)				
	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05
Date Collected	3-Aug-18	3-Aug-18	3-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	3-Aug-18	3-Aug-18	3-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	3-Aug-18	3-Aug-18	3-Aug-18	2-Aug-18	2-Aug-18
1.0	7.0	7.1	7.3	6.8	7.0	6.2	6.9	6.4	6.5	6.1	12.1	12.1	12.0	12.1	12.1	12.3	12.3	12.2	12.2	12.1	99.8	100.0	100.0	99.2	99.2
2.0	6.9	7.1	6.8	6.7	6.9	6.2	6.4	6.4	6.1	6.1	12.1	12.1	12.0	12.1	12.1	12.3	12.3	12.2	12.2	12.3	99.4	99.7	99.5	99.2	99.1
3.0	6.6	6.7	6.8	6.7	6.8	6.0	6.5	6.2	5.9	5.9	12.2	12.2	12.2	12.2	12.1	12.4	12.3	12.3	12.3	12.4	99.2	99.6	99.6	99.4	99.1
4.0	6.4	6.5	6.8	6.6	6.6	5.8	6.4	6.2	5.9	5.9	12.2	12.2	12.2	12.2	12.1	12.3	12.3	12.3	12.3	12.3	98.9	99.5	99.3	99.3	98.6
5.0	6.2	6.2		6.5	6.3	5.7	6.3	6.2	5.9	5.8	12.3	12.3		12.2	12.2	12.3	12.3	12.3	12.4	12.3	99.0	99.3		99.0	98.4
6.0	6.1	6.0		6.3	6.1	5.6	6.1	6.2	5.8	5.7	12.3	12.3		12.2	12.2	12.3	12.3	12.3	12.3	12.3	98.6	99.1		98.5	98.2
7.0	6.0	5.9		6.2	6.0		6.1	6.2	5.8	5.5	12.3	12.3		12.1	12.2		12.3	12.3	12.4	12.3	98.4	98.7		97.6	98.0
8.0	5.7	5.7		6.1	5.9		6.0	6.1	5.8		12.3	12.4		12.1	12.2		12.3	12.3	12.4		98.2	98.7		97.6	97.9
9.0	5.5	5.6		6.1	5.8		5.7	6.1	5.7		12.4	12.4		12.1	12.2		12.2	12.3	12.3		98.5	98.7		97.1	98.0
10.0	5.4				5.8		5.6	6.0	5.6		12.4				12.2		12.2	12.2	12.3		98.4				97.8
11.0	5.4				5.7		5.6	5.7	5.4		12.4				12.3		12.2	12.3	12.3		98.3				97.9
12.0	5.4				5.8		5.6	5.6	5.3		12.4				12.2		12.2	12.3	12.3		98.1				97.3
13.0	5.4				5.6		5.6	5.6	5.3		12.4				12.2		12.2	12.2	12.3		97.9				96.8
14.0	5.4				5.5		5.6	5.6	5.3		12.4				12.2		12.2	12.2	12.3		97.7				96.6
15.0	5.3				5.4		5.6	5.6	5.3		12.3				12.2		12.2	12.2	12.3		97.2				96.5
16.0					5.4		5.6	5.6	5.3						12.2		12.2	12.2	12.3						96.3
17.0					5.4		5.6	5.6	5.3						12.2		12.2	12.2	12.2						96.2
18.0					5.4		5.6	5.6	5.3						12.2		12.1	12.2	12.2						96.2
19.0					5.4			5.6	5.3						12.2			12.2	12.2						96.2
20.0									5.3										12.2						
21.0									5.3										12.2						
22.0									5.3										12.2						
23.0									5.3										12.2						
24.0									5.3										12.2						
25.0									5.3										12.2						
26.0									5.3										12.2						
27.0									5.3										12.2						
28.0									5.3										12.1						
29.0									5.3										12.1						
30.0																									

Notes: Total depth at stations BLO-01-A, BLO-01, BLO-01-B, BLO-05-A, BLO-05, BLO-05-B, BLO-03, BLO-04, BLO-09, and BLO-06 was 15.3, 10.7, 5.3, 11.3, 21.5, 7.8, 19.2, 21.7, 30.4, and 8.0 m, respectively, at the time of summer sampling.

Table C.68: In Situ Water Quality Profile Data Collected at Mary Lake Water Quality Monitoring Stations in Summer, Mary River Project CREMP, 2018

Depth (m)	Dissolved Oxygen (% Saturation)					pH (pH units)										Specific Conductance (µS/cm)									
	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-06
Date Collected	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	3-Aug-18	3-Aug-18	3-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	3-Aug-18	3-Aug-18	3-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18
1.0	99.3	100.5	98.6	98.2	97.4	8.02	7.89	7.85	7.67	7.77	7.73	7.77	7.71	7.90	8.15	108	109	108	66	74	50	50	54	53	53
2.0	99.3	100.2	99.2	98.5	98.9	8.02	7.81	7.89	7.68	7.78	7.72	7.77	7.69	7.88	8.08	107	109	108	65	73	50	50	54	51	50
3.0	99.0	100.2	99.2	97.9	98.8	8.02	7.83	7.92	7.69	7.79	7.73	7.76	7.69	7.82	7.88	109	109	109	63	73	50	49	54	51	50
4.0	98.4	100.0	99.2	98.9	98.1	8.02	7.95	7.94	7.71	7.81	7.72	7.76	7.69	7.81	7.74	109	109	107	62	70	51	50	54	51	50
5.0	98.2	99.4	99.2	98.8	98.5	8.02	7.95		7.71	7.82	7.73	7.75	7.69	7.81	7.72	109	110		63	66	51	49	54	51	50
6.0	97.9	98.1	99.2	98.7	98.3	8.02	7.96		7.70	7.82	7.73	7.75	7.69	7.80	7.70	109	110		66	64	51	49	54	51	50
7.0		98.1	99.1	98.7	97.5	8.03	7.97		7.71	7.84		7.75	7.69	7.80	7.68	109	110		64	60		49	54	51	51
8.0		98.5	99.0	98.6		8.04	7.97		7.71	7.84		7.74	7.69	7.79		101	110		66	59		49	55	51	
9.0		97.3	98.8	98.4		8.03	7.97		7.72	7.83		7.73	7.69	7.76		102	110		66	59		49	54	51	
10.0		97.1	98.3	98.0		8.03				7.83		7.73	7.71	7.74		102				59		49	54	51	
11.0		97.0	97.7	97.2		8.02				7.81		7.73	7.70	7.72		104				61		49	54	51	
12.0		96.9	97.7	97.1		8.01				7.81		7.71	7.69	7.65		105				62		49	54	51	
13.0		96.8	97.3	96.9		8.01				7.81		7.71	7.68	7.64		106				58		49	56	52	
14.0		96.8	97.3	96.8		8.00				7.81		7.70	7.68	7.63		109				57		49	56	52	
15.0		96.7	97.3	96.7		7.99				7.80		7.70	7.68	7.62		109				57		49	56	52	
16.0		96.7	97.2	96.7						7.78		7.69	7.68	7.62						57		49	56	52	
17.0		96.6	97.2	96.6						7.76		7.68	7.67	7.61						57		49	58	52	
18.0		96.5	97.3	96.4						7.76		7.68	7.67	7.61						57		49	59	52	
19.0			97.2	96.4						7.75			7.66	7.61						58			60	50	
20.0				96.4										7.60										50	
21.0				96.3										7.59										52	
22.0				96.2										7.59										52	
23.0				96.2										7.58										53	
24.0				96.1										7.58										52	
25.0				96.1										7.58										54	
26.0				96.0										7.57										54	
27.0				96.0										7.56										56	
28.0				95.9										7.56										57	
29.0				95.8										7.57										57	
30.0																									

Notes: Total depth at stations BLO-01-A, BLO-01, BLO-01-B, BLO-05-A, BLO-05, BLO-05-B, BLO-03, BLO-04, BLO-09, and BLO-06 was 15.3, 10.7, 5.3, 11.3, 21.5, 7.8, 19.2, 21.7, 30.4, and 8.0 m, respectively, at the time of summer sampling.

Table C.69: In Situ Water Quality Profile Data Collected at Mary Lake Water Quality Monitoring Stations in Fall, Mary River Project CREMP, 2018

Depth (m)	Temperature (°C)											Dissolved Oxygen (mg/L)											Dissolved Oxygen (% Saturation)				
	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05
Date Collected	26-Aug-18	26-Aug-18	26-Aug-18	25-Aug-18	24-Aug-18	24-Aug-18	25-Aug-18	25-Aug-18	20-Aug-18	25-Aug-18		26-Aug-18	26-Aug-18	26-Aug-18	25-Aug-18	24-Aug-18	24-Aug-18	25-Aug-18	25-Aug-18	20-Aug-18	25-Aug-18		26-Aug-18	26-Aug-18	26-Aug-18	25-Aug-18	24-Aug-18
surface									6.90												11.69						
1.0	6.6	6.8	6.9	7.1	7.0	7.1	7.3	7.2	7.3	6.9	7.0	11.95	11.96	11.68	11.83	11.89	11.92	11.75	11.86	11.83	11.70	11.87	97.6	98.0	95.9	97.7	98.0
2.0	6.6	6.8	6.9	7.1	7.0	7.1	7.2	7.2	7.1	6.9	7.0	11.96	11.95	11.89	11.86	11.40	11.94	11.80	11.87	11.90	11.72	11.87	97.6	97.9	97.6	98.0	98.1
3.0	6.6	6.8	6.9	7.1	7.0	7.0	7.2	7.1	7.1	6.9	6.9	11.95	11.95	11.92	11.87	11.91	11.93	11.85	11.88	11.89	11.73	11.88	97.5	97.8	97.7	98.1	98.2
4.0	6.6	6.8	6.8	7.1	7.0	7.1	7.2	7.1	7.0	6.9	6.9	11.94	11.94	11.91	11.88	11.91	11.93	11.85	11.88	11.90	11.74	11.88	97.4	97.8	97.5	98.0	98.1
5.0	6.6	6.8		7.0	7.0	7.0	7.2	7.0	7.0	6.9	6.8	11.94	11.95		11.89	11.91	11.92	11.86	11.88	11.90	11.76	11.87	97.3	97.7		98.0	98.2
6.0	6.6	6.8		7.0	7.0	7.0	7.2	7.0	6.9	6.9	6.8	11.94	11.95		11.88	11.91	11.92	11.86	11.89	11.90	11.76	11.86	97.3	97.3		97.9	98.1
7.0	6.5	6.8		7.0	7.0		7.2	7.0	6.9		6.8	11.93	11.96		11.87	11.90		11.86	11.88	11.88		11.86	97.2	97.3		97.8	98.1
8.0	6.5	6.8		7.0	7.0		7.2	7.0	6.9	6.9	6.7	11.92	11.95		11.86	11.91		11.86	11.87	11.86	11.77	11.85	97.1	97.2		97.6	98.2
9.0	6.5			7.0	7.0		7.2	7.0	6.9		6.7	11.92			11.85	11.90		11.65	11.86	11.86		11.83	97.0			97.5	98.1
10.0	6.5			7.0	7.0		7.2	7.0	6.9	6.9		11.91			11.84	11.90		11.84	11.86	11.85	11.77		97.0			97.5	98.0
11.0	6.5			6.9	7.0		7.2	7.0	6.9			11.91			11.82	11.90		11.84	11.86	11.85			97.0			97.1	98.0
12.0	6.5				7.0		7.2	7.0	6.9	6.9		11.90				11.89		11.84	11.85	11.84	11.78		96.9				97.9
13.0	6.5				7.0		7.2	7.0	6.9			11.90				11.89		11.83	11.85	11.84			96.8				97.9
14.0	6.5				7.0		7.2	7.0	6.9	6.9		11.88				11.88		11.83	11.84	11.83	11.79		96.7				97.8
15.0					6.9		7.2	7.0	6.9							11.89		11.82	11.84	11.83							97.8
16.0					6.9		7.1	7.0	6.9	6.7						11.89		11.81	11.83	11.82	11.81						97.8
17.0					6.9		7.1	6.9	6.9							11.88		11.80	11.83	11.82							97.7
18.0					6.8			6.9	6.9	6.6						11.89			11.82	11.82	11.83						97.4
19.0					6.8			6.9	6.9							11.89			11.82	11.81							97.4
20.0									6.9	6.6										11.80	11.85						
21.0									6.9											11.79							
22.0									6.9	6.5											11.78	11.85					
23.0									6.9											11.77							
24.0									6.9	6.5										11.76	11.86						
25.0																											
26.0										6.5											11.86						
27.0																											
28.0										6.5											11.86						
29.0																											

Notes: 24-Aug-18 to 26-Aug-18 sampling was conducted by Baffinland. 20-Aug-18 sampling was conducted by Minnow.Total depth at stations BLO-01-A, BLO-01, BLO-01-B, BLO-05-A, BLO-05, BLO-05-B, BLO-03, BLO-04, BLO-09, and BLO-06 was 15, 9.4, 4, 11.8, 23, 7.7, 19, 22, 32, and 9.8 m, respectively, at the time of fall sampling.

Table C.69: In Situ Water Quality Profile Data Collected at Mary Lake Water Quality Monitoring Stations in Fall, Mary River Project CREMP, 2018

Depth (m)	Dissolved Oxygen (% Saturation)						pH (pH units)										Specific Conductance (µS/cm)											
	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-09	BLO-06
Date Collected	24-Aug-18	25-Aug-18	25-Aug-18	25-Aug-18	20-Aug-18	25-Aug-18	26-Aug-18	26-Aug-18	26-Aug-18	25-Aug-18	24-Aug-18	24-Aug-18	25-Aug-18	25-Aug-18	25-Aug-18	20-Aug-18	25-Aug-18	26-Aug-18	26-Aug-18	26-Aug-18	25-Aug-18	24-Aug-18	24-Aug-18	25-Aug-18	25-Aug-18	25-Aug-18	20-Aug-18	25-Aug-18
surface					96.2											7.77											60	
1.0	98.4	97.5	98.2	98.2	96.2	97.8	7.98	7.87	7.67	7.92	8.00	7.99	7.93	7.86	7.98	7.74	7.82	119	117	117	68	63	63	61	62	62	60	63
2.0	98.5	97.8	98.2	98.4	96.4	97.8	7.98	7.91	7.76	7.87	7.93	7.96	7.84	7.83	7.88	7.72	7.82	119	117	117	68	63	63	61	62	62	60	63
3.0	98.4	98.1	98.1	98.2	96.5	97.7	7.98	7.92	7.84	7.84	7.89	7.94	7.20	7.81	7.85	7.71	7.81	119	117	117	68	63	63	61	62	62	60	63
4.0	98.4	98.1	98.1	98.0	96.5	97.7	7.98	7.93	7.85	7.81	7.87	7.92	7.81	7.81	7.80	7.70	7.80	119	117	118	68	63	63	61	62	62	60	63
5.0	98.3	98.1	98.0	97.9	96.7	97.4	7.98	7.93		7.79	7.83	7.89	7.80	7.80	7.79	7.70	7.79	120	116		68	63	63	61	62	62	60	63
6.0	98.3	98.1	97.9	97.8	96.7	97.2	7.98	7.93		7.78	7.83	7.88	7.79	7.77	7.79	7.69	7.79	120	117		68	63	63	61	62	62	60	63
7.0		98.1	97.8	97.6		97.2	7.98	7.92		7.75	7.83		7.78	7.77	7.77		7.79	121	117		68	62		61	62	62		63
8.0		98.1	97.8	97.5	96.8	97.0	7.98	7.92		7.71	7.82		7.77	7.77	7.73	7.68	7.78	121	117		68	63		61	62	62	60	63
9.0		9.8	97.7	97.4		96.8	7.98			7.70	7.82		7.76	7.75	7.72		7.78	121			68	63		61	62	62		63
10.0		97.7	97.7	97.4	96.7		7.97			7.69	7.82		7.76	7.75	7.71	7.67		122			68	63		61	62	62	60	
11.0		97.9	97.6	97.3			7.97			7.67	7.82		7.75	7.74	7.70			122			68	63		61	62	62		
12.0		97.9	97.6	97.3	96.8		7.97				7.82		7.74	7.73	7.69	7.66		122				63		61	62	62	60	
13.0		97.8	97.6	97.2			7.96				7.82		7.74	7.73	7.68			122				63		61	62	62		
14.0		97.8	97.5	97.2	96.8		7.96				7.82		7.73	7.72	7.67	7.65		122				64		61	62	62	60	
15.0		97.8	97.4	97.1							7.81		7.73	7.71	7.66							66		61	62	62		
16.0		97.7	97.4	97.1	96.6						7.81		7.72	7.70	7.65	7.64						68		61	62	62	59	
17.0		97.4	97.3	97.0							7.81		7.72	7.70	7.64							68		61	62	62		
18.0			97.3	97.0	96.6						7.81			7.69	7.64	7.63						73			62	62	59	
19.0			97.3	96.9							7.81			7.68	7.62							74			62	62		
20.0				96.8	96.5										7.61	7.62										62	59	
21.0				96.8											7.61											62		
22.0				96.7	96.5										7.60	7.60										62	59	
23.0				96.6											7.60											62		
24.0				96.5	96.4										7.60	7.58										62	60	
25.0																												
26.0					96.5											7.57											60	
27.0																												
28.0					96.6											7.54											67	
29.0																												

Notes: 24-Aug-18 to 26-Aug-18 sampling was conducted by Baffinland. 20-Aug-18 sampling was conducted by Minnow.Total depth at stations BLO-01-A, BLO-01, BLO-01-B, BLO-05-A, BLO-05, BLO-05-B, BLO-03, BLO-04, BLO-09, and BLO-06 was 15, 9.4, 4, 11.8, 23, 7.7, 19, 22, 32, and 9.8 m, respectively, at the time of fall sampling.

Table C.70: Sampling Depth, Water Clarity Measures, and Surface and Bottom *In Situ* Water Quality Measures Collected at Mary Lake Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2018

Categorization & Replicate ID		Date Sampled	Station Depth (m)	Secchi Depth (m)	Depth sampled	Temperature (°C)	Dissolved Oxygen		pH (units)	Specific Conductance (µS/cm)
							(mg/L)	(% sat.)		
Littoral (Shallow) Stations	BLO-01	20-Aug-18	9.7	4.4	surface	6.70	11.59	94.7	7.64	111
					bottom	6.40	11.83	95.9	7.85	111
	BLO-11	20-Aug-18	10.7	3.8	surface	7.00	11.74	96.6	7.68	60
					bottom	6.90	11.76	96.5	7.64	60
	BLO-07	20-Aug-18	12.1	4.2	surface	6.60	11.75	95.9	7.71	58
					bottom	6.60	11.76	95.9	7.63	58
	BLO-06	20-Aug-18	8.3	3.5	surface	6.80	11.71	95.9	7.69	59
					bottom	6.70	11.57	94.5	7.65	59
Profundal (Deep) Stations	BLO-03	20-Aug-18	15.1	4.3	surface	7.10	11.70	96.5	7.87	59
					bottom	7.00	11.67	96.1	7.75	59
	BLO-15	20-Aug-18	28.1	4.1	surface	7.00	11.68	96.3	7.75	59
					bottom	6.90	11.62	95.6	7.69	60
	BLO-14	20-Aug-18	17.1	4.6	surface	7.00	11.69	96.3	7.73	59
					bottom	6.90	11.60	95.1	7.63	59
	BLO-05	20-Aug-18	20.5	3.7	surface	7.00	11.74	96.6	7.71	61
					bottom	6.80	11.74	96.3	7.64	80
	BLO-13	20-Aug-18	21.1	4.2	surface	7.00	11.68	96.1	7.68	60
					bottom	6.70	11.72	95.8	7.64	61
	BLO-04	20-Aug-18	21.6	4.4	surface	6.90	11.71	96.3	7.66	60
					bottom	6.90	11.70	96.1	7.62	60

Table C.71: Statistical Comparison of Bottom *In Situ* Water Quality Between Mary Lake Littoral and Profundal Stations, Mary River Project CREMP, August 2018

Habitat Variable	Statistical Test Results			Summary Statistics						
	Significant Difference Between Areas?	P-value	Statistical Analysis ^a	Lake Zone	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Secchi Depth (m)	NO	0.297	α	Littoral	4	3.95	0.41	0.21	3.45	4.39
				Profundal	6	4.20	0.31	0.13	3.70	4.63
Temperature (°C)	YES	0.057	α	Littoral	4	6.65	0.21	0.10	6.40	6.90
				Profundal	6	6.87	0.10	0.04	6.70	7.00
Dissolved Oxygen (mg/L)	NO	0.326	α	Littoral	4	11.7	0.1	0.1	11.6	11.8
				Profundal	6	11.7	0.1	0.0	11.6	11.7
Dissolved Oxygen (% saturation)	NO	0.749	α	Littoral	4	95.7	0.8	0.4	94.5	96.5
				Profundal	6	95.8	0.4	0.2	95.1	96.3
pH (units)	NO	0.610	γ	Littoral	4	7.69	0.11	0.05	7.63	7.85
				Profundal	6	7.66	0.05	0.02	7.62	7.75
Specific Conductance (umho/cm)	NO	0.610	γ	Littoral	4	72.0	26.0	13.0	58.3	111.0
				Profundal	6	63.1	8.4	3.4	59.1	80.1

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log-transformed, single factor ANOVA test conducted; γ - data untransformed, Mann-Whitney U-test conducted; η - data untransformed, t-test assuming unequal variance conducted; δ - data log-transformed, t-test assuming unequal variance conducted.



Highlighted values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

Table C.72: Statistical Comparison of Bottom *In Situ* Water Quality Between Mary Lake and Reference Lake 3 Stations Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2018

Lake Zone	Habitat Variable	Statistical Test Results			Summary Statistics						
		Significant Difference Between Areas?	P-value	Statistical Analysis ^a	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Littoral (Shallow) Stations	Station Depth (m)	NO	0.670	α	Reference	5	9.80	1.11	0.49	8.40	11.20
					Mary Lake	4	10.20	1.60	0.80	8.30	12.10
	Secchi Depth (m)	YES	< 0.001	α	Reference	4	8.49	0.45	0.23	8.05	9.10
					Mary Lake	4	3.95	0.41	0.21	3.45	4.39
	Temperature (°C)	YES	0.029	γ	Reference	4	7.05	0.10	0.05	6.90	7.10
					Mary Lake	4	6.65	0.21	0.10	6.40	6.90
	Dissolved Oxygen (mg/L)	NO	0.420	α	Reference	4	11.6	0.3	0.1	11.2	11.8
					Mary Lake	4	11.7	0.1	0.1	11.6	11.8
	Dissolved Oxygen (% saturation)	NO	0.486	γ	Reference	4	95.7	2.2	1.1	92.4	97.1
					Mary Lake	4	95.7	0.8	0.4	94.5	96.5
Profundal (Deep) Stations	Station Depth (m)	NO	0.773	α	Reference	5	21.26	2.62	1.17	18.50	25.00
					Mary Lake	6	20.58	4.47	1.83	15.10	28.10
	Secchi Depth (m)	YES	< 0.001	α	Reference	4	8.63	0.26	0.13	8.30	8.90
					Mary Lake	6	4.20	0.31	0.13	3.70	4.63
	Temperature (°C)	NO	0.010	γ	Reference	4	7.08	0.05	0.02	7.00	7.10
					Mary Lake	6	6.87	0.10	0.04	6.70	7.00
	Dissolved Oxygen (mg/L)	NO	0.352	γ	Reference	4	11.5	0.4	0.2	10.9	11.7
					Mary Lake	6	11.7	0.1	0.0	11.6	11.7
	Dissolved Oxygen (% saturation)	YES	0.914	γ	Reference	4	94.6	2.8	1.4	90.4	96.1
					Mary Lake	6	95.8	0.4	0.2	95.1	96.3
	pH (units)	YES	0.245	α	Reference	4	7.63	0.04	0.02	7.58	7.67
					Mary Lake	6	7.66	0.05	0.02	7.62	7.75
	Specific Conductance (umho/cm)	YES	0.114	γ	Reference	4	62.5	0.2	0.1	62.3	62.8
					Mary Lake	6	63.1	8.4	3.4	59.1	80.1

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log-transformed, single factor ANOVA test conducted; γ - data untransformed, Mann-Whitney U-test conducted; η - data untransformed, t-test assuming unequal variance conducted; δ - data log-transformed, t-test assuming unequal variance conducted.

Highlighted values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

Table C.73: Water Chemistry at Mary Lake North Basin (BLO-01) Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Winter Sampling Event					
					BL0-01-A	BL0-01-A	BL0-01	BL0-01	BL0-01-B	BL0-01-B
					bottom	surface	bottom	surface	bottom	surface
					14-Apr-18	14-Apr-18	14-Apr-18	14-Apr-18	14-Apr-18	14-Apr-18
Conventional	Conductivity (lab)	umho/cm	-	-	219	222	220	228	225	226
	pH (lab)	pH	6.5 - 9.0	-	7.83	8.07	8.07	8.08	8.05	8.02
	Hardness (as CaCO ₃)	mg/L	-	-	115	117	115	121	119	122
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	119	121	117	124	114	123
	Turbidity	NTU	-	-	0.4	0.3	0.4	0.6	0.3	0.4
	Alkalinity (as CaCO ₃)	mg/L	-	-	97	101	96	100	100	100
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Nitrate	mg/L	13	13	0.173	0.075	0.070	0.075	0.075	0.076
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	2.2	2.3	2.4	2.4	2.4	2.4
	Total Organic Carbon	mg/L	-	-	2.2	2.7	2.7	2.6	2.6	2.4
	Total Phosphorus	mg/L	0.020 ^α	-	0.0060	0.0287	<0.0030	0.0107	0.0046	<0.0030
	Phenols	mg/L	0.004 ^α	-	<0.0010	0.0028	0.0016	0.0014	0.0016	0.0012
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	6.3	6.6	6.5	6.8	6.6	6.6
	Sulphate (SO ₄)	mg/L	218 ^β	218	2.8	3.8	3.7	3.9	3.8	3.8
Total Metals	Aluminum (Al)	mg/L	0.100	0.13	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Antimony (Sb)	mg/L	0.020 ^α	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	0.00015	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0100	0.0107	0.0105	0.0113	0.0105	0.0112
	Beryllium (Be)	mg/L	0.011 ^α	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00006	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	21	21	21	22	24	24
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^α	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0024	0.0009	0.0011	0.0012	0.0011	0.0012	0.0011
	Iron (Fe)	mg/L	0.30	0.326	0.096	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	0.0013	0.0013
	Magnesium (Mg)	mg/L	-	-	12.2	12.6	12.6	13.3	14.2	14.3
	Manganese (Mn)	mg/L	0.935 ^β	-	0.1020	0.0012	0.0020	0.0017	0.0020	0.0021
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	0.00025	0.00030	0.00028	0.00030	0.00030	0.00032
	Nickel (Ni)	mg/L	0.025	0.025	0.00071	0.00064	0.00062	0.00064	0.00064	0.00067
	Potassium (K)	mg/L	-	-	1.15	1.22	1.24	1.27	1.18	1.23
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	1.75	1.03	1.04	1.07	1.09	1.14
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	2.7	2.9	2.9	3.1	3.2	3.2
	Strontium (Sr)	mg/L	-	-	0.014	0.015	0.014	0.015	0.015	0.015
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.0017	0.0023	0.0023	0.0023	0.0022	0.0023
	Vanadium (V)	mg/L	0.006 ^α	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

^b AEMP Water Quality Benchmarks developed by Intinsik (2013) using baseline water quality data specific to Mary Lake.

Indicates parameter concentration above applicable Water Quality Guideline.

BOLD

 Indicates parameter concentration above the AEMP benchmark.

Table C.73: Water Chemistry at Mary Lake North Basin (BLO-01) Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Summer Sampling Event					
					BL0-01-A bottom	BL0-01-A surface	BL0-01 bottom	BL0-01 surface	BL0-01-B bottom	BL0-01-B surface
					03-Aug-18	03-Aug-18	03-Aug-18	03-Aug-18	03-Aug-18	03-Aug-18
Conventional	Conductivity (lab)	umho/cm	-	-	106	105	109	109	106	106
	pH (lab)	pH	6.5 - 9.0	-	7.95	8.01	7.84	8.03	7.98	8.06
	Hardness (as CaCO ₃)	mg/L	-	-	53	54	55	55	54	54
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	60	75	60	47	62	76
	Turbidity	NTU	-	-	1.0	1.0	1.0	1.0	0.9	1.0
	Alkalinity (as CaCO ₃)	mg/L	-	-	54	53	51	55	56	56
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Nitrate	mg/L	13	13	<0.020	<0.020	<0.020	0.3005	<0.020	<0.020
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	1.9	1.73	2.17	1.985	1.72	1.86
	Total Organic Carbon	mg/L	-	-	2.2	1.84	2.4	2.2	1.9	2.0
	Total Phosphorus	mg/L	0.020 ^α	-	0.0072	0.0063	0.0176	0.0065	0.0063	0.0069
	Phenols	mg/L	0.004 ^α	-	<0.0010	<0.0010	0.0026	0.0013	<0.0010	0.0018
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	1.6	1.4	1.8	1.6	1.6	1.5
	Sulphate (SO ₄)	mg/L	218 ^β	218	1.0	0.9	1.1	1.9	1.0	1.0
Total Metals	Aluminum (Al)	mg/L	0.100	0.13	0.028	0.036	0.027	0.029	0.034	0.029
	Antimony (Sb)	mg/L	0.020 ^α	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0057	0.0057	0.0060	0.0058	0.0059	0.0058
	Beryllium (Be)	mg/L	0.011 ^α	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00006	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	12	12	12	12	12	12
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^α	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0024	0.00069	0.00079	0.00073	0.00074	0.00077	0.00073
	Iron (Fe)	mg/L	0.30	0.326	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	-	-	6.3	6.1	6.5	6.1	6.3	6.0
	Manganese (Mn)	mg/L	0.935 ^β	-	0.0018	0.0010	0.0016	0.0012	0.0011	0.0010
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	0.00013	0.00012	0.00014	0.00014	0.00013	0.00013
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Potassium (K)	mg/L	-	-	0.62	0.63	0.63	0.64	0.63	0.63
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.71	0.70	0.67	0.67	0.68	0.69
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	1.1	1.1	1.2	1.1	1.1	1.1
	Strontium (Sr)	mg/L	-	-	0.008	0.008	0.008	0.008	0.008	0.008
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.0008	0.0007	0.0008	0.0008	0.0008	0.0008
	Vanadium (V)	mg/L	0.006 ^α	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

^b AEMP Water Quality Benchmarks developed by Intinsik (2013) using baseline water quality data specific to Mary Lake.

Indicates parameter concentration above applicable Water Quality Guideline.

BOLD

 Indicates parameter concentration above the AEMP benchmark.

Table C.73: Water Chemistry at Mary Lake North Basin (BLO-01) Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Fall Sampling Event					
					BLO-01-A bottom	BLO-01-A surface	BLO-01 bottom	BLO-01 surface	BLO-01-B bottom	BLO-01-B surface
					26-Aug-18	26-Aug-18	26-Aug-18	26-Aug-18	26-Aug-18	26-Aug-18
Conventional	Conductivity (lab)	umho/cm	-	-	148	143	133	140	136	141
	pH (lab)	pH	6.5 - 9.0	-	8.08	8.08	8.18	8.12	8.09	8.07
	Hardness (as CaCO ₃)	mg/L	-	-	74	72	69	70	71	70
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	65	75	65	70	55	60
	Turbidity	NTU	-	-	0.7	0.7	1.0	0.7	0.8	0.7
	Alkalinity (as CaCO ₃)	mg/L	-	-	69	66	65	65	67	66
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	<0.020	<0.020	<0.020	<0.020	0.022	<0.020
	Nitrate	mg/L	13	13	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	2.6	2.6	2.6	2.7	2.7	2.7
	Total Organic Carbon	mg/L	-	-	2.8	2.8	2.9	2.8	2.9	2.8
	Total Phosphorus	mg/L	0.020 ^α	-	<0.0030	<0.0030	0.0088	<0.0030	<0.0030	<0.0030
	Phenols	mg/L	0.004 ^α	-	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	2.5	2.4	2.2	2.2	2.3	2.3
	Sulphate (SO ₄)	mg/L	218 ^β	218	1.4	1.4	1.3	1.3	1.3	1.3
Total Metals	Aluminum (Al)	mg/L	0.100	0.13	0.024	0.020	0.031	0.026	0.026	0.027
	Antimony (Sb)	mg/L	0.020 ^α	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0075	0.0072	0.0072	0.0070	0.0075	0.0074
	Beryllium (Be)	mg/L	0.011 ^α	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00006	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	15	15	14	15	15	15
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^α	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0024	0.0009	0.0008	0.0009	0.0009	0.0009	0.0009
	Iron (Fe)	mg/L	0.30	0.326	<0.030	<0.030	<0.030	<0.030	<0.030	0.03
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	-	-	8.8	8.4	8.2	8.1	8.2	8.4
	Manganese (Mn)	mg/L	0.935 ^β	-	0.0025	0.0023	0.0024	0.0021	0.0022	0.0023
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	0.00019	0.00020	0.00018	0.00020	0.00020	0.00023
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Potassium (K)	mg/L	-	-	0.82	0.81	0.81	0.80	0.81	0.82
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.69	0.68	0.62	0.73	0.73	0.73
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	1.8	1.6	1.6	1.6	1.6	1.6
	Strontium (Sr)	mg/L	-	-	0.009	0.009	0.010	0.010	0.010	0.011
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.0014	0.0013	0.0012	0.0012	0.0012	0.0013
	Vanadium (V)	mg/L	0.006 ^α	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

^b AEMP Water Quality Benchmarks developed by Intinsik (2013) using baseline water quality data specific to Mary Lake.

Indicates parameter concentration above applicable Water Quality Guideline.

BOLD

 Indicates parameter concentration above the AEMP benchmark.

Table C.74: Summary of the Magnitude of Elevation in Seasonal Average Parameter Concentrations (Total Metal Concentrations Provided) Between Mary Lake and Reference Lake 3 in 2018, and at Mary Lake Between 2018 and the Baseline Period

Parameter	Mary Lake North Basin					Mary Lake South Basin				
	2018 vs Reference Lake 3		2018 vs Baseline			2018 vs Reference Lake 3		2018 vs Baseline		
	Summer	Fall	Winter	Summer	Fall	Summer	Fall	Winter	Summer	Fall
Conductivity (lab)	1.5	1.9	0.9	1.0	0.8	0.9	1.0	0.9	1.0	1.0
Hardness (as CaCO ₃)	1.5	2.0	1.0	1.0	0.8	0.9	1.0	0.9	1.0	0.9
Total Suspended Solids (TSS)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.6	1.0
Total Dissolved Solids (TDS)	1.8	1.4	0.7	0.9	0.6	1.2	1.4	0.7	0.9	0.9
Turbidity	4.0	1.5	1.9	0.4	0.9	11	2.6	0.8	1.4	1.2
Alkalinity (as CaCO ₃)	1.7	2.0	0.9	1.0	0.8	0.9	1.2	0.8	0.9	0.9
Total Ammonia	0.9	0.5	0.2	0.2	0.1	0.9	0.6	0.2	0.3	0.5
Nitrate	3.3	1.0	0.8	0.7	0.2	1.0	1.4	0.4	0.2	0.2
Nitrite	1.0	1.0	1.2	1.2	0.8	1.0	1.0	1.6	0.3	1.1
Total Kjeldahl Nitrogen (TKN)	1.0	0.9	0.7	0.5	0.6	1.1	0.9	1.1	1.0	0.9
Dissolved Organic Carbon	0.6	0.9	1.1	1.3	1.5	0.4	0.6	1.0	0.9	1.2
Total Organic Carbon	0.4	0.7	1.2	1.3	1.6	0.3	0.5	1.1	1.0	1.7
Total Phosphorus	1.8	0.8	1.3	1.0	0.6	1.8	1.0	1.1	1.4	0.8
Phenols	1.1	1.0	1.6	1.5	1.0	1.3	1.1	1.1	1.6	1.2
Bromide (Br)	1.0	1.0	0.5	0.5	0.7	1.0	1.0	0.9	0.4	0.4
Chloride (Cl)	1.2	1.8	0.7	0.9	0.6	1.1	1.3	0.7	0.6	0.6
Sulphate (SO ₄)	0.3	0.4	0.7	0.5	0.3	0.5	0.7	0.8	0.9	1.0
Aluminum (Al)	8.9	5.9	0.5	0.4	0.3	17	9.0	0.5	0.8	1.4
Antimony (Sb)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Arsenic (As)	1.0	1.0	1.1	1.0	0.5	1.0	1.0	1.0	1.0	0.9
Barium (Ba)	0.0	1.1	0.9	0.9	0.8	0.0	0.7	0.9	1.0	0.9
Beryllium (Be)	1.0	1.0	1.5	1.5	1.0	1.0	1.0	1.1	1.5	2.0
Bismuth (Bi)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Boron (B)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cadmium (Cd)	1.0	1.0	0.8	0.9	0.7	1.0	1.0	0.2	0.9	0.8
Calcium (Ca)	1.7	2.1	0.9	1.0	0.9	0.9	1.0	0.9	1.0	0.9
Chromium (Cr)	1.0	1.0	RDL	RDL	RDL	1.0	1.0	RDL	RDL	RDL
Cobalt (Co)	1.0	1.0	1.0	0.8	0.7	1.0	1.0	1.0	0.9	0.9
Copper (Cu)	0.9	1.1	0.9	0.8	0.3	0.9	0.8	0.9	0.9	
Iron (Fe)	1.0	1.0	1.5	0.3	0.3	2.1	1.3	1.0	0.9	1.0
Lead (Pb)	1.0	1.0	0.9	0.7	0.7	1.5	1.1	0.9	0.9	0.9
Lithium (Li)	1.0	1.0	0.4	0.3	0.2	1.0	1.0	0.2	0.3	0.4
Magnesium (Mg)	1.4	2.0	0.9	1.0	0.8	0.8	1.0	0.9	1.0	1.0
Manganese (Mn)	2.2	3.6	3.0	0.3	0.2	4.9	4.2	0.9	1.3	2.5
Mercury (Hg)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Molybdenum (Mo)	1.0	1.4	0.9	1.0	0.9	0.9	0.9	1.0	1.1	0.9
Nickel (Ni)	1.0	1.0	0.8	0.9	0.8	1.0	1.0	1.0	1.0	1.0
Potassium (K)	0.7	0.9	0.9	1.1	1.0	0.6	0.6	0.9	1.1	1.1
Selenium (Se)	1.0	1.0	RDL	RDL	RDL	1.0	1.0	RDL	RDL	RDL
Silicon (Si)	1.5	1.7	0.9	1.0	0.8	1.2	1.2	0.9	1.0	1.2
Silver (Ag)	1.0	1.0	1.6	1.8	1.8	1.0	1.0	1.2	1.9	2.3
Sodium (Na)	1.2	1.9	0.7	1.3	0.8	0.9	1.0	0.9	1.0	0.8
Strontium (Sr)	1.0	1.2	0.9	1.1	0.8	0.7	0.7	0.7	0.9	0.8
Thallium (Tl)	1.0	1.0	1.6	1.5	1.0	1.0	1.0	1.1	1.5	2.1
Tin (Sn)	1.0	1.0	0.1	0.0	0.0	1.0	1.0	0.2	0.1	0.1
Titanium (Ti)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Uranium (U)	3.3	4.9	0.7	0.9	0.5	1.7	1.8	0.7	0.8	0.7
Vanadium (V)	1.0	1.0	1.0	1.0	0.5	1.0	1.0	1.0	1.0	1.0
Zinc (Zn)	1.0	1.0	1.6	1.6	3.0	1.0	1.0	1.7	1.4	1.4

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).

Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).

Denotes highly elevated concentration (mean concentration greater than 10 times higher than respective mean reference or baseline period value).

Note: RDL = Reportable Detection Limit

Table C.75: Dissolved Metal Concentrations at Mary Lake North Basin Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Winter Sampling Event						Summer Sampling Event						Fall Sampling Event					
			BL0-01-A bottom	BL0-01-A surface	BL0-01 bottom	BL0-01 surface	BL0-01-B bottom	BL0-01-B surface	BL0-01-A bottom	BL0-01-A surface	BL0-01 bottom	BL0-01 surface	BL0-01-B bottom	BL0-01-B surface	BLO-01-A bottom	BLO-01-A surface	BLO-01 bottom	BLO-01 surface	BLO-01-B bottom	BLO-01-B surface
			14-Apr-18	14-Apr-18	14-Apr-18	14-Apr-18	14-Apr-18	14-Apr-18	03-Aug-18	03-Aug-18	03-Aug-18	03-Aug-18	03-Aug-18	03-Aug-18	26-Aug-18	26-Aug-18	26-Aug-18	26-Aug-18	26-Aug-18	26-Aug-18
Dissolved Metals	Aluminum (Al)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0038	0.0110	0.0043	0.0094	0.0044	0.0108	0.0087	0.0088	0.0090	0.0089	0.0083	0.0100
	Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.0093	0.0098	0.0100	0.0105	0.0101	0.0104	0.0056	0.0055	0.0053	0.0056	0.0058	0.0058	0.0076	0.0072	0.0069	0.0071	0.0072	0.0073
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	23.9	23.8	23.5	24.4	24.2	25	11.3	11.5	11.8	11.8	11.5	11.9	15.6	15.5	14.3	14.4	14.9	14.4
	Chromium (Cr)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.00078	0.00104	0.00104	0.00114	0.00111	0.00111	0.00068	0.00068	0.00067	0.00068	0.00068	0.00068	0.00087	0.00084	0.00079	0.00083	0.00082	0.00084
	Iron (Fe)	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	0.0012	0.0013	0.00130	0.0014	0.0013	0.0014	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	13.6	14.0	13.8	14.6	14.3	14.5	6.1	6.2	6.1	6.2	6.2	6.0	8.5	8.1	8.1	8.4	8.2	8.2
	Manganese (Mn)	mg/L	0.02270	0.00037	0.00074	0.00076	0.00093	0.00123	0.00099	0.00058	0.00079	0.00070	0.00065	0.00058	0.00178	0.00152	0.00154	0.00138	0.00145	0.00146
	Mercury (Hg)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.000259	0.000299	0.000280	0.000293	0.000305	0.000295	0.000118	0.000117	0.000128	0.000140	0.000139	0.000145	0.000233	0.000199	0.000197	0.000199	0.000210	0.000208
	Nickel (Ni)	mg/L	0.00066	0.00060	0.00060	0.00061	0.00064	0.00065	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Potassium (K)	mg/L	1.10	1.18	1.15	1.24	1.19	1.24	0.61	0.63	0.63	0.64	0.62	0.63	0.83	0.80	0.78	0.78	0.79	0.79
	Selenium (Se)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	1.66	1.08	1.06	1.11	1.09	1.14	0.66	0.65	0.61	0.64	0.62	0.65	0.66	0.66	0.67	0.70	0.67	0.67
	Silver (Ag)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	2.96	3.18	3.15	3.35	3.15	3.29	1.09	1.05	1.14	1.06	1.05	1.08	1.73	1.64	1.57	1.60	1.58	1.60
	Strontium (Sr)	mg/L	0.0138	0.0145	0.0141	0.0147	0.0142	0.015	0.0076	0.0077	0.0080	0.0079	0.0077	0.0079	0.0106	0.0099	0.0093	0.0093	0.0098	0.0098
	Thallium (Tl)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Uranium (U)	mg/L	0.00166	0.00215	0.00209	0.00234	0.00222	0.00221	0.00078	0.00077	0.00079	0.00076	0.00076	0.00077	0.00140	0.00128	0.00123	0.00122	0.00122	0.00122	
Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	

Table C.76: Magnitude of Elevation in Seasonal Average Dissolved Metal Concentrations Between Mary Lake and Reference Lake 3 in 2018, and at Mary Lake Between 2018 and the Baseline Period

Dissolved Metal	Mary Lake North Basin					Mary Lake South Basin				
	2018 vs Reference Lake 3		2018 vs Baseline			2018 vs Reference Lake 3		2018 vs Baseline		
	Summer	Fall	Winter	Summer	Fall	Summer	Fall	Winter	Summer	Fall
Aluminum (Al)	2.4	1.8	0.3	0.6	1.9	4.4	2.9	0.3	1.1	3.1
Antimony (Sb)	1.0	1.0	0.8	0.8	1.0	1.0	1.0	0.8	0.8	1.0
Arsenic (As)	1.0	1.0	0.8	0.9	1.0	1.0	1.0	0.8	0.9	1.0
Barium (Ba)	0.8	1.1	1.1	0.6	1.6	0.6	0.7	0.5	0.4	1.0
Beryllium (Be)	1.0	1.0	1.0	1.4	2.1	1.0	1.0	1.0	1.4	2.1
Bismuth (Bi)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Boron (B)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cadmium (Cd)	1.0	1.0	0.8	0.5	1.0	1.0	1.0	0.8	0.5	1.0
Calcium (Ca)	1.7	2.1	1.4	0.7	1.0	1.0	1.0	0.5	0.4	0.5
Chromium (Cr)	1.0	1.0	1.3	1.7	2.1	1.0	1.0	1.3	1.7	2.1
Cobalt (Co)	1.0	1.0	0.8	0.8	1.0	1.0	1.0	0.8	0.8	1.0
Copper (Cu)	0.9	1.1	0.7	0.5	1.1	0.7	0.7	0.4	0.4	0.7
Iron (Fe)	1.0	1.0	0.9	1.0	1.8	1.0	1.0	0.9	1.0	1.8
Lead (Pb)	1.0	1.0	1.0	0.8	1.0	1.0	1.1	1.0	0.8	1.1
Lithium (Li)	1.0	1.0	0.3	0.3	0.4	1.0	1.0	0.2	0.3	0.4
Magnesium (Mg)	1.4	2.0	1.4	0.6	0.9	0.8	1.0	0.5	0.4	0.5
Manganese (Mn)	4.7	7.3	3.4	0.5	0.3	7.5	3.5	0.3	0.8	0.2
Mercury (Hg)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Molybdenum (Mo)	1.1	1.5	1.2	0.5	1.2	1.0	1.0	0.6	0.5	0.8
Nickel (Ni)	1.0	1.0	1.0	0.7	0.9	1.0	1.0	0.8	0.7	0.9
Potassium (K)	0.7	0.9	1.4	0.7	1.0	0.5	0.6	0.7	0.6	0.7
Selenium (Se)	1.0	1.0	RDL	RDL	RDL	1.0	1.0	RDL	RDL	RDL
Silicon (Si)	1.5	1.6	1.3	0.7	0.7	1.0	1.1	0.5	0.5	0.5
Silver (Ag)	1.0	1.0	0.2	1.8	2.5	1.0	1.0	0.2	1.8	2.5
Sodium (Na)	1.2	1.9	1.9	0.5	0.8	0.9	1.0	0.7	0.4	0.4
Strontium (Sr)	1.0	1.2	1.3	0.7	1.0	0.7	0.8	0.6	0.5	0.6
Thallium (Tl)	1.0	1.0	1.0	1.4	2.5	1.0	1.0	1.0	1.4	2.5
Tin (Sn)	1.0	1.0	0.0	0.2	0.4	1.0	1.0	0.0	0.2	0.4
Titanium (Ti)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Uranium (U)	3.3	4.9	1.1	0.4	0.8	1.7	1.8	0.2	0.2	0.3
Vanadium (V)	1.0	1.0	0.8	0.9	1.0	1.0	1.0	0.8	0.9	1.0
Zinc (Zn)	1.0	1.0	1.6	1.3	1.2	1.0	1.0	1.6	1.4	1.2

 Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).
 Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).
 Denotes highly elevated concentration (mean concentration ≥ 10 times higher than respective mean reference or baseline period value).

Note: RDL = Reportable Detection Limit

Table C.77: Spearman's Rank Correlation Coefficients for Mary Lake North Basin (BLO) Water Quality Data Collected in Winter, Summer, and Fall 2018^a

Parameters	Conventional Parameters									Total Metals								
	Conduct-ivity	Hardness	Total Dissolved Solids	Turbidity	Alkalinity	Dissolved Organic Carbon	Total Phosphorus	Chloride	Sulphate	Aluminum	Copper	Manganese	Molybdenum	Potassium	Silicon	Sodium	Strontium	Uranium
Conductivity	1	0.992	0.936	-0.476	0.935	0.898	-0.562	0.954	0.994	-0.882	0.870	-0.155	0.937	0.969	0.896	0.972	0.988	0.994
Hardness	0.031	0	-0.065	0.567	-0.033	0.105	-0.664	-0.023	0.005	-0.065	0.196	0.343	0.022	0.016	0.072	-0.006	0.017	0.026
Total Dissolved Solids	0.936	0.934	1	-0.494	0.903	0.876	-0.522	0.897	0.926	-0.862	0.842	-0.061	0.928	0.928	0.885	0.926	0.933	0.941
Turbidity	-0.476	-0.469	-0.494	1	-0.409	-0.424	-0.088	-0.455	-0.455	0.419	-0.346	0.546	-0.488	-0.513	-0.367	-0.505	-0.472	-0.466
Alkalinity	0.935	0.958	0.903	-0.409	1	0.897	-0.525	0.942	0.951	-0.906	0.868	-0.118	0.938	0.933	0.888	0.935	0.951	0.950
Dissolved Organic Carbon	0.898	0.896	0.876	-0.424	0.897	1	-0.647	0.896	0.895	-0.923	0.881	-0.210	0.891	0.898	0.943	0.889	0.901	0.895
Total Phosphorus	-0.562	-0.572	-0.522	-0.088	-0.525	-0.647	1	-0.527	-0.548	0.601	-0.734	-0.031	-0.579	-0.590	-0.584	-0.551	-0.564	-0.574
Chloride	0.954	0.951	0.897	-0.455	0.942	0.896	-0.527	1	0.969	-0.924	0.847	-0.175	0.924	0.945	0.846	0.964	0.945	0.945
Sulphate	0.994	0.993	0.926	-0.455	0.951	0.895	-0.548	0.969	1	-0.888	0.872	-0.172	0.942	0.968	0.889	0.975	0.986	0.988
Aluminum (total)	-0.882	-0.894	-0.862	0.419	-0.906	-0.923	0.601	-0.924	-0.888	1	-0.795	0.125	-0.855	-0.875	-0.894	-0.869	-0.889	-0.883
Copper (total)	0.870	0.879	0.842	-0.346	0.868	0.881	-0.734	0.847	0.872	-0.795	1	-0.226	0.881	0.889	0.812	0.875	0.883	0.879
Manganese (total)	-0.155	-0.156	-0.061	0.546	-0.118	-0.210	-0.031	-0.175	-0.172	0.125	-0.226	1	-0.180	-0.155	-0.058	-0.166	-0.156	-0.142
Molybdenum (total)	0.937	0.952	0.928	-0.488	0.938	0.891	-0.579	0.924	0.942	-0.855	0.881	-0.180	1	0.964	0.862	0.970	0.955	0.944
Potassium (total)	0.969	0.975	0.928	-0.513	0.933	0.898	-0.590	0.945	0.968	-0.875	0.889	-0.155	0.964	1	0.887	0.992	0.977	0.975
Silicon (total)	0.896	0.897	0.885	-0.367	0.888	0.943	-0.584	0.846	0.889	-0.894	0.812	-0.058	0.862	0.887	1	0.866	0.904	0.901
Sodium (total)	0.972	0.971	0.926	-0.505	0.935	0.889	-0.551	0.964	0.975	-0.869	0.875	-0.166	0.970	0.992	0.866	1	0.972	0.971
Strontium (total)	0.988	0.994	0.933	-0.472	0.951	0.901	-0.564	0.945	0.986	-0.889	0.883	-0.156	0.955	0.977	0.904	0.972	1	0.992
Uranium (total)	0.994	0.994	0.941	-0.466	0.950	0.895	-0.574	0.945	0.988	-0.883	0.879	-0.142	0.944	0.975	0.901	0.971	0.992	1
Aluminum (dissolved)	-0.733	-0.699	-0.713	0.694	-0.643	-0.657	0.187	-0.790	-0.735	0.703	-0.583	0.353	-0.702	-0.716	-0.618	-0.745	-0.694	-0.699
Copper (dissolved)	0.777	0.787	0.739	-0.210	0.800	0.769	-0.571	0.814	0.805	-0.667	0.871	-0.048	0.816	0.810	0.667	0.829	0.782	0.764
Manganese (dissolved)	0.164	0.147	0.094	0.524	0.133	0.121	-0.518	0.200	0.153	-0.155	0.294	0.459	0.102	0.158	0.047	0.161	0.150	0.173
Molybdenum (dissolved)	0.926	0.937	0.896	-0.447	0.966	0.895	-0.513	0.973	0.944	-0.933	0.864	-0.162	0.926	0.940	0.856	0.953	0.938	0.933
Potassium (dissolved)	0.942	0.951	0.921	-0.487	0.948	0.899	-0.553	0.980	0.951	-0.931	0.861	-0.149	0.947	0.955	0.846	0.961	0.944	0.943
Sodium (dissolved)	0.946	0.956	0.912	-0.436	0.953	0.903	-0.530	0.976	0.959	-0.934	0.839	-0.168	0.941	0.939	0.856	0.952	0.948	0.945
Strontium (dissolved)	0.994	0.997	0.943	-0.470	0.958	0.895	-0.562	0.951	0.994	-0.878	0.888	-0.152	0.949	0.975	0.896	0.974	0.991	0.996
Uranium (dissolved)	0.979	0.982	0.937	-0.468	0.937	0.897	-0.554	0.942	0.983	-0.881	0.858	-0.181	0.950	0.945	0.877	0.956	0.967	0.968

^a Correlation matrix included only those parameters with ≥75% of values above laboratory reportable detection limits (RDL). Sample size (n) totalled 18.

Indicates strong positive correlation (i.e., Spearman's rho ≥ 0.7) between parameter pairings.

Indicates strong negative correlation (i.e., Spearman's rho ≤ -0.7) between parameter pairings.

Table C.77: Spearman's Rank Correlation Coefficients for Mary Lake North Basin (BLO) Water Quality Data Collected in Winter, Summer and Fall 2018^a

Parameters	Dissolved Metals							
	Aluminum	Copper	Manganese	Molybdenum	Potassium	Sodium	Strontium	Uranium
Conductivity	-0.733	0.777	0.164	0.926	0.942	0.946	0.994	0.979
Hardness	0.245	0.175	0.735	-0.042	0.008	0.025	0.002	0.028
Total Dissolved Solids	-0.713	0.739	0.094	0.896	0.921	0.912	0.943	0.937
Turbidity	0.694	-0.210	0.524	-0.447	-0.487	-0.436	-0.470	-0.468
Alkalinity	-0.643	0.800	0.133	0.966	0.948	0.953	0.958	0.937
Dissolved Organic Carbon	-0.657	0.769	0.121	0.895	0.899	0.903	0.895	0.897
Total Phosphorus	0.187	-0.571	-0.518	-0.513	-0.553	-0.530	-0.562	-0.554
Chloride	-0.790	0.814	0.200	0.973	0.980	0.976	0.951	0.942
Sulphate	-0.735	0.805	0.153	0.944	0.951	0.959	0.994	0.983
Aluminum (total)	0.703	-0.667	-0.155	-0.933	-0.931	-0.934	-0.878	-0.881
Copper (total)	-0.583	0.871	0.294	0.864	0.861	0.839	0.888	0.858
Manganese (total)	0.353	-0.048	0.459	-0.162	-0.149	-0.168	-0.152	-0.181
Molybdenum (total)	-0.702	0.816	0.102	0.926	0.947	0.941	0.949	0.950
Potassium (total)	-0.716	0.810	0.158	0.940	0.955	0.939	0.975	0.945
Silicon (total)	-0.618	0.667	0.047	0.856	0.846	0.856	0.896	0.877
Sodium (total)	-0.745	0.829	0.161	0.953	0.961	0.952	0.974	0.956
Strontium (total)	-0.694	0.782	0.150	0.938	0.944	0.948	0.991	0.967
Uranium (total)	-0.699	0.764	0.173	0.933	0.943	0.945	0.996	0.968
Aluminum (dissolved)	1	-0.502	0.101	-0.719	-0.783	-0.747	-0.703	-0.713
Copper (dissolved)	-0.502	1	0.378	0.809	0.808	0.796	0.797	0.802
Manganese (dissolved)	0.101	0.378	1	0.189	0.209	0.201	0.150	0.109
Molybdenum (dissolved)	-0.719	0.809	0.189	1	0.969	0.969	0.937	0.919
Potassium (dissolved)	-0.783	0.808	0.209	0.969	1	0.986	0.946	0.940
Sodium (dissolved)	-0.747	0.796	0.201	0.969	0.986	1	0.948	0.958
Strontium (dissolved)	-0.703	0.797	0.150	0.937	0.946	0.948	1	0.979
Uranium (dissolved)	-0.713	0.802	0.109	0.919	0.940	0.958	0.979	1

^a Correlation matrix included only those parameters with ≥75% of values above laboratory reportable detection limits (RDL). Sample size (n) totalled 18.

Indicates strong positive correlation (i.e., Spearman's rho ≥ 0.7) between parameter pairings.

Indicates strong negative correlation (i.e., Spearman's rho ≤ -0.7) between parameter pairings.

Table C.78: Water Chemistry at Mary Lake South Basin (BLO) Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Winter Sampling Event													
					BL0-05-A bottom 15-Apr-18	BL0-05-A surface 15-Apr-18	BL0-05 bottom 15-Apr-18	BL0-05 surface 15-Apr-18	BL0-05-B bottom 15-Apr-18	BL0-05-B surface 15-Apr-18	BL0-03 bottom 15-Apr-18	BL0-03 surface 15-Apr-18	BL0-04 bottom 16-Apr-18	BL0-04 surface 16-Apr-18	BL0-09 bottom 16-Apr-18	BL0-09 surface 16-Apr-18	BL0-06 bottom 15-Apr-18	BL0-06 surface 15-Apr-18
Conventionals	Conductivity (lab)	umho/cm	-	-	80	86	79	87	89	91	82	86	78	90	80	88	90	90
	pH (lab)	pH	6.5 - 9.0	-	7.66	7.70	7.71	7.76	7.76	7.75	7.74	7.73	7.70	7.75	7.65	7.75	7.68	7.74
	Hardness (as CaCO ₃)	mg/L	-	-	40	42	39	43	44	44	40	43	38	44	38	44	44	43
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	43	40	39	46	48	52	41	40	39	44	44	48	59	50
	Turbidity	NTU	-	-	0.4	0.5	0.3	0.4	0.5	0.9	0.3	0.4	0.2	0.3	0.3	0.5	0.4	0.4
	Alkalinity (as CaCO ₃)	mg/L	-	-	36	38	31	36	34	38	37	35	34	38	34	36	36	35
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	<0.020	<0.020	0.03	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Nitrate	mg/L	13	13	0.032	0.034	0.033	0.034	0.031	0.036	0.036	0.034	0.040	0.035	0.068	0.035	0.037	0.035
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	0.16	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	1.5	1.5	1.4	1.5	1.6	1.6	1.4	1.4	1.2	1.4	1.3	1.5	1.6	1.6
	Total Organic Carbon	mg/L	-	-	1.6	1.6	1.6	1.7	1.8	1.7	1.7	1.7	1.4	1.7	1.5	1.7	1.8	1.9
	Total Phosphorus	mg/L	0.020 ^d	-	0.0032	0.0041	<0.0030	0.0039	0.0033	0.0050	0.00475	0.0037	0.0035	0.0047	<0.0030	0.0069	0.0037	0.0031
Anions	Phenols	mg/L	0.004 ^d	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0024	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010
	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	1.9	2.1	1.9	2.1	2.2	2.2	2.0	2.1	1.8	2.2	2.0	2.1	2.2	2.2
	Sulphate (SO ₄)	mg/L	218 ^b	218	1.4	1.5	1.3	1.5	1.5	1.5	1.3	1.4	1.3	1.5	1.3	1.5	1.5	1.5
Total Metals	Aluminum (Al)	mg/L	0.100	0.130	0.004	0.005	0.004	0.005	0.0060	0.010	0.005	0.004	0.005	0.004	0.012	0.005	0.006	0.004
	Antimony (Sb)	mg/L	0.020 ^d	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0044	0.0049	0.0044	0.0047	0.00499	0.0057	0.0045	0.0044	0.0042	0.0048	0.0045	0.0047	0.0049	0.0049
	Beryllium (Be)	mg/L	0.011 ^d	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00006	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	8	8	8	9	8.74	9	8	8	7	8	8	8	9	9
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^d	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0024	0.0007	0.0007	0.0008	0.0007	0.00071	0.0008	0.0006	0.0006	0.0007	0.0007	0.0008	0.0007	0.0008	0.0007
	Iron (Fe)	mg/L	0.30	0.326	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00007	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	-	-	4.7	5.0	4.7	5.3	5.23	5.5	4.8	5.0	4.5	5.3	4.7	5.3	5.4	5.3
	Manganese (Mn)	mg/L	0.935 ^b	-	0.0005	0.0005	0.0006	0.0005	0.000676	0.0047	0.0005	0.0005	0.0007	0.0004	0.0014	0.0005	0.0009	0.0006
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	0.00015	0.00015	0.00014	0.00016	0.000170	0.00015	0.00014	0.00015	0.00012	0.00015	0.00014	0.00015	0.00017	0.00016
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Potassium (K)	mg/L	-	-	0.58	0.63	0.56	0.64	0.65	0.68	0.58	0.61	0.54	0.65	0.57	0.64	0.65	0.64
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.41	0.43	0.40	0.44	0.43	0.47	0.43	0.43	0.43	0.45	0.64	0.44	0.46	0.45
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	1.1	1.2	1.1	1.3	1.28	1.3	1.1	1.2	1.1	1.3	1.2	1.2	1.2	1.3
	Strontium (Sr)	mg/L	-	-	0.00593	0.00644	0.00584	0.00632	0.00653	0.00677	0.00596	0.00601	0.00506	0.00618	0.00579	0.0061	0.00664	0.00653
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.0005	0.0005	0.0005	0.0005	0.000531	0.0006	0.0005	0.0005	0.0004	0.0005	0.0004	0.0005	0.0005	0.0005
	Vanadium (V)	mg/L	0.006 ^d	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

^b AEMP Water Quality Benchmarks developed by Intinsik (2013) using baseline water quality data specific to Mary Lake.

 Indicates parameter concentration above applicable Water Quality Guideline.

 **BOLD** Indicates parameter concentration above the AEMP benchmark.

Table C.78: Water Chemistry at Mary Lake South Basin (BLO) Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Summer Sampling Event													
					BL0-05-A bottom 2-Aug-18	BL0-05-A surface 2-Aug-18	BL0-05 bottom 2-Aug-18	BL0-05 surface 2-Aug-18	BL0-05-B bottom 2-Aug-18	BL0-05-B surface 2-Aug-18	BL0-03 bottom 2-Aug-18	BL0-03 surface 2-Aug-18	BL0-04 bottom 2-Aug-18	BL0-04 surface 2-Aug-18	BL0-09 bottom 2-Aug-18	BL0-09 surface 2-Aug-18	BL0-06 bottom 2-Aug-18	BL0-06 surface 2-Aug-18
Conventionals	Conductivity (lab)	umho/cm	-	-	78	79	67	87	60	59	57	60	70	64	68	60	60	60
	pH (lab)	pH	6.5 - 9.0	-	7.77	7.81	7.68	7.78	7.64	7.68	7.61	7.70	7.71	7.72	7.72	7.67	7.65	7.61
	Hardness (as CaCO ₃)	mg/L	-	-	38	38	32	41	27	28	28	28	34	31	32	28	27	28
	Total Suspended Solids (TSS)	mg/L	-	-	2.4	<2.0	2.0	<2.0	<2.0	2.0	<2.0	<2.0	<2.0	2.0	2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	43	38	52	48	33	43	35	40	50	45	38	29	38	48
	Turbidity	NTU	-	-	4.0	3.9	3.2	4.3	2.0	1.9	1.3	0.9	3.2	2.0	3.0	1.9	2.1	2.1
	Alkalinity (as CaCO ₃)	mg/L	-	-	32	31	29	37	25	25	25	26	30	27	28	27	28	27
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Nitrate	mg/L	13	13	<0.020	<0.020	<0.020	0.023	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	0.27	<0.15
	Dissolved Organic Carbon	mg/L	-	-	1.3	1.3	1.3	1.2	1.3	1.3	1.4	1.4	1.3	1.2	1.3	1.3	1.3	1.3
	Total Organic Carbon	mg/L	-	-	1.4	1.6	1.4	1.4	1.5	1.4	1.5	1.5	1.5	1.5	1.5	1.5	1.7	1.5
	Total Phosphorus	mg/L	0.020 ^d	-	0.0079	0.0075	0.0099	0.0074	0.0074	0.0080	0.0073	0.0076	0.0078	0.0086	0.0069	0.0064	0.0117	0.0092
Anions	Phenols	mg/L	0.004 ^d	-	0.0015	0.0013	<0.0010	0.0022	0.0018	0.0016	0.0011	0.0012	<0.0010	<0.0010	0.0012	0.0012	0.0058	<0.0010
	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	1.5	1.5	1.4	1.7	1.4	1.4	1.3	1.3	1.5	1.4	1.5	1.4	1.4	1.4
	Sulphate (SO ₄)	mg/L	218 ^g	218	2.8	2.8	1.9	3.0	1.3	1.3	0.9	0.9	2.2	1.6	1.9	1.4	1.4	1.4
Total Metals	Aluminum (Al)	mg/L	0.100	0.13	0.094	0.079	0.074	0.086	0.046	0.044	0.033	0.022	0.075	0.050	0.039	0.049	0.050	0.046
	Antimony (Sb)	mg/L	0.020 ^d	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0052	0.0054	0.0045	0.0061	0.0038	0.0038	0.0034	0.0038	0.0049	0.0044	0.0044	0.0039	0.0041	0.0039
	Beryllium (Be)	mg/L	0.011 ^d	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00006	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	8	8	7	9	6	6	6	6	7	6	7	6	6	6
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^d	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0024	0.00073	0.00070	0.0006	0.0008	0.00057	0.00058	0.00067	0.00181	0.0006	0.00056	0.0005	0.00067	0.00066	0.00055
	Iron (Fe)	mg/L	0.30	0.326	0.102	0.088	0.082	0.092	0.057	0.054	0.045	<0.030	0.088	0.060	<0.030	0.053	0.058	0.057
	Lead (Pb)	mg/L	0.001	0.001	0.000101	0.000096	0.000085	0.000099	0.000060	0.000061	0.000085	<0.000050	0.000092	0.000068	<0.000050	0.000063	0.000065	0.000067
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	-	-	4.4	4.4	3.7	4.7	3.2	3.3	3.3	3.3	3.9	3.5	3.9	3.3	3.3	3.2
	Manganese (Mn)	mg/L	0.935 ^g	-	0.0040	0.0040	0.0036	0.0034	0.0027	0.0025	0.0025	0.0018	0.0036	0.0031	0.0011	0.0025	0.0025	0.0025
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	0.00013	0.00015	0.00011	0.00021	0.00010	0.00010	0.00009	0.00010	0.00013	0.00011	0.00012	0.00011	0.00010	0.00010
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Potassium (K)	mg/L	-	-	0.59	0.60	0.54	0.68	0.49	0.49	0.46	0.46	0.55	0.51	0.56	0.50	0.49	0.48
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.77	0.69	0.59	0.81	0.43	0.44	0.39	0.37	0.63	0.49	0.51	0.45	0.44	0.44
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	0.9	0.9	0.8	1.0	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.7	0.7
	Strontium (Sr)	mg/L	-	-	0.00701	0.00724	0.00592	0.00847	0.00494	0.00487	0.00471	0.00486	0.00625	0.00544	0.00590	0.00494	0.00496	0.00510
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.0006	0.0006	0.0004	0.0006	0.0003	0.0003	0.0003	0.0003	0.0005	0.0004	0.0002	0.0003	0.0003	0.0003
	Vanadium (V)	mg/L	0.006 ^d	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

^b AEMP Water Quality Benchmarks developed by Intinsik (2013) using baseline water quality data specific to Mary Lake.

Indicates parameter concentration above applicable Water Quality Guideline.

BOLD

 Indicates parameter concentration above the AEMP benchmark.

Table C.78: Water Chemistry at Mary Lake South Basin (BLO) Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Water Quality Guideline (WQG) ^a	AEMP Benchmark ^b	Fall Sampling Event													
					BL0-05-A bottom 25-Aug-18	BL0-05-A surface 25-Aug-18	BL0-05 bottom 24-Aug-18	BL0-05 surface 24-Aug-18	BL0-05-B bottom 24-Aug-18	BL0-05-B surface 24-Aug-18	BL0-03 bottom 25-Aug-18	BL0-03 surface 25-Aug-18	BL0-04 bottom 25-Aug-18	BL0-04 surface 25-Aug-18	BL0-09 bottom 25-Aug-18	BL0-09 surface 25-Aug-18	BL0-06 bottom 25-Aug-18	BL0-06 surface 25-Aug-18
Conventionals	Conductivity (lab)	umho/cm	-	-	82	82	75	77	76	72	74	74	75	75	75	75	76	76
	pH (lab)	pH	6.5 - 9.0	-	7.73	7.72	7.85	7.86	7.90	7.87	7.75	7.76	7.72	7.72	7.70	7.72	7.58	7.73
	Hardness (as CaCO ₃)	mg/L	-	-	38	38	41	35	36	36	36	35	36	34	34	34	35	35
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	60	35	38	190	40	42	50	60	50	30	175	40	40	50
	Turbidity	NTU	-	-	1.4	1.4	1.4	1.5	1.6	1.5	0.7	0.9	1.3	1.3	1.8	1.0	1.6	1.3
	Alkalinity (as CaCO ₃)	mg/L	-	-	37	36	35	35	35	33	30	34	95	56	32	33	34	34
Nutrients and Organics	Total Ammonia	mg/L	variable ^c	0.855	<0.020	<0.020	<0.020	<0.020	<0.020	0.022	0.021	0.062	0.045	<0.020	0.03	0.023	0.048	<0.020
	Nitrate	mg/L	13	13	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.12	<0.020	<0.020	<0.020	<0.020
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	1.8	1.8	1.5	1.5	1.4	1.4	1.9	1.9	1.7	1.7	1.8	1.8	1.7	1.7
	Total Organic Carbon	mg/L	-	-	2.2	2.0	1.6	1.6	1.8	1.1	2.4	2.3	2.2	2.3	2.3	2.3	2.7	2.3
	Total Phosphorus	mg/L	0.020 ^d	-	0.0048	0.0051	0.0092	0.0056	0.0052	0.0051	0.0060	0.0041	0.0061	<0.0030	0.0039	0.0045	0.0057	0.0038
Anions	Phenols	mg/L	0.004 ^d	-	<0.0010	0.0010	0.0012	0.0011	0.0010	0.0011	0.0014	0.0019	<0.0010	0.0014	<0.0010	<0.0010	<0.0010	0.0014
	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	1.9	1.9	1.6	1.7	1.7	1.7	1.4	1.4	1.6	1.6	1.6	1.6	1.7	1.7
Total Metals	Sulphate (SO ₄)	mg/L	218 ^β	218	3.1	3.1	2.5	2.6	2.6	2.6	1.4	1.3	2.5	2.5	2.6	2.4	2.9	2.8
	Aluminum (Al)	mg/L	0.100	0.13	0.049	0.032	0.053	0.039	0.040	0.038	0.023	0.021	0.042	0.034	0.041	0.037	0.052	0.044
	Antimony (Sb)	mg/L	0.020 ^d	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0045	0.0047	0.0051	0.0044	0.0044	0.0044	0.0044	0.0043	0.0044	0.0042	0.0043	0.0043	0.0047	0.0043
	Beryllium (Be)	mg/L	0.011 ^d	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00006	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	8	8	8	7	7	7	7	7	7	7	7	7	7	7
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009 ^d	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0024	0.0006	0.0006	0.0007	0.0006	0.00055	0.0006	0.00059	0.0006	0.0007	0.0006	0.00059	0.0005	0.0006	0.0006
	Iron (Fe)	mg/L	0.30	0.326	0.046	0.035	0.045	0.039	0.039	0.036	<0.030	<0.030	0.038	0.031	0.035	0.033	0.049	0.039
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	0.000058	<0.000050	<0.000050	0.000075	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000055	<0.000050
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	-	-	4.7	4.6	5.0	4.2	4.2	4.3	4.1	4.3	4.3	4.3	4.3	4.1	4.4	4.4
	Manganese (Mn)	mg/L	0.935 ^β	-	0.0038	0.0031	0.0035	0.0026	0.0028	0.0027	0.0016	0.0015	0.0028	0.0023	0.0027	0.0023	0.0032	0.0028
	Mercury (Hg)	mg/L	0.000026	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.073	-	0.00015	0.00015	0.00018	0.00011	0.00012	0.00012	0.00012	0.00009	0.00011	0.00012	0.00012	0.00012	0.00013	0.00012
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Potassium (K)	mg/L	-	-	0.58	0.55	0.61	0.55	0.53	0.54	0.50	0.50	0.54	0.53	0.53	0.53	0.55	0.54
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.54	0.50	0.58	0.47	0.50	0.49	0.45	0.44	0.49	0.48	0.49	0.50	0.53	0.51
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	0.9	0.9	1.0	0.8	0.9	0.9	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9
	Strontium (Sr)	mg/L	-	-	0.007	0.007	0.007	0.006	0.006	0.006	0.006	0.005	0.006	0.006	0.006	0.006	0.006	0.006
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.0005	0.0005	0.0006	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0005	0.0005
	Vanadium (V)	mg/L	0.006 ^d	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

^a Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

^b AEMP Water Quality Benchmarks developed by Intinsik (2013) using baseline water quality data specific to Mary Lake.

 Indicates parameter concentration above applicable Water Quality Guideline.

 **BOLD** Indicates parameter concentration above the AEMP benchmark.

Table C.79: Dissolved Metal Concentrations at Mary Lake South Basin Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Winter Sampling Event													
			BL0-05-A bottom 15-Apr-18	BL0-05-A surface 15-Apr-18	BL0-05 bottom 15-Apr-18	BL0-05 surface 15-Apr-18	BL0-05-B bottom 15-Apr-18	BL0-05-B surface 15-Apr-18	BL0-03 bottom 4/15/2018	BL0-03 surface 15-Apr-18	BL0-04 bottom 16-Apr-18	BL0-04 surface 16-Apr-18	BL0-09 bottom 16-Apr-18	BL0-09 surface 16-Apr-18	BL0-06 bottom 15-Apr-18	BL0-06 surface 15-Apr-18
Dissolved Metals	Aluminum (Al)	mg/L	<0.0030	0.0034	<0.0030	0.00300	0.0033	0.0036	0.0031	0.0044	<0.0030	0.0039	0.0041	0.0042	<0.0030	0.0031
	Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.00434	0.00491	0.00420	0.00466	0.00510	0.00503	0.00441	0.00477	0.00414	0.00503	0.00435	0.00480	0.00476	0.00481
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	7.67	8.44	7.70	8.51	8.63	8.84	7.87	8.58	7.44	8.65	7.40	8.60	8.76	8.60
	Chromium (Cr)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.00064	0.00065	0.00059	0.00065	0.00069	0.00069	0.00060	0.00063	0.00060	0.00067	0.00059	0.00107	0.00065	0.00067
	Iron (Fe)	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	5.01	5.08	4.71	5.34	5.37	5.40	4.88	5.23	4.66	5.39	4.82	5.38	5.29	5.23
	Manganese (Mn)	mg/L	0.000366	0.000322	0.000349	0.000323	0.000391	0.000453	0.000291	0.000390	0.000345	0.000337	0.000514	0.000648	0.000525	0.000348
	Mercury (Hg)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.000151	0.000157	0.000146	0.000166	0.000159	0.000169	0.000150	0.000152	0.000137	0.000163	0.000140	0.000161	0.000150	0.000159
	Nickel (Ni)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Potassium (K)	mg/L	0.58	0.63	0.57	0.63	0.65	0.65	0.59	0.63	0.55	0.65	0.56	0.65	0.64	0.65
	Selenium (Se)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	0.41	0.44	0.40	0.43	0.45	0.45	0.42	0.44	0.42	0.46	0.67	0.45	0.45	0.45
	Silver (Ag)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	1.19	1.20	1.12	1.22	1.32	1.31	1.19	1.21	1.10	1.31	1.21	1.29	1.29	1.23
	Strontium (Sr)	mg/L	0.00605	0.00624	0.00569	0.00635	0.00638	0.00681	0.00588	0.00634	0.00558	0.00647	0.00565	0.00653	0.00652	0.00672
	Thallium (Tl)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00034	<0.00010	<0.00010
	Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.000463	0.000515	0.000450	0.000539	0.000553	0.000529	0.000459	0.000515	0.000445	0.000534	0.000395	0.000538	0.000521	0.000519
	Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	0.00330	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table C.79: Dissolved Metal Concentrations at Mary Lake South Basin Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Summer Sampling Event							Summer Sampling Event						
			BL0-05-A	BL0-05-A	BL0-05	BL0-05	BL0-05-B	BL0-05-B	BL0-03	BL0-03	BL0-04	BL0-04	BL0-09	BL0-09	BL0-06	BL0-06
			bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
			2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18
Dissolved Metals	Aluminum (Al)	mg/L	0.0253	0.0182	0.0209	0.0405	0.0042	0.0050	0.0044	0.0086	0.0099	0.0067	0.0175	0.0049	0.0136	0.0061
	Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.00471	0.00490	0.00394	0.00566	0.00338	0.00337	0.00327	0.00347	0.00461	0.00417	0.00441	0.00340	0.00366	0.00382
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	7.88	8.03	6.76	8.96	5.76	5.99	5.94	5.99	7.28	6.73	6.73	5.74	5.91	5.83
	Chromium (Cr)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.00058	0.00062	0.00052	0.00097	<0.00050	<0.00050	<0.00050	<0.00050	0.00053	<0.00050	0.00054	<0.00050	0.0008	<0.00050
	Iron (Fe)	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	<0.000050	<0.000050	<0.000050	0.00006	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	4.37	4.36	3.73	4.54	3.05	3.13	3.17	3.16	3.83	3.49	3.64	3.24	3.04	3.31
	Manganese (Mn)	mg/L	0.002050	0.002340	0.001230	0.001910	0.000625	0.000683	0.000453	0.000638	0.001400	0.001010	0.001465	0.000740	0.000798	0.000744
	Mercury (Hg)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.000157	0.000162	0.000130	0.000213	0.000105	0.000106	0.000106	0.000094	0.000122	0.000116	0.000110	0.000098	0.000105	0.000111
	Nickel (Ni)	mg/L	<0.00050	<0.00050	<0.00050	0.0007	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Potassium (K)	mg/L	0.57	0.59	0.52	0.64	0.45	0.46	0.44	0.44	0.53	0.49	0.51	0.47	0.46	0.47
	Selenium (Se)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	0.62	0.60	0.47	0.71	0.35	0.36	0.33	0.35	0.51	0.40	0.46	0.37	0.38	0.36
	Silver (Ag)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	0.88	0.90	0.79	1.01	0.70	0.72	0.70	0.70	0.81	0.77	0.79	0.73	0.70	0.73
	Strontium (Sr)	mg/L	0.00710	0.00730	0.00594	0.00844	0.00486	0.00494	0.00467	0.00468	0.00625	0.00556	0.00571	0.00478	0.00490	0.00478
	Thallium (Tl)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.000541	0.000557	0.000410	0.000657	0.000316	0.000327	0.000293	0.000314	0.000422	0.000372	0.000393	0.000313	0.000315	0.000313
	Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	0.0045	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table C.79: Dissolved Metal Concentrations at Mary Lake South Basin Water Quality Monitoring Stations, Mary River Project CREMP, 2018

Parameters		Units	Fall Sampling Event													
			BL0-05-A	BL0-05-A	BL0-05	BL0-05	BL0-05-B	BL0-05-B	BL0-03	BL0-03	BL0-04	BL0-04	BL0-09	BL0-09	BL0-06	BL0-06
			bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
			25-Aug-18	25-Aug-18	24-Aug-18	24-Aug-18	24-Aug-18	24-Aug-18	25-Aug-18	25-Aug-18	25-Aug-18	25-Aug-18	25-Aug-18	25-Aug-18	25-Aug-18	25-Aug-18
Dissolved Metals	Aluminum (Al)	mg/L	0.0166	0.0137	0.0177	0.0133	0.0160	0.0147	0.0101	0.0084	0.0149	0.0121	0.0113	0.0137	0.0158	0.0278
	Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.00452	0.00438	0.00496	0.00410	0.00410	0.00427	0.00418	0.00408	0.00422	0.00413	0.00407	0.00412	0.00417	0.00457
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	7.79	7.70	8.40	7.09	7.59	7.26	7.28	7.15	7.07	7.20	6.98	7.15	7.15	7.27
	Chromium (Cr)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.00055	0.00055	0.00057	0.00053	0.00054	0.00054	0.00053	0.00056	0.00056	0.00052	0.00051	0.00052	0.00055	0.00054
	Iron (Fe)	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000095	<0.000050	<0.000050
	Lithium (Li)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	4.57	4.68	4.83	4.14	4.15	4.26	4.22	4.19	4.38	3.94	3.92	4.03	4.15	4.21
	Manganese (Mn)	mg/L	0.001350	0.001170	0.001510	0.000736	0.000769	0.000822	0.000242	0.000270	0.000566	0.000571	0.000454	0.000542	0.000603	0.000820
	Mercury (Hg)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)	mg/L	0.000148	0.000148	0.000165	0.000108	0.000129	0.000149	0.000127	0.000121	0.000130	0.000130	0.000125	0.000118	0.000120	0.000128
	Nickel (Ni)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Potassium (K)	mg/L	0.54	0.55	0.58	0.51	0.52	0.52	0.48	0.48	0.52	0.52	0.49	0.50	0.52	0.54
	Selenium (Se)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	0.47	0.45	0.50	0.43	0.44	0.44	0.42	0.42	0.45	0.43	0.44	0.42	0.45	0.47
	Silver (Ag)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	0.92	0.91	0.97	0.86	0.86	0.86	0.84	0.84	0.85	0.82	0.77	0.82	0.89	0.85
	Strontium (Sr)	mg/L	0.00663	0.00644	0.00725	0.00581	0.00617	0.00595	0.00542	0.00536	0.00572	0.00597	0.00582	0.00571	0.00600	0.00607
	Thallium (Tl)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.000538	0.000533	0.000669	0.000448	0.000434	0.000451	0.000404	0.000400	0.000441	0.000431	0.000421	0.000429	0.000452	0.000451
	Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table C.80: Spearman's Rank Correlation Coefficients for Mary Lake South Basin (BLO) Water Quality Data Collected in Winter, Summer, and Fall 2018^a

Parameters	Conventional Parameters									Total Metals										
	Conduct-ivity	Hardness	Total Dissolved Solids	Turbidity	Alkalinity	Dissolved Organic Carbon	Total Phosphorus	Chloride	Sulphate	Aluminum	Barium	Copper	Iron	Manganese	Molybdenum	Potassium	Silicon	Sodium	Strontium	Uranium
Conductivity	1	0.935	0.354	-0.450	0.828	0.336	-0.611	0.916	0.341	-0.397	0.756	0.398	-0.394	-0.103	0.856	0.880	0.237	0.936	0.771	0.824
Hardness	0.935	1	0.318	-0.500	0.793	0.242	-0.523	0.846	0.259	-0.408	0.772	0.446	-0.424	-0.122	0.882	0.891	0.213	0.943	0.764	0.849
Total Dissolved Solids	0.354	0.318	1	-0.120	0.287	0.181	-0.166	0.263	0.147	-0.083	0.343	0.082	-0.113	0.053	0.133	0.281	0.130	0.229	0.252	0.278
Turbidity	-0.450	-0.500	-0.120	1	0	-0.391	0.756	-0.518	0.466	0.909	0.057	-0.238	0.874	0.699	-0.233	-0.191	0.500	-0.572	0.052	-0.092
Alkalinity	0.828	0.793	0.287	0	1	0.484	-0.594	0.796	0.391	-0.362	0.566	0.224	-0.390	-0.072	0.696	0.697	0.190	0.814	0.640	0.705
Dissolved Organic Carbon	0.336	0.242	0.181	-0.391	0.484	1	-0.484	0.272	0.228	-0.285	0.109	-0.167	-0.390	-0.124	0.193	0.089	-0.010	0.322	0.199	0.178
Total Phosphorus	-0.611	-0.523	-0.166	0.756	-0.594	-0.484	1	-0.674	0.080	0.751	-0.074	-0.105	0.750	0.554	-0.392	-0.340	0.170	-0.688	-0.184	-0.206
Chloride	0.916	0.846	0.263	-0.518	0.796	0.272	-0.674	1	0.288	-0.486	0.625	0.263	-0.470	-0.185	0.807	0.807	0.168	0.907	0.635	0.690
Sulphate	0.341	0.259	0.147	0.466	0.391	0.228	0.080	0.288	1	0.516	0.574	-0.172	0.416	0.647	0.473	0.421	0.768	0.204	0.677	0.590
Aluminum (total)	-0.397	-0.408	-0.083	0.909	-0.362	-0.285	0.751	-0.486	0.516	1	0.137	-0.128	0.928	0.806	-0.149	-0.146	0.609	-0.495	0.085	0.023
Barium (total)	0.756	0.772	0.343	0.057	0.566	0.109	-0.074	0.625	0.574	0.137	1	0.355	0.079	0.352	0.822	0.903	0.631	0.671	0.898	0.885
Copper (total)	0.398	0.446	0.082	-0.238	0.224	-0.167	-0.105	0.263	-0.172	-0.128	0.355	1	-0.092	-0.013	0.379	0.443	-0.018	0.384	0.249	0.388
Iron (total)	-0.394	-0.424	-0.113	0.874	-0.390	-0.390	0.750	-0.470	0.416	0.928	0.079	-0.092	1	0.746	-0.181	-0.192	0.448	-0.509	0.043	0.033
Manganese (total)	-0.103	-0.122	0.053	0.699	-0.072	-0.124	0.554	-0.185	0.647	0.806	0.352	-0.013	0.746	1	0.051	0.055	0.647	-0.204	0.320	0.292
Molybdenum (total)	0.856	0.882	0.133	-0.233	0.696	0.193	-0.392	0.807	0.473	-0.149	0.822	0.379	-0.181	0.051	1	0.897	0.425	0.851	0.861	0.866
Potassium (total)	0.880	0.891	0.281	-0.191	0.697	0.089	-0.340	0.807	0.421	-0.146	0.903	0.443	-0.192	0.055	0.897	1	0.437	0.840	0.860	0.866
Silicon (total)	0.237	0.213	0.130	0.500	0.190	-0.010	0.170	0.168	0.768	0.609	0.631	-0.018	0.448	0.647	0.425	0.437	1	0.174	0.596	0.440
Sodium (total)	0.936	0.943	0.229	-0.572	0.814	0.322	-0.688	0.907	0.204	-0.495	0.671	0.384	-0.509	-0.204	0.851	0.840	0.174	1	0.689	0.748
Strontium (total)	0.771	0.764	0.252	0.052	0.640	0.199	-0.184	0.635	0.677	0.085	0.898	0.249	0.043	0.320	0.861	0.860	0.596	0.689	1	0.908
Uranium (total)	0.824	0.849	0.278	-0.092	0.705	0.178	-0.206	0.690	0.590	0.023	0.885	0.388	0.033	0.292	0.866	0.866	0.440	0.748	0.908	1
Aluminum (dissolved)	-0.163	-0.234	-0.019	0.666	-0.070	0.086	0.409	-0.296	0.692	0.687	0.184	-0.296	0.536	0.617	-0.073	-0.052	0.673	-0.307	0.235	0.148
Barium (dissolved)	0.837	0.788	0.256	-0.129	0.608	0.186	-0.353	0.727	0.459	-0.162	0.847	0.254	-0.186	0.074	0.795	0.854	0.450	0.744	0.796	0.756
Copper (dissolved)	0.788	0.756	0.221	-0.344	0.577	0.221	-0.405	0.641	0.121	-0.353	0.610	0.447	-0.336	-0.210	0.671	0.727	0.110	0.718	0.592	0.617
Manganese (dissolved)	-0.189	-0.283	-0.097	0.805	-0.246	-0.208	0.614	-0.310	0.528	0.797	0.242	-0.104	0.729	0.685	-0.031	-0.004	0.621	-0.355	0.235	0.127
Molybdenum (dissolved)	0.906	0.859	0.349	-0.286	0.744	0.183	-0.465	0.775	0.364	-0.290	0.753	0.353	-0.226	0.013	0.762	0.804	0.288	0.825	0.757	0.790
Potassium (dissolved)	0.939	0.887	0.357	-0.333	0.722	0.213	-0.479	0.828	0.307	-0.299	0.827	0.416	-0.274	-0.052	0.822	0.904	0.308	0.867	0.779	0.799
Silicon (dissolved)	0.577	0.513	0.245	0.129	0.442	0.161	-0.175	0.445	0.572	0.177	0.768	0.165	0.072	0.303	0.587	0.672	0.795	0.482	0.713	0.603
Sodium (dissolved)	0.957	0.943	0.341	-0.545	0.748	0.244	-0.627	0.901	0.208	-0.482	0.708	0.379	-0.470	-0.199	0.829	0.858	0.192	0.929	0.712	0.762
Strontium (dissolved)	0.821	0.748	0.329	-0.014	0.685	0.286	-0.271	0.659	0.636	0.014	0.871	0.280	0.011	0.262	0.782	0.841	0.527	0.683	0.907	0.882
Uranium (dissolved)	0.876	0.840	0.237	-0.189	0.731	0.314	-0.380	0.711	0.550	-0.131	0.790	0.270	-0.131	0.127	0.829	0.822	0.376	0.783	0.867	0.902

^a Correlation matrix included only those parameters with ≥75% of values above laboratory reportable detection limits (RDL). Sample size (n) totalled 42.

Indicates strong positive correlation (i.e., Spearman's rho ≥ 0.7) between parameter pairings.

Indicates strong negative correlation (i.e., Spearman's rho ≤ -0.7) between parameter pairings.

Table C.80: Spearman's Rank Correlation Coefficients for Mary Lake South Basin (BLO) Water Quality Data Collected in Winter, Summer, and Fall 2018^a

Parameters	Dissolved Metals									
	Aluminum	Barium	Copper	Manganese	Molybdenum	Potassium	Silicon	Sodium	Strontium	Uranium
Conductivity	-0.163	0.837	0.788	-0.189	0.906	0.939	0.577	0.957	0.821	0.876
Hardness	-0.234	0.788	0.756	-0.283	0.859	0.887	0.513	0.943	0.748	0.840
Total Dissolved Solids	-0.019	0.256	0.221	-0.097	0.349	0.357	0.245	0.341	0.329	0.237
Turbidity	0.666	-0.129	-0.344	0.805	-0.286	-0.333	0.129	-0.545	-0.014	-0.189
Alkalinity	-0.070	0.608	0.577	-0.246	0.744	0.722	0.442	0.748	0.685	0.731
Dissolved Organic Carbon	0.086	0.186	0.221	-0.208	0.183	0.213	0.161	0.244	0.286	0.314
Total Phosphorus	0.409	-0.353	-0.405	0.614	-0.465	-0.479	-0.175	-0.627	-0.271	-0.380
Chloride	-0.296	0.727	0.641	-0.310	0.775	0.828	0.445	0.901	0.659	0.711
Sulphate	0.692	0.459	0.121	0.528	0.364	0.307	0.572	0.208	0.636	0.550
Aluminum (total)	0.687	-0.162	-0.353	0.797	-0.290	-0.299	0.177	-0.482	0.014	-0.131
Barium (total)	0.184	0.847	0.610	0.242	0.753	0.827	0.768	0.708	0.871	0.790
Copper (total)	-0.296	0.254	0.447	-0.104	0.353	0.416	0.165	0.379	0.280	0.270
Iron (total)	0.536	-0.186	-0.336	0.729	-0.226	-0.274	0.072	-0.470	0.011	-0.131
Manganese (total)	0.617	0.074	-0.210	0.685	0.013	-0.052	0.303	-0.199	0.262	0.127
Molybdenum (total)	-0.073	0.795	0.671	-0.031	0.762	0.822	0.587	0.829	0.782	0.829
Potassium (total)	-0.052	0.854	0.727	-0.004	0.804	0.904	0.672	0.858	0.841	0.822
Silicon (total)	0.673	0.450	0.110	0.621	0.288	0.308	0.795	0.192	0.527	0.376
Sodium (total)	-0.307	0.744	0.718	-0.355	0.825	0.867	0.482	0.929	0.683	0.783
Strontium (total)	0.235	0.796	0.592	0.235	0.757	0.779	0.713	0.712	0.907	0.867
Uranium (total)	0.148	0.756	0.617	0.127	0.790	0.799	0.603	0.762	0.882	0.902
Aluminum (dissolved)	1	0.105	-0.106	0.757	-0.011	-0.089	0.510	-0.227	0.282	0.194
Barium (dissolved)	0.105	1	0.735	0.144	0.855	0.897	0.763	0.803	0.871	0.847
Copper (dissolved)	-0.106	0.735	1	-0.147	0.757	0.803	0.499	0.796	0.647	0.705
Manganese (dissolved)	0.757	0.144	-0.147	1	-0.033	-0.038	0.440	-0.248	0.293	0.139
Molybdenum (dissolved)	-0.011	0.855	0.757	-0.033	1	0.926	0.640	0.875	0.857	0.885
Potassium (dissolved)	-0.089	0.897	0.803	-0.038	0.926	1	0.683	0.932	0.870	0.872
Silicon (dissolved)	0.510	0.763	0.499	0.440	0.640	1	1	0.549	0.787	0.666
Sodium (dissolved)	-0.227	0.803	0.796	-0.248	0.875	0.932	0.549	1	0.747	0.825
Strontium (dissolved)	0.282	0.871	0.647	0.293	0.857	0.870	0.787	0.747	1	0.932
Uranium (dissolved)	0.194	0.847	0.705	0.139	0.885	0.872	0.666	0.825	0.932	1

^a Correlation matrix included only those parameters with ≥75% of values above laboratory reportable detection limits (RDL). Sample size (n) totalled 42.

Indicates strong positive correlation (i.e., Spearman's rho ≥ 0.7) between parameter pairings.

Indicates strong negative correlation (i.e., Spearman's rho ≤ -0.7) between parameter pairings.

APPENDIX D

SEDIMENT QUALITY DATA

Table D.1: Field Observations of Sediment Properties at Reference Lake 3 (REF-03) Benthic Stations^a, Mary River Project CREMP, August 2018

Station	Station Depth (m)	Colour and Texture Observations	Evidence of Anoxia ^b	Plant or Algal Presence
REF-03-1	10.5	thin oxidized layer of reddish silt over light grey-brown coloured silt; some organics	none detected	sparse bryophytes, sparse algae (mare's eggs)
REF-03-2	9.1	thin surficial oxidized reddish layer over grey-brown coloured silt	none detected	sparse byrophytes
REF-03-3	9.8	light brown-coloured silt with some sand intermixed	none detected	none observed
REF-03-4	8.4	medium brown-grey coloured silt with some sand intermixed at greater depth	none detected	sparse algae (mare's eggs)
REF-03-5	11.2	oxidized orange layer over medium grey-coloured silt; sediment grey-green at greater depths	none detected	sparse algae (mare's eggs)
REF-03-6	22.5	medium brown-coloured silt	none detected	none observed
REF-03-7	25.0	medium brown-coloured silt	none detected	none observed
REF-03-8	18.0	iron oxide layer at sediment surface (1 cm thick), occurring as ferricrete layer at greater depth, and with reduced sediment layer occurring below; mostly silt, but some fine sand intermixed	blackened sediment present	none observed
REF-03-9	21.1	medium brown-coloured silt	none detected	none observed
REF-03-10	19.2	reddish oxidized layer at sediment surface and at approximately 3 cm below surface occurring as ferricrete layer with reduced substrate below; silt material	blackened sediment present	sparse algae (mare's eggs)

^a Sediment particle size and benthic invertebrate community samples were collected by Petite Ponar.

^b Evidence of anoxic sediments assessed visually as the presence of blackened substrate, and by smell based on presence/strength of hydrogen sulphide odour.

Table D.2: Observations from Sediment Cores Collected at Reference Lake 3 (REF-03), Mary River Project CREMP, August 2018

Sample Station	Station Depth (m)	Station Type	Core Number	Core Length (cm)	Surficial Substrate Texture Description
REF-03-1	8.0	Littoral	1	16	reddish-brown sandy loam; grey silt beginning at 2 cm depth, with some evidence of anoxia for deep sediment
			2	21	
			3	11	
			4	33	
REF-03-6	20.0	Profundal	1	13	brown-coloured loam, becoming more compact with depth; grey silt beginning at depth from 11 to 16 cm
			2	16	
			3	14	
			4	16	
REF-03-2	9.4	Littoral	1	32	reddish-brown sandy loam; grey silt beginning at 2 cm depth and deeper
			2	27	
			3	33	
			4	36	
REF-03-7	24.0	Profundal	1	23	brown-coloured loam, becoming more compact with depth; grey silt beginning at depth from 6 to 19 cm
			2	22	
			3	22	
			4	12	
REF-03-3	10.2	Littoral	1	22	brown-coloured sandy loam, becoming more compact with depth; grey silt beginning at depth of 11 to 13 cm
			2	18	
			3	17	
			4	not measured	
REF-03-8	18.5	Profundal	1	22	brown-coloured loam, becoming more compact with depth; grey silt beginning at depth from 11 to 25 cm
			2	17	
			3	32	
			4	28	
REF-03-4	9.3	Littoral	1	16	reddish-brown sandy loam; grey silt beginning at depth from 2 to 7 cm
			2	15	
			3	8	
			4	22	
REF-03-9	20.1	Profundal	1	24	brown-coloured loam; multiple layers, including oxidized reddish material at greater depth
			2	30	
			3	16	
			4	14	
REF-03-5	11.1	Littoral	1	26	oxidized red-brown floc over dark gray-brown sandy loam; grey silt beginning from 9 to 14 cm below surface
			2	27	
			3	29	
			4	32	
REF-03-10	19.5	Profundal	1	28	brown-coloured loam; multiple layers, including oxidized reddish material at greater depth
			2	11	
			3	11	
			4	17	

Table D.3: Statistical Comparison of Substrate Physical Properties between Littoral and Profundal Sediment Stations of Individual Study Lakes, Mary River Project CREMP, August 2018

Lake	Sediment Variable	Statistical Test Results			Summary Statistics						
		Significant Difference Between Areas?	P-value	Statistical Analysis ^a	Station Type	N	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Camp Lake	Sand (% by weight)	NO	0.240	γ	Littoral	5	59.7	20.3	9.1	34.5	79.2
					Profundal	9	42.8	26.8	8.9	19.3	89.8
	Silt (% by weight)	NO	0.438	γ	Littoral	5	36.9	18.7	8.4	18.6	60.6
					Profundal	9	47.6	21.9	7.3	8.3	68.8
	Clay (% by weight)	YES	0.032	α	Littoral	5	3.4	1.6	0.7	1.6	5.2
					Profundal	9	9.6	5.5	1.8	1.3	17.6
Sheardown Lake NW	TOC (%)	NO	0.416	α	Littoral	5	1.5	0.9	0.4	0.7	2.9
					Profundal	9	1.1	0.7	0.2	0.1	2.3
	Sand (% by weight)	YES	0.056	β	Littoral	7	38.9	16.2	6.1	24.6	68.8
					Profundal	7	23.1	15.7	5.9	11.0	55.2
	Silt (% by weight)	NO	0.137	α	Littoral	7	49.6	13.7	5.2	27.0	63.4
					Profundal	7	61.1	13.2	5.0	34.1	72.8
Sheardown Lake SE	Clay (% by weight)	YES	0.060	α	Littoral	7	11.5	3.7	1.4	4.2	16.9
					Profundal	7	15.8	4.1	1.5	10.7	21.0
	TOC (%)	YES	0.091	α	Littoral	7	3.0	1.4	0.5	0.9	4.9
					Profundal	7	1.9	0.9	0.3	0.5	3.4
	Sand (% by weight)	NO	0.718	α	Littoral	5	12.8	5.6	2.5	7.9	22.0
					Profundal	5	14.0	4.8	2.2	7.1	18.8
Mary Lake	Silt (% by weight)	NO	0.421	γ	Littoral	5	73.7	4.5	2.0	67.7	77.6
					Profundal	5	71.0	3.7	1.6	68.8	77.5
	Clay (% by weight)	NO	0.398	α	Littoral	5	13.6	2.3	1.0	10.3	16.4
					Profundal	5	15.0	2.6	1.2	12.3	18.2
	TOC (%)	NO	0.502	α	Littoral	5	1.3	0.4	0.2	0.9	1.9
					Profundal	5	1.2	0.1	0.1	1.0	1.4
Mary Lake	Sand (% by weight)	NO	0.706	β	Littoral	4	16.7	17.7	8.8	3.6	41.0
					Profundal	10	20.7	21.9	6.9	2.6	71.7
	Silt (% by weight)	NO	0.409	α	Littoral	4	64.0	9.5	4.8	50.5	72.8
					Profundal	10	55.6	18.4	5.8	16.8	77.4
	Clay (% by weight)	NO	0.539	γ	Littoral	4	19.3	12.4	6.2	8.6	30.5
					Profundal	10	23.8	11.4	3.6	8.5	43.5
Mary Lake	TOC (%)	NO	0.186	α	Littoral	4	1.1	0.2	0.1	0.8	1.3
					Profundal	10	0.9	0.2	0.1	0.4	1.3

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data logit transformed, single factor ANOVA test conducted; γ - data non-normal, Mann Whitney U-test conducted; and, δ - data untransformed, t-test assuming unequal variance conducted.

Highlighted values indicate significant difference between habitat types based on ANOVA p-value less than 0.10.

Table D.4: Sediment Particle Size, Total Organic Carbon, and Metal Concentrations at Reference Lake 3 (REF-03) Sediment Stations, Mary River Project CREMP, August 2018

Parameter		Units	Sediment Quality Guideline (SQG) ^a	Reference Lake 3 Station										Study Area Summary Statistics		
				REF-03-1 (littoral)	REF-03-6 (profundal)	REF-03-2 (littoral)	REF-03-7 (profundal)	REF-03-3 (littoral)	REF-03-8 (profundal)	REF-03-4 (littoral)	REF-03-9 (profundal)	REF-03-5 (littoral)	REF-03-10 (profundal)	Mean	Standard Deviation	Standard Error
Non-metals	Sand	%	-	59.4	49.9	56.6	50.9	60.7	44.5	66.4	47.0	54.9	45.1	53.5	7.3	2.30
	Silt	%	-	29.8	40.4	32.6	33.8	33.5	41.5	26.6	38.7	34.7	40.4	35.2	4.96	1.57
	Clay	%	-	10.80	9.7	10.8	15.3	5.80	14.0	7.00	14.3	10.40	14.5	11.3	3.25	1.03
	Moisture	%	-	90.7	76.7	94.0	87.2	84.7	87.0	72.6	86.8	90.3	87.6	86	6.48	2.05
	Total Organic Carbon	%	10 ^α	5.13	0.84	7.37	4.64	3.09	4.89	1.78	4.47	6.14	4.27	4.26	1.94	0.613
Metals	Aluminum (Al)	mg/kg	-	21,400	10,900	20,800	29,000	17,400	28,100	10,400	24,500	19,400	29,600	21,150	6,916	2,187
	Antimony (Sb)	mg/kg	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0	0
	Arsenic (As)	mg/kg	17	7.03	3.03	4.92	7.14	4.09	6.85	2.53	6.18	7.68	7.14	5.66	1.88	0.594
	Barium (Ba)	mg/kg	-	131	72	158	164	101.0	191	61.7	134	212.0	197	142	51.9	16.42
	Beryllium (Be)	mg/kg	-	0.83	0.41	0.82	1.04	0.66	0.99	0.39	0.83	0.70	1.07	0.77	0.24	0.075
	Bismuth (Bi)	mg/kg	-	<0.20	<0.20	<0.20	<0.20	<0.20	0.21	<0.20	<0.20	<0.20	0.21	0.20	0.0042	0.0013
	Boron (B)	mg/kg	-	13.9	7.8	17.3	16.8	14.1	18.9	8.1	14.1	16.2	20.3	14.8	4.15	1.31
	Cadmium (Cd)	mg/kg	3.5	0.238	0.184	0.217	0.201	0.099	0.204	0.095	0.186	0.324	0.210	0.20	0.066	0.021
	Calcium (Ca)	mg/kg	-	5,620	3,100	6,970	5,920	4,700	6,450	2,850	5,530	7,260	6,920	5,532	1,556	492.0
	Chromium (Cr)	mg/kg	90	74.0	34.6	65.5	89.9	54.5	90.5	30.9	77.4	69.8	93.9	68.1	22.3	7.04
	Cobalt (Co)	mg/kg	-	15.30	8.4	10.30	20.4	11.2	19.8	7.5	17.1	14.2	21.4	14.6	5.09	1.61
	Copper (Cu)	mg/kg	197	94.2	39.1	96.3	118	61.0	111	37.7	97.3	80.2	116.0	85.1	29.9	9.45
	Iron (Fe)	mg/kg	40,000 ^α	63,600	23,900	36,300	59,200	35,300	58,100	24,000	49,700	74,300	63,600	48,800	17,818	5,635
	Lead (Pb)	mg/kg	91.3	19.7	8.7	18.7	22.3	14.4	22.5	9.1	20.3	20.2	23.8	18.0	5.43	1.72
	Lithium (Li)	mg/kg	-	30.0	16.8	30.7	42.8	26.3	39.1	15.7	36.6	27.4	45.0	31.0	10.02	3.17
	Magnesium (Mg)	mg/kg	-	13,100	6,870	12,500	18,100	10,400	17,500	6,120	15,600	13,400	18,900	13,249	4,463	1,411
	Manganese (Mn)	mg/kg	1,100 ^{α,β}	803	914	454	1,410	703	1,320	563	1,160	678	1,590	960	388.0	122.7
	Mercury (Hg)	mg/kg	0.486	0.051	0.018	0.062	0.082	0.023	0.076	0.012	0.083	0.069	0.066	0.054	0.027	0.009
	Molybdenum (Mo)	mg/kg	-	6.75	1.59	3.48	2.97	2.57	2.77	1.83	2.39	4.56	3.13	3.20	1.50	0.475
	Nickel (Ni)	mg/kg	75 ^{α,β}	54.9	29.0	47.9	61.3	36.0	61.6	23.2	52.0	52.6	65.2	48.4	14.38	4.55
	Phosphorus (P)	mg/kg	2,000 ^α	1,420	769	1,130	1,240	986	1,350	698	1,130	2,290	1,450	1,246	446.6	141.2
	Potassium (K)	mg/kg	-	4,730	2,610	4,880	6,460	4,240	6,640	2,310	5,600	4,510	6,990	4,897	1,595	504.3
	Selenium (Se)	mg/kg	-	0.79	0.20	0.83	0.89	0.48	0.99	0.22	0.97	0.98	0.98	0.73	0.31	0.100
	Silver (Ag)	mg/kg	-	0.18	<0.10	0.20	0.34	<0.10	0.30	<0.10	0.27	0.16	0.30	0.21	0.092	0.029
	Sodium (Na)	mg/kg	-	332	199	401	471	301	530	165	421	400	542	376	128	40.4
	Strontium (Sr)	mg/kg	-	13.3	7.6	14.4	15.6	11.2	15.5	6.9	13.7	15.1	16.7	13.0	3.38	1.07
	Sulphur (S)	mg/kg	-	1800	<1000	2700	1800	<1000	1400	<1000	1500	2400	1300	1,590.0	591.5	187.1
	Thallium (Tl)	mg/kg	-	0.586	0.409	0.460	0.798	0.396	0.890	0.238	0.751	0.569	0.921	0.602	0.231	0.0730
	Tin (Sn)	mg/kg	-	<2.0	<2.0	<2.0	2.1	<2.0	2.0	<2.0	<2.0	<2.0	2.2	2.0	0.07	0.021
	Titanium (Ti)	mg/kg	-	1,160	801	1,190	1,490	1,140	1,620	726	1,300	1,560	1,730	1,272	336	106.4
	Tungsten (W)	mg/kg	-	<0.50	<0.50	0.51	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	0.00	0.00
	Uranium (U)	mg/kg	-	19.70	9.7	12.1	29.8	9.9	28.2	7.47	23.6	17.7	31.1	18.9	8.95	2.83
	Vanadium (V)	mg/kg	-	73.8	37.2	66.4	84.2	52.5	83.4	34.3	70.7	64.3	88.2	65.5	18.9	5.99
	Zinc (Zn)	mg/kg	315	103.0	45	91.9	117	70.3	115	46.9	98.5	94.7	121	90	27.6	8.74
	Zirconium (Zr)	mg/kg	-	3.6	2.1	4.6	4.6	3.4	4.5	1.9	3.6	6.9	4.6	4.0	1.4	0.5

^a Canadian Sediment Quality Guideline for the protection of aquatic life, probable effects level (PEL; CCME 2015) except those indicated by α (Ontario Provincial Sediment Quality Objective [PSQO], severe effect level (SEL); OMOE 1993) and β (British Columbia Working Sediment Quality Guideline [BCSQG], probable effects level (PEL; BCMOE 2015)).

Indicates parameter concentration above Sediment Quality Guideline (SQG).

Table D.5: Field Observations of Sediment Properties at Camp Lake (JLO) Benthic Stations^a, Mary River Project CREMP, August 2018

Station	Station Depth (m)	Colour and Texture Observations	Evidence of Anoxia ^b	Plant or Algal Presence
JLO-02	11.3	iron oxide precipitate over grey-brown coloured silt with some sand intermixed	none detected	sparse algae (mare's eggs)
JLO-01	17.8	reddish brown-coloured silt	none detected	none observed
JLO-21	10.0	medium brown-coloured silt with some sand intermixed	none detected	algae common (mare's eggs)
JLO-20	6.6	thin layer of oxidized red material overlying brown-coloured silt with some sand intermixed	none detected	sparse algae (mare's eggs)
JLO-19	7.0	sand	none detected	sparse algae (mare's eggs)
JLO-07	31.4	oxidized floc material overlying light brown-coloured silt	none detected	sparse algae
JLO-18	12.2	terrestrial organics (from eroding banks) intermixed with sand	none detected	sparse algae (mare's eggs)
JLO-16	16.0	brown-coloured silty sand	none detected	sparse algae (mare's eggs)
JLO-11	29.0	red to light brown coloured silt, some layering with dark material at depth	none detected	sparse algae (mare's eggs)
JLO-12	15.3	medium brown-coloured sand with gravel occurring at depth; some oxidized material at sediment surface	none detected	sparse algae (mare's eggs)

^a Sediment particle size and benthic invertebrate community samples were collected by Petite-Ponar.

^b Evidence of anoxic sediments assessed visually as the presence of blackened substrate, and by smell based on presence/strength of hydrogen sulphide odour.

Table D.6: Observations from Sediment Cores Collected at Camp Lake (JLO), Mary River Project CREMP, August 2018

Sample Station	Station Depth (m)	Station Type	Core Number	Core Length (cm)	Surficial Substrate Texture Description
JLO-02	11.3	Littoral	1	approx. 14	reddish-brown coloured silt loam with some organics
			2		
			3		
			4		
JLO-01	16.5	Profundal	1	approx. 16	reddish-brown coloured silt loam
			2		
			3		
			4		
JLO-14	26.1	Profundal	1	14	brown coloured silt loam, some blackened substrate at approximately 10 cm depth
			2	15	
			3	11	
			4	13	
JLO-17	14.4	Profundal	1	approx. 9	reddish-brown coloured silt loam
			2		
			3		
			4		
JLO-07	32.8	Profundal	1	17	reddish-brown coloured silt loam; grey silt sand at depth showing some blackening
			2	22	
			3	9	
			4	20	
JLO-16	16.1	Profundal	1	approx. 7	brown-grey coloured sand with thin oxidized layer at sediment surface
			2		
			3		
			4		
JLO-15	17.3	Profundal	1	approx. 13	reddish-brown coloured loam
			2		
			3		
			4		
JLO-11	28.8	Profundal	1	no information taken	silt loam
			2		
			3		
			4		
JLO-13	16.6	Profundal	1	no information taken	silt loam
			2		
			3		
			4		
JLO-12	16.2	Profundal	1	no information taken	sand
			2		
			3		
			4		

Table D.7: Statistical Comparison of Sediment Physical Properties Between Camp Lake and Reference Lake 3 Stations Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2018

Lake Zone	Sediment Variable	Statistical Test Results			Summary Statistics						
		Significant Difference Between Areas?	P-value	Statistical Analysis ^a	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Littoral (Shallow) Stations	Sand-Sized Material (%)	NO	0.992	η	Reference	5	59.6	4.4	2.0	54.9	66.4
					Camp	5	59.7	20.3	9.1	34.5	79.2
	Silt-Sized Material (%)	NO	0.554	η	Reference	5	31.4	3.3	1.5	26.6	34.7
					Camp	5	36.9	18.7	8.4	18.6	60.6
	Clay-Sized Material (%)	YES	0.003	α	Reference	5	9.0	2.4	1.1	5.8	10.8
					Camp	5	3.4	1.6	0.7	1.6	5.2
	Moisture (%)	YES	0.005	α	Reference	5	86.5	8.4	3.8	72.6	94.0
					Camp	5	55.6	15.7	7.0	32.7	71.5
	Total Organic Carbon (TOC) Content (%)	YES	0.031	η	Reference	5	4.7	2.3	1.0	1.8	7.4
					Camp	5	1.5	0.9	0.4	0.7	2.9
Profundal (Deep) Stations	Sand-Sized Material (%)	NO	0.112	γ	Reference	5	47.5	2.8	1.3	44.5	50.9
					Camp	9	42.8	26.8	8.9	19.3	89.8
	Silt-Sized Material (%)	NO	0.112	γ	Reference	5	39.0	3.1	1.4	33.8	41.5
					Camp	9	47.6	21.9	7.3	8.3	68.8
	Clay-Sized Material (%)	NO	0.147	γ	Reference	5	13.6	2.2	1.0	9.7	15.3
					Camp	9	9.6	5.5	1.8	1.3	17.6
	Moisture (%)	YES	0.001	γ	Reference	5	85.1	4.7	2.1	76.7	87.6
					Camp	9	51.7	15.6	5.2	22.7	74.5
	Total Organic Carbon (TOC) Content (%)	YES	0.042	γ	Reference	5	3.8	1.7	0.8	0.8	4.9
					Camp	9	1.1	0.7	0.2	0.1	2.3

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data logit- or log-transformed, single factor ANOVA test conducted; γ - data untransformed, Mann-Whitney U-test conducted; η - data untransformed, t-test assuming unequal variance conducted; δ - data logit- or log-transformed, t-test assuming unequal variance conducted.

 Highlighted values indicate significant difference between study areas based on statistical p-value less than 0.10.

Table D.8: Sediment Particle Size, Total Organic Carbon, and Metal Concentrations at Camp Lake (JLO) Sediment Stations, Mary River Project CREMP, August 2018

Parameter		Units	Sediment Quality Guideline (SQG) ^a	AEMP Benchmark ^b	Camp Lake Stations										Summary Statistics	
					JLO-02 (littoral)	JLO-01 (profundal)	JLO-14 (profundal)	JLO-17 (profundal)	JLO-07 (profundal)	JLO-16 (profundal)	JLO-15 (profundal)	JLO-11 (profundal)	JLO-13 (profundal)	JLO-12 (profundal)	Mean	Standard Deviation
Non-metals	Sand	%	-	-	44	22	19	35	26	90	44	31	32	87	43	25
	Silt	%	-	-	51	69	63	56	59	8	48	56	58	12	48	21
	Clay	%	-	-	5.2	9.6	18	9.2	15	1.9	8.0	13.4	10.3	1.3	9.2	5.3
	Moisture	%	-	-	72	75	57	50	58	23	55	57	58	31	54	16
	Total Organic Carbon	%	10 ^α	-	2.91	1.87	0.93	1.07	1.57	0.18	1.02	2.29	1.31	<0.10	1.33	0.88
Metals	Aluminum (Al)	mg/kg	-	-	18,600	20,900	22,200	18,100	21,000	5,470	16,600	18,100	18,300	7,350	16,662	5,676
	Antimony (Sb)	mg/kg	-	-	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.100	0.000
	Arsenic (As)	mg/kg	17	5.9	9.6	6.0	6.5	5.4	6.7	1.0	4.4	3.4	5.1	1.7	5.0	2.5
	Barium (Ba)	mg/kg	-	-	164	86	89	89	111	21	63	70	71	28	79	41
	Beryllium (Be)	mg/kg	-	-	0.89	1.09	1.21	0.99	1.11	0.22	0.78	0.97	0.94	0.34	0.85	0.33
	Bismuth (Bi)	mg/kg	-	-	0.30	0.32	0.32	0.25	0.30	<0.20	0.24	0.32	0.27	<0.20	0.27	0.05
	Boron (B)	mg/kg	-	-	19.7	26.2	28.4	24.2	28.3	7.5	19.9	26.4	23.5	7.8	21.2	7.74
	Cadmium (Cd)	mg/kg	3.5	1.5	0.237	0.208	0.185	0.204	0.281	0.036	0.131	0.226	0.146	0.050	0.17	0.080
	Calcium (Ca)	mg/kg	-	-	5,310	4,630	4,710	4,430	4,850	16,200	3,720	5,540	3,910	1,990	5,529	3,880
	Chromium (Cr)	mg/kg	90	98	76.5	83	88	74.6	83.1	32.1	69.1	74.5	70.6	33.5	68.4	19.6
	Cobalt (Co)	mg/kg	-	-	25.6	20.1	22.5	20.8	23.2	5.47	16.3	14.4	18.2	7.64	17.4	6.62
	Copper (Cu)	mg/kg	197	50	49.6	53	54	43.2	51.3	10.3	38.0	51.5	44.2	14.5	40.9	15.8
	Iron (Fe)	mg/kg	40,000 ^α	52,400	65,100	38,200	40,900	33,100	41,800	12,000	30,900	31,500	33,800	16,900	34,420	14,471
	Lead (Pb)	mg/kg	91.3	35	19.8	24.1	26.3	20.9	23.2	5.07	17.6	21.6	19.9	6.27	18.5	7.18
	Lithium (Li)	mg/kg	-	-	30.4	40.4	38.4	33.4	39.1	8.5	26.6	33.9	31.7	11.1	29.4	11.15
	Magnesium (Mg)	mg/kg	-	-	15,800	14,500	15,700	12,700	14,400	13,700	12,800	14,300	12,600	6,610	13,311	2,618
	Manganese (Mn)	mg/kg	1,100 ^{α,β}	4,370	2,390	1,200	1,140	1,470	2,230	146	814	284	1,800	1,100	1,257	744.6
	Mercury (Hg)	mg/kg	0.486	0.17	0.0418	0.0383	0.0305	0.0214	0.0347	<0.0050	0.0221	0.0519	0.0276	0.0064	0.0280	0.0149
	Molybdenum (Mo)	mg/kg	-	-	2.35	0.96	0.77	1.26	1.33	0.34	0.62	0.55	0.89	0.60	0.97	0.58
	Nickel (Ni)	mg/kg	75 ^{α,β}	72	83.4	77.1	74.8	73	80.6	31.2	60.3	63.9	63	31.7	63.9	18.7
	Phosphorus (P)	mg/kg	2,000 ^α	1,580	1,650	1,060	1,160	1,080	1,320	476	931	867	1,010	565	1,012	341
	Potassium (K)	mg/kg	-	-	4,100	4,830	5,490	4,570	5,210	1,390	4,000	4,650	4,440	1,510	4,019	1,427
	Selenium (Se)	mg/kg	-	-	0.48	0.43	0.30	0.32	0.41	<0.20	0.23	0.43	0.23	<0.20	0.32	0.11
	Silver (Ag)	mg/kg	-	-	0.11	0.14	0.16	0.10	0.14	<0.10	<0.10	0.17	0.11	<0.10	0.12	0.027
	Sodium (Na)	mg/kg	-	-	185	216	257	183	335	74	174	275	179	69	195	83
	Strontium (Sr)	mg/kg	-	-	10.1	12.2	17.1	15.6	22.3	8.6	10.6	12.8	12.5	4.76	12.7	4.85
	Sulphur (S)	mg/kg	-	-	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1,000	0
	Thallium (Tl)	mg/kg	-	-	0.564	0.622	0.599	0.489	0.573	0.101	0.401	0.452	0.470	0.155	0.443	0.180
	Tin (Sn)	mg/kg	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0
	Titanium (Ti)	mg/kg	-	-	1,180	1,110	1,230	1,010	1,180	393	950	1,040	939	473	951	290
	Tungsten (W)	mg/kg	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	0.00
	Uranium (U)	mg/kg	-	-	6.4	6.8	7.2	5.0	6.8	1.0	4.6	5.7	5.4	1.6	5.0	2.1
	Vanadium (V)	mg/kg	-	-	67.0	72.3	75.8	62.5	71.2	19.7	58.4	62.7	61.6	26.1	57.7	19.2
	Zinc (Zn)	mg/kg	315	135	66.4	65.4	70.1	55.2	66.4	17.2	51.1	59.5	55.1	23.4	53.0	18.3
	Zirconium (Zr)	mg/kg	-	-	6.4	4.9	6.4	4.6	5.9	5.5	3.9	10.6	3.6	1.6	5.3	2.4

^a Canadian Sediment Quality Guideline for the protection of aquatic life, probable effects level (PEL; CCME 2015) except those indicated by α (Ontario Provincial Sediment Quality Objective [PSQO], severe effect level (SEL); OMOE 1993) and β (British Columbia Working Sediment Quality Guideline [BCSQG], probable effects level (PEL; BCMOE 2015)).

^b AEMP Sediment Quality Benchmarks developed by Intrinsik (2013) using sediment quality guidelines, background sediment quality data, and method detection limits. The indicated values are specific to Camp Lake.

	Indicates parameter concentration above Sediment Quality Guideline (SQG).
BOLD	Indicates parameter concentration above the AEMP Benchmark.

Table D.9: Magnitude of Elevation in Sediment Metal Concentrations between Camp Lake and Reference Lake 3 2018 Data, and between Camp Lake 2018 and Baseline Data, Mary River Project CREMP, 2018

Parameter	Camp Lake versus Reference Lake 3, 2018				Camp Lake 2018 versus Baseline Period			
	Littoral Stations		Profundal Stations		Littoral Stations		Profundal Stations	
	Reference Lake Concentration (mg/kg)	Magnitude of Elevation	Reference Lake Concentration (mg/kg)	Magnitude of Elevation	Camp Lake Baseline Concentration (mg/kg)	Magnitude of Elevation	Camp Lake Baseline Concentration (mg/kg)	Magnitude of Elevation
Aluminum (Al)	17,880	1.0	24,420	0.7	18,267	1.0	15,175	1.1
Antimony (Sb)	<0.10	1.0	<0.10	1.0	1.0	0.1	1.0	0.1
Arsenic (As)	5.3	3.0	6.1	0.7	2.8	3.4	3.5	1.3
Barium (Ba)	133	1.2	152	0.5	105	1.6	68	1.0
Beryllium (Be)	0.7	1.3	0.9	1.0	1.0	0.9	1.0	0.9
Bismuth (Bi)	<0.20	1.5	0.20	1.3	-	-	-	-
Boron (B)	13.9	1.4	15.6	1.4	0.7	26.9	1.8	11.6
Cadmium (Cd)	0.2	1.2	0.2	0.8	0.5	0.5	0.5	0.3
Calcium (Ca)	5,480	1.0	5,584	1.0	3,130	1.7	2,857	1.9
Chromium (Cr)	59	1.3	77	0.9	81	0.9	71	1.0
Cobalt (Co)	12	2.2	17	0.9	18	1.4	17	1.0
Copper (Cu)	74	0.7	96	0.4	45	1.1	40	1.0
Iron (Fe)	46,700	1.4	50,900	0.6	36,133	1.8	33,206	0.9
Lead (Pb)	16	1.2	20	0.9	18	1.1	19	1.0
Lithium (Li)	26	1.2	36	0.8	-	-	-	-
Magnesium (Mg)	11,104	1.4	15,394	0.8	13,967	1.1	10,113	1.3
Manganese (Mn)	640	3.7	1,279	0.9	699	3.4	942	1.2
Mercury (Hg)	0.0433	1.0	0.0650	0.4	0.100	0.4	0.100	0.3
Molybdenum (Mo)	3.838	0.6	2.570	0.3	1.0	2.4	1.0	0.8
Nickel (Ni)	43	1.9	54	1.1	67	1.2	63	1.0
Phosphorus (P)	1,305	1.3	1,188	0.8	800	2.1	1,125	0.8
Potassium (K)	4,134	1.0	5,660	0.7	3,450	1.2	3,771	1.1
Selenium (Se)	0.7	0.7	0.8	0.4	1.0	0.5	1.0	0.3
Silver (Ag)	0.1	0.7	0.3	0.5	0.3	0.4	0.3	0.4
Sodium (Na)	320	0.6	433	0.5	279	0.7	254	0.8
Strontium (Sr)	12	0.8	14	0.9	9.3	1.1	12.0	1.1
Sulphur (S)	1,780	0.6	1,400	0.7	-	-	-	-
Thallium (Tl)	0.450	1.3	0.754	0.6	1.0	0.6	1.0	0.4
Tin (Sn)	2	1.0	2	1.0	-	-	-	-
Titanium (Ti)	1,155	1.0	1,388	0.7	-	-	-	-
Tungsten	1		1	0.0	-	-	-	-
Uranium (U)	13	0.5	24	0.2	-	-	-	-
Vanadium (V)	58	1.2	73	0.8	69	1.0	57	1.0
Zinc (Zn)	81	0.8	99	0.5	67	1.0	57	0.9
Zirconium (Zr)	4.1	1.6	3.9	1.3	-	-	-	-

 Denotes slight elevation (mean parameter concentration is 3 to 5 times higher than respective mean reference lake value or baseline period, as applicable).
 Denotes moderate elevation (mean parameter concentration 5 to 10 times higher than respective mean reference area value or baseline period value, as applicable).
 Denotes high elevation (mean parameter concentration is ≥ 10 times higher than respective mean reference area value or baseline period value, as applicable).

Table D.10: Field Observations of Sediment Properties at Sheardown Lake Northwest (DLO-01) Benthic Stations ^a, Mary River Project CREMP, August 2018

Station	Station Depth (m)	Colour and Texture Observations	Evidence of Anoxia ^b	Plant or Algal Presence
DLO-01-9	8.2	thin oxidized layer over medium brown-coloured silt	none detected	globular algae (sparse), bryophytes (sparse)
DLO-01-4	6.7	some iron oxide precipitate over medium brown-grey coloured silt	none detected	aquatic moss (sparse)
DLO-01-3	7.3	medium dark brown-grey coloured silt	none detected	<i>Chara</i> present (sparse)
DLO-01-11	8.2	thin iron oxide precipitate over brown coloured silt	none detected	none observed
DLO-01-10	8.8	reddish-brown coloured silt over sand-silt	some blackened substrate	none observed
DLO-01-5	23.8	brown-coloured silt, with some decaying organics	none detected	none observed
DLO-01-14	23.8	brown-coloured silt, with some decaying organics	none detected	none observed
DLO-01-15	21.3	reddish-brown coloured silt	none detected	none observed
DLO-01-2	17.0	reddish-brown coloured silt	none detected	none observed
DLO-01-12	14.0	reddish-brown coloured silt	none detected	none observed

^a Sediment particle size and benthic invertebrate community samples were collected by Petite-Ponar.

^b Evidence of anoxic sediments assessed visually as the presence of blackened substrate, and by smell based on presence/strength of hydrogen sulphide odour.

Table D.11: Observations from Sediment Cores Collected at Sheardown Lake NW (DLO-01), Mary River Project CREMP, August 2018

Sample Station	Station Depth (m)	Station Type	Core Number	Core Length (cm)	Surficial Substrate Texture Description
DLO-01-05	23.2	Profundal	1	10	reddish-brown oxidized layer over dark grey coloured silt loam; some blackened substrate in upper 5 cm
			2	15	
			3	21	
			4	23	
DD-HAB 9-STN2	10.5	Littoral	1	13	reddish-brown coloured loam over grey-brown coloured silt
			2	16	
			3	16	
			4	21	
DLO-01-08	12.1	Littoral	1	13	reddish-brown oxidized layer over grey-brown coloured silt loam
			2	23	
			3	26	
			4	24	
DLO-01	22.0	Profundal	1	14	reddish-brown coloured oxidized floc over light brown-grey coloured silt loam
			2	5	
			3	20	
			4	20	
DLO-01-13	17.8	Profundal	1	16	reddish-brown coloured silt loam; some blackened substrate at 6 - 10 cm below sediment surface
			2	12	
			3	20	
			4	19	
DLO-01-2	16.8	Profundal	1	11	reddish-brown coloured oxidized floc over brown coloured silt loam
			2	16	
			3	17	
			4	12	
DLO-01-9	7.7	Littoral	1	20	reddish-brown coloured oxidized floc over brown coloured loam
			2	20	
			3	23	
			4	23	
DLO-01-10	7.8	Littoral	1	15	reddish-brown coloured oxidized floc over brown coloured sandy loam; some blackened substrate 6 to 7 cm below sediment surface
			2	10	
			3	16	
			4	14	

Table D.12: Statistical Comparison of Sediment Physical Properties Between Sheardown Lake NW and Reference Lake 3 Stations Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2018

Lake Zone	Sediment Variable	Statistical Test Results			Summary Statistics						
		Significant Difference Between Areas?	P-value	Statistical Analysis ^a	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Littoral (Shallow) Stations	Sand-Sized Material (%)	YES	0.014	η	Reference	5	59.6	4.4	2.0	54.9	66.4
					Sheardown NW	7	38.9	16.2	6.1	24.6	68.8
	Silt-Sized Material (%)	YES	0.012	η	Reference	5	31.4	3.3	1.5	26.6	34.7
					Sheardown NW	7	49.6	13.7	5.2	27.0	63.4
	Clay-Sized Material (%)	NO	0.220	α	Reference	5	9.0	2.4	1.1	5.8	10.8
					Sheardown NW	7	11.5	3.7	1.4	4.2	16.9
	Moisture (%)	YES	0.013	α	Reference	5	86.5	8.4	3.8	72.6	94.0
					Sheardown NW	7	67.8	11.7	4.4	45.7	79.9
	Total Organic Carbon (TOC) Content (%)	NO	0.129	α	Reference	5	4.7	2.3	1.0	1.8	7.4
					Sheardown NW	7	3.0	1.4	0.5	0.9	4.9
Profundal (Deep) Stations	Sand-Sized Material (%)	YES	0.007	δ	Reference	5	47.5	2.8	1.3	44.5	50.9
					Sheardown NW	7	23.1	15.7	5.9	11.0	55.2
	Silt-Sized Material (%)	YES	0.005	α	Reference	5	39.0	3.1	1.4	33.8	41.5
					Sheardown NW	7	61.1	13.2	5.0	34.1	72.8
	Clay-Sized Material (%)	NO	0.432	γ	Reference	5	13.6	2.2	1.0	9.7	15.3
					Sheardown NW	7	15.8	4.1	1.5	10.7	21.0
	Moisture (%)	YES	0.003	γ	Reference	5	85.1	4.7	2.1	76.7	87.6
					Sheardown NW	7	60.8	15.8	6.0	27.7	74.0
	Total Organic Carbon (TOC) Content (%)	YES	0.073	γ	Reference	5	3.8	1.7	0.8	0.8	4.9
					Sheardown NW	7	1.9	0.9	0.3	0.5	3.4

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data logit- or log-transformed, single factor ANOVA test conducted; γ - data untransformed, Mann-Whitney U-test conducted; η - data untransformed, t-test assuming unequal variance conducted; δ - data logit- or log-transformed, t-test assuming unequal variance conducted.

 Highlighted values indicate significant difference between study areas based on statistical p-value less than 0.10.

Table D.13: Sediment Particle Size, Total Organic Carbon, Metal Concentrations at Sheardown Lake Northwest (DLO-01) Sediment Stations, Mary River Project CREMP, August 2018

Parameter		Units	Sediment Quality Guideline (SQG) ^a	AEMP Benchmark ^b	Sheardown Lake Northwest Stations							Summary Statistics	
					DLO-01-5 (profundal)	DD-HAB 9-STN2 (littoral)	DLO-01-8 (littoral)	DLO-01 (profundal)	DLO-01-2 (profundal)	DLO-01-9 (littoral)	DLO-01-10 (littoral)	Mean	Standard Deviation
Non-metals	Sand	%	-	-	11	51	25	23	14	42	69	33	20
	Silt	%	-	-	68	38	63	58	73	46	27	54	16
	Clay	%	-	-	21	12	12	19	13	12	4.2	13	5.2
	Moisture	%	-	-	67	65	77	56	62	72	46	65	10
	Total Organic Carbon	%	10 ^α	-	2.12	3.64	2.18	1.33	1.64	4.86	0.87	2.50	1.35
Metals	Aluminum (Al)	mg/kg	-	-	21,100	17,100	1,090	27,700	23,400	1,180	7,190	14,109	10,904
	Antimony (Sb)	mg/kg	-	-	<0.10	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	0.0151
	Arsenic (As)	mg/kg	17	6.2	7.61	15.80	0.51	6.19	5.05	0.26	1.68	5.30	5.45
	Barium (Ba)	mg/kg	-	-	104	487	8	138	142	7	33	131	167
	Beryllium (Be)	mg/kg	-	-	1.15	0.78	<0.10	1.31	1.10	<0.10	0.34	0.697	0.515
	Bismuth (Bi)	mg/kg	-	-	0.34	0.27	<0.20	0.32	0.28	<0.20	<0.20	0.26	0.060
	Boron (B)	mg/kg	-	-	24.2	20.6	<5.0	33.4	30.3	<5.0	9.0	18.2	11.9
	Cadmium (Cd)	mg/kg	3.5	1.5	0.278	0.454	<0.020	0.359	0.316	0.027	0.069	0.218	0.176
	Calcium (Ca)	mg/kg	-	-	4,380	4,690	256	5,400	5,430	326	2,290	3,253	2,279
	Chromium (Cr)	mg/kg	90	97	78.1	64.1	4.1	101.0	89.2	4.3	33.3	53.4	39.8
	Cobalt (Co)	mg/kg	-	-	17.5	15.8	1.1	21.2	18.6	0.8	5.76	11.5	8.71
	Copper (Cu)	mg/kg	197	58	49.7	50.9	2.6	63.9	50.2	3.6	14.30	33.6	25.78
	Iron (Fe)	mg/kg	40,000 ^α	52,200	62,900	80,300	4,830	50,900	46,900	2,630	18,000	38,066	30,017
	Lead (Pb)	mg/kg	91.3	35	24.5	20.6	1.2	28.9	24.0	1.2	8.05	15.5	11.71
	Lithium (Li)	mg/kg	-	-	39.1	28.2	<2.0	42.9	37.2	<2.0	12.0	23.3	17.7
	Magnesium (Mg)	mg/kg	-	-	14,100	11,400	731	17,700	15,200	778	5,590	9,357	6,983
	Manganese (Mn)	mg/kg	1,100 ^{α,β}	4,530	584	4,870	121	1,420	7,770	22	223	2,144	3,009
	Mercury (Hg)	mg/kg	0.486	0.17	0.0603	0.0487	0.0347	0.0317	0.0324	0.051	0.0144	0.0390	0.0153
	Molybdenum (Mo)	mg/kg	-	-	3.13	12.40	0.82	2.11	7.76	0.25	1.16	3.95	4.50
	Nickel (Ni)	mg/kg	75 ^{α,β}	77	69.4	81.6	4.4	86.7	79.0	4.3	28.4	50.5	37.0
	Phosphorus (P)	mg/kg	2,000 ^α	1,958	1,440	2,200	81	1,150	1,050	<50	547	931	772
	Potassium (K)	mg/kg	-	-	5,150	4,110	270	7,010	5,910	290	1,880	3,517	2,726
	Selenium (Se)	mg/kg	-	-	0.56	0.54	<0.20	0.36	0.40	<0.20	<0.20	0.35	0.16
	Silver (Ag)	mg/kg	-	-	0.21	0.15	<0.10	0.23	0.17	<0.10	<0.10	0.15	0.055
	Sodium (Na)	mg/kg	-	-	299	227	<50	367	328	<50	105	204	135
	Strontium (Sr)	mg/kg	-	-	11.5	9.6	0.6	14.1	13.2	0.6	5.9	7.9	5.7
	Sulphur (S)	mg/kg	-	-	<1000	1,100	<1000	<1000	<1000	<1000	<1000	1,014.3	37.8
	Thallium (Tl)	mg/kg	-	-	0.514	0.575	<0.050	0.758	0.658	<0.050	0.183	0.398	0.297
	Tin (Sn)	mg/kg	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0
	Titanium (Ti)	mg/kg	-	-	1,250	1,040	69	1,670	1,530	75	541	882	662
	Tungsten (W)	mg/kg	-	-	<0.50	<0.50	<0.50	<0.50	0.54	<0.50	<0.50	0.51	0.02
	Uranium (U)	mg/kg	-	-	9.12	9.76	0.35	11.20	8.36	0.69	3.08	6.08	4.57
	Vanadium (V)	mg/kg	-	-	59.9	51.5	3.4	81.3	70.2	3.6	21.90	41.7	31.9
	Zinc (Zn)	mg/kg	315	123	75.2	64.6	3.9	94.0	79.9	4.2	25.1	49.6	37.7
	Zirconium (Zr)	mg/kg	-	-	11.7	7.1	<1.0	8.9	6.8	<1.0	4.8	5.9	3.96

^a Canadian Sediment Quality Guideline for the protection of aquatic life, probable effects level (PEL; CCME 2015) except those indicated by α (Ontario Provincial Sediment Quality Objective [PSQO], severe effect level (SEL); OMOE 1993) and β (British Columbia Working Sediment Quality Guideline [BCSQG], probable effects level (PEL; BCMOE 2015)).

^b AEMP Sediment Quality Benchmarks developed by Intrinsik (2013) using sediment quality guidelines, background sediment quality data, and method detection limits. The indicated values are specific to Sheardown Lake Northwest.

Indicates parameter concentration above Sediment Quality Guideline (SQG).

BOLD5

 Indicates parameter concentration above the AEMP Benchmark.

Table D.14: Magnitude of Elevation in Sediment Metal Concentrations between Sheardown Lake NW and Reference Lake 3 2018 Data, and between Sheardown Lake NW 2018 and Baseline Data, Mary River Project CREMP, 2018

Parameter	Sheardown Lake NW versus Reference Lake 3 in 2018				Sheardown Lake NW 2018 versus Baseline Period			
	Littoral Stations		Profundal Stations		Littoral Stations		Profundal Stations	
	Reference Lake Concentration (mg/kg)	Magnitude of Elevation	Reference Lake Concentration (mg/kg)	Magnitude of Elevation	Sheardown Lake NW Baseline Concentration (mg/kg)	Magnitude of Elevation	Sheardown Lake NW Baseline Concentration (mg/kg)	Magnitude of Elevation
Aluminum (Al)	17,880	0.4	24,420	1.0	11,792	0.6	17,745	1.4
Antimony (Sb)	<0.10	1.1	<0.10	1.0	1.0	0.1	1.0	0.1
Arsenic (As)	5.3	0.9	6.1	1.0	3.0	1.5	3.2	2.0
Barium (Ba)	133	1.0	152	0.8	78	1.7	93	1.4
Beryllium (Be)	0.7	0.5	0.9	1.4	1.0	0.3	1.0	1.2
Bismuth (Bi)	<0.20	1.1	0.20	1.5	-	-	-	-
Boron (B)	13.9	0.7	15.6	1.9	3	3.5	3	9.4
Cadmium (Cd)	0.2	0.7	0.2	1.6	0.5	0.3	0.5	0.6
Calcium (Ca)	5,480	0.3	5,584	0.9	2,697	0.7	3,558	1.4
Chromium (Cr)	59	0.4	77	1.2	53	0.5	81	1.1
Cobalt (Co)	12	0.5	17	1.1	10	0.6	15	1.2
Copper (Cu)	74	0.2	96	0.6	33	0.5	48	1.1
Iron (Fe)	46,700	0.6	50,900	1.1	28,120	0.9	40,382	1.3
Lead (Pb)	16	0.5	20	1.3	13	0.6	20	1.3
Lithium (Li)	26	0.4	36	1.1	-	-	-	-
Magnesium (Mg)	11,104	0.4	15,394	1.0	7,448	0.6	11,498	1.4
Manganese (Mn)	640	2.0	1,279	2.5	756	1.7	2,164	1.5
Mercury (Hg)	0.0433	0.9	0.0650	0.6	0.100	0.4	0.100	0.4
Molybdenum (Mo)	3.838	1.0	2.570	1.7	3.4	1.1	3.5	1.2
Nickel (Ni)	43	0.7	54	1.5	49	0.6	69	1.1
Phosphorus (P)	1,305	0.6	1,188	1.0	863	0.8	1,400	0.9
Potassium (K)	4,134	0.4	5,660	1.1	2,681	0.6	4,612	1.3
Selenium (Se)	0.7	0.4	0.8	0.5	1.0	0.3	1.0	0.4
Silver (Ag)	0.1	0.8	0.3	0.8	0.3	0.4	0.3	0.7
Sodium (Na)	320	0.3	433	0.8	249	0.4	342	1.0
Strontium (Sr)	12	0.3	14	0.9	7.2	0.6	11.4	1.1
Sulphur (S)	1,780	0.6	1,400	0.7	-	-	-	-
Thallium (Tl)	0.450	0.5	0.754	0.9	1.0	0.2	1.0	0.6
Tin (Sn)	2	1.0	2	1.0	-	-	-	-
Titanium (Ti)	1,155	0.4	1,388	1.1	-	-	-	-
Uranium (U)	13	0.3	24	0.4	-	-	-	-
Vanadium (V)	58	0.3	73	1.0	37	0.5	58	1.2
Zinc (Zn)	81	0.3	99	0.8	51	0.5	76	1.1
Zirconium (Zr)	4.1	0.9	3.9	2.4	-	-	-	-

 Denotes slight elevation (mean parameter concentration is 3 to 5 times higher than respective mean reference lake value or baseline period, as applicable).
 Denotes moderate elevation (mean parameter concentration 5 to 10 times higher than respective mean reference area value or baseline period value, as applicable).
 Denotes high elevation (mean parameter concentration is ≥ 10 times higher than respective mean reference area value or baseline period value, as applicable).

Table D.15: Field Observations of Sediment Properties at Sheardown Lake Southeast (DLO-02) Benthic Stations^a, Mary River Project CREMP, August 2018

Station	Station Depth (m)	Colour and Texture Observations	Evidence of Anoxia ^b	Plant or Algal Presence
DLO-02-11	8.2	reddish-brown coloured silt-clay	blackened substrate at greater depth	sparse periphyton and globular algae (mare's eggs), sparse <i>Chara</i>
DLO-02-10	6.7	greyish-brown coloured silt-clay	none detected	sparse globular algae (Mare's eggs), <i>Chara</i> common
DLO-02-4	7.6	reddish-brown coloured silt-clay	none detected	sparse globular algae (Mare's eggs), <i>Chara</i> sparse
DLO-02-9	8.8	reddish-brown coloured silt-clay	none detected	sparse globular algae (Mare's eggs), <i>Chara</i> sparse
DLO-02-1	9.8	brownish-grey coloured silt	none detected	none observed
DLO-02-12	10.5	reddish-brown coloured silt-clay	none detected	none observed
DLO-02-8	13.4	brownish-grey coloured silt	none detected	none observed
DLO-02-13	7.0	brownish-red coloured silt-clay	none detected	sparse globular algae (Mare's eggs), <i>Chara</i> sparse
DLO-02-2	14.0	brownish-grey coloured silt	none detected	sparse periphyton
DLO-02-3	13.4	brownish-grey clay	blackened substrate just below sediment surface	sparse globular algae (Mare's eggs), macrophyte roots

^a Sediment particle size and benthic invertebrate community samples were collected by Petite-Ponar.

^b Evidence of anoxic sediments assessed visually as the presence of blackened substrate, and by smell based on presence/strength of hydrogen sulphide odour.

Table D.16: Observations from Sediment Cores Collected at Sheardown Lake SE (DLO-02), Mary River Project CREMP, August 2018

Sample Station	Station Depth (m)	Station Type	Core Number	Core Length (cm)	Surficial Substrate Texture Description
DLO-02-1	11.5	Littoral	1	16	thin reddish-brown oxidized layer overlying light brown-grey coloured silt loam
			2	5	
			3	5	
			4	6	
DLO-02-11	7.8	Littoral	1	17	thin reddish-brown oxidized layer overlying light brown coloured silt loam; some blackened substrate at depths between 1 and 11 cm below surface
			2	16	
			3	11	
			4	12	
DLO-02-4	8.5	Littoral	1	15	thin reddish-brown oxidized layer over light brown-grey coloured silt loam; some blackened substrate at depths between 6 and 18 cm below surface
			2	18	
			3	14	
			4	15	
DLO-02-2	13.4	Profundal	1	18	thin reddish-brown oxidized layer overlying brown coloured silt loam; some blackened substrate at depths between 1 and 5 cm below surface
			2	11	
			3	11	
DLO-02-3	13.0	Profundal	1	18	thin reddish-brown oxidized layer overlying brown coloured silt loam; some blackened substrate at depths between 1 and 4 cm below surface
			2	12	
			3	10	

Table D.17: Statistical Comparison of Sediment Physical Properties Between Sheardown Lake SE and Reference Lake 3 Stations Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2018

Lake Zone	Sediment Variable	Statistical Test Results			Summary Statistics						
		Significant Difference Between Areas?	P-value	Statistical Analysis ^a	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Littoral (Shallow) Stations	Sand-Sized Material (%)	YES	< 0.001	α	Reference	5	59.6	4.4	2.0	54.9	66.4
					Sheardown SE	5	12.8	5.6	2.5	7.9	22.0
	Silt-Sized Material (%)	YES	< 0.001	α	Reference	5	31.4	3.3	1.5	26.6	34.7
					Sheardown SE	5	73.7	4.5	2.0	67.7	77.6
	Clay-Sized Material (%)	NO	0.014	α	Reference	5	9.0	2.4	1.1	5.8	10.8
					Sheardown SE	5	13.6	2.3	1.0	10.3	16.4
	Moisture (%)	YES	< 0.001	α	Reference	5	86.5	8.4	3.8	72.6	94.0
					Sheardown SE	5	53.4	7.9	3.5	42.5	61.2
	Total Organic Carbon (TOC) Content (%)	NO	0.027	η	Reference	5	4.7	2.3	1.0	1.8	7.4
					Sheardown SE	5	1.3	0.4	0.2	0.9	1.9
Profundal (Deep) Stations	Sand-Sized Material (%)	YES	< 0.001	α	Reference	5	47.5	2.8	1.3	44.5	50.9
					Sheardown SE	5	14.0	4.8	2.2	7.1	18.8
	Silt-Sized Material (%)	YES	0.008	γ	Reference	5	39.0	3.1	1.4	33.8	41.5
					Sheardown SE	5	71.0	3.7	1.6	68.8	77.5
	Clay-Sized Material (%)	NO	0.421	γ	Reference	5	13.6	2.2	1.0	9.7	15.3
					Sheardown SE	5	15.0	2.6	1.2	12.3	18.2
	Moisture (%)	YES	0.008	γ	Reference	5	85.1	4.7	2.1	76.7	87.6
					Sheardown SE	5	50.9	2.7	1.2	46.9	54.4
	Total Organic Carbon (TOC) Content (%)	YES	0.151	γ	Reference	5	3.8	1.7	0.8	0.8	4.9
					Sheardown SE	5	1.2	0.1	0.1	1.0	1.4

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data logit- or log-transformed, single factor ANOVA test conducted; γ - data untransformed, Mann-Whitney U-test conducted; η - data untransformed, t-test assuming unequal variance conducted; δ - data logit- or log-transformed, t-test assuming unequal variance conducted.

 Highlighted values indicate significant difference between study areas based on statistical p-value less than 0.10.

Table D.18: Sediment Particle Size, Total Organic Carbon, and Metal Concentrations at Sheardown Lake Southeast (DLO-02) Sediment Stations, Mary River Project CREMP, August 2018

Parameter		Units	Sediment Quality Guideline (SQG) ^a	AEMP Benchmark ^b	Sheardown Lake Southeast Basin Station					Summary Statistics		
					DLO-02-1 (littoral)	DLO-02-11 (littoral)	DLO-02-4 (littoral)	DLO-02-2 (profundal)	DLO-02-3 (profundal)	Mean	Standard Deviation	Standard Error
Non-metals	Sand	%	-	-	22	8	9	19	18	15	6.4	2.9
	Silt	%	-	-	68	77	78	69	69	72	4.9	2.2
	Clay	%	-	-	10	15	14	12	12	13	1.7	0.7
	Moisture	%	-	-	48	61	56	51	51	53	5.2	2.3
	Total Organic Carbon	%	10 ^α	-	0.99	1.35	1.25	1.08	1.11	1.16	0.14	0.064
Metals	Aluminum (Al)	mg/kg	-	-	15,300	16,800	18,300	16,600	16,700	16,740	1,064	476
	Antimony (Sb)	mg/kg	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0	0
	Arsenic (As)	mg/kg	17	5.9	3.41	4.29	6.01	3.02	3.62	4.07	1.18	0.527
	Barium (Ba)	mg/kg	-	-	78.1	97.8	110	75.5	89.0	90.1	14.3	6.38
	Beryllium (Be)	mg/kg	-	-	0.68	0.78	0.83	0.76	0.79	0.77	0.06	0.025
	Bismuth (Bi)	mg/kg	-	-	<0.20	0.21	0.29	<0.20	<0.20	0.22	0.0394	0.0176
	Boron (B)	mg/kg	-	-	16.4	17.9	18.5	15.9	19.0	17.5	1.34	0.60
	Cadmium (Cd)	mg/kg	3.5	1.5	0.103	0.102	0.119	0.089	0.086	0.100	0.013	0.006
	Calcium (Ca)	mg/kg	-	-	5,170	5,040	9,310	5,310	6,300	6,226	1,794	802.4
	Chromium (Cr)	mg/kg	90	79	64.7	72.5	89.7	63.9	67.4	71.6	10.6	4.76
	Cobalt (Co)	mg/kg	-	-	12.7	13.0	14.9	12.7	13.5	13.4	0.92	0.412
	Copper (Cu)	mg/kg	110	56	24.6	27.7	31.5	27.0	26.3	27.4	2.55	1.14
	Iron (Fe)	mg/kg	40,000 ^α	34,400	37,200	38,600	45,800	34,400	38,300	38,860	4,219	1,887
	Lead (Pb)	mg/kg	91.3	35	14.6	17.3	18.7	15.6	16.0	16.4	1.59	0.71
	Lithium (Li)	mg/kg	-	-	28.1	31.3	30.5	32.8	37.2	32.0	3.38	1.51
	Magnesium (Mg)	mg/kg	-	-	12,100	13,000	16,600	13,000	12,900	13,520	1,763	788
	Manganese (Mn)	mg/kg	1,100 ^{α,β}	657	726	1,050	1,100	442	983	860	275	123
	Mercury (Hg)	mg/kg	0.486	0.17	0.0212	0.0245	0.0198	0.0264	0.0261	0.0236	0.0030	0.0013
	Molybdenum (Mo)	mg/kg	-	-	1.36	1.50	1.43	0.87	1.47	1.33	0.26	0.12
	Nickel (Ni)	mg/kg	75 ^{α,β}	66	51.5	59.1	72.6	49.8	52.6	57.1	9.3	4.2
	Phosphorus (P)	mg/kg	2,000 ^α	1,278	1,040	984	1,380	917	993	1,063	183	81.7
	Potassium (K)	mg/kg	-	-	3,590	4,070	4,250	3,920	4,190	4,004	264	117.9
	Selenium (Se)	mg/kg	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	0.000	0.0000
	Silver (Ag)	mg/kg	-	-	<0.10	0.11	0.12	0.11	0.11	0.11	0.007	0.0032
	Sodium (Na)	mg/kg	-	-	225	245	266	251	246	247	15	7
	Strontium (Sr)	mg/kg	-	-	9.5	9.6	12.2	9.6	9.4	10.1	1.2	0.5
	Sulphur (S)	mg/kg	-	-	<1000	<1000	<1000	<1000	<1000	<1,000	0	0
	Thallium (Tl)	mg/kg	-	-	0.334	0.405	0.440	0.366	0.367	0.382	0.041	0.018
	Tin (Sn)	mg/kg	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0	0
	Titanium (Ti)	mg/kg	-	-	1,210	1,190	1,340	1,210	1,240	1,238	60	27
	Tungsten (W)	mg/kg	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0	0
	Uranium (U)	mg/kg	-	-	4.81	4.90	4.86	5.24	5.43	5.05	0.27	0.12
	Vanadium (V)	mg/kg	-	-	46.3	49.1	55.6	47.8	48.6	49.5	3.6	1.6
	Zinc (Zn)	mg/kg	315	135	51.8	54.4	59.3	55.4	55.5	55.3	2.7	1.2
	Zirconium (Zr)	mg/kg	-	-	13.2	13.3	15.8	16.7	16.7	15.1	1.8	0.8

^a Canadian Sediment Quality Guideline for the protection of aquatic life, probable effects level (PEL; CCME 2015) except those indicated by α (Ontario Provincial Sediment Quality Objective [PSQO], severe effect level (SEL); OMOE 1993) and β (British Columbia Working Sediment Quality Guideline [BCSQG], probable effects level (PEL; BCMOE 2015)).

^b AEMP Sediment Quality Benchmarks developed by Intrinsic (2013) using sediment quality guidelines, background sediment quality data, and method detection limits. The indicated values are specific to Sheardown Lake Southeast.

Indicates parameter concentration above Sediment Quality Guideline (SQG).

BOLD Indicates parameter concentration above the AEMP Benchmark.

Table D.19: Magnitude of Elevation in Sediment Metal Concentrations between Sheardown Lake SE and Reference Lake 3 2018 Data, and between Sheardown Lake SE 2018 and Baseline Data, Mary River Project CREMP, 2018

Parameter	Sheardown Lake SE versus Reference Lake 3 in 2018				Sheardown Lake SE 2018 versus Baseline Period			
	Littoral Stations		Profundal Stations		Littoral Stations		Profundal Stations	
	Reference Lake Concentration (mg/kg)	Magnitude of Elevation	Reference Lake Concentration (mg/kg)	Magnitude of Elevation	Sheardown Lake SE Baseline Concentration (mg/kg)	Magnitude of Elevation	Sheardown Lake SE Baseline Concentration (mg/kg)	Magnitude of Elevation
Aluminum (Al)	17,880	0.9	24,420	0.7	14,950	1.1	13,133	1.3
Antimony (Sb)	<0.10	1.0	<0.10	1.0	1.0	0.1	1.0	0.1
Arsenic (As)	5.3	0.9	6.1	0.5	1.9	2.5	1.5	2.2
Barium (Ba)	133	0.7	152	0.5	81	1.2	64	1.3
Beryllium (Be)	0.7	1.1	0.9	0.9	1.0	0.8	1.0	0.8
Bismuth (Bi)	<0.20	1.2	0.20	1.0	-	-	-	-
Boron (B)	13.9	1.3	15.6	1.1	2.5	7.0	1.4	12.9
Cadmium (Cd)	0.2	0.6	0.2	0.4	0.5	0.2	0.6	0.1
Calcium (Ca)	5,480	1.2	5,584	1.0	6,310	1.0	8,925	0.7
Chromium (Cr)	59	1.3	77	0.8	78	1.0	72	0.9
Cobalt (Co)	12	1.2	17	0.8	13	1.1	12	1.1
Copper (Cu)	74	0.4	96	0.3	30	0.9	25	1.1
Iron (Fe)	46,700	0.9	50,900	0.7	32,284	1.3	29,117	1.2
Lead (Pb)	16	1.0	20	0.8	17	1.0	14	1.1
Lithium (Li)	26	1.2	36	1.0	-	-	-	-
Magnesium (Mg)	11,104	1.3	15,394	0.8	12,634	1.1	13,742	0.9
Manganese (Mn)	640	1.5	1,279	0.6	462	2.1	410	1.7
Mercury (Hg)	0.0433	0.5	0.0650	0.4	0.100	0.2	0.100	0.3
Molybdenum (Mo)	3.838	0.4	2.570	0.5	1.5	1.0	1.0	1.2
Nickel (Ni)	43	1.4	54	1.0	62	1.0	62	0.8
Phosphorus (P)	1,305	0.9	1,188	0.8	1,150	1.0	950	1.0
Potassium (K)	4,134	1.0	5,660	0.7	3,947	1.0	3,317	1.2
Selenium (Se)	0.7	0.3	0.8	0.2	1.0	0.2	1.0	0.2
Silver (Ag)	0.1	0.7	0.3	0.4	0.4	0.3	0.3	0.4
Sodium (Na)	320	0.8	433	0.6	353	0.7	330	0.8
Strontium (Sr)	12.2	0.9	13.8	0.7	16.0	0.7	11.0	0.9
Sulphur (S)	1,780	0.6	1,400	0.7	-	-	-	-
Thallium (Tl)	0.450	0.9	0.754	0.5	1.0	0.4	1.0	0.4
Tin (Sn)	<2	1.0	<2	1.0	-	-	-	-
Titanium (Ti)	1,155	1.1	1,388	0.9	-	-	-	-
Tungsten (W)	0.50	1.0	0.50	1.0	-	-	-	-
Uranium (U)	13	0.4	24	0.2	-	-	-	-
Vanadium (V)	58	0.9	73	0.7	52	1.0	44	1.1
Zinc (Zn)	81	0.7	99	0.6	51	1.1	51	1.1

 Denotes slight elevation (mean parameter concentration is 3 to 5 times higher than respective mean reference lake value or baseline period, as applicable).
 Denotes moderate elevation (mean parameter concentration 5 to 10 times higher than respective mean reference area value or baseline period value, as applicable).
 Denotes high elevation (mean parameter concentration is ≥ 10 times higher than respective mean reference area value or baseline period value, as applicable).

Table D.20: Field Observations of Sediment Properties at Mary Lake (BLO) Benthic Stations^a, Mary River Project CREMP, August 2018

Station	Station Depth (m)	Colour and Texture Observations	Evidence of Anoxia ^b	Plant or Algal Presence
BLO-01	9.7	medium brown coloured silt with some sand intermixed	none detected	none observed
BLO-11	10.7	reddish-brown coloured silt-sand mixture	none detected	none observed
BLO-7	12.1	medium reddish-brown coloured silt	none detected	sparse algae (mare's eggs)
BLO-6	8.3	reddish-brown coloured silt	none detected	none observed
BLO-3	15.1	medium to coarse sand with some organics	none detected	none observed
BLO-15	28.1	reddish-brown (~2cm) layer of silt overlying brown coloured silt with some sand intermixed	none detected	none observed
BLO-14	17.1	reddish-brown coloured, moderately compact, silt	none detected	none observed
BLO-13	20.1	reddish-brown coloured silt	none detected	none observed
BLO-4	21.6	medium brown coloured, moderately compact, silt	none detected	none observed
BLO-5	20.5	dark brown coloured silt, minor amount of fine sand, organic debris from river mouth	none detected	none observed

^a Sediment particle size and benthic invertebrate community samples were collected by Petite-Ponar.

^b Evidence of anoxic sediments assessed visually as the presence of blackened substrate, and by smell based on presence/strength of hydrogen sulphide odour.

Table D.21: Observations from Sediment Cores Collected at Mary Lake (BLO), Mary River Project CREMP, August 2018

Sample Station	Station Depth (m)	Station Type	Core Number	Core Length (cm)	Surficial Substrate Texture Description
BLO-01	9.8	Littoral	1	14	reddish-brown coloured silt loam
			2	16	
			3	14	
			4	16	
BLO-16	30.5	Profundal	1	30	thin oxidized layer overlying grey-brown coloured clay loam
			2	32	
			3	29	
			4	32	
BLO-03	16.0	Profundal	1	15	reddish-brown coloured sandy loam overlying grey-brown coloured sandy silt
			2	13	
			3	17	
			4	-	
BLO-14	20.0	Profundal	1	17	reddish-brown coloured silty clay overlying grey-brown coloured silt; some blackened substrate 6 to 10 cm below sediment surface
			2	13	
			3	18	
			4	18	
BLO-12	20.0	Profundal	1	14	medium brown coloured silt loam
			2	14	
			3	14	
			4	15	
BLO-04	19.5	Profundal	1	22	reddish-brown coloured silt loam overlying grey-brown coloured silt; some blackened substrate 1 to 3 cm below sediment surface
			2	13	
			3	15	
			4	12	
BLO-10	9.8	Profundal	1	14	brown coloured silty clay loam; some blackened substrate 3 to 4 cm below sediment surface
			2	17	
			3	14	
			4	15	
BLO-09	30.0	Profundal	1	15	thin layer of reddish brown silt loam/silty clay loam over grey-brown coloured silt; some blackened substrate 2 to 6 cm below sediment surface
			2	17	
			3	15	
			4	15	
BLO-08	25.8	Profundal	1	19	reddish-brown coloured silty clay loam overlying grey-brown coloured silt; some blackened substrate about 2 cm below sediment surface
			2	17	
			3	19	
			4	16	
BLO-06	5.5	Littoral	1	12	medium brown coloured silt loam; some blackened substrate about 2 cm below sediment surface
			2	11	
			3	11	
			4	12	

Table D.22: Statistical Comparison of Sediment Physical Properties Between Mary Lake and Reference Lake 3 Stations Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2018

Lake Zone	Sediment Variable	Statistical Test Results			Summary Statistics						
		Significant Difference Between Areas?	P-value	Statistical Analysis ^a	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Littoral (Shallow) Stations	Sand-Sized Material (%)	YES	0.001	α	Reference	5	59.6	4.4	2.0	54.9	66.4
					Mary	4	16.7	17.7	8.8	3.6	41.0
	Silt-Sized Material (%)	YES	< 0.001	α	Reference	5	31.4	3.3	1.5	26.6	34.7
					Mary	4	64.0	9.5	4.8	50.5	72.8
	Clay-Sized Material (%)	NO	0.413	γ	Reference	5	9.0	2.4	1.1	5.8	10.8
					Mary	4	19.3	12.4	6.2	8.6	30.5
	Moisture (%)	YES	0.003	α	Reference	5	86.5	8.4	3.8	72.6	94.0
					Mary	4	54.6	13.5	6.7	40.2	68.0
	Total Organic Carbon (TOC) Content (%)	YES	0.023	η	Reference	5	4.7	2.3	1.0	1.8	7.4
					Mary	4	1.1	0.2	0.1	0.8	1.3
Profundal (Deep) Stations	Sand-Sized Material (%)	YES	0.004	δ	Reference	5	47.5	2.8	1.3	44.5	50.9
					Mary	10	20.7	21.9	6.9	2.6	71.7
	Silt-Sized Material (%)	YES	0.019	η	Reference	5	39.0	3.1	1.4	33.8	41.5
					Mary	10	55.6	18.4	5.8	16.8	77.4
	Clay-Sized Material (%)	NO	0.129	γ	Reference	5	13.6	2.2	1.0	9.7	15.3
					Mary	10	23.8	11.4	3.6	8.5	43.5
	Moisture (%)	YES	0.001	γ	Reference	5	85.1	4.7	2.1	76.7	87.6
					Mary	10	48.4	7.6	2.4	35.3	57.9
	Total Organic Carbon (TOC) Content (%)	YES	0.019	γ	Reference	5	3.8	1.7	0.8	0.8	4.9
					Mary	10	0.9	0.2	0.1	0.4	1.3

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data logit- or log-transformed, single factor ANOVA test conducted; γ - data untransformed, Mann-Whitney U-test conducted; η - data untransformed, t-test assuming unequal variance conducted; δ - data logit- or log-transformed, t-test assuming unequal variance conducted.

 Highlighted values indicate significant difference between study areas based on statistical p-value less than 0.10.

Table D.23: Sediment Particle Size, Total Organic Carbon, and Metal Concentrations at Mary Lake (BLO) Sediment Stations, Mary River Project CREMP, August 2018

Analyte		Units	Sediment Quality Guideline (SQG) ^a	AEMP Benchmark ^b	Mary Lake Stations										Summary Statistics		
					BLO-01 (littoral)	BLO-16 (profundal)	BLO-03 (profundal)	BLO-14 (profundal)	BLO-12 (profundal)	BLO-04 (profundal)	BLO-10 (profundal)	BLO-09 (profundal)	BLO-08 (profundal)	BLO-06 (littoral)	Mean	Standard Deviation	Standard Error
Non-metals	Sand	%	-	-	19	29	72	12	21	12	5	4.8	2.6	3.6	18	21	6.6
	Silt	%	-	-	73	37	16.8	45	65	67	65	68	65	66	57	18	5.7
	Clay	%	-	-	9	34	11.4	44	14	21	30	27	32	31	25	11	3.5
	Moisture	%	-	-	46	54	38	56	45	58	52	49	52	64	51	7.4	2.3
	Total Organic Carbon	%	10 ^α	-	1.25	0.43	1.34	0.92	0.89	0.82	0.92	0.72	0.66	1.07	0.90	0.27	0.086
Metals	Aluminum (Al)	mg/kg	-	-	17,600	28,900	16,600	36,000	20,100	22,300	31,300	27,700	31,600	31,200	26,330	6,701	2,119
	Antimony (Sb)	mg/kg	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0	0
	Arsenic (As)	mg/kg	17	5.9	7.95	8.20	3.38	5.73	4.29	4.15	4.80	4.66	5.11	4.85	5.31	1.58	0.50
	Barium (Ba)	mg/kg	-	-	103	126	64	125	83	90	138	132	133	136	113	26	8
	Beryllium (Be)	mg/kg	-	-	0.90	1.42	0.81	1.70	0.89	0.96	1.44	1.22	1.45	1.46	1.23	0.312	0.0987
	Bismuth (Bi)	mg/kg	-	-	<0.20	0.28	0.24	0.35	0.23	0.24	0.30	0.31	0.34	0.29	0.28	0.049	0.016
	Boron (B)	mg/kg	-	-	23.4	37.9	23.7	47.7	26.0	26.5	40.3	33.8	39.1	41.0	33.9	8.54	2.70
	Cadmium (Cd)	mg/kg	3.5	1.5	0.106	0.151	0.130	0.200	0.1190	0.124	0.183	0.171	0.180	0.166	0.153	0.0317	0.01004
	Calcium (Ca)	mg/kg	-	-	10,200	4,180	2,950	5,640	4,880	4,420	5,680	5,450	5,990	5,490	5,488	1,891	597.9
	Chromium (Cr)	mg/kg	90	98	72.3	96.6	57.4	115.0	81.4	88.3	110.0	111	119	108.0	95.9	20.5	6.48
	Cobalt (Co)	mg/kg	-	-	16.9	18.9	13.4	23.8	15.8	17.2	21.3	21.1	22.3	21.0	19.2	3.28	1.036
	Copper (Cu)	mg/kg	110	50	31.8	40	24.8	48.6	29.4	31.2	42.6	39.6	44.8	41.3	37.5	7.67	2.42
	Iron (Fe)	mg/kg	40,000 ^α	52,400	45,200	57,200	32,500	58,600	41,100	43,800	51,700	48,300	52,600	51,200	48,220	7,853	2,483
	Lead (Pb)	mg/kg	91.3	35	17.0	28.3	17.0	34.2	19.1	20.8	29.9	26.5	31.2	30.1	25.4	6.37	2.01
	Lithium (Li)	mg/kg	-	-	36.7	55.1	29.0	62.2	35.9	37.3	53.7	44.4	53.2	52.5	46.0	10.8	3.42
	Magnesium (Mg)	mg/kg	-	-	16,200	18,100	10,700	22,200	14,800	15,200	20,700	18,500	20,900	20,100	17,740	3,527	1,115
	Manganese (Mn)	mg/kg	1,100 ^{α,β}	4,370	2,180	567	2,800	1,020	2,030	2,600	898	4,360	1,530	878	1,886	1,163	368
	Mercury (Hg)	mg/kg	0.486	0.17	0.0262	0.0659	0.0420	0.0669	0.0380	0.0395	0.0607	0.0416	0.0559	0.0560	0.0493	0.0136	0.00431
	Molybdenum (Mo)	mg/kg	-	-	0.78	1.04	0.78	0.89	0.89	1.21	0.93	1.34	1.19	0.95	1.00	0.19	0.06
	Nickel (Ni)	mg/kg	75 ^{α,β}	72	60.7	66.8	43.8	78.2	60.9	65.1	77.6	83	87.4	73.0	69.7	12.9	4.08
	Phosphorus (P)	mg/kg	2,000 ^α	1,580	1,460	1,490	727	1,040	1,350	1,230	1,050	1,140	1,080	987	1,155	233	74
	Potassium (K)	mg/kg	-	-	3,900	6,880	4,230	8,840	4,770	5,360	8,090	6,810	7,730	7,870	6,448	1,758	556
	Selenium (Se)	mg/kg	-	-	0.24	0.27	<0.20	0.37	0.22	0.21	0.32	0.24	0.25	0.31	0.26	0.055	0.017
	Silver (Ag)	mg/kg	-	-	<0.10	0.18	<0.10	0.2	0.13	0.12	0.18	0.17	0.19	0.17	0.15	0.038	0.012
	Sodium (Na)	mg/kg	-	-	262	488	249	520	324	361	507	470	521	483	419	108.4	34.3
	Strontium (Sr)	mg/kg	-	-	14.3	22.9	10.5	20.4	13.0	13.0	18.1	16.6	18.5	17.2	16.5	3.78	1.195
	Sulphur (S)	mg/kg	-	-	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1,000	0	0
	Thallium (Tl)	mg/kg	-	-	0.366	0.59	0.399	0.820	0.469	0.483	0.698	0.627	0.703	0.729	0.588	0.153	0.0484
	Tin (Sn)	mg/kg	-	-	<2.0	<2.0	<2.0	2.4	<2.0	<2.0	2.1	<2.0	2.2	2.4	<2.0	0.000	0.000
	Titanium (Ti)	mg/kg	-	-	1,190	1,720	1,130	2,350	1,620	1,620	2,220	2,010	2,240	2,210	1,831	443	140
	Tungsten (W)	mg/kg	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0	0
	Uranium (U)	mg/kg	-	-	4.18	10.20	6.66	13.6	7.47	7.31	11.1	8.69	10.1	10.8	9.01	2.70	0.853
	Vanadium (V)	mg/kg	-	-	56.9	80.9	49.2	99.5	60.5	62.7	87.8	77.6	88.8	87.8	75.2	16.7	5.29
	Zinc (Zn)	mg/kg	315	135	58	89	45.5	94.2	60.3	62.2	101.0	87.6	101	103.0	80.2	21.5	6.79
	Zirconium (Zr)	mg/kg	-	-	9.8	27.5	11.8	29.9	16.9	17.8	29.4	24.5	31.2	24.5	22.3	7.75	2.45

^a Canadian Sediment Quality Guideline for the protection of aquatic life, probable effects level (PEL; CCME 2015) except those indicated by α (Ontario Provincial Sediment Quality Objective [PSQO], severe effect level (SEL); OMOE 1993) and β (British Columbia Working Sediment Quality Guideline [BCSQG], probable effects level (PEL; BCMOE 2015)).

^b AEMP Sediment Quality Benchmarks developed by Intrinsic (2013) using sediment quality guidelines, background sediment quality data, and method detection limits. The indicated values are specific to Mary Lake.

Indicates parameter concentration above Sediment Quality Guideline (SQG).

BOLD

 Indicates parameter concentration above the AEMP Benchmark.

Table D.24: Magnitude of Elevation in Sediment Metal Concentrations between Mary Lake and Reference Lake 3 2018 Data, and between Mary Lake 2018 and Baseline Data, Mary River Project CREMP, 2018

Parameter	Mary Lake versus Reference Lake 3 in 2018				Mary Lake 2018 versus Baseline Period			
	Littoral Stations		Profundal Stations		Littoral Stations		Profundal Stations	
	Reference Lake Concentration (mg/kg)	Magnitude of Elevation	Reference Lake Concentration (mg/kg)	Magnitude of Elevation	Mary Lake Baseline Concentration (mg/kg)	Magnitude of Elevation	Mary Lake Baseline Concentration (mg/kg)	Magnitude of Elevation
Aluminum (Al)	17,880	1.4	24,420	1.1	18,267	1.3	17,000	1.6
Antimony (Sb)	<0.10	1.0	0.10	1.0	1.0	0.1	1.0	0.1
Arsenic (As)	5.3	1.2	6.1	0.8	2.8	2.3	3.7	1.4
Barium (Ba)	133	0.9	152	0.7	105	1.1	76	1.5
Beryllium (Be)	0.7	1.7	0.9	1.4	1.0	1.2	1.0	1.2
Bismuth (Bi)	<0.20	1.2	0.20	1.4	-	-	-	-
Boron (B)	13.9	2.3	15.6	2.2	1	43.9	2	16.5
Cadmium (Cd)	0.2	0.7	0.2	0.8	0.5	0.3	0.5	0.3
Calcium (Ca)	5,480	1.4	5,584	0.9	3,130	2.5	2,934	1.7
Chromium (Cr)	59	1.5	77	1.3	81	1.1	76	1.3
Cobalt (Co)	12	1.6	17	1.1	18	1.0	18	1.1
Copper (Cu)	74	0.5	96	0.4	45	0.8	44	0.9
Iron (Fe)	46,700	1.0	50,900	0.9	36,133	1.3	35,654	1.4
Lead (Pb)	16	1.4	20	1.3	18	1.3	21	1.2
Lithium (Li)	26	1.7	36	1.3	-	-	-	-
Magnesium (Mg)	11,104	1.6	15,394	1.1	13,967	1.3	10,903	1.6
Manganese (Mn)	640	2.4	1,279	1.5	699	2.2	991	2.0
Mercury (Hg)	0.0433	0.9	0.0650	0.8	0.100	0.4	0.100	0.5
Molybdenum (Mo)	3.838	0.2	2.570	0.4	1.0	0.9	1.0	1.0
Nickel (Ni)	43	1.6	54	1.3	67	1.0	65	1.1
Phosphorus (P)	1,305	0.9	1,188	1.0	800	1.5	1,325	0.9
Potassium (K)	4,134	1.4	5,660	1.2	3,450	1.7	4,287	1.5
Selenium (Se)	0.7	0.4	0.8	0.3	1.0	0.3	1.0	0.3
Silver (Ag)	0.1	0.9	0.3	0.6	0.3	0.5	0.4	0.4
Sodium (Na)	320	1.2	433	1.0	279	1.3	284	1.5
Strontium (Sr)	12.2	1.3	13.8	1.2	9.3	1.7	13.3	1.3
Sulphur (S)	1,780	0.6	1,400	0.7	-	-	-	-
Thallium (Tl)	0.450	1.2	0.754	0.8	1.0	0.5	1.0	0.6
Tin (Sn)	2	1.1	2	1.0	-	-	-	-
Titanium (Ti)	1,155	1.5	1,388	1.3	-	-	-	-
Tungsten (W)	1	1.0	1	1.0	-	-	-	-
Uranium (U)	13	0.6	24	0.4	-	-	-	-
Vanadium (V)	58	1.2	73	1.0	69	1.0	63	1.2
Zinc (Zn)	81	1.0	99	0.8	67	1.2	64	1.3

 Denotes slight elevation (mean parameter concentration is 3 to 5 times higher than respective mean reference lake value or baseline period).
 Denotes moderate elevation (mean parameter concentration 5 to 10 times higher than mean reference area value or baseline period value).
 Denotes high elevation (mean parameter concentration is ≥ 10 times higher than mean reference area value or baseline period value).

APPENDIX E
PHYTOPLANKTON DATA

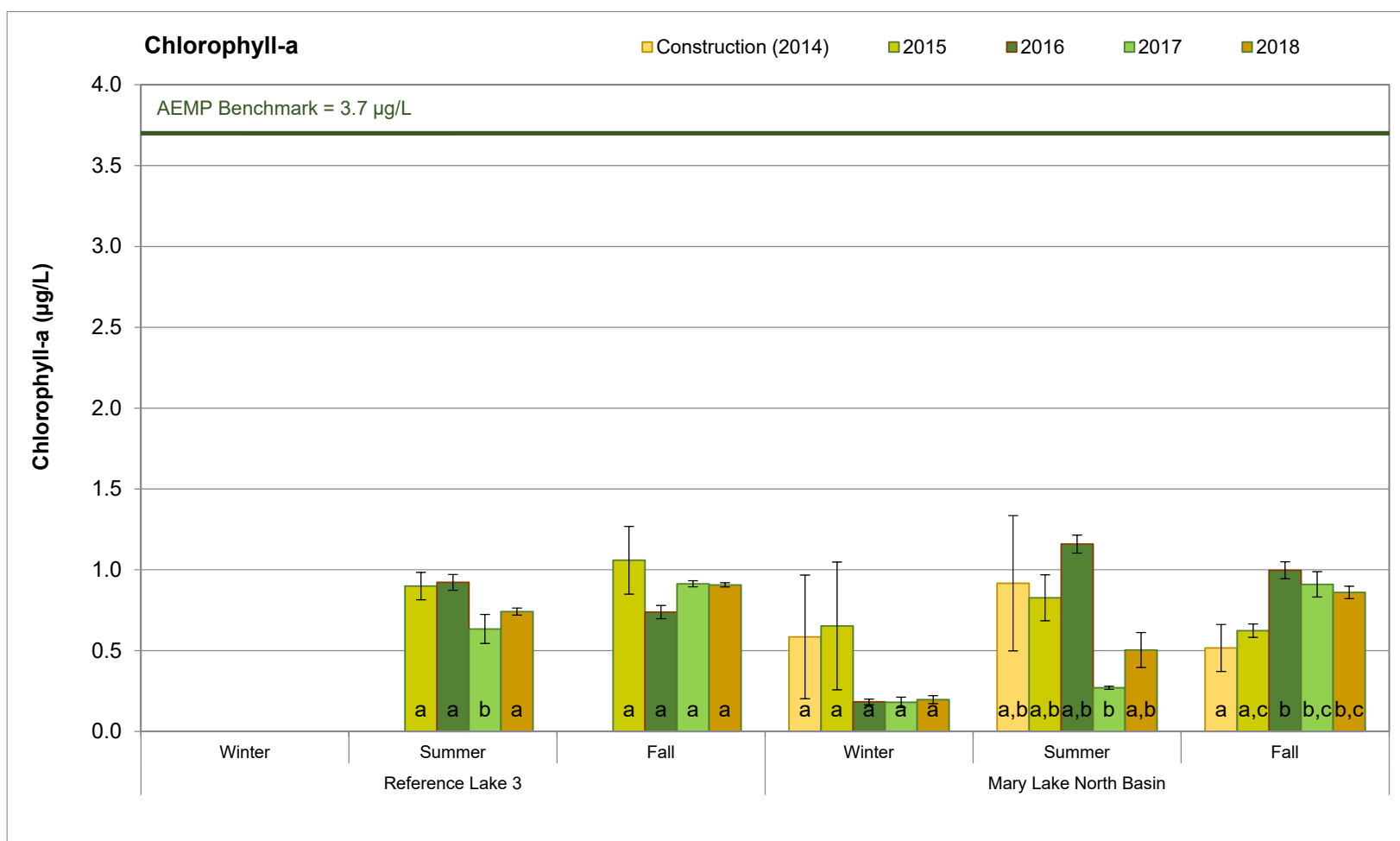


Figure E.1: Temporal Comparison of Chlorophyll-a Concentrations Among Seasons between the Mary Lake North Basin and Reference Lake 3 for Mine Construction (2014) and Operational (2015 to 2018) Periods (mean $\pm$ SE)

Note: Bars with the same letter at the base do not differ significantly between years for the applicable season.

Table E.1: Phytoplankton Monitoring Data (i.e., chlorophyll-a and phaeophytin-a concentrations) Collected at Lotic Reference Stations, Camp Lake Tributaries, Sheardown Lake Tributary 1, and Tom River, Mary River Project 2018 CREMP

Station		Reference Creek Stations				Camp Lake Tributary 1 (CLT1)						Camp Lake Tributary 2	Camp Lake Outlet	Sheardown Lake Tributary 1 (SDLT1)		Tom River
						North Branch		Main Stem								
		CLT-REF3	CLT-REF4	MRY-REF2	MRY-REF3	L1-08	L1-02	L2-03	L1-09	L1-05	L0-01	K0-01	J0-01	D1-05	D1-00	I0-01
Sample Collection Date	Spring	30-Jun-18	30-Jun-18	30-Jun-18	30-Jun-18	30-Jun-18	3-Jul-18	1-Jul-18	1-Jul-18	3-Jul-18	3-Jul-18	3-Jul-18	30-Jun-18	3-Jul-18	3-Jul-18	3-Jul-18
							10-Jul-18			10-Jul-18	10-Jul-18	10-Jul-18		10-Jul-18	10-Jul-18	
	Summer	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	10-Aug-18	1-Aug-18	1-Aug-18	1-Aug-18	1-Aug-18	1-Aug-18	10-Aug-18	1-Aug-18	1-Aug-18	1-Aug-18	
Fall	25-Aug-18	24-Aug-18	24-Aug-18	24-Aug-18	25-Aug-18	25-Aug-18	26-Aug-18	25-Aug-18	18-Aug-18	18-Aug-18	26-Aug-18	27-Aug-18	26-Aug-18	26-Aug-18	19-Aug-18	
Chlorophyll-a (µg/L)	Spring	0.24	0.28	0.36	0.19	0.13	0.18	1.47	0.36	0.22	0.18	0.17	0.60	0.21	0.12	0.13
							0.24			0.37	0.32	0.23		0.38	0.27	0.21
	Summer	0.15	0.48	0.21	0.13	0.11	0.25	0.77	0.29	0.34	0.35	0.20	1.81	0.27	0.16	0.51
	Fall	0.18	0.47	0.44	0.18	0.12	0.33	1.68	0.54	0.91	0.85	0.56	2.25	0.38	0.19	0.21
	Average	0.19	0.41	0.34	0.17	0.12	0.25	1.31	0.40	0.46	0.43	0.29	1.55	0.31	0.19	0.27
	Standard Deviation	0.05	0.11	0.12	0.03	0.01	0.06	0.48	0.13	0.31	0.29	0.18	0.85	0.08	0.06	0.17
	Standard Error	0.03	0.07	0.07	0.02	0.01	0.04	0.28	0.07	0.18	0.17	0.10	0.49	0.05	0.04	0.10
Phaeophytin-a (µg/L)	Spring	0.26	0.30	0.35	0.26	0.27	0.18	0.83	0.41	0.23	0.18	0.14	0.52	0.21	0.16	0.12
							0.28			0.35	0.29	0.24		0.33	0.28	0.24
	Summer	0.22	0.40	0.24	0.31	0.19	0.32	0.50	0.30	0.32	0.30	0.23	0.70	0.28	0.22	0.42
	Fall	0.25	0.41	0.35	0.35	0.21	0.36	0.90	0.43	0.55	0.50	0.37	0.80	0.33	0.25	0.31
	Average	0.24	0.37	0.31	0.31	0.22	0.29	0.74	0.38	0.36	0.32	0.25	0.67	0.29	0.23	0.27
	Standard Deviation	0.02	0.06	0.06	0.05	0.04	0.08	0.21	0.07	0.14	0.13	0.09	0.14	0.06	0.05	0.12
	Standard Error	0.01	0.04	0.04	0.03	0.02	0.04	0.12	0.04	0.08	0.08	0.05	0.08	0.03	0.03	0.07

Table E.2: Chlorophyll-a Concentration ($\mu\text{g/L}$) Data Summary and Statistical Comparison Results between Camp Lake Tributary 1 Main Stem Stations and Lotic Reference Creek Stations for Spring, Summer and Fall Sampling Events in 2018

Season	Two-Area Comparison			Study Area	Sample Size	Mean	Standard Deviation	Standard Error	Minimum	Maximum
	Significant Difference between Areas?	P-value	Statistical Test							
Spring	No	0.4019	β	Reference	4	0.268	0.072	0.036	0.190	0.360
				CLT1 Main Stem	6	0.487	0.488	0.199	0.180	1.470
Summer	No	0.1251	β	Reference	4	0.243	0.162	0.081	0.130	0.480
				CLT1 Main Stem	4	0.438	0.223	0.112	0.290	0.770
Fall	YES	0.0376	α	Reference	4	0.316	0.161	0.080	0.175	0.470
				CLT1 Main Stem	4	0.995	0.485	0.242	0.540	1.680

 Highlighted values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log-transformed, single factor ANOVA test conducted; γ - data untransformed, Mann-Whitney U-test conducted; ζ - data untransformed, t-test assuming unequal variance conducted; η - data log-transformed, t-test assuming unequal variance conducted.

Table E.3: Phytoplankton Monitoring Data (i.e., chlorophyll-a and phaeophytin-a concentrations) Collected at Reference Lake 3 (REF-03), Mary River Project 2018 CREMP

Analyte		Chlorophyll-a (µg/L)						Phaeophytin-a (µg/L)					
Station		REF3-01	REF3-02	REF3-03	Average	Standard Deviation	Standard Error	REF3-01	REF3-02	REF3-03	Average	Standard Deviation	Standard Error
Sample Collection Date	Summer	12-Aug-18			-	-	-	12-Aug-18			-	-	-
	Fall	27-Aug-17			-	-	-	27-Aug-17			-	-	-
Summer	Surface	0.57	0.74	0.63	0.65	0.09	0.05	0.5	0.61	0.525	0.55	0.06	0.03
	Bottom	0.77	0.86	0.88	0.84	0.06	0.03	0.51	0.53	0.64	0.56	0.07	0.04
	Average	0.67	0.80	0.76	0.74	0.07	0.04	0.51	0.57	0.58	0.55	0.04	0.02
Fall	Surface	0.88	0.86	0.87	0.87	0.01	0.01	0.56	0.56	0.56	0.56	0.00	0.00
	Bottom	1.02	0.93	0.88	0.94	0.07	0.04	0.62	0.51	0.59	0.57	0.06	0.03
	Average	0.95	0.90	0.88	0.91	0.04	0.02	0.59	0.54	0.58	0.57	0.03	0.02

Table E.4: Statistical Comparisons of Chlorophyll-a Concentrations Among Years at Reference Lake 3, Mary River Project CREMP

Season	Overall 4-group Comparison			Summary		Pair-wise, <i>post hoc</i> comparisons ^a				
	Significant Difference Among Years?	P-value	Statistical Treatment ^b	Year	Mean Concentration (mg/L)	(I) Year	(J) Year	Significant Difference Between 2 Years?	P-value	Statistical Test ^b
Summer	YES	0.0247	α	2015	0.899	2015	2016	NO	0.992	Tukey's HSD (α)
				2016	0.923	2015	2017	YES	0.050	
				2017	0.634	2015	2018	NO	0.298	
				2018	0.742	2016	2017	YES	0.034	
						2016	2018	NO	0.206	
						2017	2018	NO	0.587	
Fall	NO	0.2887	α	2015	1.059	2015	2016	NO	0.840	Tamhane's (α)
				2016	0.738	2015	2017	NO	0.993	
				2017	0.913	2015	2018	NO	0.991	
				2018	0.907	2016	2017	NO	0.230	
						2016	2018	NO	0.190	
						2017	2018	NO	1.000	

Shaded values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

^a *Post hoc* analysis of 1-way ANOVA among all areas protected for multiple comparisons.

^b Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log transformed, single factor ANOVA test conducted; γ - data non-normal, Kruskal-Wallis H-test (multiple group comparison) or Mann-Whitney U-test (pair-wise comparison) conducted, as appropriate.

Table E.5: Phytoplankton Monitoring Data (i.e., chlorophyll-a and phaeophytin-a concentrations) Collected at Camp Lake (JLO), Mary River Project CREMP, 2018

Analyte		Chlorophyll-a (µg/L)							
Station		JLO-02	JLO-10	JLO-01	JLO-07	JLO-09	Average	Standard Deviation	Standard Error
Sample Collection Date	Winter	4/13/2018	4/13/2018	4/13/2018	4/13/2018	4/14/2018	-	-	-
	Summer	7/30/2018	7/29/2018	7/30/2018	7/29/2018	7/29/2018	-	-	-
	Fall	8/21/2018	8/21/2018	8/20/2018	8/20/2018	8/20/2018	-	-	-
Winter	Surface	0.42	0.55	0.63	0.51	0.58	0.54	0.08	0.04
	Bottom	0.38	0.31	0.17	0.13	<0.17	0.23	0.11	0.05
	Average	0.40	0.43	0.40	0.32	0.37	0.38	0.04	0.02
Summer	Surface	1.88	2.02	1.98	2.10	2.10	2.02	0.09	0.04
	Bottom	2.10	1.98	1.94	1.87	2.01	1.98	0.09	0.04
	Average	1.99	2.00	1.96	1.99	2.06	2.00	0.04	0.02
Fall	Surface	2.19	2.16	2.20	2.12	2.20	2.17	0.03	0.02
	Bottom	2.22	2.15	2.03	2.12	2.12	2.13	0.07	0.03
	Average	2.20	2.16	2.12	2.12	2.16	2.15	0.04	0.02

Analyte		Phaeophytin-a (µg/L)							
Station		JLO-02	JLO-10	JLO-01	JLO-07	JLO-09	Average	Standard Deviation	Standard Error
Sample Collection Date	Winter	4/13/2018	4/13/2018	4/13/2018	4/13/2018	4/14/2018	-	-	-
	Summer	7/30/2018	7/29/2018	7/30/2018	7/29/2018	7/29/2018	-	-	-
	Fall	8/21/2018	8/21/2018	8/20/2018	8/20/2018	8/20/2018	-	-	-
Winter	Surface	0.30	0.38	0.31	0.39	0.29	0.33	0.05	0.02
	Bottom	0.29	0.33	0.26	0.21	0.20	0.26	0.06	0.02
	Average	0.30	0.36	0.29	0.30	0.24	0.30	0.04	0.02
Summer	Surface	0.90	0.92	0.89	0.98	0.89	0.92	0.04	0.02
	Bottom	0.80	0.94	0.79	1.13	1.00	0.93	0.14	0.06
	Average	0.85	0.93	0.84	1.06	0.95	0.92	0.09	0.04
Fall	Surface	0.77	0.87	0.88	0.93	0.86	0.86	0.06	0.03
	Bottom	0.97	0.91	1.01	0.87	0.84	0.92	0.07	0.03
	Average	0.87	0.89	0.95	0.90	0.85	0.89	0.04	0.02

Table E.6: Statistical Comparisons of Chlorophyll-a Concentrations Among Winter, Spring, Summer and/or Fall Sampling Events at Mine-Exposed and Reference Creek and Lake Study Areas, Mary River Project CREMP, 2018

Study Area	Overall 3-group Comparison			Pair-wise, <i>post hoc</i> comparisons ^a				
	Significant Difference Among Seasons?	P-value	Statistical Test ^b	(I) Season	(J) Season	Significant Difference Between 2 Seasons?	P-value	Statistical Test
Reference Creek Stations	NO	0.75140	ANOVA ^a	Spring	Summer	NO	0.9646	Tamhane's ^a
				Spring	Fall	NO	0.8735	
				Summer	Fall	NO	0.7381	
Mary River GO-09 Reference Stations	YES	0.00935	ANOVA ^a	Spring	Summer	YES	0.0088	Tukey's ^a
				Spring	Fall	YES	0.0383	
				Summer	Fall	NO	0.4381	
Reference Lake 3	-	-	-	Winter	Summer	not applicable		ANOVA ^a
				Winter	Fall	not applicable		
				Summer	Fall	YES	0.0203	
Camp Lake	YES	< 0.001	ANOVA ^a	Winter	Summer	YES	0.0000	Tukey's ^{a,c}
				Winter	Fall	YES	0.0000	
				Summer	Fall	YES	0.0001	
Sheardown Lake NW	YES	0.00022	ANOVA ^a	Winter	Summer	YES	0.0102	Tamhane's ^{a,c}
				Winter	Fall	YES	0.0426	
				Summer	Fall	YES	0.0679	
Sheardown Lake SE	NO	0.28874	KW H-test ^e	Winter	Summer	NO	0.2222	MW U-test ^f
				Winter	Fall	NO	0.5476	
				Summer	Fall	NO	0.3095	
Mary Lake North Basin	YES	0.00136	ANOVA ^a	Winter	Summer	YES	0.0419	Tukey's ^{a,c}
				Winter	Fall	YES	0.0011	
				Summer	Fall	YES	0.0231	
Mary Lake South Basin	YES	0.01645	ANOVA ^b	Winter	Summer	NO	0.1786	Tukey's ^b
				Winter	Fall	YES	0.0783	
				Summer	Fall	NO	0.8935	

^a *Post hoc* analysis of 1-way ANOVA among all areas protected for multiple comparisons.

^b Statistical tests include Analysis of Variance (ANOVA) and Kruskal Wallis H-test (KW H-test).

^c Untransformed data, normally distributed, used for the analysis

^d Log-transformed data, normally distributed, used for the analysis.

^e Kruskal-Wallis H-test performed using untransformed data.

^f Mann-Whitney U-test performed using untransformed data.

Table E.7: Summary Data and Statistical Results for Chlorophyll-a Concentration (mg/L) Comparisons between Individual Mine-Exposed Lakes and Reference Lake 3 for Summer Sampling, Mary River Project CREMP, 2018

Study Lake	Two-Group Comparison to Reference				Number of Stations (n)	Mean	Standard Deviation	Standard Error	95% Confidence Interval for Mean		Minimum	Maximum
	Significant Difference between Areas?	P-value	Statistical Test	Magnitude of Difference					Lower Bound	Upper Bound		
Reference Lake 03	-	-	-	-	3	0.74	0.07	0.04	0.58	0.91	0.67	0.80
Camp Lake	YES	<0.001	α	19.0	5	2.00	0.04	0.02	1.95	2.04	1.96	2.06
Sheardown Lake NW	YES	<0.001	α	19.2	6	2.01	0.18	0.07	1.81	2.20	1.71	2.21
Sheardown Lake SE	YES	<0.001	α	20.9	5	2.12	0.07	0.03	2.03	2.21	2.01	2.21
Mary Lake North	YES	<0.001	α	-3.6	3	0.50	0.19	0.11	0.04	0.97	0.35	0.71
Mary Lake South	No	0.444	α	1.6	7	0.85	0.22	0.08	0.65	1.05	0.55	1.09

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log transformed, single factor ANOVA test conducted; γ - data non-normal, test results validated using Mann-Whitney U-test; δ - data exhibit unequal variance; test results validated using t-test assuming unequal variance

^b Magnitude calculated by comparing the difference between the reference area and mine-exposed area means divided by the reference area standard deviation.

 Shaded values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

Table E.8: Summary Data and Statistical Results for Chlorophyll-a Concentration (mg/L) Comparisons between Individual Mine-Exposed Lakes and Reference Lake 3 for Fall Sampling, Mary River Project CREMP, 2018

Study Lake	Two-Group Comparison to Reference				Number of Stations (n)	Mean	Standard Deviation	Standard Error	95% Confidence Interval for Mean		Minimum	Maximum
	Significant Difference between Areas?	P-value	Statistical Test	Magnitude of Difference					Lower Bound	Upper Bound		
Reference Lake 03	-	-	-	-	3	0.91	0.04	0.02	0.81	1.00	0.88	0.95
Camp Lake	YES	<0.001	α	32.0	5	2.15	0.04	0.02	2.11	2.19	2.12	2.20
Sheardown Lake NW	YES	<0.001	α	21.8	6	1.75	0.14	0.06	1.61	1.90	1.64	2.01
Sheardown Lake SE	YES	<0.001	α	29.0	5	2.03	0.11	0.05	1.89	2.17	1.93	2.23
Mary Lake North	No	0.3514	α	-1.2	3	0.86	0.07	0.04	0.70	1.02	0.79	0.91
Mary Lake South	No	0.8952	α	-0.1	7	0.90	0.03	0.01	0.88	0.93	0.88	0.95

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log transformed, single factor ANOVA test conducted; γ - data non-normal, test results validated using Mann-Whitney U-test; δ - data exhibit unequal variance; test results validated using t-test assuming unequal variance

^b Magnitude calculated by comparing the difference between the reference area and mine-exposed area means divided by the reference area standard deviation.

 Shaded values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

Table E.9: Statistical Comparisons of Chlorophyll-a Concentrations Among Years at Camp Lake, Mary River Project CREMP

Season	Overall 5-group Comparison			Summary		Pair-wise, <i>post hoc</i> comparisons ^a				
	Significant Difference Among Years?	P-value	Statistical Treatment ^b	Year	Mean Concentration (µg/L)	(I) Year	(J) Year	Significant Difference Between 2 Years?	P-value	Statistical Test ^b
Winter	YES	0.0015	Y	2014	0.275	2014	2015	YES	0.016	Mann-Whitney U-test
						2014	2016	YES	0.032	
				2015	0.742	2014	2017	NO	0.190	
						2014	2018	NO	0.286	
				2016	0.646	2015	2016	NO	0.151	
						2015	2017	YES	0.008	
				2017	0.316	2015	2018	YES	0.008	
						2016	2017	YES	0.016	
				2018	0.385	2016	2018	YES	0.008	
						2017	2018	NO	0.151	
Summer	YES	0.0054	Y	2014	1.050	2014	2015	-	-	Mann-Whitney U-test
						2014	2016	-	-	
				2015	1.262	2014	2017	-	-	
						2014	2018	-	-	
				2016	1.503	2015	2016	NO	0.151	
						2015	2017	NO	0.548	
				2017	1.243	2015	2018	YES	0.008	
						2016	2017	NO	0.151	
				2018	1.998	2016	2018	YES	0.008	
						2017	2018	YES	0.008	

Table E.9: Statistical Comparisons of Chlorophyll-a Concentrations Among Years at Camp Lake, Mary River Project CREMP

Season	Overall 5-group Comparison			Summary		Pair-wise, <i>post hoc</i> comparisons ^a				
	Significant Difference Among Years?	P-value	Statistical Treatment ^b	Year	Mean Concentration (µg/L)	(I) Year	(J) Year	Significant Difference Between 2 Years?	P-value	Statistical Test ^b
Fall	YES	<0.0001	α	2014	1.590	2014	2015	NO	0.362	Tamhane's (α)
						2014	2016	NO	0.868	
				2015	0.651	2014	2017	NO	0.965	
						2014	2018	NO	0.824	
				2016	1.063	2015	2016	YES	0.096	
						2015	2017	YES	0.004	
				2017	1.187	2015	2018	YES	0.000	
						2016	2017	NO	0.980	
				2018	2.151	2016	2018	YES	0.003	
						2017	2018	YES	0.001	
Annual	NO	0.1704	γ	2014	1.014	2014	2015	NO	0.799	Mann-Whitney U-test
						2014	2016	NO	0.610	
				2015	0.885	2014	2017	NO	0.683	
						2014	2018	NO	0.087	
				2016	1.070	2015	2016	NO	0.217	
						2015	2017	NO	0.744	
				2017	0.915	2015	2018	NO	0.126	
						2016	2017	NO	0.486	
				2018	1.511	2016	2018	NO	0.126	
						2017	2018	NO	0.016	

Shaded values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

^a *Post hoc* analysis of 1-way ANOVA among all areas protected for multiple comparisons.

^b Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log transformed, single factor ANOVA test conducted; γ - data untransformed, Kruskal-Wallis H-test (multiple group comparison) or Mann-Whitney U-test (pair-wise comparison) conducted, as appropriate.

Table E.10: Phytoplankton Monitoring Data (i.e., chlorophyll-a and phaeophytin-a concentrations) Collected at Sheardown Lake Northwest (DLO-01), Mary River Project CREMP, 2018

Analyte		Chlorophyll-a (µg/L)								
Station		DD-HAB 9-STN1	DL0-01-5	DL0-01-1	DL0-01-4	DL0-01-2	DL0-01-7	Average	Standard Deviation	Standard Error
Sample Collection Date	Winter	4/23/2018	4/23/2018	4/22/2018	4/22/2018	4/23/2018	4/23/2018	-	-	-
	Summer	7/30/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018	-	-	-
	Fall	8/21/2018	8/22/2018	8/21/2018	8/22/2018	8/22/2018	8/22/2018	-	-	-
Winter	Surface	1.60	0.73	1.19	0.76	2.22	0.34	1.14	0.68	0.28
	Bottom	1.18	0.16	0.28	1.18	1.41	1.28	0.92	0.55	0.22
	Average	1.39	0.45	0.74	0.97	1.82	0.81	1.03	0.50	0.20
Summer	Surface	1.61	2.15	1.94	1.52	1.87	2.09	1.86	0.25	0.10
	Bottom	1.81	2.26	2.14	2.33	2.08	2.28	2.15	0.19	0.08
	Average	1.71	2.21	2.04	1.93	1.98	2.19	2.01	0.18	0.07
Fall	Surface	1.77	1.79	1.70	1.63	1.64	1.74	1.71	0.07	0.03
	Bottom	1.74	1.50	2.31	1.93	1.63	1.66	1.80	0.29	0.12
	Average	1.76	1.65	2.01	1.78	1.64	1.70	1.75	0.14	0.06

Analyte		Phaeophytin-a (µg/L)								
Station		DD-HAB 9-STN1	DL0-01-5	DL0-01-1	DL0-01-4	DL0-01-2	DL0-01-7	Average	Standard Deviation	Standard Error
Sample Collection Date	Winter	4/23/2018	4/23/2018	4/22/2018	4/22/2018	4/23/2018	4/23/2018	-	-	-
	Summer	7/30/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018	-	-	-
	Fall	8/21/2018	8/22/2018	8/21/2018	8/22/2018	8/22/2018	8/22/2018	-	-	-
Winter	Surface	0.45	0.36	0.54	0.44	0.47	0.31	0.43	0.08	0.03
	Bottom	0.36	0.24	0.28	0.60	0.51	0.66	0.44	0.17	0.07
	Average	0.41	0.30	0.41	0.52	0.49	0.49	0.44	0.08	0.03
Summer	Surface	0.84	0.76	0.96	0.95	1.03	1.13	0.95	0.13	0.05
	Bottom	0.89	1.01	1.01	1.12	1.00	1.11	1.02	0.08	0.03
	Average	0.87	0.89	0.99	1.04	1.02	1.12	0.98	0.10	0.04
Fall	Surface	0.70	0.74	0.86	0.86	0.78	0.80	0.79	0.06	0.03
	Bottom	0.85	0.93	0.93	0.68	0.76	0.88	0.84	0.10	0.04
	Average	0.78	0.84	0.90	0.77	0.77	0.84	0.81	0.05	0.02

Table E.11: Statistical Comparisons of Chlorophyll-a Concentrations Among Years at Sheardown Lake NW, Mary River Project CREMP

Season	Overall 5-group Comparison			Summary		Pair-wise, <i>post hoc</i> comparisons ^a				
	Significant Difference Among Years?	P-value	Statistical Treatment ^b	Year	Mean Concentration (µg/L)	(I) Year	(J) Year	Significant Difference Between 2 Years?	P-value	Statistical Test ^b
Winter	YES	0.0077	β	2014	2.550	2014	2015	NO	0.162	Tukey's HSD (β)
						2014	2016	YES	0.019	
				2015	1.104	2014	2017	YES	0.007	
						2014	2018	YES	0.046	
				2016	0.874	2015	2016	NO	0.847	
						2015	2017	NO	0.630	
				2017	0.790	2015	2018	NO	0.970	
						2016	2017	NO	0.995	
				2018	1.028	2016	2018	NO	0.995	
						2017	2018	NO	0.933	
Summer	YES	0.0004	α	2014	2.425	2014	2015	NO	0.342	Tamhane's (α)
						2014	2016	NO	0.998	
				2015	1.512	2014	2017	NO	0.142	
						2014	2018	NO	0.959	
				2016	2.131	2015	2016	YES	0.094	
						2015	2017	NO	0.289	
				2017	1.220	2015	2018	YES	0.030	
						2016	2017	YES	0.015	
				2018	2.007	2016	2018	NO	0.999	
						2017	2018	YES	0.000	

Table E.11: Statistical Comparisons of Chlorophyll-a Concentrations Among Years at Sheardown Lake NW, Mary River Project CREMP

Season	Overall 5-group Comparison			Summary		Pair-wise, <i>post hoc</i> comparisons ^a				
	Significant Difference Among Years?	P-value	Statistical Treatment ^b	Year	Mean Concentration (µg/L)	(I) Year	(J) Year	Significant Difference Between 2 Years?	P-value	Statistical Test ^b
Fall	YES	0.0003	β	2014	0.800	2014	2015	NO	0.250	Tamhane's (β)
						2014	2016	NO	0.290	
				2015	1.611	2014	2017	NO	0.268	
						2014	2018	NO	0.172	
				2016	1.526	2015	2016	NO	1.000	
						2015	2017	NO	1.000	
				2017	1.560	2015	2018	NO	0.982	
						2016	2017	NO	1.000	
Annual	YES	0.0885	γ	2014	1.925	2014	2015	NO	0.339	Mann-Whitney U-test
						2014	2016	NO	0.389	
				2015	1.409	2014	2017	NO	0.126	
						2014	2018	NO	0.443	
				2016	1.510	2015	2016	NO	0.501	
						2015	2017	NO	0.181	
				2017	1.190	2015	2018	YES	0.068	
						2016	2017	YES	0.064	
				2018	1.596	2016	2018	NO	0.406	
						2017	2018	YES	0.006	

Shaded values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

^a *Post hoc* analysis of 1-way ANOVA among all areas protected for multiple comparisons.

^b Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log transformed, single factor ANOVA test conducted; γ - data untransformed, Kruskal-Wallis H-test (multiple group comparison) or Mann-Whitney U-test (pair-wise comparison) conducted, as appropriate.

Table E.12: Phytoplankton Monitoring Data (i.e., chlorophyll-a and phaeophytin-a concentrations) Collected at Sheardown Lake SE (DLO-02), Mary River Project CREMP, 2018

Analyte		Chlorophyll-a (µg/L)							
Station		DL0-02-06	DL0-02-07	DL0-02-4	DL0-02-8	DL0-02-03	Average	Standard Deviation	Standard Error
Sample Collection Date	Winter	4/17/2018	4/17/2018	4/17/2018	4/17/2018	4/17/2018	-	-	-
	Summer	7/31/2018	7/31/2018	7/31/2018	7/31/2018	7/31/2018	-	-	-
	Fall	8/23/2018	8/23/2018	8/23/2018	8/23/2018	8/23/2018	-	-	-
Winter	Surface	2.27	1.86	0.64	2.34	5.84	2.59	1.94	0.87
	Bottom	1.29		2.74	1.88	1.62	1.88	0.62	0.31
	Average	1.78	1.86	1.69	2.11	3.73	2.23	0.85	0.38
Summer	Surface	2.04	2.12	2.07	2.28	2.11	2.12	0.09	0.04
	Bottom	1.97	2.14	2.16	2.13	2.18	2.12	0.08	0.04
	Average	2.01	2.13	2.12	2.21	2.15	2.12	0.07	0.03
Fall	Surface	1.92	2.02	2.03	2.06	1.83	1.97	0.10	0.04
	Bottom	2.53	2.02	1.91	1.98	2.02	2.09	0.25	0.11
	Average	2.23	2.02	1.97	2.02	1.93	2.03	0.11	0.05

Analyte		Phaeophytin-a (µg/L)							
Station		DL0-02-06	DL0-02-07	DL0-02-4	DL0-02-8	DL0-02-03	Average	Standard Deviation	Standard Error
Sample Collection Date	Winter	4/17/2018	4/17/2018	4/17/2018	4/17/2018	4/17/2018	-	-	-
	Summer	7/31/2018	7/31/2018	7/31/2018	7/31/2018	7/31/2018	-	-	-
	Fall	8/23/2018	8/23/2018	8/23/2018	8/23/2018	8/23/2018	-	-	-
Winter	Surface	0.77	0.83	0.42	1.06	1.01	0.82	0.25	0.11
	Bottom	0.60		1.01	0.80	0.81	0.81	0.17	0.08
	Average	0.69	0.83	0.72	0.93	0.91	0.81	0.11	0.05
Summer	Surface	0.89	0.85	0.82	0.88	0.92	0.87	0.04	0.02
	Bottom	0.83	0.86	0.90	0.86	0.86	0.86	0.02	0.01
	Average	0.86	0.86	0.86	0.87	0.89	0.87	0.01	0.01
Fall	Surface	0.85	0.85	0.84	0.84	0.82	0.84	0.01	0.01
	Bottom	1.04	0.80	0.92	0.87	0.83	0.89	0.10	0.04
	Average	0.95	0.82	0.88	0.86	0.83	0.87	0.05	0.02

Table E.13: Statistical Comparisons of Chlorophyll-a Concentrations Among Years at Sheardown Lake SE, Mary River Project CREMP

Season	Overall 5-group Comparison			Summary		Pair-wise, <i>post hoc</i> comparisons ^a				
	Significant Difference Among Years?	P-value	Statistical Treatment ^b	Year	Mean Concentration (µg/L)	(I) Year	(J) Year	Significant Difference Between 2 Years?	P-value	Statistical Test ^b
Winter	YES	0.0776	γ	2014	2.670	2014	2015	NO	0.151	Mann-Whitney U-test
						2014	2016	NO	0.310	
				2015	1.576	2014	2017	YES	0.056	
						2014	2018	NO	0.421	
				2016	1.903	2015	2016	NO	0.421	
						2015	2017	NO	1.000	
				2017	1.359	2015	2018	YES	0.095	
						2016	2017	NO	0.222	
				2018	2.234	2016	2018	NO	0.548	
						2017	2018	YES	0.016	
Summer	YES	0.0004	α	2014	0.203	2014	2015	YES	0.000	Tamhane's (α)
						2014	2016	YES	0.001	
				2015	0.914	2014	2017	YES	0.001	
						2014	2018	YES	0.000	
				2016	1.509	2015	2016	YES	0.019	
						2015	2017	YES	0.013	
				2017	1.366	2015	2018	YES	0.000	
						2016	2017	NO	0.948	
				2018	2.120	2016	2018	YES	0.016	
						2017	2018	YES	0.001	

Table E.13: Statistical Comparisons of Chlorophyll-a Concentrations Among Years at Sheardown Lake SE, Mary River Project CREMP

Season	Overall 5-group Comparison			Summary		Pair-wise, <i>post hoc</i> comparisons ^a				
	Significant Difference Among Years?	P-value	Statistical Treatment ^b	Year	Mean Concentration (µg/L)	(I) Year	(J) Year	Significant Difference Between 2 Years?	P-value	Statistical Test ^b
Fall	YES	0.0003	α	2014	1.540	2014	2015	NO	0.999	Tamhane's (α)
						2014	2016	NO	0.809	
				2015	0.992	2014	2017	NO	1.000	
						2014	2018	NO	1.000	
				2016	2.869	2015	2016	YES	0.043	
						2015	2017	YES	0.000	
				2017	1.496	2015	2018	YES	0.000	
						2016	2017	NO	0.129	
Annual	YES	0.0885	γ	2014	1.471	2014	2015	NO	0.683	Mann-Whitney U-test
						2014	2016	NO	0.126	
				2015	1.160	2014	2017	NO	0.461	
						2014	2018	NO	0.116	
				2016	2.094	2015	2016	YES	0.000	
						2015	2017	YES	0.010	
				2017	1.407	2015	2018	YES	0.000	
						2016	2017	YES	0.009	
				2018	2.129	2016	2018	NO	0.436	
						2017	2018	YES	0.000	

Shaded values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

^a *Post hoc* analysis of 1-way ANOVA among all areas protected for multiple comparisons.

^b Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log transformed, single factor ANOVA test conducted; γ - data untransformed, Kruskal-Wallis H-test (multiple group comparison) or Mann-Whitney U-test (pair-wise comparison) conducted, as appropriate.

Table E.14: Phytoplankton Monitoring Data (i.e., chlorophyll-a and phaeophytin-a concentrations) Collected at the Mary River, Mary River Project CREMP, 2018

	Station	Upstream Reference			Upstream Mine-Exposed							Downstream Mine-Exposed		
		G0-09-A	G0-09	G0-09-B	G0-03	G0-01	F0-01	E0-10	E0-03	E0-20	E0-21	C0-10	C0-05	C0-01
Sample Collection Date	Spring	1-Jul-18	1-Jul-18	1-Jul-18	1-Jul-18	30-Jun-18	30-Jun-18	1-Jul-18	30-Jun-18	30-Jun-18	30-Jun-18	30-Jun-18	30-Jun-18	30-Jun-18
	Summer	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	12-Aug-18	10-Aug-18
	Fall	27-Aug-18	25-Aug-18	25-Aug-18	25-Aug-18	27-Aug-18	25-Aug-18	27-Aug-18	26-Aug-18	27-Aug-18	27-Aug-18	27-Aug-18	27-Aug-18	27-Aug-18
Chlorophyll-a (µg/L)	Spring	0.38	0.32	0.25	0.20	0.21	<0.19	0.24	0.32	0.27	0.30	0.19	0.44	0.37
	Summer	0.16	0.16	0.14	0.13	0.11	0.11	0.12	0.11	0.15	0.11	1.22	0.22	0.30
	Fall	0.17	0.24	0.19	0.14	0.12	0.41	0.21	0.32	0.35	0.15	0.21	0.52	0.29
	Average	0.24	0.24	0.19	0.16	0.15	0.24	0.19	0.25	0.26	0.19	0.54	0.39	0.32
	Standard Deviation	0.12	0.08	0.06	0.04	0.06	0.16	0.06	0.12	0.10	0.10	0.59	0.16	0.04
	Standard Error	0.07	0.05	0.03	0.02	0.032	0.09	0.04	0.07	0.06	0.06	0.34	0.09	0.03
Phaeophytin-a (µg/L)	Spring	0.34	0.28	0.27	0.26	0.27	0.24	0.25	0.30	0.27	0.30	0.25	0.33	0.33
	Summer	0.31	0.28	0.27	0.24	0.27	0.19	0.31	0.28	<0.32	0.24	0.42	0.28	0.31
	Fall	0.26	0.30	0.28	0.28	0.28	0.30	0.34	0.34	0.35	<0.40	0.29	0.40	0.31
	Average	0.30	0.29	0.27	0.26	0.27	0.24	0.30	0.31	0.31	0.27	0.32	0.34	0.32
	Standard Deviation	0.04	0.01	0.01	0.02	0.01	0.06	0.05	0.03	0.04	0.04	0.09	0.06	0.01
	Standard Error	0.02	0.01	0.00	0.01	0.00	0.03	0.03	0.018	0.02	0.03	0.05	0.03	0.01

Table E.15: Phytoplankton Monitoring Data (i.e., chlorophyll-a and phaeophytin-a concentrations) Collected at Mary Lake (north and south basins; BLO), Mary River Project CREMP, 2018

Analyte		Chlorophyll-a (µg/L)												
Station		Mary Lake North			Mary Lake South							Average	Standard Deviation	Standard Error
		BL0-01A	BL0-01	BL0-01B	BL0-05-A	BL0-05	BL0-05-B	BL0-03	BL0-04	BL0-09	BL0-06			
Sample Collection Date	Winter	4/14/2018	4/14/2018	4/14/2018	4/15/2018	4/15/2018	4/15/2018	4/15/2018	4/16/2018	4/16/2018	4/15/2018	-	-	-
	Summer	8/3/2018	8/3/2018	8/3/2018	8/2/2018	8/2/2018	8/2/2018	8/2/2018	8/2/2018	8/2/2018	8/2/2018	-	-	-
	Fall	8/26/2018	8/26/2018	8/26/2018	8/25/2018	8/24/2018	8/24/2018	8/25/2018	8/25/2018	8/25/2018	8/25/2018	-	-	-
Winter	Surface	0.23	0.26	0.35	0.49	0.66	1.57	0.63	0.42	0.44	1.35	0.64	0.46	0.14
	Bottom	<0.10	<0.10	0.14	<0.10	<0.10	0.78	0.62	<0.10	<0.10	<0.10	0.22	0.25	0.08
	Average	0.17	0.18	0.25	0.30	0.38	1.18	0.63	0.26	0.27	0.73	0.43	0.32	0.10
Summer	Surface	0.27	0.45	0.37	0.56	0.36	1.03	1.16	0.96	1.02	0.90	0.71	0.34	0.11
	Bottom	0.43	0.98	0.53	0.54	0.74	1.14	0.91	0.74	0.80	1.02	0.78	0.23	0.07
	Average	0.35	0.71	0.45	0.55	0.55	1.09	1.04	0.85	0.91	0.96	0.75	0.26	0.08
Fall	Surface	0.95	1.04	0.84	0.92	0.89	0.96	0.95	0.86	0.86	0.89	0.92	0.06	0.02
	Bottom	0.62	0.78	0.93	0.85	0.86	0.90	0.94	0.91	0.95	0.92	0.87	0.10	0.03
	Average	0.79	0.91	0.89	0.89	0.88	0.93	0.95	0.89	0.91	0.91	0.89	0.04	0.01

Analyte		Phaeophytin-a (µg/L)												
Station		Mary Lake North			Mary Lake South							Average	Standard Deviation	Standard Error
		BL0-01-A	BL0-01	BL0-01-B	BL0-05-A	BL0-05	BL0-05-B	BL0-03	BL0-04	BL0-09	BL0-06			
Sample Collection Date	Winter	4/14/2018	4/14/2018	4/14/2018	4/15/2018	4/15/2018	4/15/2018	4/15/2018	4/16/2018	4/16/2018	4/15/2018	-	-	-
	Summer	8/3/2018	8/3/2018	8/3/2018	8/2/2018	8/2/2018	8/2/2018	8/2/2018	8/2/2018	8/2/2018	8/2/2018	-	-	-
	Fall	8/26/2018	8/26/2018	8/26/2018	8/25/2018	8/24/2018	8/24/2018	8/25/2018	8/25/2018	8/25/2018	8/25/2018	-	-	-
Winter	Surface	0.22	0.22	0.23	0.25	0.33	1.63	0.36	<0.10	0.11	0.56	0.40	0.45	0.14
	Bottom	0.17	0.17	0.19	0.17	0.18	0.40	0.24	<0.10	<0.10	0.19	0.19	0.08	0.03
	Average	0.20	0.20	0.21	0.21	0.26	1.02	0.30	0.10	0.11	0.38	0.30	0.27	0.08
Summer	Surface	0.25	0.29	0.30	0.46	0.32	0.74	0.78	0.90	0.85	0.73	0.56	0.26	0.08
	Bottom	0.37	0.41	0.34	0.47	0.57	0.90	0.83	0.59	0.65	0.78	0.59	0.20	0.06
	Average	0.31	0.35	0.32	0.47	0.45	0.82	0.81	0.75	0.75	0.76	0.58	0.22	0.07
Fall	Surface	0.43	0.36	0.47	0.98	0.99	1.01	1.14	1.02	0.89	1.05	0.83	0.29	0.09
	Bottom	0.39	0.40	0.34	0.90	0.88	0.88	1.01	0.98	1.06	1.02	0.79	0.29	0.09
	Average	0.41	0.38	0.41	0.94	0.94	0.94	1.08	1.00	0.98	1.04	0.81	0.29	0.09

Table E.16: Statistical Comparisons of Chlorophyll-a Concentrations Among Years at Mary Lake North, Mary River Project CREMP

Season	Overall 5-group Comparison			Summary		Pair-wise, <i>post hoc</i> comparisons ^a				
	Significant Difference Among Years?	P-value	Statistical Treatment ^b	Year	Mean Concentration (µg/L)	(I) Year	(J) Year	Significant Difference Between 2 Years?	P-value	Statistical Test ^b
Winter	NO	0.1615	γ	2014	0.585	2014	2015	NO	0.400	Mann-Whitney U-test
						2014	2016	NO	0.200	
				2015	0.653	2014	2017	NO	0.400	
						2014	2018	NO	0.400	
				2016	0.183	2015	2016	NO	0.200	
						2015	2017	NO	0.100	
				2017	0.178	2015	2018	NO	0.200	
						2016	2017	NO	1.000	
Summer	YES	0.0759	α	2014	0.917	2016	2018	NO	0.800	Tukey's HSD (α)
						2017	2018	NO	1.000	
				2015	0.827	2014	2015	NO	0.998	
						2014	2016	NO	0.913	
				2016	1.159	2014	2017	NO	0.240	
						2014	2018	NO	0.629	
				2017	0.266	2015	2016	NO	0.780	
						2015	2017	NO	0.361	
Summer	YES	0.0759	α	2017	0.266	2015	2018	NO	0.797	Tukey's HSD (α)
						2016	2017	YES	0.069	
				2018	0.504	2016	2018	NO	0.235	
						2017	2018	NO	0.918	

Table E.16: Statistical Comparisons of Chlorophyll-a Concentrations Among Years at Mary Lake North, Mary River Project CREMP

Season	Overall 5-group Comparison			Summary		Pair-wise, <i>post hoc</i> comparisons ^a				
	Significant Difference Among Years?	P-value	Statistical Treatment ^b	Year	Mean Concentration (µg/L)	(I) Year	(J) Year	Significant Difference Between 2 Years?	P-value	Statistical Test ^b
Fall	YES	0.0093	α	2014	0.517	2014	2015	NO	0.881	Tukey's HSD (α)
						2014	2016	YES	0.013	
				2015	0.623	2014	2017	YES	0.044	
						2014	2018	YES	0.081	
				2016	0.997	2015	2016	YES	0.054	
						2015	2017	NO	0.181	
				2017	0.905	2015	2018	NO	0.310	
						2016	2017	NO	0.926	
				2018	0.860	2016	2018	NO	0.759	
						2017	2018	NO	0.994	
Annual	NO	0.3640	γ	2014	0.673	2014	2015	NO	0.605	Mann-Whitney U-test
						2014	2016	NO	0.606	
				2015	0.701	2014	2017	NO	0.605	
						2014	2018	NO	0.666	
				2016	0.854	2015	2016	NO	0.481	
						2015	2017	NO	0.190	
				2017	0.450	2015	2018	NO	0.546	
						2016	2017	NO	0.074	
				2018	0.520	2016	2018	NO	0.059	
						2017	2018	NO	0.730	

Shaded values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

^a *Post hoc* analysis of 1-way ANOVA among all areas protected for multiple comparisons.

^b Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log transformed, single factor ANOVA test conducted; γ - data untransformed, Kruskal-Wallis H-test (multiple group comparison) or Mann-Whitney U-test (pair-wise comparison) conducted, as appropriate.

Table E.17: Statistical Comparisons of Chlorophyll-a Concentrations Among Years at Mary Lake South, Mary River Project CREMP

Season	Overall 5-group Comparison			Summary		Pair-wise, <i>post hoc</i> comparisons ^a				
	Significant Difference Among Years?	P-value	Statistical Treatment ^b	Year	Mean Concentration (µg/L)	(I) Year	(J) Year	Significant Difference Between 2 Years?	P-value	Statistical Test ^b
Winter	NO	0.2455	γ	2014	0.879	2014	2015	NO	0.456	Mann-Whitney U-test
						2014	2016	NO	0.805	
				2015	0.646	2014	2017	NO	0.710	
						2014	2018	NO	0.165	
				2016	0.306	2015	2016	NO	0.073	
						2015	2017	NO	0.073	
				2017	0.351	2015	2018	NO	0.535	
						2016	2017	NO	0.620	
				2018	0.533	2016	2018	NO	0.097	
						2017	2018	NO	0.456	
Summer	NO	0.3989	α	2014	0.864	2014	2015	NO	1.000	Tamhane's (α)
						2014	2016	NO	0.993	
				2015	0.789	2014	2017	NO	1.000	
						2014	2018	NO	1.000	
				2016	1.076	2015	2016	NO	0.039	
						2015	2017	NO	1.000	
				2017	0.803	2015	2018	NO	1.000	
						2016	2017	NO	0.045	
				2018	0.848	2016	2018	NO	0.413	
						2017	2018	NO	1.000	

Table E.17: Statistical Comparisons of Chlorophyll-a Concentrations Among Years at Mary Lake South, Mary River Project CREMP

Season	Overall 5-group Comparison			Summary		Pair-wise, <i>post hoc</i> comparisons ^a				
	Significant Difference Among Years?	P-value	Statistical Treatment ^b	Year	Mean Concentration (µg/L)	(I) Year	(J) Year	Significant Difference Between 2 Years?	P-value	Statistical Test ^b
Fall	NO	0.1910	γ	2014	0.750	2014	2015	NO	0.620	Mann-Whitney U-test
						2014	2016	NO	0.805	
				2015	0.895	2014	2017	NO	0.710	
						2014	2018	NO	0.209	
				2016	0.752	2015	2016	NO	0.259	
						2015	2017	NO	0.053	
				2017	0.750	2015	2018	NO	0.710	
						2016	2017	NO	1.000	
				2018	0.904	2016	2018	NO	0.209	
						2017	2018	NO	0.007	
Annual	NO	0.4764	γ	2014	0.831	2014	2015	NO	0.772	Mann-Whitney U-test
						2014	2016	NO	0.734	
				2015	0.777	2014	2017	NO	0.650	
						2014	2018	NO	0.443	
				2016	0.711	2015	2016	NO	0.811	
						2015	2017	NO	0.068	
				2017	0.634	2015	2018	NO	0.960	
						2016	2017	NO	0.385	
				2018	0.762	2016	2018	NO	0.763	
						2017	2018	NO	0.043	

Shaded values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

^a *Post hoc* analysis of 1-way ANOVA among all areas protected for multiple comparisons.

^b Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log transformed, single factor ANOVA test conducted; γ - data untransformed, Kruskal-Wallis H-test (multiple group comparison) or Mann-Whitney U-test (pair-wise comparison) conducted, as appropriate.

APPENDIX F

**BENTHIC INVERTEBRATE COMMUNITY
DATA**

Table F.1: Replicate Grab Data for Benthic Invertebrate Community Samples Collected at the Unnamed Reference Creek and Camp Lake Tributaries, Mary River Project CREMP, August 2018

Study Area	Station	Water Depth (cm)			Water Velocity (m/s)			Embeddedness			In-Stream Vegetation			Algae Presence		
		Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3
Unnamed Reference Creek	REF-CRK-B1	10	10	10	0.42	0.41	0.42	25%	25%	25%	scarce	scarce	scarce	scarce	scarce	scarce
	REF-CRK-B2	9	9	11	0.52	0.48	0.42	25%	25%	25%	scarce	scarce	scarce	scarce	common	common
	REF-CRK-B3	17	17	10	0.55	0.46	0.55	25%	25%	25%	scarce	scarce	scarce	common	common	common
	REF-CRK-B4	10	12	10	0.45	0.45	0.60	25%	25%	25%	scarce	common	scarce	common	common	common
	REF-CRK-B5	12	14	14	0.41	0.47	0.59	25%	25%	25%	scarce	scarce	scarce	common	common	common
Camp Lake Tributary 1 Upstream	CLT-1-US-B1	10	10	10	0.45	0.48	0.39	13%	25%	38%	scarce	scarce	scarce	common	common	scarce
	CLT-1-US-B2	10	12	14	0.32	0.43	0.51	25%	38%	38%	scarce	scarce	scarce	common	common	scarce
	CLT-1-US-B3	15	10	12	0.43	0.39	0.37	25%	50%	50%	scarce	common	scarce	scarce	scarce	scarce
	CLT-1-US-B4	8	13	9	0.39	0.40	0.31	25%	14%	25%	scarce	common	scarce	scarce	common	scarce
	CLT-1-US-B5	10	9	8	0.62	0.43	0.38	50%	50%	50%	common	scarce	none	scarce	scarce	scarce
Camp Lake Tributary 1 Downstream	CLT-1-DS-B1	15	17	16	0.53	0.51	0.53	25%	13%	25%	scarce	scarce	scarce	scarce	scarce	scarce
	CLT-1-DS-B2	13	14	15	-	-	-	25%	25%	38%	scarce	none	none	common	scarce	scarce
	CLT-1-DS-B3	13	13	15	-	-	-	25%	25%	25%	scarce	none	none	common	scarce	common
	CLT-1-DS-B4	13	15	16	-	-	-	38%	25%	38%	scarce	none	common	common	common	common
	CLT-1-DS-B5	13	15	16	-	-	-	25%	25%	25%	scarce	scarce	scarce	scarce	common	scarce
Camp Lake Tributary 2 Upstream	CLT-2-US-B1	22	20	14	0.42	0.52	0.50	25%	50%	50%	none	none	scarce	none	none	scarce
	CLT-2-US-B2	15	16	18	0.53	0.50	0.46	25%	75%	25%	none	none	none	none	none	scarce
	CLT-2-US-B3	19	11	15	0.42	0.42	0.41	25%	25%	50%	none	scarce	none	scarce	scarce	scarce
	CLT-2-US-B4	16	8	10	0.39	0.45	0.40	13%	13%	38%	scarce	scarce	none	scarce	scarce	scarce
	CLT-2-US-B5	8	10	8	0.42	0.51	0.39	0%	13%	13%	none	none	none	scarce	scarce	scarce
Camp Lake Tributary 2 Downstream	CLT-2-DS-B1	15	19	11	0.46	0.58	0.44	50%	75%	25%	scarce	none	none	common	common	scarce
	CLT-2-DS-B2	12	13	13	0.53	0.51	0.55	25%	25%	50%	scarce	scarce	none	scarce	scarce	scarce
	CLT-2-DS-B3	16	16	14	0.41	0.52	0.42	25%	25%	50%	none	none	none	scarce	scarce	scarce
	CLT-2-DS-B4	18	17	11	0.50	0.45	0.48	50%	50%	25%	none	none	none	scarce	scarce	scarce
	CLT-2-DS-B5	15	13	14	0.42	0.42	0.56	50%	25%	25%	none	none	none	none	none	scarce

Table F.2: Replicate Station Habitat Feature Summary Statistics for the Camp Lake Tributary Benthic Stations, Mary River Project CREMP, August 2018

Metric	Study Area	Sample Size	Mean	Standard Deviation	Standard Error	95% Confidence Interval		Minimum	Maximum
						Lower Bound	Upper Bound		
Water Depth (cm)	Unnamed Reference Creek	5	11.7	2.2	1.0	8.9	14.4	9.7	14.7
	CLT1-US North Branch	5	10.7	1.4	0.6	8.9	12.4	9.0	12.3
	CLT1-DS Lower Main Stem	5	14.6	0.9	0.4	13.5	15.7	13.7	16.0
	CLT2-US Upstream	5	9.1	1.7	0.8	7.0	11.2	7.3	11.0
	CLT2-DS Downstream	5	8.7	0.9	0.4	7.5	9.8	7.3	9.7
Water Velocity (cm/s)	Unnamed Reference Creek	5	48.0	3.9	1.8	43.1	52.9	41.7	52.0
	CLT1-US North Branch	5	42.0	4.2	1.9	36.8	47.2	36.7	47.7
	CLT1-DS Lower Main Stem	1	52.3	-	-	-	-	52.3	52.3
	CLT2-US Upstream	5	49.5	4.1	1.8	44.4	54.6	44.7	55.3
	CLT2-DS Downstream	5	44.9	1.5	0.7	43.0	46.8	42.3	46.3
Substrate Embeddedness (%)	Unnamed Reference Creek	5	25	0	0	25	25	25	25
	CLT1-US North Branch	5	34	12	5	20	49	21	50
	CLT1-DS Lower Main Stem	5	27	5	2	21	33	21	33
	CLT2-US Upstream	5	62	5	2	56	69	58	71
	CLT2-DS Downstream	5	60	6	3	53	67	52	67

Note: Five stations were sampled at each study area.

Table F.3: Benthic Station Habitat Feature Statistical Comparisons among Camp Lake Tributary 1 and Unnamed Reference Creek Study Areas, Mary River Project CREMP, August 2018

Metric	Overall 3-group Comparison			Pair-wise, post-hoc comparisons ^a				
	Significant Difference Among Areas?	P-value	Statistical Test ^b	(I) Area	(J) Area	Significant Difference Between 2 Areas?	P-value	Statistical Test
Water Depth (cm)	YES	0.0060	α	Unnamed Reference Creek	CLT1 Upstream	No	0.8097	Tamhane's
				Unnamed Reference Creek	CLT1 Downstream	No	0.1099	
				CLT1 Upstream	CLT1 Downstream	YES	0.0043	
Water Velocity (cm/s)	not applicable data available for only two study areas			Unnamed Reference Creek	CLT1 Upstream	YES	0.0475	α
				Unnamed Reference Creek	CLT1 Downstream	-	na	
				CLT1 Upstream	CLT1 Downstream	-	na	
Substrate Embeddedness (%)	NO	0.1499	α	Unnamed Reference Creek	CLT1 Upstream	No	0.3990	Tamhane's
				Unnamed Reference Creek	CLT1 Downstream	No	0.8566	
				CLT1 Upstream	CLT1 Downstream	No	0.5601	

Note: Shading indicates a significant difference for respective comparison (p-value ≤ 0.1).

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

^b Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log-transformed, single factor ANOVA test conducted; γ - Kruskal-Wallis H-test (multiple group) or Mann-Whitney U-test (pair-wise) conducted using untransformed data; ζ - data untransformed, t-test assuming unequal variance used; η - data log transformed, t-test assuming unequal variance used.

Table F.4: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Unnamed Reference Creek Study Area, August 2018

Taxa	Study Area Replicate Station	Unnamed Reference Creek				
		B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		25	29	57	14	36
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		-	-	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Sperchonidae						
Sperchon		14	11	22	14	18
SEED SHRIMPS						
Cl. Ostracoda		-	4	7	7	7
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
Acentrella feropagus		25	50	36	11	29
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature		7	7	4	-	-
TRUE FLIES						
O. Diptera						
BITING-MIDGE						
F. Ceratopogonidae						
Culicoides		32	4	-	14	4
MIDGES						
F. Chironomidae						
chironomid pupae		25	4	11	4	14
S.F. Chironominae						
Tanytarsus		4	-	-	-	-
S.F. Diamesinae						
Diamesa		97	36	32	18	39
Pseudokiefferiella		11	29	36	-	32
S.F. Orthoclaadiinae						
Chaetocladius		-	11	-	-	11
Corynoneura		-	-	4	-	-
Cricotopus		-	4	4	-	-
Cricotopus/Orthocladus		-	4	14	-	14
Diplocladius		-	-	-	-	-
Eukiefferiella		29	7	11	-	-
Hydrobaenus		-	4	4	-	4
Hydrosmittia		-	-	7	-	-
Krenosmittia		-	-	-	-	-
Limnophyes		133	57	86	39	29
Orthocladus (Euorthocladus)		36	47	50	29	25

Table F.4: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Unnamed Reference Creek Study Area, August 2018

Taxa	Study Area Replicate Station	Unnamed Reference Creek				
		B1	B2	B3	B4	B5
<i>Paraphaenocladus</i>		-	4	-	-	-
<i>Synorthocladus</i>		-	-	-	-	-
<i>Thienemanniella</i>		7	32	22	22	50
<i>Tokunagaia</i>		65	90	86	25	90
<i>Tvetenia</i>		18	11	-	7	18
indeterminate		-	-	-	-	-
S.F. Tanypodinae						
<i>Thienemannimyia complex</i>		-	-	-	-	4
F. Empididae						
<i>Clinocera</i>		11	18	11	4	7
pupae		-	-	-	-	-
F. Simuliidae						
<i>Gymnopsis</i>		-	4	-	4	-
<i>Metacnephia</i>		50	32	47	32	61
<i>Prosimulium</i>		36	25	36	14	65
<i>Simulium</i>		-	-	-	-	-
indeterminate		-	-	-	-	-
F. Tipulidae						
<i>Tipula</i>		11	22	29	4	11
Number of Organisms (No. organisms per m²)		636	546	616	262	568
Richness (total number of taxa)^a		18	24	21	16	20
Simpson's Evenness (E)		0.942	0.961	0.963	0.972	0.964
Bray-Curtis Index		0.262	0.114	0.144	0.342	0.175
Percent Composition						
% Nemata		3.9%	5.3%	9.3%	5.3%	6.3%
% Oligochaeta		0.0%	0.0%	0.0%	0.0%	0.0%
% Hydracarina		2.2%	2.0%	3.6%	5.3%	3.2%
% Ostracods		0.0%	0.7%	1.1%	2.7%	1.2%
% Ephemeroptera		3.9%	9.2%	5.8%	4.2%	5.1%
% Chironomids		66.8%	62.3%	59.6%	55.0%	58.1%
% Metal Sensitive Chironomids		18.7%	12.1%	11.4%	6.9%	13.0%
% Simuliidae		13.5%	11.2%	13.5%	19.1%	22.2%
% Tipulidae		1.7%	4.0%	4.7%	1.5%	1.9%
Functional Feeding Group Composition						
% Collector - Gatherers		74.1%	76.0%	72.9%	67.2%	67.4%
% Filterers		14.2%	11.2%	13.5%	19.1%	22.2%
% Shredders		2.8%	6.8%	8.3%	1.5%	4.6%
Habitat Preference Group Composition						
% Clingers		18.1%	17.9%	21.8%	26.0%	29.2%
% Sprawlers		71.2%	72.0%	64.3%	61.8%	61.8%
% Burrowers		10.7%	10.1%	14.0%	12.2%	9.0%

^a Bold entries excluded from taxa count

Table F.5: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake Tributary 1 Study Areas, August 2018

Taxa	Study Area Replicate Station	North Branch Upstream (CLT1-US)				
		B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		14	43	7	36	11
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		7	43	14	22	7
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Sperchonidae						
Sperchon		47	122	57	108	39
SEED SHRIMPS						
Cl. Ostracoda		-	-	-	-	-
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
Acentrella feropagus		22	-	14	14	14
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature		4	-	-	-	-
TRUE FLIES						
O. Diptera						
BITING-MIDGE						
F. Ceratopogonidae						
Culicoides		-	-	-	-	-
MIDGES						
F. Chironomidae						
chironomid pupae		61	100	129	57	47
S.F. Chironominae						
Tanytarsus		-	-	-	-	-
S.F. Diamesinae						
Diamesa		7	14	-	7	7
Pseudokiefferiella		104	187	251	337	190
S.F. Orthocladiinae						
Chaetocladius		-	-	-	-	4
Corynoneura		-	-	-	-	-
Cricotopus		29	93	158	115	61
Cricotopus/Orthocladius		319	782	337	337	118
Diplocladius		-	-	-	-	-
Eukiefferiella		11	-	-	-	-
Hydrobaenus		-	129	7	36	22
Hydrosmittia		18	151	201	172	100
Krenosmittia		-	-	-	7	7
Limnophyes		7	29	7	7	-
Orthocladius (Euorthocladius)		7	36	244	194	79
Paraphaenocladius		-	-	-	-	-
Synorthocladius		-	-	-	7	-

Table F.5: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake Tributary 1 Study Areas, August 2018

Taxa	Study Area Replicate Station	North Branch Upstream (CLT1-US)				
		B1	B2	B3	B4	B5
<i>Thienemanniella</i>		7	-	14	-	-
<i>Tokunagaia</i>		11	151	57	22	47
<i>Tvetenia</i>		39	72	43	122	111
indeterminate		-	-	-	-	-
S.F. Tanypodinae						
<i>Thienemannimyia complex</i>		-	-	-	-	-
F. Empididae						
<i>Clinocera</i>		-	14	-	7	4
pupae		-	-	-	-	-
F. Simuliidae						
<i>Gymnopaia</i>		-	-	7	7	-
<i>Metacnephia</i>		-	-	-	-	-
<i>Prosimulium</i>		-	-	-	-	-
<i>Simulium</i>		-	-	7	-	-
indeterminate		-	-	-	7	7
F. Tipulidae						
<i>Tipula</i>		47	22	7	57	32
Number of Organisms (No. organisms per m²)		761	1,988	1,561	1,678	907
Richness (total number of taxa)^a		17	15	17	19	18
Simpson's Evenness (E)		0.792	0.845	0.899	0.917	0.931
Bray-Curtis Index		0.743	0.769	0.792	0.817	0.717
Percent Composition						
% Nemata		1.8%	2.2%	0.4%	2.1%	1.2%
% Oligochaeta		0.9%	2.2%	0.9%	1.3%	0.8%
% Hydracarina		6.2%	6.1%	3.7%	6.4%	4.3%
% Ostracods		0.0%	0.0%	0.0%	0.0%	0.0%
% Ephemeroptera		2.9%	0.0%	0.9%	0.8%	1.5%
% Chironomids		81.5%	87.7%	92.8%	84.6%	87.4%
% Metal Sensitive Chironmids		16.2%	10.7%	17.7%	21.3%	23.0%
% Simuliidae		0.0%	0.0%	0.9%	0.8%	0.8%
% Tipulidae		6.2%	1.1%	0.4%	3.4%	3.5%
Functional Feeding Group Composition						
% Collector - Gatherers		36.4%	45.3%	60.2%	60.8%	70.0%
% Filterers		0.0%	0.0%	0.9%	0.8%	0.8%
% Shredders		57.4%	47.8%	35.2%	31.5%	24.5%
Habitat Preference Group Composition						
% Clingers		56.9%	53.6%	39.3%	35.8%	26.5%
% Sprawlers		34.2%	41.0%	58.9%	57.4%	68.0%
% Burrowers		8.9%	5.4%	1.8%	6.9%	5.5%

^a Bold entries excluded from taxa count

Table F.5: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake Tributary 1 Study Areas, August 2018

Taxa	Study Area	Lower Main Stem (CLT1-DS)				
	Replicate Station	B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		11	32	7	7	36
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		4	18	-	11	14
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Sperchonidae						
Sperchon		14	11	29	39	50
SEED SHRIMPS						
Cl. Ostracoda		-	-	4	-	-
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
Acentrella feropagus		7	-	4	-	-
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature		-	-	-	-	-
TRUE FLIES						
O. Diptera						
BITING-MIDGE						
F. Ceratopogonidae						
Culicoides		-	-	-	-	-
MIDGES						
F. Chironomidae						
chironomid pupae		86	93	133	165	208
S.F. Chironominae						
Tanytarsus		-	-	-	-	-
S.F. Diamesinae						
Diamesa		-	4	4	7	7
Pseudokiefferiella		47	86	14	39	22
S.F. Orthoclaadiinae						
Chaetocladius		-	-	-	-	-
Corynoneura		-	-	-	-	-
Cricotopus		36	18	18	90	72
Cricotopus/Orthocladus		65	122	147	251	115
Diplocladius		-	-	-	-	-
Eukiefferiella		-	-	-	-	-
Hydrobaenus		-	4	-	-	-
Hydrosmittia		100	133	97	431	323
Krenosmittia		4	-	-	4	-
Limnophyes		4	-	-	11	14
Orthocladus (Euorthocladus)		7	25	25	65	22
Paraphaenocladus		-	-	-	-	-
Synorthocladus		-	-	-	-	-

Table F.5: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake Tributary 1 Study Areas, August 2018

Taxa	Study Area	Lower Main Stem (CLT1-DS)				
	Replicate Station	B1	B2	B3	B4	B5
<i>Thienemanniella</i>		-	-	-	-	-
<i>Tokunagaia</i>		11	-	-	7	-
<i>Tvetenia</i>		32	50	32	50	57
indeterminate		-	-	-	-	-
S.F. Tanypodinae						
<i>Thienemannimyia complex</i>		-	-	-	-	-
F. Empididae						
<i>Clinocera</i>		4	11	4	4	7
pupae		-	-	-	-	-
F. Simuliidae						
<i>Gymnopaia</i>		-	-	-	4	-
<i>Metacnephia</i>		-	7	4	-	-
<i>Prosimulium</i>		-	-	-	-	-
<i>Simulium</i>		-	-	-	-	-
indeterminate		-	-	-	-	-
F. Tipulidae						
<i>Tipula</i>		43	25	39	25	22
Number of Organisms (No. organisms per m²)		475	639	561	1,210	969
Richness (total number of taxa)^a		15	14	14	16	13
Simpson's Evenness (E)		0.912	0.903	0.848	0.800	0.819
Bray-Curtis Index		0.752	0.729	0.764	0.826	0.778
Percent Composition						
% Nemata		2.3%	5.0%	1.2%	0.6%	3.7%
% Oligochaeta		0.8%	2.8%	0.0%	0.9%	1.4%
% Hydracarina		2.9%	1.7%	5.2%	3.2%	5.2%
% Ostracods		0.0%	0.0%	0.7%	0.0%	0.0%
% Ephemeroptera		1.5%	0.0%	0.7%	0.0%	0.0%
% Chironomids		82.5%	83.7%	83.8%	92.6%	86.7%
% Metal Sensitive Chironmids		12.6%	17.1%	4.6%	4.5%	3.9%
% Simuliidae		0.0%	1.1%	0.7%	0.3%	0.0%
% Tipulidae		9.1%	3.9%	7.0%	2.1%	2.3%
Functional Feeding Group Composition						
% Collector - Gatherers		60.0%	65.1%	45.5%	61.0%	66.2%
% Filterers		0.0%	1.1%	0.7%	0.3%	0.0%
% Shredders		36.2%	30.4%	48.0%	35.1%	28.0%
Habitat Preference Group Composition						
% Clingers		30.9%	31.0%	47.6%	36.9%	31.6%
% Sprawlers		56.8%	57.3%	44.2%	59.5%	61.0%
% Burrowers		12.2%	11.7%	8.2%	3.6%	7.4%

^a Bold entries excluded from taxa count

Table F.6: Benthic Invertebrate Community Summary Statistics for Camp Lake Tributary 1 Study Areas, Mary River Project CREMP, August 2018

Metric	Area	Mean	Standard Deviation	Standard Error	95% Confidence Interval		Minimum	Maximum
					Lower Bound	Upper Bound		
Density (no. organisms / m ²)	Unnamed Reference Creek	526	152	68	337	714	262	636
	CLT1 Upstream	1,379	524	234	728	2,030	761	1,988
	CLT1 Downstream	771	309	138	388	1,154	475	1,210
Richness (Number of Taxa)	Unnamed Reference Creek	19.8	3.0	1.4	16.0	23.6	16.0	24.0
	CLT1 Upstream	17.2	1.5	0.7	15.4	19.0	15.0	19.0
	CLT1 Downstream	14.4	1.1	0.5	13.0	15.8	13.0	16.0
Simpson's Evenness	Unnamed Reference Creek	0.960	0.011	0.005	0.946	0.974	0.942	0.972
	CLT1 Upstream	0.877	0.058	0.026	0.805	0.949	0.792	0.931
	CLT1 Downstream	0.857	0.050	0.022	0.795	0.919	0.800	0.912
Bray-Curtis Index	Unnamed Reference Creek	0.208	0.093	0.042	0.092	0.324	0.114	0.342
	CLT1 Upstream	0.767	0.039	0.018	0.719	0.816	0.717	0.817
	CLT1 Downstream	0.770	0.036	0.016	0.725	0.815	0.729	0.826
Nemata (% of community)	Unnamed Reference Creek	6.0%	2.0%	0.9%	3.6%	8.5%	3.9%	9.3%
	CLT1 Upstream	1.6%	0.7%	0.3%	0.7%	2.5%	0.4%	2.2%
	CLT1 Downstream	2.6%	1.8%	0.8%	0.3%	4.8%	0.6%	5.0%
Oligochaeta (% of community)	Unnamed Reference Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	CLT1 Upstream	1.2%	0.6%	0.3%	0.5%	1.9%	0.8%	2.2%
	CLT1 Downstream	1.2%	1.0%	0.5%	-0.1%	2.5%	0.0%	2.8%
Hydracarina (% of community)	Unnamed Reference Creek	3.3%	1.3%	0.6%	1.6%	4.9%	2.0%	5.3%
	CLT1 Upstream	5.3%	1.3%	0.6%	3.8%	6.9%	3.7%	6.4%
	CLT1 Downstream	3.6%	1.5%	0.7%	1.8%	5.5%	1.7%	5.2%
Ostracoda (% of community)	Unnamed Reference Creek	1.2%	1.0%	0.4%	-0.1%	2.4%	0.0%	2.7%
	CLT1 Upstream	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	CLT1 Downstream	0.1%	0.3%	0.1%	-0.3%	0.5%	0.0%	0.7%
Ephemeroptera (% of community)	Unnamed Reference Creek	5.6%	2.1%	0.9%	3.0%	8.3%	3.9%	9.2%
	CLT1 Upstream	1.2%	1.1%	0.5%	-0.1%	2.6%	0.0%	2.9%
	CLT1 Downstream	0.4%	0.7%	0.3%	-0.4%	1.3%	0.0%	1.5%
Chironomidae (% of community)	Unnamed Reference Creek	60.3%	4.5%	2.0%	54.8%	65.9%	55.0%	66.8%
	CLT1 Upstream	86.8%	4.2%	1.9%	81.6%	92.0%	81.5%	92.8%
	CLT1 Downstream	85.9%	4.0%	1.8%	80.8%	90.9%	82.5%	92.6%
Metal-Sensitive Chironomidae (% of community)	Unnamed Reference Creek	12.4%	4.2%	1.9%	7.1%	17.7%	6.9%	18.7%
	CLT1 Upstream	17.8%	4.8%	2.2%	11.8%	23.8%	10.7%	23.0%
	CLT1 Downstream	8.6%	6.0%	2.7%	1.2%	16.0%	3.9%	17.1%
Simuliidae (% of community)	Unnamed Reference Creek	15.9%	4.6%	2.0%	10.2%	21.6%	11.2%	22.2%
	CLT1 Upstream	0.5%	0.5%	0.2%	-0.1%	1.1%	0.0%	0.9%
	CLT1 Downstream	0.4%	0.5%	0.2%	-0.2%	1.0%	0.0%	1.1%
Tipulidae (% of community)	Unnamed Reference Creek	2.8%	1.5%	0.7%	1.0%	4.6%	1.5%	4.7%
	CLT1 Upstream	2.9%	2.3%	1.0%	0.1%	5.7%	0.4%	6.2%
	CLT1 Downstream	4.9%	3.1%	1.4%	1.1%	8.6%	2.1%	9.1%
Collector-Gatherer FFG (% of community)	Unnamed Reference Creek	71.5%	4.0%	1.8%	66.5%	76.5%	67.2%	76.0%
	CLT1 Upstream	54.6%	13.5%	6.0%	37.8%	71.3%	36.4%	70.0%
	CLT1 Downstream	59.5%	8.3%	3.7%	49.2%	69.8%	45.5%	66.2%
Filterer FFG (% of community)	Unnamed Reference Creek	16.0%	4.5%	2.0%	10.4%	21.6%	11.2%	22.2%
	CLT1 Upstream	0.5%	0.5%	0.2%	-0.1%	1.1%	0.0%	0.9%
	CLT1 Downstream	0.4%	0.5%	0.2%	-0.2%	1.0%	0.0%	1.1%
Shredder FFG (% of community)	Unnamed Reference Creek	4.8%	2.8%	1.2%	1.4%	8.2%	1.5%	8.3%
	CLT1 Upstream	39.3%	13.2%	5.9%	22.9%	55.7%	24.5%	57.4%
	CLT1 Downstream	35.5%	7.7%	3.5%	25.9%	45.1%	28.0%	48.0%
Clinger HPG (% of community)	Unnamed Reference Creek	22.6%	4.9%	2.2%	16.4%	28.7%	17.9%	29.2%
	CLT1 Upstream	42.4%	12.7%	5.7%	26.7%	58.1%	26.5%	56.9%
	CLT1 Downstream	35.6%	7.2%	3.2%	26.7%	44.5%	30.9%	47.6%
Sprawler HPG (% of community)	Unnamed Reference Creek	66.2%	5.0%	2.2%	60.0%	72.5%	61.8%	72.0%
	CLT1 Upstream	51.9%	13.9%	6.2%	34.6%	69.1%	34.2%	68.0%
	CLT1 Downstream	55.8%	6.7%	3.0%	47.5%	64.1%	44.2%	61.0%
Burrower HPG (% of community)	Unnamed Reference Creek	11.2%	1.9%	0.9%	8.8%	13.6%	9.0%	14.0%
	CLT1 Upstream	5.7%	2.6%	1.2%	2.5%	8.9%	1.8%	8.9%
	CLT1 Downstream	8.6%	3.5%	1.6%	4.2%	13.0%	3.6%	12.2%

Table F.7: Statistical Comparison of Primary and Percent Compositional Benthic Metrics at Camp Lake Tributary 1 North Branch (CLT1 US) Among Years of Mine Operation (2015 to 2018) and Baseline (2007, 2011) for the Mary River Project CREMP

Metric	Data Transform-ation	Overall 6-Year Comparison		Pair-wise, post-hoc comparisons ^a							
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size		Pairwise Comparison	Statistical Test
								vs. Baseline Year 2007	vs. Baseline Year 2011		
Density (No. per m ²)	none	NO	0.1864	2007	3	505	330	-	-3.2	a	Tukey's HSD
				2011	3	949	139	1.3	-	a	
				2015	5	1,446	836	2.9	3.6	a	
				2016	5	1,610	806	3.4	4.8	a	
				2017	5	1,242	143	2.2	2.1	a	
				2018	5	1,379	524	2.7	3.1	a	
Richness (No. of Taxa)	none	YES	0.0318	2007	3	13.7	2.3	-	-0.3	a	Mann-Whitney U-test
				2011	3	14.3	2.1	0.3	-	a	
				2015	5	15.0	2.7	0.6	0.3	a,c	
				2016	5	14.0	2.6	0.1	-0.2	a	
				2017	5	19.2	2.6	2.4	2.3	b,c	
				2018	5	17.2	1.5	1.5	1.4	c	
Simpson's Evenness	none	YES	0.0009	2007	3	0.749	0.082	-	-3.0	a	Tukey's HSD
				2011	3	0.874	0.042	1.5	-	b	
				2015	5	0.899	0.037	1.8	0.6	b	
				2016	5	0.908	0.032	1.9	0.8	b	
				2017	5	0.925	0.019	2.1	1.2	b	
				2018	5	0.877	0.058	1.6	0.1	b	
Nemata (% of community)	modified probit	YES	0.0013	2007	3	0.1	0.3	-	-0.7	a	Tamhane's
				2011	3	0.7	0.8	2.1	-	a	
				2015	5	1.7	0.7	6.0	1.3	a	
				2016	5	1.3	0.5	4.5	0.8	a	
				2017	5	4.1	2.1	15.4	4.4	a	
				2018	5	1.6	0.7	5.5	1.1	a	
Oligochaeta (% of community)	none	NO	0.6918	2007	3	1.5	2.1	-	1.4	a	Mann-Whitney U-test
				2011	3	0.7	0.5	-0.3	-	a	
				2015	5	1.4	1.3	0.0	1.3	a	
				2016	5	1.5	0.6	0.0	1.5	a	
				2017	5	1.1	1.3	-0.2	0.7	a	
				2018	5	1.2	0.6	-0.1	0.9	a	
Hydracarina (% of community)	none	YES	0.0000	2007	3	0.8	1.0	-	-2.0	a	Tukey's HSD
				2011	3	14.4	6.7	13.3	-	a,b,c	
				2015	5	2.3	1.7	1.5	-1.8	a,c	
				2016	5	9.8	3.2	8.8	-0.7	b,d	
				2017	5	7.6	1.1	6.7	-1.0	b,d	
				2018	5	5.3	1.3	4.4	-1.4	c,d	
Chironomidae (% of community)	none	YES	0.0024	2007	3	88.1	7.1	-	2.3	a,d	Tukey's HSD
				2011	3	76.3	5.1	-1.7	-	a,b,c,d	
				2015	5	75.6	7.5	-1.8	-0.1	a,b,c,d	
				2016	5	68.6	10.6	-2.7	-1.5	b,c	
				2017	5	74.0	1.7	-2.0	-0.5	c	
				2018	5	86.8	4.2	-0.2	2.1	d	
Metal Sensitive Taxa (% of community)	none	NO	0.2747	2007	3	3.7	3.6	-	-1.1	a	Tukey's HSD
				2011	3	10.8	6.6	2.0	-	a	
				2015	5	12.7	14.0	2.5	0.3	a	
				2016	5	9.1	9.0	1.5	-0.3	a	
				2017	5	7.2	5.2	1.0	-0.5	a	
				2018	5	17.8	4.8	3.9	1.1	a	
Tipulidae (% of community)	none	YES	0.0087	2007	3	8.9	4.1	-	0.9	a,b,c	Tukey's HSD
				2011	3	6.9	2.1	-0.5	-	a,b,c	
				2015	5	16.8	4.7	2.0	4.6	a,b	
				2016	5	16.9	11.8	2.0	4.7	b	
				2017	5	8.4	1.5	-0.1	0.7	a,b,c	
				2018	5	2.9	2.3	-1.5	-1.9	c	

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study ye

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.8: Statistical Comparison of Functional Feeding Group (FFG) Benthic Metrics at Camp Lake Tributary 1 North Branch (CLT1 US) Among Years of Mine Operation (2015 to 2018) and Baseline (2007, 2011) for the Mary River Project CREMP

Metric	Data Transform- ation	Overall 6-Year Comparison		Pair-wise, post-hoc comparisons ^a							
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size		Pairwise Comparison	Statistical Test
								vs. Baseline Year 2007	vs. Baseline Year 2011		
Collector-Gatherer FFG (% of community)	none	YES	0.0040	2007	3	72.6	11.0	-	2.2	a	Tamhane's
				2011	3	41.4	14.1	-2.8	-	b	
				2015	5	50.2	7.3	-2.0	0.6	b	
				2016	5	40.8	11.4	-2.9	0.0	b	
				2017	5	38.8	7.1	-3.1	-0.2	b	
				2018	5	54.6	13.5	-1.6	0.9	a,b	
Filterer FFG (% of community)	modified probit	YES	0.0554	2007	3	0.3	0.3	-	nc	a	Mann-Whitney U-test
				2011	3	0.0	0.0	-1.2	-	a,b	
				2015	5	0.0	0.0	-1.2	nc	b	
				2016	5	0.5	0.6	0.9	nc	a,b	
				2017	5	1.3	1.5	3.9	nc	a,b	
				2018	5	0.5	0.5	0.8	nc	a,b	
Shredder FFG (% of community)	none	YES	0.0490	2007	3	23.1	8.8	-	-1.2	a	Mann-Whitney U-test
				2011	3	40.1	14.3	1.9	-	a,b	
				2015	5	46.1	7.3	2.6	0.4	b	
				2016	5	47.8	14.0	2.8	0.5	b	
				2017	5	49.5	6.4	3.0	0.7	b	
				2018	5	39.3	13.2	1.8	-0.1	a,b	

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint values between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.9: Statistical Comparison of Primary and Percent Compositional Benthic Metrics at the Camp Lake Tributary 1 Lower Main Stem (CLT1 DS) Among Years of Mine Operation (2015 to 2018) and Baseline (2007, 2011) for the Mary River Project CREMP

Metric	Data Transform-ation	Overall 6-Year Comparison		Pair-wise, post-hoc comparisons ^a							
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size		Pairwise Comparison	Statistical Test
								vs. Baseline Year 2007	vs. Baseline Year 2011		
Density (No. per m ²)	none	NO	0.2257	2007	3	754	573	-	-0.8	a	Tukey's HSD
				2011	3	898	183	0.3	-	a	
				2015	5	1,301	479	1.0	2.2	a	
				2016	5	1,143	443	0.7	1.3	a	
				2017	5	1,465	735	1.2	3.1	a	
				2018	5	771	309	0.0	-0.7	a	
Richness (No. of Taxa)	none	YES	0.0777	2007	3	20.3	6.0	-	1.1	a	Tamhane's
				2011	3	15.3	4.5	-0.8	-	a	
				2015	5	14.6	1.1	-1.0	-0.2	a	
				2016	5	17.0	1.6	-0.6	0.4	a	
				2017	5	16.8	1.9	-0.6	0.3	a	
				2018	5	14.4	1.1	-1.0	-0.2	a	
Simpson's Evenness	none	NO	0.9565	2007	3	0.864	0.040	-	0.0	a	Tukey's HSD
				2011	3	0.864	0.026	0.0	-	a	
				2015	5	0.889	0.043	0.6	1.0	a	
				2016	5	0.864	0.095	0.0	0.0	a	
				2017	5	0.874	0.033	0.2	0.4	a	
				2018	5	0.857	0.050	-0.2	-0.3	a	
Nemata (% of community)	none	NO	0.4075	2007	3	1.0	1.3	-	1.7	a	Tukey's HSD
				2011	3	0.4	0.4	-0.5	-	a	
				2015	5	3.2	2.6	1.6	7.7	a	
				2016	5	4.5	4.1	2.6	11.3	a	
				2017	5	4.6	5.0	2.6	11.5	a	
				2018	5	2.6	1.8	1.2	6.0	a	
Oligochaeta (% of community)	none	YES	0.0055	2007	3	7.3	6.2	-	3.9	a,b	Tukey's HSD
				2011	3	1.1	1.6	-1.0	-	b	
				2015	5	5.6	3.1	-0.3	2.9	a,b	
				2016	5	9.7	3.7	0.4	5.5	a	
				2017	5	5.0	2.7	-0.4	2.5	a,b	
				2018	5	1.2	1.0	-1.0	0.1	b	
Hydracarina (% of community)	none	YES	0.0000	2007	3	2.9	1.4	-	-3.4	a	Tamhane's
				2011	3	24.7	6.4	15.4	-	a	
				2015	5	1.7	1.6	-0.8	-3.6	a	
				2016	5	4.6	0.8	1.2	-3.1	a	
				2017	5	4.0	1.4	0.8	-3.2	a	
				2018	5	3.6	1.5	0.5	-3.3	a	
Chironomidae (% of community)	none	YES	0.0720	2007	3	80.8	8.5	-	1.7	a,c,d	Tukey's HSD
				2011	3	65.3	9.0	-1.8	-	b	
				2015	5	85.2	4.0	0.5	2.2	c	
				2016	5	73.9	5.9	-0.8	1.0	d	
				2017	5	80.9	4.5	0.0	1.7	a,c,d	
				2018	5	85.9	4.0	0.6	2.3	a,c,d	
Metal Sensitive Taxa (% of community)	modified probit	YES	0.0720	2007	3	15.1	10.2	-	1.0	a	Tukey's HSD
				2011	3	7.6	7.3	-0.7	-	a,b	
				2015	5	4.4	3.5	-1.1	-0.4	a,b	
				2016	5	3.8	3.3	-1.1	-0.5	a,b	
				2017	5	1.5	0.7	-1.3	-0.8	b	
				2018	5	8.6	6.0	-0.6	0.1	a,b	
Tipulidae (% of community)	none	NO	0.1637	2007	3	6.4	2.6	-	-0.6	a	Tukey's HSD
				2011	3	8.4	3.2	0.7	-	a	
				2015	5	3.1	1.0	-1.3	-1.6	a	
				2016	5	6.1	3.4	-0.1	-0.7	a	
				2017	5	3.9	3.1	-1.0	-1.4	a	
				2018	5	4.9	3.1	-0.6	-1.1	a	

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study ye

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.10: Statistical Comparison of Functional Feeding Group (FFG) Benthic Metrics at the Camp Lake Tributary 1 Lower Main Stem (CLT1 DS) Among Years of Mine Operation (2015 to 2018) and Baseline (2007, 2011) for the Mary River Project CREMP

Metric	Data Transform- ation	Overall 6-Year Comparison		Pair-wise, post-hoc comparisons ^a							
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size		Pairwise Comparison	Statistical Test
								vs. Baseline Year 2007	vs. Baseline Year 2011		
Collector-Gatherer FFG (% of community)	none	YES	0.0006	2007	3	51.7	24.3	-	1.5	a,b	Tamhane's
				2011	3	35.6	10.5	-0.7	-	b	
				2015	5	78.4	9.5	1.1	4.1	a	
				2016	5	73.8	9.9	0.9	3.7	a	
				2017	5	67.2	6.4	0.6	3.0	a,b	
				2018	5	59.5	8.3	0.3	2.3	a,b	
Filterer FFG (% of community)	none	NO	0.3782	2007	3	10.2	13.1	-	nc	a	Mann-Whitney U-test
				2011	3	0.3	0.3	-0.8	-	a	
				2015	5	0.2	0.5	-0.8	nc	a	
				2016	5	1.3	1.5	-0.7	nc	a	
				2017	5	0.3	0.5	-0.8	0.2	a	
				2018	5	0.4	0.5	-0.7	nc	a	
Shredder FFG (% of community)	none	YES	0.0118	2007	3	22.1	3.1	-	-3.7	a,b,c	Mann-Whitney U-test
				2011	3	38.9	4.5	5.5	-	b,d	
				2015	5	19.3	9.0	-0.9	-4.3	c	
				2016	5	19.6	9.5	-0.8	-4.2	c	
				2017	5	27.6	4.9	1.8	-2.5	c,d	
				2018	5	35.5	7.7	4.4	-0.7	d	

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint values between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.11: Benthic Station Habitat Feature Statistical Comparisons among Camp Lake Tributary 2 and Unnamed Reference Creek Study Areas, Mary River Project CREMP, August 2018

Metric	Overall 3-group Comparison			Pair-wise, post-hoc comparisons ^a				
	Significant Difference Among Areas?	P-value	Statistical Test ^b	(I) Area	(J) Area	Significant Difference Between 2 Areas?	P-value	Statistical Test
Water Depth (cm)	YES	0.0322	α	Unnamed Reference Creek	CLT2 Upstream	NO	0.2021	Tamhane's
				Unnamed Reference Creek	CLT2 Downstream	NO	0.1021	
				CLT2 Upstream	CLT2 Downstream	NO	0.9598	
Water Velocity (cm/s)	NO	0.1350	α	Unnamed Reference Creek	CLT2 Upstream	NO	0.7602	Tukey's HSD
				Unnamed Reference Creek	CLT2 Downstream	NO	0.3584	
				CLT2 Upstream	CLT2 Downstream	NO	0.1229	
Substrate Embeddedness (%)	YES	< 0.0001	α	Unnamed Reference Creek	CLT2 Upstream	YES	0.0000	Tukey's HSD
				Unnamed Reference Creek	CLT2 Downstream	YES	0.0000	
				CLT2 Upstream	CLT2 Downstream	NO	0.7776	

Note: Shading indicates a significant difference for respective comparison (p-value ≤ 0.1).

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

^b Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log-transformed, single factor ANOVA test conducted; γ - Kruskal-Wallis H-test (multiple group) or Mann-Whitney U-test (pair-wise) conducted using untransformed data; ζ - data untransformed, t-test assuming unequal variance used; η - data log transformed, t-test assuming unequal variance used.

Table F.12: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake Tributary 2 Study Areas, August 2018

Taxa	Study Area Replicate Station	Upstream (CLT2-US)				
		B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		-	-	4	7	-
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		7	7	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Sperchonidae						
Sperchon		-	4	14	4	18
SEED SHRIMPS						
Cl. Ostracoda		-	-	-	-	-
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
Acentrella feropagus		-	-	-	-	-
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature		-	-	-	-	-
TRUE FLIES						
O. Diptera						
BITING-MIDGE						
F. Ceratopogonidae						
Culicoides		-	-	-	4	-
MIDGES						
F. Chironomidae						
chironomid pupae		4	18	11	39	22
S.F. Chironominae						
Tanytarsus		-	-	-	-	-
S.F. Diamesinae						
Diamesa		-	14	-	7	11
Pseudokiefferiella		7	-	4	22	7
S.F. Orthocladiinae						
Chaetocladius		-	4	-	-	4
Corynoneura		-	-	-	-	-
Cricotopus		-	-	4	7	7
Cricotopus/Orthocladius		7	4	11	22	18
Diplocladius		4	-	-	-	-
Eukiefferiella		4	4	-	7	11
Hydrobaenus		-	-	-	-	-
Hydrosmittia		-	-	-	4	-
Krenosmittia		4	4	4	7	4
Limnophyes		-	-	-	4	-
Orthocladius (Euorthocladius)		22	25	50	29	57
Paraphaenocladius		-	-	-	4	-
Synorthocladius		-	-	-	-	-

Table F.12: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake Tributary 2 Study Areas, August 2018

Taxa	Study Area Replicate Station	Upstream (CLT2-US)				
		B1	B2	B3	B4	B5
<i>Thienemanniella</i>		7	4	-	14	11
<i>Tokunagaia</i>		7	4	7	11	7
<i>Tvetenia</i>		14	7	14	18	14
indeterminate		14	7	-	-	7
S.F. Tanypodinae						
<i>Thienemannimyia complex</i>		-	-	-	-	-
F. Empididae						
<i>Clinocera</i>		4	-	4	4	-
pupae		-	4	-	-	-
F. Simuliidae						
<i>Gymnopaia</i>		-	7	4	14	4
<i>Metacnephia</i>		-	-	-	4	4
<i>Prosimulium</i>		-	4	-	18	7
<i>Simulium</i>		-	-	-	-	-
indeterminate		-	-	-	-	-
F. Tipulidae						
<i>Tipula</i>		4	-	4	4	7
Number of Organisms (No. organisms per m²)		109	121	135	254	220
Richness (total number of taxa)^a		12	14	12	21	16
Simpson's Evenness (E)		0.943	0.920	0.856	0.972	0.918
Bray-Curtis Index		0.730	0.700	0.710	0.531	0.626
Percent Composition						
% Nemata		0.0%	0.0%	3.0%	2.8%	0.0%
% Oligochaeta		6.4%	5.8%	0.0%	0.0%	0.0%
% Hydracarina		0.0%	3.3%	10.4%	1.6%	8.2%
% Ostracods		0.0%	0.0%	0.0%	0.0%	0.0%
% Ephemeroptera		0.0%	0.0%	0.0%	0.0%	0.0%
% Chironomids		86.2%	78.5%	77.8%	76.8%	81.8%
% Metal Sensitive Chironmids		6.4%	14.0%	3.0%	14.6%	9.5%
% Simuliidae		0.0%	9.1%	3.0%	14.2%	6.8%
% Tipulidae		3.7%	0.0%	3.0%	1.6%	3.2%
Functional Feeding Group Composition						
% Collector - Gatherers		84.4%	80.2%	68.1%	65.0%	68.2%
% Filterers		0.0%	9.1%	3.0%	14.2%	6.8%
% Shredders		11.9%	4.1%	15.6%	16.1%	16.8%
Habitat Preference Group Composition						
% Clingers		11.9%	19.8%	28.9%	31.9%	28.6%
% Sprawlers		78.0%	74.4%	65.2%	62.2%	68.2%
% Burrowers		10.1%	5.8%	5.9%	5.9%	3.2%

^a Bold entries excluded from taxa count

Table F.12: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake Tributary 2 Study Areas, August 2018

Taxa	Study Area	Downstream (CLT2-DS)				
	Replicate Station	B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		7	4	-	11	-
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		-	-	-	-	4
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Sperchonidae						
Sperchon		-	4	-	14	4
SEED SHRIMPS						
Cl. Ostracoda		-	4	-	-	-
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
Acentrella feropagus		-	-	-	-	-
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature		-	-	-	-	-
TRUE FLIES						
O. Diptera						
BITING-MIDGE						
F. Ceratopogonidae						
Culicoides		4	-	4	-	-
MIDGES						
F. Chironomidae						
chironomid pupae		7	4	4	14	14
S.F. Chironominae						
Tanytarsus		-	-	-	-	-
S.F. Diamesinae						
Diamesa		11	4	-	7	7
Pseudokiefferiella		18	-	-	4	-
S.F. Orthocladiinae						
Chaetocladius		-	-	4	4	-
Corynoneura		4	-	-	-	-
Cricotopus		14	-	-	-	4
Cricotopus/Orthocladius		14	4	-	-	-
Diplocladius		-	-	-	-	-
Eukiefferiella		-	-	4	-	-
Hydrobaenus		-	-	-	-	-
Hydrosmittia		4	-	-	14	-
Krenosmittia		22	-	18	-	4
Limnophyes		-	4	11	4	4
Orthocladius (Euorthocladius)		36	75	14	14	4
Paraphaenocladius		-	-	-	-	-
Synorthocladius		-	-	-	-	-

Table F.12: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake Tributary 2 Study Areas, August 2018

Taxa	Study Area	Downstream (CLT2-DS)				
	Replicate Station	B1	B2	B3	B4	B5
<i>Thienemanniella</i>		-	4	-	-	-
<i>Tokunagaia</i>		11	25	7	29	18
<i>Tvetenia</i>		18	11	4	18	4
indeterminate		-	4	-	4	-
S.F. Tanypodinae						
<i>Thienemannimyia complex</i>		-	-	-	-	-
F. Empididae						
<i>Clinocera</i>		7	-	4	-	4
pupae		-	-	-	-	-
F. Simuliidae						
<i>Gymnopaia</i>		-	-	-	-	-
<i>Metacnephia</i>		-	-	-	-	-
<i>Prosimulium</i>		-	-	-	7	-
<i>Simulium</i>		-	-	-	-	-
indeterminate		-	-	-	-	-
F. Tipulidae						
<i>Tipula</i>		7	7	-	7	-
Number of Organisms (No. organisms per m²)		184	154	74	151	71
Richness (total number of taxa)^a		14	11	9	12	10
Simpson's Evenness (E)		0.963	0.755	0.941	0.957	0.926
Bray-Curtis Index		0.645	0.656	0.823	0.633	0.798
Percent Composition						
% Nemata		3.8%	2.6%	0.0%	7.3%	0.0%
% Oligochaeta		0.0%	0.0%	0.0%	0.0%	5.6%
% Hydracarina		0.0%	2.6%	0.0%	9.3%	5.6%
% Ostracods		0.0%	2.6%	0.0%	0.0%	0.0%
% Ephemeroptera		0.0%	0.0%	0.0%	0.0%	0.0%
% Chironomids		86.4%	87.7%	89.2%	74.2%	83.1%
% Metal Sensitive Chironmids		16.8%	2.6%	0.0%	7.9%	12.7%
% Simuliidae		0.0%	0.0%	0.0%	4.6%	0.0%
% Tipulidae		3.8%	4.5%	0.0%	4.6%	0.0%
Functional Feeding Group Composition						
% Collector - Gatherers		74.5%	90.3%	89.2%	81.5%	81.7%
% Filterers		0.0%	0.0%	0.0%	4.6%	0.0%
% Shredders		19.6%	7.1%	0.0%	4.6%	7.0%
Habitat Preference Group Composition						
% Clingers		19.6%	5.2%	5.4%	13.9%	18.3%
% Sprawlers		70.7%	87.7%	89.2%	74.2%	76.1%
% Burrowers		9.8%	7.1%	5.4%	11.9%	5.6%

^a Bold entries excluded from taxa count

Table F.13: Benthic Invertebrate Community Summary Statistics for Camp Lake Tributary 2 Study Areas, Mary River Project CREMP, August 2018

Metric	Area	Mean	Standard Deviation	Standard Error	95% Confidence Interval		Minimum	Maximum
					Lower Bound	Upper Bound		
Density (no. organisms / m ²)	Unnamed Reference Creek	526	152	68	337	714	262	636
	CLT2 Upstream	168	65	29	87	248	109	254
	CLT2 Downstream	127	51	23	63	190	71	184
Richness (Number of Taxa)	Unnamed Reference Creek	19.8	3.0	1.4	16.0	23.6	16.0	24.0
	CLT2 Upstream	15.0	3.7	1.7	10.4	19.6	12.0	21.0
	CLT2 Downstream	11.2	1.9	0.9	8.8	13.6	9.0	14.0
Simpson's Evenness	Unnamed Reference Creek	0.960	0.011	0.005	0.946	0.974	0.942	0.972
	CLT2 Upstream	0.922	0.042	0.019	0.869	0.975	0.856	0.972
	CLT2 Downstream	0.908	0.087	0.039	0.800	1.016	0.755	0.963
Bray-Curtis Index	Unnamed Reference Creek	0.208	0.093	0.042	0.092	0.324	0.114	0.342
	CLT2 Upstream	0.659	0.082	0.037	0.558	0.761	0.531	0.730
	CLT2 Downstream	0.711	0.092	0.041	0.597	0.825	0.633	0.823
Nemata (% of community)	Unnamed Reference Creek	6.0%	2.0%	0.9%	3.6%	8.5%	3.9%	9.3%
	CLT2 Upstream	1.1%	1.6%	0.7%	-0.8%	3.1%	0.0%	3.0%
	CLT2 Downstream	2.7%	3.0%	1.4%	-1.0%	6.5%	0.0%	7.3%
Oligochaeta (% of community)	Unnamed Reference Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	CLT2 Upstream	2.4%	3.4%	1.5%	-1.7%	6.6%	0.0%	6.4%
	CLT2 Downstream	1.1%	2.5%	1.1%	-2.0%	4.3%	0.0%	5.6%
Hydracarina (% of community)	Unnamed Reference Creek	3.3%	1.3%	0.6%	1.6%	4.9%	2.0%	5.3%
	CLT2 Upstream	4.7%	4.4%	2.0%	-0.8%	10.2%	0.0%	10.4%
	CLT2 Downstream	3.5%	4.0%	1.8%	-1.4%	8.4%	0.0%	9.3%
Ostracoda (% of community)	Unnamed Reference Creek	1.2%	1.0%	0.4%	-0.1%	2.4%	0.0%	2.7%
	CLT2 Upstream	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	CLT2 Downstream	0.5%	1.2%	0.5%	-0.9%	2.0%	0.0%	2.6%
Ephemeroptera (% of community)	Unnamed Reference Creek	5.6%	2.1%	0.9%	3.0%	8.3%	3.9%	9.2%
	CLT2 Upstream	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	CLT2 Downstream	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Chironomidae (% of community)	Unnamed Reference Creek	60.3%	4.5%	2.0%	54.8%	65.9%	55.0%	66.8%
	CLT2 Upstream	80.2%	3.9%	1.7%	75.4%	85.0%	76.8%	86.2%
	CLT2 Downstream	84.1%	6.0%	2.7%	76.7%	91.5%	74.2%	89.2%
Metal-Sensitive Chironomidae (% of community)	Unnamed Reference Creek	12.4%	4.2%	1.9%	7.1%	17.7%	6.9%	18.7%
	CLT2 Upstream	9.5%	5.0%	2.2%	3.3%	15.7%	3.0%	14.6%
	CLT2 Downstream	8.0%	7.0%	3.1%	-0.6%	16.6%	0.0%	16.8%
Simuliidae (% of community)	Unnamed Reference Creek	15.9%	4.6%	2.0%	10.2%	21.6%	11.2%	22.2%
	CLT2 Upstream	6.6%	5.5%	2.5%	-0.2%	13.4%	0.0%	14.2%
	CLT2 Downstream	0.9%	2.1%	0.9%	-1.6%	3.5%	0.0%	4.6%
Tipulidae (% of community)	Unnamed Reference Creek	2.8%	1.5%	0.7%	1.0%	4.6%	1.5%	4.7%
	CLT2 Upstream	2.3%	1.5%	0.7%	0.4%	4.1%	0.0%	3.7%
	CLT2 Downstream	2.6%	2.4%	1.1%	-0.4%	5.6%	0.0%	4.6%
Collector-Gatherer FFG (% of community)	Unnamed Reference Creek	71.5%	4.0%	1.8%	66.5%	76.5%	67.2%	76.0%
	CLT2 Upstream	73.2%	8.6%	3.8%	62.6%	83.8%	65.0%	84.4%
	CLT2 Downstream	83.4%	6.5%	2.9%	75.4%	91.4%	74.5%	90.3%
Filterer FFG (% of community)	Unnamed Reference Creek	16.0%	4.5%	2.0%	10.4%	21.6%	11.2%	22.2%
	CLT2 Upstream	6.6%	5.5%	2.5%	-0.2%	13.4%	0.0%	14.2%
	CLT2 Downstream	0.9%	2.1%	0.9%	-1.6%	3.5%	0.0%	4.6%
Shredder FFG (% of community)	Unnamed Reference Creek	4.8%	2.8%	1.2%	1.4%	8.2%	1.5%	8.3%
	CLT2 Upstream	12.9%	5.3%	2.4%	6.4%	19.4%	4.1%	16.8%
	CLT2 Downstream	7.7%	7.2%	3.2%	-1.3%	16.7%	0.0%	19.6%
Clinger HPG (% of community)	Unnamed Reference Creek	22.6%	4.9%	2.2%	16.4%	28.7%	17.9%	29.2%
	CLT2 Upstream	24.2%	8.2%	3.7%	14.0%	34.4%	11.9%	31.9%
	CLT2 Downstream	12.5%	6.9%	3.1%	3.9%	21.0%	5.2%	19.6%
Sprawler HPG (% of community)	Unnamed Reference Creek	66.2%	5.0%	2.2%	60.0%	72.5%	61.8%	72.0%
	CLT2 Upstream	69.6%	6.5%	2.9%	61.5%	77.7%	62.2%	78.0%
	CLT2 Downstream	79.5%	8.4%	3.7%	69.2%	89.9%	70.7%	89.2%
Burrower HPG (% of community)	Unnamed Reference Creek	11.2%	1.9%	0.9%	8.8%	13.6%	9.0%	14.0%
	CLT2 Upstream	6.2%	2.5%	1.1%	3.1%	9.3%	3.2%	10.1%
	CLT2 Downstream	8.0%	2.8%	1.3%	4.5%	11.5%	5.4%	11.9%

Table F.14: Statistical Comparison of Benthic Invertebrate Community Metrics at Camp Lake Tributary 2 Upstream (CLT2 US) Among Years of Mine Operation (2015 to 2018) and Baseline (2007) for the Mary River Project CREMP

Metric	Data Transform- ation	Overall 5-Year Comparison		Pair-wise, post-hoc comparisons ^a						
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Pairwise Comparison	Statistical Test
Density (No. per m ²)	none	YES	0.0039	2007	3	364	205	-	a,b,c,d	Mann-Whitney U-test
				2015	5	741	416	1.8	a	
				2016	5	412	100	0.2	b	
				2017	5	216	30	-0.7	c	
				2018	5	168	65	-1.0	c,d	
Richness (No. of Taxa)	none	YES	0.0045	2007	3	12.7	2.1	-	a	Tukey's HSD
				2015	5	20.8	1.8	3.9	b	
				2016	5	17.2	2.9	2.2	a,b	
				2017	5	14.6	2.5	0.9	a	
				2018	5	15.0	3.7	1.1	a	
Simpson's Evenness	none	YES	0.0002	2007	3	0.825	0.008	-	a	Tukey's HSD
				2015	5	0.922	0.025	11.8	b,c,d	
				2016	5	0.898	0.035	9.0	b	
				2017	5	0.955	0.013	15.8	c,d	
				2018	5	0.922	0.042	11.8	d	
Nemata (% of community)	none	NO	0.9528	2007	3	1.1	0.6	-	a	Mann-Whitney U-test
				2015	5	0.9	0.9	-0.5	a	
				2016	5	1.0	0.8	-0.3	a	
				2017	5	1.0	1.4	-0.3	a	
				2018	5	1.1	1.6	0.0	a	
Oligochaeta (% of community)	modified probit	NO	0.4018	2007	3	2.1	0.8	-	a	Tamhane's
				2015	5	2.7	2.8	0.7	a	
				2016	5	4.9	3.5	3.5	a	
				2017	5	3.4	6.4	1.6	a	
				2018	5	2.4	3.4	0.4	a	
Hydracarina (% of community)	none	YES	0.0314	2007	3	2.9	2.1	-	a	Tamhane's
				2015	5	0.9	0.7	-1.0	a	
				2016	5	5.5	2.6	1.2	a	
				2017	5	8.0	4.2	2.4	a	
				2018	5	4.7	4.4	0.8	a	
Chironomidae (% of community)	none	NO	0.2272	2007	3	88.4	4.3	-	a	Mann-Whitney U-test
				2015	5	80.2	8.9	-1.9	a	
				2016	5	79.5	8.5	-2.1	a	
				2017	5	75.9	7.5	-2.9	a	
				2018	5	80.2	3.9	-1.9	a	
Metal Sensitive Taxa (% of community)	none	YES	0.0000	2007	3	5.3	0.6	-	a	Tukey's HSD
				2015	5	10.5	5.7	8.8	a	
				2016	5	5.3	3.3	0.0	a	
				2017	5	22.0	3.1	28.3	b	
				2018	5	9.5	5.0	7.1	a	
Tipulidae (% of community)	none	NO	0.1544	2007	3	5.2	2.0	-	a	Tukey's HSD
				2015	5	4.1	3.5	-0.5	a	
				2016	5	4.0	1.8	-0.6	a	
				2017	5	1.6	1.6	-1.8	a	
				2018	5	2.3	1.5	-1.5	a	
Collector-Gatherer FFG (% of community)	none	NO	0.1944	2007	3	68.5	6.5	-	a	Tamhane's
				2015	5	63.8	10.3	-0.7	a	
				2016	5	66.6	5.8	-0.3	a	
				2017	5	75.6	3.9	1.1	a	
				2018	5	73.2	8.6	0.7	a	
Filterer FFG (% of community)	none	YES	0.0038	2007	3	0.2	0.4	-	a,b	Mann-Whitney U-test
				2015	5	1.0	1.1	1.7	a,b,c	
				2016	5	0.2	0.4	-0.2	a,b	
				2017	5	6.5	3.1	14.3	c	
				2018	5	6.6	5.5	14.7	a,b,c	
Shredder FFG (% of community)	none	YES	0.0000	2007	3	27.6	5.8	-	a	Tukey's HSD
				2015	5	26.2	5.8	-0.3	a	
				2016	5	25.9	4.4	-0.3	a	
				2017	5	7.4	5.9	-3.5	b	
				2018	5	12.9	5.3	-2.5	b	

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.15: Statistical Comparison of Benthic Invertebrate Community Metrics at Camp Lake Tributary 2 Downstream (CLT2 DS) Among Years of Mine Operation (2015 to 2018) and Baseline (2007) for the Mary River

Metric	Data Transform-ation	Overall 5-Year Comparison		Pair-wise, post-hoc comparisons ^a						
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Pairwise Comparison	Statistical Test
Density (No. per m ²)	none	YES	0.0146	2007	3	431	109	-	a	Tamhane's
				2015	5	447	258	0.1	a	
				2016	5	205	61	-2.1	a	
				2017	5	222	144	-1.9	a	
				2018	5	127	51	-2.8	a	
Richness (No. of Taxa)	none	NO	0.2038	2007	3	17.7	2.1	-	a	Tukey's HSD
				2015	5	14.2	3.3	-1.7	a	
				2016	5	14.0	4.0	-1.8	a	
				2017	5	13.2	4.7	-2.1	a	
				2018	5	11.2	1.9	-3.1	a	
Simpson's Evenness	none	YES	0.0576	2007	3	0.865	0.017	-	a,c	Mann-Whitney U-test
				2015	5	0.934	0.034	4.0	b	
				2016	5	0.838	0.079	-1.5	c	
				2017	5	0.913	0.052	2.8	a,b	
				2018	5	0.908	0.087	2.5	a,b	
Nemata (% of community)	none	NO	0.6529	2007	3	1.1	1.2	-	a	Tukey's HSD
				2015	5	4.2	2.4	2.6	a	
				2016	5	2.0	2.4	0.8	a	
				2017	5	3.2	4.4	1.8	a	
				2018	5	2.7	3.0	1.4	a	
Oligochaeta (% of community)	none	NO	0.1626	2007	3	2.6	0.6	-	a	Mann-Whitney U-test
				2015	5	8.8	12.8	10.1	a	
				2016	5	1.9	3.2	-1.1	a	
				2017	5	4.8	6.9	3.6	a	
				2018	5	1.1	2.5	-2.3	a	
Hydracarina (% of community)	modified probit	YES	0.0106	2007	3	1.8	1.2	-	a,b	Tamhane's
				2015	5	0.3	0.6	-1.2	b	
				2016	5	4.5	1.9	2.2	a	
				2017	5	3.3	4.0	1.3	a,b	
				2018	5	3.5	4.0	1.4	a,b	
Chironomidae (% of community)	none	NO	0.2782	2007	3	88.0	6.0	-	a	Tukey's HSD
				2015	5	75.6	10.4	-2.1	a	
				2016	5	82.4	6.3	-0.9	a	
				2017	5	81.8	8.4	-1.0	a	
				2018	5	84.1	6.0	-0.7	a	
Metal Sensitive Taxa (% of community)	none	NO	0.1125	2007	3	11.8	2.0	-	a	Tukey's HSD
				2015	5	10.6	10.6	-0.6	a	
				2016	5	5.4	0.9	-3.3	a	
				2017	5	20.2	12.6	4.3	a	
				2018	5	8.0	7.0	-1.9	a	
Tipulidae (% of community)	none	NO	0.2784	2007	3	6.4	6.6	-	a	Mann-Whitney U-test
				2015	5	5.8	5.1	-0.1	a	
				2016	5	2.2	1.6	-0.6	a	
				2017	5	0.8	1.9	-0.9	a	
				2018	5	2.6	2.4	-0.6	a	
Collector-Gatherer FFG (% of community)	none	NO	0.1548	2007	3	66.4	11.0	-	a	Tukey's HSD
				2015	5	69.3	10.9	0.3	a	
				2016	5	77.6	11.6	1.0	a	
				2017	5	77.1	10.5	1.0	a	
				2018	5	83.4	6.5	1.5	a	
Filterer FFG (% of community)	modified probit	NO	0.1591	2007	3	2.7	1.9	-	a	Tukey's HSD
				2015	5	0.8	0.9	-1.0	a	
				2016	5	1.1	1.0	-0.9	a	
				2017	5	3.5	3.1	0.4	a	
				2018	5	0.9	2.1	-1.0	a	
Shredder FFG (% of community)	none	YES	0.0641	2007	3	21.5	5.9	-	a,b	Tukey's HSD
				2015	5	25.7	11.6	0.7	b	
				2016	5	13.8	10.4	-1.3	a,b	
				2017	5	14.6	8.9	-1.2	a,b	
				2018	5	7.7	7.2	-2.3	a	

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.16: Statistical Comparison of Physical Sediment Quality Between Littoral and Profundal Stations of Reference Lake 3, Mary River Project CREMP, August 2018

Habitat Variable	Statistical Test Results			Summary Statistics							
	Significant Difference Between Habitats?	P-value	Statistical Analysis ^a	Station Type	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Median	Maximum
Sand-Sized Particles (% by weight)	YES	<0.001	α	Littoral	5	59.6	4.4	2.0	54.9	59.4	66.4
				Profundal	5	47.5	2.8	1.3	44.5	47.0	50.9
Silt-Sized Particles (% by weight)	YES	0.007	β	Littoral	5	31.4	3.3	1.5	26.6	32.6	34.7
				Profundal	5	39.0	3.1	1.4	33.8	40.4	41.5
Clay-Sized Particles (% by weight)	YES	0.022	β	Littoral	5	9.0	2.4	1.1	5.8	10.4	10.8
				Profundal	5	13.6	2.2	1.0	9.7	14.3	15.3
Total Organic Carbon (%)	NO	0.505	α	Littoral	5	4.7	2.3	1.0	1.8	5.1	7.4
				Profundal	5	3.8	1.7	0.8	0.8	4.5	4.9

 Highlighted values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log-transformed, single factor ANOVA test conducted; ζ - data fourth root transformed, single factor ANOVA test conducted; $\sqrt{}$ - data square root transformed, single factor ANOVA test conducted; η - data log-transformed, t-test assuming unequal variance; γ - data untransformed, Mann-Whitney U-test conducted.

Table F.17: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Reference Lake 3, August 2018

Taxa	Study Area Replicate Station	Reference Lake 03 - Littoral Stations				
		REF-01	REF-02	REF-03	REF-04	REF-05
ROUNDWORMS						
P. Nemata		-	9	147	112	34
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Lumbriculidae						
<i>Lumbriculus</i>		-	-	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Acalyptonotidae						
<i>Acalyptonotus</i>		43	17	-	9	-
F. Hygrobatidae						
<i>Hygrobates</i>		-	-	-	9	-
F. Lebertiidae						
<i>Lebertia</i>		34	-	-	-	17
F. Sperchontidae						
<i>Sperchon</i>		-	-	-	-	-
SEED SHRIMPS						
Cl. Ostracoda		284	164	172	621	34
INSECTS						
Cl. Insecta						
CADDISFLIES						
O. Trichoptera						
pupae		-	-	-	-	-
F. Apataniidae						
<i>Apatania</i>		-	-	-	-	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		-	-	-	-	-
S.F. Chironominae						
<i>Chironomus</i>		-	-	-	-	-
<i>Micropsectra</i>		207	431	172	181	560
<i>Paratanytarsus</i>		-	-	-	-	-
<i>Sergentia</i>		-	-	-	-	-
<i>Stictochironomus</i>		95	52	-	-	69
<i>Tanytarsus</i>		86	60	-	-	-
S.F. Diamesinae						
<i>Protanypus</i>		-	9	9	17	17
<i>Pseudodiamesa</i>		9	26	9	9	17
S.F. Orthocladiinae						
<i>Abiskomyia</i>		284	69	129	155	78
<i>Cricotopus/Orthocladius</i>		-	-	-	-	-
<i>Heterotrissocladius</i>		60	17	-	9	60
<i>Hydrobaenus</i>		-	-	-	-	-
<i>Limnophyes</i>		-	-	-	-	-

Table F.17: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Reference Lake 3, August 2018

Taxa	Study Area Replicate Station	Reference Lake 03 - Littoral Stations				
		REF-01	REF-02	REF-03	REF-04	REF-05
<i>Mesocricotopus</i>		-	-	-	-	-
<i>Paracladius</i>		60	43	-	-	17
<i>Parakiefferiella</i>		-	-	-	-	-
<i>Psectrocladius</i>		-	-	-	-	-
<i>Zalutschia</i>		129	60	52	34	86
S.F. Tanypodinae						
<i>Arctopelopia</i>		17	-	-	-	-
<i>Procladius</i>		69	-	-	9	-
F. Tipulidae						
<i>Tipula</i>		-	-	-	-	-
Density (No. organisms per m²)		1,377	957	690	1,165	989
Richness (total number of taxa)^a		13	12	7	11	11
Simpson's Evenness (E)		0.939	0.816	0.921	0.730	0.719
Bray-Curtis Index		0.467	0.408	0.371	0.493	0.516
Dominant Taxonomic Group Composition						
% Nemata		0.0%	0.9%	21.3%	9.6%	3.4%
% Hydracarina		5.6%	1.8%	0.0%	1.5%	1.7%
% Ostracods		20.6%	17.1%	24.9%	53.3%	3.4%
% Chironomids		73.8%	80.1%	53.8%	35.5%	91.4%
% Metal Sensitive Chironmids		21.9%	55.0%	27.5%	17.8%	60.1%
% Tipulidae		0.0%	0.0%	0.0%	0.0%	0.0%
Functional Feeding Group Composition						
% Collector - Gatherers		57.5%	40.6%	67.5%	79.2%	33.0%
% Filterers		21.3%	51.3%	24.9%	15.5%	56.6%
% Shredders		9.4%	6.3%	7.5%	2.9%	8.7%
Habitat Preference Group Composition						
% Clingers		26.9%	53.1%	24.9%	17.1%	58.3%
% Sprawlers		66.2%	39.6%	52.5%	71.8%	29.5%
% Burrowers		6.9%	7.3%	22.6%	11.1%	12.1%

^a Bold entries excluded from taxa count

Table F.17: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Reference Lake 3, August 2018

Taxa	Study Area	Reference Lake 03 - Profundal Stations				
	Replicate Station	REF-06	REF-07	REF-08	REF-09	REF-10
ROUNDWORMS						
P. Nemata		9	-	17	-	-
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Lumbriculidae						
<i>Lumbriculus</i>		-	-	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Acalyptonotidae						
<i>Acalyptonotus</i>		9	9	9	-	-
F. Hygrobatidae						
<i>Hygrobates</i>		-	-	-	-	-
F. Lebertiidae						
<i>Lebertia</i>		-	17	9	-	-
F. Sperchontidae						
<i>Sperchon</i>		-	-	-	-	-
SEED SHRIMPS						
Cl. Ostracoda		-	9	9	34	17
INSECTS						
Cl. Insecta						
CADDISFLIES						
O. Trichoptera						
pupae		-	-	-	-	-
F. Apataniidae						
<i>Apatania</i>		-	-	-	-	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		-	-	-	9	-
S.F. Chironominae						
<i>Chironomus</i>		-	-	-	-	-
<i>Micropsectra</i>		26	17	-	17	-
<i>Paratanytarsus</i>		-	-	-	-	-
<i>Sergentia</i>		-	-	-	-	-
<i>Stictochironomus</i>		9	-	-	60	-
<i>Tanytarsus</i>		-	-	-	-	-
S.F. Diamesinae						
<i>Protanypus</i>		17	-	9	-	-
<i>Pseudodiamesa</i>		-	9	9	-	9
S.F. Orthocladiinae						
<i>Abiskomyia</i>		-	-	-	-	9
<i>Cricotopus/Orthocladus</i>		-	-	-	-	-
<i>Heterotrissocladius</i>		34	388	405	336	362
<i>Hydrobaenus</i>		-	-	-	-	-
<i>Limnophyes</i>		-	-	-	-	-

Table F.17: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Reference Lake 3, August 2018

Taxa	Study Area	Reference Lake 03 - Profundal Stations				
	Replicate Station	REF-06	REF-07	REF-08	REF-09	REF-10
<i>Mesocricotopus</i>		-	-	-	-	-
<i>Paracladius</i>		-	-	-	-	-
<i>Parakiefferiella</i>		-	-	-	-	-
<i>Psectrocladius</i>		-	-	-	-	-
<i>Zalutschia</i>		-	-	-	-	-
S.F. Tanypodinae						
<i>Arctopelopia</i>		-	-	-	-	-
<i>Procladius</i>		-	-	-	-	-
F. Tipulidae						
<i>Tipula</i>		-	-	-	-	-
Density (No. organisms per m²)		104	449	467	456	397
Richness (total number of taxa)^a		6	6	7	4	4
Simpson's Evenness (E)		0.938	0.299	0.286	0.545	0.221
Bray-Curtis Index		0.765	0.050	0.109	0.144	0.054
Dominant Taxonomic Group Composition						
% Nemata		8.7%	0.0%	3.6%	0.0%	0.0%
% Hydracarina		8.7%	5.8%	3.9%	0.0%	0.0%
% Ostracods		0.0%	2.0%	1.9%	7.5%	4.3%
% Chironomids		82.7%	92.2%	90.6%	92.5%	95.7%
% Metal Sensitive Chironomids		41.3%	5.8%	3.9%	3.7%	2.3%
% Tipulidae		0.0%	0.0%	0.0%	0.0%	0.0%
Functional Feeding Group Composition						
% Collector - Gatherers		66.3%	90.4%	96.1%	96.3%	100.0%
% Filterers		25.0%	3.8%	0.0%	3.7%	0.0%
% Shredders		0.0%	0.0%	0.0%	0.0%	0.0%
Habitat Preference Group Composition						
% Clingers		33.7%	9.6%	3.9%	3.7%	0.0%
% Sprawlers		32.7%	90.4%	90.6%	82.7%	100.0%
% Burrowers		33.7%	0.0%	5.6%	13.6%	0.0%

^a Bold entries excluded from taxa count

Table F.18: Statistical Comparison of Benthic Metrics at Reference Lake 3 Littoral (Shallow) Stations Among Years of Mine Operation (2015 to 2018) for the Mary River Project CREMP

Metric	Data Transformation	Overall 4-Year Comparison ^a		Pair-wise, post-hoc comparisons ^a							
		Significant Difference Among Years?	P-value	Year	Mean	Standard Deviation	Effect Size			Pairwise Comparison	Statistical Test
							vs. Year 2015	vs. Year 2016	vs. Year 2017		
Density (No. per m ²)	log	NO	0.2773	2015	1,278	888	-	-0.8	-0.2	a	Tukey's HSD
				2016	2,390	1,396	1.3	-	1.1	a	
				2017	1,489	850	0.2	-0.6	-	a	
				2018	1,036	255	-0.3	-1.0	-0.5	a	
Richness (No. of Taxa)	none	NO	0.7194	2015	12.6	4.1	-	0.4	0.1	a	Tamhane's
				2016	12.2	1.1	-0.1	-	-0.1	a	
				2017	12.4	2.5	0.0	0.2	-	a	
				2018	10.8	2.3	-0.4	-1.3	-0.6	a	
Simpson's Evenness	none	NO	0.8206	2015	0.865	0.052	-	0.6	0.4	a	Mann-Whitney U-test
				2016	0.758	0.189	-2.0	-	-0.3	a	
				2017	0.807	0.142	-1.1	0.3	-	a	
				2018	0.825	0.103	-0.8	0.4	0.1	a	
Nemata (% of community)	modified probit	NO	0.8818	2015	8.1%	7.4%	-	0.7	1.3	a	Tukey's HSD
				2016	4.0%	5.6%	-0.6	-	0.0	a	
				2017	3.9%	3.3%	-0.6	0.0	-	a	
				2018	7.1%	8.8%	-0.1	0.5	0.9	a	
Hydracarina (% of community)	none	NO	0.2715	2015	4.2%	2.7%	-	0.3	-0.4	a	Tukey's HSD
				2016	3.6%	2.0%	-0.2	-	-0.6	a	
				2017	5.3%	3.0%	0.4	0.9	-	a	
				2018	2.1%	2.1%	-0.8	-0.7	-1.0	a	
Ostracoda (% of community)	none	NO	0.1159	2015	20.9%	18.5%	-	-1.5	-1.0	a	Mann-Whitney U-test
				2016	46.9%	17.5%	1.4	-	0.4	a	
				2017	38.8%	18.4%	1.0	-0.5	-	a	
				2018	23.9%	18.3%	0.2	-1.3	-0.8	a	
Chironomidae (% of community)	none	NO	0.2447	2015	66.5%	18.9%	-	1.1	0.8	a	Tukey's HSD
				2016	45.4%	18.8%	-1.1	-	-0.4	a	
				2017	51.8%	17.9%	-0.8	0.3	-	a	
				2018	66.9%	22.2%	0.0	1.1	0.8	a	
Metal Sensitive Taxa (% of community)	none	YES	0.0579	2015	11.4%	12.6%	-	-0.9	-0.3	a	Tukey's HSD
				2016	19.3%	8.3%	0.6	-	0.3	a,b	
				2017	15.5%	13.4%	0.3	-0.4	-	a,b	
				2018	36.5%	19.6%	2.0	2.1	1.6	b	
Collector-Gatherer FFG (% of community)	none	NO	0.1085	2015	81.4%	17.1%	-	0.6	0.5	a	Tukey's HSD
				2016	75.0%	11.4%	-0.4	-	0.1	a	
				2017	73.9%	16.0%	-0.4	-0.1	-	a	
				2018	55.6%	19.0%	-1.5	-1.7	-1.1	a	
Filterer FFG (% of community)	none	YES	0.0786	2015	11.4%	12.6%	-	-0.6	-0.2	a	Tukey's HSD
				2016	16.1%	8.4%	0.4	-	0.1	a,b	
				2017	14.7%	13.3%	0.3	-0.2	-	a,b	
				2018	33.9%	18.7%	1.8	2.1	1.5	b	

Indicates a significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of initial year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.19: Statistical Comparison of Benthic Metrics at Reference Lake 3 Profundal (Deep) Stations Among Years of Mine Operation (2015 to 2018) for the Mary River Project CREMP

Metric	Data Transformation	Overall 4-Year Comparison ^a		Pair-wise, post-hoc comparisons ^a							
		Significant Difference Among Years?	P-value	Year	Mean	Standard Deviation	Effect Size			Pairwise Comparison	Statistical Test
							vs. Year 2015	vs. Year 2016	vs. Year 2017		
Density (No. per m ²)	none	YES	0.0174	2015	180	39	-	-5.0	1.0	a	Mann-Whitney U-test
				2016	452	55	6.9	-	9.5	b	
				2017	149	32	-0.8	-5.5	-	a	
				2018	375	154	4.9	-1.4	7.1	a,b	
Richness (No. of Taxa)	none	YES	0.0485	2015	2.8	0.8	-	-0.9	-0.9	a	Tukey's HSD
				2016	4.2	1.5	1.7	-	0.0	a,b	
				2017	4.2	1.5	1.7	0.0	-	a,b	
				2018	5.4	1.3	3.1	0.8	0.8	b	
Simpson's Evenness	none	YES	0.0201	2015	0.397	0.232	-	3.2	-2.9	a,b	Tamhane's
				2016	0.267	0.041	-0.6	-	-4.2	a	
				2017	0.704	0.105	1.3	10.6	-	b	
				2018	0.458	0.295	0.3	4.6	-2.4	a,b	
Nemata (% of community)	none	NO	0.2544	2015	1.0%	2.2%	-	nc	nc	a	Mann-Whitney U-test
				2016	0.0%	0.0%	-0.4	-	nc	a	
				2017	0.0%	0.0%	-0.4	nc	-	a	
				2018	2.5%	3.8%	0.7	nc	nc	a	
Hydracarina (% of community)	none	NO	0.1199	2015	1.5%	3.3%	-	-0.3	-1.2	a	Mann-Whitney U-test
				2016	2.1%	2.1%	0.2	-	-1.1	a	
				2017	8.2%	5.5%	2.0	2.8	-	a	
				2018	3.7%	3.8%	0.7	0.7	-0.8	a	
Ostracoda (% of community)	none	NO	0.5312	2015	9.7%	13.1%	-	2.2	1.7	a	Mann-Whitney U-test
				2016	5.7%	1.8%	-0.3	-	0.7	a	
				2017	2.8%	4.1%	-0.5	-1.5	-	a	
				2018	3.1%	2.9%	-0.5	-1.4	0.1	a	
Chironomidae (% of community)	none	NO	0.2208	2015	87.4%	12.8%	-	-1.5	-0.2	a	Tukey's HSD
				2016	92.2%	3.2%	0.4	-	0.5	a	
				2017	88.8%	7.2%	0.1	-1.1	-	a	
				2018	90.7%	4.9%	0.3	-0.5	0.3	a	
Metal Sensitive Taxa (% of community)	none	NO	0.1211	2015	2.8%	2.6%	-	0.6	-1.0	a	Mann-Whitney U-test
				2016	1.7%	1.7%	-0.4	-	-1.2	a	
				2017	12.0%	8.9%	3.6	6.0	-	a	
				2018	11.4%	16.8%	3.3	5.6	-0.1	a	
Collector-Gatherer FFG (% of community)	modified probit	YES	0.0277	2015	96.2%	2.8%	-	-0.3	2.9	a,b	Tamhane's
				2016	96.9%	2.1%	0.2	-	3.0	a	
				2017	84.3%	4.1%	-4.2	-6.0	-	b	
				2018	89.6%	13.4%	-2.3	-3.5	1.3	a,b	
Filterer FFG (% of community)	modified probit	NO	0.1154	2015	1.9%	2.7%	-	nc	-0.5	a	Tamhane's
				2016	0.0%	0.0%	-0.7	-	-0.7	a	
				2017	6.5%	9.3%	1.7	nc	-	a	
				2018	6.5%	10.5%	1.7	nc	0.0	a	

Indicates a significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of initial year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.20: Statistical Comparison of Physical Sediment Quality Between Camp Lake and Reference Lake 3 for Samples Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2018

Lake Zone	Habitat Variable	Statistical Test Results			Summary Statistics							
		Significant Difference Between Areas?	P-value	Statistical Analysis ^a	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Median	Maximum
Littoral (Shallow) Stations	Station Depth (m)	NO	0.810	α	Reference	5	9.7	1.0	0.5	8.5	-	11.2
					Camp	5	9.4	2.7	1.2	6.3	-	12.4
	Sand-Sized Particles (% by weight)	NO	0.897	δ	Reference	5	59.6	4.4	2.0	54.9	59.4	66.4
					Camp	5	59.7	20.3	9.1	34.5	62.1	79.2
	Silt-Sized Particles (% by weight)	NO	0.685	δ	Reference	5	31.4	3.3	1.5	26.6	32.6	34.7
					Camp	5	36.9	18.8	8.4	18.6	34.7	60.6
	Clay-Sized Particles (% by weight)	YES	0.004	β	Reference	5	9.0	2.4	1.1	5.8	10.4	10.8
					Camp	5	3.4	1.6	0.7	1.6	3.2	5.2
	Total Organic Carbon (%)	YES	0.019	α	Reference	5	4.7	2.3	1.0	1.8	5.1	7.4
					Camp	5	1.5	0.9	0.4	0.7	1.4	2.9
Profundal (Deep) Stations	Station Depth (m)	NO	0.714	β	Reference	5	20.6	2.2	1.0	18.5	-	24.2
					Camp	5	23.5	9.7	4.3	16.2	-	35.1
	Sand-Sized Particles (% by weight)	NO	0.717	β	Reference	5	47.5	2.8	1.3	44.5	47.0	50.9
					Camp	5	51.0	34.1	15.3	21.5	31.2	89.8
	Silt-Sized Particles (% by weight)	NO	0.889	α	Reference	5	39.0	3.1	1.4	33.8	40.4	41.5
					Camp	5	40.8	28.3	12.7	8.3	55.5	68.8
	Clay-Sized Particles (% by weight)	NO	0.117	Υ	Reference	5	13.6	2.2	1.0	9.7	14.3	15.3
					Camp	5	8.2	6.4	2.9	1.3	9.6	15.0
	Total Organic Carbon (%)	YES	0.062	β	Reference	5	3.8	1.7	0.8	0.8	4.5	4.9
					Camp	5	1.2	1.0	0.4	0.1	1.6	2.3

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log-transformed, single factor ANOVA test conducted; γ - data untransformed, Mann-Whitney U-test conducted; ζ - data untransformed, t-test conducted assuming unequal variance; η - data log-transformed, t-test assuming unequal variance; δ - data square-root transformed, t-test assuming unequal variance conducted; Υ - data square-root transformed, single factor ANOVA conducted.

Highlighted values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

Table F.21: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake, August 2018

Taxa	Study Area Replicate Station	Camp Lake - Littoral Stations				
		JLO-02	JLO-21	JLO-20	JLO-19	JLO-18
ROUNDWORMS						
P. Nemata		-	86	17	233	17
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Lumbriculidae						
Lumbriculus		17	-	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Acalyptonotidae						
Acalyptonotus		17	17	43	78	-
F. Hygrobatidae						
Hygrobates		-	-	9	-	-
F. Lebertiidae						
Lebertia		-	-	9	-	-
F. Sperchontidae						
Sperchon		-	-	-	-	-
SEED SHRIMPS						
Cl. Ostracoda		-	-	52	9	-
INSECTS						
Cl. Insecta						
CADDISFLIES						
O. Trichoptera						
pupae		-	-	9	-	-
F. Apataniidae						
Apatania		-	-	17	9	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		17	26	43	17	-
S.F. Chironominae						
Chironomus		34	-	-	-	172
Micropsectra		69	52	155	534	-
Paratanytarsus		69	190	198	655	34
Sergentia		-	-	-	-	-
Stictochironomus		1,190	448	1,284	302	586
Tanytarsus		34	17	155	224	-
S.F. Diamesinae						
Protanypus		17	9	17	52	-
Pseudodiamesa		-	-	9	9	-
S.F. Orthocladiinae						
Abiskomyia		172	95	397	138	86
Cricotopus/Orthocladius		-	-	-	-	-
Heterotrissocladius		1,052	629	431	422	207
Hydrobaenus		-	-	-	-	-
Limnophyes		-	-	-	-	-

Table F.21: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake, August 2018

Taxa	Study Area Replicate Station	Camp Lake - Littoral Stations				
		JLO-02	JLO-21	JLO-20	JLO-19	JLO-18
<i>Mesocricotopus</i>		-	-	-	-	-
<i>Paracladius</i>		52	9	9	17	-
<i>Parakiefferiella</i>		17	-	-	-	-
<i>Psectrocladius</i>		-	-	-	-	-
<i>Zalutschia</i>		121	43	112	112	17
S.F. Tanypodinae						
<i>Arctopelopia</i>		259	138	147	147	52
<i>Procladius</i>		207	181	397	60	17
F. Tipulidae						
<i>Tipula</i>		-	-	-	-	-
Density (No. organisms per m²)		3,344	1,940	3,510	3,018	1,188
Richness (total number of taxa)^a		15	13	18	16	9
Simpson's Evenness (E)		0.811	0.874	0.858	0.930	0.784
Bray-Curtis Index		0.839	0.791	0.777	0.735	0.838
Dominant Taxonomic Group Composition						
% Nemata		0.0%	4.4%	0.5%	7.7%	1.4%
% Hydracarina		0.5%	0.9%	1.7%	2.6%	0.0%
% Ostracods		0.0%	0.0%	1.5%	0.3%	0.0%
% Chironomids		99.0%	94.7%	95.6%	89.1%	98.6%
% Metal Sensitive Chironmids		5.7%	14.0%	15.4%	49.1%	2.9%
% Tipulidae		0.0%	0.0%	0.0%	0.0%	0.0%
Functional Feeding Group Composition						
% Collector - Gatherers		76.7%	66.6%	63.9%	39.4%	89.9%
% Filterers		5.2%	13.6%	14.7%	47.1%	2.9%
% Shredders		3.6%	2.2%	3.2%	3.7%	1.4%
Habitat Preference Group Composition						
% Clingers		3.6%	4.5%	11.4%	28.1%	0.0%
% Sprawlers		58.6%	67.2%	50.5%	52.4%	34.8%
% Burrowers		37.8%	28.3%	38.0%	19.5%	65.2%

^a Bold entries excluded from taxa count

Table F.21: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake, August 2018

Taxa	Study Area Replicate Station	Camp Lake - Profundal Stations				
		JLO-16	JLO-01	JLO-07	JLO-11	JLO-12
ROUNDWORMS						
P. Nemata		34	-	-	-	129
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Lumbriculidae						
<i>Lumbriculus</i>		-	-	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Acalyptonotidae						
<i>Acalyptonotus</i>		-	-	9	-	9
F. Hygrobatidae						
<i>Hygrobates</i>		-	-	-	-	-
F. Lebertiidae						
<i>Lebertia</i>		-	9	-	17	17
F. Sperchontidae						
<i>Sperchon</i>		-	-	-	-	-
SEED SHRIMPS						
Cl. Ostracoda		-	-	-	-	34
INSECTS						
Cl. Insecta						
CADDISFLIES						
O. Trichoptera						
pupae		-	-	-	-	-
F. Apataniidae						
<i>Apatania</i>		-	-	-	-	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		-	-	17	34	9
S.F. Chironominae						
<i>Chironomus</i>		207	-	741	810	-
<i>Micropsectra</i>		172	-	9	-	-
<i>Paratanytarsus</i>		-	-	9	17	-
<i>Sergentia</i>		86	-	-	-	-
<i>Stictochironomus</i>		1,724	9	34	43	-
<i>Tanytarsus</i>		34	-	-	26	-
S.F. Diamesinae						
<i>Protanypus</i>		34	52	9	9	43
<i>Pseudodiamesa</i>		17	9	-	26	9
S.F. Orthocladiinae						
<i>Abiskomyia</i>		34	-	43	26	-
<i>Cricotopus/Orthocladius</i>		-	-	-	-	-
<i>Heterotrissocladius</i>		-	931	9	26	741
<i>Hydrobaenus</i>		-	-	-	-	-
<i>Limnophyes</i>		-	-	-	-	-

Table F.21: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake, August 2018

Taxa	Study Area Replicate Station	Camp Lake - Profundal Stations				
		JLO-16	JLO-01	JLO-07	JLO-11	JLO-12
<i>Mesocricotopus</i>		-	-	-	-	-
<i>Paracladius</i>		-	17	-	-	9
<i>Parakiefferiella</i>		-	-	-	-	-
<i>Psectrocladius</i>		-	-	-	-	-
<i>Zalutschia</i>		-	9	-	-	-
S.F. Tanypodinae						
<i>Arctopelopia</i>		-	-	-	-	-
<i>Procladius</i>		-	-	-	-	-
F. Tipulidae						
<i>Tipula</i>		-	-	-	-	-
Density (No. organisms per m²)		2,342	1,036	880	1,034	1,000
Richness (total number of taxa)^a		9	7	8	9	8
Simpson's Evenness (E)		0.498	0.221	0.294	0.380	0.479
Bray-Curtis Index		0.981	0.485	0.958	0.950	0.447
Dominant Taxonomic Group Compos						
% Nemata		1.5%	0.0%	0.0%	0.0%	12.9%
% Hydracarina		0.0%	0.9%	1.0%	1.6%	2.6%
% Ostracods		0.0%	0.0%	0.0%	0.0%	3.4%
% Chironomids		98.5%	99.1%	99.0%	98.4%	81.1%
% Metal Sensitive Chironmids		11.0%	5.9%	3.1%	7.8%	5.3%
% Tipulidae		0.0%	0.0%	0.0%	0.0%	0.0%
Functional Feeding Group Compos						
% Collector - Gatherers		91.2%	98.3%	96.9%	94.0%	97.4%
% Filterers		8.8%	0.0%	2.0%	4.4%	0.0%
% Shredders		0.0%	0.9%	0.0%	0.0%	0.0%
Habitat Preference Group Composi						
% Clingers		12.5%	0.9%	2.0%	4.3%	2.6%
% Sprawlers		2.2%	93.2%	7.0%	9.6%	80.1%
% Burrowers		85.4%	5.9%	90.9%	86.2%	17.3%

^a Bold entries excluded from taxa count

Table F.22: Statistical Comparison of Benthic Invertebrate Community Metrics at Camp Lake Littoral (Shallow) Statoins Among Years of Mine Operation (2015 to 2018) and Baseline (2013) for the Mary River Project CREMP

Metric	Data Transform- ation	Overall 5-Year Comparison		Pair-wise, post-hoc comparisons ^a						
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2013	Pairwise Comparison	Statistical Test
Density (No. per m ²)	none	NO	0.3477	2013	3	7,752	3,849	-	a	Mann-Whitney U-test
				2015	5	3,671	1,891	-1.1	a	
				2016	5	2,639	668	-1.3	a	
				2017	5	3,642	1,449	-1.1	a	
				2018	5	2,600	998	-1.3	a	
Richness (No. of Taxa)	none	NO	0.1815	2013	3	18.0	4.4	-	a	Mann-Whitney U-test
				2015	5	12.8	3.7	-1.2	a	
				2016	5	15.8	3.3	-0.5	a	
				2017	5	12.8	2.3	-1.2	a	
				2018	5	14.2	3.4	-0.9	a	
Simpson's Evenness	none	YES	0.0002	2013	3	0.893	0.054	-	a	Tukey's HSD
				2015	5	0.712	0.063	-3.4	b	
				2016	5	0.917	0.034	0.4	a	
				2017	5	0.848	0.068	-0.8	a	
				2018	5	0.851	0.057	-0.8	a	
Nemata (% of community)	none	NO	0.8963	2013	3	5.6%	3.6%	-	a	Tukey's HSD
				2015	5	4.7%	4.6%	-0.2	a	
				2016	5	4.4%	4.8%	-0.3	a	
				2017	5	4.2%	4.2%	-0.4	a	
				2018	5	2.8%	3.2%	-0.8	a	
Ostracoda (% of community)	none	YES	0.0692	2013	3	0.7%	0.5%	-	a,b	Mann-Whitney U-test
				2015	5	0.2%	0.3%	-1.0	a	
				2016	5	1.8%	1.1%	2.5	b	
				2017	5	0.2%	0.3%	-1.1	a	
				2018	5	0.4%	0.6%	-0.7	a	
Chironomidae (% of community)	none	NO	0.2332	2013	3	90.1%	4.4%	-	a	Tukey's HSD
				2015	5	93.1%	4.7%	0.7	a	
				2016	5	87.4%	7.0%	-0.6	a	
				2017	5	92.2%	6.5%	0.5	a	
				2018	5	95.4%	4.0%	1.2	a	
Metal Sensitive Taxa (% of community)	none	NO	0.3710	2013	3	30.8%	14.6%	-	a	Tukey's HSD
				2015	5	38.5%	24.5%	0.5	a	
				2016	5	29.7%	11.8%	-0.1	a	
				2017	5	38.2%	17.3%	0.5	a	
				2018	5	17.4%	18.5%	-0.9	a	
Collector-Gatherer FFG (% of community)	none	NO	0.2665	2013	3	55.9%	12.4%	-	a	Tukey's HSD
				2015	5	51.1%	14.7%	-0.4	a	
				2016	5	65.7%	7.8%	0.8	a	
				2017	5	50.8%	17.4%	-0.4	a	
				2018	5	67.3%	18.6%	0.9	a	
Filterer FFG (% of community)	none	NO	0.2879	2013	3	30.8%	14.5%	-	a	Tukey's HSD
				2015	5	38.2%	24.3%	0.5	a	
				2016	5	25.0%	7.5%	-0.4	a	
				2017	5	37.3%	17.3%	0.4	a	
				2018	5	16.7%	17.8%	-1.0	a	

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.23: Statistical Comparison of Benthic Metrics at Camp Lake Profundal (Deep) Stations Among Years of Mine Operation (2015 to 2018) and Baseline (2007, 2013) for the Mary River Project CREMP

Metric	Data Transformation	Overall 5-Year Comparison ^a		Pair-wise, post-hoc comparisons ^a							Statistical Test
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	vs. Baseline Year 2013	Pairwise Comparison	
Density (No. per m ²)	none	NO	0.1685	2007	4	2,627	1,403	-	0.9	a	Mann-Whitney U-test
				2013	5	2,140	567	-0.3	-	a	
				2015	5	1,552	1,005	-0.8	-1.0	a	
				2017	5	1,510	844	-0.8	-1.1	a	
				2018	5	1,258	609	-1.0	-1.6	a	
Richness (No. of Taxa)	none	YES	0.0066	2007	4	9.0	1.7	-	-1.8	a	Tukey's HSD
				2013	5	14.2	2.9	3.0	-	b	
				2015	5	8.2	2.8	-0.5	-2.0	a	
				2017	5	10.8	3.3	1.0	-1.2	b	
				2018	5	8.2	0.8	-0.5	-2.0	a	
Simpson's Evenness	none	YES	0.0451	2007	4	0.602	0.114	-	-1.0	a,b	Tukey's HSD
				2013	5	0.720	0.122	1.0	-	a	
				2015	5	0.604	0.283	0.0	-0.9	a,b	
				2017	5	0.681	0.154	0.7	-0.3	a	
				2018	5	0.374	0.118	-2.0	-2.8	b	
Nemata (% of community)	modified probit	NO	0.4597	2007	4	3.5%	3.1%	-	-0.3	a	Tukey's HSD
				2013	5	4.4%	3.2%	0.3	-	a	
				2015	5	6.7%	10.4%	1.0	0.7	a	
				2017	5	7.1%	6.2%	1.2	0.9	a	
				2018	5	2.9%	5.6%	-0.2	-0.5	a	
Ostracoda (% of community)	none	NO	0.7498	2007	4	0.0%	0.1%	-	-0.8	a	Mann-Whitney U-test
				2013	5	0.4%	0.4%	4.9	-	a	
				2015	5	0.3%	0.7%	3.6	-0.2	a	
				2017	5	0.3%	0.6%	3.3	-0.3	a	
				2018	5	0.7%	1.5%	8.6	0.6	a	
Chironomidae (% of community)	none	NO	0.7144	2007	4	94.9%	4.3%	-	0.8	a	Mann-Whitney U-test
				2013	5	91.1%	4.7%	-0.9	-	a	
				2015	5	90.4%	11.3%	-1.1	-0.1	a	
				2017	5	90.0%	6.6%	-1.1	-0.2	a	
				2018	5	95.2%	7.9%	0.1	0.9	a	
Metal Sensitive Taxa (% of community)	modified probit	YES	0.0060	2007	4	34.8%	4.8%	-	-0.3	a	Tukey's HSD
				2013	5	39.5%	17.2%	1.0	-	a	
				2015	5	11.7%	7.3%	-4.9	-1.6	b,c,d	
				2017	5	33.3%	25.5%	-0.3	-0.4	a,c	
				2018	5	6.6%	3.0%	-5.9	-1.9	d	
Collector-Gatherer FFG (% of community)	none	YES	0.0027	2007	4	64.6%	6.1%	-	0.4	a	Mann-Whitney U-test
				2013	5	57.0%	19.9%	-1.3	-	a	
				2015	5	84.7%	7.3%	3.3	1.4	b	
				2017	5	64.2%	28.1%	-0.1	0.4	a,b	
				2018	5	95.6%	2.9%	5.1	1.9	c	
Filterer FFG (% of community)	none	YES	0.0061	2007	4	32.6%	4.0%	-	-0.3	a,c	Tamhane's
				2013	5	37.5%	16.8%	1.2	-	a,b,c	
				2015	5	11.4%	6.8%	-5.3	-1.6	b,d	
				2017	5	31.6%	26.4%	-0.2	-0.3	b,c	
				2018	5	3.0%	3.7%	-7.3	-2.1	b,d	

Indicates a significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.24: Replicate Grab Habitat Data for Benthic Invertebrate Community Samples Collected at the Sheardown Lake Tributaries, Mary River Project CREMP, August 2018

Study Area	Station	Water Depth (cm)			Water Velocity (m/s)			Embeddedness			In-Stream Vegetation			Algae Presence		
		Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3
Unnamed Reference Creek	REF-CRK-B1	10	10	10	0.42	0.41	0.42	25%	25%	25%	scarce	scarce	scarce	scarce	scarce	scarce
	REF-CRK-B2	9	9	11	0.52	0.48	0.42	25%	25%	25%	scarce	scarce	scarce	scarce	common	common
	REF-CRK-B3	17	17	10	0.55	0.46	0.55	25%	25%	25%	scarce	scarce	scarce	common	common	common
	REF-CRK-B4	10	12	10	0.45	0.45	0.60	25%	25%	25%	scarce	common	scarce	common	common	common
	REF-CRK-B5	12	14	14	0.41	0.47	0.59	25%	25%	25%	scarce	scarce	scarce	common	common	common
Sheardown Tributary 1 Reach 1	SDLT1 - B1	15	18	17	0.40	0.40	0.55	25%	25%	75%	abundant	common	scarce	abundant	common	common
	SDLT1 - B2	18	10	12	0.43	0.45	0.35	25%	25%	25%	common	common	common	common	common	common
	SDLT1 - B3	21	15	14	0.60	0.41	0.54	25%	75%	50%	common	scarce	common	common	common	common
	SDLT1 - B4	12	21	17	0.53	0.42	0.49	25%	50%	25%	scarce	common	common	abundant	common	common
	SDLT1 - B5	15	15	16	0.39	0.39	0.35	50%	50%	50%	common	common	scarce	common	common	common
Sheardown Tributary 9	SDLT9 - B1	8	12	11	0.40	0.45	0.47	75%	25%	50%	common	common	common	common	common	common
	SDLT9 - B2	6	5	7	0.43	0.51	0.40	25%	50%	50%	scarce	scarce	scarce	common	common	common
	SDLT9 - B3	8	9	11	0.41	0.41	0.51	25%	50%	88%	none	none	none	common	common	common
	SDLT9 - B4	8	10	7	0.48	0.42	0.41	50%	63%	25%	none	scarce	none	common	common	common
	SDLT9 - B5	5	7	10	0.42	0.40	0.59	38%	25%	50%	scarce	scarce	none	common	common	common
Sheardown Tributary 12	SDLT12 - B1	8	10	10	0.11	0.16	0.14	25%	50%	50%	scarce	scarce	scarce	common	common	common
	SDLT12 - B2	14	5	8	0.11	0.09	0.45	25%	50%	50%	common	scarce	scarce	common	common	common
	SDLT12 - B3	7	12	15	0.12	0.10	0.11	50%	50%	50%	scarce	common	scarce	common	common	common

Table F.25: Replicate Station Habitat Feature Summary Statistics for the Sheardown Lake Tributary Benthic Stations, Mary River Project CREMP, August 2018

Metric	Study Area	Mean	Standard Deviation	Standard Error	95% Confidence Interval		Minimum	Maximum
					Lower Bound	Upper Bound		
Water Depth (cm)	Unnamed Reference Creek	11.7	2.2	1.0	8.9	14.4	9.7	14.7
	Sheardown Tributary 1 (SDLT1)	15.7	1.5	0.7	13.9	17.6	13.3	16.7
	Sheardown Tributary 12 (SDLT12)	9.9	1.3	0.7	6.8	13.0	9.0	11.3
	Sheardown Tributary 9 (SDLT9)	8.3	1.7	0.8	6.2	10.4	6.0	10.3
Water Velocity (cm/s)	Unnamed Reference Creek	48.0	3.9	1.8	43.1	52.9	41.7	52.0
	Sheardown Tributary 1 (SDLT1)	44.7	5.5	2.5	37.8	51.5	37.7	51.7
	Sheardown Tributary 12 (SDLT12)	15.4	5.6	3.2	1.7	29.2	11.0	21.7
	Sheardown Tributary 9 (SDLT9)	44.7	1.3	0.6	43.1	46.4	43.7	47.0
Substrate Embeddedness (%)	Unnamed Reference Creek	25	0	0	25	25	25	25
	Sheardown Tributary 1 (SDLT1)	40	11	5	27	53	25	50
	Sheardown Tributary 12 (SDLT12)	44	5	3	32	56	42	50
	Sheardown Tributary 9 (SDLT9)	46	7	3	38	54	38	54

Note: Five stations were sampled at Unnamed Reference Creek, SDLT1, and SDLT9, and three stations were sampled at SDLT12.

Table F.26: Benthic Station Habitat Feature Statistical Comparisons Between Individual Sheardown Lake Tributaries and Unnamed Reference Creek, Mary River Project CREMP, August 2018

Metric	Pair-wise comparisons ^a				
	(I) Area	(J) Area	Significant Difference Between Areas?	P-value	Statistical Test ^b
Water Depth (cm)	Unnamed Reference Creek	SDLT1	YES	0.0159	γ
	Unnamed Reference Creek	SDLT12	NO	0.2500	
	Unnamed Reference Creek	SDLT9	YES	0.0317	
Water Velocity (cm/s)	Unnamed Reference Creek	SDLT1	NO	0.6133	α , ζ
	Unnamed Reference Creek	SDLT12	YES	0.0000	
	Unnamed Reference Creek	SDLT9	NO	0.6278	
Substrate Embeddedness (%)	Unnamed Reference Creek	SDLT1	YES	0.0317	γ
	Unnamed Reference Creek	SDLT12	YES	0.0357	
	Unnamed Reference Creek	SDLT9	YES	0.0079	

Note: Shading indicates a significant difference for respective comparison (p-value ≤ 0.1).

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

^b Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log-transformed, single factor ANOVA test conducted; ζ - Tukey's HSD post-hoc test used; η - Tamhane's post-hoc test used; γ - non-parametric Kruskal Wallis (multiple group) and Mann-Whitney U-tests (pair-wise) used on untransformed data

Table F.27: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake Tributaries 1 and 12, August 2018

Taxa	Study Area Replicate Station	Sheardown Lake Tributary 1 (SDLT1)				
		B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		7	29	29	22	-
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		-	57	7	14	43
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Trombidiformes						
F. Lebertiidae						
Lebertia		-	-	-	-	-
F. Sperchonidae						
Sperchon		14	86	14	14	29
SEED SHRIMPS						
Cl. Ostracoda		-	-	-	-	-
SPRINGTAILS						
Cl. Entognatha						
O. Collembola		-	29	-	-	-
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
Acentrella feropagus		-	-	-	7	-
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature		-	-	-	-	-
CADDISFLIES						
O. Trichoptera						
F. Limnephilidae						
immature		-	-	-	-	-
TRUE FLIES						
O. Diptera						
BITING-MIDGE						
F. Ceratopogonidae						
Culicoides		-	-	-	-	-
MIDGES						
F. Chironomidae						
chironomid pupae		47	144	86	122	75
S.F. Chironominae						
Paratanytarsus		-	-	-	-	4
Rheotanytarsus		4	86	7	7	-
Tanytarsus		-	-	-	-	-
Chironomini indeterminate		-	-	-	-	-
S.F. Diamesinae						
Diamesa		-	-	7	-	4

Table F.27: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake Tributaries 1 and 12, August 2018

Taxa	Study Area Replicate Station	Sheardown Lake Tributary 1 (SDLT1)				
		B1	B2	B3	B4	B5
<i>Pseudokiefferiella</i>		79	316	330	65	36
S.F. Orthoclaadiinae						
<i>Chaetocladius</i>		-	-	-	-	-
<i>Corynoneura</i>		-	-	-	-	-
<i>Cricotopus</i>		86	287	158	158	68
<i>Cricotopus/Orthocladus</i>		22	517	144	122	32
<i>Diplocladius</i>		-	-	-	-	-
<i>Eukiefferiella</i>		-	-	-	-	-
<i>Hydrobaenus</i>		-	-	22	7	-
<i>Hydrosmittia</i>		39	488	237	481	269
<i>Krenosmittia</i>		-	-	-	-	-
<i>Limnophyes</i>		-	-	-	-	-
<i>Metriocnemus</i>		-	-	-	-	-
<i>Orthocladus (Euorthocladus)</i>		4	57	22	50	7
<i>Parakiefferiella</i>		-	57	14	22	-
<i>Paraphaenocladus</i>		-	-	-	-	-
<i>Thienemanniella</i>		-	-	-	-	-
<i>Tokunagaia</i>		-	-	-	-	-
<i>Tvetenia</i>		7	115	36	22	22
indeterminate		-	-	-	-	-
S.F. Podonominae						
<i>Trichotanypus</i>		-	-	-	-	-
S.F. Tanypodinae						
<i>Thienemannimyia</i> complex		-	-	-	-	7
F. Empididae						
<i>Chelifera/Metachela</i>		-	-	-	-	4
<i>Clinocera</i>		-	-	-	-	-
pupae		-	-	-	-	-
F. Simuliidae						
<i>Gymnopaia</i>		-	-	-	-	-
<i>Metacnephia</i>		-	-	-	-	-
<i>Prosimulium</i>		-	-	-	-	-
F. Tipulidae						
<i>Tipula</i>		4	57	14	7	25
Density (No. organisms per m²)		313	2,325	1,127	1,120	625
Richness (total number of taxa)^a		10	13	14	14	13
Simpson's Evenness (E)		0.854	0.915	0.862	0.770	0.772
Bray-Curtis Index		0.464	0.462	0.202	0.165	0.259
Dominant Group Composition						
% Nemata		2.2%	1.2%	2.6%	2.0%	0.0%
% Oligochaeta		0.0%	2.5%	0.6%	1.3%	6.9%
% Hydracarina		4.5%	3.7%	1.2%	1.3%	4.6%
% Ostracods		0.0%	0.0%	0.0%	0.0%	0.0%
% Ephemeroptera		0.0%	0.0%	0.0%	0.6%	0.0%
% Chironomids		92.0%	88.9%	94.3%	94.3%	83.8%
% Metal Sensitive Chironomids		31.6%	18.6%	33.3%	7.2%	8.3%
% Simuliidae		0.0%	0.0%	0.0%	0.0%	0.0%
% Tipulidae		1.3%	2.5%	1.2%	0.6%	4.0%
Functional Feeding Group Composition						
% Collector - Gatherers		51.4%	52.7%	67.6%	69.1%	70.1%
% Filterers		1.6%	4.0%	0.7%	0.7%	0.8%
% Shredders		42.5%	39.6%	30.4%	28.9%	22.6%
Habitat Preference Group Composition						
% Clingers		47.3%	46.1%	31.1%	30.3%	23.8%
% Sprawlers		47.6%	45.2%	62.3%	60.8%	64.0%
% Burrowers		3.5%	6.2%	4.4%	3.8%	10.9%

^a Bold entries excluded from taxa count

Table F.27: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake Tributaries 1 and 12, August 2018

Taxa	Study Area	Sheardown Tributary 12 (SDLT12)		
	Replicate Station	B1	B2	B3
ROUNDWORMS				
P. Nemata		-	11	72
ANNELIDS				
P. Annelida				
WORMS				
Cl. Oligochaeta				
F. Enchytraeidae		144	54	50
ARTHROPODS				
P. Arthropoda				
MITES				
Cl. Arachnida				
O. Trombidiformes				
F. Lebertiidae				
Lebertia		-	-	-
F. Sperchonidae				
Sperchon		-	22	-
SEED SHRIMPS				
Cl. Ostracoda		-	-	7
SPRINGTAILS				
Cl. Entognatha				
O. Collembola		-	-	-
INSECTS				
Cl. Insecta				
MAYFLIES				
O. Ephemeroptera				
F. Baetidae				
Acentrella feropagus		-	-	-
STONEFLIES				
O. Plecoptera				
F. Capniidae				
immature				
CADDISFLIES				
O. Trichoptera				
F. Limnephilidae				
immature		-	-	-
TRUE FLIES				
O. Diptera				
BITING-MIDGE				
F. Ceratopogonidae				
Culicoides		-	-	-
MIDGES				
F. Chironomidae				
chironomid pupae		57	7	36
S.F. Chironominae				
Paratanytarsus		-	4	7
Rheotanytarsus		-	-	-
Tanytarsus		-	-	-
Chironomini indeterminate		-	4	-
S.F. Diamesinae				
Diamesa		-	4	-

Table F.27: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake Tributaries 1 and 12, August 2018

Taxa	Study Area	Sheardown Tributary 12 (SDLT12)		
	Replicate Station	B1	B2	B3
<i>Pseudokiefferiella</i>		-	-	-
S.F. Orthocladiinae				
<i>Chaetocladius</i>		201	25	43
<i>Corynoneura</i>		29	-	-
<i>Cricotopus</i>		29	25	72
<i>Cricotopus/Orthocladius</i>		144	147	36
<i>Diplocladius</i>		3244	395	1119
<i>Eukiefferiella</i>		201	11	-
<i>Hydrobaenus</i>		-	29	-
<i>Hydrosmittia</i>		29	-	-
<i>Krenosmittia</i>		-	4	-
<i>Limnophyes</i>		86	-	7
<i>Metriocnemus</i>		86	61	-
<i>Orthocladius (Euorthocladius)</i>		29	-	-
<i>Parakiefferiella</i>		-	-	-
<i>Paraphaenocladius</i>		574	32	-
<i>Thienemanniella</i>		-	-	-
<i>Tokunagaia</i>		29	129	208
<i>Tvetenia</i>		-	7	-
indeterminate		431	65	337
S.F. Podonominae				
<i>Trichotanypus</i>		-	-	7
S.F. Tanypodinae				
<i>Thienemannimyia</i> complex		-	-	-
F. Empididae				
<i>Chelifera/Metachela</i>		-	-	-
<i>Clinocera</i>		-	-	-
pupae		-	-	-
F. Simuliidae				
<i>Gymnopaia</i>		-	-	-
<i>Metacnephia</i>		-	-	-
<i>Prosimulium</i>		-	-	-
F. Tipulidae				
<i>Tipula</i>		29	25	75
Density (No. organisms per m²)		5,342	1,061	2,076
Richness (total number of taxa)^a		14	17	12
Simpson's Evenness (E)		0.571	0.835	0.571
Bray-Curtis Index		0.951	0.804	0.884
Dominant Group Composition				
% Nemata		0.0%	1.0%	3.5%
% Oligochaeta		2.7%	5.1%	2.4%
% Hydracarina		0.0%	2.1%	0.0%
% Ostracods		0.0%	0.0%	0.3%
% Ephemeroptera		0.0%	0.0%	0.0%
% Chironomids		96.8%	89.4%	90.2%
% Metal Sensitive Chironmids		0.0%	1.1%	0.7%
% Simuliidae		0.0%	0.0%	0.0%
% Tipulidae		0.5%	2.4%	3.6%
Functional Feeding Group Compos				
% Collector - Gatherers		95.9%	77.4%	89.5%
% Filterers		0.0%	0.8%	0.3%
% Shredders		4.1%	19.8%	10.1%
Habitat Preference Group Composi				
% Clingers		3.6%	19.5%	6.5%
% Sprawlers		90.8%	65.7%	84.0%
% Burrowers		5.0%	14.8%	9.5%

^a Bold entries excluded from taxa count

Table F.28: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake Tributary 9, August 2018

Taxa	Study Area Replicate Station	Sheardown Lake Tributary 9 (SDLT9)				
		B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		43	79	136	72	86
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		-	29	4	14	14
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Trombidiformes						
F. Lebertiidae						
Lebertia		-	-	11	-	-
F. Sperchonidae						
Sperchon		165	100	126	144	72
SEED SHRIMPS						
Cl. Ostracoda		-	22	39	14	29
SPRINGTAILS						
Cl. Entognatha						
O. Collembola		-	7	11	-	-
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
Acentrella feropagus		-	57	7	-	-
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature						
CADDISFLIES						
O. Trichoptera						
F. Limnephilidae						
immature		14	-	25	-	-
TRUE FLIES						
O. Diptera						
BITING-MIDGE						
F. Ceratopogonidae						
Culicoides		-	-	-	-	-
MIDGES						
F. Chironomidae						
chironomid pupae		86	65	79	144	258
S.F. Chironominae						
Paratanytarsus		-	-	-	-	-
Rheotanytarsus		-	-	-	-	14
Tanytarsus		-	-	-	-	-
Chironomini indeterminate		-	-	-	-	-
S.F. Diamesinae						
Diamesa		-	-	4	-	-

Table F.28: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake Tributary 9, August 2018

Taxa	Study Area Replicate Station	Sheardown Lake Tributary 9 (SDLT9)				
		B1	B2	B3	B4	B5
<i>Pseudokiefferiella</i>		29	-	-	14	-
S.F. Orthocladinae						
<i>Chaetocladius</i>		-	-	4	14	-
<i>Corynoneura</i>		57	-	7	29	-
<i>Cricotopus</i>		136	22	118	187	100
<i>Cricotopus/Orthocladus</i>		445	158	133	287	388
<i>Diplocladius</i>		-	7	7	-	-
<i>Eukiefferiella</i>		-	-	-	14	-
<i>Hydrobaenus</i>		-	-	-	-	-
<i>Hydrosmittia</i>		29	7	47	144	57
<i>Krenosmittia</i>		14	72	50	57	14
<i>Limnophyes</i>		-	14	11	43	29
<i>Metriocnemus</i>		-	-	-	-	-
<i>Orthocladus (Euorthocladus)</i>		7	158	7	-	43
<i>Parakiefferiella</i>		-	-	-	-	-
<i>Paraphaenocladus</i>		-	-	-	-	-
<i>Thienemanniella</i>		-	-	-	14	-
<i>Tokunagaia</i>		545	201	151	416	187
<i>Tvetenia</i>		14	14	4	14	29
indeterminate		323	-	122	86	14
S.F. Podonominae						
<i>Trichotanytus</i>		-	-	-	-	-
S.F. Tanypodinae						
<i>Thienemannimyia</i> complex		-	7	-	-	-
F. Empididae						
<i>Chelifera/Metachela</i>		-	-	-	-	-
<i>Clinocera</i>		-	-	-	-	-
pupae		7	7	-	-	-
F. Simuliidae						
<i>Gymnopaia</i>		-	36	7	-	-
<i>Metacnephia</i>		-	7	7	14	-
<i>Prosimulium</i>		-	-	-	-	-
F. Tipulidae						
<i>Tipula</i>		86	79	43	14	32
Density (No. organisms per m²)		2,000	1,148	1,160	1,735	1,366
Richness (total number of taxa)^a		14	20	23	18	14
Simpson's Evenness (E)		0.821	0.937	0.929	0.892	0.866
Bray-Curtis Index		0.842	0.689	0.754	0.759	0.739
Dominant Group Composition						
% Nemata		2.2%	6.9%	11.7%	4.1%	6.3%
% Oligochaeta		0.0%	2.5%	0.3%	0.8%	1.0%
% Hydracarina		8.3%	8.7%	11.8%	8.3%	5.3%
% Ostracods		0.0%	1.9%	3.4%	0.8%	2.1%
% Ephemeroptera		0.0%	5.0%	0.6%	0.0%	0.0%
% Chironomids		84.3%	63.2%	64.1%	84.3%	82.9%
% Metal Sensitive Chironomids		1.6%	0.0%	0.3%	0.9%	1.3%
% Simuliidae		0.0%	3.7%	1.2%	0.8%	0.0%
% Tipulidae		4.3%	6.9%	3.7%	0.8%	2.3%
Functional Feeding Group Composition						
% Collector - Gatherers		47.9%	62.2%	51.5%	57.6%	44.0%
% Filterers		0.0%	3.7%	1.2%	0.8%	1.3%
% Shredders		43.5%	24.1%	35.5%	33.3%	49.4%
Habitat Preference Group Composition						
% Clingers		47.8%	30.9%	45.8%	41.6%	53.7%
% Sprawlers		45.4%	37.6%	37.6%	52.6%	32.5%
% Burrowers		6.5%	16.3%	15.8%	5.8%	9.7%

^a Bold entries excluded from taxa count

Table F.29: Benthic Invertebrate Community Summary Statistics for the Sheardown Lake Tributaries, Mary River Project CREMP, August 2018

Metric	Area	Mean	Standard Deviation	Standard Error	95% Confidence Interval		Minimum	Maximum
					Lower Bound	Upper Bound		
Density (no. organisms / m²)	Unnamed Reference Creek	526	152	68	337	714	262	636
	Sheardown Tributary 1 (SDLT1)	1,102	766	343	151	2,053	313	2,325
	Sheardown Tributary 12 (SDLT12)	2,826	2,237	1,292	-2,731	8,383	1,061	5,342
	Sheardown Tributary 9 (SDLT9)	1,482	375	167	1,017	1,947	1,148	2,000
Richness (Number of Taxa)	Unnamed Reference Creek	19.8	3.0	1.4	16.0	23.6	16.0	24.0
	Sheardown Tributary 1 (SDLT1)	12.8	1.6	0.7	10.8	14.8	10.0	14.0
	Sheardown Tributary 12 (SDLT12)	14.3	2.5	1.5	8.1	20.6	12.0	17.0
	Sheardown Tributary 9 (SDLT9)	17.8	3.9	1.7	13.0	22.6	14.0	23.0
Simpson's Evenness	Unnamed Reference Creek	0.960	0.011	0.005	0.946	0.974	0.942	0.972
	Sheardown Tributary 1 (SDLT1)	0.834	0.062	0.028	0.757	0.912	0.770	0.915
	Sheardown Tributary 12 (SDLT12)	0.659	0.152	0.088	0.281	1.037	0.571	0.835
	Sheardown Tributary 9 (SDLT9)	0.889	0.047	0.021	0.830	0.947	0.821	0.937
Bray-Curtis Index	Unnamed Reference Creek	0.208	0.093	0.042	0.092	0.324	0.114	0.342
	Sheardown Tributary 1 (SDLT1)	0.310	0.143	0.064	0.132	0.489	0.165	0.464
	Sheardown Tributary 12 (SDLT12)	0.879	0.074	0.042	0.697	1.062	0.804	0.951
	Sheardown Tributary 9 (SDLT9)	0.757	0.055	0.025	0.688	0.825	0.689	0.842
Nemata (% of community)	Unnamed Reference Creek	6.0%	2.0%	0.9%	3.6%	8.5%	3.9%	9.3%
	Sheardown Tributary 1 (SDLT1)	1.6%	1.0%	0.5%	0.3%	2.9%	0.0%	2.6%
	Sheardown Tributary 12 (SDLT12)	1.5%	1.8%	1.0%	-2.9%	5.9%	0.0%	3.5%
	Sheardown Tributary 9 (SDLT9)	6.2%	3.6%	1.6%	1.8%	10.7%	2.2%	11.7%
Oligochaeta (% of community)	Unnamed Reference Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Sheardown Tributary 1 (SDLT1)	2.2%	2.7%	1.2%	-1.2%	5.7%	0.0%	6.9%
	Sheardown Tributary 12 (SDLT12)	3.4%	1.5%	0.9%	-0.3%	7.1%	2.4%	5.1%
	Sheardown Tributary 9 (SDLT9)	0.9%	1.0%	0.4%	-0.3%	2.1%	0.0%	2.5%
Hydracarina (% of community)	Unnamed Reference Creek	3.3%	1.3%	0.6%	1.6%	4.9%	2.0%	5.3%
	Sheardown Tributary 1 (SDLT1)	3.1%	1.7%	0.8%	1.0%	5.2%	1.2%	4.6%
	Sheardown Tributary 12 (SDLT12)	0.7%	1.2%	0.7%	-2.3%	3.7%	0.0%	2.1%
	Sheardown Tributary 9 (SDLT9)	8.5%	2.3%	1.0%	5.6%	11.3%	5.3%	11.8%
Ostracoda (% of community)	Unnamed Reference Creek	1.2%	1.0%	0.4%	-0.1%	2.4%	0.0%	2.7%
	Sheardown Tributary 1 (SDLT1)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Sheardown Tributary 12 (SDLT12)	0.1%	0.2%	0.1%	-0.4%	0.6%	0.0%	0.3%
	Sheardown Tributary 9 (SDLT9)	1.6%	1.3%	0.6%	0.0%	3.2%	0.0%	3.4%
Ephemeroptera (% of community)	Unnamed Reference Creek	5.6%	2.1%	0.9%	3.0%	8.3%	3.9%	9.2%
	Sheardown Tributary 1 (SDLT1)	0.1%	0.3%	0.1%	-0.2%	0.5%	0.0%	0.6%
	Sheardown Tributary 12 (SDLT12)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Sheardown Tributary 9 (SDLT9)	1.1%	2.2%	1.0%	-1.6%	3.8%	0.0%	5.0%
Chironomidae (% of community)	Unnamed Reference Creek	60.3%	4.5%	2.0%	54.8%	65.9%	55.0%	66.8%
	Sheardown Tributary 1 (SDLT1)	90.7%	4.4%	2.0%	85.2%	96.2%	83.8%	94.3%
	Sheardown Tributary 12 (SDLT12)	92.1%	4.0%	2.3%	82.1%	102.1%	89.4%	96.8%
	Sheardown Tributary 9 (SDLT9)	75.8%	11.1%	5.0%	62.0%	89.5%	63.2%	84.3%
Metal-Sensitive Chironomidae (% of community)	Unnamed Reference Creek	12.4%	4.2%	1.9%	7.1%	17.7%	6.9%	18.7%
	Sheardown Tributary 1 (SDLT1)	19.8%	12.4%	5.5%	4.4%	35.2%	7.2%	33.3%
	Sheardown Tributary 12 (SDLT12)	0.6%	0.6%	0.3%	-0.8%	2.0%	0.0%	1.1%
	Sheardown Tributary 9 (SDLT9)	0.8%	0.6%	0.3%	0.0%	1.6%	0.0%	1.6%
Simuliidae (% of community)	Unnamed Reference Creek	15.9%	4.6%	2.0%	10.2%	21.6%	11.2%	22.2%
	Sheardown Tributary 1 (SDLT1)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Sheardown Tributary 12 (SDLT12)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Sheardown Tributary 9 (SDLT9)	1.2%	1.5%	0.7%	-0.8%	3.1%	0.0%	3.7%
Tipulidae (% of community)	Unnamed Reference Creek	2.8%	1.5%	0.7%	1.0%	4.6%	1.5%	4.7%
	Sheardown Tributary 1 (SDLT1)	1.9%	1.3%	0.6%	0.3%	3.6%	0.6%	4.0%
	Sheardown Tributary 12 (SDLT12)	2.2%	1.5%	0.9%	-1.7%	6.0%	0.5%	3.6%
	Sheardown Tributary 9 (SDLT9)	3.6%	2.3%	1.0%	0.8%	6.4%	0.8%	6.9%

Table F.29: Benthic Invertebrate Community Summary Statistics for the Sheardown Lake Tributaries, Mary River Project CREMP, August 2018

Metric	Area	Mean	Standard Deviation	Standard Error	95% Confidence Interval		Minimum	Maximum
					Lower Bound	Upper Bound		
Collector-Gatherer FFG (% of community)	Unnamed Reference Creek	71.5%	4.0%	1.8%	66.5%	76.5%	67.2%	76.0%
	Sheardown Tributary 1 (SDLT1)	62.2%	9.3%	4.2%	50.7%	73.7%	51.4%	70.1%
	Sheardown Tributary 12 (SDLT12)	87.6%	9.4%	5.4%	64.3%	110.9%	77.4%	95.9%
	Sheardown Tributary 9 (SDLT9)	52.6%	7.3%	3.3%	43.5%	61.7%	44.0%	62.2%
Filterer FFG (% of community)	Unnamed Reference Creek	16.0%	4.5%	2.0%	10.4%	21.6%	11.2%	22.2%
	Sheardown Tributary 1 (SDLT1)	1.6%	1.4%	0.6%	-0.2%	3.3%	0.7%	4.0%
	Sheardown Tributary 12 (SDLT12)	0.4%	0.4%	0.2%	-0.6%	1.3%	0.0%	0.8%
	Sheardown Tributary 9 (SDLT9)	1.4%	1.4%	0.6%	-0.3%	3.2%	0.0%	3.7%
Shredder FFG (% of community)	Unnamed Reference Creek	4.8%	2.8%	1.2%	1.4%	8.2%	1.5%	8.3%
	Sheardown Tributary 1 (SDLT1)	32.8%	8.2%	3.6%	22.7%	42.9%	22.6%	42.5%
	Sheardown Tributary 12 (SDLT12)	11.3%	7.9%	4.6%	-8.3%	31.0%	4.1%	19.8%
	Sheardown Tributary 9 (SDLT9)	37.2%	9.7%	4.3%	25.1%	49.2%	24.1%	49.4%
Clinger HPG (% of community)	Unnamed Reference Creek	22.6%	4.9%	2.2%	16.4%	28.7%	17.9%	29.2%
	Sheardown Tributary 1 (SDLT1)	35.7%	10.4%	4.7%	22.8%	48.6%	23.8%	47.3%
	Sheardown Tributary 12 (SDLT12)	9.9%	8.5%	4.9%	-11.2%	30.9%	3.6%	19.5%
	Sheardown Tributary 9 (SDLT9)	44.0%	8.5%	3.8%	33.4%	54.5%	30.9%	53.7%
Sprawler HPG (% of community)	Unnamed Reference Creek	58.4%	6.0%	2.7%	51.0%	65.8%	50.4%	65.3%
	Sheardown Tributary 1 (SDLT1)	56.0%	8.9%	4.0%	45.0%	67.0%	45.2%	64.0%
	Sheardown Tributary 12 (SDLT12)	80.2%	13.0%	7.5%	47.9%	112.4%	65.7%	90.8%
	Sheardown Tributary 9 (SDLT9)	41.1%	7.9%	3.5%	31.3%	50.9%	32.5%	52.6%
Burrower HPG (% of community)	Unnamed Reference Creek	11.2%	1.9%	0.9%	8.8%	13.6%	9.0%	14.0%
	Sheardown Tributary 1 (SDLT1)	5.8%	3.0%	1.4%	2.0%	9.5%	3.5%	10.9%
	Sheardown Tributary 12 (SDLT12)	9.8%	4.9%	2.8%	-2.4%	21.9%	5.0%	14.8%
	Sheardown Tributary 9 (SDLT9)	10.8%	5.0%	2.2%	4.6%	17.0%	5.8%	16.3%

Note: Sample size equals five for Unnamed Reference Creek, SDLT1, and SDLT9, and three for SDLT12.

Table F.30: Benthic Invertebrate Community Metric Statistical Comparisons between Individual Sheardown Lake Tributaries and Unnamed Reference Creek, Mary River Project CREMP, August 2018

Metric	Data Transform- ation	Overall 4-Area Comparison ^a		Pair-wise, post-hoc comparisons ^a					
		Significant Difference Among Areas?	P-value	Area	Sample Size (n)	Mean	Standard Deviation	Effect Size	Pairwise Comparison
								vs. Reference	
Density (No. per m ²)	log	YES	0.010	Reference	5	526	152	-	a
				SDLT1	5	1,102	766	3.8	a,b
				SDLT12	3	2,826	2,237	15.2	b
				SDLT9	5	1,482	375	6.3	b
Richness (No. of Taxa)	none	YES	0.010	Reference	5	19.8	3.0	-	a
				SDLT1	5	12.8	1.6	-2.3	b
				SDLT12	3	14.3	2.5	-1.8	b,c
				SDLT9	5	17.8	3.9	-0.7	a,c
Simpson's Evenness	none	YES	< 0.001	Reference	5	0.960	0.011	-	a
				SDLT1	5	0.834	0.062	-11.2	b
				SDLT12	3	0.659	0.152	-26.9	c
				SDLT9	5	0.889	0.047	-6.4	a,b
Bray Curtis Index	none	YES	< 0.001	Reference	5	0.208	0.093	-	a
				SDLT1	5	0.310	0.143	1.1	b,c
				SDLT12	3	0.879	0.074	7.2	b
				SDLT9	5	0.757	0.055	5.9	c
Nemata (% of community)	square-root	YES	0.006	Reference	5	6.0%	2.0%	-	a
				SDLT1	5	1.6%	1.0%	-2.2	b
				SDLT12	3	1.5%	1.8%	-2.3	b
				SDLT9	5	6.2%	3.6%	0.1	a
Oligochaeta (% of community)	square-root	YES	0.007	Reference	5	0.0%	0.0%	-	a
				SDLT1	5	2.2%	2.7%	2.0	b
				SDLT12	3	3.4%	1.5%	2.9	b
				SDLT9	5	0.9%	1.0%	1.3	a,b
Hydracarina (% of community)	none	YES	< 0.001	Reference	5	3.3%	1.3%	-	a
				SDLT1	5	3.1%	1.7%	-0.1	a
				SDLT12	3	0.7%	1.2%	-1.9	a
				SDLT9	5	8.5%	2.3%	3.9	b
Ephemeroptera (% of community)	rank	YES	0.009	Reference	5	5.6%	2.1%	-	a
				SDLT1	5	0.1%	0.3%	-2.6	b
				SDLT12	3	0.0%	0.0%	-2.7	b
				SDLT9	5	1.1%	2.2%	-2.2	b
Chironomidae (% of community)	none	YES	< 0.001	Reference	5	60.3%	4.5%	-	a
				SDLT1	5	90.7%	4.4%	6.8	b
				SDLT12	3	92.1%	4.0%	7.1	b
				SDLT9	5	75.8%	11.1%	3.4	c
Metal Sensitive Chironomidae (% of community)	square-root	YES	< 0.001	Reference	5	12.4%	4.2%	-	a
				SDLT1	5	19.8%	12.4%	1.7	a
				SDLT12	3	0.6%	0.6%	-2.8	b
				SDLT9	5	0.8%	0.6%	-2.7	b
Simuliidae (% of community)	square-root	YES	< 0.001	Reference	5	15.9%	4.6%	-	a
				SDLT1	5	0.0%	0.0%	-3.5	b
				SDLT12	3	0.0%	0.0%	-3.5	b
				SDLT9	5	1.2%	1.5%	-3.2	b
Tipulidae (% of community)	square-root	NO	0.501	Reference	5	2.8%	1.5%	-	a
				SDLT1	5	1.9%	1.3%	-0.6	a
				SDLT12	3	2.2%	1.5%	-0.4	a
				SDLT9	5	3.6%	2.3%	0.6	a
Collector-Gatherer FFG (% of community)	log	YES	< 0.001	Reference	5	71.5%	4.0%	-	a,b
				SDLT1	5	62.2%	9.3%	-2.3	a,c
				SDLT12	3	87.6%	9.4%	4.0	b
				SDLT9	5	52.6%	7.3%	-4.7	c
Filterer FFG (% of community)	square root	YES	< 0.001	Reference	5	16.0%	4.5%	-	a
				SDLT1	5	1.6%	1.4%	-3.2	b
				SDLT12	3	0.4%	0.4%	-3.5	b
				SDLT9	5	1.4%	1.4%	-3.2	b
Shredder FFG (% of community)	none	YES	< 0.001	Reference	5	4.8%	2.8%	-	a
				SDLT1	5	32.8%	8.2%	10.1	b
				SDLT12	3	11.3%	7.9%	2.4	a
				SDLT9	5	37.2%	9.7%	11.7	b
Clinger HPG (% of community)	fourth-root	YES	< 0.001	Reference	5	22.6%	4.9%	-	a
				SDLT1	5	35.7%	10.4%	2.7	a,b
				SDLT12	3	9.9%	8.5%	-2.6	c
				SDLT9	5	44.0%	8.5%	4.3	b
Sprawler HPG (% of community)	none	YES	< 0.001	Reference	5	58.4%	6.0%	-	a
				SDLT1	5	56.0%	8.9%	-0.4	a
				SDLT12	3	80.2%	13.0%	3.7	b
				SDLT9	5	41.1%	7.9%	-2.9	c
Burrower HPG (% of community)	log	YES	0.065	Reference	5	11.2%	1.9%	-	a
				SDLT1	5	5.8%	3.0%	-2.8	b
				SDLT12	3	9.8%	4.9%	-0.7	a,b
				SDLT9	5	10.8%	5.0%	-0.2	a,b

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of reference mean, suggesting an ecologically meaningful difference in endpoint value relative to reference conditions.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.31: Statistical Comparison of Primary and Percent Compositional Benthic Metrics at Sheardown Lake Tributary 1 (SDLT1) Among Years of Mine Operation (2015 to 2018) and Baseline (2008, 2013) for the Mary River Project CREMP

Metric	Data Transform-ation	Overall 6-Year Comparison		Pair-wise, post-hoc comparisons ^a							
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size		Pairwise Comparison	Statistical Test
								vs. Baseline Year 2008	vs. Baseline Year 2013		
Density (No. per m ²)	none	YES	0.0170	2008	3	300	52	-	-2.0	a,b,f	Mann-Whitney U-test
				2013	3	657	176	6.8	-	b,c,e,f	
				2015	5	722	485	8.1	0.4	c,e,f	
				2016	5	2,453	814	41.1	10.2	d	
				2017	5	1,660	1,643	25.9	5.7	d,e,f	
				2018	5	1,102	766	15.3	2.5	f	
Richness (No. of Taxa)	none	NO	0.2228	2008	3	12.0	1.0	-	-1.9	a	Tukey's HSD
				2013	3	16.7	2.5	4.7	-	a	
				2015	5	15.4	4.3	3.4	-0.5	a	
				2016	5	15.2	2.5	3.2	-0.6	a	
				2017	5	14.0	2.0	2.0	-1.1	a	
				2018	5	12.8	1.6	0.8	-1.5	a	
Simpson's Evenness	none	NO	0.5854	2008	3	0.894	0.034	-	0.1	a	Tukey's HSD
				2013	3	0.887	0.064	-0.2	-	a	
				2015	5	0.869	0.067	-0.7	-0.3	a	
				2016	5	0.872	0.032	-0.6	-0.2	a	
				2017	5	0.883	0.028	-0.3	-0.1	a	
				2018	5	0.834	0.062	-1.8	-0.8	a	
Oligochaeta (% of community)	none	YES	0.0783	2008	3	3.0%	2.5%	-	-1.3	a	Tukey's HSD
				2013	3	7.3%	3.3%	1.7	-	a	
				2015	5	14.4%	10.8%	4.6	2.1	a	
				2016	5	14.1%	8.8%	4.5	2.0	a	
				2017	5	8.6%	7.4%	2.3	0.4	a	
				2018	5	2.2%	2.7%	-0.3	-1.5	a	
Hydracarina (% of community)	modified probit	YES	0.0115	2008	3	12.1%	4.7%	-	2.6	a	Tukey's HSD
				2013	3	4.6%	2.9%	-1.6	-	b	
				2015	5	4.6%	1.6%	-1.6	0.0	b	
				2016	5	5.3%	1.3%	-1.4	0.2	a,b	
				2017	5	3.9%	2.0%	-1.7	-0.2	b	
				2018	5	3.1%	1.7%	-1.9	-0.5	b	
Chironomidae (% of community)	none	YES	0.0101	2008	3	69.2%	2.0%	-	-3.0	a	Tukey's HSD
				2013	3	81.1%	3.9%	6.0	-	a,b	
				2015	5	72.0%	9.0%	1.4	-2.3	a	
				2016	5	73.1%	11.9%	2.0	-2.0	a	
				2017	5	82.4%	10.1%	6.7	0.3	a,b	
				2018	5	90.7%	4.4%	10.9	2.4	b	
Metal Sensitive Taxa (% of community)	modified probit	YES	0.0135	2008	3	27.5%	5.4%	-	0.5	a	Tamhane's
				2013	3	19.9%	14.3%	-1.4	-	a,b	
				2015	5	6.1%	2.9%	-3.9	-1.0	b	
				2016	5	15.6%	4.4%	-2.2	-0.3	a	
				2017	5	26.1%	15.6%	-0.3	0.4	a	
				2018	5	19.8%	12.4%	-1.4	0.0	a,b	
Tipulidae (% of community)	none	YES	0.0404	2008	3	14.7%	2.7%	-	22.8	a	Mann-Whitney U-test
				2013	3	3.8%	0.5%	-4.0	-	b	
				2015	5	2.1%	1.3%	-4.7	-3.7	c	
				2016	5	3.5%	1.9%	-4.1	-0.6	b,c	
				2017	5	2.8%	2.7%	-4.4	-2.1	b,c	
				2018	5	1.9%	1.3%	-4.7	-4.0	b,c	

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study ye

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.32: Statistical Comparison of Functional Feeding Group (FFG) Benthic Metrics at Sheardown Lake Tributary 1 (SDLT1) Among Years of Mine Operation (2015 to 2018) and Baseline (2008, 2013) for the Mary River Project CREMP

Metric	Data Transform- ation	Overall 6-Year Comparison		Pair-wise, post-hoc comparisons ^a							
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size		Pairwise Comparison	Statistical Test
								vs. Baseline Year 2008	vs. Baseline Year 2013		
Collector-Gatherer FFG (% of community)	modified probit	YES	0.0147	2008	3	40.3%	2.9%	-	-2.0	a	Tukey's HSD
				2013	3	55.5%	7.5%	5.2	-	a,b	
				2015	5	64.2%	5.2%	8.2	1.2	b	
				2016	5	58.6%	10.7%	6.3	0.4	b	
				2017	5	55.3%	8.0%	5.2	0.0	a,b	
				2018	5	62.2%	9.3%	7.5	0.9	b	
Filterer FFG (% of community)	0.0634	YES	0.0266	2008	3	5.2%	3.5%	-	-2.0	a	Mann-Whitney U-test
				2013	3	8.5%	1.6%	0.9	-	a	
				2015	5	4.5%	1.4%	-0.2	-2.4	b	
				2016	5	7.6%	3.3%	0.7	-0.5	a,b	
				2017	5	8.9%	8.0%	1.1	0.2	a,b	
				2018	5	1.6%	1.4%	-1.0	-4.2	c	
Shredder FFG (% of community)	none	YES	0.0634	2008	3	40.6%	4.2%	-	1.6	a	Tukey's HSD
				2013	3	28.7%	7.4%	-2.8	-	a,b	
				2015	5	22.9%	4.5%	-4.2	-0.8	b	
				2016	5	27.4%	9.4%	-3.1	-0.2	a,b	
				2017	5	31.6%	7.7%	-2.1	0.4	a,b	
				2018	5	32.8%	8.2%	-1.9	0.6	a,b	

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint values between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.33: Statistical Comparison of Benthic Invertebrate Community Metrics at Sheardown Lake Tributary 12 (SDLT12) Among Years of Mine Operation (2015 to 2018) and Baseline (2007) for the Mary River Project CREMP

Metric	Data Transform-ation	Overall 5-Year Comparison		Pair-wise, post-hoc comparisons ^a						
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Pairwise Comparison	Statistical Test
Density (No. per m ²)	log	NO	0.2482	2007	5	1,016	669	-	a	Tamhane's
				2015	3	841	575	-0.3	a	
				2016	3	894	502	-0.2	a	
				2017	3	783	561	-0.3	a	
				2018	3	2,826	2,237	2.7	a	
Richness (No. of Taxa)	none	YES	0.0145	2007	5	19.0	1.9	-	a	Mann-Whitney U-test
				2015	3	12.0	1.0	-3.7	b	
				2016	3	18.3	1.2	-0.4	a	
				2017	3	15.3	0.6	-2.0	c	
				2018	3	14.3	2.5	-2.5	b,c,d	
Simpson's Evenness	none	YES	0.0212	2007	5	0.854	0.020	-	a	Mann-Whitney U-test
				2015	3	0.884	0.041	1.5	a,b	
				2016	3	0.884	0.046	1.5	a,b	
				2017	3	0.931	0.021	3.9	b	
				2018	3	0.659	0.152	-9.9	c	
Oligochaeta (% of community)	modified probit	YES	0.0000	2007	5	0.7%	0.6%	-	a	
				2015	3	28.8%	8.8%	48.8	b	
				2016	3	31.6%	11.1%	53.6	b	
				2017	3	21.9%	8.4%	36.8	b	
				2018	3	3.4%	1.5%	4.7	c	
Hydracarina (% of community)	modified probit	NO	0.2205	2007	5	3.0%	2.9%	-	a	Tamhane's
				2015	3	0.0%	0.0%	-1.0	a	
				2016	3	0.4%	0.4%	-0.9	a	
				2017	3	0.0%	0.0%	-1.0	a	
				2018	3	0.7%	1.2%	-0.8	a	
Chironomidae (% of community)	none	YES	0.0281	2007	5	88.0%	10.2%	-	a	Mann-Whitney U-test
				2015	3	65.1%	6.7%	-2.3	b	
				2016	3	54.9%	18.0%	-3.2	b	
				2017	3	64.6%	7.2%	-2.3	b	
				2018	3	92.1%	4.0%	0.4	a	
Metal Sensitive Taxa (% of community)	none	YES	0.0004	2007	5	3.2%	2.0%	-	a	Tukey's HSD
				2015	3	1.4%	1.5%	-0.9	a	
				2016	3	2.6%	0.5%	-0.3	a	
				2017	3	12.7%	5.2%	4.7	a	
				2018	3	0.6%	0.6%	-1.3	a	
Tipulidae (% of community)	modified probit	YES	0.0058	2007	5	0.3%	0.5%	-	a	
				2015	3	3.4%	1.3%	6.3	b	
				2016	3	3.8%	3.1%	7.2	b	
				2017	3	3.4%	2.0%	6.5	b	
				2018	3	2.2%	1.5%	3.9	b	
Collector-Gatherer FFG (% of community)	modified probit	YES	0.0095	2007	5	57.8%	15.8%	-	a	Tukey's HSD
				2015	3	83.7%	11.4%	1.6	b	
				2016	3	87.0%	2.6%	1.8	b	
				2017	3	88.5%	3.2%	1.9	b	
				2018	3	87.6%	9.4%	1.9	b	
Filterer FFG (% of community)	none	NO	0.4131	2007	5	6.8%	9.2%	-	a	Tukey's HSD
				2015	3	0.0%	0.0%	-0.7	a	
				2016	3	2.1%	0.1%	-0.5	a	
				2017	3	3.5%	2.8%	-0.4	a	
				2018	3	0.4%	0.4%	-0.7	a	
Shredder FFG (% of community)	modified probit	YES	0.0992	2007	5	22.5%	8.9%	-	a	Tukey's HSD
				2015	3	16.3%	11.4%	-0.7	a	
				2016	3	9.3%	1.5%	-1.5	a	
				2017	3	8.0%	2.1%	-1.6	a	
				2018	3	11.3%	7.9%	-1.2	a	

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.34: Statistical Comparison of Primary and Percent Compositional Benthic Metrics at Sheardown Lake Tributary 9 (SDLT9) Among Years of Mine Operation (2015 to 2018) and Baseline (2008, 2013) for the Mary River Project CREMP

Metric	Data Transform-ation	Overall 6-Year Comparison		Pair-wise, post-hoc comparisons ^a							
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size		Pairwise Comparison	Statistical Test
								vs. Baseline Year 2008	vs. Baseline Year 2013		
Density (No. per m ²)	none	YES	0.0048	2008	3	300	52	-	-2.0	a	Mann-Whitney U-test
				2013	3	657	176	6.8	-	b	
				2015	5	722	485	8.1	0.4	b	
				2016	5	2,453	814	41.1	10.2	c	
				2017	5	1,660	1,643	25.9	5.7	b,c	
				2018	5	1,482	375	22.5	4.7	d	
Richness (No. of Taxa)	none	NO	0.1976	2008	3	12.0	1.0	-	-1.9	a	Tukey's HSD
				2013	3	16.7	2.5	4.7	-	a	
				2015	5	15.4	4.3	3.4	-0.5	a	
				2016	5	15.2	2.5	3.2	-0.6	a	
				2017	5	14.0	2.0	2.0	-1.1	a	
				2018	5	17.8	3.9	5.8	0.5	a	
Simpson's Evenness	none	NO	0.9651	2008	3	0.894	0.034	-	0.1	a	Tukey's HSD
				2013	3	0.887	0.064	-0.2	-	a	
				2015	5	0.869	0.067	-0.7	-0.3	a	
				2016	5	0.872	0.032	-0.6	-0.2	a	
				2017	5	0.883	0.028	-0.3	-0.1	a	
				2018	5	0.889	0.047	-0.2	0.0	a	
Oligochaeta (% of community)	modified probit	NO	0.1339	2008	3	3.0%	2.5%	-	-1.3	a	Tukey's HSD
				2013	3	7.3%	3.3%	1.7	-	a	
				2015	5	14.4%	10.8%	4.6	2.1	a	
				2016	5	14.1%	8.8%	4.5	2.0	a	
				2017	5	8.6%	7.4%	2.3	0.4	a	
				2018	5	0.9%	1.0%	-0.8	-1.9	a	
Hydracarina (% of community)	modified probit	YES	0.0039	2008	3	12.1%	4.7%	-	2.6	a	Tukey's HSD
				2013	3	4.6%	2.9%	-1.6	-	b,c,d	
				2015	5	4.6%	1.6%	-1.6	0.0	b,c,d	
				2016	5	5.3%	1.3%	-1.4	0.2	b,c,d	
				2017	5	3.9%	2.0%	-1.7	-0.2	c	
				2018	5	8.5%	2.3%	-0.8	1.3	a,d	
Chironomidae (% of community)	none	NO	0.4291	2008	3	69.2%	2.0%	-	-3.0	a	Mann-Whitney U-test
				2013	3	81.1%	3.9%	6.0	-	a	
				2015	5	72.0%	9.0%	1.4	-2.3	a	
				2016	5	73.1%	11.9%	2.0	-2.0	a	
				2017	5	82.4%	10.1%	6.7	0.3	a	
				2018	5	75.8%	11.1%	3.3	-1.4	a	
Metal Sensitive Taxa (% of community)	modified probit	YES	0.0000	2008	3	27.5%	5.4%	-	0.5	a,c	Tukey's HSD
				2013	3	19.9%	14.3%	-1.4	-	a,b,c	
				2015	5	6.1%	2.9%	-3.9	-1.0	b	
				2016	5	15.6%	4.4%	-2.2	-0.3	b,c	
				2017	5	26.1%	15.6%	-0.3	0.4	c	
				2018	5	0.8%	0.6%	-4.9	-1.3	d	
Tipulidae (% of community)	none	YES	0.0591	2008	3	14.7%	2.7%	-	22.8	a	Mann-Whitney U-test
				2013	3	3.8%	0.5%	-4.0	-	b	
				2015	5	2.1%	1.3%	-4.7	-3.7	c	
				2016	5	3.5%	1.9%	-4.1	-0.6	b,c	
				2017	5	2.8%	2.7%	-4.4	-2.1	b,c	
				2018	5	3.6%	2.3%	-4.1	-0.4	b,c	

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study ye

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.35: Statistical Comparison of Functional Feeding Group (FFG) Benthic Metrics at Sheardown Lake Tributary 9 (SDLT9) Among Years of Mine Operation (2015 to 2018) and Baseline (2007, 2013) for the Mary River Project CREMP

Metric	Data Transform- ation	Overall 6-Year Comparison		Pair-wise, post-hoc comparisons ^a							
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size		Pairwise Comparison	Statistical Test
								vs. Baseline Year 2008	vs. Baseline Year 2013		
Collector-Gatherer FFG (% of community)	modified probit	YES	0.0127	2007	3	40.3%	2.9%	-	-2.0	a	Tukey's HSD
				2013	3	55.5%	7.5%	5.2	-	a,b	
				2015	5	64.2%	5.2%	8.2	1.2	b	
				2016	5	58.6%	10.7%	6.3	0.4	b	
				2017	5	55.3%	8.0%	5.2	0.0	a,b	
				2018	5	52.6%	7.3%	4.2	-0.4	a,b	
Filterer FFG (% of community)	modified probit	YES	0.0179	2007	3	5.2%	3.5%	-	-2.0	a,b	Tukey's HSD
				2013	3	8.5%	1.6%	0.9	-	a	
				2015	5	4.5%	1.4%	-0.2	-2.4	a,b	
				2016	5	7.6%	3.3%	0.7	-0.5	a	
				2017	5	8.9%	8.0%	1.1	0.2	a	
				2018	5	1.4%	1.4%	-1.1	-4.3	b	
Shredder FFG (% of community)	modified probit	YES	0.0350	2007	3	40.6%	4.2%	-	1.6	a	Tukey's HSD
				2013	3	28.7%	7.4%	-2.8	-	a,b	
				2015	5	22.9%	4.5%	-4.2	-0.8	b	
				2016	5	27.4%	9.4%	-3.1	-0.2	a,b	
				2017	5	31.6%	7.7%	-2.1	0.4	a,b	
				2018	5	37.2%	9.7%	-0.8	1.1	a	

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint values between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.36: Statistical Comparison of Physical Sediment Quality Between Sheardown Lake NW and Reference Lake 3 for Samples Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2018

Lake Zone	Habitat Variable	Statistical Test Results			Summary Statistics							
		Significant Difference Between Areas?	P-value	Statistical Analysis ^a	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Median	Maximum
Littoral (Shallow) Stations	Station Depth (m)	YES	0.011	β	Reference	5	9.74	1.04	0.46	8.50	-	11.20
					Sheardown NW	5	8.20	0.38	0.17	7.80	-	8.60
	Sand-Sized Particles (% by weight)	YES	0.029	β	Reference	5	59.6	4.4	2.0	54.9	59.4	66.4
					Sheardown NW	5	39.5	17.5	7.9	24.8	31.2	68.8
	Silt-Sized Particles (% by weight)	YES	0.025	α	Reference	5	31.4	3.3	1.5	26.6	32.6	34.7
					Sheardown NW	5	49.3	14.1	6.3	27.0	51.9	63.4
	Clay-Sized Particles (% by weight)	NO	0.346	α	Reference	5	9.0	2.4	1.1	5.8	10.4	10.8
					Sheardown NW	5	11.3	4.6	2.0	4.2	11.8	16.9
	Total Organic Carbon (%)	NO	0.208	α	Reference	5	4.7	2.3	1.0	1.8	5.1	7.4
					Sheardown NW	5	3.0	1.6	0.7	0.9	3.4	4.9
Profundal (Deep) Stations	Station Depth (m)	NO	0.775	α	Reference	5	20.56	2.17	0.97	18.50	-	24.20
					Sheardown NW	5	21.14	3.82	1.71	15.00	-	24.20
	Sand-Sized Particles (% by weight)	NO	0.151	γ	Reference	5	47.5	2.8	1.3	44.5	47.0	50.9
					Sheardown NW	5	21.6	18.8	8.4	11.0	14.0	55.2
	Silt-Sized Particles (% by weight)	YES	0.094	γ	Reference	5	39.0	3.1	1.4	33.8	40.4	41.5
					Sheardown NW	5	62.3	15.9	7.1	34.1	68.0	72.8
	Clay-Sized Particles (% by weight)	NO	0.266	α	Reference	5	13.6	2.2	1.0	9.7	14.3	15.3
					Sheardown NW	5	16.0	4.1	1.8	10.7	17.3	21.0
	Total Organic Carbon (%)	YES	0.095	γ	Reference	5	3.8	1.7	0.8	0.8	4.5	4.9
					Sheardown NW	5	1.7	0.7	0.3	0.5	1.6	2.4

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log-transformed, single factor ANOVA test conducted; γ - data untransformed, Mann-Whitney U-test conducted; ζ - data untransformed, t-test conducted assuming unequal variance; η - data log-transformed, t-test assuming unequal variance; δ - data square-root transformed, t-test assuming unequal variance conducted; τ - data square-root transformed, single factor ANOVA conducted.

Highlighted values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

Table F.37: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake NW, August 2018

Taxa	Study Area Replicate Station	Sheardown Lake NW - Littoral Stations				
		DLO-1-9	DLO-1-4	DLO-1-3	DLO-1-11	DLO-1-10
ROUNDWORMS						
P. Nemata		155	155	138	17	9
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Lumbriculidae						
Lumbriculus		-	-	-	9	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Acalyptonotidae						
Acalyptonotus		-	-	-	34	69
F. Hygrobatidae						
Hygrobates		-	-	-	95	69
F. Lebertiidae						
Lebertia		-	17	-	9	9
F. Sperchontidae						
Sperchon		-	-	-	-	-
SEED SHRIMPS						
Cl. Ostracoda		638	1,586	1,759	302	284
INSECTS						
Cl. Insecta						
CADDISFLIES						
O. Trichoptera						
pupae		-	-	-	-	-
F. Apataniidae						
Apatania		-	-	34	-	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		34	17	-	-	9
S.F. Chironominae						
Chironomus		1,241	-	34	-	-
Micropsectra		103	828	724	-	43
Paratanytarsus		379	1,310	3,276	9	9
Sergentia		103	-	34	-	-
Stictochironomus		1,207	1,621	4,069	2,078	1,888
Tanytarsus		638	276	138	-	17
S.F. Diamesinae						
Protanypus		17	-	34	26	52
Pseudodiamesa		-	-	-	9	17
S.F. Orthocladiinae						
Abiskomyia		759	1,534	414	198	95
Cricotopus/Orthocladus		-	-	-	-	-

Table F.37: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake NW, August 2018

Taxa	Study Area Replicate Station	Sheardown Lake NW - Littoral Stations				
		DLO-1-9	DLO-1-4	DLO-1-3	DLO-1-11	DLO-1-10
<i>Heterotrissocladius</i>		121	466	552	138	250
<i>Hydrobaenus</i>		-	-	-	-	-
<i>Limnophyes</i>		-	-	-	-	-
<i>Mesocricotopus</i>		-	-	-	-	-
<i>Paracladius</i>		-	17	-	-	60
<i>Parakiefferiella</i>		-	-	103	-	9
<i>Psectrocladius</i>		-	17	-	-	-
<i>Zalutschia</i>		17	17	-	9	34
S.F. Tanypodinae						
<i>Arctopelopia</i>		52	379	345	26	-
<i>Procladius</i>		17	52	103	103	155
F. Tipulidae						
<i>Tipula</i>		-	-	-	-	-
Density (No. organisms per m²)		5,481	8,292	11,757	3,062	3,078
Richness (total number of taxa)^a		14	14	15	15	17
Simpson's Evenness (E)		0.910	0.914	0.827	0.558	0.638
Bray-Curtis Index		0.839	0.863	0.904	0.799	0.779
Dominant Group Composition						
% Nemata		2.8%	1.9%	1.2%	0.6%	0.3%
% Hydracarina		0.0%	0.2%	0.0%	4.5%	4.8%
% Ostracods		11.6%	19.1%	15.0%	9.9%	9.2%
% Chironomids		85.5%	78.8%	83.6%	84.8%	85.7%
% Metal Sensitive Chironomids		20.9%	29.2%	35.5%	1.4%	4.5%
% Tipulidae		0.0%	0.0%	0.0%	0.0%	0.0%
Functional Feeding Group Composition						
% Collector - Gatherers		77.8%	65.2%	60.7%	90.7%	86.8%
% Filterers		20.6%	29.2%	35.2%	0.3%	2.2%
% Shredders		0.3%	0.2%	0.0%	0.3%	1.1%
Habitat Preference Group Composition						
% Clingers		15.5%	13.6%	7.9%	4.5%	6.7%
% Sprawlers		36.3%	65.0%	55.7%	25.9%	29.8%
% Burrowers		48.1%	21.5%	36.4%	69.6%	63.5%

^a Bold entries excluded from taxa count

Table F.37: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake NW, August 2018

Taxa	Study Area Replicate Station	Sheardown Lake NW - Profundal Stations				
		DLO-1-5	DLO-1-14	DLO-1-15	DLO-1-2	DLO-1-12
ROUNDWORMS						
P. Nemata		9	-	-	-	34
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Lumbriculidae						
<i>Lumbriculus</i>		17	-	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Acalyptonotidae						
<i>Acalyptonotus</i>		60	52	17	26	60
F. Hygrobatidae						
<i>Hygrobates</i>		34	9	17	9	34
F. Lebertiidae						
<i>Lebertia</i>		9	-	-	17	9
F. Sperchontidae						
<i>Sperchon</i>		-	-	-	-	-
SEED SHRIMPS						
Cl. Ostracoda		26	69	-	26	43
INSECTS						
Cl. Insecta						
CADDISFLIES						
O. Trichoptera						
pupae		-	-	-	-	-
F. Apataniidae						
<i>Apatania</i>		-	-	-	-	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		52	17	-	-	-
S.F. Chironominae						
<i>Chironomus</i>		862	647	-	-	-
<i>Micropsectra</i>		-	-	-	-	9
<i>Paratanytarsus</i>		-	9	-	-	-
<i>Sergentia</i>		-	-	-	-	-
<i>Stictochironomus</i>		103	155	-	-	-
<i>Tanytarsus</i>		43	-	-	-	-
S.F. Diamesinae						
<i>Protanypus</i>		9	-	60	17	26
<i>Pseudodiamesa</i>		-	-	-	-	17
S.F. Orthocladiinae						
<i>Abiskomyia</i>		17	26	-	-	-
<i>Cricotopus/Orthocladus</i>		-	17	-	-	-

Table F.37: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake NW, August 2018

Taxa	Study Area Replicate Station	Sheardown Lake NW - Profundal Stations				
		DLO-1-5	DLO-1-14	DLO-1-15	DLO-1-2	DLO-1-12
<i>Heterotrissocladius</i>		9	-	853	621	1,216
<i>Hydrobaenus</i>		-	-	-	-	-
<i>Limnophyes</i>		-	9	-	-	-
<i>Mesocricotopus</i>		9	-	-	-	-
<i>Paracladius</i>		-	-	-	-	-
<i>Parakiefferiella</i>		-	-	-	-	-
<i>Psectrocladius</i>		-	-	-	-	-
<i>Zalutschia</i>		-	-	-	-	-
S.F. Tanypodinae						
<i>Arctopelopia</i>		-	-	-	-	9
<i>Procladius</i>		43	34	52	207	43
F. Tipulidae						
<i>Tipula</i>		-	-	-	-	-
Density (No. organisms per m²)		1,302	1,044	999	923	1,500
Richness (total number of taxa)^a		14	10	5	7	11
Simpson's Evenness (E)		0.545	0.633	0.330	0.577	0.372
Bray-Curtis Index		0.968	0.975	0.472	0.428	0.582
Dominant Group Composition						
% Nemata		0.7%	0.0%	0.0%	0.0%	2.3%
% Hydracarina		7.9%	5.8%	3.4%	5.6%	6.9%
% Ostracods		2.0%	6.6%	0.0%	2.8%	2.9%
% Chironomids		88.1%	87.5%	96.6%	91.5%	88.0%
% Metal Sensitive Chironmids		4.1%	0.9%	6.0%	1.8%	3.5%
% Tipulidae		0.0%	0.0%	0.0%	0.0%	0.0%
Functional Feeding Group Composition						
% Collector - Gatherers		85.2%	88.3%	91.4%	71.9%	89.1%
% Filterers		3.5%	0.9%	0.0%	0.0%	0.6%
% Shredders		0.0%	1.6%	0.0%	0.0%	0.0%
Habitat Preference Group Composition						
% Clingers		11.4%	7.5%	3.4%	5.6%	7.5%
% Sprawlers		8.3%	14.3%	90.6%	92.5%	88.5%
% Burrowers		80.3%	78.3%	6.0%	1.8%	4.0%

^a Bold entries excluded from taxa count

Table F.38: Statistical Comparison of Benthic Metrics at Sheardown Lake NW Littoral (Shallow) Stations Among Years of Mine Operation (2015 to 2018) and Baseline (2007, 2008, 2013) for the Mary River Project CREMP

Metric	Data Transformation	Overall 7-Year Comparison ^a		Pair-wise, post-hoc comparisons ^a								
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	vs. Baseline Year 2007	Effect Size		Pairwise Comparison	Statistical Test
Density (No. per m²)	log	NO	0.6600	2007	4	5,974	3,000	-	-0.3	-1.5	a	Tukey's HSD
				2008	4	7,536	5,273	0.5	-	-0.9	a	
				2013	3	9,940	2,634	1.3	0.5	-	a	
				2015	5	5,665	3,230	-0.1	-0.4	-1.6	a	
				2016	5	5,503	4,184	-0.2	-0.4	-1.7	a	
				2017	5	5,216	2,398	-0.3	-0.4	-1.8	a	
				2018	5	6,334	3,717	0.1	-0.2	-1.4	a	
Richness (No. of Taxa)	none	NO	0.2829	2007	4	12.3	1.5	-	-1.3	-1.7	a	Mann-Whitney U-test
				2008	4	14.5	1.7	1.4	-	-1.0	a	
				2013	3	17.7	3.2	3.5	1.9	-	a	
				2015	5	13.8	1.9	1.0	-0.4	-1.2	a	
				2016	5	14.6	2.4	1.5	0.1	-1.0	a	
				2017	5	14.0	3.2	1.1	-0.3	-1.1	a	
				2018	5	15.0	1.2	1.8	0.3	-0.8	a	
Simpson's Evenness	none	NO	0.1080	2007	4	0.768	0.055	-	-0.7	-2.0	a	Mann-Whitney U-test
				2008	4	0.840	0.098	1.3	-	-0.5	a	
				2013	3	0.863	0.047	1.7	0.2	-	a	
				2015	5	0.759	0.096	-0.2	-0.8	-2.2	a	
				2016	5	0.893	0.024	2.3	0.5	0.6	a	
				2017	5	0.842	0.048	1.3	0.0	-0.5	a	
				2018	5	0.769	0.163	0.0	-0.7	-2.0	a	
Nemata (% of community)	none	NO	0.9123	2007	4	1.5%	1.6%	-	0.4	1.1	a	Mann-Whitney U-test
				2008	4	1.1%	1.0%	-0.3	-	0.6	a	
				2013	3	0.6%	0.8%	-0.6	-0.5	-	a	
				2015	5	0.9%	1.1%	-0.4	-0.2	0.3	a	
				2016	5	1.1%	0.7%	-0.2	0.1	0.6	a	
				2017	5	1.3%	1.5%	-0.2	0.2	0.8	a	
				2018	5	1.3%	1.0%	-0.1	0.3	0.9	a	
Ostracoda (% of community)	none	NO	0.1255	2007	4	11.9%	12.8%	-	0.1	-1.4	a	Tamhane's
				2008	4	10.8%	8.7%	-0.1	-	-1.5	a	
				2013	3	23.4%	8.1%	0.9	1.4	-	a	
				2015	5	7.8%	3.7%	-0.3	-0.3	-1.9	a	
				2016	5	9.2%	6.1%	-0.2	-0.2	-1.7	a	
				2017	5	19.5%	11.1%	0.6	1.0	-0.5	a	
				2018	5	13.0%	4.1%	0.1	0.2	-1.3	a	

Table F.38: Statistical Comparison of Benthic Metrics at Sheardown Lake NW Littoral (Shallow) Stations Among Years of Mine Operation (2015 to 2018) and Baseline (2007, 2008, 2013) for the Mary River Project CREMP

Metric	Data Transformation	Overall 7-Year Comparison ^a		Pair-wise, post-hoc comparisons ^a								
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	vs. Baseline Year 2007	Effect Size vs. Baseline Year 2008	vs. Baseline Year 2013	Pairwise Comparison	Statistical Test
Chironomidae (% of community)	modified probit	YES	0.0132	2007	4	83.0%	8.3%	-	0.3	1.3	a,b,c	Tukey's HSD
				2008	4	81.2%	6.7%	-0.2	-	1.1	a,b,c	
				2013	3	70.5%	9.6%	-1.5	-1.6	-	a,c	
				2015	5	89.8%	3.2%	0.8	1.3	2.0	b	
				2016	5	85.0%	6.6%	0.2	0.6	1.5	a,b,c	
				2017	5	73.5%	11.2%	-1.1	-1.2	0.3	c	
				2018	5	83.7%	2.9%	0.1	0.4	1.4	a,b,c	
Metal Sensitive Taxa (% of community)	none	NO	0.9668	2007	4	16.9%	16.8%	-	-0.2	-0.9	a	Tamhane's
				2008	4	20.7%	17.2%	0.2	-	-0.1	a	
				2013	3	21.0%	4.6%	0.2	0.0	-	a	
				2015	5	19.1%	7.2%	0.1	-0.1	-0.4	a	
				2016	5	24.6%	15.2%	0.5	0.2	0.8	a	
				2017	5	16.6%	7.9%	0.0	-0.2	-0.9	a	
				2018	5	18.3%	15.0%	0.1	-0.1	-0.6	a	
Collector-Gatherer FFG (% of community)	none	NO	0.1646	2007	4	71.6%	13.5%	-	0.7	0.7	a	Tukey's HSD
				2008	4	61.1%	15.0%	-0.8	-	-0.5	a	
				2013	3	65.3%	9.0%	-0.5	0.3	-	a	
				2015	5	68.9%	8.0%	-0.2	0.5	0.4	a	
				2016	5	56.8%	7.7%	-1.1	-0.3	-1.0	a	
				2017	5	69.4%	9.2%	-0.2	0.6	0.5	a	
				2018	5	76.2%	13.1%	0.3	1.0	1.2	a	
Filterer FFG (% of community)	none	NO	0.9880	2007	4	16.7%	17.1%	-	-0.2	-0.9	a	Tamhane's
				2008	4	19.9%	17.1%	0.2	-	-0.2	a	
				2013	3	21.0%	4.7%	0.3	0.1	-	a	
				2015	5	18.6%	6.8%	0.1	-0.1	-0.5	a	
				2016	5	23.0%	17.3%	0.4	0.2	0.4	a	
				2017	5	16.5%	8.0%	0.0	-0.2	-1.0	a	
				2018	5	17.5%	15.7%	0.0	-0.1	-0.7	a	

Indicates a significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.39: Statistical Comparison of Benthic Metrics at Sheardown Lake NW Profundal (Deep) Stations Among Years of Mine Operation (2015 to 2018) and Baseline (2007, 2013) for the Mary River Project CREMP

Metric	Data Transformation	Overall 5-Year Comparison ^a		Pair-wise, post-hoc comparisons ^a							
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size		Pairwise Comparison	Statistical Test
Density (No. per m ²)	none	YES	0.0000	2007	4	1,461	308	-	-4.3	a	Tukey's HSD
				2013	3	2,744	302	4.2	-	b	
				2015	5	1,425	210	-0.1	-4.4	a	
				2017	5	861	391	-1.9	-6.2	c	
				2018	5	1,154	240	-1.0	-5.3	a,c	
Richness (No. of Taxa)	none	NO	0.8178	2007	4	7.5	0.4	-	-0.9	a	Tamhane's
				2013	3	9.8	2.5	5.4	-	a	
				2015	5	8.4	3.0	2.1	-0.6	a	
				2017	5	9.2	3.5	4.0	-0.3	a	
				2018	5	9.4	3.5	4.4	-0.2	a	
Simpson's Evenness	none	YES	0.0288	2007	4	0.426	0.165	-	-0.6	a	Tukey's HSD
				2013	3	0.521	0.167	0.6	-	a,b	
				2015	5	0.355	0.212	-0.4	-1.0	a	
				2017	5	0.717	0.113	1.8	1.2	b	
				2018	5	0.491	0.133	0.4	-0.2	a,b	
Nemata (% of community)	none	NO	0.1691	2007	4	0.6%	0.5%	-	-1.2	a	Mann-Whitney U-test
				2013	3	3.6%	2.6%	5.8	-	a	
				2015	5	0.5%	0.3%	-0.2	-1.2	a	
				2017	5	1.4%	3.0%	1.4	-0.9	a	
				2018	5	0.6%	1.0%	-0.1	-1.2	a	
Ostracoda (% of community)	none	NO	0.2096	2007	4	0.3%	0.4%	-	-0.7	a	Tamhane's
				2013	3	6.2%	8.7%	16.4	-	a	
				2015	5	2.8%	3.7%	7.0	-0.4	a	
				2017	5	6.8%	4.6%	18.2	0.1	a	
				2018	5	2.9%	2.4%	7.1	-0.4	a	
Chironomidae (% of community)	none	NO	0.1208	2007	4	94.6%	1.9%	-	1.1	a	Tukey's HSD
				2013	3	84.9%	8.8%	-5.0	-	a	
				2015	5	93.2%	6.0%	-0.7	0.9	a	
				2017	5	85.1%	8.5%	-4.9	0.0	a	
				2018	5	90.4%	3.8%	-2.2	0.6	a	
Metal Sensitive Taxa (% of community)	modified probit	YES	0.0141	2007	4	0.5%	0.6%	-	-0.5	a	Tamhane's
				2013	3	1.4%	1.7%	1.4	-	a	
				2015	5	2.8%	2.8%	3.7	0.9	a	
				2017	5	6.3%	4.4%	9.2	2.9	a	
				2018	5	3.3%	2.0%	4.4	1.1	a	
Collector-Gatherer FFG (% of community)	none	YES	0.0452	2007	4	83.6%	8.4%	-	-0.6	a,b	Tukey's HSD
				2013	3	86.4%	4.8%	0.3	-	a,b	
				2015	5	90.5%	5.3%	0.8	0.9	a	
				2017	5	75.5%	7.3%	-1.0	-2.3	b	
				2018	5	85.2%	7.7%	0.2	-0.3	a,b	
Filterer FFG (% of community)	none	NO	0.3319	2007	4	0.1%	0.1%	-	-0.8	a	Mann-Whitney U-test
				2013	3	1.3%	1.6%	11.6	-	a	
				2015	5	1.9%	2.6%	16.7	0.3	a	
				2017	5	2.9%	2.5%	26.2	1.0	a	
				2018	5	1.0%	1.4%	8.5	-0.2	a	

Indicates a significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.40: Statistical Comparison of Physical Sediment Quality Between Sheardown Lake SE and Reference Lake 3 for Samples Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2018

Lake Zone	Habitat Variable	Statistical Test Results			Summary Statistics							
		Significant Difference Between Areas?	P-value	Statistical Analysis ^a	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Median	Maximum
Littoral (Shallow) Stations	Station Depth (m)	NO	0.423	β	Reference	5	9.74	1.04	0.46	8.50	-	11.20
					Sheardown NW	5	9.10	1.58	0.71	7.50	-	11.50
	Sand-Sized Particles (% by weight)	YES	0.001	Υ	Reference	5	59.6	4.4	2.0	54.9	59.4	66.4
					Sheardown NW	5	12.8	5.6	2.5	7.9	11.7	22.0
	Silt-Sized Particles (% by weight)	YES	0.001	β	Reference	5	31.4	3.3	1.5	26.6	32.6	34.7
					Sheardown NW	5	73.7	4.5	2.0	67.7	75.6	77.6
	Clay-Sized Particles (% by weight)	YES	0.014	α	Reference	5	9.0	2.4	1.1	5.8	10.4	10.8
					Sheardown NW	5	13.6	2.3	1.0	10.3	13.6	16.4
	Total Organic Carbon (%)	YES	0.005	Υ	Reference	5	4.7	2.3	1.0	1.8	5.1	7.4
					Sheardown NW	5	1.3	0.4	0.2	0.9	1.3	1.9
Profundal (Deep) Stations	Station Depth (m)	YES	0.001	β	Reference	5	20.56	2.17	0.97	18.50	-	24.20
					Sheardown NW	5	12.44	1.17	0.52	10.50	-	13.50
	Sand-Sized Particles (% by weight)	YES	0.001	α	Reference	5	47.5	2.8	1.3	44.5	47.0	50.9
					Sheardown NW	5	14.0	4.9	2.2	7.1	13.8	18.8
	Silt-Sized Particles (% by weight)	YES	0.001	Υ	Reference	5	39.0	3.1	1.4	33.8	40.4	41.5
					Sheardown NW	5	71.0	3.7	1.6	68.8	69.6	77.5
	Clay-Sized Particles (% by weight)	NO	0.385	α	Reference	5	13.6	2.2	1.0	9.7	14.3	15.3
					Sheardown NW	5	15.0	2.6	1.2	12.3	15.3	18.2
	Total Organic Carbon (%)	YES	0.151	γ	Reference	5	3.8	1.7	0.8	0.8	4.5	4.9
					Sheardown NW	5	1.2	0.1	0.1	1.0	1.1	1.4

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log-transformed, single factor ANOVA test conducted; γ - data untransformed, Mann-Whitney U-test conducted; ζ - data untransformed, t-test conducted assuming unequal variance; η - data log-transformed, t-test assuming unequal variance; δ - data square-root transformed, t-test assuming unequal variance conducted; Υ - data square-root transformed, single factor ANOVA conducted.

Highlighted values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

Table F.41: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake SE, August 2018

Taxa	Study Area Replicate Station	Sheardown Lake SE - Littoral Stations				
		DLO-2-11	DLO-2-10	DLO-2-4	DLO-2-9	DLO-2-1
ROUNDWORMS						
P. Nemata		17	-	34	26	17
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Lumbriculidae						
Lumbriculus		-	-	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Acalyptonotidae						
Acalyptonotus		17	-	-	17	9
F. Hygrobatidae						
Hygrobates		26	-	17	9	9
F. Lebertiidae						
Lebertia		-	34	-	9	9
F. Sperchontidae						
Sperchon		-	-	-	-	-
SEED SHRIMPS						
Cl. Ostracoda		164	1,310	9	86	43
INSECTS						
Cl. Insecta						
CADDISFLIES						
O. Trichoptera						
pupae		-	-	-	-	-
F. Apataniidae						
Apatania		-	69	-	-	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		-	-	-	-	-
S.F. Chironominae						
Chironomus		-	69	-	-	-
Micropsectra		60	276	60	293	138
Paratanytarsus		-	828	-	26	-
Sergentia		-	172	-	9	-
Stictochironomus		2,681	517	1,586	1,974	1,759
Tanytarsus		578	379	78	224	-
S.F. Diamesinae						
Protanypus		-	-	-	-	-
Pseudodiamesa		-	-	-	-	-
S.F. Orthocladiinae						
Abiskomyia		-	-	-	9	-
Cricotopus/Orthocladius		-	-	-	-	-

Table F.41: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake SE, August 2018

Taxa	Study Area Replicate Station	Sheardown Lake SE - Littoral Stations				
		DLO-2-11	DLO-2-10	DLO-2-4	DLO-2-9	DLO-2-1
<i>Heterotrissocladius</i>		26	-	-	26	-
<i>Hydrobaenus</i>		-	-	-	-	-
<i>Limnophyes</i>		-	-	-	-	-
<i>Mesocricotopus</i>		-	-	-	-	-
<i>Paracladius</i>		-	-	-	-	-
<i>Parakiefferiella</i>		-	-	-	-	-
<i>Psectrocladius</i>		-	-	-	-	-
<i>Zalutschia</i>		-	-	-	9	9
S.F. Tanypodinae						
<i>Arctopelopia</i>		9	586	-	-	-
<i>Procladius</i>		2,371	1,310	879	1,534	793
F. Tipulidae						
<i>Tipula</i>		-	-	-	-	-
Density (No. organisms per m²)		5,949	5,550	2,663	4,251	2,786
Richness (total number of taxa)^a		10	11	7	14	9
Simpson's Evenness (E)		0.697	0.922	0.624	0.696	0.582
Bray-Curtis Index		0.910	0.871	0.919	0.846	0.864
Dominant Group Composition						
% Nemata		0.3%	0.0%	1.3%	0.6%	0.6%
% Hydracarina		0.7%	0.6%	0.6%	0.8%	1.0%
% Ostracods		2.8%	23.6%	0.3%	2.0%	1.5%
% Chironomids		96.2%	74.5%	97.7%	96.5%	96.9%
% Metal Sensitive Chironomids		10.7%	26.7%	5.2%	12.8%	5.0%
% Tipulidae		0.0%	0.0%	0.0%	0.0%	0.0%
Functional Feeding Group Composition						
% Collector - Gatherers		48.5%	37.3%	61.2%	50.1%	65.3%
% Filterers		10.7%	26.7%	5.2%	12.8%	5.0%
% Shredders		0.0%	0.0%	0.0%	0.2%	0.3%
Habitat Preference Group Composition						
% Clingers		11.4%	16.8%	5.8%	13.2%	5.9%
% Sprawlers		43.2%	72.7%	33.3%	39.8%	30.3%
% Burrowers		45.4%	10.6%	60.8%	47.0%	63.7%

^a Bold entries excluded from taxa count

Table F.41: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake SE, August 2018

Taxa	Study Area Replicate Station	Sheardown Lake SE - Profundal Stations				
		DLO-2-12	DLO-2-8	DLO-2-13	DLO-2-2	DLO-2-3
ROUNDWORMS						
P. Nemata		-	9	60	-	-
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Lumbriculidae						
Lumbriculus		-	-	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Acalyptonotidae						
Acalyptonotus		26	26	-	-	-
F. Hygrobatidae						
Hygrobates		17	-	9	-	-
F. Lebertiidae						
Lebertia		-	9	-	-	-
F. Sperchontidae						
Sperchon		-	-	-	-	-
SEED SHRIMPS						
Cl. Ostracoda		112	9	-	-	34
INSECTS						
Cl. Insecta						
CADDISFLIES						
O. Trichoptera						
pupae		-	-	-	-	-
F. Apataniidae						
Apatania		-	-	-	-	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		-	-	-	-	-
S.F. Chironominae						
Chironomus		-	-	-	112	552
Micropsectra		181	52	9	26	621
Paratanytarsus		-	-	-	-	-
Sergentia		-	-	-	-	-
Stictochironomus		819	1,060	1,103	948	4,828
Tanytarsus		26	9	69	17	310
S.F. Diamesinae						
Protanypus		-	-	-	-	-
Pseudodiamesa		-	-	-	-	-
S.F. Orthocladiinae						
Abiskomyia		17	17	-	17	69
Cricotopus/Orthocladus		-	-	-	-	-

Table F.41: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake SE, August 2018

Taxa	Study Area Replicate Station	Sheardown Lake SE - Profundal Stations				
		DLO-2-12	DLO-2-8	DLO-2-13	DLO-2-2	DLO-2-3
<i>Heterotrissocladius</i>		9	-	-	-	34
<i>Hydrobaenus</i>		-	-	-	-	-
<i>Limnophyes</i>		-	-	-	-	-
<i>Mesocricotopus</i>		-	-	-	-	-
<i>Paracladius</i>		-	-	-	-	-
<i>Parakiefferiella</i>		-	-	-	-	-
<i>Psectrocladius</i>		-	-	-	-	-
<i>Zalutschia</i>		-	9	-	-	34
S.F. Tanypodinae						
<i>Arctopelopia</i>		9	-	-	-	34
<i>Procladius</i>		2,440	543	284	164	1,310
F. Tipulidae						
<i>Tipula</i>		-	-	-	-	-
Density (No. organisms per m²)		3,656	1,743	1,534	1,284	7,826
Richness (total number of taxa)^a		10	10	6	6	10
Simpson's Evenness (E)		0.557	0.591	0.534	0.516	0.643
Bray-Curtis Index		0.978	0.967	0.991	0.980	0.985
Dominant Group Composition						
% Nemata		0.0%	0.5%	3.9%	0.0%	0.0%
% Hydracarina		1.2%	2.0%	0.6%	0.0%	0.0%
% Ostracods		3.1%	0.5%	0.0%	0.0%	0.4%
% Chironomids		95.8%	97.0%	95.5%	100.0%	99.6%
% Metal Sensitive Chironmids		5.7%	3.5%	5.1%	3.3%	11.9%
% Tipulidae		0.0%	0.0%	0.0%	0.0%	0.0%
Functional Feeding Group Composition						
% Collector - Gatherers		26.2%	62.8%	75.8%	83.9%	70.5%
% Filterers		5.7%	3.5%	5.1%	3.3%	11.9%
% Shredders		0.0%	0.5%	0.0%	0.0%	0.4%
Habitat Preference Group Composition						
% Clingers		6.8%	5.5%	5.7%	3.3%	11.9%
% Sprawlers		70.8%	33.2%	18.5%	14.1%	19.4%
% Burrowers		22.4%	61.3%	75.8%	82.6%	68.7%

^a Bold entries excluded from taxa count

Table F.42: Statistical Comparison of Benthic Invertebrate Community Metrics at Sheardown Lake SE Littoral (Shallow) Statoins Among Years of Mine Operation (2015 to 2018) and Baseline (2013) for the Mary River Project

Metric	Data Transform-ation	Overall 5-Year Comparison		Pair-wise, post-hoc comparisons ^a						
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2013	Pairwise Comparison	Statistical Test
Density (No. per m ²)	log	YES	0.0022	2013	5	10,649	4,062	-	a	Tukey's HSD
				2015	5	4,829	1,898	-1.4	b	
				2016	5	3,700	1,485	-1.7	b	
				2017	5	4,417	1,317	-1.5	b	
				2018	5	4,240	1,520	-1.6	b	
Richness (No. of Taxa)	log	YES	0.0764	2013	5	14.2	4.0	-	a	Tukey's HSD
				2015	5	10.6	2.5	-0.9	a,b	
				2016	5	11.4	2.3	-0.7	a,b	
				2017	5	9.0	0.7	-1.3	b	
				2018	5	10.2	2.6	-1.0	a,b	
Simpson's Evenness	log	NO	0.6122	2013	5	0.785	0.096	-	a	Tukey's HSD
				2015	5	0.759	0.123	-0.3	a	
				2016	5	0.772	0.089	-0.1	a	
				2017	5	0.712	0.055	-0.8	a	
				2018	5	0.704	0.131	-0.8	a	
Nemata (% of community)	none	NO	0.8755	2013	5	0.2%	0.2%	-	a	Mann-Whitney U-test
				2015	5	1.5%	2.9%	7.0	a	
				2016	5	1.1%	1.3%	4.4	a	
				2017	5	0.5%	0.6%	1.4	a	
				2018	5	0.6%	0.5%	1.8	a	
Ostracoda (% of community)	none	NO	0.6679	2013	5	5.9%	8.8%	-	a	Mann-Whitney U-test
				2015	5	5.5%	10.0%	0.0	a	
				2016	5	1.7%	2.5%	-0.5	a	
				2017	5	0.8%	0.8%	-0.6	a	
				2018	5	6.1%	9.9%	0.0	a	
Chironomidae (% of community)	none	NO	0.1549	2013	5	89.9%	7.5%	-	a	Mann-Whitney U-test
				2015	5	88.9%	9.4%	-0.1	a	
				2016	5	95.4%	3.9%	0.7	a	
				2017	5	95.6%	1.8%	0.8	a	
				2018	5	92.4%	10.0%	0.3	a	
Metal Sensitive Taxa (% of community)	modified probit	NO	0.5354	2013	5	15.1%	9.8%	-	a	Tukey's HSD
				2015	5	12.7%	10.4%	-0.2	a	
				2016	5	6.8%	4.2%	-0.8	a	
				2017	5	12.1%	4.2%	-0.3	a	
				2018	5	12.1%	8.9%	-0.3	a	
Collector-Gatherer FFG (% of community)	modified probit	NO	0.4486	2013	5	44.6%	8.2%	-	a	Tukey's HSD
				2015	5	59.1%	10.6%	1.8	a	
				2016	5	56.5%	12.8%	1.5	a	
				2017	5	48.4%	18.8%	0.5	a	
				2018	5	52.5%	11.1%	1.0	a	
Filterer FFG (% of community)	modified probit	NO	0.4544	2013	5	15.1%	9.8%	-	a	Tukey's HSD
				2015	5	12.5%	10.4%	-0.3	a	
				2016	5	6.7%	4.4%	-0.9	a	
				2017	5	12.1%	4.2%	-0.3	a	
				2018	5	12.1%	8.9%	-0.3	a	

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.43: Statistical Comparison of Benthic Metrics at Sheardown Lake SE Profundal (Deep) Stations Among Years of Mine Operation (2015 to 2018) and Baseline (2007, 2013) for the Mary River Project CREMP

Metric	Data Transformation	Overall 5-Year Comparison ^a		Pair-wise, post-hoc comparisons ^a							
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size		Pairwise Comparison	Statistical Test
Density (No. per m ²)	none	YES	0.0103	2007	3	4,998	348	-	-1.8	a	Tamhane's
				2013	4	6,602	874	4.6	-	a	
				2015	5	3,185	281	-5.2	-3.9	b	
				2017	5	3,234	880	-5.1	-3.9	b	
				2018	5	3,209	2,747	-5.1	-3.9	a,b	
Richness (No. of Taxa)	none	NO	0.6465	2007	3	9.0	2.8	-	-0.7	a	Mann-Whitney U-test
				2013	4	10.5	2.1	0.5	-	a	
				2015	5	8.8	1.8	-0.1	-0.8	a	
				2017	5	8.8	1.6	-0.1	-0.8	a	
				2018	5	8.4	2.2	-0.2	-1.0	a	
Simpson's Evenness	none	NO	0.1103	2007	3	0.607	0.093	-	-2.4	a	Mann-Whitney U-test
				2013	4	0.703	0.039	1.0	-	a	
				2015	5	0.588	0.130	-0.2	-2.9	a	
				2017	5	0.651	0.086	0.5	-1.3	a	
				2018	5	0.568	0.050	-0.4	-3.4	a	
Nemata (% of community)	none	NO	0.3782	2007	3	0.0%	0.1%	-	-0.9	a	Mann-Whitney U-test
				2013	4	0.1%	0.1%	1.6	-	a	
				2015	5	0.6%	1.1%	11.4	5.4	a	
				2017	5	0.0%	0.0%	-0.6	-1.2	a	
				2018	5	0.9%	1.7%	16.4	8.2	a	
Ostracoda (% of community)	none	NO	0.6343	2007	3	1.1%	1.5%	-	5.1	a	Mann-Whitney U-test
				2013	4	0.2%	0.2%	-0.7	-	a	
				2015	5	0.5%	0.4%	-0.4	1.8	a	
				2017	5	1.0%	1.4%	-0.1	4.5	a	
				2018	5	0.8%	1.3%	-0.2	3.3	a	
Chironomidae (% of community)	none	NO	0.7961	2007	3	97.0%	2.9%	-	-5.6	a	Tukey's HSD
				2013	4	98.6%	0.3%	0.6	-	a	
				2015	5	97.0%	2.9%	0.0	-5.5	a	
				2017	5	97.1%	1.6%	0.0	-5.3	a	
				2018	5	97.6%	2.1%	0.2	-3.7	a	
Metal Sensitive Taxa (% of community)	none	NO	0.1690	2007	3	13.5%	11.4%	-	-1.2	a	Tukey's HSD
				2013	4	16.8%	2.8%	0.3	-	a	
				2015	5	8.0%	4.7%	-0.5	-3.2	a	
				2017	5	12.3%	9.5%	-0.1	-1.6	a	
				2018	5	5.9%	3.5%	-0.7	-3.9	a	
Collector-Gatherer FFG (% of community)	none	NO	0.3004	2007	3	74.1%	15.7%	-	1.2	a	Tukey's HSD
				2013	4	64.9%	7.5%	-0.6	-	a	
				2015	5	60.2%	23.0%	-0.9	-0.6	a	
				2017	5	45.1%	17.4%	-1.8	-2.6	a	
				2018	5	63.8%	22.4%	-0.7	-0.1	a	
Filterer FFG (% of community)	none	NO	0.1701	2007	3	13.4%	11.5%	-	-1.2	a	Tukey's HSD
				2013	4	16.8%	2.8%	0.3	-	a	
				2015	5	7.8%	4.7%	-0.5	-3.2	a	
				2017	5	12.2%	9.6%	-0.1	-1.6	a	
				2018	5	5.9%	3.5%	-0.7	-3.9	a	

Indicates a significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

Table F.44: Replicate Grab Data for Benthic Invertebrate Community Samples Collected at the Mary River, Mary River Project CREMP, August 2018

Study Area	Station	Water Depth (cm)			Water Velocity (m/s)			Embeddedness			In-Stream Vegetation			Algae Presence		
		Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3
Mary River Upstream Reference (GO-09) (Reference)	GO-09 B1	18	15	22	0.37	0.51	0.34	25%	25%	25%	none	none	none	common	common	common
	GO-09 B2	25	22	18	0.40	0.52	0.52	25%	25%	25%	none	none	none	scarce	scarce	scarce
	GO-09 B3	11	22	38	0.57	0.41	0.10	25%	25%	25%	none	none	none	scarce	none	scarce
	GO-09 B4	14	15	14	0.39	0.42	0.57	25%	25%	25%	none	none	none	scarce	scarce	scarce
	GO-09 B5	22	18	17	0.39	0.39	0.44	25%	0%	50%	none	none	none	none	none	none
Mary River Upstream (GO-03)	GO-03 B1	18	18	23	0.35	0.41	0.42	25%	50%	75%	none	scarce	common	scarce	scarce	scarce
	GO-03 B2	18	20	22	0.41	0.39	0.53	75%	50%	75%	none	none	none	scarce	scarce	scarce
	GO-03 B3	20	16	20	0.37	0.47	0.47	25%	25%	50%	none	none	none	scarce	scarce	scarce
	GO-03 B4	16	23	15	0.44	0.53	0.51	25%	25%	25%	none	none	none	scarce	scarce	scarce
	GO-03 B5	16	13	15	0.48	0.45	0.40	25%	25%	75%	none	none	none	scarce	scarce	scarce
Mary River Upper Mine-Exposed (EO-01)	EO-01 B1	24	29	26	0.26	0.34	0.35	25%	25%	25%	none	none	none	none	none	none
	EO-01 B2	16	10	13	0.53	0.47	0.56	25%	50%	50%	none	none	none	none	none	none
	EO-01 B3	28	28	23	0.46	0.56	0.34	50%	50%	50%	none	none	none	none	none	none
	EO-01 B4	16	20	22	0.46	0.50	0.43	50%	50%	25%	none	none	none	none	none	none
	EO-01 B5	13	14	23	0.43	0.46	0.53	25%	25%	25%	none	none	none	none	none	none
Mary River Middle Mine-Exposed (EO-20)	EO-20 B1	17	26	25	0.43	0.46	0.42	50%	50%	50%	none	none	none	none	none	none
	EO-20 B2	18	10	20	0.41	0.40	0.55	25%	25%	25%	none	none	none	none	none	none
	EO-20 B3	22	23	27	0.30	0.58	0.46	50%	50%	50%	none	none	none	none	none	none
	EO-20 B4	22	25	30	0.40	0.57	0.46	50%	50%	50%	none	none	none	none	none	none
	EO-20 B5	23	23	22	0.59	0.43	0.47	25%	25%	25%	none	none	none	none	none	none
Mary River Lower Mine-Exposed (CO-05)	CO-05 B1	13	15	14	0.47	0.42	0.54	50%	50%	50%	common	common	common	scarce	scarce	scarce
	CO-05 B2	14	13	10	0.41	0.60	0.40	50%	50%	50%	common	common	common	scarce	scarce	scarce
	CO-05 B3	12	6	10	0.53	0.55	0.41	50%	25%	25%	scarce	scarce	scarce	common	common	common
	CO-05 B4	10	12	12	0.40	0.57	0.56	75%	75%	63%	common	common	common	common	common	common
	CO-05 B5	10	12	20	0.42	0.42	0.52	50%	50%	50%	scarce	scarce	common	common	common	common

Table F.45: Replicate Station Habitat Feature Summary Statistics for Mary River Benthic Stations, Mary River Project CREMP, August 2018

Metric	Study Area	Mean	Standard Deviation	Standard Error	95% Confidence Interval		Minimum	Maximum
					Lower Bound	Upper Bound		
Water Depth (cm)	GO-09 Reference Area	19.4	3.5	1.6	15.0	23.8	14.3	23.7
	GO-03 Upstream Area	18.2	2.1	1.0	15.6	20.8	14.7	20.0
	EO-01 Upper Mine-Exposed Area	20.3	5.9	2.6	13.0	27.7	13.0	26.3
	EO-20 Middle Mine-Exposed Area	22.2	3.7	1.6	17.6	26.8	16.0	25.7
	CO-05 Lower Mine-Exposed Area	12.2	2.0	0.9	9.8	14.6	9.3	14.0
Water Velocity (cm/s)	GO-09 Reference Area	42.3	4.8	2.1	36.3	48.2	36.0	48.0
	GO-03 Upstream Area	44.2	3.5	1.6	39.8	48.6	39.3	49.3
	EO-01 Upper Mine-Exposed Area	44.5	7.6	3.4	35.1	54.0	31.7	52.0
	EO-20 Middle Mine-Exposed Area	46.2	2.4	1.1	43.2	49.2	43.7	49.7
	CO-05 Lower Mine-Exposed Area	48.1	2.2	1.0	45.4	50.9	45.3	51.0
Substrate Embeddedness (%)	GO-09 Reference Area	25	0	0	25	25	25	25
	GO-03 Upstream Area	43	16	7	23	63	25	67
	EO-01 Upper Mine-Exposed Area	37	11	5	23	51	25	50
	EO-20 Middle Mine-Exposed Area	40	14	6	23	57	25	50
	CO-05 Lower Mine-Exposed Area	51	13	6	34	67	33	71

Note: Five stations were sampled at each study area.

Table F.46: Benthic Station Habitat Feature Statistical Comparisons Among Mary River Reference and Mine-Exposed Study Areas, Mary River Project CREMP, August 2018

Metric	Overall 5-group Comparison			Pair-wise, post-hoc comparisons ^a				
	Significant Difference Among Areas?	P-value	Statistical Test ^b	(I) Area	(J) Area	Significant Difference Between Areas?	P-value	Test
Water Depth (cm)	YES	0.0018	β	GO-09	GO-03	NO	0.9921	Tukey's HSD
				GO-09	EO-01	NO	0.9996	
				GO-09	EO-20	NO	0.8239	
				GO-09	CO-05	YES	0.0142	
				GO-03	EO-01	NO	0.9685	
				GO-03	EO-20	NO	0.5779	
				GO-03	CO-05	YES	0.0360	
				EO-01	EO-20	NO	0.9064	
				EO-01	CO-05	YES	0.0092	
				EO-20	CO-05	YES	0.0013	
Water Velocity (cm/s)	NO	0.3539	α	GO-09	GO-03	NO	0.9609	Tukey's HSD
				GO-09	EO-01	NO	0.9324	
				GO-09	EO-20	NO	0.6586	
				GO-09	CO-05	NO	0.2888	
				GO-03	EO-01	NO	1.0000	
				GO-03	EO-20	NO	0.9560	
				GO-03	CO-05	NO	0.6586	
				EO-01	EO-20	NO	0.9771	
				EO-01	CO-05	NO	0.7261	
				EO-20	CO-05	NO	0.9609	
Substrate Embeddedness (%)	YES	0.0394	γ	GO-09	GO-03	YES	0.0317	Mann-Whitney U-test
				GO-09	EO-01	NO	0.1508	
				GO-09	EO-20	NO	0.1508	
				GO-09	CO-05	YES	0.0079	
				GO-03	EO-01	NO	0.5476	
				GO-03	EO-20	NO	0.8413	
				GO-03	CO-05	NO	0.4206	
				EO-01	EO-20	NO	0.5476	
				EO-01	CO-05	YES	0.0952	
				EO-20	CO-05	NO	0.3095	

Note: Shading indicates a significant difference for respective comparison (p-value ≤ 0.1).

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

^b Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log transformed, single factor ANOVA test conducted; γ - data untransformed, Kruskal-Wallis H-test conducted.

Table F.47: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Mary River Upstream Reference (GO-09) Study Area, August 2018

Taxa	Study Area Replicate Station	GO-09 (Upstream Reference)				
		B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		11	-	-	18	-
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		-	-	-	-	-
F. Lumbriculidae						
<i>Lumbriculus</i>		-	-	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
immature		-	-	-	-	-
F. Sperchonidae						
<i>Sperchon</i>		4	-	-	-	-
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
<i>Acentrella feropagus</i>		-	-	4	4	4
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature		-	-	-	-	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		22	14	-	14	25
S.F. Chironominae						
<i>Chironomus</i>		-	-	-	-	-
S.F. Diamesinae						
<i>Diamesa</i>		83	50	11	93	25
<i>Pseudokiefferiella</i>		-	4	-	18	7
S.F. Orthoclaadiinae						
<i>Chaetocladius</i>		7	-	-	-	4
<i>Cardiocladius</i>		-	-	-	-	-
<i>Corynoneura</i>		-	4	-	-	-
<i>Cricotopus</i>		-	-	-	-	-
<i>Cricotopus/Orthocladus</i>		-	4	-	18	-
<i>Diplocladius</i>		4	-	4	-	-
<i>Eukiefferiella</i>		22	7	4	22	4
<i>Hydrobaenus</i>		14	7	-	-	14
<i>Hydrosmittia</i>		-	-	-	-	-
<i>Krenosmittia</i>		22	18	7	22	11
<i>Limnophyes</i>		4	11	4	25	-
<i>Orthocladus (Euorthocladus)</i>		14	7	7	22	-
<i>Parakiefferiella</i>		-	-	-	-	-
<i>Paraphaenocladus</i>		-	-	-	-	-
<i>Thienemanniella</i>		-	-	-	-	-

Table F.47: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Mary River Upstream Reference (GO-09) Study Area, August 2018

Taxa	Study Area Replicate Station	GO-09 (Upstream Reference)				
		B1	B2	B3	B4	B5
<i>Tokunagaia</i>		7	4	14	4	32
<i>Tvetenia</i>		-	-	-	-	-
indeterminate		-	-	-	-	4
S.F. Tanypodinae						
<i>Thienemannimyia</i> complex		-	-	-	-	-
F. Empididae						
pupae		-	-	-	-	-
F. Simuliidae						
<i>Gymnopaia</i>		25	11	22	54	4
<i>Metacnephia</i>		4	-	-	7	-
<i>Prosimulium</i>		4	-	-	4	-
F. Tipulidae						
<i>Tipula</i>		-	4	-	36	4
Density (No. organisms per m²)		247	145	77	361	138
Richness (total number of taxa)^a		14	12	9	14	10
Simpson's Evenness (E)		0.876	0.879	0.942	0.932	0.907
Bray-Curtis Index		0.318	0.120	0.399	0.471	0.415
Dominant Group Composition						
% Nematoda		4.5%	0.0%	0.0%	5.0%	0.0%
% Oligochaeta		0.0%	0.0%	0.0%	0.0%	0.0%
% Hydracarina		1.6%	0.0%	0.0%	0.0%	0.0%
% Ostracods		0.0%	0.0%	0.0%	0.0%	0.0%
% Ephemeroptera		0.0%	0.0%	5.2%	1.1%	2.9%
% Chironomids		80.6%	89.7%	66.2%	65.9%	91.3%
% Metal Sensitive Chironomids		37.7%	41.4%	14.3%	32.7%	29.0%
% Simuliidae		13.4%	7.6%	28.6%	18.0%	2.9%
% Tipulidae		0.0%	2.8%	0.0%	10.0%	2.9%
Functional Feeding Group Composition						
% Collector - Gatherers		85.0%	86.9%	71.4%	66.8%	94.2%
% Filterers		13.4%	7.6%	28.6%	18.0%	2.9%
% Shredders		0.0%	5.5%	0.0%	15.2%	2.9%
Habitat Preference Group Composition						
% Clingers		15.0%	10.3%	28.6%	23.3%	2.9%
% Sprawlers		80.6%	86.9%	71.4%	61.8%	94.2%
% Burrowers		4.5%	2.8%	0.0%	15.0%	2.9%

^a Bold entries excluded from taxa count

Table F.48: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Mary River Upstream of the Mine (GO-03) Study Area, August 2018

Taxa	Study Area Replicate Station	GO-03 (Upstream of Mine)				
		B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		7	7	11	4	4
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		-	-	-	4	-
F. Lumbriculidae						
Lumbriculus		-	-	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
immature		-	-	-	-	-
F. Sperchonidae						
Sperchon		14	-	4	11	-
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
Acentrella feropagus		-	-	18	7	4
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature		-	-	-	-	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		7	18	29	22	22
S.F. Chironominae						
Chironomus		-	-	-	-	-
S.F. Diamesinae						
Diamesa		4	11	11	14	14
Pseudokiefferiella		83	25	18	14	11
S.F. Orthoclaadiinae						
Chaetocladius		-	-	-	-	-
Cardiocladius		-	-	-	4	-
Corynoneura		-	-	-	-	-
Cricotopus		-	-	-	4	4
Cricotopus/Orthocladus		-	7	32	18	7
Diplocladius		4	-	-	-	-
Eukiefferiella		-	-	7	-	-
Hydrobaenus		-	7	-	97	4
Hydrosmittia		4	-	-	4	7
Krenosmittia		4	4	-	-	-
Limnophyes		-	-	-	-	4
Orthocladus (Euorthocladus)		-	4	25	4	22
Parakiefferiella		-	-	-	-	-
Paraphaenocladus		-	-	-	-	-
Thienemanniella		-	-	-	4	-

Table F.48: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Mary River Upstream of the Mine (GO-03) Study Area, August 2018

Taxa	Study Area Replicate Station	GO-03 (Upstream of Mine)				
		B1	B2	B3	B4	B5
<i>Tokunagaia</i>		11	7	14	7	22
<i>Tvetenia</i>		-	7	4	7	-
indeterminate		7	-	-	-	4
S.F. Tanypodinae						
<i>Thienemannimyia</i> complex		-	-	-	-	-
F. Empididae						
pupae		-	-	4	-	-
F. Simuliidae						
<i>Gymnopais</i>		-	-	11	-	7
<i>Metacnephia</i>		-	-	11	-	4
<i>Prosimulium</i>		-	-	-	-	-
F. Tipulidae						
<i>Tipula</i>		-	-	7	7	4
Density (No. organisms per m²)		145	97	206	232	144
Richness (total number of taxa)^a		8	9	14	16	14
Simpson's Evenness (E)		0.689	0.938	0.963	0.804	0.948
Bray-Curtis Index		0.856	0.638	0.653	0.741	0.579
Dominant Group Composition						
% Nemata		4.8%	7.2%	5.3%	1.7%	2.8%
% Oligochaeta		0.0%	0.0%	0.0%	1.7%	0.0%
% Hydracarina		9.7%	0.0%	1.9%	4.7%	0.0%
% Ostracods		0.0%	0.0%	0.0%	0.0%	0.0%
% Ephemeroptera		0.0%	0.0%	8.7%	3.0%	2.8%
% Chironomids		85.5%	92.8%	68.0%	85.8%	84.0%
% Metal Sensitive Chironomids		63.4%	46.4%	18.0%	13.8%	20.8%
% Simuliidae		0.0%	0.0%	10.7%	0.0%	7.6%
% Tipulidae		0.0%	0.0%	3.4%	3.0%	2.8%
Functional Feeding Group Composition						
% Collector - Gatherers		90.3%	90.7%	62.6%	79.7%	79.9%
% Filterers		0.0%	0.0%	10.7%	0.0%	7.6%
% Shredders		0.0%	9.3%	22.8%	13.8%	12.5%
Habitat Preference Group Composition						
% Clingers		9.7%	9.3%	34.0%	15.5%	17.4%
% Sprawlers		85.5%	83.5%	57.3%	76.3%	77.1%
% Burrowers		4.8%	7.2%	8.7%	8.2%	5.6%

^a Bold entries excluded from taxa count

Table F.49: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Mary River Upper Mine-Exposed (EO-01) Study Area, August 2018

Taxa	Study Area Replicate Station	EO-01 (Upper Mine-Exposed)				
		B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		-	4	14	-	25
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		-	-	-	-	4
F. Lumbriculidae						
Lumbriculus		-	-	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
immature		-	-	-	-	-
F. Sperchonidae						
Sperchon		-	7	-	4	11
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
Acentrella feropagus		-	11	7	-	7
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature		-	-	-	4	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		4	7	4	7	43
S.F. Chironominae						
Chironomus		-	-	-	-	-
S.F. Diamesinae						
Diamesa		-	18	7	11	50
Pseudokiefferiella		-	4	11	7	129
S.F. Orthoclaadiinae						
Chaetocladius		-	-	-	-	7
Cardiocladius		7	-	-	-	-
Corynoneura		-	-	-	-	-
Cricotopus		-	-	-	-	-
Cricotopus/Orthocladus		4	4	-	11	32
Diplocladius		-	-	-	4	7
Eukiefferiella		-	-	-	-	11
Hydrobaenus		-	-	-	-	7
Hydrosmittia		-	-	-	-	-
Krenosmittia		-	-	-	-	-
Limnophyes		-	-	-	-	18
Orthocladus (Euorthocladus)		-	-	7	4	14
Parakiefferiella		-	-	-	-	-
Paraphaenocladus		-	-	-	-	-
Thienemanniella		-	-	-	-	-

Table F.49: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Mary River Upper Mine-Exposed (EO-01) Study Area, August 2018

Taxa	Study Area Replicate Station	EO-01 (Upper Mine-Exposed)				
		B1	B2	B3	B4	B5
<i>Tokunagaia</i>		-	-	-	-	29
<i>Tvetenia</i>		-	-	-	-	11
indeterminate		-	-	-	-	-
S.F. Tanypodinae						
<i>Thienemannimyia</i> complex		-	-	-	-	-
F. Empididae						
pupae		-	-	-	-	-
F. Simuliidae						
<i>Gymnopaia</i>		4	4	-	-	-
<i>Metacnephia</i>		-	-	-	-	-
<i>Prosimulium</i>		-	-	4	-	-
F. Tipulidae						
<i>Tipula</i>		-	-	-	-	7
Density (No. organisms per m²)		19	59	54	52	412
Richness (total number of taxa)^a		3	7	6	7	16
Simpson's Evenness (E)		0.914	0.905	0.970	0.958	0.883
Bray-Curtis Index		0.952	0.659	0.760	0.778	0.627
Dominant Group Composition						
% Nematoda		0.0%	6.8%	25.9%	0.0%	6.1%
% Oligochaeta		0.0%	0.0%	0.0%	0.0%	1.0%
% Hydracarina		0.0%	11.9%	0.0%	7.7%	2.7%
% Ostracods		0.0%	0.0%	0.0%	0.0%	0.0%
% Ephemeroptera		0.0%	18.6%	13.0%	0.0%	1.7%
% Chironomids		78.9%	55.9%	53.7%	84.6%	86.9%
% Metal Sensitive Chironomids		0.0%	47.5%	38.9%	40.4%	49.5%
% Simuliidae		21.1%	6.8%	7.4%	0.0%	0.0%
% Tipulidae		0.0%	0.0%	0.0%	0.0%	1.7%
Functional Feeding Group Composition						
% Collector - Gatherers		0.0%	72.9%	92.6%	59.6%	86.9%
% Filterers		21.1%	6.8%	7.4%	0.0%	0.0%
% Shredders		26.3%	8.5%	0.0%	32.7%	10.4%
Habitat Preference Group Composition						
% Clingers		47.4%	27.1%	7.4%	32.7%	11.4%
% Sprawlers		0.0%	66.1%	66.7%	67.3%	79.9%
% Burrowers		52.6%	6.8%	25.9%	0.0%	8.7%

^a Bold entries excluded from taxa count

Table F.50: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Mary River Middle Mine-Exposed (EO-20) Study Area, August 2018

Taxa	Study Area Replicate Station	EO-20 (Middle Mine-Exposed)				
		B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		-	7	-	-	-
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		-	-	-	-	-
F. Lumbriculidae						
<i>Lumbriculus</i>		-	-	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
immature		-	-	-	-	-
F. Sperchonidae						
<i>Sperchon</i>		-	4	-	-	-
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
<i>Acentrella feropagus</i>		4	4	4	-	4
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature		-	-	-	-	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		4	18	14	7	4
S.F. Chironominae						
<i>Chironomus</i>		-	-	-	-	-
S.F. Diamesinae						
<i>Diamesa</i>		29	22	14	7	25
<i>Pseudokiefferiella</i>		-	-	4	7	-
S.F. Orthocladiinae						
<i>Chaetocladius</i>		-	-	-	-	-
<i>Cardiocladius</i>		-	-	-	-	-
<i>Corynoneura</i>		-	-	-	-	-
<i>Cricotopus</i>		-	-	-	-	-
<i>Cricotopus/Orthocladius</i>		-	7	7	4	-
<i>Diplocladius</i>		-	-	-	-	-
<i>Eukiefferiella</i>		4	-	-	-	7
<i>Hydrobaenus</i>		-	-	-	-	-
<i>Hydrosmittia</i>		-	-	4	-	-
<i>Krenosmittia</i>		-	-	4	-	7
<i>Limnophyes</i>		-	-	-	-	-
<i>Orthocladius (Euorthocladius)</i>		7	7	-	-	7
<i>Parakiefferiella</i>		-	-	-	-	-
<i>Paraphaenocladius</i>		-	-	-	-	-
<i>Thienemanniella</i>		-	-	-	-	-

Table F.50: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Mary River Middle Mine-Exposed (EO-20) Study Area, August 2018

Taxa	Study Area Replicate Station	EO-20 (Middle Mine-Exposed)				
		B1	B2	B3	B4	B5
<i>Tokunagaia</i>		7	14	-	-	-
<i>Tvetenia</i>		-	-	-	-	-
indeterminate		-	-	-	-	-
S.F. Tanypodinae						
<i>Thienemannimyia</i> complex		-	-	-	-	-
F. Empididae						
pupae		-	-	-	-	-
F. Simuliidae						
<i>Gymnopaia</i>		4	-	-	4	4
<i>Metacnephia</i>		7	-	-	-	-
<i>Prosimulium</i>		4	4	-	-	-
F. Tipulidae						
<i>Tipula</i>		-	4	-	-	4
Density (No. organisms per m²)		70	91	51	29	62
Richness (total number of taxa)^a		8	9	6	4	7
Simpson's Evenness (E)		0.840	0.914	0.917	0.951	0.852
Bray-Curtis Index		0.454	0.544	0.655	0.794	0.404
Dominant Group Composition						
% Nemata		0.0%	7.7%	0.0%	0.0%	0.0%
% Oligochaeta		0.0%	0.0%	0.0%	0.0%	0.0%
% Hydracarina		0.0%	4.4%	0.0%	0.0%	0.0%
% Ostracods		0.0%	0.0%	0.0%	0.0%	0.0%
% Ephemeroptera		5.7%	4.4%	7.8%	0.0%	6.5%
% Chironomids		72.9%	74.7%	92.2%	86.2%	80.6%
% Metal Sensitive Chironomids		47.1%	33.0%	49.0%	69.0%	46.8%
% Simuliidae		21.4%	4.4%	0.0%	13.8%	6.5%
% Tipulidae		0.0%	4.4%	0.0%	0.0%	6.5%
Functional Feeding Group Composition						
% Collector - Gatherers		78.6%	75.8%	80.4%	69.0%	87.1%
% Filterers		21.4%	4.4%	0.0%	13.8%	6.5%
% Shredders		0.0%	15.4%	19.6%	17.2%	6.5%
Habitat Preference Group Composition						
% Clingers		21.4%	19.8%	19.6%	31.0%	6.5%
% Sprawlers		78.6%	68.1%	80.4%	69.0%	87.1%
% Burrowers		0.0%	12.1%	0.0%	0.0%	6.5%

^a Bold entries excluded from taxa count

Table F.51: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Mary River Lower Mine-Exposed (CO-05) Study Area, August 2018

Taxa	Study Area Replicate Station	CO-05 (Lower Mine-Exposed)				
		B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		108	4	7	22	18
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		7	4	-	-	7
F. Lumbriculidae						
<i>Lumbriculus</i>		-	-	-	-	4
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
immature		-	-	-	7	-
F. Sperchonidae						
<i>Sperchon</i>		7	4	29	22	-
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
<i>Acentrella feropagus</i>		7	39	50	29	11
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature		-	-	-	-	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		29	18	11	14	32
S.F. Chironominae						
<i>Chironomus</i>		14	-	-	-	-
S.F. Diamesinae						
<i>Diamesa</i>		-	25	29	50	11
<i>Pseudokiefferiella</i>		1,392	344	219	2,146	316
S.F. Orthocladiinae						
<i>Chaetocladius</i>		-	-	-	-	-
<i>Cardiocladius</i>		50	22	39	7	14
<i>Corynoneura</i>		-	-	-	-	-
<i>Cricotopus</i>		-	-	11	-	14
<i>Cricotopus/Orthocladius</i>		22	22	11	50	25
<i>Diplocladius</i>		-	-	-	-	4
<i>Eukiefferiella</i>		-	-	7	-	4
<i>Hydrobaenus</i>		86	4	4	7	7
<i>Hydrosmittia</i>		50	11	-	36	4
<i>Krenosmittia</i>		7	-	-	-	4
<i>Limnophyes</i>		-	-	-	7	-
<i>Orthocladius (Euorthocladius)</i>		72	43	25	43	18
<i>Parakiefferiella</i>		7	-	-	-	-
<i>Paraphaenocladius</i>		-	-	-	-	4
<i>Thienemanniella</i>		-	-	-	-	-

Table F.51: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Mary River Lower Mine-Exposed (CO-05) Study Area, August 2018

Taxa	Study Area Replicate Station	CO-05 (Lower Mine-Exposed)				
		B1	B2	B3	B4	B5
<i>Tokunagaia</i>		122	93	14	165	75
<i>Tvetenia</i>		65	22	4	22	7
indeterminate		29	-	18	7	-
S.F. Tanypodinae						
<i>Thienemannimyia</i> complex		36	11	7	14	4
F. Empididae						
pupae		-	-	-	-	-
F. Simuliidae						
<i>Gymnopaia</i>		-	4	7	22	-
<i>Metacnephia</i>		14	36	14	129	11
<i>Prosimulium</i>		29	47	14	100	-
F. Tipulidae						
<i>Tipula</i>		7	7	7	14	-
Density (No. organisms per m²)		2,160	760	527	2,913	594
Richness (total number of taxa)^a		19	18	18	18	20
Simpson's Evenness (E)		0.591	0.795	0.833	0.469	0.689
Bray-Curtis Index		0.962	0.863	0.771	0.927	0.862
Dominant Group Composition						
% Nematoda		5.0%	0.5%	1.3%	0.8%	3.0%
% Oligochaeta		0.3%	0.5%	0.0%	0.0%	1.9%
% Hydracarina		0.3%	0.5%	5.5%	1.0%	0.0%
% Ostracods		0.0%	0.0%	0.0%	0.0%	0.0%
% Ephemeroptera		0.3%	5.1%	9.5%	1.0%	1.9%
% Chironomids		91.7%	80.9%	75.7%	88.2%	91.4%
% Metal Sensitive Chironomids		65.4%	50.0%	48.4%	75.8%	58.6%
% Simuliidae		2.0%	11.4%	6.6%	8.6%	1.9%
% Tipulidae		0.3%	0.9%	1.3%	0.5%	0.0%
Functional Feeding Group Composition						
% Collector - Gatherers		92.1%	79.6%	71.3%	87.4%	87.9%
% Filterers		2.0%	11.4%	6.6%	8.6%	1.9%
% Shredders		1.4%	3.9%	6.5%	2.3%	7.1%
Habitat Preference Group Composition						
% Clingers		3.4%	15.0%	17.3%	11.4%	8.9%
% Sprawlers		87.8%	80.0%	71.3%	87.1%	83.7%
% Burrowers		8.8%	5.0%	11.4%	1.5%	7.4%

^a Bold entries excluded from taxa count

Table F.52: Benthic Invertebrate Community Summary Statistics for Mary River, Mary River Project CREMP, August 2018

Metric	Area	Mean	Standard Deviation	Standard Error	95% Confidence Interval		Minimum	Maximum
					Lower Bound	Upper Bound		
Density (no. organisms / m ²)	GO-09 Reference Area	194	112	50	55	332	77	361
	GO-03 Upstream Area	165	54	24	98	232	97	232
	EO-01 Upper Mine-Exposed Area	119	164	74	-85	323	19	412
	EO-20 Middle Mine-Exposed Area	61	23	10	32	89	29	91
	CO-05 Lower Mine-Exposed Area	1,391	1,083	484	47	2,735	527	2,913
Richness (Number of Taxa)	GO-09 Reference Area	11.8	2.3	1.0	9.0	14.6	9.0	14.0
	GO-03 Upstream Area	12.2	3.5	1.6	7.9	16.5	8.0	16.0
	EO-01 Upper Mine-Exposed Area	7.8	4.9	2.2	1.8	13.8	3.0	16.0
	EO-20 Middle Mine-Exposed Area	6.8	1.9	0.9	4.4	9.2	4.0	9.0
	CO-05 Lower Mine-Exposed Area	18.6	0.9	0.4	17.5	19.7	18.0	20.0
Simpson's Evenness	GO-09 Reference Area	0.907	0.030	0.013	0.870	0.945	0.876	0.942
	GO-03 Upstream Area	0.868	0.119	0.053	0.721	1.016	0.689	0.963
	EO-01 Upper Mine-Exposed Area	0.926	0.037	0.016	0.880	0.972	0.883	0.970
	EO-20 Middle Mine-Exposed Area	0.895	0.047	0.021	0.836	0.953	0.840	0.951
	CO-05 Lower Mine-Exposed Area	0.675	0.149	0.067	0.490	0.860	0.469	0.833
Bray-Curtis Index	GO-09 Reference Area	0.345	0.137	0.061	0.175	0.515	0.120	0.471
	GO-03 Upstream Area	0.693	0.108	0.048	0.560	0.827	0.579	0.856
	EO-01 Upper Mine-Exposed Area	0.755	0.127	0.057	0.597	0.913	0.627	0.952
	EO-20 Middle Mine-Exposed Area	0.570	0.158	0.070	0.375	0.766	0.404	0.794
	CO-05 Lower Mine-Exposed Area	0.877	0.073	0.033	0.786	0.968	0.771	0.962
Nemata (% of community)	GO-09 Reference Area	1.9%	2.6%	1.2%	-1.3%	5.1%	0.0%	5.0%
	GO-03 Upstream Area	4.4%	2.2%	1.0%	1.7%	7.1%	1.7%	7.2%
	EO-01 Upper Mine-Exposed Area	7.8%	10.7%	4.8%	-5.5%	21.0%	0.0%	25.9%
	EO-20 Middle Mine-Exposed Area	1.5%	3.4%	1.5%	-2.7%	5.8%	0.0%	7.7%
	CO-05 Lower Mine-Exposed Area	2.1%	1.9%	0.8%	-0.2%	4.5%	0.5%	5.0%
Hydracarina (% of community)	GO-09 Reference Area	0.3%	0.7%	0.3%	-0.6%	1.2%	0.0%	1.6%
	GO-03 Upstream Area	3.3%	4.1%	1.8%	-1.8%	8.3%	0.0%	9.7%
	EO-01 Upper Mine-Exposed Area	4.4%	5.2%	2.3%	-2.0%	10.9%	0.0%	11.9%
	EO-20 Middle Mine-Exposed Area	0.9%	2.0%	0.9%	-1.6%	3.3%	0.0%	4.4%
	CO-05 Lower Mine-Exposed Area	1.5%	2.3%	1.0%	-1.4%	4.3%	0.0%	5.5%
Ephemeroptera (% of community)	GO-09 Reference Area	1.8%	2.2%	1.0%	-0.9%	4.6%	0.0%	5.2%
	GO-03 Upstream Area	2.9%	3.6%	1.6%	-1.5%	7.3%	0.0%	8.7%
	EO-01 Upper Mine-Exposed Area	6.7%	8.6%	3.9%	-4.0%	17.4%	0.0%	18.6%
	EO-20 Middle Mine-Exposed Area	4.9%	3.0%	1.3%	1.2%	8.6%	0.0%	7.8%
	CO-05 Lower Mine-Exposed Area	3.6%	3.8%	1.7%	-1.2%	8.3%	0.3%	9.5%
Chironomidae (% of community)	GO-09 Reference Area	78.7%	12.3%	5.5%	63.5%	94.0%	65.9%	91.3%
	GO-03 Upstream Area	83.2%	9.2%	4.1%	71.8%	94.6%	68.0%	92.8%
	EO-01 Upper Mine-Exposed Area	72.0%	16.0%	7.1%	52.2%	91.9%	53.7%	86.9%
	EO-20 Middle Mine-Exposed Area	81.3%	8.0%	3.6%	71.4%	91.3%	72.9%	92.2%
	CO-05 Lower Mine-Exposed Area	85.6%	7.0%	3.1%	76.9%	94.3%	75.7%	91.7%
Metal-Sensitive Chironomidae (% of community)	GO-09 Reference Area	31.0%	10.5%	4.7%	18.0%	44.0%	14.3%	41.4%
	GO-03 Upstream Area	32.5%	21.5%	9.6%	5.8%	59.2%	13.8%	63.4%
	EO-01 Upper Mine-Exposed Area	35.2%	20.2%	9.0%	10.1%	60.4%	0.0%	49.5%
	EO-20 Middle Mine-Exposed Area	49.0%	12.9%	5.8%	33.0%	65.0%	33.0%	69.0%
	CO-05 Lower Mine-Exposed Area	59.6%	11.3%	5.1%	45.5%	73.7%	48.4%	75.8%
Simuliidae (% of community)	GO-09 Reference Area	14.1%	9.9%	4.4%	1.8%	26.4%	2.9%	28.6%
	GO-03 Upstream Area	3.7%	5.1%	2.3%	-2.7%	10.0%	0.0%	10.7%
	EO-01 Upper Mine-Exposed Area	7.0%	8.6%	3.8%	-3.6%	17.7%	0.0%	21.1%
	EO-20 Middle Mine-Exposed Area	9.2%	8.5%	3.8%	-1.3%	19.7%	0.0%	21.4%
	CO-05 Lower Mine-Exposed Area	6.1%	4.2%	1.9%	0.9%	11.3%	1.9%	11.4%

Table F.52: Benthic Invertebrate Community Summary Statistics for Mary River, Mary River Project CREMP, August 2018

Metric	Area	Mean	Standard Deviation	Standard Error	95% Confidence Interval		Minimum	Maximum
					Lower Bound	Upper Bound		
Tipulidae (% of community)	GO-09 Reference Area	3.1%	4.1%	1.8%	-1.9%	8.2%	0.0%	10.0%
	GO-03 Upstream Area	1.8%	1.7%	0.8%	-0.3%	3.9%	0.0%	3.4%
	EO-01 Upper Mine-Exposed Area	0.3%	0.8%	0.3%	-0.6%	1.3%	0.0%	1.7%
	EO-20 Middle Mine-Exposed Area	2.2%	3.1%	1.4%	-1.6%	6.0%	0.0%	6.5%
	CO-05 Lower Mine-Exposed Area	0.6%	0.5%	0.2%	0.0%	1.3%	0.0%	1.3%
Collector-Gatherer FFG (% of community)	GO-09 Reference Area	80.9%	11.4%	5.1%	66.7%	95.0%	66.8%	94.2%
	GO-03 Upstream Area	80.7%	11.4%	5.1%	66.5%	94.8%	62.6%	90.7%
	EO-01 Upper Mine-Exposed Area	62.4%	37.2%	16.6%	16.3%	108.5%	0.0%	92.6%
	EO-20 Middle Mine-Exposed Area	78.2%	6.6%	3.0%	70.0%	86.4%	69.0%	87.1%
	CO-05 Lower Mine-Exposed Area	83.7%	8.2%	3.7%	73.4%	93.9%	71.3%	92.1%
Filterer FFG (% of community)	GO-09 Reference Area	14.1%	9.9%	4.4%	1.8%	26.4%	2.9%	28.6%
	GO-03 Upstream Area	3.7%	5.1%	2.3%	-2.7%	10.0%	0.0%	10.7%
	EO-01 Upper Mine-Exposed Area	7.0%	8.6%	3.8%	-3.6%	17.7%	0.0%	21.1%
	EO-20 Middle Mine-Exposed Area	9.2%	8.5%	3.8%	-1.3%	19.7%	0.0%	21.4%
	CO-05 Lower Mine-Exposed Area	6.1%	4.2%	1.9%	0.9%	11.3%	1.9%	11.4%
Shredder FFG (% of community)	GO-09 Reference Area	4.7%	6.3%	2.8%	-3.1%	12.6%	0.0%	15.2%
	GO-03 Upstream Area	11.7%	8.2%	3.7%	1.5%	21.9%	0.0%	22.8%
	EO-01 Upper Mine-Exposed Area	15.6%	13.5%	6.0%	-1.2%	32.3%	0.0%	32.7%
	EO-20 Middle Mine-Exposed Area	11.7%	8.2%	3.7%	1.5%	22.0%	0.0%	19.6%
	CO-05 Lower Mine-Exposed Area	4.2%	2.5%	1.1%	1.1%	7.3%	1.4%	7.1%
Clinger HPG (% of community)	GO-09 Reference Area	16.0%	10.2%	4.6%	3.4%	28.7%	2.9%	28.6%
	GO-03 Upstream Area	17.2%	10.1%	4.5%	4.7%	29.6%	9.3%	34.0%
	EO-01 Upper Mine-Exposed Area	25.2%	16.3%	7.3%	5.0%	45.4%	7.4%	47.4%
	EO-20 Middle Mine-Exposed Area	19.7%	8.8%	3.9%	8.8%	30.5%	6.5%	31.0%
	CO-05 Lower Mine-Exposed Area	11.2%	5.4%	2.4%	4.5%	17.9%	3.4%	17.3%
Sprawler HPG (% of community)	GO-09 Reference Area	79.0%	12.7%	5.7%	63.1%	94.8%	61.8%	94.2%
	GO-03 Upstream Area	75.9%	11.2%	5.0%	62.1%	89.8%	57.3%	85.5%
	EO-01 Upper Mine-Exposed Area	56.0%	31.8%	14.2%	16.5%	95.5%	0.0%	79.9%
	EO-20 Middle Mine-Exposed Area	76.6%	8.0%	3.6%	66.7%	86.6%	68.1%	87.1%
	CO-05 Lower Mine-Exposed Area	82.0%	6.7%	3.0%	73.7%	90.3%	71.3%	87.8%
Burrower HPG (% of community)	GO-09 Reference Area	5.0%	5.8%	2.6%	-2.2%	12.2%	0.0%	15.0%
	GO-03 Upstream Area	6.9%	1.7%	0.7%	4.8%	9.0%	4.8%	8.7%
	EO-01 Upper Mine-Exposed Area	18.8%	21.2%	9.5%	-7.5%	45.1%	0.0%	52.6%
	EO-20 Middle Mine-Exposed Area	3.7%	5.5%	2.4%	-3.1%	10.5%	0.0%	12.1%
	CO-05 Lower Mine-Exposed Area	6.8%	3.8%	1.7%	2.1%	11.5%	1.5%	11.4%

Table F.53: Benthic Invertebrate Community Metric Statistical Comparison Results among Mary River Reference (GO-09), Upstream (GO-03) and Mine-Exposed (EO-01, EO-20, CO-05) Study Areas, Mary River Project CREMP, August 2018

Metric	Data Transform-ation	Overall 5-Area Comparison		Pair-wise, post-hoc comparisons ^a				
		Significant Difference Among Areas?	P-value	Area	Mean	Standard Deviation	Effect Size	Pairwise Comparison
							vs. GO-09 Reference	
Density (No. per m ²)	log	YES	< 0.001	GO-09 Ref	194	112	-	a
				GO-03	165	54	-0.3	a
				EO-01	119	164	-0.7	a
				EO-20	61	23	-1.2	a
				CO-05	1,391	1,083	10.7	b
Richness (No. of Taxa)	square root	YES	< 0.001	GO-09 Ref	11.8	2.3	-	a
				GO-03	12.2	3.5	0.2	a
				EO-01	7.8	4.9	-1.8	a,b
				EO-20	6.8	1.9	-2.2	b
				CO-05	18.6	0.9	3.0	c
Simpson's Evenness	none	YES	0.0020	GO-09 Ref	0.907	0.030	-	a
				GO-03	0.868	0.119	-1.3	a
				EO-01	0.926	0.037	0.6	a
				EO-20	0.895	0.047	-0.4	a
				CO-05	0.675	0.149	-7.7	b
Bray-Curtis Index	none	YES	< 0.001	GO-09 Ref	0.345	0.137	-	a
				GO-03	0.693	0.108	2.5	b,c
				EO-01	0.755	0.127	3.0	b,c
				EO-20	0.570	0.158	1.6	b
				CO-05	0.877	0.073	3.9	c
Nemata (% of community)	fourth-root	NO	0.1280	GO-09 Ref	1.9%	2.6%	-	a
				GO-03	4.4%	2.2%	1.0	a
				EO-01	7.8%	10.7%	2.3	a
				EO-20	1.5%	3.4%	-0.1	a
				CO-05	2.1%	1.9%	0.1	a
Hydracarina (% of community)	fourth-root	NO	0.3270	GO-09 Ref	0.3%	0.7%	-	a
				GO-03	3.3%	4.1%	4.1	a
				EO-01	4.4%	5.2%	5.7	a
				EO-20	0.9%	2.0%	0.8	a
				CO-05	1.5%	2.3%	1.6	a
Ephemeroptera (% of community)	square root	NO	0.7740	GO-09 Ref	1.8%	2.2%	-	a
				GO-03	2.9%	3.6%	0.5	a
				EO-01	6.7%	8.6%	2.2	a
				EO-20	4.9%	3.0%	1.4	a
				CO-05	3.6%	3.8%	0.8	a
Chironomidae (% of community)	log	NO	0.3260	GO-09 Ref	78.7%	12.3%	-	a
				GO-03	83.2%	9.2%	0.4	a
				EO-01	72.0%	16.0%	-0.5	a
				EO-20	81.3%	8.0%	0.2	a
				CO-05	85.6%	7.0%	0.6	a
Metal Sensitive Chironomidae (% of community)	none	YES	0.0420	GO-09 Ref	31.0%	10.5%	-	a
				GO-03	32.5%	21.5%	0.1	a
				EO-01	35.2%	20.2%	0.4	a,b
				EO-20	49.0%	12.9%	1.7	a,b
				CO-05	59.6%	11.3%	2.7	b
Simuliidae (% of community)	fourth-root	NO	0.1940	GO-09 Ref	14.1%	9.9%	-	a
				GO-03	3.7%	5.1%	-1.1	a
				EO-01	7.0%	8.6%	-0.7	a
				EO-20	9.2%	8.5%	-0.5	a
				CO-05	6.1%	4.2%	-0.8	a

Table F.53: Benthic Invertebrate Community Metric Statistical Comparison Results among Mary River Reference (GO-09), Upstream (GO-03) and Mine-Exposed (EO-01, EO-20, CO-05) Study Areas, Mary River Project CREMP, August 2018

Metric	Data Transform-ation	Overall 5-Area Comparison		Pair-wise, post-hoc comparisons ^a				
		Significant Difference Among Areas?	P-value	Area	Mean	Standard Deviation	Effect Size	Pairwise Comparison
							vs. GO-09 Reference	
Tipulidae (% of community)	square root	NO	0.5350	GO-09 Ref	3.1%	4.1%	-	a
				GO-03	1.8%	1.7%	-0.3	a
				EO-01	0.3%	0.8%	-0.7	a
				EO-20	2.2%	3.1%	-0.2	a
				CO-05	0.6%	0.5%	-0.6	a
Collector-Gatherer FFG (% of community)	rank	NO	0.7520	GO-09 Ref	80.9%	11.4%	-	a
				GO-03	80.7%	11.4%	0.0	a
				EO-01	62.4%	37.2%	-1.6	a
				EO-20	78.2%	6.6%	-0.2	a
				CO-05	83.7%	8.2%	0.2	a
Filterer FFG (% of community)	fourth-root	NO	0.1940	GO-09 Ref	14.1%	9.9%	-	a
				GO-03	3.7%	5.1%	-1.1	a
				EO-01	7.0%	8.6%	-0.7	a
				EO-20	9.2%	8.5%	-0.5	a
				CO-05	6.1%	4.2%	-0.8	a
Shredder FFG (% of community)	none	NO	0.1960	GO-09 Ref	4.7%	6.3%	-	a
				GO-03	11.7%	8.2%	1.1	a
				EO-01	15.6%	13.5%	1.7	a
				EO-20	11.7%	8.2%	1.1	a
				CO-05	4.2%	2.5%	-0.1	a
Clinger HPG (% of community)	none	NO	0.3640	GO-09 Ref	16.0%	10.2%	-	a
				GO-03	17.2%	10.1%	0.1	a
				EO-01	25.2%	16.3%	0.9	a
				EO-20	19.7%	8.8%	0.4	a
				CO-05	11.2%	5.4%	-0.5	a
Sprawler HPG (% of community)	rank	NO	0.1210	GO-09 Ref	79.0%	12.7%	-	a
				GO-03	75.9%	11.2%	-0.2	a
				EO-01	56.0%	31.8%	-1.8	a
				EO-20	76.6%	8.0%	-0.2	a
				CO-05	82.0%	6.7%	0.2	a
Burrower HPG (% of community)	square root	NO	0.2360	GO-09 Ref	5.0%	5.8%	-	a
				GO-03	6.9%	1.7%	0.3	a
				EO-01	18.8%	21.2%	2.4	a
				EO-20	3.7%	5.5%	-0.2	a
				CO-05	6.8%	3.8%	0.3	a

Indicates a significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.54: Statistical Comparison of Benthic Invertebrate Community Metrics at the Mary River Reference Area (GO-09) Among Years of Mine Operation (2015 to 2018) and Baseline (2007, 2011) for the Mary River Project CREMP

Metric	Data Transform-ation	Overall 6-Year Comparison		Pair-wise, post-hoc comparisons ^a							
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Effect Size vs. Baseline Year 2011	Pairwise Comparison	Statistical Test
Density (No. per m ²)	log	YES	0.0096	2006	3	404	149	-	-4.0	a,b	Tukey's HSD
				2007	3	739	84	2.3	-	a	
				2015	5	472	255	0.5	-3.2	a,b	
				2016	5	662	320	1.7	-0.9	a	
				2017	5	410	313	0.0	-3.9	a,b	
				2018	5	194	112	-1.4	-6.5	b	
Richness (No. of Taxa)	none	YES	0.0785	2006	3	7.3	2.9	-	-10.4	a	Mann-Whitney U-test
				2007	3	13.3	0.6	2.1	-	b,c,d,e	
				2015	5	11.4	3.2	1.4	-3.3	a	
				2016	5	14.0	1.6	2.3	1.2	a,c	
				2017	5	11.2	2.9	1.3	-3.7	d	
				2018	5	11.8	2.3	1.5	-2.7	e	
Simpson's Evenness	none	YES	0.0025	2006	3	0.324	0.095	-	-8.6	a	Mann-Whitney U-test
				2007	3	0.655	0.039	3.5	-	b	
				2015	5	0.878	0.049	5.8	5.8	c,d	
				2016	5	0.907	0.023	6.1	6.5	c	
				2017	5	0.770	0.097	4.7	3.0	d	
				2018	5	0.907	0.030	6.1	6.5	c,d	
Nemata (% of community)	none	NO	0.4398	2006	3	0.6%	0.5%	-	1.4	a	Mann-Whitney U-test
				2007	3	0.2%	0.3%	-0.8	-	a	
				2015	5	0.0%	0.0%	-1.1	-0.6	a	
				2016	5	1.0%	1.0%	0.8	2.9	a	
				2017	5	0.5%	1.0%	-0.1	1.2	a	
				2018	5	1.9%	2.6%	2.4	5.7	a	
Hydracarina (% of community)	modified probit	YES	0.0000	2006	3	0.5%	0.9%	-	1.2	a	Tukey's HSD
				2007	3	0.2%	0.3%	-0.4	-	a	
				2015	5	4.0%	5.5%	4.0	13.4	b	
				2016	5	4.3%	3.0%	4.4	14.6	b	
				2017	5	0.0%	0.0%	-0.6	-0.6	a	
				2018	5	0.3%	0.7%	-0.2	0.6	a	
Chironomidae (% of community)	modified probit	YES	0.0000	2006	3	98.7%	0.8%	-	nc	a	Tukey's HSD
				2007	3	100.0%	0.0%	1.7	-	a	
				2015	5	88.0%	4.5%	-13.2	nc	b	
				2016	5	84.8%	5.3%	-17.1	nc	b	
				2017	5	79.1%	6.4%	-24.3	nc	b	
				2018	5	78.7%	12.3%	-24.7	nc	b	
Metal Sensitive Taxa (% of community)	none	YES	0.0049	2006	3	62.1%	3.7%	-	1.7	a	Mann-Whitney U-test
				2007	3	30.7%	18.2%	-8.6	-	b,c	
				2015	5	13.7%	14.8%	-13.2	-0.9	b	
				2016	5	23.4%	12.3%	-10.6	-0.4	c	
				2017	5	59.7%	13.2%	-0.7	1.6	a	
				2018	5	31.0%	10.5%	-8.5	0.0	c	
Tipulidae (% of community)	none	NO	0.4476	2006	3	0.2%	0.4%	-	nc	a	Mann-Whitney U-test
				2007	3	0.0%	0.0%	-0.6	-	a	
				2015	5	4.0%	5.5%	9.2	nc	a	
				2016	5	1.4%	1.7%	2.9	nc	a	
				2017	5	1.5%	1.3%	3.1	nc	a	
				2018	5	3.1%	4.1%	7.0	nc	a	
Collector-Gatherer FFG (% of community)	modified probit	YES	0.0000	2006	3	98.6%	1.1%	-	0.9	a	Tukey's HSD
				2007	3	93.3%	5.8%	-4.7	-	b	
				2015	5	76.3%	10.9%	-19.8	-3.0	c	
				2016	5	74.5%	8.3%	-21.3	-3.3	c	
				2017	5	74.6%	6.6%	-21.3	-3.3	c	
				2018	5	80.9%	11.4%	-15.7	-2.2	b,c	
Filterer FFG (% of community)	modified probit	YES	0.0000	2006	3	0.1%	0.2%	-	nc	a,b	Tukey's HSD
				2007	3	0.0%	0.0%	-0.6	-	a	
				2015	5	0.0%	0.0%	-0.6	nc	b	
				2016	5	6.3%	5.4%	30.3	nc	c	
				2017	5	18.9%	5.2%	91.4	nc	c	
				2018	5	14.1%	9.9%	68.0	nc	c	
Shredder FFG (% of community)	modified probit	YES	0.0013	2006	3	0.2%	0.4%	-	nc	a	Tamhane's
				2007	3	0.0%	0.0%	-0.6	-	b	
				2015	5	14.0%	11.4%	33.5	nc	c	
				2016	5	12.4%	3.3%	29.5	nc	c	
				2017	5	5.8%	2.2%	13.6	nc	a,b,c	
				2018	5	4.7%	6.3%	10.9	nc	a,b,c	

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.55: Statistical Comparison of Benthic Invertebrate Community Metrics at Mary River Upstream of Mine (GO-03) Among Years of Mine Operation (2015 to 2018) and Baseline (2007) for the Mary River Project CREMP

Metric	Data Transform-ation	Overall 5-Year Comparison		Pair-wise, post-hoc comparisons ^a						
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Pairwise Comparison	Statistical Test
Density (No. per m ²)	none	NO	0.1745	2007	3	136	29	-	a	Tamhane's
				2015	5	169	122	1.1	a	
				2016	5	287	92	5.1	a	
				2017	5	282	172	5.0	a	
				2018	5	165	54	1.0	a	
Richness (No. of Taxa)	none	YES	0.0249	2007	3	6.3	1.2	-	a	Mann-Whitney U-test
				2015	5	9.4	3.5	2.7	b	
				2016	5	14.4	1.8	7.0	b,c	
				2017	5	13.6	3.9	6.3	c	
				2018	5	12.2	3.5	5.1	b,c	
Simpson's Evenness	none	YES	0.0728	2007	3	0.591	0.003	-	a	Mann-Whitney U-test
				2015	5	0.921	0.045	114.3	b	
				2016	5	0.899	0.041	106.5	b	
				2017	5	0.873	0.142	97.7	b	
				2018	5	0.868	0.119	96.0	b	
Nemata (% of community)	modified probit	YES	0.0000	2007	3	0.0%	0.0%	-	a	Tamhane's
				2015	5	0.0%	0.0%	nc	a	
				2016	5	2.2%	1.3%	nc	b	
				2017	5	1.3%	1.2%	nc	a,b	
				2018	5	4.4%	2.2%	nc	c,b	
Hydracarina (% of community)	modified probit	YES	0.0106	2007	3	0.0%	0.0%	-	a	Tamhane's
				2015	5	8.0%	4.5%	nc	a	
				2016	5	10.3%	4.4%	nc	a	
				2017	5	1.9%	1.9%	nc	a	
				2018	5	3.3%	4.1%	nc	a	
Chironomidae (% of community)	none	YES	0.0030	2007	3	100.0%	0.0%	-	a	Tukey's HSD
				2015	5	71.9%	8.2%	nc	b	
				2016	5	77.9%	8.0%	nc	b	
				2017	5	75.3%	10.3%	nc	b	
				2018	5	83.2%	9.2%	nc	b	
Metal Sensitive Taxa (% of community)	modified probit	YES	0.0029	2007	3	6.6%	3.0%	-	a	Mann-Whitney U-test
				2015	5	7.9%	4.9%	0.4	a	
				2016	5	8.8%	5.9%	0.7	a	
				2017	5	46.9%	12.6%	13.3	b	
				2018	5	32.5%	21.5%	8.5	b	
Tipulidae (% of community)	none	YES	0.0005	2007	3	0.0%	0.0%	-	a	Tamhane's
				2015	5	18.0%	8.4%	nc	b	
				2016	5	8.3%	7.3%	nc	a,b	
				2017	5	2.9%	2.0%	nc	a,b	
				2018	5	1.8%	1.7%	nc	a,b	
Collector-Gatherer FFG (% of community)	modified probit	YES	0.0000	2007	3	93.3%	5.8%	-	a	Tukey's HSD
				2015	5	62.1%	11.0%	-5.4	b	
				2016	5	63.5%	6.4%	-5.2	b	
				2017	5	74.2%	10.6%	-3.3	b,c	
				2018	5	80.7%	11.4%	-2.2	c	
Filterer FFG (% of community)	modified probit	YES	0.0013	2007	3	0.0%	0.0%	-	a	Tamhane's
				2015	5	0.0%	0.0%	nc	a	
				2016	5	0.3%	0.7%	nc	a	
				2017	5	15.2%	5.4%	nc	b	
				2018	5	3.7%	5.1%	nc	a,b	
Shredder FFG (% of community)	modified probit	YES	0.0020	2007	3	6.7%	5.8%	-	a	Mann-Whitney U-test
				2015	5	30.0%	7.1%	4.0	b	
				2016	5	20.7%	5.5%	2.4	c	
				2017	5	5.7%	2.2%	-0.2	a	
				2018	5	11.7%	8.2%	0.9	a	

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.56: Statistical Comparison of Benthic Invertebrate Community Metrics at the Mary River Upper Mine-Exposed Area (EO-01) Among Years of Mine Operation (2015 to 2018) and Baseline (2007) for the Mary River

Metric	Data Transform-ation	Overall 5-Year Comparison		Pair-wise, post-hoc comparisons ^a						
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Pairwise Comparison	Statistical Test
Density (No. per m ²)	log	NO	0.1161	2007	3	797	648	-	a	Tukey's HSD
				2015	5	116	97	-1.1	a	
				2016	5	230	109	-0.9	a	
				2017	5	126	106	-1.0	a	
				2018	5	119	164	-1.0	a	
Richness (No. of Taxa)	none	NO	0.1147	2007	3	16.3	8.1	-	a	Tukey's HSD
				2015	5	7.8	2.7	-1.0	a	
				2016	5	13.2	4.1	-0.4	a	
				2017	5	10.6	5.3	-0.7	a	
				2018	5	7.8	4.9	-1.0	a	
Simpson's Evenness	none	YES	0.0254	2007	3	0.698	0.059	-	a	Mann-Whitney U-test
				2015	5	0.873	0.095	3.0	b,c,d	
				2016	5	0.865	0.037	2.8	c	
				2017	5	0.940	0.053	4.1	d	
				2018	5	0.926	0.037	3.9	d	
Nemata (% of community)	modified probit	NO	0.2421	2007	3	2.1%	3.6%	-	a	Tukey's HSD
				2015	5	2.0%	4.5%	0.0	a	
				2016	5	1.3%	1.3%	-0.2	a	
				2017	5	0.8%	1.8%	-0.4	a	
				2018	5	7.8%	10.7%	1.6	a	
Hydracarina (% of community)	none	NO	0.3633	2007	3	3.3%	5.8%	-	a	Mann-Whitney U-test
				2015	5	2.0%	4.5%	-0.2	a	
				2016	5	7.2%	4.6%	0.7	a	
				2017	5	2.2%	2.1%	-0.2	a	
				2018	5	4.4%	5.2%	0.2	a	
Chironomidae (% of community)	none	NO	0.1630	2007	3	90.0%	0.0%	-	a	Tamhane's
				2015	5	82.5%	8.3%	nc	a	
				2016	5	82.9%	7.3%	nc	a	
				2017	5	78.1%	7.2%	nc	a	
				2018	5	72.0%	16.0%	nc	a	
Metal Sensitive Taxa (% of community)	none	YES	0.0804	2007	3	36.4%	32.0%	-	a	Mann-Whitney U-test
				2015	5	7.4%	7.7%	-0.9	a	
				2016	5	5.7%	4.7%	-1.0	a	
				2017	5	29.0%	8.2%	-0.2	b	
				2018	5	35.2%	20.2%	0.0	b	
Tipulidae (% of community)	modified probit	YES	0.0237	2007	3	3.3%	5.8%	-	a,b	Tukey's HSD
				2015	5	10.0%	7.1%	1.2	b	
				2016	5	2.5%	2.6%	-0.2	a,b	
				2017	5	0.3%	0.6%	-0.5	a	
				2018	5	0.3%	0.8%	-0.5	a	
Collector-Gatherer FFG (% of community)	none	NO	0.1334	2007	3	40.0%	26.5%	-	a	Tukey's HSD
				2015	5	72.2%	16.5%	1.2	a	
				2016	5	77.9%	6.9%	1.4	a	
				2017	5	80.3%	8.5%	1.5	a	
				2018	5	62.4%	37.2%	0.8	a	
Filterer FFG (% of community)	modified probit	YES	0.0122	2007	3	36.7%	32.1%	-	a,b	Tamhane's
				2015	5	0.0%	0.0%	-1.1	a	
				2016	5	0.9%	0.8%	-1.1	a	
				2017	5	14.0%	11.2%	-0.7	b	
				2018	5	7.0%	8.6%	-0.9	a,b	
Shredder FFG (% of community)	modified probit	YES	0.0484	2007	3	6.7%	11.5%	-	a,b	Tukey's HSD
				2015	5	18.0%	17.9%	1.0	b	
				2016	5	7.4%	7.6%	0.1	a,b	
				2017	5	2.5%	5.5%	-0.4	a	
				2018	5	15.6%	13.5%	0.8	a,b	

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.57: Statistical Comparison of Benthic Invertebrate Community Metrics at the Mary River Middle Mine-Exposed Area (EO-20) Among Years of Mine Operation (2015 to 2018) and Baseline (2011) for the Mary River

Metric	Data Transform-ation	Overall 5-Year Comparison		Pair-wise, post-hoc comparisons ^a						
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2011	Pairwise Comparison	Statistical Test
Density (No. per m ²)	log	YES	0.0031	2011	3	854	348	-	a	Tukey's HSD
				2015	5	278	146	-1.7	a,c	
				2016	5	283	118	-1.6	a,b	
				2017	5	382	665	-1.4	b,c,d	
				2018	5	61	23	-2.3	d	
Richness (No. of Taxa)	none	YES	0.0454	2011	3	14.0	2.6	-	a	Mann-Whitney U-test
				2015	5	11.6	2.2	-0.9	a	
				2016	5	13.6	3.1	-0.2	a	
				2017	5	12.4	5.0	-0.6	a	
				2018	5	6.8	1.9	-2.7	b	
Simpson's Evenness	none	YES	0.0010	2011	3	0.483	0.247	-	a	Tamhane's
				2015	5	0.726	0.140	1.0	a	
				2016	5	0.835	0.038	1.4	a	
				2017	5	0.902	0.103	1.7	a	
				2018	5	0.895	0.047	1.7	a	
Nemata (% of community)	modified probit	NO	0.1223	2011	3	0.0%	0.0%	-	a	Tukey's HSD
				2015	5	0.0%	0.0%	nc	a	
				2016	5	1.4%	0.9%	nc	a	
				2017	5	0.6%	1.4%	nc	a	
				2018	5	1.5%	3.4%	nc	a	
Hydracarina (% of community)	modified probit	YES	0.0036	2011	3	0.2%	0.4%	-	a	Tukey's HSD
				2015	5	2.0%	4.5%	4.3	b	
				2016	5	7.2%	3.3%	17.1	c	
				2017	5	4.1%	2.8%	9.6	b	
				2018	5	0.9%	2.0%	1.6	a,b	
Chironomidae (% of community)	modified probit	YES	0.0046	2011	3	96.7%	5.8%	-	a	Tukey's HSD
				2015	5	88.6%	5.0%	-1.4	a,b	
				2016	5	86.1%	6.3%	-1.8	b	
				2017	5	71.4%	11.7%	-4.4	b	
				2018	5	81.3%	8.0%	-2.7	b	
Metal Sensitive Taxa (% of community)	modified probit	YES	0.0000	2011	3	3.1%	5.4%	-	a,b	Tamhane's
				2015	5	4.2%	4.0%	0.2	a	
				2016	5	4.3%	2.9%	0.2	a	
				2017	5	31.4%	22.5%	5.2	b	
				2018	5	49.0%	12.9%	8.4	b	
Tipulidae (% of community)	modified probit	NO	0.7179	2011	3	0.0%	0.0%	-	a	Tukey's HSD
				2015	5	4.0%	5.5%	nc	a	
				2016	5	3.9%	5.1%	nc	a	
				2017	5	2.7%	3.3%	nc	a	
				2018	5	2.2%	3.1%	nc	a	
Collector-Gatherer FFG (% of community)	none	YES	0.0000	2011	3	23.3%	15.3%	-	a	Tukey's HSD
				2015	5	78.3%	8.5%	3.6	b	
				2016	5	70.2%	7.5%	3.1	b	
				2017	5	68.2%	5.1%	2.9	b	
				2018	5	78.2%	6.6%	3.6	b	
Filterer FFG (% of community)	modified probit	YES	0.0003	2011	3	3.3%	5.8%	-	a,b	Tamhane's
				2015	5	0.0%	0.0%	-0.6	a	
				2016	5	0.4%	0.8%	-0.5	a	
				2017	5	17.0%	7.1%	2.4	b	
				2018	5	9.2%	8.5%	1.0	b	
Shredder FFG (% of community)	none	NO	0.5790	2011	3	6.7%	11.5%	-	a	Mann-Whitney U-test
				2015	5	12.0%	4.5%	0.5	a	
				2016	5	7.7%	6.3%	0.1	a	
				2017	5	7.0%	4.1%	0.0	a	
				2018	5	11.7%	8.2%	0.4	a	

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.58: Statistical Comparison of Benthic Invertebrate Community Metrics at the Mary River Lower Mine-Exposed Area (CO-05) Among Years of Mine Operation (2015 to 2018) and Baseline (2007, 2011) for the Mary River Project CREMP

Metric	Data Transform-ation	Overall 6-Year Comparison		Pair-wise, post-hoc comparisons ^a							
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Effect Size vs. Baseline Year 2011	Pairwise Comparison	Statistical Test
Density (No. per m ²)	none	YES	0.0480	2007	3	311	230	-	-0.4	a	Tamhane's
				2011	3	491	455	0.8	-	a	
				2015	5	234	168	-0.3	-0.6	a	
				2016	5	1,161	584	3.7	1.5	a	
				2017	5	1,214	654	3.9	1.6	a	
				2018	5	1,391	1,083	4.7	2.0	a	
Richness (No. of Taxa)	none	YES	0.0050	2007	3	10.7	3.8	-	-2.1	a,b	Mann-Whitney U-test
				2011	3	19.0	4.0	2.2	-	a,c,d	
				2015	5	13.2	2.7	0.7	-1.5	b	
				2016	5	19.6	3.3	2.4	0.2	c,d,e	
				2017	5	22.0	3.2	3.0	0.8	d	
				2018	5	18.6	0.9	2.1	-0.1	e	
Simpson's Evenness	none	YES	0.0069	2007	3	0.668	0.022	-	-2.7	a	Tamhane's
				2011	3	0.879	0.079	9.8	-	a,b	
				2015	5	0.923	0.038	11.8	0.6	b	
				2016	5	0.849	0.015	8.4	-0.4	b	
				2017	5	0.798	0.161	6.0	-1.0	a,b	
				2018	5	0.675	0.149	0.4	-2.6	a,b	
Nemata (% of community)	modified probit	YES	0.0506	2007	3	0.2%	0.4%	-	-0.5	a	Tukey's HSD
				2011	3	1.6%	2.7%	3.2	-	b	
				2015	5	2.0%	4.5%	4.3	0.2	b	
				2016	5	1.0%	1.0%	1.9	-0.2	a,b	
				2017	5	2.1%	1.6%	4.5	0.2	a,b	
				2018	5	2.1%	1.9%	4.6	0.2	a,b	
Hydracarina (% of community)	modified probit	YES	0.0590	2007	3	0.5%	0.4%	-	3.6	a,b	Tukey's HSD
				2011	3	0.1%	0.1%	-1.0	-	a,b	
				2015	5	2.0%	4.5%	3.7	16.9	a,b	
				2016	5	5.5%	3.9%	12.2	47.8	b	
				2017	5	3.9%	4.7%	8.2	33.2	a,b	
				2018	5	1.5%	2.3%	2.4	12.3	a	
Chironomidae (% of community)	modified probit	YES	0.0000	2007	3	99.0%	0.8%	-	nc	a	Tukey's HSD
				2011	3	90.0%	0.0%	-10.9	-	b	
				2015	5	80.4%	11.4%	-22.4	nc	b,c	
				2016	5	87.8%	3.0%	-13.5	nc	b	
				2017	5	63.8%	12.6%	-42.5	nc	c	
				2018	5	85.6%	7.0%	-16.2	nc	b	
Metal Sensitive Taxa (% of community)	none	YES	0.0026	2007	3	37.2%	16.0%	-	2.2	a,b	Tukey's HSD
				2011	3	14.4%	10.4%	-1.4	-	a	
				2015	5	15.9%	11.5%	-1.3	0.1	a	
				2016	5	29.2%	13.6%	-0.5	1.4	a	
				2017	5	39.0%	23.3%	0.1	2.4	a,b	
				2018	5	59.6%	11.3%	1.4	4.3	b	
Tipulidae (% of community)	modified probit	NO	0.2541	2007	3	0.0%	0.0%	-	nc	a	Tukey's HSD
				2011	3	0.0%	0.0%	nc	-	a	
				2015	5	6.0%	8.9%	nc	nc	a	
				2016	5	1.7%	1.2%	nc	nc	a	
				2017	5	1.1%	1.6%	nc	nc	a	
				2018	5	0.6%	0.5%	nc	nc	a	
Collector-Gatherer FFG (% of community)	modified probit	YES	0.0012	2007	3	35.0%	15.3%	-	-2.7	a	Tukey's HSD
				2011	3	66.7%	11.5%	2.1	-	a,b,c	
				2015	5	82.9%	13.0%	3.1	1.4	b,c	
				2016	5	59.0%	10.2%	1.6	-0.7	a	
				2017	5	63.9%	13.5%	1.9	-0.2	a,b	
				2018	5	83.7%	8.2%	3.2	1.5	c	
Filterer FFG (% of community)	none	YES	0.0035	2007	3	21.0%	28.3%	-	0.7	a,c,d	Mann-Whitney U-test
				2011	3	13.3%	11.5%	-0.3	-	a,b,c,d	
				2015	5	0.0%	0.0%	-0.7	-1.2	b	
				2016	5	0.6%	0.7%	-0.7	-1.1	b	
				2017	5	19.9%	10.4%	0.0	0.6	c	
				2018	5	6.1%	4.2%	-0.5	-0.6	d	
Shredder FFG (% of community)	modified probit	YES	0.0025	2007	3	40.2%	20.9%	-	5.8	a	Tukey's HSD
				2011	3	6.7%	5.8%	-1.6	-	b	
				2015	5	16.0%	11.4%	-1.2	1.6	a,b	
				2016	5	8.9%	6.8%	-1.5	0.4	b	
				2017	5	6.7%	3.1%	-1.6	0.0	b	
				2018	5	4.2%	2.5%	-1.7	-0.4	b	

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.59: Statistical Comparison of Physical Sediment Quality Between Mary Lake and Reference Lake 3 for Samples Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2018

Lake Zone	Habitat Variable	Statistical Test Results			Summary Statistics							
		Significant Difference Between Areas?	P-value	Statistical Analysis ^a	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Median	Maximum
Littoral (Shallow) Stations	Station Depth (m)	NO	0.751	α	Reference	5	9.74	1.04	0.46	8.50	-	11.20
					Mary Lake	4	9.38	2.22	1.11	6.60	-	12.00
	Sand-Sized Particles (% by weight)	YES	0.045	Υ	Reference	5	59.6	4.4	2.0	54.9	59.4	66.4
					Mary Lake	4	16.7	17.7	8.8	3.6	11.1	41.0
	Silt-Sized Particles (% by weight)	YES	< 0.001	Υ	Reference	5	31.4	3.3	1.5	26.6	32.6	34.7
					Mary Lake	4	64.0	9.5	4.8	50.5	66.3	72.8
	Clay-Sized Particles (% by weight)	NO	0.191	δ	Reference	5	9.0	2.4	1.1	5.8	10.4	10.8
					Mary Lake	4	19.3	12.4	6.2	8.6	19.1	30.5
	Total Organic Carbon (%)	YES	0.007	Υ	Reference	5	4.7	2.3	1.0	1.8	5.1	7.4
					Mary Lake	4	1.1	0.2	0.1	0.8	1.1	1.3
Profundal (Deep) Stations	Station Depth (m)	NO	0.748	β	Reference	5	20.56	2.17	0.97	18.50	-	24.20
					Mary Lake	6	21.58	4.50	1.84	15.00	-	29.00
	Sand-Sized Particles (% by weight)	YES	0.077	η	Reference	5	47.5	2.8	1.3	44.5	47.0	50.9
					Mary Lake	6	29.0	24.8	10.1	6.6	20.7	71.7
	Silt-Sized Particles (% by weight)	NO	0.320	ζ	Reference	5	39.0	3.1	1.4	33.8	40.4	41.5
					Mary Lake	6	48.8	21.6	8.8	16.8	47.0	77.4
	Clay-Sized Particles (% by weight)	NO	0.240	η	Reference	5	13.6	2.2	1.0	9.7	14.3	15.3
					Mary Lake	6	22.3	13.6	5.6	8.5	18.4	43.5
	Total Organic Carbon (%)	YES	0.052	γ	Reference	5	3.8	1.7	0.8	0.8	4.5	4.9
					Mary Lake	6	0.9	0.3	0.1	0.4	1.0	1.3

^a Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log-transformed, single factor ANOVA test conducted; γ - data untransformed, Mann-Whitney U-test conducted; ζ - data untransformed, t-test conducted assuming unequal variance; η - data log-transformed, t-test assuming unequal variance; δ - data square-root transformed, t-test assuming unequal variance conducted; Υ - data square-root transformed, single factor ANOVA conducted.

Highlighted values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

Table F.60: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Mary Lake, August 2018

Taxa	Study Area Replicate Station	Mary Lake - Littoral Stations			
		BLO-1	BLO-11	BLO-7	BLO-6
ROUNDWORMS					
P. Nemata		17	9	-	95
ANNELIDS					
P. Annelida					
WORMS					
Cl. Oligochaeta					
F. Lumbriculidae					
Lumbriculus		-	-	-	-
ARTHROPODS					
P. Arthropoda					
MITES					
Cl. Arachnida					
O. Acarina					
F. Acalyptonotidae					
Acalyptonotus		34	9	-	17
F. Hygrobatidae					
Hygrobates		-	-	-	-
F. Lebertiidae					
Lebertia		-	26	-	-
F. Sperchontidae					
Sperchon		-	-	-	-
SEED SHRIMPS					
Cl. Ostracoda		164	43	9	181
INSECTS					
Cl. Insecta					
CADDISFLIES					
O. Trichoptera					
pupae		-	-	-	-
F. Apataniidae					
Apatania		-	-	-	9
TRUE FLIES					
O. Diptera					
MIDGES					
F. Chironomidae					
chironomid pupae		9	-	-	-
S.F. Chironominae					
Chironomus		-	-	-	-
Micropsectra		233	-	-	9
Paratanytarsus		-	-	-	-
Sergentia		-	-	-	-
Stictochironomus		302	-	9	-
Tanytarsus		181	-	-	-
S.F. Diamesinae					
Protanypus		-	69	34	26
Pseudodiamesa		-	9	34	-
S.F. Orthocladinae					
Abiskomyia		69	34	9	17
Cricotopus/Orthocladus		-	-	-	-

Table F.60: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Mary Lake, August 2018

Taxa	Study Area Replicate Station	Mary Lake - Littoral Stations			
		BLO-1	BLO-11	BLO-7	BLO-6
<i>Heterotrissocladius</i>		34	2,888	164	345
<i>Hydrobaenus</i>		-	-	-	-
<i>Limnophyes</i>		-	-	-	-
<i>Mesocricotopus</i>		-	-	-	-
<i>Paracladius</i>		17	-	-	9
<i>Parakiefferiella</i>		-	-	-	-
<i>Psectrocladius</i>		-	-	-	-
<i>Zalutschia</i>		26	-	-	17
S.F. Tanypodinae					
<i>Arctopelopia</i>		9	-	-	-
<i>Procladius</i>		1,681	-	26	-
F. Tipulidae					
<i>Tipula</i>		-	-	-	-
Density (No. organisms per m²)		2,776	3,087	285	725
Richness (total number of taxa)^a		12	8	7	10
Simpson's Evenness (E)		0.658	0.142	0.734	0.767
Bray-Curtis Index		0.705	0.939	0.913	0.687
Dominant Group Composition					
% Nemata		0.6%	0.3%	0.0%	13.1%
% Hydracarina		1.2%	1.1%	0.0%	2.3%
% Ostracods		5.9%	1.4%	3.2%	25.0%
% Chironomids		92.3%	97.2%	96.8%	58.3%
% Metal Sensitive Chironomids		15.0%	2.5%	23.9%	4.8%
% Tipulidae		0.0%	0.0%	0.0%	0.0%
Functional Feeding Group Composition					
% Collector - Gatherers		21.8%	98.9%	90.9%	92.8%
% Filterers		15.0%	0.0%	0.0%	1.2%
% Shredders		0.9%	0.0%	0.0%	2.3%
Habitat Preference Group Composition					
% Clingers		16.2%	1.1%	0.0%	4.8%
% Sprawlers		72.3%	96.3%	84.9%	78.5%
% Burrowers		11.5%	2.5%	15.1%	16.7%

^a Bold entries excluded from taxa count

Table F.60: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Mary Lake, August 2018

Taxa	Study Area Replicate Station	Mary Lake - Profundal Stations					
		BLO-3	BLO-15	BLO-14	BLO-13	BLO-4	BLO-5
ROUNDWORMS							
P. Nemata		52	-	-	17	26	34
ANNELIDS							
P. Annelida							
WORMS							
Cl. Oligochaeta							
F. Lumbriculidae							
Lumbriculus		-	-	-	-	-	-
ARTHROPODS							
P. Arthropoda							
MITES							
Cl. Arachnida							
O. Acarina							
F. Acalyptonotidae							
Acalyptonotus		-	-	-	9	9	17
F. Hygrobatidae							
Hygrobates		9	-	-	-	-	-
F. Lebertiidae							
Lebertia		9	-	-	9	-	-
F. Sperchontidae							
Sperchon		-	-	-	-	-	34
SEED SHRIMPS							
Cl. Ostracoda		34	86	-	17	26	138
INSECTS							
Cl. Insecta							
CADDISFLIES							
O. Trichoptera							
pupae		-	-	-	-	-	-
F. Apataniidae							
Apatania		-	-	-	-	-	-
TRUE FLIES							
O. Diptera							
MIDGES							
F. Chironomidae							
chironomid pupae		17	-	-	-	-	-
S.F. Chironominae							
Chironomus		-	-	-	-	-	241
Micropsectra		224	17	-	-	9	431
Paratanytarsus		-	-	-	-	-	-
Sergentia		9	-	9	-	-	103
Stictochironomus		414	-	-	-	-	690
Tanytarsus		34	-	-	-	-	17
S.F. Diamesinae							
Protanypus		-	-	9	-	9	-
Pseudodiamesa		9	-	26	9	9	-
S.F. Orthocladiinae							
Abiskomyia		9	-	-	-	-	17
Cricotopus/Orthocladus		-	-	-	-	-	17

Table F.60: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Mary Lake, August 2018

Taxa	Study Area Replicate Station	Mary Lake - Profundal Stations					
		BLO-3	BLO-15	BLO-14	BLO-13	BLO-4	BLO-5
<i>Heterotrissocladius</i>		155	853	1,767	1,716	983	655
<i>Hydrobaenus</i>		-	-	-	-	-	52
<i>Limnophyes</i>		-	-	-	-	-	-
<i>Mesocricotopus</i>		-	-	-	9	-	-
<i>Paracladius</i>		-	-	-	-	-	-
<i>Parakiefferiella</i>		-	-	-	-	-	-
<i>Psectrocladius</i>		-	-	-	-	-	-
<i>Zalutschia</i>		9	-	-	-	-	-
S.F. Tanypodinae							
<i>Arctopelopia</i>		-	-	-	-	-	-
<i>Procladius</i>		26	26	-	-	-	-
F. Tipulidae							
<i>Tipula</i>		-	-	-	-	-	17
Density (No. organisms per m²)		1,010	982	1,811	1,786	1,071	2,463
Richness (total number of taxa)^a		13	4	4	7	7	14
Simpson's Evenness (E)		0.806	0.316	0.064	0.089	0.182	0.867
Bray-Curtis Index		0.727	0.441	0.665	0.645	0.461	0.723
Dominant Group Composition							
% Nemata		5.1%	0.0%	0.0%	1.0%	2.4%	1.4%
% Hydracarina		1.8%	0.0%	0.0%	1.0%	0.8%	2.1%
% Ostracods		3.4%	8.8%	0.0%	1.0%	2.4%	5.6%
% Chironomids		89.7%	91.2%	100.0%	97.1%	94.3%	90.3%
% Metal Sensitive Chironomids		26.9%	1.7%	1.9%	0.5%	2.5%	18.2%
% Tipulidae		0.0%	0.0%	0.0%	0.0%	0.0%	0.7%
Functional Feeding Group Composition							
% Collector - Gatherers		68.6%	95.6%	100.0%	99.0%	98.3%	78.4%
% Filterers		26.0%	1.7%	0.0%	0.0%	0.8%	18.2%
% Shredders		0.9%	0.0%	0.0%	0.0%	0.0%	1.4%
Habitat Preference Group Composition							
% Clingers		28.7%	1.7%	0.5%	1.0%	1.7%	25.1%
% Sprawlers		24.4%	98.3%	99.0%	98.0%	95.1%	35.0%
% Burrowers		46.9%	0.0%	0.5%	1.0%	3.3%	39.9%

^a Bold entries excluded from taxa count

Table F.61: Statistical Comparison of Benthic Invertebrate Community Metrics at Mary Lake Littoral (Shallow) Statoins Among Years of Mine Operation (2015 to 2018) and Baseline (2007) for the Mary River Project CREMP

Metric	Data Transform-ation	Overall 5-Year Comparison		Pair-wise, post-hoc comparisons ^a						
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Pairwise Comparison	Statistical Test
Density (No. per m²)	none	NO	0.9526	2007	3	2,667	1,454	-	a	Tukey's HSD
				2015	4	2,453	2,186	-0.1	a	
				2016	6	1,947	1,591	-0.5	a	
				2017	4	1,839	1,853	-0.6	a	
				2018	4	1,839	1,853	-0.6	a	
Richness (No. of Taxa)	none	NO	0.7876	2007	3	8.0	2.0	-	a	Mann-Whitney U-test
				2015	4	9.0	1.8	0.5	a	
				2016	6	8.7	0.5	0.3	a	
				2017	4	9.5	2.1	0.8	a	
				2018	4	9.5	2.1	0.8	a	
Simpson's Evenness	none	NO	0.2279	2007	3	0.718	0.041	-	a	Tamhane's
				2015	4	0.761	0.058	1.1	a	
				2016	6	0.574	0.299	-3.5	a	
				2017	4	0.818	0.110	2.4	a	
				2018	4	0.818	0.110	2.4	a	
Nemata (% of community)	modified probit	NO	0.8162	2007	3	7.3%	11.2%	-	a	Tukey's HSD
				2015	4	5.6%	6.3%	-0.1	a	
				2016	6	3.6%	7.5%	-0.3	a	
				2017	4	3.5%	6.2%	-0.3	a	
				2018	4	3.5%	6.2%	-0.3	a	
Ostracoda (% of community)	modified probit	NO	0.4530	2007	3	0.2%	0.4%	-	a	Tukey's HSD
				2015	4	1.9%	2.2%	4.3	a	
				2016	6	2.3%	2.2%	5.5	a	
				2017	4	2.1%	2.2%	5.0	a	
				2018	4	2.1%	2.2%	5.0	a	
Chironomidae (% of community)	modified probit	NO	0.7484	2007	3	90.8%	11.8%	-	a	Tukey's HSD
				2015	4	91.1%	7.7%	0.0	a	
				2016	6	90.6%	12.2%	0.0	a	
				2017	4	85.7%	13.1%	-0.4	a	
				2018	4	85.7%	13.1%	-0.4	a	
Metal Sensitive Taxa (% of community)	none	NO	0.9448	2007	3	22.4%	13.8%	-	a	Tukey's HSD
				2015	4	15.8%	14.6%	-0.5	a	
				2016	6	19.2%	13.3%	-0.2	a	
				2017	4	21.3%	7.7%	-0.1	a	
				2018	4	21.3%	7.7%	-0.1	a	
Collector-Gatherer FFG (% of community)	none	NO	0.5172	2007	3	66.0%	26.7%	-	a	Tukey's HSD
				2015	4	72.8%	23.1%	0.3	a	
				2016	6	73.5%	24.7%	0.3	a	
				2017	4	52.2%	23.6%	-0.5	a	
				2018	4	52.2%	23.6%	-0.5	a	
Filterer FFG (% of community)	none	NO	0.9190	2007	3	22.0%	14.5%	-	a	Tukey's HSD
				2015	4	14.4%	16.2%	-0.5	a	
				2016	6	12.4%	13.2%	-0.7	a	
				2017	4	13.3%	16.0%	-0.6	a	
				2018	4	13.3%	16.0%	-0.6	a	

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

Table F.62: Statistical Comparison of Benthic Metrics at Mary Lake Profundal (Deep) Stations Among Years of Mine Operation (2015 to 2018) and Baseline (2007) for the Mary River Project CREMP

Metric	Data Transformation	Overall 4-Year Comparison ^a		Pair-wise, post-hoc comparisons ^a						
		Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Pairwise Comparison	Statistical Test
Density (No. per m ²)	log	YES	0.0313	2007	4	3,512	3,257	-	a	Tukey's HSD
				2015	6	775	748	-0.8	a,b	
				2017	6	536	497	-0.9	b	
				2018	6	536	497	-0.9	b	
Richness (No. of Taxa)	none	NO	0.9612	2007	4	8.0	6.2	-	a	Tamhane's
				2015	6	7.7	4.1	0.0	a	
				2017	6	7.0	1.5	-0.2	a	
				2018	6	7.0	1.5	-0.2	a	
Simpson's Evenness	none	NO	0.4078	2007	4	0.453	0.268	-	a	Mann-Whitney U-test
				2015	6	0.696	0.142	0.9	a	
				2017	6	0.604	0.236	0.6	a	
				2018	6	0.604	0.236	0.6	a	
Nemata (% of community)	none	NO	0.8357	2007	4	1.3%	1.8%	-	a	Tukey's HSD
				2015	6	2.0%	2.6%	0.4	a	
				2017	6	2.4%	1.9%	0.6	a	
				2018	6	2.4%	1.9%	0.6	a	
Ostracoda (% of community)	modified probit	NO	0.5326	2007	4	1.6%	2.2%	-	a	Tukey's HSD
				2015	6	11.1%	10.9%	4.4	a	
				2017	6	3.2%	6.2%	0.7	a	
				2018	6	3.2%	6.2%	0.7	a	
Chironomidae (% of community)	none	NO	0.4102	2007	4	96.4%	4.7%	-	a	Tukey's HSD
				2015	6	83.8%	12.2%	-2.7	a	
				2017	6	84.9%	13.8%	-2.5	a	
				2018	6	84.9%	13.8%	-2.5	a	
Metal Sensitive Taxa (% of community)	none	NO	0.2821	2007	4	33.7%	27.9%	-	a	Mann-Whitney U-test
				2015	6	9.5%	8.2%	-0.9	a	
				2017	6	5.6%	3.2%	-1.0	a	
				2018	6	5.6%	3.2%	-1.0	a	
Collector-Gatherer FFG (% of community)	modified probit	NO	0.9998	2007	4	64.4%	27.7%	-	a	Tamhane's
				2015	6	82.7%	5.9%	0.7	a	
				2017	6	80.7%	18.2%	0.6	a	
				2018	6	80.7%	18.2%	0.6	a	
Filterer FFG (% of community)	none	YES	0.0060	2007	4	33.1%	27.8%	-	a	Tamhane's
				2015	6	9.4%	7.9%	-0.9	a	
				2017	6	3.8%	2.7%	-1.1	a	
				2018	6	3.8%	2.7%	-1.1	a	

Indicates a significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

^a Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons

APPENDIX G

FISH POPULATION SURVEY DATA

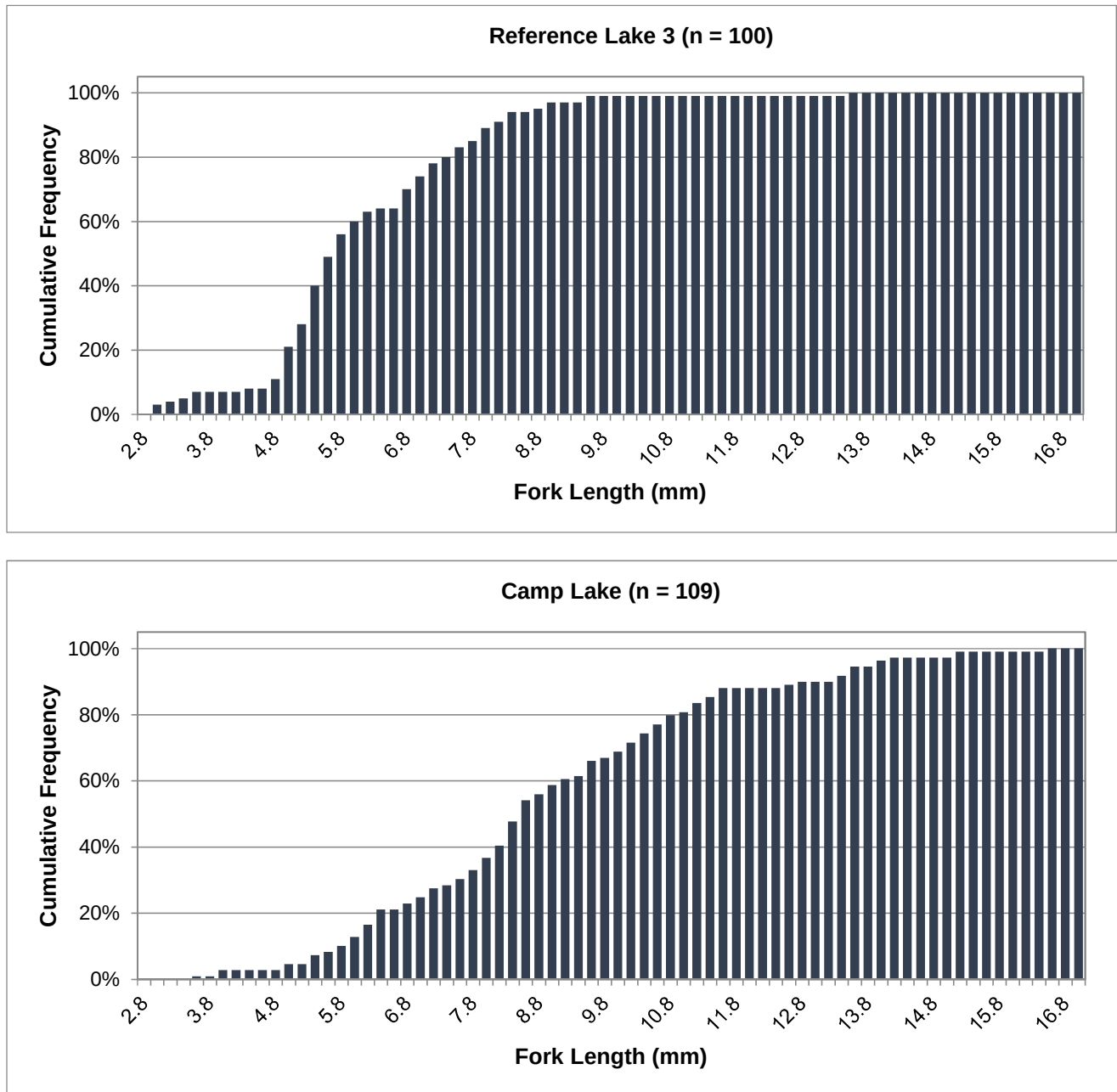


Figure G.1: Cumulative Length-frequency Distributions for Juvenile Arctic Charr Captured by Electrofishing at Nearshore Areas of Camp Lake and Reference Lake 3, Mary River Project CREMP, August 2018

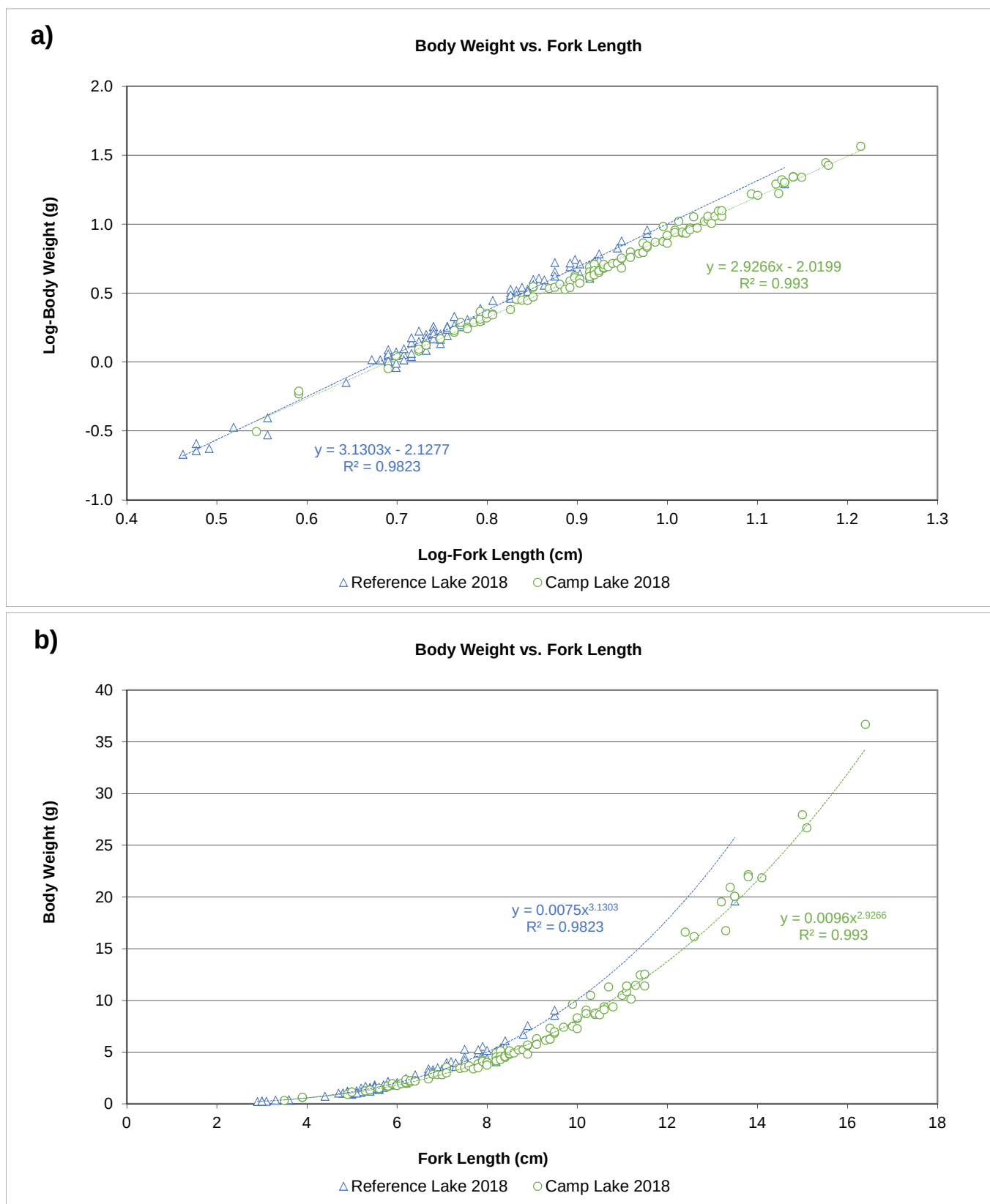


Figure G.2: Comparison of Condition (Weight-at-fork-length Relationship) for Arctic Charr Collected at the Nearshore Area of Camp Lake and Reference Lake 3 in August 2018 using Log-transformed (a) and Untransformed (b) Data, Mary River Project 2018 CREMP

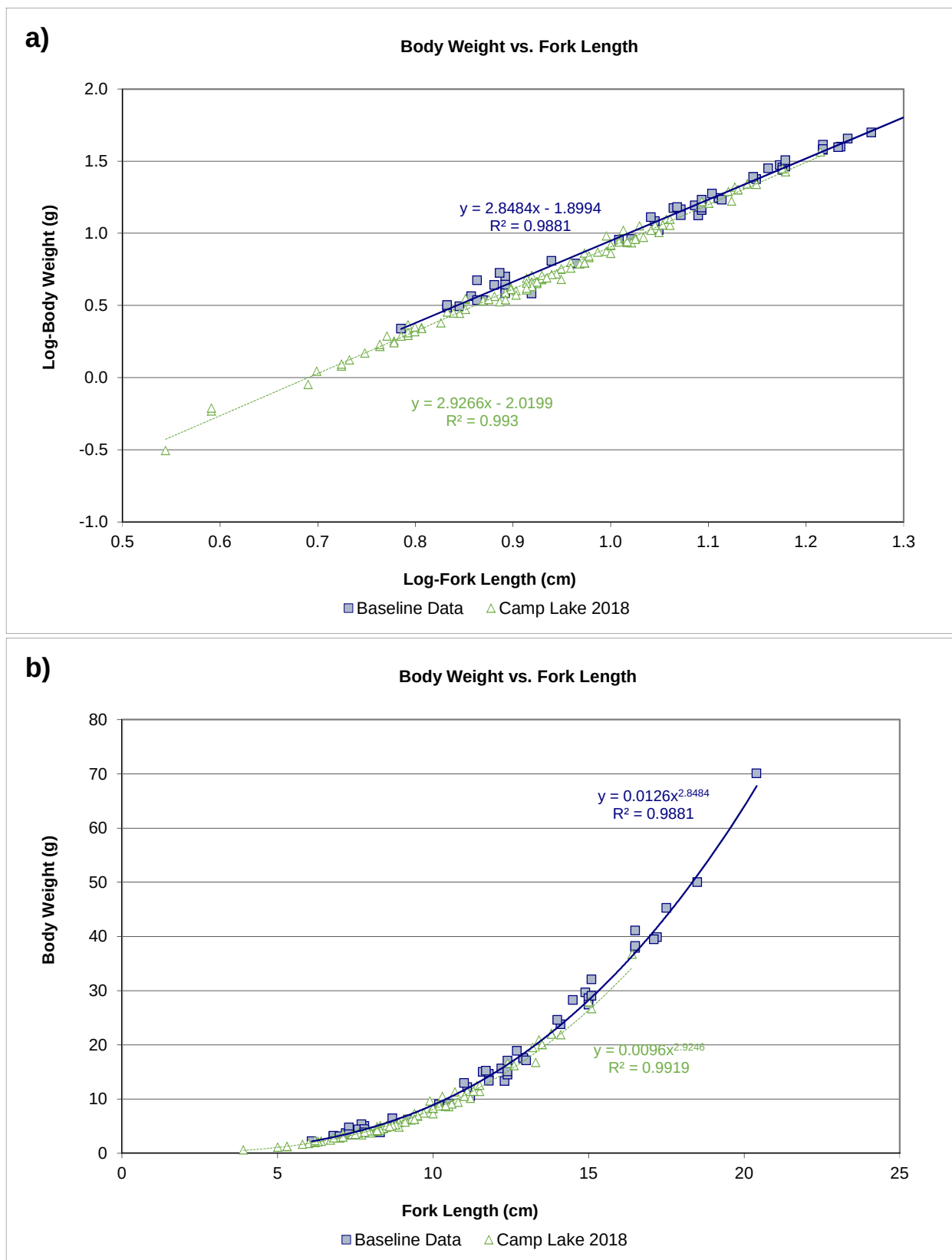


Figure G.3: Comparison of Condition (Weight-at-fork length Relationship) for Arctic Charr Collected in Fall (August-September) at Camp Lake Nearshore Areas in 2018 and during the Mine Baseline Period (2013) using Log-transformed (a) and Untransformed (b) Data, Mary River Project CREMP

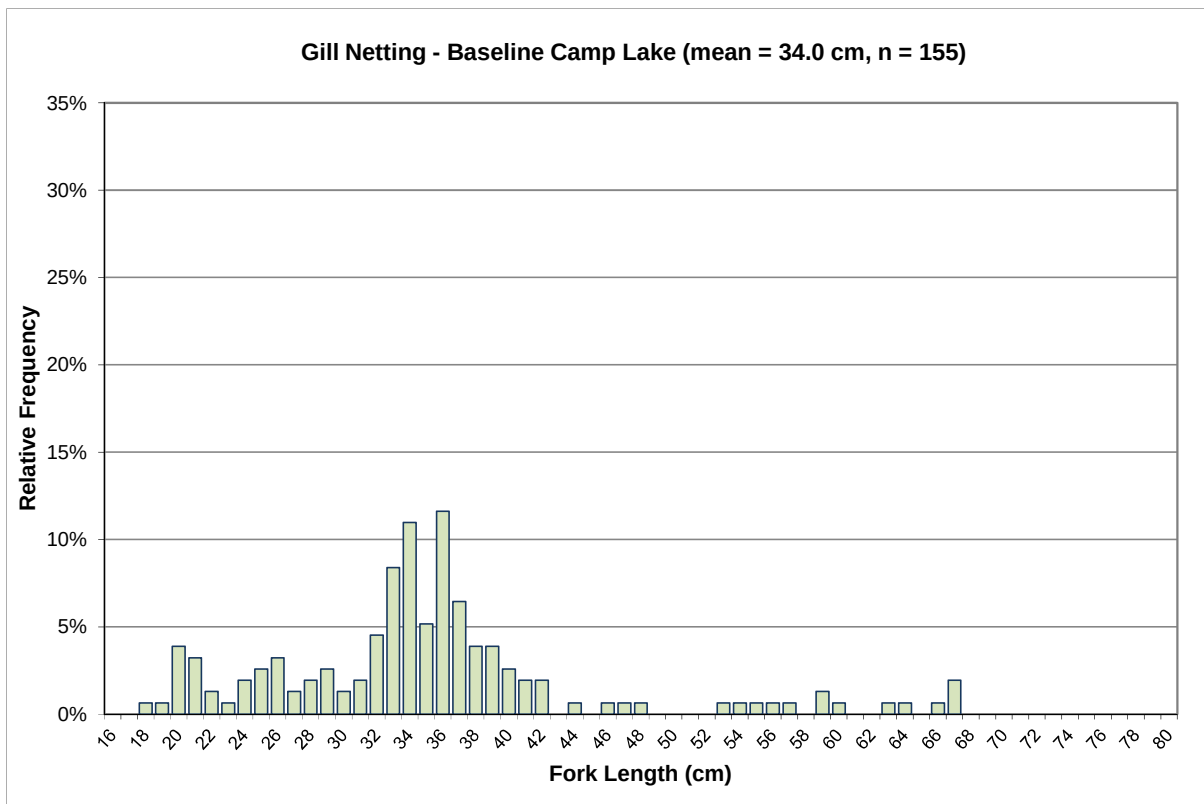
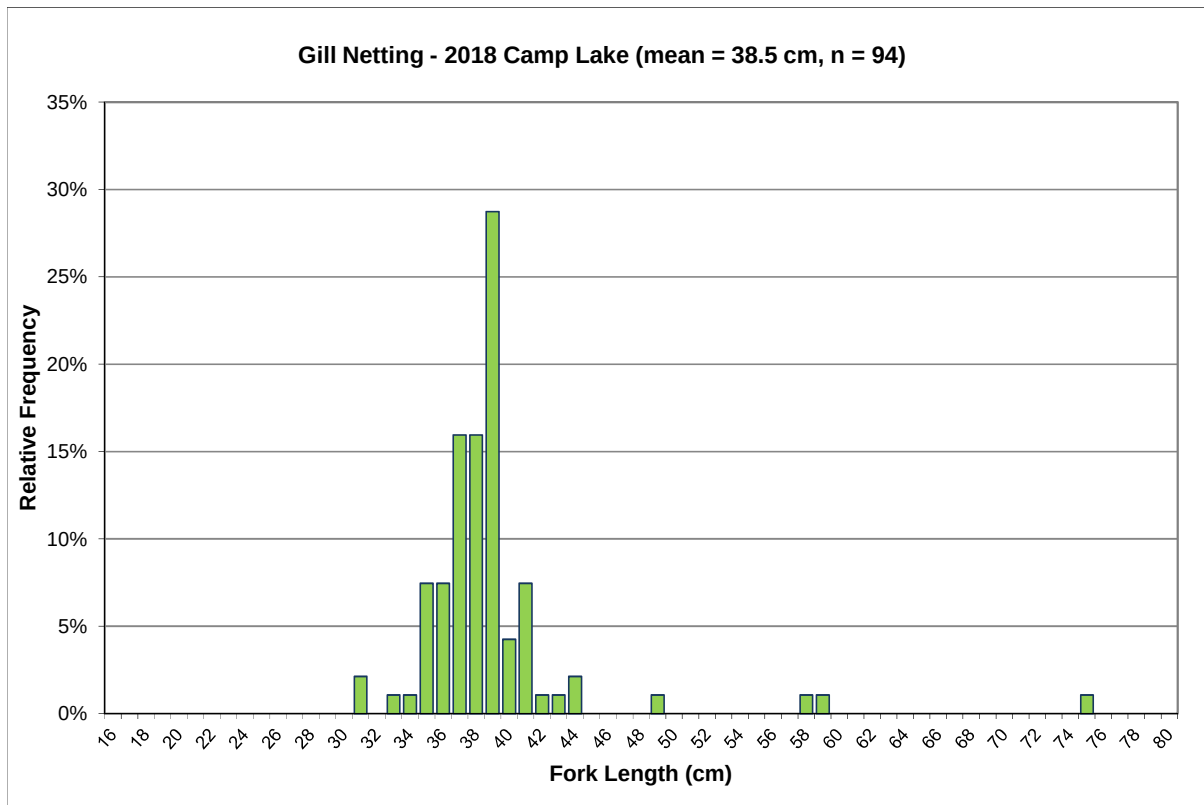


Figure G.4: Length-Frequency Distributions for Arctic Charr Captured by Gill Netting at Camp Lake (JLO) in 2018 and Baseline Studies Conducted in Fall, Mary River Project CREMP

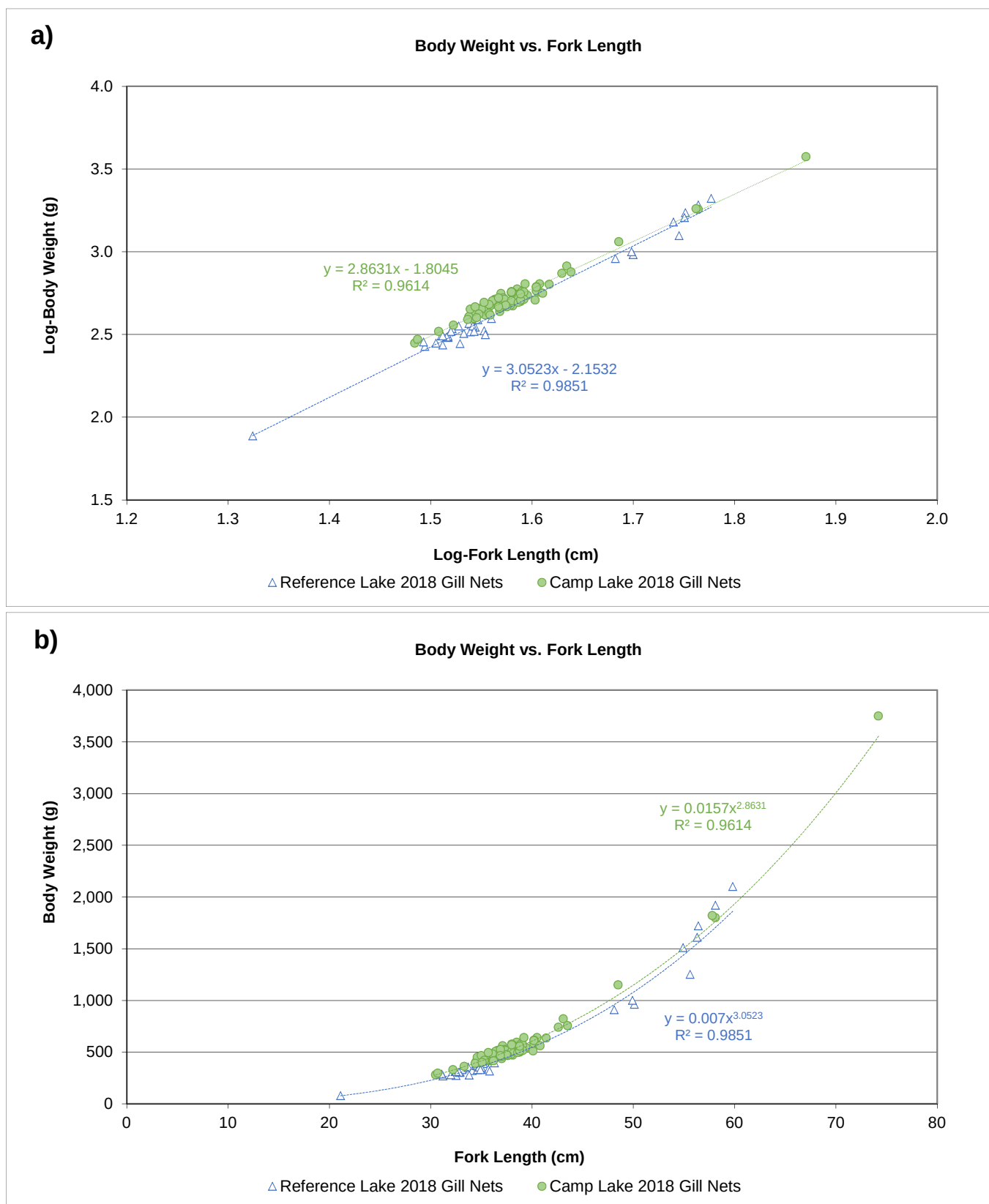


Figure G.5: Comparison of Condition (Weight-at-fork-length Relationship) for Arctic Charr Collected at Littoral/Profundal Areas of Camp Lake and Reference Lake 3 in August 2018 using Log-transformed (a) and Untransformed (b) Data, Mary River Project 2018 CREMP

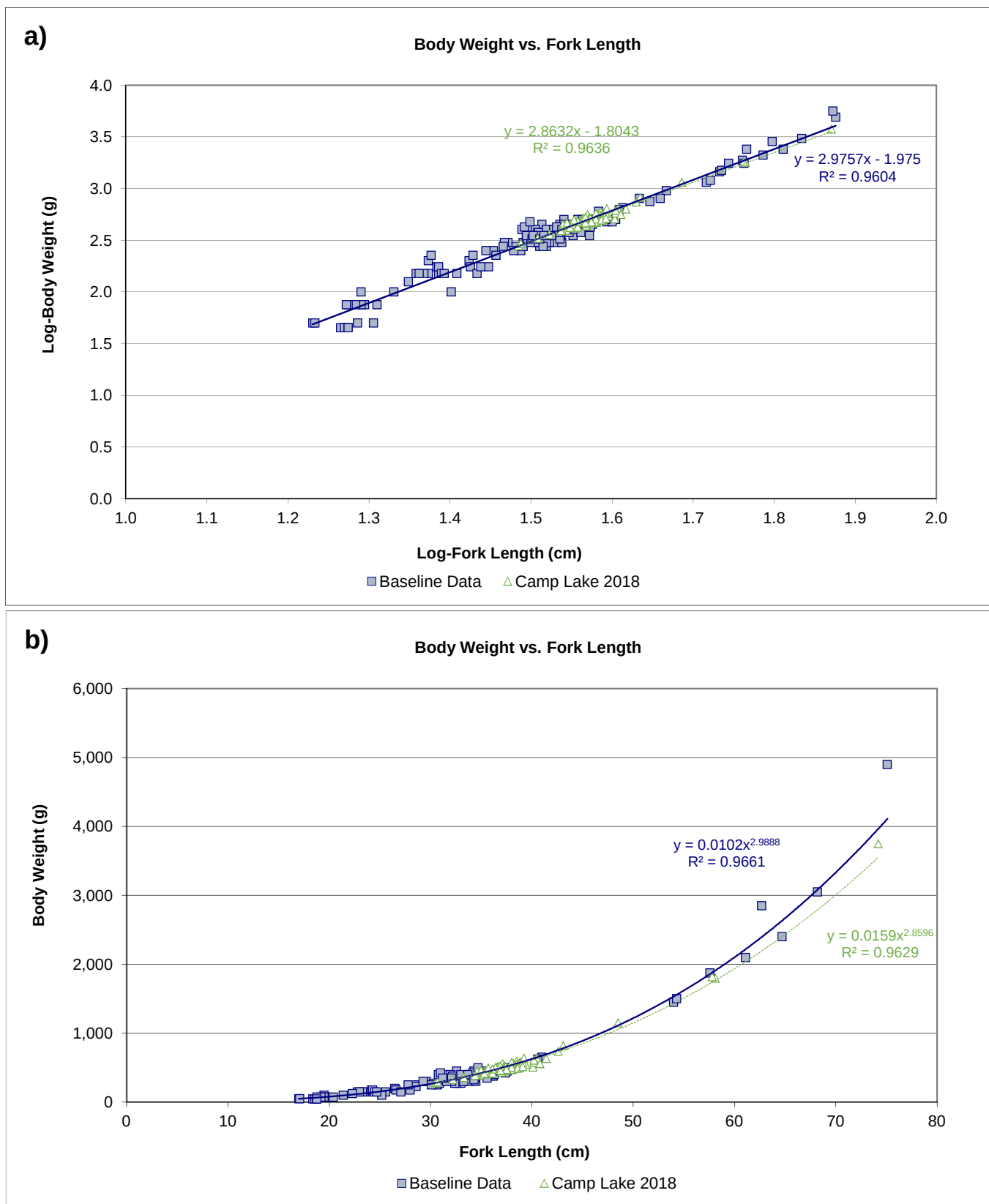


Figure G.6: Comparison of Condition (Weight-at-fork Length Relationship) for Arctic Charr Collected in Fall (August-September) at Camp Lake Littoral/Profundal Areas in 2018 and during the Mine Baseline Period (2006, 2007, 2008, 2013) using Log-transformed (a) and Untransformed (b) Data, Mary River Project CREMP

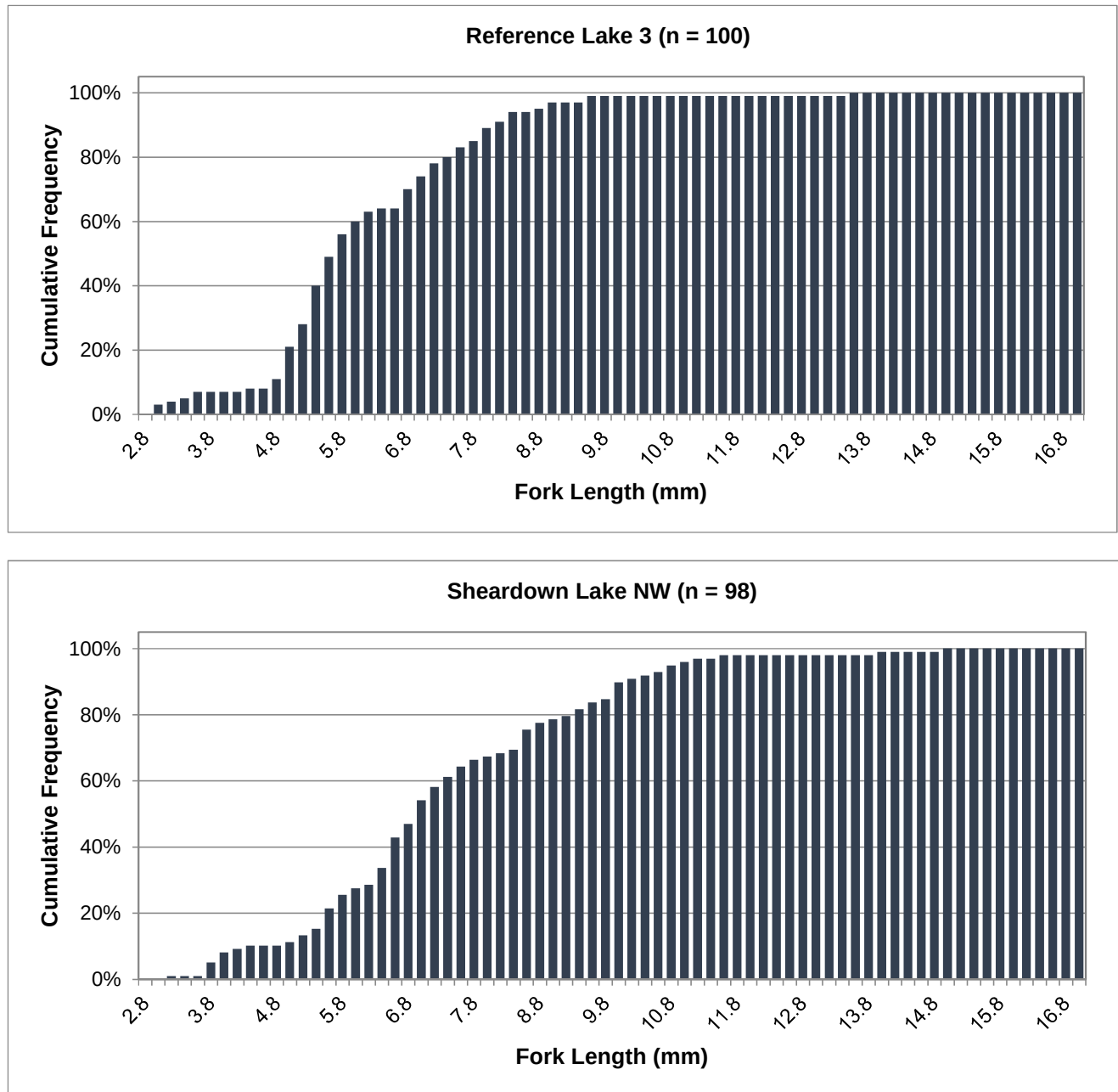


Figure G.7: Cumulative Length-frequency Distributions for Juvenile Arctic Charr Captured by Electrofishing at Nearshore Areas of Sheardown Lake NW and Reference Lake 3, Mary River Project CREMP, August 2018

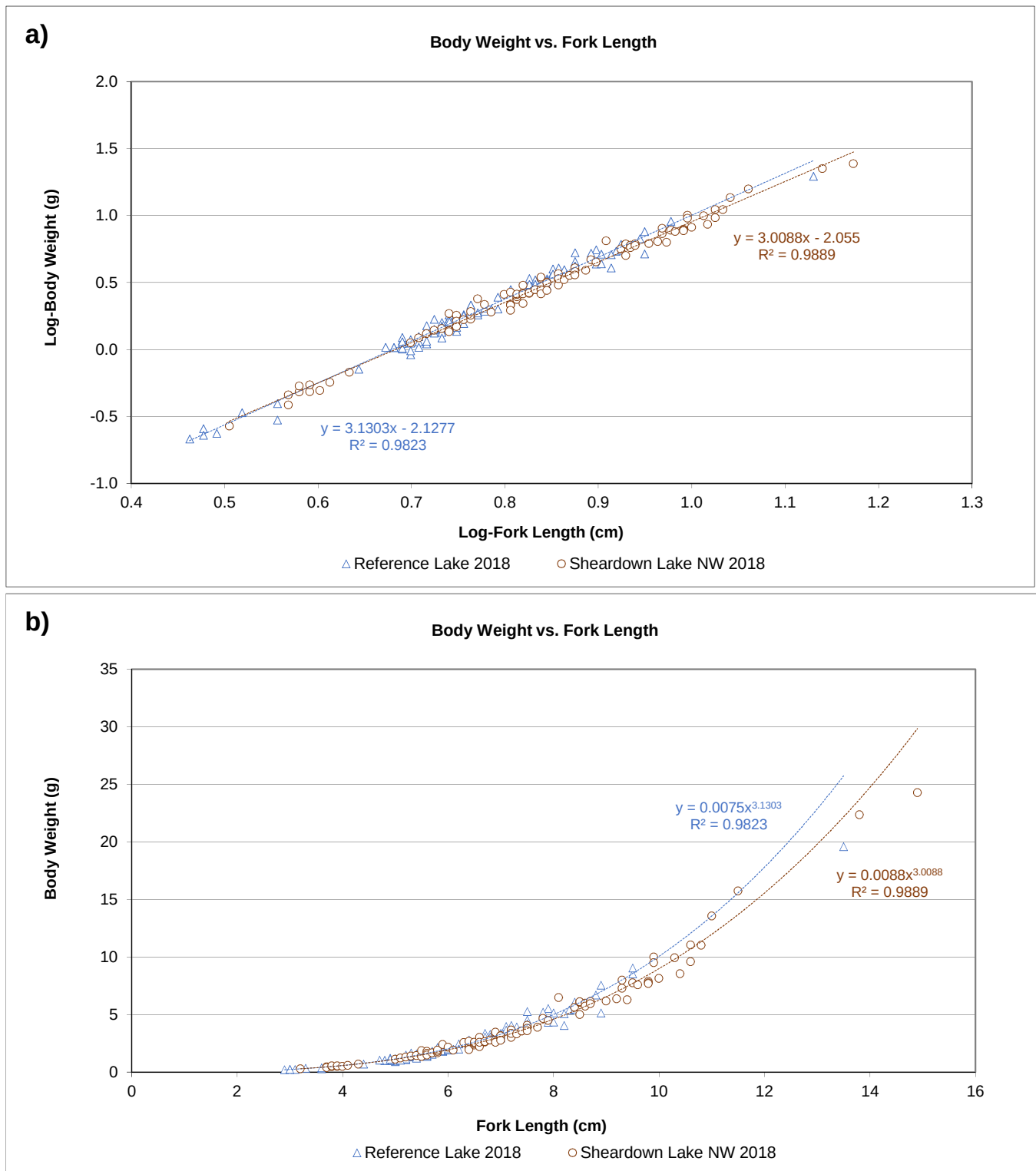


Figure G.8: Comparison of Condition (Weight-at-fork-length Relationship) for Arctic Charr Collected at the Nearshore Area of Sheardown Lake NW and Reference Lake 3 in August 2018 using Log-transformed (a) and Untransformed (b) Data, Mary River Project 2018 CREMP

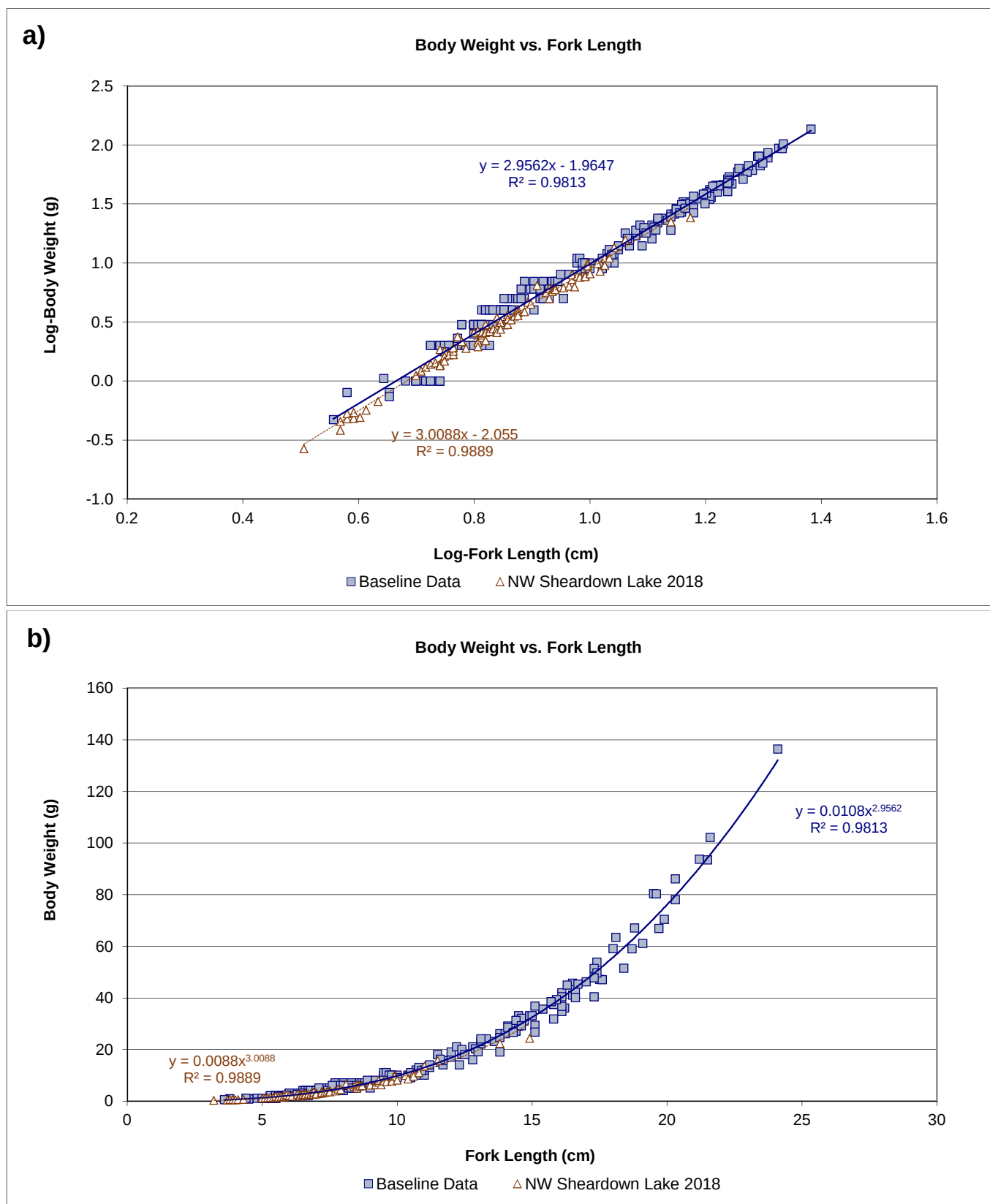


Figure G.9: Comparison of Condition (Weight-at-fork length Relationship) for Arctic Charr Collected in Fall (August-September) at Sheardown Lake NW Nearshore Areas in 2018 and During the Mine Baseline Period (2007, 2008, 2013) using Log-transformed (a) and Untransformed (b) Data, Mary River Project CREMP

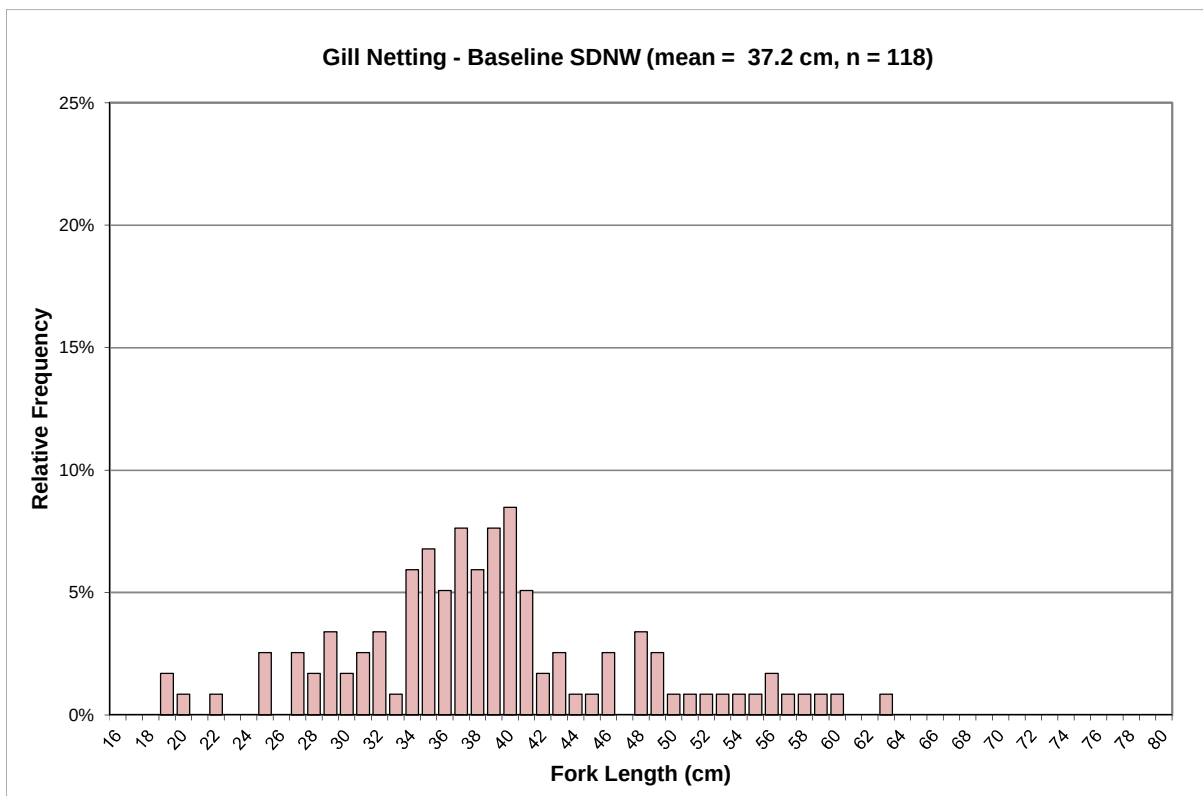
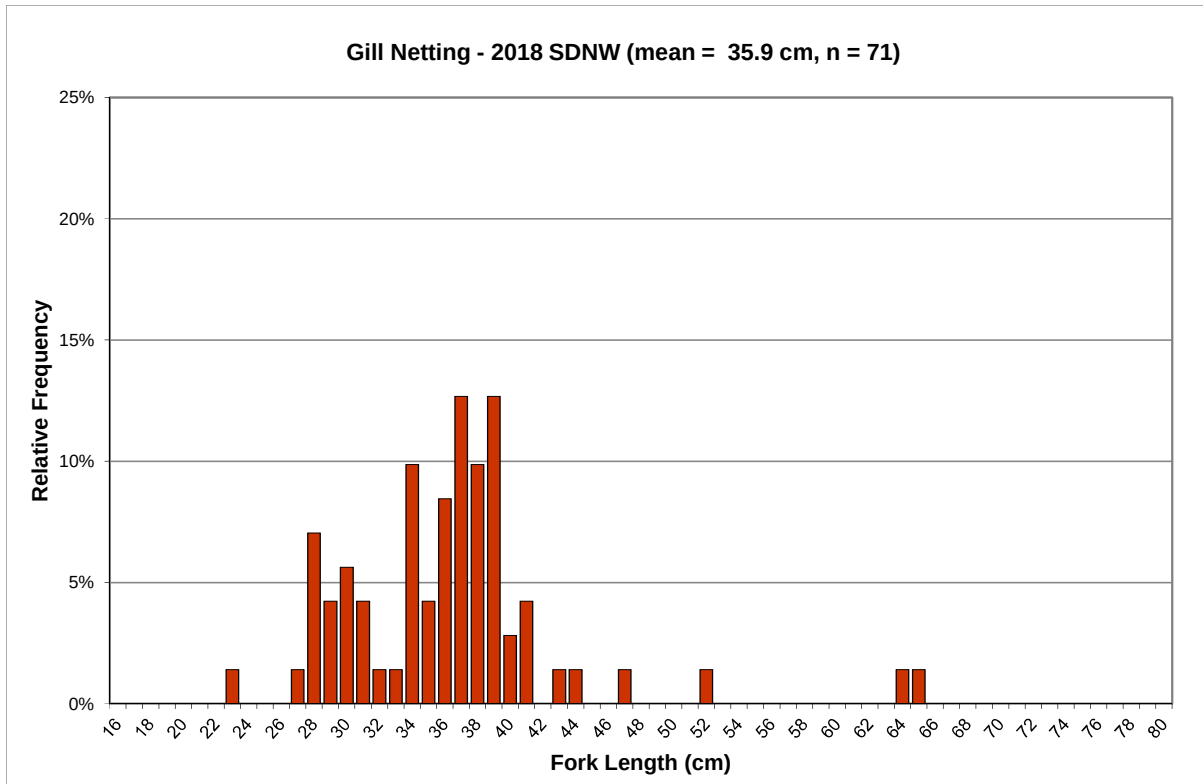


Figure G.10: Length-Frequency Distributions for Arctic Charr Captured by Gill Netting at Sheardown Lake NW (DLO-01) in 2018 and Baseline Studies Conducted in Fall, Mary River Project CREMP

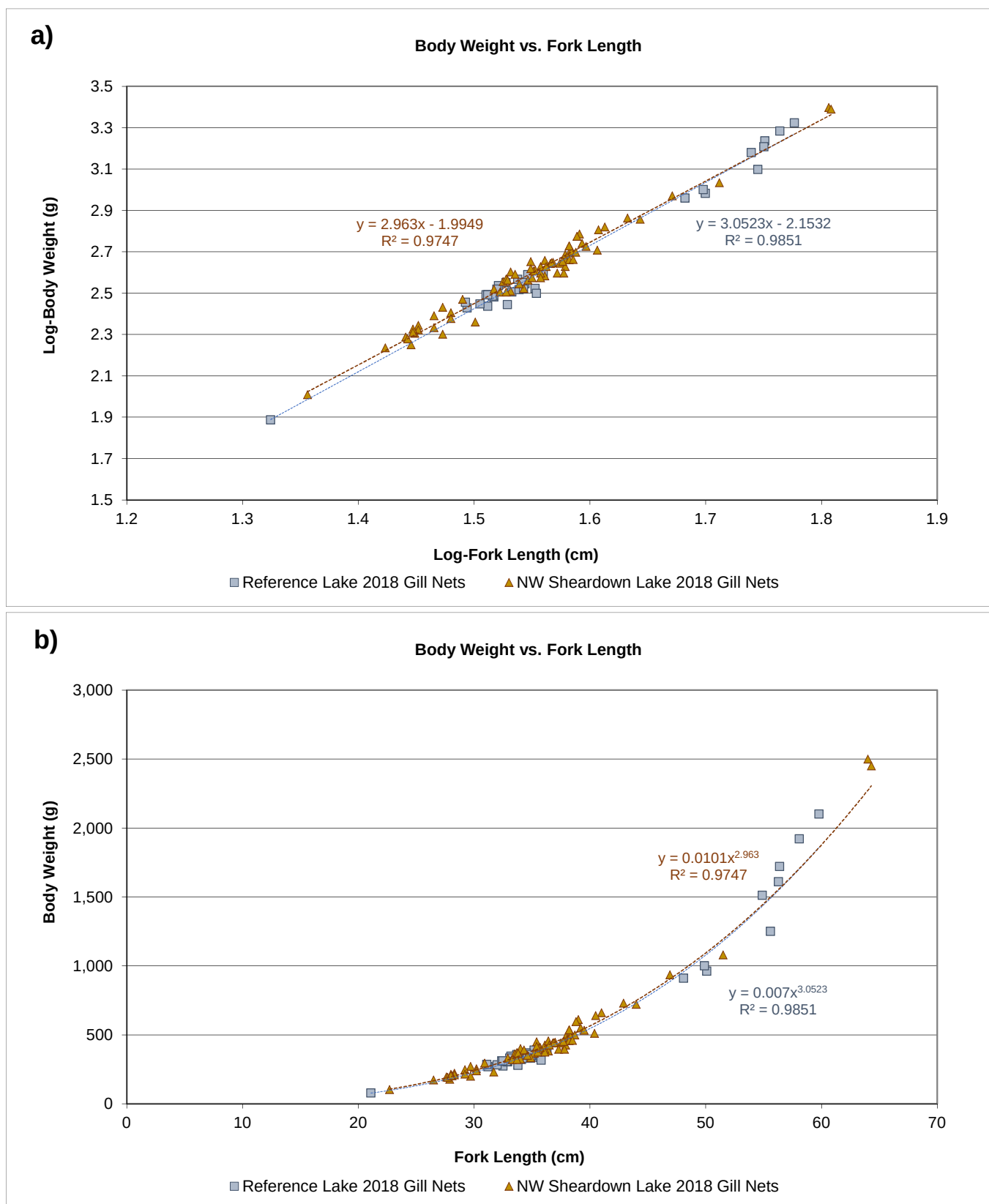


Figure G.11: Comparison of Condition (Weight-at-fork-length Relationship) for Arctic Charr Collected at Littoral/Profundal Areas of Sheardown Lake NW and Reference Lake 3 in August 2018 using Log-transformed (a) and Untransformed (b) Data, Mary River Project 2018 CREMP

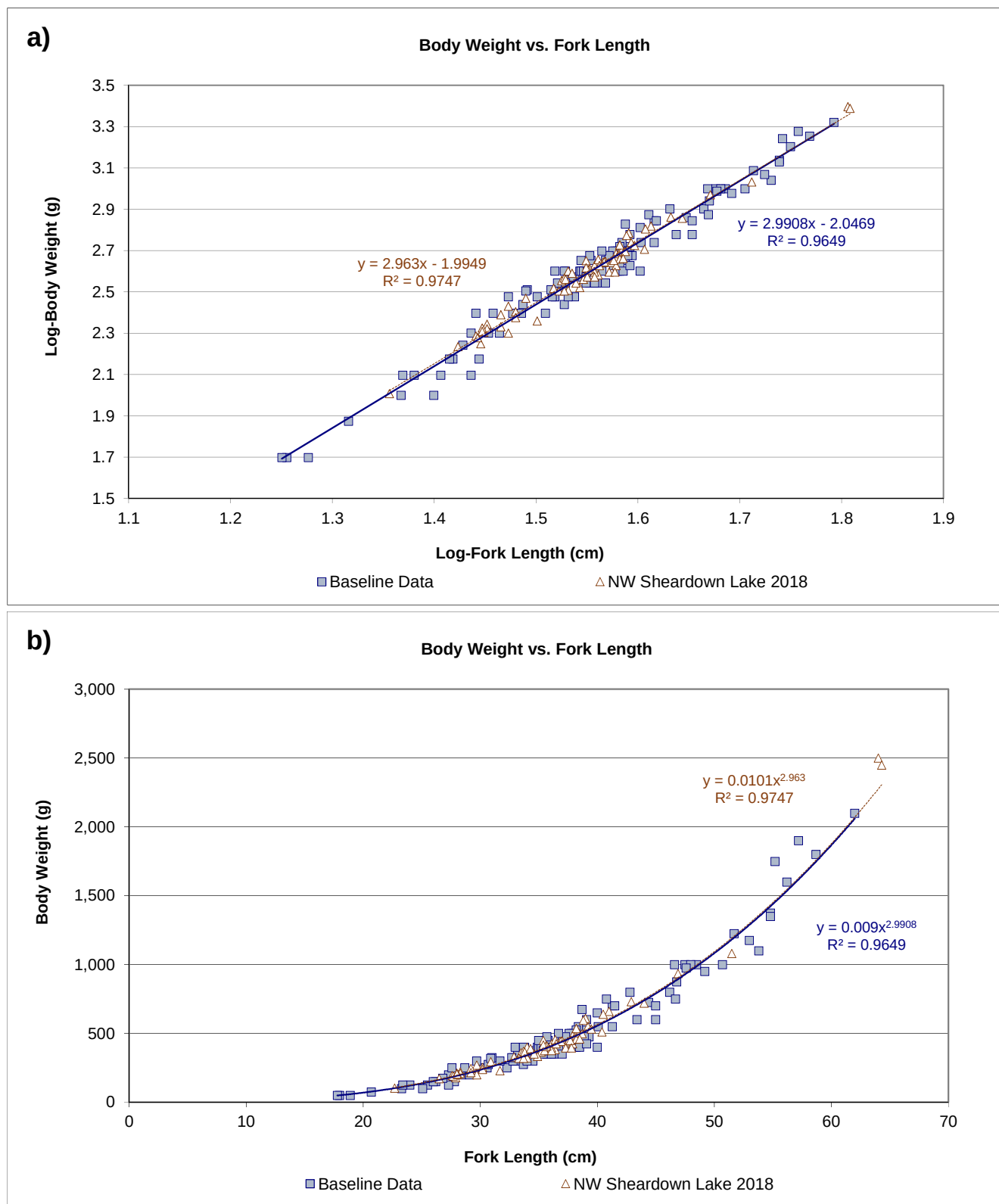


Figure G.12: Comparison of Condition (Weight-at-fork Length Relationship) for Arctic Charr Collected in Fall (August-September) at Sheardown Lake NW Nearshore Areas in 2018 and during the Mine Baseline Period (2006, 2007, 2008, 2013) using Log-transformed (a) and Untransformed (b) Data, Mary River Project CREMP

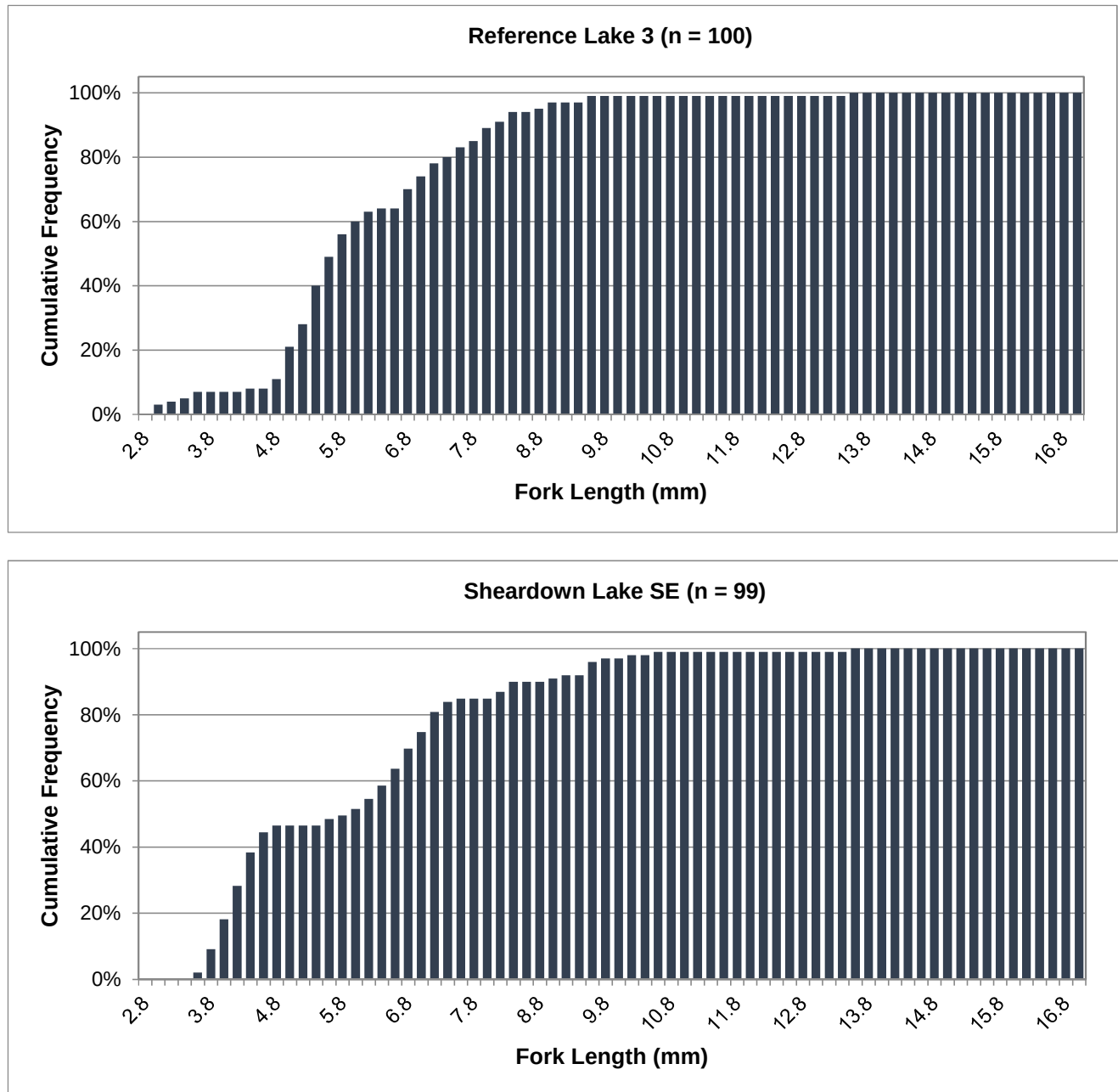


Figure G.13: Cumulative Length-frequency Distributions for Juvenile Arctic Charr Captured by Electrofishing at Nearshore Areas of Sheardown Lake SE and Reference Lake 3, Mary River Project CREMP, August 2018

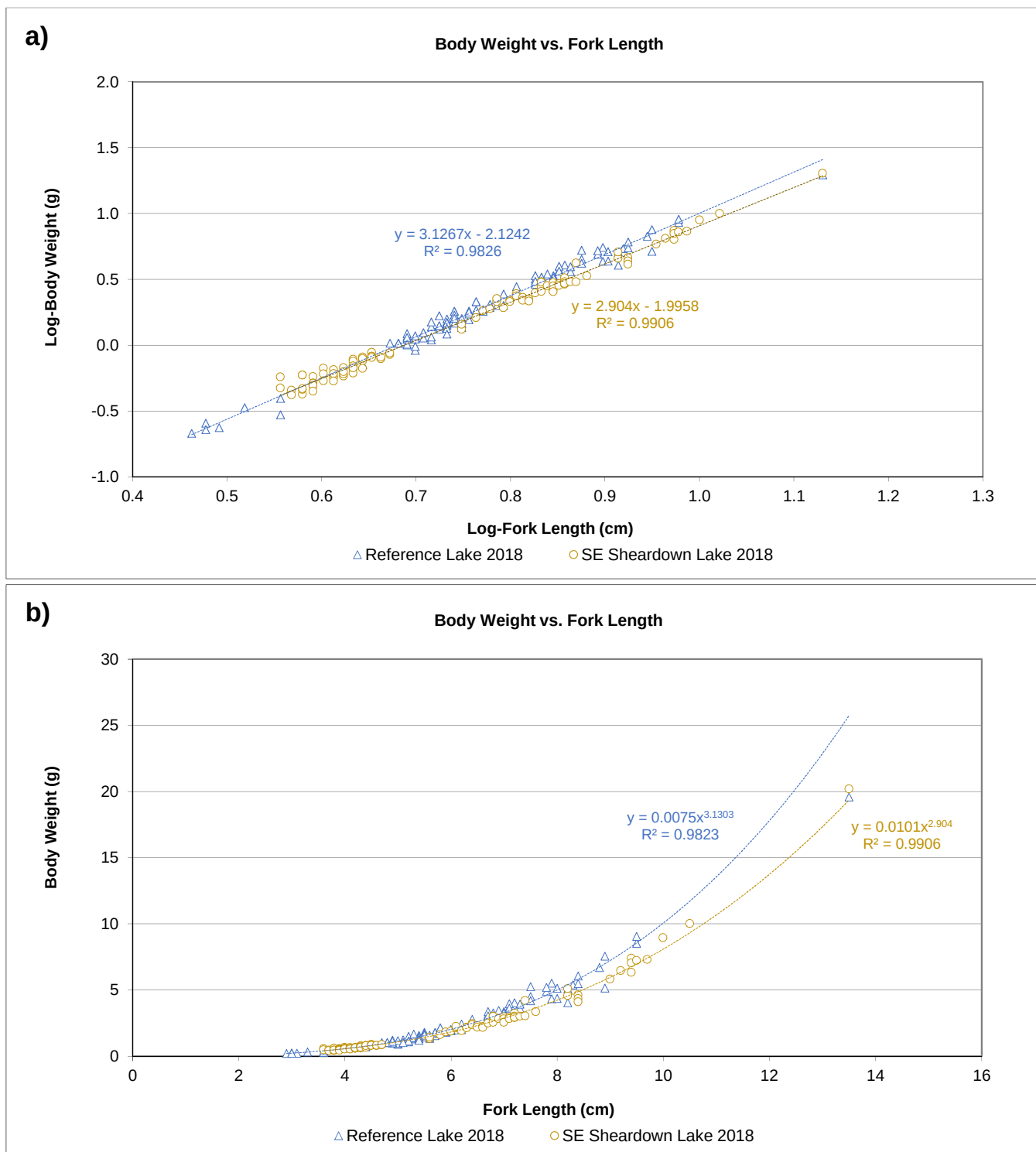


Figure G.14: Comparison of Condition (Weight-at-fork Length Relationship) for Arctic Charr Collected at the Nearshore Area of Sheardown Lake SE and Reference Lake 3 in August 2018 using Log-transformed (a) and Untransformed (b) Data, Mary River Project 2018 CREMP

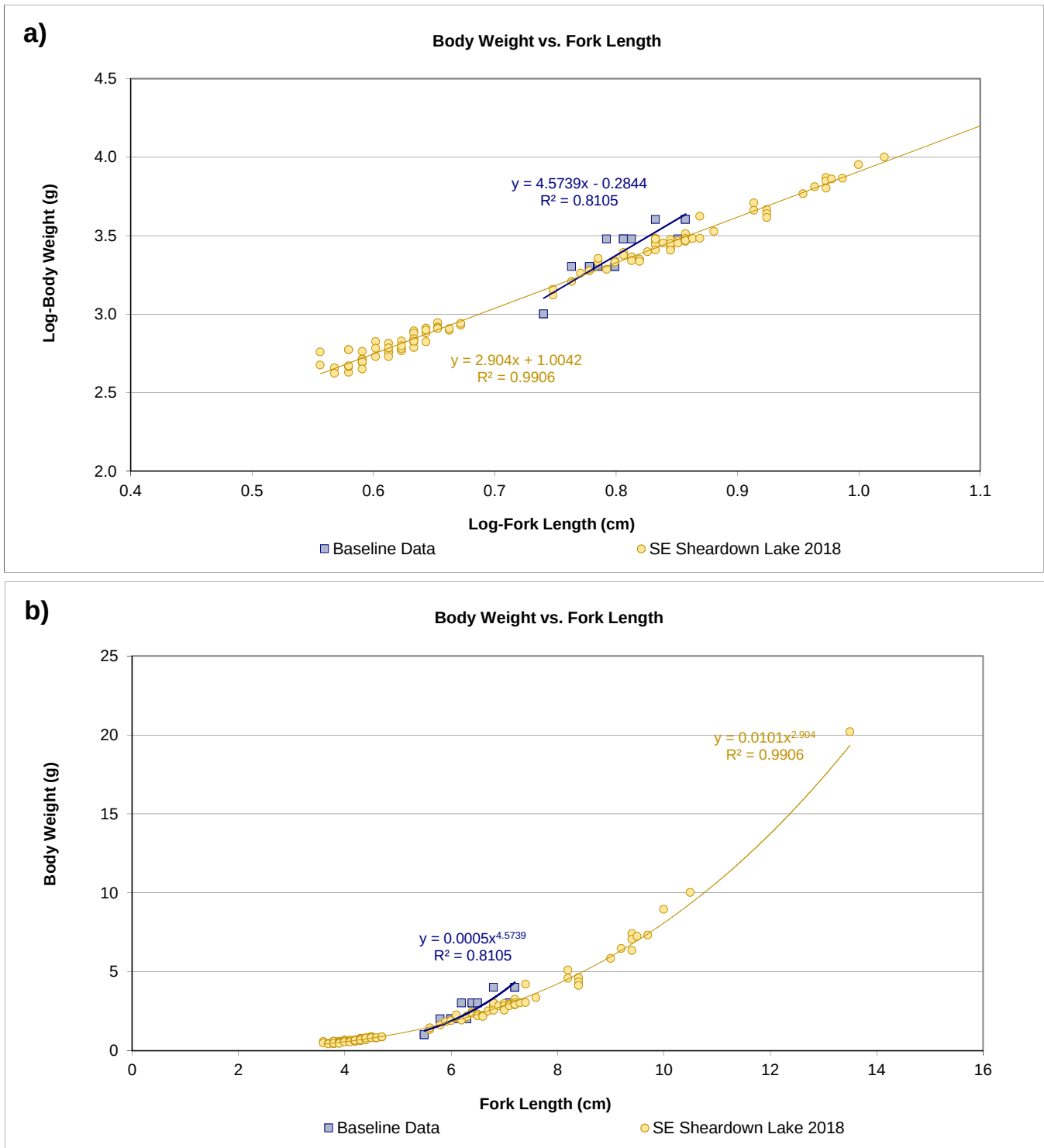


Figure G.15: Comparison of Condition (Weight-at-fork Length Relationship) for Arctic Charr Collected in Fall (August-September) at Sheardown Lake SE Nearshore Areas in 2018 and During the Mine Baseline Period (2007) using Log-transformed (a) and Untransformed (b) Data, Mary River Project CREMP

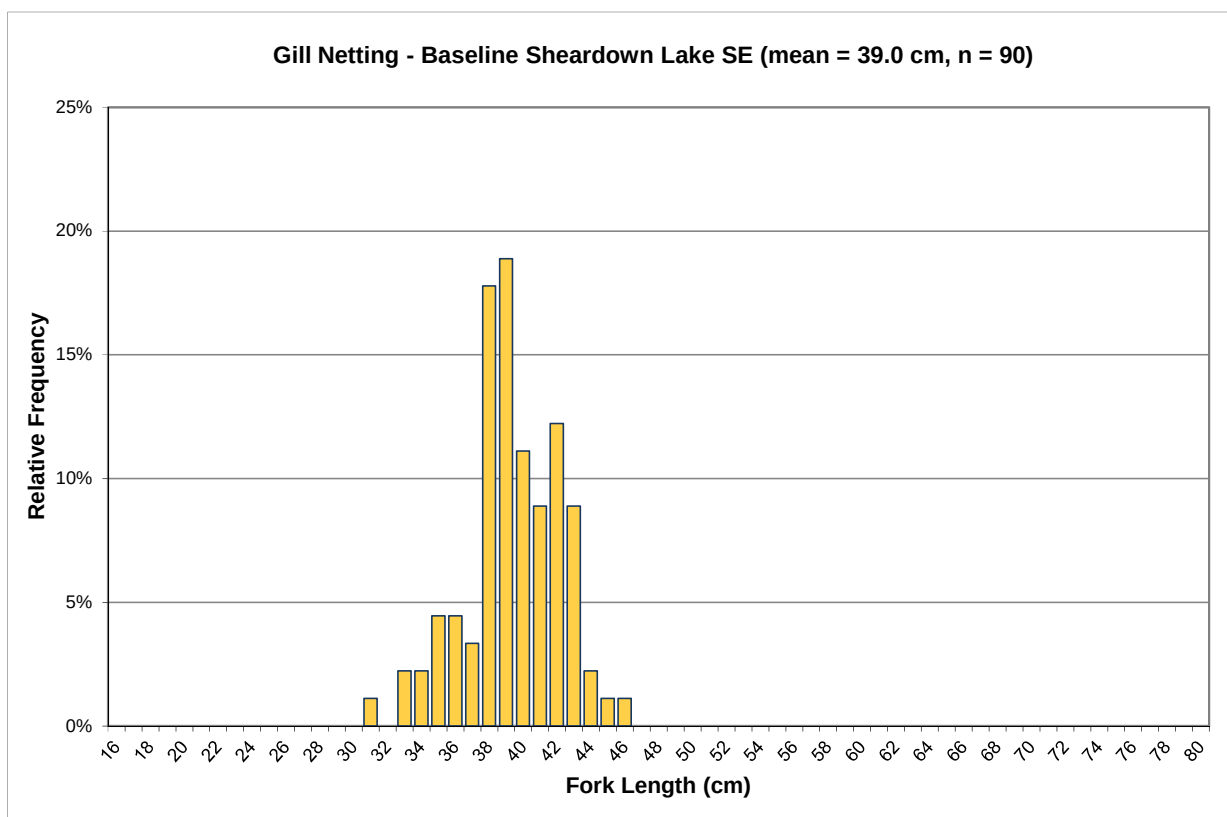
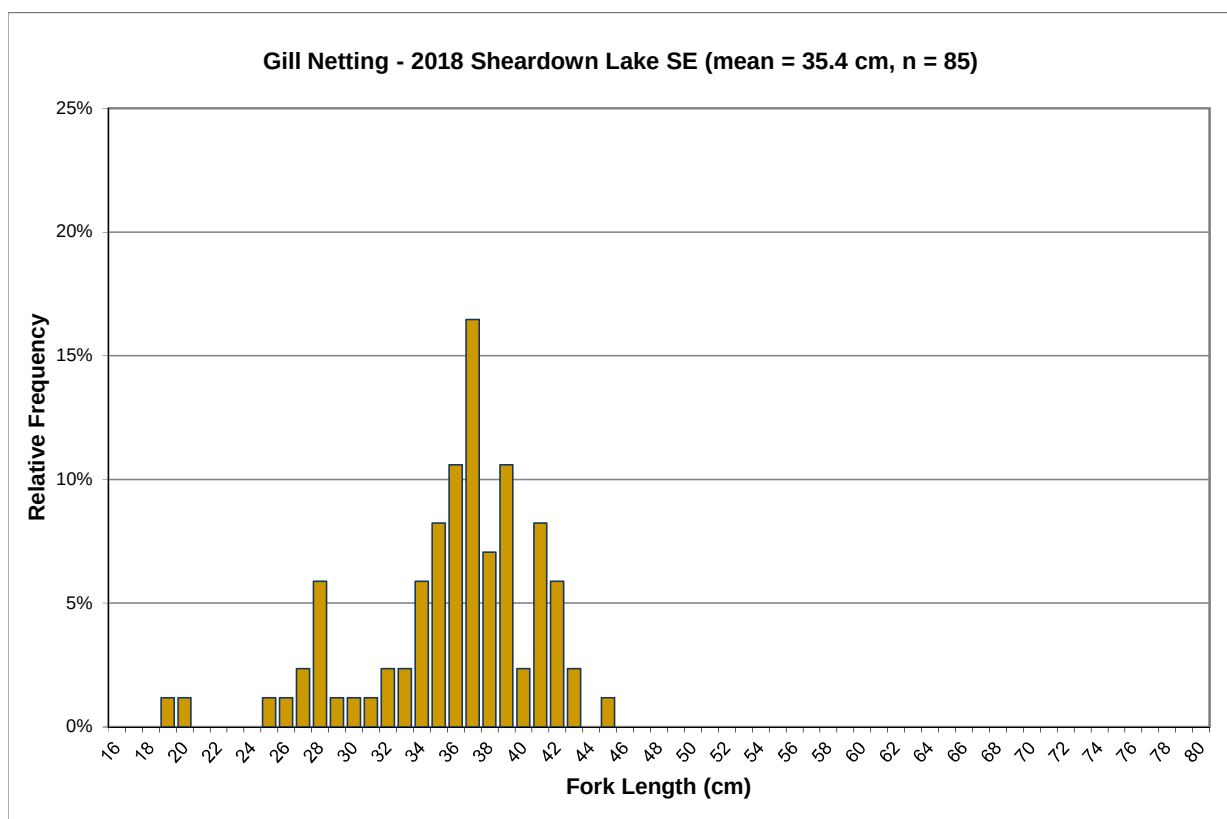


Figure G.16: Length-Frequency Distributions for Arctic Charr Captured by Gill Netting at Sheardown Lake SE (DLO-02) in 2018 and Baseline Studies Conducted in Fall, Mary River Project CREMP

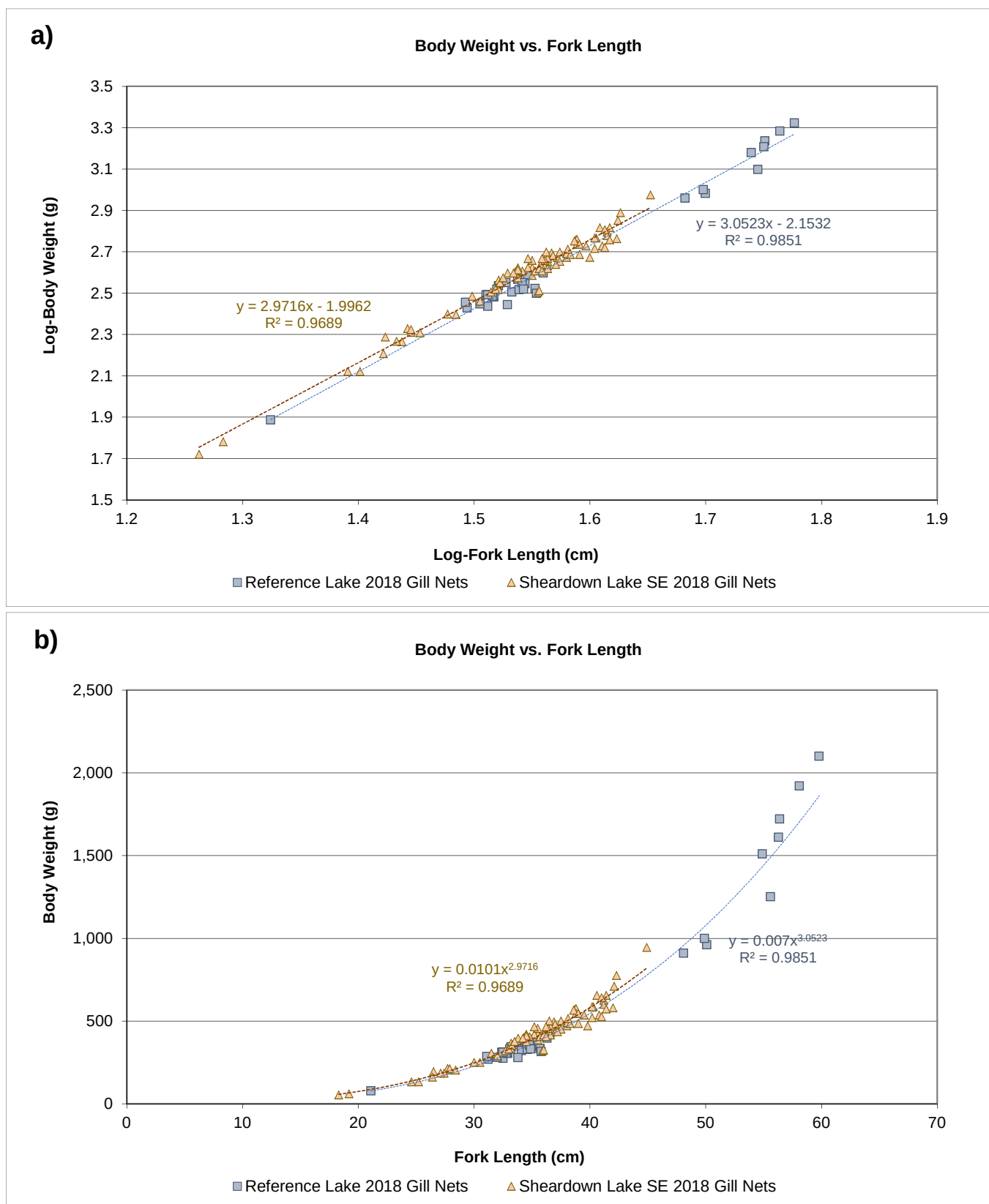


Figure G.17: Comparison of Condition (Weight-at-fork-length Relationship) for Arctic Charr Collected at Littoral/Profundal Areas of Sheardown Lake SE and Reference Lake 3 in August 2018 using Log-transformed (a) and Untransformed (b) Data, Mary River Project 2018 CREMP

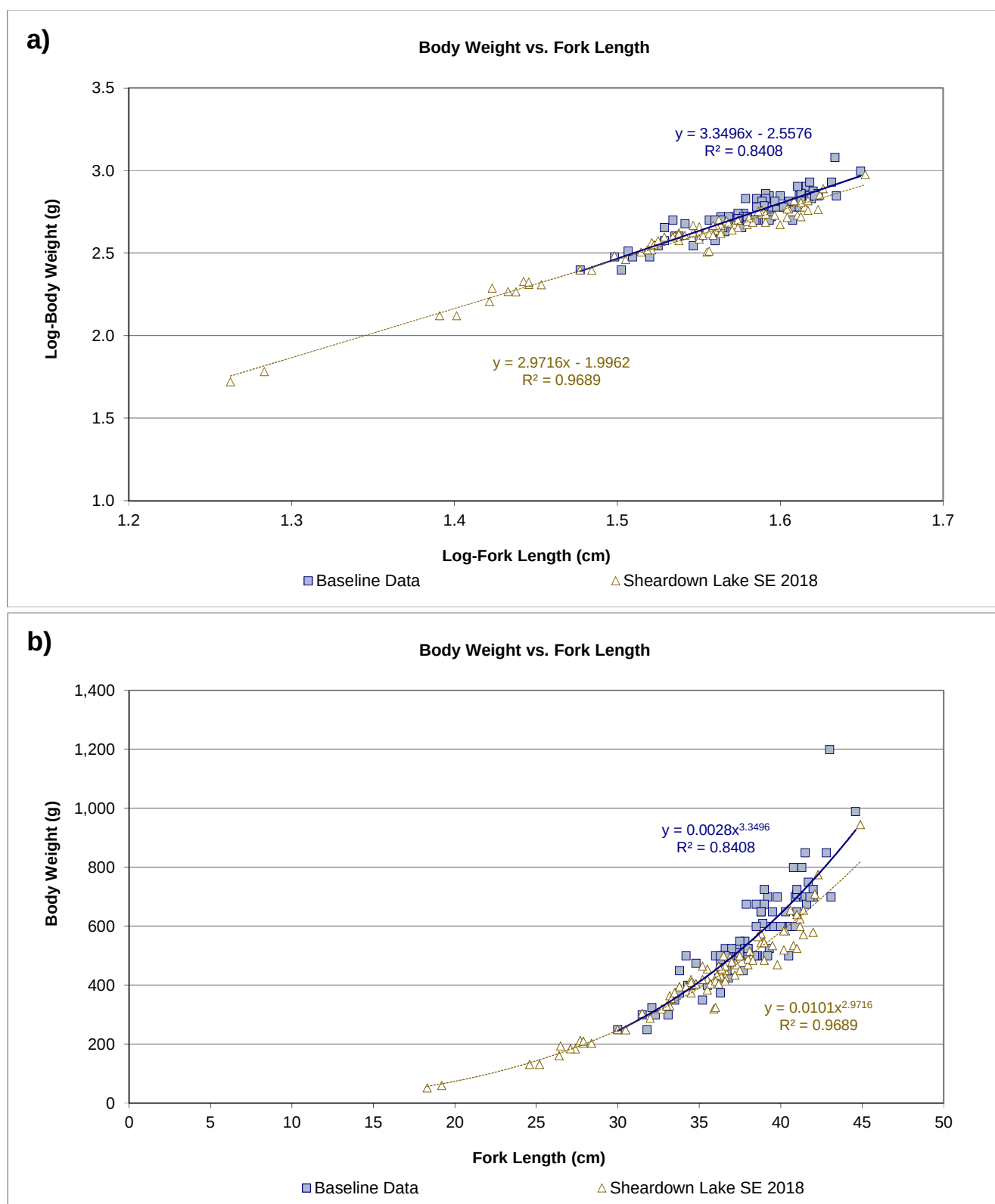


Figure G.18: Comparison of Condition (Weight-at-fork Length Relationship) for Arctic Charr collected in Fall (August-September) at Sheardown Lake SE Nearshore Areas in 2018 and During the Mine Baseline Period (2007, 2008) using Log-transformed (a) and Untransformed (b) Data, Mary River Project CREMP

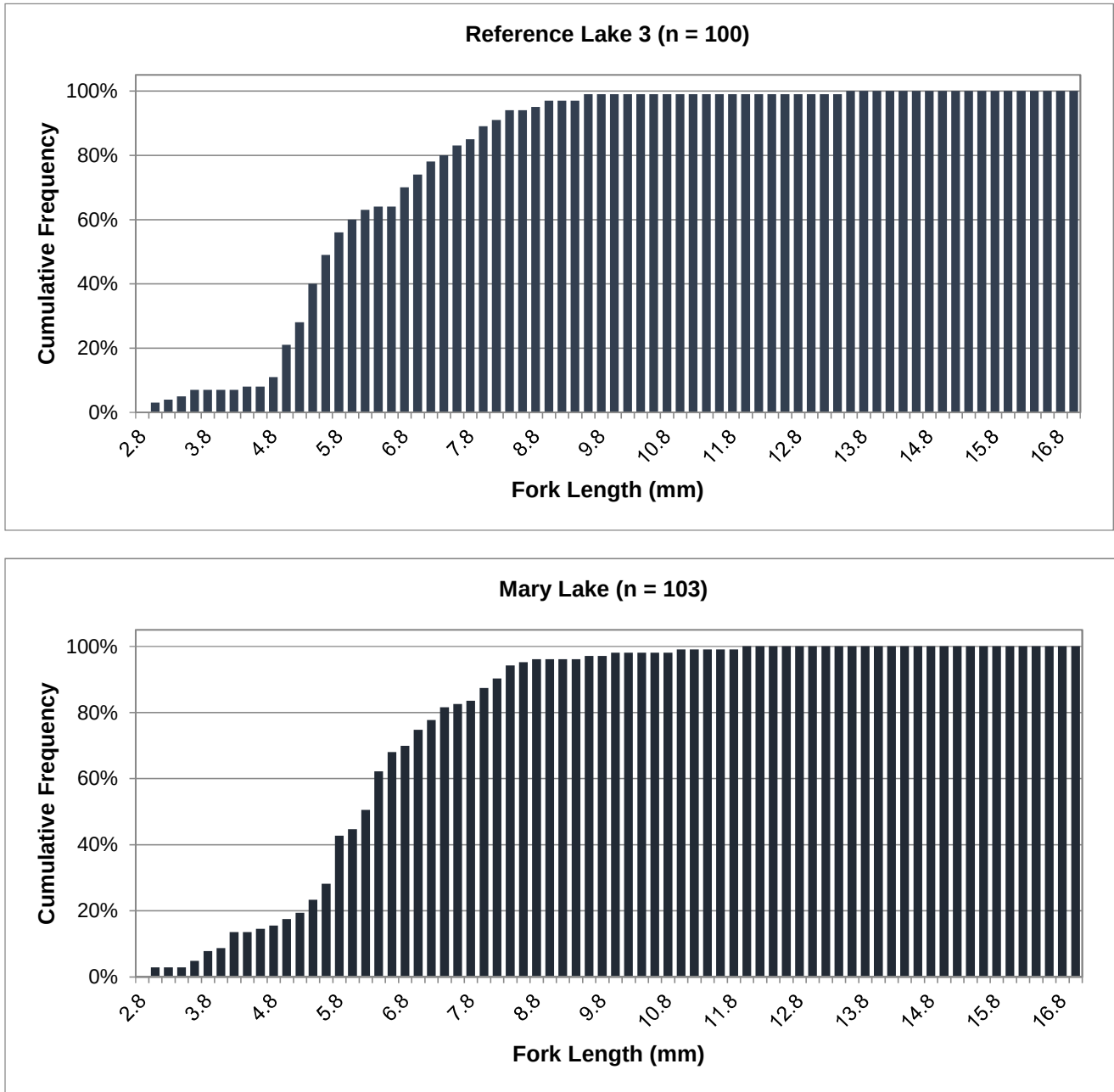


Figure G.19: Cumulative Length-frequency Distributions for Juvenile Arctic Charr Captured by Electrofishing at Nearshore Areas of Mary Lake and Reference Lake 3, Mary River Project CREMP, August 2018

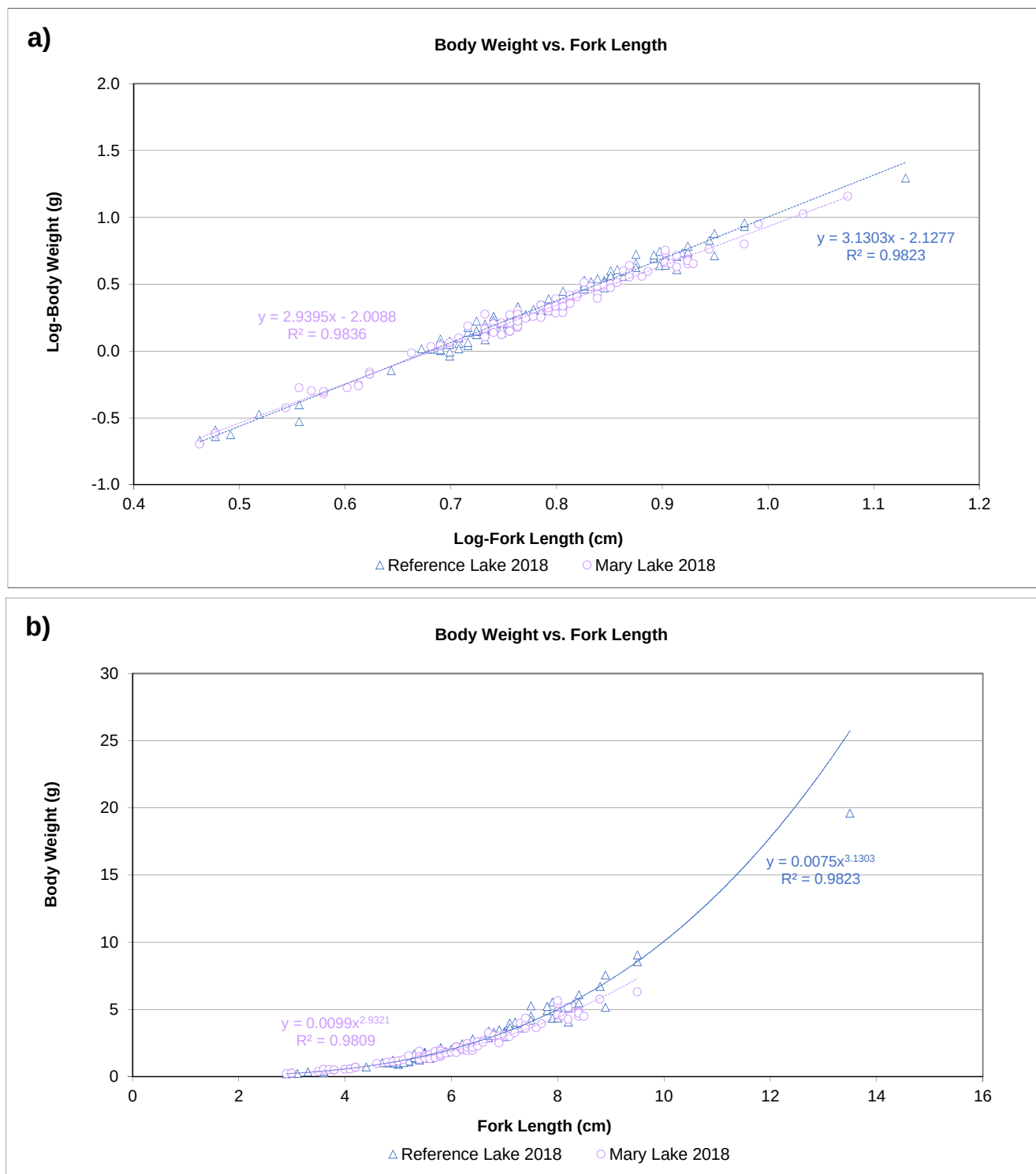


Figure G.20: Comparison of Condition (Weight-at-fork-Length Relationship) for Arctic Charr Collected at the Nearshore Area of Mary Lake and Reference Lake 3 in August 2018 using Log-Transformed (a) and Untransformed (b) Data, Mary River Project 2018 CREMP

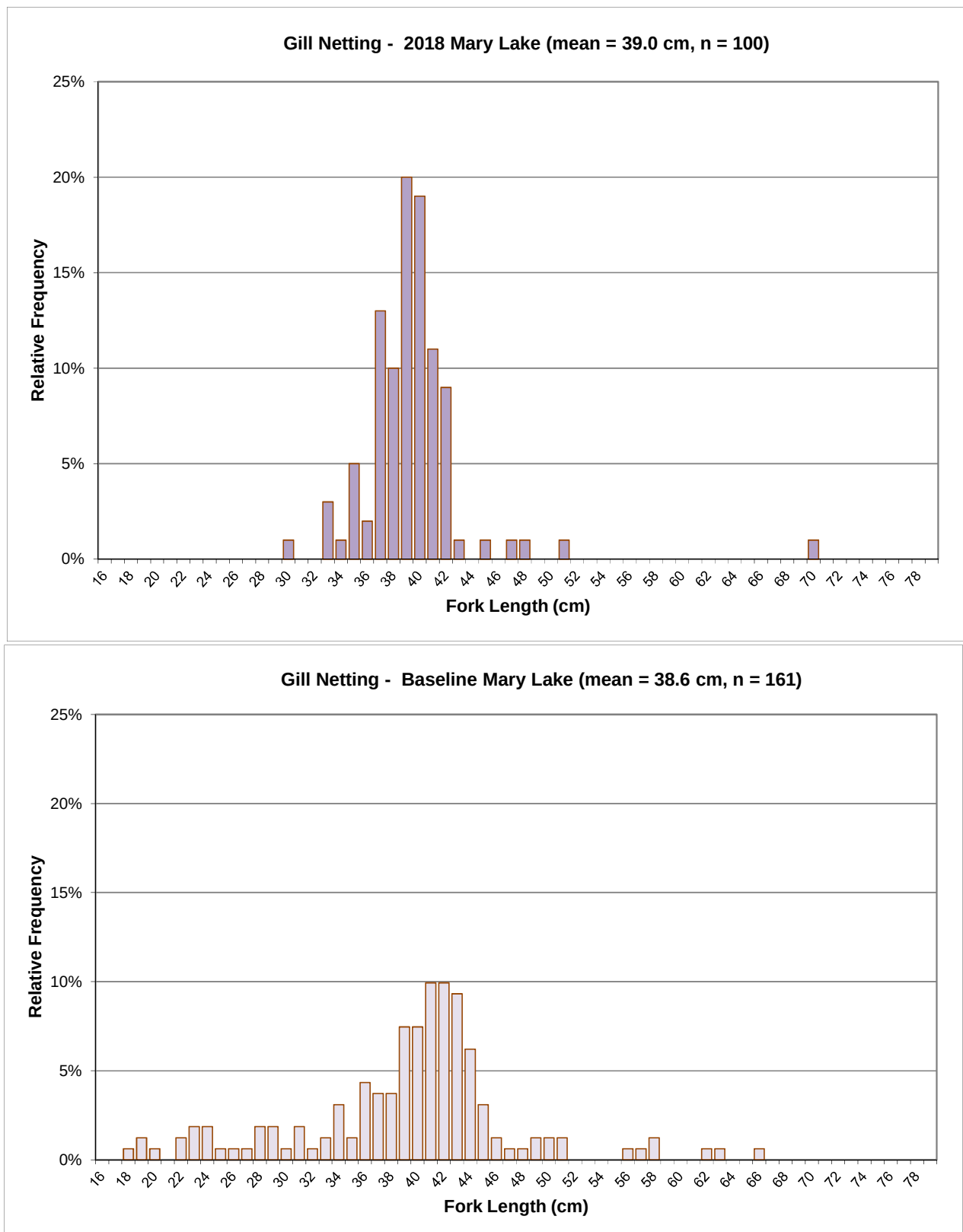


Figure G.21: Length-Frequency Distributions for Arctic Charr Captured by Gill Netting at Mary Lake (BLO) in 2018 and Baseline Studies Conducted in Fall, Mary River Project

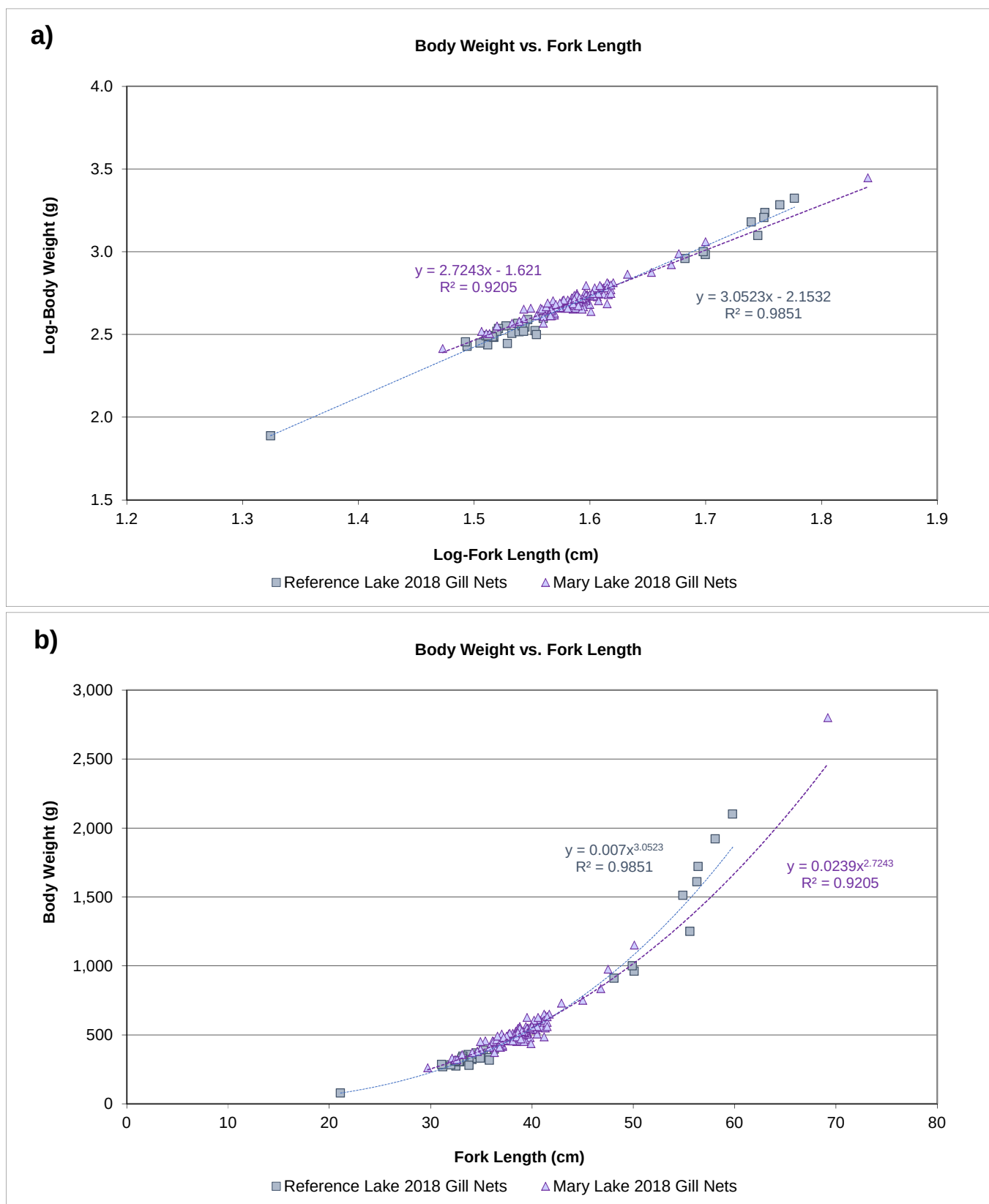


Figure G.22: Comparison of Condition (Weight-at-fork-length Relationship) for Arctic Charr Collected at Littoral/Profundal Areas of Mary Lake and Reference Lake 3 in August 2018 using Log-transformed (a) and Untransformed (b) Data, Mary River Project 2018 CREMP

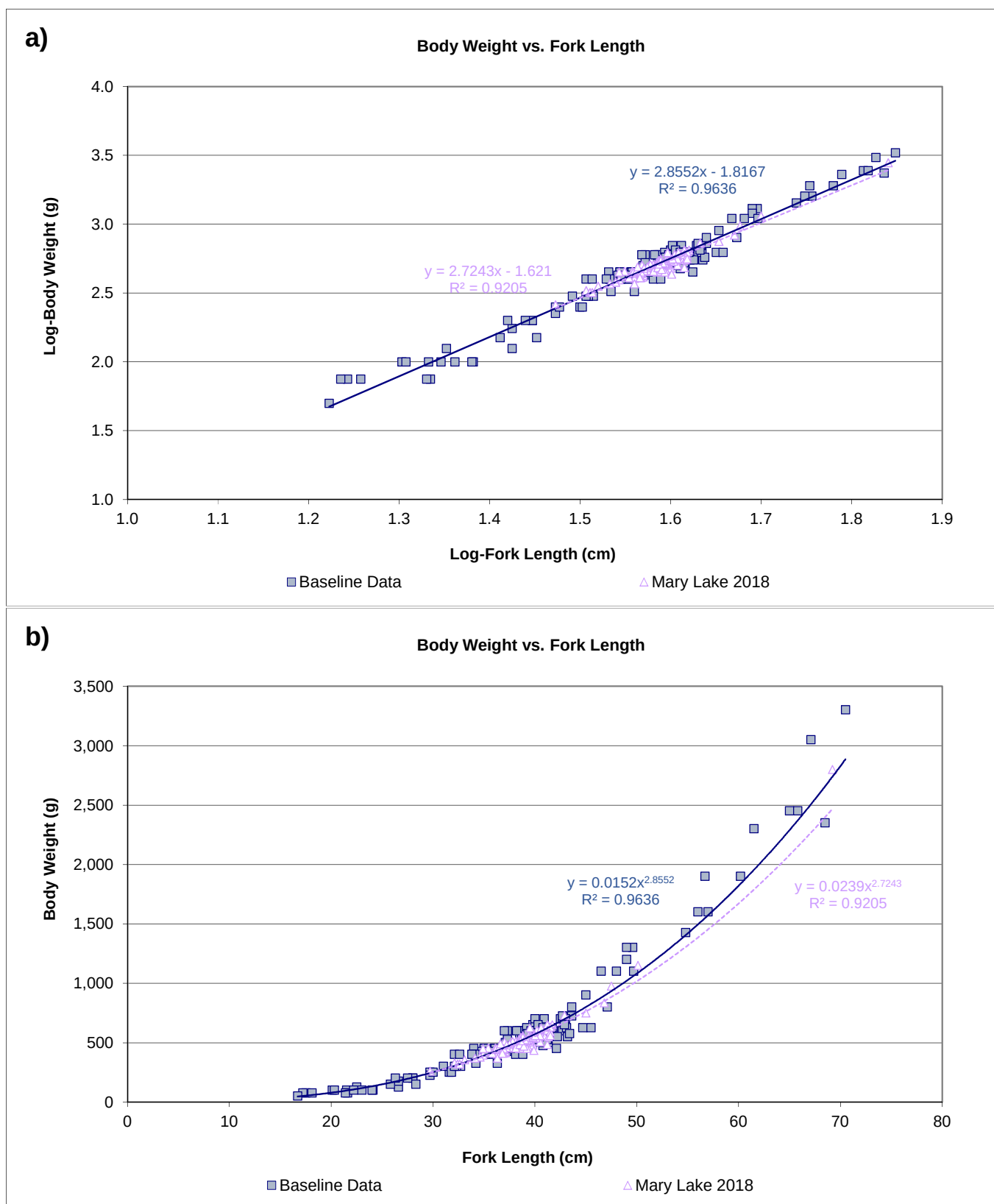


Figure G.23: Comparison of Condition (Weight-at-fork Length Relationship) for Arctic Charr Collected in Fall (August-September) at Mary Lake Nearshore Areas in 2018 and During the Mine Baseline Period (2006, 2007) using Log-transformed (a) and Untransformed (b) Data, Mary River Project CREMP

Table G.1: Electrofishing Catch Records, Mary River Project CREMP, August 2018

Waterbody	Sample Station Identifier	Location (NAD83, UTM Zone 17W)				Fishing Date	Electrofisher Settings			Effort (seconds)	Fish Species						Total (all species)	
											Arctic Charr			Nine-spine Stickleback				
		Start		Finish			Output Voltage (volts)	Cycle Freq. (Hz)	Duty Cycle (%)		No. Captured	No. Mortalities / Retained	CPUE	No. Captured	No. Mortalities / Retained	CPUE	Total Catch	CPUE
		Easting	Northing	Easting	Northing													
Reference Lake 3	REF3-18-EF-1	574894	7853034	575052	7853060	23-Aug-18	500-600	30-50	-	3,153	68	23	1.29	2	0	0.04	103	1.61
	REF3-18-EF-2	575052	7853060	575120	785086	23-Aug-18	600	50	-	1,047	33	0	1.89	0	0	0.00		
Camp Lake	JLO-18-EF-1	557805	7914662	557798	7914646	15-Aug-18	500	30	12	837	109	11	7.81	1	0	0.07	110	7.89
Sheardown Lake NW	DLO1-18-EF-1	560272	7913489	560197	7913483	16-Aug-18	500	30	-	1,357	98	10	4.33	0	0	0.00	98	4.33
Sheardown Lake SE	DLO2-18-EF-1	560721	7912355	560763	7912313	16-Aug-18	-	-	-	1,102	99	10	5.39	1	0	0.05	100	5.44
Mary Lake	BLO-18-EF-1	555405	7905135	555507	7904989	16-Aug-18	500	30	12	2,988	103	10	2.07	4	0	0.08	107	2.15

Note: Catch-per-unit-effort (CPUE) represents the number of fish captured per electrofishing minute.

Table G.2: Gill Netting Catch Records for Reference Lake 3, Mary River Project CREMP, August 2018

Gill Net Set ID	Location (NAD83, UTM Zone 17W)		Length (m)	Set Date	Lift Date	Set Time	Lift Time	Fishing Hours	Effort (m*hrs/100 m)	Arctic Charr Catch Per Mesh Size			Total Catch	CPUE
	Eastings	Northing								1½"	2"	3"		
REF318-GN-01	575233	7853040	91.4	25-Aug-18	25-Aug-18	13:05	16:00	2.92	2.67	0	0	0	0	0
REF318-GN-02	574636	7853005	91.4	25-Aug-18	25-Aug-18	13:15	15:40	2.42	2.21	0	5	1	6	2.72
REF318-GN-03	573850	7852686	91.4	25-Aug-18	25-Aug-18	13:25	16:20	2.92	2.67	1	1	1	3	1.12
REF318-GN-04	573717	7853819	91.4	25-Aug-18	25-Aug-18	13:35	16:40	3.08	2.82	0	0	0	0	0
REF318-GN-05	574130	7853547	91.4	25-Aug-18	25-Aug-18	13:45	16:40	2.92	2.67	0	2	0	2	0.75
REF318-GN-06	574636	7853005	91.4	25-Aug-18	25-Aug-18	15:55	17:30	1.58	1.45	1	1	1	3	2.07
REF318-GN-07	574932	7852983	91.4	25-Aug-18	25-Aug-18	16:10	17:10	1.00	0.91	0	0	0	0	0
REF318-GN-08	573850	7852686	91.4	25-Aug-18	25-Aug-18	16:30	17:20	0.83	0.76	0	0	0	0	0
REF318-GN-09	574543	7852952	91.4	27-Aug-18	27-Aug-18	8:45	12:10	3.42	3.12	0	0	0	0	0
REF318-GN-10	573887	7852680	91.4	27-Aug-18	27-Aug-18	9:00	11:35	2.58	2.36	0	0	0	0	0
REF318-GN-11	574122	7852281	91.4	27-Aug-18	27-Aug-18	9:10	11:45	2.58	2.36	0	0	0	0	0
REF318-GN-12	574295	7852483	61.0	27-Aug-18	27-Aug-18	9:30	12:00	2.50	1.52	0	0	0	0	0
REF318-GN-13	574512	7853046	91.4	27-Aug-18	27-Aug-18	10:15	12:40	2.42	2.21	0	0	0	0	0
REF318-GN-14	574249	7853518	91.4	27-Aug-18	27-Aug-18	10:25	13:30	3.08	2.82	0	1	0	1	0.35
REF318-GN-15	574451	7853682	91.4	27-Aug-18	27-Aug-18	10:30	13:45	3.25	2.97	1	0	0	1	0.34
REF318-GN-16	575530	7852911	91.4	27-Aug-18	27-Aug-18	10:50	14:00	3.17	2.90	0	1	0	1	0.35
REF318-GN-17	575622	7852435	91.4	27-Aug-18	27-Aug-18	11:00	14:15	3.25	2.97	1	2	0	3	1.01
REF318-GN-18	576087	7852489	91.4	27-Aug-18	27-Aug-18	11:10	14:30	3.33	3.05	2	0	0	2	0.66
REF318-GN-19	574972	7852512	91.4	27-Aug-18	27-Aug-18	11:20	14:55	3.58	3.28	0	0	0	0	0
REF318-GN-20	573887	7852680	91.4	27-Aug-18	27-Aug-18	11:35	15:30	3.92	3.58	0	1	0	1	0.28
REF318-GN-21	574122	7852281	91.4	27-Aug-18	27-Aug-18	11:45	15:50	4.08	3.73	0	0	0	0	0
REF318-GN-22	574295	7852483	61.0	27-Aug-18	27-Aug-18	12:00	16:00	4.00	2.44	0	0	0	0	0
REF318-GN-23	574543	7852952	91.4	27-Aug-18	27-Aug-18	12:10	16:15	4.08	3.73	0	4	1	5	1.34
REF318-GN-24	574512	7853046	91.4	27-Aug-18	27-Aug-18	12:40	16:25	3.75	3.43	0	0	0	0	0
REF318-GN-25	574249	7853518	91.4	27-Aug-18	27-Aug-18	13:30	17:00	3.50	3.20	0	2	2	4	1.25
REF318-GN-26	574451	7853682	91.4	27-Aug-18	27-Aug-18	13:45	17:10	3.42	3.12	0	1	0	1	0.32
REF318-GN-27	575530	7852911	91.4	27-Aug-18	27-Aug-18	14:00	16:40	2.67	2.44	0	0	0	0	0
REF318-GN-28	575622	7852435	91.4	27-Aug-18	27-Aug-18	14:15	16:45	2.50	2.29	0	0	0	0	0
REF318-GN-29	574073	7853622	91.4	27-Aug-18	27-Aug-18	15:18	17:25	2.12	1.94	0	0	0	0	0
REF318-GN-30	573634	7853664	91.4	27-Aug-18	27-Aug-18	15:20	17:30	2.17	1.98	0	0	1	1	0.50
REF318-GN-31	573887	7852680	91.4	27-Aug-18	27-Aug-18	15:35	17:45	2.17	1.98	0	0	0	0	0
REF318-GN-32	574122	7852281	91.4	27-Aug-18	27-Aug-18	15:50	17:50	2.00	1.83	0	0	0	0	0
REF318-GN-33	574295	7852483	61.0	27-Aug-18	27-Aug-18	16:00	18:00	2.00	1.22	0	0	0	0	0
REF318-GN-34	574543	7852952	91.4	27-Aug-18	27-Aug-18	16:15	18:10	1.92	1.75	0	0	0	0	0
Total									84.38	6	21	7	34	0.38

Note: Catch-per-unit-effort (CPUE) represents the number of fish captured per 100 m-hours of net.

Table G.3: Summary of Arctic Charr Gill Net Catches by Mesh Size, Mary River Project CREMP, August 2018

Waterbody	Effort (m*hrs/100 m)	Arctic Charr Catch Per Mesh Size			Total Catch	CPUE	Mortalities
		1½"	2"	3"			
Reference Lake 3	84.38	6	21	7	34	0.38	12
Camp Lake	22.32	22	22	50	94	4.29	6
Sheardown Lake NW	108.20	17	52	22	91	0.63	8
Sheardown Lake SE	20.35	17	43	25	91	3.98	9
Mary Lake	18.14	5	54	70	129	7.30	20
Total	253.38	67	192	174	439	3.31	55

Note: Catch-per-unit-effort (CPUE) represents the number of fish captured per 100 m·hours of net.

Table G.4: Arctic Charr Measurements from Fish Captured at Reference Lake 3 by Electrofishing, Mary River Project CREMP, August 2018

Specimen ID	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
REF318-ACJ-01	4.4	4.7	0.712	0	0.836
REF318-ACJ-02	5.4	5.8	1.585	1	1.007
REF318-ACJ-03	9.5	10.4	8.542	2	0.996
REF318-ACJ-04	9.5	10.4	9.055	2	1.056
REF318-ACJ-05	8.8	9.4	6.705	1	0.984
REF318-ACJ-06	7.8	8.3	4.901	2	1.033
REF318-ACJ-07	6.7	7.2	3.172	1	1.055
REF318-ACJ-08	6.8	7.3	3.290	1	1.046
REF318-ACJ-09	5.5	5.8	1.806	-	1.085
REF318-ACJ-10	5.1	5.4	1.135	-	0.856
REF318-ACJ-11	3.6	3.7	0.296	-	0.634
REF318-ACJ-12	4.8	5.1	1.033	-	0.934
REF318-ACJ-13	5.4	5.7	1.415	-	0.899
REF318-ACJ-14	5.8	6.1	1.849	-	0.948
REF318-ACJ-15	8.2	8.8	4.051	-	0.735
REF318-ACJ-16	5.9	6.2	1.805	-	0.879
REF318-ACJ-17	8.3	8.9	5.406	-	0.945
REF318-ACJ-18	3.3	3.4	0.336	-	0.935
REF318-ACJ-19	5.1	5.4	1.247	-	0.940
REF318-ACJ-20	7.0	7.5	3.370	-	0.983
REF318-ACJ-21	5.5	5.8	1.696	-	1.019
REF318-ACJ-22	5.7	5.9	1.559	-	0.842
REF318-ACJ-23	7.3	7.7	3.610	-	0.928
REF318-ACJ-24	5.0	5.2	1.114	-	0.891
REF318-ACJ-25	4.9	5.2	1.167	-	0.992
REF318-ACJ-26	8.4	9.0	5.482	-	0.925
REF318-ACJ-27	7.9	8.5	4.344	-	0.881
REF318-ACJ-28	7.9	8.4	5.534	-	1.122
REF318-ACJ-29	5.2	5.4	1.097	-	0.780
REF318-ACJ-30	5.3	5.5	1.323	-	0.889
REF318-ACJ-31	6.2	6.6	2.448	-	1.027
REF318-ACJ-32	2.9	3.0	0.214	-	0.877
REF318-ACJ-33	5.0	5.2	0.912	-	0.730
REF318-ACJ-34	7.8	8.5	5.219	-	1.100
REF318-ACJ-35	6.7	7.2	2.898	-	0.964
REF318-ACJ-36	8.2	8.8	5.092	-	0.924
REF318-ACJ-37	8.9	9.6	7.559	-	1.072
REF318-ACJ-38	4.9	5.2	1.227	-	1.043
REF318-ACJ-39	5.3	5.6	1.398	-	0.939
REF318-ACJ-40	7.0	7.5	2.961	-	0.863
REF318-ACJ-41	5.2	5.5	1.377	-	0.979
REF318-ACJ-42	5.7	6.0	1.726	-	0.932
REF318-ACJ-43	7.0	7.4	3.259	-	0.950
REF318-ACJ-44	3.6	3.7	0.394	-	0.844
REF318-ACJ-45	7.1	7.6	3.706	-	1.035
REF318-ACJ-46	5.5	5.9	1.807	-	1.086
REF318-ACJ-47	5.2	5.5	1.499	-	1.066
REF318-ACJ-48	5.8	6.1	2.136	-	1.095
REF318-ACJ-49	5.9	6.3	1.868	-	0.910
REF318-ACJ-50	7.2	7.7	4.056	-	1.087
REF318-ACJ-51	3.0	3.1	0.256	-	0.948
REF318-ACJ-52	5.5	5.8	1.693	-	1.018
REF318-ACJ-53	6.7	7.1	3.373	-	1.121
REF318-ACJ-54	6.4	6.7	2.792	-	1.065
REF318-ACJ-55	6.8	7.3	3.060	-	0.973
REF318-ACJ-56	7.5	8.0	4.516	-	1.070
REF318-ACJ-57	4.9	5.2	1.107	-	0.941

Table G.4: Arctic Charr Measurements from Fish Captured at Reference Lake 3 by Electrofishing, Mary River Project CREMP, August 2018

Specimen ID		Fork Length (cm)	Total Length (cm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
REF318-ACJ-58		5.0	5.3	0.978	-	0.782
REF318-ACJ-59		4.9	5.1	1.004	-	0.853
REF318-ACJ-60		8.0	8.5	5.138	-	1.004
REF318-ACJ-61		4.9	5.2	1.019	-	0.866
REF318-ACJ-62		6.2	6.5	2.003	-	0.840
REF318-ACJ-63		5.6	5.9	1.362	-	0.776
REF318-ACJ-64		3.1	3.2	0.236	-	0.792
REF318-ACJ-65		4.8	5.0	1.033	-	0.934
REF318-ACJ-66		3.0	3.1	0.228	-	0.844
REF318-ACJ-67		8.4	9.0	6.077	-	1.025
REF318-ACJ-68		7.5	8.0	4.193	-	0.994
REF318-ACJ-69		13.5	14.6	19.603	6	0.797
REF318-ACJ-70		7.5	8.0	5.265	1	1.248
REF318-ACJ-71		5.4	5.7	1.442	-	0.916
REF318-ACJ-72		5.5	5.8	1.471	-	0.884
REF318-ACJ-73		6.1	6.5	1.995	-	0.879
REF318-ACJ-74		8.0	8.5	4.360	-	0.852
REF318-ACJ-75		5.0	5.3	1.180	-	0.944
REF318-ACJ-76		5.4	5.7	1.488	-	0.945
REF318-ACJ-77		5.7	6.0	1.814	-	0.980
REF318-ACJ-78		7.1	7.6	3.977	-	1.111
REF318-ACJ-79		4.7	4.9	1.037	-	0.999
REF318-ACJ-80		5.3	5.6	1.408	-	0.946
REF318-ACJ-81		6.0	6.3	1.928	-	0.893
REF318-ACJ-82		6.7	7.1	3.058	-	1.017
REF318-ACJ-83		5.5	5.9	1.604	-	0.964
REF318-ACJ-84		5.7	6.0	1.789	-	0.966
REF318-ACJ-85		5.4	5.8	1.476	-	0.937
REF318-ACJ-86		5.4	5.7	1.484	-	0.942
REF318-ACJ-87		6.9	7.3	3.473	-	1.057
REF318-ACJ-88		5.4	5.7	1.340	-	0.851
REF318-ACJ-89		5.3	5.6	1.674	-	1.124
REF318-ACJ-90		5.2	5.4	1.153	-	0.820
REF318-ACJ-91		6.0	6.3	2.038	-	0.944
REF318-ACJ-92		7.3	7.8	3.938	-	1.012
REF318-ACJ-93		4.9	5.1	1.141	-	0.970
REF318-ACJ-94		8.9	9.4	5.152	-	0.731
REF318-ACJ-95		7.1	7.6	3.645	-	1.018
REF318-ACJ-96		5.4	5.6	1.214	-	0.771
REF318-ACJ-97		5.6	5.8	1.596	-	0.909
REF318-ACJ-98		5.6	5.8	1.459	-	0.831
REF318-ACJ-99		5.1	5.3	1.036	-	0.781
REF318-ACJ-100		5.8	6.1	2.138	-	1.096
Overall Catch Summary	Sample Size (N)	100	100	100	10.0	100
	Average	6.1	6.5	2.678	1.7	0.946
	Median	5.7	6.0	1.797	1.0	0.944
	Standard Deviation	1.6	1.8	2.517	1.6	0.107
	Standard Error	0.2	0.2	0.252	0.5	0.011
	Minimum	2.9	3.0	0.214	0.0	0.634
	Maximum	13.5	14.6	19.603	6.0	1.248
Young-of-the-Year Catch Summary	proportion of YOY	8%				
	Sample Size (N)	8	8	8	1	8
	Average	3.4	3.5	0.334	0	0.839
	Median	3.2	3.3	0.276	0	0.844
	Standard Deviation	0.5	0.6	0.164	-	0.098
	Standard Error	0.2	0.2	0.058	-	0.035
	Minimum	2.9	3.0	0.214	0	0.634
	Maximum	4.4	4.7	0.712	0	0.948

Table G.5: Arctic Charr Measurements from Fish Captured at Camp Lake by Electrofishing, Mary River Project CREMP, August 2018

Specimen ID	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
JLO-18-ACJ-01	10.3	10.9	10.474	3	0.959
JLO-18-ACJ-02	10.4	11.1	8.621	2	0.766
JLO-18-ACJ-03	7.7	8.3	3.356	2	0.735
JLO-18-ACJ-04	14.1	15.3	21.845	2	0.779
JLO-18-ACJ-05	6.4	6.7	2.224	1	0.848
JLO-18-ACJ-06	9.9	10.6	9.602	2	0.990
JLO-18-ACJ-07	6.4	6.8	2.191	1	0.836
JLO-18-ACJ-08	15.1	16.1	26.672	3	0.775
JLO-18-ACJ-09	6.7	7.0	2.396	1	0.797
JLO-18-ACJ-10	13.5	14.6	20.054	3	0.815
JLO-18-ACJ-11	3.9	4.2	0.586	0	0.988
JLO-18-ACJ-12	10.6	11.3	9.351	-	0.785
JLO-18-ACJ-13	8.3	8.9	5.108	-	0.893
JLO-18-ACJ-14	9.9	10.6	7.491	-	0.772
JLO-18-ACJ-15	7.9	8.3	4.203	-	0.852
JLO-18-ACJ-16	8.4	9.1	4.476	-	0.755
JLO-18-ACJ-17	11.5	12.4	11.367	-	0.747
JLO-18-ACJ-18	12.6	13.7	16.156	-	0.808
JLO-18-ACJ-19	10.5	11.3	8.584	-	0.742
JLO-18-ACJ-20	8.9	9.5	5.622	-	0.797
JLO-18-ACJ-21	11.1	12.0	10.824	-	0.791
JLO-18-ACJ-22	13.8	14.6	22.133	-	0.842
JLO-18-ACJ-23	10.8	11.6	9.373	-	0.744
JLO-18-ACJ-24	12.4	13.5	16.590	-	0.870
JLO-18-ACJ-25	11.4	12.3	12.448	-	0.840
JLO-18-ACJ-26	13.2	14.1	19.516	-	0.849
JLO-18-ACJ-27	10.0	10.8	8.235	-	0.824
JLO-18-ACJ-28	8.5	9.1	4.773	-	0.777
JLO-18-ACJ-29	13.4	14.3	20.915	-	0.869
JLO-18-ACJ-30	15.0	16.2	27.926	-	0.827
JLO-18-ACJ-31	11.1	12.0	11.367	-	0.831
JLO-18-ACJ-32	8.4	9.0	4.629	-	0.781
JLO-18-ACJ-33	11.2	12.1	10.113	-	0.720
JLO-18-ACJ-34	13.3	14.4	16.731	-	0.711
JLO-18-ACJ-35	13.8	14.9	21.944	-	0.835
JLO-18-ACJ-36	7.6	8.1	3.663	-	0.834
JLO-18-ACJ-37	8.0	8.5	3.995	-	0.780
JLO-18-ACJ-38	6.0	6.3	1.790	-	0.829
JLO-18-ACJ-39	8.0	8.6	3.727	-	0.728
JLO-18-ACJ-40	9.4	10.2	7.293	-	0.878
JLO-18-ACJ-41	10.6	11.4	9.091	-	0.763
JLO-18-ACJ-42	10.2	11.0	9.050	-	0.853
JLO-18-ACJ-43	16.4	17.7	36.690	-	0.832
JLO-18-ACJ-44	8.9	9.5	5.665	-	0.804
JLO-18-ACJ-45	6.2	6.5	1.964	-	0.824
JLO-18-ACJ-46	8.5	9.1	4.948	-	0.806
JLO-18-ACJ-47	9.3	9.8	6.130	-	0.762
JLO-18-ACJ-48	8.9	9.6	4.796	-	0.680
JLO-18-ACJ-49	9.7	10.3	7.390	-	0.810
JLO-18-ACJ-50	5.0	5.2	1.107	-	0.886
JLO-18-ACJ-51	8.8	9.5	5.225	-	0.767
JLO-18-ACJ-52	8.5	9.1	4.903	-	0.798
JLO-18-ACJ-53	7.0	7.4	2.789	-	0.813

Table G.5: Arctic Charr Measurements from Fish Captured at Camp Lake by Electrofishing, Mary River Project CREMP, August 2018

Specimen ID	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
JLO-18-ACJ-54	8.5	9.0	4.884	-	0.795
JLO-18-ACJ-55	11.5	12.3	12.501	-	0.822
JLO-18-ACJ-56	11.0	11.8	10.481	-	0.787
JLO-18-ACJ-57	13.5	14.7	20.059	-	0.815
JLO-18-ACJ-58	8.3	8.8	4.503	-	0.788
JLO-18-ACJ-59	7.9	8.4	4.078	-	0.827
JLO-18-ACJ-60	7.1	7.5	3.475	-	0.971
JLO-18-ACJ-61	7.4	7.8	3.406	-	0.841
JLO-18-ACJ-62	7.5	7.9	3.475	-	0.824
JLO-18-ACJ-63	8.3	8.7	4.568	-	0.799
JLO-18-ACJ-64	10.2	11.1	8.701	-	0.820
JLO-18-ACJ-65	8.2	8.7	4.888	-	0.887
JLO-18-ACJ-66	9.4	10.0	6.242	-	0.752
JLO-18-ACJ-67	9.5	10.1	6.792	-	0.792
JLO-18-ACJ-68	8.3	8.8	4.593	-	0.803
JLO-18-ACJ-69	10.7	11.4	11.278	-	0.921
JLO-18-ACJ-70	11.3	12.1	11.447	-	0.793
JLO-18-ACJ-71	6.8	7.1	2.844	-	0.904
JLO-18-ACJ-72	10.0	10.7	7.253	-	0.725
JLO-18-ACJ-73	10.0	10.7	8.300	-	0.830
JLO-18-ACJ-74	8.2	8.7	4.045	-	0.734
JLO-18-ACJ-75	9.1	9.7	6.271	-	0.832
JLO-18-ACJ-76	8.5	9.1	4.856	-	0.791
JLO-18-ACJ-77	8.4	9.0	4.586	-	0.774
JLO-18-ACJ-78	8.7	9.3	5.189	-	0.788
JLO-18-ACJ-79	10.4	11.2	8.747	-	0.778
JLO-18-ACJ-80	9.1	9.8	5.735	-	0.761
JLO-18-ACJ-81	9.5	10.2	6.945	-	0.810
JLO-18-ACJ-82	9.4	10.0	6.235	-	0.751
JLO-18-ACJ-83	8.5	9.1	5.109	-	0.832
JLO-18-ACJ-84	7.1	7.5	3.523	-	0.984
JLO-18-ACJ-85	8.3	8.9	4.275	-	0.748
JLO-18-ACJ-86	8.2	8.7	4.510	-	0.818
JLO-18-ACJ-87	8.6	9.2	4.909	-	0.772
JLO-18-ACJ-88	5.3	5.5	1.199	-	0.805
JLO-18-ACJ-89	6.3	6.7	2.189	-	0.875
JLO-18-ACJ-90	5.8	6.1	1.643	-	0.842
JLO-18-ACJ-91	7.8	8.5	3.861	-	0.814
JLO-18-ACJ-92	5.3	5.6	1.238	-	0.832
JLO-18-ACJ-93	8.2	8.6	4.162	-	0.755
JLO-18-ACJ-94	6.2	6.6	2.044	-	0.858
JLO-18-ACJ-95	7.1	7.5	2.966	-	0.829
JLO-18-ACJ-96	6.3	6.6	2.081	-	0.832
JLO-18-ACJ-97	6.2	6.5	2.321	-	0.974
JLO-18-ACJ-98	6.3	6.7	2.237	-	0.895
JLO-18-ACJ-99	5.4	5.6	1.326	-	0.842
JLO-18-ACJ-100	6.1	6.5	1.937	-	0.853
JLO-18-ACJ-101	7.8	8.3	3.464	-	0.730
JLO-18-ACJ-102	5.6	6.0	1.479	-	0.842
JLO-18-ACJ-103	5.8	6.1	1.694	-	0.868
JLO-18-ACJ-104	5.9	6.3	1.938	-	0.944
JLO-18-ACJ-105	6.0	6.4	1.741	-	0.806
JLO-18-ACJ-106	6.9	7.4	2.805	-	0.854

Table G.5: Arctic Charr Measurements from Fish Captured at Camp Lake by Electrofishing, Mary River Project CREMP, August 2018

Specimen ID		Fork Length (cm)	Total Length (cm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
JLO-18-ACJ-107		4.9	5.2	0.895	-	0.761
JLO-18-ACJ-108		3.9	4.2	0.615	-	1.037
JLO-18-ACJ-109		3.5	3.6	0.312	-	0.728
Overall Catch Summary	Sample Size (N)	109	109	109	11	109
	Average	8.9	9.5	7.165	1.8	0.819
	Median	8.5	9.1	4.888	2	0.814
	Standard Deviation	2.6	2.8	6.519	1.0	0.065
	Standard Error	0.2	0.3	0.624	0.3	0.006
	Minimum	3.5	3.6	0.312	0	0.680
	Maximum	16.4	17.7	36.690	3	1.037
Young-of-the-Year Catch Summary	proportion of YOY	3%				
	Sample Size (N)	3	3	3	1	3
	Average	3.8	4.0	0.504	0	0.917
	Median	3.9	4.2	0.586	0	0.988
	Standard Deviation	0.2	0.3	0.167	-	0.166
	Standard Error	0.1	0.2	0.097	-	0.096
	Minimum	3.5	3.6	0.312	0	0.728
	Maximum	3.9	4.2	0.615	0	1.037

Table G.6: Results of Nearshore Arctic Charr Young-of-the-Year (YOY) and Non-YOY Health Endpoint Statistical Comparisons between Camp Lake (JLO) and Reference Lake 3 (REF), Mary River Project CREMP, August 2018

Group	Indicator	Endpoint	Variables		Sample Size		Test	ANCOVA Model Statistics			Summary Statistics ^b			Test P-value	Magnitude of Difference (%) ^{c,d}
			Response	Covariate	REF	JLO		Interaction Model	Parallel Slope Model	Covariate Value for Comparisons ^a					
								Interaction P-value	Covariate P-value		Statistic	REF	JLO		
All Fish	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	100	109	K-S	-	-	-	-	-	-	<0.001	-54
YOY	Body Size	Fork Length	log[Fork Length (cm)]	-	8	3	tequal	-	-	-	Geometric Mean	3.4	3.8	0.22	12
		Body Weight	log[Body Weight (g)]	-	8	3	tequal	-	-	-	Geometric Mean	0.334	0.504	0.162	51
	Energy Storage	Condition ^e	log[Body Weight (g)]	log[Fork Length (cm)]	7	3	ANCOVA	0.00525	<0.001	'3.50	Predicted Mean	0.352	0.312	0.489	-11
					7	3	ANCOVA	0.00525	<0.001	'3.90	Predicted Mean	0.473	0.6	0.489	27
Non-YOY	Survival	Length Frequency Distribution	Fork Length (cm)	-	92	106	K-S	-	-	-	-	-	-	<0.001	-54
	Body Size	Fork Length	Fork Length (cm)	-	92	106	tunequal	-	-	-	Median	6.2	8.7	<0.001	40
		Body Weight	Body Weight (g)	-	92	106	tunequal	-	-	-	Median	2.28	5.36	<0.001	135
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	92	106	ANCOVA ^f	0.00876	<0.001	'7.44	Adjusted Mean	4.46	3.84	<0.001	-14

Area P-value < 0.1 or Interaction P-value < 0.05

Absolute Magnitude of Difference ≥ 10% for Condition (EEM effect endpoint)

^a The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

^b The median, mean (geometric mean for log₁₀-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted mean values from the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction was detected.

^c The magnitude of difference calculated as: [(exposed area mean - reference area mean) / reference area mean] x 100. When there is a significant interaction in the ANCOVA, the magnitude of difference is calculated at the minimum and maximum values of overlap in covariate values as : [(exposed area predicted mean - reference area predicted mean) / reference area predicted mean] x 100.

^d Calculated as the maximum difference in the cumulative relative frequency distributions (CRFD) between areas. A negative difference implies that the exposed area has more fish less than the length where the maximum difference in CFRDs was observed. A positive difference implies that the exposed area has fewer fish less than the length where the maximum difference in CFRDs was observed.

^e One outlier (Fish ID:REF318-ACJ-11; Studentized residual = -4.3) was removed from the analysis

^f ANCOVA proceeded under the assumption that the slopes are practically parallel (R2 of interaction model = 0.9888 and R2 of parallel slope model = 0.9884; a difference < 0.02) following Environment Canada (2012).

Table G.7: Results of Nearshore Arctic Charr Non-Young-of-the-Year (Non-YOY) Health Endpoint Statistical Comparisons between Samples Collected in 2018 and the Baseline Period at Individual Mine-Exposed Lakes, Mary River Project 2018 CREMP

Lake	Group	Indicator	Endpoint	Variables		Sample Size		Test	ANCOVA Model Statistics			Summary Statistics ^b			Test P-value	Magnitude of Difference (%) ^{c,d}
				Response	Covariate	Baseline	2018		Interaction Model	Parallel Slope Model	Covariate Value for Comparisons ^a					
									Interaction P-value	Covariate P-value		Statistic	Baseline	2018		
Camp (JLO)	Non-YOY	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	51	106	K-S	-	-	-	-	-	-	<0.001	45
		Body Size	Fork Length	Fork Length (cm)	-	51	106	M-W	-	-	-	Median	11.8	8.5	<0.001	-28
			Body Weight	Body Weight (g)	-	51	106	tunequal	-	-	-	Geometric Mean	12.3	5.36	<0.001	-56
		Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	51	106	ANCOVA	0.0534	<0.001	9.44	Adjusted Mean	8.62	7.83	<0.001	-9.2
Sheardown NW (DLO-01)	Non-YOY	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	247	88	K-S	-	-	-	-	-	-	<0.001	32
		Body Size	Fork Length	Fork Length (cm)	-	247	88	M-W	-	-	-	Median	8.2	7.2	0.0017	-12
			Body Weight	Body Weight (g)	-	247	88	M-W	-	-	-	Median	6.00	3.00	<0.001	-50
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	247	88	ANCOVA	0.259	<0.001	8.68	Adjusted Mean	8.19	7.38	<0.001	-9.9
Sheardown SE (DLO-02) ^e	Non-YOY	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	16	53	K-S	-	-	-	-	-	-	0.009	-47
		Body Size	Fork Length	log[Fork Length (cm)]	-	16	53	M-W	-	-	-	Median	6.30	7.00	<0.001	11
			Body Weight	Body Weight (g)	-	16	53	M-W	-	-	-	Median	2.50	3.00	0.109	20
		Energy Storage	Condition ^e	log[Body Weight (g)]	log[Fork Length (cm)]	16	53	ANCOVA	0.00146	<0.001	7.08	Adjusted Mean	3.57	3.02	<0.001	-15

Area P-value < 0.1 or Interaction P-value < 0.05

Absolute Magnitude of Difference ≥ 10% for Condition (EEM effect endpoint)

^a The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

^b The median, mean (geometric mean for log₁₀-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted mean values from the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction was detected.

^c The magnitude of difference calculated as: [(2018 mean - baseline mean) / baseline area mean] x 100. When there is a significant interaction in the ANCOVA, the magnitude of difference is calculated at the minimum and maximum values of overlap in covariate values as : [(2018 predicted mean - baseline predicted mean) / baseline predicted mean] x 100.

^d Calculated as the maximum difference in the cumulative relative frequency distributions (CRFD) between groups. A negative difference implies that 2018 has more fish less than the length where the maximum difference in CFRDs was observed. A positive difference implies that 2017 has fewer fish less than the length where the maximum difference in CFRDs was observed.

^e Poor accuracy in arctic charr weight measurements occurred during baseline studies (i.e., weight measurements to the nearest gram), and therefore greater uncertainty was associated with the statistical evaluation of data between the mine operational and baseline periods.

Table G.8: Arctic Charr Estimated Sample Sizes to Detect Various Effect Sizes as a Percentage Change in Respective Fish Health Endpoints at Camp Lake Using 2018 Data Relative to Reference Lake 3 Data (2018) or Camp Lake Baseline Data (2006 to 2013) with $\alpha=\beta=0.1$, Mary River Project 2018 CREMP

Comparison	Group	Indicator	Endpoint	Variables		Test ^c	S ^a	COV (%) ^b	Minimum Sample Size to Detect an Effect Size (% Increase/Decrease Relative to Reference) with α=β=0.1										
				Response	Covariate				log(Response)	5%	10%	20%	25%	30%	33%	40%	50%	100%	
										-5%	-9%	-17%	-20%	-23%	-25%	-29%	-33%	-50%	
										Response	±5%	±10%	±20%	±25%	±30%	±33%	±40%	±50%	±100%
Nearshore Arctic Charr (Electrofishing) versus Ref. Lake 3, 2018 Data	Non-YOY	Body Size	Fork Length	Fork Length (cm)	-	tunequal	0.10533	-	log10(Response)	424	112	32	21	16	13	10	7	4	
			Body Weight	Body Weight (g)	-	tunequal	0.31717	-	log10(Response)	3,839	1,007	276	185	134	112	82	57	20	
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.03961	-	log10(Response)	62	18	7	5	5	4	4	4	3	
Nearshore Arctic Charr (Electrofishing) 2018 versus Baseline	Non-YOY	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.12518	4.05	Response	14	5	3	3	3	3	3	3	3	
			Body Weight	Body Weight (g)	-	tunequal	0.36500	-	log10(Response)	5,083	1,333	365	244	177	147	108	75	26	
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.03560	-	log10(Response)	51	15	6	5	4	4	4	3	3	
Littoral/Profundal Arctic Charr (Gill Netting) versus Ref. Lake 3, 2018 Data	All fish	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.0685	5.63	Response	27	9	4	4	3	3	3	3	3	
			Body Weight	Body Weight (g)	-	M-W	0.207	1.39	Response	4	3	3	3	3	3	3	3	3	
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0324	-	log10(Response)	42	13	5	4	4	4	4	3	3	
Littoral/Profundal Arctic Charr (Gill Netting) 2018 versus Baseline	All fish	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.104	3.79	Response	13	5	3	3	3	3	3	3	3	
			Body Weight	Body Weight (g)	-	M-W	0.314	0.829	Response	3	3	3	3	3	3	3	3	3	
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0627	-	log10(Response)	152	42	13	9	8	7	6	5	4	

^a Pooled standard deviation of the regression residuals

^b Coefficient of variation (pooled standard deviation/reference mean)×100%

^c Sample size estimates for the M-W test were estimated based for a two-sample t-test using sample sizes multiplied by 0.864. The 0.864 is the lower bound of the asymptotic relative efficiency of the Mann-Whitney test and the two-sample t-test (Hodges and Lehmann 1956). Estimates were generated for the response variable on the untransformed and log₁₀-transformed scales and the lowest sample size is reported.

Table G.9: Arctic Charr Measurements from Fish Captured at Reference Lake 3 by Gill Netting, Mary River Project CREMP, August 2018

Specimen ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Fulton's Condition Factor (K)
REF318-AC-01	3	35.2	37.9	388	0.890
REF318-AC-02	2	35.7	38.0	333	0.732
REF318-AC-03	2	48.1	51.3	910	0.818
REF318-AC-04	2	35.0	37.6	350	0.816
REF318-AC-05	2	32.5	35.1	273	0.795
REF318-AC-06	2	32.9	35.2	303	0.851
REF318-AC-07	1½	32.9	35.7	308	0.865
REF318-AC-08	2	33.7	36.5	355	0.928
REF318-AC-09	3	59.8	63.1	2,100	0.982
REF318-AC-10	2	50.1	53.4	960	0.763
REF318-AC-11	2	35.8	38.3	315	0.687
REF318-AC-12	3	55.6	58.8	1,250	0.727
REF318-AC-13	2	34.1	36.6	320	0.807
REF318-AC-14	1½	54.9	58.0	1,510	0.913
REF318-AC-15	2	56.4	59.7	1,720	0.959
REF318-AC-16	1½	21.1	22.8	77	0.820
REF318-AC-17	2	33.2	37.1	343	0.937
REF318-AC-18	1½	33.1	35.8	330	0.910
REF318-AC-19	2	32.5	35.3	310	0.903
REF318-AC-20	2	34.5	37.8	368	0.896
REF318-AC-21	1½	58.1	61.2	1,920	0.979
REF318-AC-22	1½	33.8	36.2	278	0.720
REF318-AC-23	2	32.0	34.6	280	0.854
REF318-AC-24	2	31.2	33.4	268	0.882
REF318-AC-25	2	31.1	33.7	285	0.947
REF318-AC-26	2	49.9	52.9	999	0.804
REF318-AC-27	2	34.6	37.2	328	0.792
REF318-AC-28	3	34.8	37.5	355	0.842
REF318-AC-29	3	56.3	59.5	1,610	0.902
REF318-AC-30	3	36.3	39.0	395	0.826
REF318-AC-31	2	32.8	35.6	305	0.864
REF318-AC-32	2	32.4	34.9	310	0.911
REF318-AC-33	2	32.5	35.3	310	0.903
REF318-AC-34	3	34.9	38.1	330	0.776
Overall Catch Summary	Sample Size (N)	34	34	34	34
	Average	38.8	41.6	612	0.853
	Median	34.6	37.4	332	0.859
	Standard Deviation	10.0	10.3	552	0.077
	Standard Error	1.7	1.8	95	0.013
	Minimum	21.1	22.8	77	0.687
	Maximum	59.8	63.1	2,100	0.982

Table G.10: Gill Netting Catch Records for Camp Lake, Mary River Project CREMP, August 2018

Gill Net Set ID	Location (NAD83, UTM Zone 17W)		Length (m)	Set Date	Lift Date	Set Time	Lift Time	Hours	Effort (m*hrs/100 m)	Arctic Charr Catch Per Mesh Size			Total Catch	CPUE
	Easting	Northing								1½"	2"	3"		
JLO-18-GN-01	557726	7914710	91.4	19-Aug-18	19-Aug-18	9:00	10:35	1.58	1.45	2	3	2	7	4.84
JLO-18-GN-02	557759	7914591	91.4	19-Aug-18	19-Aug-18	9:15	11:00	1.75	1.60	2	3	2	7	4.38
JLO-18-GN-03	557741	7914293	91.4	19-Aug-18	19-Aug-18	9:30	12:00	2.50	2.28	1	1	5	7	3.06
JLO-18-GN-04	552685	7914324	91.4	19-Aug-18	19-Aug-18	9:40	12:20	2.67	2.44	0	0	1	1	0.41
JLO-18-GN-05	557375	7914878	91.4	19-Aug-18	19-Aug-18	9:50	12:15	2.42	2.21	8	4	11	23	10.41
JLO-18-GN-06	557726	7914710	91.4	19-Aug-18	19-Aug-18	10:45	13:30	2.75	2.51	4	1	9	14	5.57
JLO-18-GN-07	557759	7914591	91.4	19-Aug-18	19-Aug-18	11:20	14:30	3.17	2.89	2	1	3	6	2.07
JLO-18-GN-08	557741	7914293	91.4	19-Aug-18	19-Aug-18	11:45	14:45	3.00	2.74	1	4	9	14	5.11
JLO-18-GN-09	557375	7914878	91.4	19-Aug-18	19-Aug-18	13:20	15:50	2.50	2.28	2	3	5	10	4.4
JLO-18-GN-10	557726	7914710	91.4	19-Aug-18	19-Aug-18	14:55	17:00	2.08	1.90	0	2	3	5	2.63
Total									22.32	22	22	50	94	4.29

Note: Catch-per-unit-effort (CPUE) represents the number of fish captured per 100 m-hours of net.

Table G.11: Arctic Charr Measurements from Fish Captured at Camp Lake by Gill Netting, Mary River Project CREMP, August 2018

Specimen ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Fulton's Condition Factor (K)
JLO-18-AC-01	1½	38.9	42.4	580	0.985
JLO-18-AC-02	1½	35.4	38.4	455	1.026
JLO-18-AC-03	2	40.5	43.7	570	0.858
JLO-18-AC-04	2	30.5	33.2	280	0.987
JLO-18-AC-05	2	34.5	37.5	395	0.962
JLO-18-AC-06	3	37.0	40.5	485	0.957
JLO-18-AC-07	3	38.5	41.9	525	0.920
JLO-18-AC-08	1½	38.3	41.7	520	0.926
JLO-18-AC-09	1½	35.3	38.6	425	0.966
JLO-18-AC-10	2	34.9	37.9	395	0.929
JLO-18-AC-11	2	38.0	41.2	565	1.030
JLO-18-AC-12	2	37.5	40.6	490	0.929
JLO-18-AC-13	3	38.5	41.8	535	0.938
JLO-18-AC-14	3	36.6	40.0	515	1.050
JLO-18-AC-15	3	40.1	43.2	510	0.791
JLO-18-AC-16	3	35.8	39.1	415	0.904
JLO-18-AC-17	3	38.8	41.9	580	0.993
JLO-18-AC-18	3	41.4	44.3	635	0.895
JLO-18-AC-19	3	40.2	43.5	580	0.893
JLO-18-AC-20	2	38.5	41.9	495	0.867
JLO-18-AC-21	1½	38.3	41.5	505	0.899
JLO-18-AC-22	3	38.1	41.6	510	0.922
JLO-18-AC-23	3	38.5	42.0	565	0.990
JLO-18-AC-24	3	38.1	42.0	470	0.850
JLO-18-AC-25	3	38.4	41.9	520	0.918
JLO-18-AC-26	3	37.7	40.7	490	0.914
JLO-18-AC-27	3	39.4	42.6	545	0.891
JLO-18-AC-28	3	34.8	38.2	435	1.032
JLO-18-AC-29	3	34.5	37.5	405	0.986
JLO-18-AC-30	3	40.5	44.3	640	0.963
JLO-18-AC-31	3	38.2	41.1	520	0.933
JLO-18-AC-32	3	36.9	39.9	480	0.955
JLO-18-AC-33	3	37.1	40.4	560	1.097
JLO-18-AC-34	2	38.9	42.0	550	0.934
JLO-18-AC-35	2	37.3	40.1	525	1.012
JLO-18-AC-36	2	30.7	33.4	295	1.020
JLO-18-AC-37	2	38.6	42.9	530	0.922
JLO-18-AC-38	1½	37.6	41.9	500	0.941
JLO-18-AC-39	1½	37.2	41.2	510	0.991
JLO-18-AC-40	1½	34.6	37.6	450	1.086
JLO-18-AC-41	1½	38.8	42.4	545	0.933
JLO-18-AC-42	1½	38.2	41.5	540	0.969
JLO-18-AC-43	1½	38.5	41.5	595	1.043
JLO-18-AC-44	1½	37.9	41.9	475	0.873
JLO-18-AC-45	1½	43.1	46.7	820	1.024
JLO-18-AC-46	3	74.2	79.5	3,750	0.918

Table G.11: Arctic Charr Measurements from Fish Captured at Camp Lake by Gill Netting, Mary River Project CREMP, August 2018

Specimen ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Fulton's Condition Factor (K)
JLO-18-AC-47	3	58.1	62.2	1,800	0.918
JLO-18-AC-48	3	42.6	45.7	740	0.957
JLO-18-AC-49	3	32.2	35.1	330	0.988
JLO-18-AC-50	3	36.4	39.8	490	1.016
JLO-18-AC-51	3	38.2	41.5	560	1.005
JLO-18-AC-52	3	38.5	41.5	550	0.964
JLO-18-AC-53	3	36.4	39.4	480	0.995
JLO-18-AC-54	2	38.8	42.1	525	0.899
JLO-18-AC-55	1½	38.7	47.9	555	0.958
JLO-18-AC-56	1½	35.5	38.6	450	1.006
JLO-18-AC-57	1½	35.0	37.7	465	1.085
JLO-18-AC-58	1½	57.8	61.6	1,820	0.943
JLO-18-AC-59	3	38.6	42.0	525	0.913
JLO-18-AC-60	3	38.9	42.3	575	0.977
JLO-18-AC-61	3	37.0	40.5	435	0.859
JLO-18-AC-62	2	36.7	40.3	515	1.042
JLO-18-AC-63	1½	37.0	40.9	455	0.898
JLO-18-AC-64	1½	48.5	52.5	1,150	1.008
JLO-18-AC-65	3	38.0	41.7	575	1.048
JLO-18-AC-66	3	39.1	42.7	570	0.954
JLO-18-AC-67	3	38.8	42.7	500	0.856
JLO-18-AC-68	3	37.3	40.1	505	0.973
JLO-18-AC-69	3	36.2	39.2	470	0.991
JLO-18-AC-70	3	36.1	39.4	425	0.903
JLO-18-AC-71	3	39.2	42.4	640	1.062
JLO-18-AC-72	3	37.4	41.4	515	0.984
JLO-18-AC-73	3	38.0	41.1	505	0.920
JLO-18-AC-74	2	40.2	43.6	615	0.947
JLO-18-AC-75	2	33.3	36.3	360	0.975
JLO-18-AC-76	2	36.4	39.5	505	1.047
JLO-18-AC-77	2	40.2	43.5	610	0.939
JLO-18-AC-78	1½	34.4	37.4	390	0.958
JLO-18-AC-79	1½	37.6	40.7	465	0.875
JLO-18-AC-80	1½	37.5	40.9	475	0.901
JLO-18-AC-81	2	38.6	42.1	495	0.861
JLO-18-AC-82	2	36.9	40.2	525	1.045
JLO-18-AC-83	2	36.1	39.2	480	1.020
JLO-18-AC-84	3	35.3	38.2	420	0.955
JLO-18-AC-85	3	36.9	39.8	465	0.925
JLO-18-AC-86	3	35.7	38.9	495	1.088
JLO-18-AC-87	3	39.1	41.9	515	0.862
JLO-18-AC-88	3	40.8	44.4	561	0.826
JLO-18-AC-89	3	35.1	38.1	400	0.925
JLO-18-AC-90	3	43.5	47.2	755	0.917
JLO-18-AC-91	3	38.8	42.2	510	0.873
JLO-18-AC-92	3	36.2	39.1	415	0.875

Table G.11: Arctic Charr Measurements from Fish Captured at Camp Lake by Gill Netting, Mary River Project CREMP, August 2018

Specimen ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Fulton's Condition Factor (K)
JLO-18-AC-93	2	38.8	42.9	555	0.950
JLO-18-AC-94	2	38.0	41.3	570	1.039
Overall Catch Summary	Sample Size (N)	94	94	94	94
	Average	38.5	45.7	579	0.955
	Median	38.0	41.5	513	0.954
	Standard Deviation	5.3	37.5	395	0.064
	Standard Error	0.6	3.9	41	0.007
	Minimum	30.5	33.2	280	0.791
	Maximum	74.2	401.1	3,750	1.097

Table G.12: Results of Littoral/Profundal Arctic Charr Health Endpoint Statistical Comparisons between 2018 Camp Lake (JLO) and 2018 Reference Lake 3 (REF) Data, and for Camp Lake between 2018 and the Mine Baseline Period (2005 to 2013), Mary River Project 2018 CREMP

Comparison	Indicator	Endpoint	Variables		Sample Size		Test	ANCOVA Model Statistics			Summary Statistics ^b			Test P-value	Magnitude of Difference (%) ^{c,d}
			Response	Covariate	REF 2018 or JLO Base	JLO 2018		Interaction Model	Parallel Slope Model	Covariate Value for Comparisons ^a					
											Interaction P-value	Covariate P-value			
Camp Lake versus Reference Lake 3, 2018	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	34	94	K-S	-	-	-	-	-	-	<0.001	-52
	Body Size	Fork Length	Fork Length (cm)	-	34	94	M-W	-	-	-	Median	34.5	38	<0.001	10
		Body Weight	Body Weight (g)	-	34	94	M-W	-	-	-	Median	331	512	<0.001	55
	Energy Storage	Condition ^e	log[Body Weight (g)]	log[Fork Length (cm)]	34	94	ANCOVA	0.028	<0.001	38.1	Adjusted Mean	487	546	<0.001	12
Camp Lake 2018 versus Baseline	Survival	Length Frequency Distribution	Fork Length (cm)	-	155	94	K-S	-	-	-	-	-	-	<0.001	-57
	Body Size	Fork Length	Fork Length (cm)	-	155	94	M-W	-	-	-	Median	33	38	<0.001	15
		Body Weight	Body Weight (g)	-	155	94	M-W	-	-	-	Median	350	512	<0.001	46
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	155	94	ANCOVA	0.414	<0.001	34.6	Adjusted Mean	440	433	0.424	-1.6

Area P-value < 0.1 or Interaction P-value < 0.05

Absolute Magnitude of Difference ≥ 10% for Condition (EEM effect endpoint)

^a The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

^b The median, mean (geometric mean for log₁₀-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted mean values from the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction was detected.

^c The magnitude of difference calculated as: [(exposed area mean - reference area mean) / reference area mean] x 100. When there is a significant interaction in the ANCOVA, the magnitude of difference is calculated at the minimum and maximum values of overlap in covariate values as : [(exposed area predicted mean - reference area predicted mean) / reference area predicted mean] x 100.

^d Calculated as the maximum difference in the cumulative relative frequency distributions (CRFD) between areas. A negative difference implies that the exposed area has more fish less than the length where the maximum difference in CFRDs was observed. A positive difference implies that the exposed area has fewer fish less than the length where the maximum difference in CFRDs was observed.

Table G.13: Arctic Charr Measurements from Fish Captured at Sheardown Lake NW by Electrofishing, Mary River Project CREMP, August 2018

Specimen ID	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
DLO1-18-ACJ-01	6.6	6.9	2.198	1	0.765
DLO1-18-ACJ-02	8.6	9.1	5.977	2	0.940
DLO1-18-ACJ-03	6.6	6.9	2.636	1	0.917
DLO1-18-ACJ-04	3.2	3.3	0.267	0	0.815
DLO1-18-ACJ-05	13.8	14.8	22.349	3	0.850
DLO1-18-ACJ-06	9.4	9.9	6.284	2	0.757
DLO1-18-ACJ-07	6.1	6.3	1.895	1	0.835
DLO1-18-ACJ-08	3.8	4.0	0.479	0	0.873
DLO1-18-ACJ-09	9.3	9.9	7.291	1	0.906
DLO1-18-ACJ-10	11.5	12.3	15.725	3	1.034
DLO1-18-ACJ-11	6.0	6.3	2.158	-	0.999
DLO1-18-ACJ-12	3.9	4.1	0.483	-	0.814
DLO1-18-ACJ-13	8.6	9.0	5.730	-	0.901
DLO1-18-ACJ-14	5.1	5.3	1.214	-	0.915
DLO1-18-ACJ-15	9.8	10.2	7.870	-	0.836
DLO1-18-ACJ-16	5.6	5.8	1.790	-	1.019
DLO1-18-ACJ-17	6.4	6.6	2.160	-	0.824
DLO1-18-ACJ-18	5.8	6.0	1.674	-	0.858
DLO1-18-ACJ-19	5.5	5.7	1.382	-	0.831
DLO1-18-ACJ-20	4.0	4.2	0.493	-	0.770
DLO1-18-ACJ-21	3.9	4.1	0.543	-	0.915
DLO1-18-ACJ-22	8.7	9.0	6.129	-	0.931
DLO1-18-ACJ-23	6.5	6.8	2.471	-	0.900
DLO1-18-ACJ-24	6.5	6.8	2.348	-	0.855
DLO1-18-ACJ-25	6.4	6.7	2.129	-	0.812
DLO1-18-ACJ-26	5.3	5.5	1.387	-	0.932
DLO1-18-ACJ-27	6.5	6.8	2.461	-	0.896
DLO1-18-ACJ-28	9.9	10.5	9.989	-	1.029
DLO1-18-ACJ-29	5.9	6.2	2.384	-	1.161
DLO1-18-ACJ-30	7.0	7.4	3.168	-	0.924
DLO1-18-ACJ-31	5.6	5.8	1.620	-	0.922
DLO1-18-ACJ-32	10.0	10.6	8.126	-	0.813
DLO1-18-ACJ-33	10.6	11.1	11.032	-	0.926
DLO1-18-ACJ-34	9.9	10.5	9.503	-	0.979
DLO1-18-ACJ-35	9.3	9.6	7.989	-	0.993
DLO1-18-ACJ-36	14.9	15.7	24.267	-	0.734
DLO1-18-ACJ-37	11.0	11.6	13.548	-	1.018
DLO1-18-ACJ-38	7.9	8.4	4.485	-	0.910
DLO1-18-ACJ-39	6.7	6.9	2.615	-	0.869
DLO1-18-ACJ-40	6.9	7.3	2.783	-	0.847
DLO1-18-ACJ-41	6.8	7.2	2.778	-	0.883
DLO1-18-ACJ-42	5.4	5.6	1.428	-	0.907
DLO1-18-ACJ-43	7.5	7.8	4.047	-	0.959
DLO1-18-ACJ-44	5.5	5.7	1.352	-	0.813

Table G.13: Arctic Charr Measurements from Fish Captured at Sheardown Lake NW by Electrofishing, Mary River Project CREMP, August 2018

Specimen ID	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
DLO1-18-ACJ-45	7.0	7.4	3.138	-	0.915
DLO1-18-ACJ-46	3.8	4.0	0.531	-	0.968
DLO1-18-ACJ-47	7.2	7.5	3.660	-	0.981
DLO1-18-ACJ-48	4.1	4.3	0.567	-	0.823
DLO1-18-ACJ-49	3.7	3.9	0.457	-	0.902
DLO1-18-ACJ-50	6.4	6.7	2.664	-	1.016
DLO1-18-ACJ-51	6.6	6.9	3.006	-	1.046
DLO1-18-ACJ-52	6.4	6.6	1.952	-	0.745
DLO1-18-ACJ-53	8.1	8.6	6.461	-	1.216
DLO1-18-ACJ-54	8.5	9.0	6.069	-	0.988
DLO1-18-ACJ-55	10.8	11.5	11.010	-	0.874
DLO1-18-ACJ-56	6.5	6.7	2.553	-	0.930
DLO1-18-ACJ-57	6.9	7.2	3.376	-	1.028
DLO1-18-ACJ-58	9.2	9.5	6.367	-	0.818
DLO1-18-ACJ-59	7.4	7.7	3.570	-	0.881
DLO1-18-ACJ-60	6.5	6.8	2.574	-	0.937
DLO1-18-ACJ-61	5.0	5.2	1.115	-	0.892
DLO1-18-ACJ-62	9.0	9.5	6.169	-	0.846
DLO1-18-ACJ-63	6.7	7.0	2.638	-	0.877
DLO1-18-ACJ-64	7.0	7.4	2.750	-	0.802
DLO1-18-ACJ-65	10.6	11.1	9.595	-	0.806
DLO1-18-ACJ-66	6.9	7.2	2.588	-	0.788
DLO1-18-ACJ-67	8.5	8.9	6.068	-	0.988
DLO1-18-ACJ-68	9.8	10.4	7.756	-	0.824
DLO1-18-ACJ-69	8.7	9.0	5.943	-	0.903
DLO1-18-ACJ-70	6.6	6.9	2.588	-	0.900
DLO1-18-ACJ-71	7.2	7.5	3.325	-	0.891
DLO1-18-ACJ-72	8.5	8.9	6.105	-	0.994
DLO1-18-ACJ-73	7.3	7.6	3.303	-	0.849
DLO1-18-ACJ-74	9.6	10.0	7.585	-	0.857
DLO1-18-ACJ-75	5.8	6.1	1.796	-	0.920
DLO1-18-ACJ-76	7.4	7.6	3.556	-	0.878
DLO1-18-ACJ-77	9.8	10.4	7.682	-	0.816
DLO1-18-ACJ-78	9.5	10.0	7.749	-	0.904
DLO1-18-ACJ-79	7.5	7.8	3.809	-	0.903
DLO1-18-ACJ-80	7.2	7.5	3.013	-	0.807
DLO1-18-ACJ-81	10.3	10.7	9.928	-	0.909
DLO1-18-ACJ-82	10.4	10.7	8.547	-	0.760
DLO1-18-ACJ-83	7.7	8.0	3.878	-	0.849
DLO1-18-ACJ-84	8.4	8.8	5.609	-	0.946
DLO1-18-ACJ-85	8.5	8.9	5.003	-	0.815
DLO1-18-ACJ-86	6.3	6.6	2.566	-	1.026
DLO1-18-ACJ-87	5.5	5.7	1.848	-	1.111
DLO1-18-ACJ-88	7.5	7.9	3.587	-	0.850
DLO1-18-ACJ-89	7.2	7.5	3.361	-	0.900
DLO1-18-ACJ-90	6.9	7.2	3.449	-	1.050

Table G.13: Arctic Charr Measurements from Fish Captured at Sheardown Lake NW by Electrofishing, Mary River Project CREMP, August 2018

Specimen ID		Fork Length (cm)	Total Length (cm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
DLO1-18-ACJ-91		6.8	7.1	2.784	-	0.885
DLO1-18-ACJ-92		4.3	4.5	0.673	-	0.846
DLO1-18-ACJ-93		5.7	5.9	1.664	-	0.899
DLO1-18-ACJ-94		7.8	8.1	4.658	-	0.982
DLO1-18-ACJ-95		5.2	5.5	1.308	-	0.930
DLO1-18-ACJ-96		5.6	5.8	1.478	-	0.842
DLO1-18-ACJ-97		3.7	3.8	0.384	-	0.758
DLO1-18-ACJ-98		5.8	6.0	1.908	-	0.978
Overall Catch Summary	Sample Size (N)	98	98	98	10	98
	Average	7.3	8	4.432	1.4	0.900
	Median	6.9	7	3.010	1.0	0.900
	Standard Deviation	2.2	2	4.130	1.1	0.089
	Standard Error	0.2	0	0.417	0.3	0.009
	Minimum	3.2	3	0.267	0.0	0.734
	Maximum	14.9	16	24.267	3.0	1.216
Young-of-the-Year Catch Summary	proportion of YOY	10%				
	Sample Size (N)	10	10	10	2	10
	Average	3.8	4.0	0.488	0	0.848
	Median	3.9	4.1	0.488	0	0.835
	Standard Deviation	0.3	0.3	0.109	0	0.066
	Standard Error	0.1	0.1	0.034	0	0.021
	Minimum	3.2	3.3	0.267	0	0.758
	Maximum	4.3	4.5	0.673	0	0.968

Table G.14: Results of Nearshore Arctic Charr Young-of-the-Year (YOY) and Non-YOY Health Endpoint Statistical Comparisons between Sheardown Lake NW (DLO1) and Reference Lake 3 (REF), Mary River Project CREMP, August 2018

Group	Indicator	Endpoint	Variables		Sample Size		Test	ANCOVA Model Statistics			Summary Statistics ^b			Test P-value	Magnitude of Difference (%) ^{c,d}
			Response	Covariate	REF	DLO1		Interaction Model	Parallel Slope Model	Covariate Value for Comparisons ^a					
								Interaction P-value	Covariate P-value		Statistic	REF	DLO1		
All Fish	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	100	98	K-S	-	-	-	-	-	-	<0.001	-34
YOY	Body Size	Fork Length	Fork Length (cm)	-	8	10	tequal	-	-	-	Mean	3.4	3.8	0.0216	14
		Body Weight	Body Weight (g)	-	8	10	tequal	-	-	-	Mean	0.334	0.488	0.0298	46
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	8	10	ANCOVA	0.555	<0.001	3.60	Adjusted Mean	0.391	0.408	0.483	4
Non-YOY	Survival	Length Frequency Distribution	Fork Length (cm)	-	92	88	K-S	-	-	-	-	-	-	<0.001	-39
	Body Size	Fork Length	Fork Length (cm)	-	92	88	M-W	-	-	-	Median	5.8	7.2	<0.001	24
		Body Weight	Body Weight (g)	-	92	88	M-W	-	-	-	Median	1.83	3.34	<0.001	83
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	92	88	ANCOVA	0.0321	<0.001	6.81	Adjusted Mean	3.27	3.11	0.00243	-5

Area P-value < 0.1 or Interaction P-value < 0.05

Absolute Magnitude of Difference ≥ 10% for Condition (EEM effect endpoint)

^a The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

^b The median, mean (geometric mean for log₁₀-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted mean values from the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction was detected.

^c The magnitude of difference calculated as: [(exposed area mean - reference area mean) / reference area mean] x 100. When there is a significant interaction in the ANCOVA, the magnitude of difference is calculated at the minimum and maximum values of overlap in covariate values as : [(exposed area predicted mean - reference area predicted mean) / reference area predicted mean] x 100.

^d Calculated as the maximum difference in the cumulative relative frequency distributions (CRFD) between areas. A negative difference implies that the exposed area has more fish less than the length where the maximum difference in CFRDs was observed. A positive difference implies that the exposed area has fewer fish less than the length where the maximum difference in CFRDs was observed.

Table G.15: Arctic Charr Estimated Sample Sizes to Detect Various Effect Sizes as a Percentage Change in Respective Fish Health Endpoints at Sheardown Lake NW (DLO1) Using 2018 Data Relative to Reference Lake 3 Data (2018) or Sheardown Lake NW Baseline Data (2006 to 2013) with $\alpha=\beta=0.1$, Mary River Project 2018 CREMP

Comparison	Group	Indicator	Endpoint	Variables		Test ^c	S ^a	COV (%) ^b	Minimum Sample Size to Detect an Effect Size (% Increase/Decrease Relative to Reference) with α=β=0.1										
				Response	Covariate				log(Response)	5%	10%	20%	25%	30%	33%	40%	50%	100%	
										-5%	-9%	-17%	-20%	-23%	-25%	-29%	-33%	-50%	
										Response	±5%	±10%	±20%	±25%	±30%	±33%	±40%	±50%	±100%
Nearshore Arctic Charr (Electrofishing) versus Ref. Lake 3, 2018 Data	Non-YOY	Body Size	Fork Length	Fork Length (cm)	-	tequal	-	8.50	Response	51	14	5	3	3	3	3	2	2	
			Body Weight	Body Weight (g)	-	tequal	-	2.5	Response	5	3	2	2	2	2	2	2	2	
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.04437	-	log10(Response)	77	22	8	6	5	5	4	4	3	
Nearshore Arctic Charr (Electrofishing) 2018 versus Baseline	Non-YOY	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.09542	3.74	Response	13	5	3	3	3	3	3	3	3	
			Body Weight	Body Weight (g)	-	M-W	0.29004	0.85	Response	3	3	3	3	3	3	3	3	3	
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.04497	-	log10(Response)	79	22	8	6	5	5	4	4	3	
Littoral/Profundal Arctic Charr (Gill Netting) versus Ref. Lake 3, 2018 Data	All fish	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.0865	4.82	Response	20	6	4	3	3	3	3	3	3	
			Body Weight	Body Weight (g)	-	M-W	0.263	1.37	Response	4	3	3	3	3	3	3	3	3	
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0377	-	log10(Response)	57	16	6	5	4	4	4	4	3	
Littoral/Profundal Arctic Charr (Gill Netting) 2018 versus Baseline	All fish	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.0943	4.62	Response	19	6	4	3	3	3	3	3	3	
			Body Weight	Body Weight (g)	-	M-W	0.286	1.35	Response	4	3	3	3	3	3	3	3	3	
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0519	-	log10(Response)	105	29	10	7	6	5	5	4	3	

^a Pooled standard deviation of the regression residuals

^b Coefficient of variation (pooled standard deviation/reference mean)×100%

^c Sample size estimates for the M-W test were estimated based for a two-sample t-test using sample sizes multiplied by 0.864. The 0.864 is the lower bound of the asymptotic relative efficiency of the Mann-Whitney test and the two-sample t-test (Hodges and Lehmann 1956). Estimates were generated for the response variable on the untransformed and log₁₀-transformed scales and the lowest sample size is reported.

Table G.16: Gill Netting Catch Records for Sheardown Lake NW, Mary River Project CREMP, August 2018

Gill Net Set ID	Location (NAD83, UTM Zone 17W)		Length (ft)	Length (m)	Set Date	Lift Date	Set Time	Lift Time	Fishing Hours	Effort (m*hrs/100 m)	Arctic Charr Catch Per Mesh Size			Total Catch	CPUE
	Easting	Northing									1½"	2"	3"		
DLO1-18-GN-01	560276	7913384	300	91.4	18-Aug-18	18-Aug-18	9:05	10:38	1.55	1.42	0	1	0	1	0.706
DLO1-18-GN-02	560517	7913112	300	91.4	18-Aug-18	18-Aug-18	9:15	10:50	1.58	1.44	0	0	0	0	0
DLO1-18-GN-03	560563	7913029	300	91.4	18-Aug-18	18-Aug-18	9:25	11:10	1.75	1.60	0	2	0	2	1.250
DLO1-18-GN-04	560762	7913069	300	91.4	18-Aug-18	18-Aug-18	9:33	11:30	1.95	1.78	1	0	3	4	2.243
DLO1-18-GN-05	559982	7913513	300	91.4	18-Aug-18	18-Aug-18	9:45	11:53	2.13	1.95	1	1	0	2	1.027
DLO1-18-GN-06	560086	7913441	300	91.4	18-Aug-18	18-Aug-18	9:55	12:10	2.25	2.06	0	1	1	2	0.972
DLO1-18-GN-07	560276	7913384	300	91.4	18-Aug-18	18-Aug-18	10:44	12:50	1.10	1.01	0	0	0	0	0
DLO1-18-GN-08	560538	7913170	300	91.4	18-Aug-18	18-Aug-18	11:00	13:10	2.17	1.98	1	1	0	2	1.008
DLO1-18-GN-09	560563	7913029	300	91.4	18-Aug-18	18-Aug-18	11:16	13:30	2.23	2.04	0	0	0	0	0
DLO1-18-GN-10	560762	7913069	300	91.4	18-Aug-18	18-Aug-18	11:37	13:49	2.20	2.01	1	0	0	1	0.497
DLO1-18-GN-11	559982	7913513	300	91.4	18-Aug-18	18-Aug-18	11:57	14:02	2.08	1.90	1	0	0	1	0.526
DLO1-18-GN-12	560780	7913058	300	91.4	18-Aug-18	18-Aug-18	12:20	14:27	2.12	1.94	1	0	0	1	0.516
DLO1-18-GN-13	560501	7912552	300	91.4	18-Aug-18	18-Aug-18	12:58	14:50	1.87	1.71	1	0	0	1	0.585
DLO1-18-GN-14	560599	7912584	300	91.4	18-Aug-18	18-Aug-18	13:20	15:08	1.80	1.65	0	1	0	1	0.608
DLO1-18-GN-15	560175	7912874	300	91.4	18-Aug-18	18-Aug-18	13:35	15:30	1.92	1.76	1	1	1	3	1.709
DLO1-18-GN-16	560762	7913069	300	91.4	18-Aug-18	18-Aug-18	13:53	15:51	1.97	1.80	2	0	1	3	1.665
DLO1-18-GN-17	560514	7912502	300	91.4	18-Aug-18	18-Aug-18	14:12	16:08	1.93	1.76	0	2	0	2	1.133
DLO1-18-GN-18	560780	7913058	300	91.4	18-Aug-18	18-Aug-18	14:31	16:23	1.87	1.71	0	0	1	1	0.585
DLO1-18-GN-19	560501	7912552	300	91.4	18-Aug-18	18-Aug-18	14:57	16:40	1.72	1.57	0	1	0	1	0.636
DLO1-18-GN-20	560599	7912584	300	91.4	18-Aug-18	18-Aug-18	15:11	16:56	1.75	1.60	0	0	1	1	0.625
DLO1-18-GN-21	560175	7912874	300	91.4	18-Aug-18	18-Aug-18	15:35	17:06	1.52	1.39	0	0	0	0	0
DLO1-18-GN-22	560762	7913069	300	91.4	18-Aug-18	18-Aug-18	15:55	17:20	1.42	1.30	0	0	0	0	0
DLO1-18-GN-23	560514	7912502	300	91.4	18-Aug-18	18-Aug-18	16:13	17:32	1.32	1.21	0	0	1	1	0.828
DLO1-18-GN-24	560659	7913070	300	91.4	19-Aug-18	19-Aug-18	8:13	11:36	2.38	2.18	0	0	1	1	0.460
DLO1-18-GN-25	560823	7913084	300	91.4	19-Aug-18	19-Aug-18	8:19	11:40	3.35	3.06	0	1	0	1	0.326
DLO1-18-GN-26	560399	7912966	300	91.4	19-Aug-18	19-Aug-18	8:30	12:25	3.92	3.58	0	4	1	5	1.395
DLO1-18-GN-27	560125	7912823	300	91.4	19-Aug-18	19-Aug-18	8:36	12:39	4.05	3.70	0	1	0	1	0.270
DLO1-18-GN-28	560506	7912536	200	61.0	19-Aug-18	19-Aug-18	8:47	12:55	4.13	2.52	1	-	1	2	0.794
DLO1-18-GN-29	560586	7912578	300	91.4	19-Aug-18	19-Aug-18	8:51	13:14	3.38	3.09	0	2	0	2	0.647
DLO1-18-GN-30	560659	7913070	300	91.4	19-Aug-18	19-Aug-18	11:40	13:57	2.28	2.08	0	0	0	0	0
DLO1-18-GN-31	559809	7913274	300	91.4	19-Aug-18	19-Aug-18	11:57	14:10	2.22	2.03	0	0	0	0	0
DLO1-18-GN-32	560399	7912966	300	91.4	19-Aug-18	19-Aug-18	12:29	14:27	1.97	1.80	0	1	0	1	0.555
DLO1-18-GN-33	560399	7912966	300	91.4	19-Aug-18	19-Aug-18	12:44	14:35	1.85	1.69	1	0	0	1	0.591
DLO1-18-GN-34	560506	7912536	300	91.4	19-Aug-18	19-Aug-18	13:01	14:42	1.68	1.54	0	-	0	0	0
DLO1-18-GN-35	560495	7912539	200	61.0	20-Aug-18	20-Aug-18	13:41	16:07	2.43	1.48	0	-	0	0	0
DLO1-18-GN-36	560403	7913041	200	61.0	20-Aug-18	20-Aug-18	13:32	15:37	2.08	1.27	0	0	1	1	0.789
DLO1-18-GN-37	560385	7912945	300	91.4	20-Aug-18	20-Aug-18	13:36	15:56	2.33	2.13	0	1	2	3	1.408
DLO1-18-GN-39	560580	7912565	300	91.4	20-Aug-18	20-Aug-18	13:45	16:18	2.55	2.33	1	1	0	2	0.858
DLO1-18-GN-40	560573	7912860	300	91.4	20-Aug-18	20-Aug-18	13:57	16:29	2.53	2.31	0	1	0	1	0.432
DLO1-18-GN-41	560467	7912859	300	91.4	20-Aug-18	20-Aug-18	14:01	16:42	2.68	2.45	1	1	0	2	0.816

Table G.16: Gill Netting Catch Records for Sheardown Lake NW, Mary River Project CREMP, August 2018

Gill Net Set ID	Location (NAD83, UTM Zone 17W)		Length (ft)	Length (m)	Set Date	Lift Date	Set Time	Lift Time	Fishing Hours	Effort (m*hrs/100 m)	Arctic Charr Catch Per Mesh Size			Total Catch	CPUE
	Easting	Northing									1½"	2"	3"		
DLO1-18-GN-42	560245	7913473	300	91.4	21-Aug-18	21-Aug-18	8:50	11:15	2.42	2.21	0	1	1	2	0.904
DLO1-18-GN-43	560398	7913316	200	61.0	21-Aug-18	21-Aug-18	9:15	11:30	2.25	1.37	0	-	0	0	0
DLO1-18-GN-44	559917	7913193	300	91.4	21-Aug-18	21-Aug-18	9:35	11:45	2.17	1.98	0	0	0	0	0
DLO1-18-GN-45	560594	7912439	300	91.4	21-Aug-18	21-Aug-18	9:55	12:15	2.33	2.13	0	1	0	1	0.469
DLO1-18-GN-46	560838	7913037	300	91.4	21-Aug-18	21-Aug-18	10:20	12:40	2.33	2.13	0	1	1	2	0.939
DLO1-18-GN-47	559984	7913064	300	91.4	21-Aug-18	21-Aug-18	10:35	11:45	1.17	1.07	0	0	0	0	0
DLO1-18-GN-48	560479	7912800	300	91.4	21-Aug-18	21-Aug-18	12:30	14:50	2.33	2.13	3	0	3	6	2.816
DLO1-18-GN-49	560838	7913037	300	91.4	21-Aug-18	21-Aug-18	12:50	15:30	2.66	2.43	0	1	0	1	0.411
DLO1-18-GN-50	560047	7913428	300	91.4	21-Aug-18	21-Aug-18	13:35	16:10	2.58	2.36	0	0	0	0	0
DLO1-18-GN-51	560504	7913014	200	61.0	21-Aug-18	21-Aug-18	14:35	16:35	2.00	1.22	1	-	0	1	0.820
DLO1-18-GN-52	560594	7912439	300	91.4	21-Aug-18	21-Aug-18	14:50	16:20	1.50	1.37	0	0	0	0	0
DLO1-18-GN-53	560479	7912800	300	91.4	21-Aug-18	21-Aug-18	15:35	17:45	2.17	1.98	0	0	1	1	0.504
DLO1-18-GN-54	560479	7912800	300	91.4	21-Aug-18	21-Aug-18	16:00	18:00	2.00	1.83	0	1	1	2	1.094
DLO1-18-GN-55	560515	7912737	200	61.0	21-Aug-18	21-Aug-18	16:45	18:20	1.58	0.96	0	-	0	0	0
DLO1-18-GN-56	560451	7912846	300	91.4	21-Aug-18	21-Aug-18	17:10	18:45	1.58	1.44	0	0	0	0	0
DLO1-18-GN-57	560586	7912578	300	91.4	19-Aug-18	19-Aug-18	13:18	14:52	1.57	1.44	0	1	1	2	1.393
DLO1-18-GN-58	560245	7913473	300	91.4	21-Aug-18	21-Aug-18	13:30	16:00	2.50	2.29	0	0	0	0	0
Total										108.20	18	30	23	71	0.63

Note: Catch-per-unit-effort (CPUE) represents the number of fish captured per 100 m·hours of net.

Table G.17: Arctic Charr Measurements from Fish Captured at Sheardown Lake NW by Gill Netting, Mary River Project CREMP, August 2018

Specimen ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Fulton's Condition Factor (K)
DLO1-18-AC-01	2	27.9	30.0	178	0.820
DLO1-18-AC-02	2	31.7	33.7	229	0.719
DLO1-18-AC-03	2	37.0	40.5	445	0.879
DLO1-18-AC-04	1.5	27.6	30.1	194	0.923
DLO1-18-AC-05	3	36.4	39.3	383	0.794
DLO1-18-AC-06	3	46.9	49.9	935	0.906
DLO1-18-AC-07	3	38.2	41.5	535	0.960
DLO1-18-AC-08	1.5	64.0	67.8	2,500	0.954
DLO1-18-AC-09	2	33.5	36.8	360	0.958
DLO1-18-AC-10	3	42.9	46.1	730	0.925
DLO1-18-AC-11	2	35.4	38.4	449	1.012
DLO1-18-AC-12	2	28.3	30.7	221	0.975
DLO1-18-AC-13	1.5	37.9	41.2	458	0.841
DLO1-18-AC-14	1.5	51.5	55.0	1,080	0.791
DLO1-18-AC-15	1.5	29.7	32.3	270	1.031
DLO1-18-AC-16	1.5	36.1	39.5	395	0.840
DLO1-18-AC-17	1.5	37.9	40.3	485	0.891
DLO1-18-AC-18	2	29.2	31.6	246	0.988
DLO1-18-AC-19	3	22.7	24.6	102	0.872
DLO1-18-AC-20	2	36.1	39.0	425	0.903
DLO1-18-AC-21	1.5	32.9	35.6	330	0.927
DLO1-18-AC-22	1.5	35.2	38.6	365	0.837
DLO1-18-AC-23	1.5	35.5	38.7	375	0.838
DLO1-18-AC-24	3	33.7	36.4	370	0.967
DLO1-18-AC-25	2	38.2	41.3	495	0.888
DLO1-18-AC-26	2	40.4	43.7	510	0.773
DLO1-18-AC-27	3	39.2	42.4	550	0.913
DLO1-18-AC-28	2	26.5	28.8	172	0.924
DLO1-18-AC-29	3	37.5	40.3	441	0.836
DLO1-18-AC-30	3	37.9	40.6	425	0.781
DLO1-18-AC-31	3	30.2	32.6	254	0.922
DLO1-18-AC-32	2	36.4	39.5	455	0.943
DLO1-18-AC-33	3	39.5	41.5	532	0.863
DLO1-18-AC-34	2	27.7	30.1	190	0.894
DLO1-18-AC-35	2	64.3	68.5	2,450	0.922
DLO1-18-AC-36	2	28.3	30.8	210	0.927
DLO1-18-AC-37	2	34.0	36.9	323	0.822
DLO1-18-AC-38	2	29.7	32.2	200	0.763
DLO1-18-AC-39	3	36.8	39.9	440	0.883
DLO1-18-AC-40	1.5	38.2	41.5	458	0.822
DLO1-18-AC-41	2	29.2	31.7	215	0.864
DLO1-18-AC-42	2	28.1	30.4	202	0.910
DLO1-18-AC-43	2	38.4	41.3	505	0.892
DLO1-18-AC-44	1.5	38.2	41.5	535	0.960
DLO1-18-AC-45	3	37.7	40.4	450	0.840
DLO1-18-AC-46	2	33.3	36.1	320	0.867

Table G.17: Arctic Charr Measurements from Fish Captured at Sheardown Lake NW by Gill Netting, Mary River Project CREMP, August 2018

Specimen ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Fulton's Condition Factor (K)
DLO1-18-AC-47	3	34.0	37.0	400	1.018
DLO1-18-AC-48	3	38.7	42.2	498	0.859
DLO1-18-AC-49	3	36.9	39.8	443	0.882
DLO1-18-AC-50	2	34.9	37.7	333	0.783
DLO1-18-AC-51	2	30.2	33.0	238	0.864
DLO1-18-AC-52	1.5	36.5	39.7	425	0.874
DLO1-18-AC-53	2	30.9	33.6	295	1.000
DLO1-18-AC-54	1.5	36.1	39.3	375	0.797
DLO1-18-AC-55	2	35.7	38.8	409	0.899
DLO1-18-AC-56	3	35.6	38.7	405	0.898
DLO1-18-AC-57	2	35.4	38.1	415	0.935
DLO1-18-AC-58	2	33.7	36.5	320	0.836
DLO1-18-AC-59	2	33.8	36.7	365	0.945
DLO1-18-AC-60	3	41.0	44.2	660	0.958
DLO1-18-AC-61	3	39.0	42.7	610	1.028
DLO1-18-AC-62	3	40.5	43.7	640	0.963
DLO1-18-AC-63	3	37.3	40.2	395	0.761
DLO1-18-AC-64	1.5	38.8	42.5	595	1.019
DLO1-18-AC-65	1.5	37.8	40.9	395	0.731
DLO1-18-AC-66	1.5	34.6	37.6	350	0.845
DLO1-18-AC-67	2	28.0	30.5	212	0.966
DLO1-18-AC-68	1.5	34.3	37.0	390	0.966
DLO1-18-AC-69	3	38.5	42.2	460	0.806
DLO1-18-AC-70	3	44.0	47.1	720	0.845
DLO1-18-AC-71	2	28.0	30.6	204	0.929
Overall Catch Summary	Sample Size (N)	71	71	71	71
	Average	35.9	38.9	464	0.890
	Median	36.1	39.0	400	0.892
	Standard Deviation	6.9	7.2	384	0.074
	Standard Error	0.8	0.9	45.6	0.009
	Minimum	22.7	24.6	102	0.719
	Maximum	64.3	68.5	2,500	1.031

Table G.18: Results of Littoral/Profundal Arctic Charr Health Endpoint Statistical Comparisons between 2018 Sheardown Lake NW (DLO1) and 2018 Reference Lake 3 (REF) Data, and for Sheardown Lake NW between 2018 and the Mine Baseline Period (2006 to 2013), Mary River Project 2018 CREMP

Comparison	Indicator	Endpoint	Variables		Sample Size		Test	ANCOVA Model Statistics			Summary Statistics ^b			Test P-value	Magnitude of Difference (%) ^{c,d}
			Response	Covariate	REF 2018 or DLO1 Base	DLO1 2018		Interaction Model	Parallel Slope Model	Covariate Value for Comparisons ^a					
								Interaction P-value	Covariate P-value		Statistic	REF 2018 or DLO1 Base	DLO1 2018		
Sheardown Lake NW versus Reference Lake 3, 2018	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	34	71	K-S	-	-	-	-	-	-	0.197	-22
	Body Size	Fork Length	Fork Length (cm)	-	34	71	M-W	-	-	-	Median	34.5	36.1	0.875	4.5
		Body Weight	Body Weight (g)	-	34	71	M-W	-	-	-	Median	331	400	0.547	21
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	34	71	ANCOVA	0.302	<0.001	36.1	Adjusted Mean	425	443	0.021	4.4
Sheardown Lake NW 2018 versus Baseline	Survival	Length Frequency Distribution	Fork Length (cm)	-	118	71	K-S	-	-	-	-	-	-	0.252	15
	Body Size	Fork Length	Fork Length (cm)	-	118	71	M-W	-	-	-	Median	36.5	36.1	0.302	-1.1
		Body Weight	Body Weight (g)	-	118	71	M-W	-	-	-	Median	400	400	0.346	0
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	118	71	ANCOVA	0.767	<0.001	35.9	Adjusted Mean	430	439	0.260	2.1

Area P-value < 0.1 or Interaction P-value < 0.05

Absolute Magnitude of Difference ≥ 10% for Condition (EEM effect endpoint)

^a The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

^b The median, mean (geometric mean for log₁₀-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted mean values from the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction was detected.

^c The magnitude of difference calculated as: [(exposed area mean - reference area mean) / reference area mean] x 100. When there is a significant interaction in the ANCOVA, the magnitude of difference is calculated at the minimum and maximum values of overlap in covariate values as : [(exposed area predicted mean - reference area predicted mean) / reference area predicted mean] x 100.

^d Calculated as the maximum difference in the cumulative relative frequency distributions (CRFD) between areas. A negative difference implies that the exposed area has more fish less than the length where the maximum difference in CFRDs was observed. A positive difference implies that the exposed area has fewer fish less than the length where the maximum difference in CFRDs was observed.

Table G.19: Arctic Charr Measurements from Fish Captured at Sheardown Lake SE by Electrofishing, Mary River Project CREMP, August 2018

Specimen ID	Fork Length (mm)	Total Length (mm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
DLO2-18-ACJ-01	3.7	3.9	0.455	0	0.898
DLO2-18-ACJ-02	4.4	4.6	0.757	0	0.889
DLO2-18-ACJ-03	13.5	14.4	20.198	3	0.821
DLO2-18-ACJ-04	8.4	8.8	4.624	2	0.780
DLO2-18-ACJ-05	10.5	11.2	10.010	2	0.865
DLO2-18-ACJ-06	6.3	6.6	2.188	1	0.875
DLO2-18-ACJ-07	9.5	10.0	7.232	2	0.844
DLO2-18-ACJ-08	6.3	6.6	2.138	1	0.855
DLO2-18-ACJ-09	7.3	7.6	3.026	1	0.778
DLO2-18-ACJ-10	4.2	4.4	0.596	0	0.804
DLO2-18-ACJ-11	8.2	8.6	4.577	-	0.830
DLO2-18-ACJ-12	9.4	9.8	7.406	-	0.892
DLO2-18-ACJ-13	4.2	4.4	0.673	-	0.908
DLO2-18-ACJ-14	4.3	4.5	0.663	-	0.834
DLO2-18-ACJ-15	4.0	4.2	0.667	-	1.042
DLO2-18-ACJ-16	7.4	7.8	4.200	-	1.036
DLO2-18-ACJ-18	7.2	7.5	3.245	-	0.869
DLO2-18-ACJ-18	8.2	8.6	5.094	-	0.924
DLO2-18-ACJ-19	9.4	9.7	6.334	-	0.763
DLO2-18-ACJ-20	9.2	9.6	6.457	-	0.829
DLO2-18-ACJ-21	3.9	4.1	0.578	-	0.974
DLO2-18-ACJ-22	7.0	7.3	2.975	-	0.867
DLO2-18-ACJ-23	4.2	4.4	0.583	-	0.787
DLO2-18-ACJ-24	9.7	10.1	7.308	-	0.801
DLO2-18-ACJ-25	6.0	6.3	1.885	-	0.873
DLO2-18-ACJ-26	3.6	3.8	0.574	-	1.230
DLO2-18-ACJ-27	6.4	6.6	2.463	-	0.940
DLO2-18-ACJ-28	6.8	7.1	2.862	-	0.910
DLO2-18-ACJ-29	9.0	9.4	5.836	-	0.801
DLO2-18-ACJ-30	9.4	9.7	7.041	-	0.848
DLO2-18-ACJ-31	10.0	10.5	8.945	-	0.895
DLO2-18-ACJ-32	6.8	7.1	3.028	-	0.963
DLO2-18-ACJ-33	4.0	4.2	0.605	-	0.945
DLO2-18-ACJ-34	3.9	4.1	0.516	-	0.870
DLO2-18-ACJ-35	4.2	4.4	0.604	-	0.815
DLO2-18-ACJ-36	7.0	7.3	2.628	-	0.766
DLO2-18-ACJ-37	4.3	4.5	0.613	-	0.771
DLO2-18-ACJ-38	8.4	8.7	4.346	-	0.733
DLO2-18-ACJ-39	6.8	7.1	2.768	-	0.880
DLO2-18-ACJ-40	6.6	6.8	2.236	-	0.778
DLO2-18-ACJ-41	3.9	4.1	0.514	-	0.867
DLO2-18-ACJ-42	7.4	7.6	3.032	-	0.748
DLO2-18-ACJ-43	6.8	7.1	2.552	-	0.812
DLO2-18-ACJ-44	8.4	8.7	4.115	-	0.694
DLO2-18-ACJ-45	4.1	4.3	0.577	-	0.837
DLO2-18-ACJ-46	4.1	4.3	0.567	-	0.823
DLO2-18-ACJ-47	5.8	6.0	1.613	-	0.827
DLO2-18-ACJ-48	3.9	4.1	0.491	-	0.828
DLO2-18-ACJ-49	7.2	7.5	3.026	-	0.811
DLO2-18-ACJ-50	4.2	4.4	0.628	-	0.848
DLO2-18-ACJ-51	4.6	4.8	0.788	-	0.810
DLO2-18-ACJ-52	4.3	4.5	0.780	-	0.981
DLO2-18-ACJ-53	4.1	4.3	0.651	-	0.945
DLO2-18-ACJ-54	7.0	7.3	2.815	-	0.821
DLO2-18-ACJ-55	6.9	7.3	2.830	-	0.861
DLO2-18-ACJ-56	4.5	4.7	0.882	-	0.968
DLO2-18-ACJ-57	6.7	7.0	2.495	-	0.830

Table G.19: Arctic Charr Measurements from Fish Captured at Sheardown Lake SE by Electrofishing, Mary River Project CREMP, August 2018

Specimen ID		Fork Length (mm)	Total Length (mm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
DLO2-18-ACJ-58		4.3	4.5	0.755	-	0.950
DLO2-18-ACJ-59		5.9	6.1	1.822	-	0.887
DLO2-18-ACJ-60		4.5	4.7	0.824	-	0.904
DLO2-18-ACJ-61		3.8	4.0	0.425	-	0.775
DLO2-18-ACJ-62		4.4	4.6	0.813	-	0.954
DLO2-18-ACJ-63		4.7	4.9	0.848	-	0.817
DLO2-18-ACJ-64		7.0	7.3	2.550	-	0.743
DLO2-18-ACJ-65		3.7	3.9	0.419	-	0.827
DLO2-18-ACJ-66		6.6	6.8	2.159	-	0.751
DLO2-18-ACJ-67		7.6	7.9	3.356	-	0.765
DLO2-18-ACJ-68		7.1	7.4	2.929	-	0.818
DLO2-18-ACJ-69		4.7	4.9	0.872	-	0.840
DLO2-18-ACJ-70		3.6	3.8	0.472	-	1.012
DLO2-18-ACJ-71		6.4	6.6	2.365	-	0.902
DLO2-18-ACJ-72		6.8	7.0	3.002	-	0.955
DLO2-18-ACJ-73		7.1	7.4	2.833	-	0.792
DLO2-18-ACJ-74		6.1	6.3	2.142	-	0.944
DLO2-18-ACJ-75		6.2	6.4	1.922	-	0.806
DLO2-18-ACJ-76		6.5	6.7	2.288	-	0.833
DLO2-18-ACJ-77		4.1	4.3	0.607	-	0.881
DLO2-18-ACJ-78		5.6	5.8	1.320	-	0.752
DLO2-18-ACJ-79		7.2	7.5	2.903	-	0.778
DLO2-18-ACJ-80		3.8	4.0	0.593	-	1.081
DLO2-18-ACJ-81		3.8	4.0	0.592	-	1.079
DLO2-18-ACJ-82		4.5	4.7	0.822	-	0.902
DLO2-18-ACJ-83		4.3	4.5	0.695	-	0.874
DLO2-18-ACJ-84		4.3	4.5	0.671	-	0.844
DLO2-18-ACJ-85		4.4	4.6	0.665	-	0.781
DLO2-18-ACJ-86		6.1	6.3	2.256	-	0.994
DLO2-18-ACJ-87		3.9	4.1	0.495	-	0.834
DLO2-18-ACJ-88		4.5	4.7	0.806	-	0.884
DLO2-18-ACJ-89		3.9	4.1	0.446	-	0.752
DLO2-18-ACJ-90		3.8	4.0	0.461	-	0.840
DLO2-18-ACJ-91		6.5	6.7	2.306	-	0.840
DLO2-18-ACJ-92		4.1	4.3	0.534	-	0.775
DLO2-18-ACJ-93		7.2	7.5	2.932	-	0.786
DLO2-18-ACJ-94		4.4	4.6	0.790	-	0.927
DLO2-18-ACJ-95		3.8	4.0	0.467	-	0.851
DLO2-18-ACJ-96		4.6	4.8	0.807	-	0.829
DLO2-18-ACJ-97		4.0	4.2	0.535	-	0.836
DLO2-18-ACJ-98		6.5	6.8	2.186	-	0.796
DLO2-18-ACJ-99		5.6	5.9	1.435	-	0.817
Overall Catch Summary	Sample Size (N)	99	99	99	10.0	99
	Average	5.9	6.2	2.378	1.2	0.860
	Median	5.9	6.1	1.822	1.0	0.840
	Standard Deviation	2.0	2.1	2.740	1.0	0.086
	Standard Error	0.2	0.2	0.275	0.3	0.009
	Minimum	3.6	3.8	0.419	0.0	0.694
	Maximum	13.5	14.4	20.198	3.0	1.230
Young-of-the-Year Catch Summary	proportion of YOY	46%				
	Sample Size (N)	46	46	46	3	46
	Average	4.1	4.3	0.634	0	0.885
	Median	4.2	4.4	0.606	0	0.859
	Standard Deviation	0.3	0.3	0.132	0	0.095
	Standard Error	0.0	0.0	0.020	0	0.014
	Minimum	3.6	3.8	0.419	0	0.752
	Maximum	4.7	4.9	0.882	0	1.230

Table G.20: Results of Nearshore Arctic Charr Young-of-the-Year (YOY) and Non-YOY Health Endpoint Statistical Comparisons between Sheardown Lake SE (DLO-02) and Reference Lake 3 (REF), Mary River Project CREMP, August 2018

Group	Indicator	Endpoint	Variables		Sample Size		Test	ANCOVA Model Statistics			Summary Statistics ^b			Test P-value	Magnitude of Difference (%) ^{c,d}
			Response	Covariate	REF	DLO-02		Interaction Model	Parallel Slope Model	Covariate Value for Comparisons ^a					
								Interaction P-value	Covariate P-value		Statistic	REF	DLO-02		
All Fish	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	100	99	K-S	-	-	-	-	-	-	<0.001	37
YOY	Body Size	Fork Length	Fork Length (cm)	-	8	46	tequal	-	-	-	Mean	3.4	4.1	<0.001	23
		Body Weight	Body Weight (g)	-	8	46	M-W	-	-	-	Median	0.276	0.606	<0.001	120
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	8	46	ANCOVA	0.735	<0.001	4.00	Adjusted Mean	0.508	0.58	0.0159	14
Non-YOY	Survival	Length Frequency Distribution	Fork Length (cm)	-	92	53	K-S	-	-	-	-	-	-	<0.001	-47
	Body Size	Fork Length	Fork Length (cm)	-	92	53	M-W	-	-	-	Median	5.8	7.0	<0.001	21
		Body Weight	Body Weight (g)	-	92	53	M-W	-	-	-	Median	1.83	2.90	<0.001	59
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	92	53	ANCOVA	0.107	<0.001	6.60	Adjusted Mean	2.94	2.57	<0.001	-13

Area P-value < 0.1 or Interaction P-value < 0.05

Absolute Magnitude of Difference ≥ 10% for Condition (EEM effect endpoint)

^a The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

^b The median, mean (geometric mean for log₁₀-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted mean values from the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction was detected.

^c The magnitude of difference calculated as: [(exposed area mean - reference area mean) / reference area mean] x 100. When there is a significant interaction in the ANCOVA, the magnitude of difference is calculated at the minimum and maximum values of overlap in covariate values as : [(exposed area predicted mean - reference area predicted mean) / reference area predicted mean] x 100.

^d Calculated as the maximum difference in the cumulative relative frequency distributions (CRFD) between areas. A negative difference implies that the exposed area has more fish less than the length where the maximum difference in CFRDs was observed. A positive difference implies that the exposed area has fewer fish less than the length where the maximum difference in CFRDs was observed.

Table G.21: Arctic Charr Estimated Sample Sizes to Detect Various Effect Sizes as a Percentage Change in Respective Fish Health Endpoints at Sheardown Lake SE (DLO-02) Using 2018 Data Relative to Reference Lake 3 Data (2018) or Sheardown Lake SE Baseline Data (2006 to 2013) with $\alpha=\beta=0.1$, Mary River Project 2018 CREMP

Comparison	Group	Indicator	Endpoint	Variables		Test ^c	S ^a	COV (%) ^b	Minimum Sample Size to Detect an Effect Size (% Increase/Decrease Relative to Reference) with α=β=0.1										
				Response	Covariate				log(Response)	5%	10%	20%	25%	30%	33%	40%	50%	100%	
										-5%	-9%	-17%	-20%	-23%	-25%	-29%	-33%	-50%	
										Response	±5%	±10%	±20%	±25%	±30%	±33%	±40%	±50%	±100%
Nearshore Arctic Charr (Electrofishing) versus Ref. Lake 3, 2018 Data	Non-YOY	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.08546	4.33	Response	17	6	4	3	3	3	3	3	3	3
			Body Weight	Body Weight (g)	-	M-W	0.26352	1.1	Response	4	3	3	3	3	3	3	3	3	3
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.04366	-	log10(Response)	75	21	8	6	5	5	4	4	3	3
Nearshore Arctic Charr (Electrofishing) 2018 versus Baseline	Non-YOY	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.07109	4.74	Response	20	6	4	3	3	3	3	3	3	3
			Body Weight	Body Weight (g)	-	M-W	0.23243	0.96	Response	3	3	3	3	3	3	3	3	3	3
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.06847	-	log10(Response)	181	49	15	11	8	7	6	5	4	4
Littoral/Profundal Arctic Charr (Gill Netting) versus Ref. Lake 3, 2018 Data	All fish	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.0814	5.68	Response	27	9	4	4	3	3	3	3	3	3
			Body Weight	Body Weight (g)	-	M-W	0.248	1.9	Response	5	3	3	3	3	3	3	3	3	3
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0382	-	log10(Response)	58	17	6	5	4	4	4	4	3	3
Littoral/Profundal Arctic Charr (Gill Netting) 2018 versus Baseline	All fish	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.0544	9.32	Response	71	19	6	5	4	4	4	3	3	3
			Body Weight	Body Weight (g)	-	M-W	0.171	3.57	Response	12	5	3	3	3	3	3	3	3	3
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0445	-	log10(Response)	78	22	8	6	5	5	4	4	3	3

^a Pooled standard deviation of the regression residuals

^b Coefficient of variation (pooled standard deviation/reference mean)×100%

^c Sample size estimates for the M-W test were estimated based for a two-sample t-test using sample sizes multiplied by 0.864. The 0.864 is the lower bound of the asymptotic relative efficiency of the Mann-Whitney test and the two-sample t-test (Hodges and Lehmann 1956). Estimates were generated for the response variable on the untransformed and log₁₀-transformed scales and the lowest sample size is reported.

Table G.22: Gill Netting Catch Records for Sheardown Lake SE, Mary River Project CREMP, August 2018

Gill Net Set ID	Location (NAD83, UTM Zone 17W)		Length (m)	Set Date	Lift Date	Set Time	Lift Time	Fishing Hours	Effort (m*hrs/100 m)	Arctic Charr Catch Per Mesh Size			Total Catch	CPUE
	Easting	Northing								1½"	2"	3"		
DLO2-18-GN-01	561266	7911890	91.4	18-Aug-18	18-Aug-18	9:30	11:15	1.75	1.60	2	3	0	5	3.12
DLO2-18-GN-02	561540	7911797	91.4	18-Aug-18	18-Aug-18	9:45	11:45	2.00	1.83	2	4	3	9	4.92
DLO2-18-GN-03	560982	7912041	91.4	18-Aug-18	18-Aug-18	10:10	12:30	2.33	2.13	0	6	6	12	5.62
DLO2-18-GN-04	560830	7912159	91.4	18-Aug-18	18-Aug-18	10:25	12:45	2.33	2.13	0	1	2	3	1.41
DLO2-18-GN-05	560787	7912249	91.4	18-Aug-18	18-Aug-18	10:30	13:00	2.50	2.29	3	9	3	15	6.56
DLO2-18-GN-06	561266	7911890	91.4	18-Aug-18	18-Aug-18	11:20	14:00	2.67	2.44	2	11	1	14	5.74
DLO2-18-GN-07	560982	7912041	91.4	18-Aug-18	18-Aug-18	13:30	15:30	2.00	1.83	1	5	3	9	4.92
DLO2-18-GN-08	560787	7912249	91.4	18-Aug-18	18-Aug-18	14:00	16:15	2.25	2.06	4	1	3	8	3.89
DLO2-18-GN-09	561540	7911797	91.4	18-Aug-18	18-Aug-18	15:20	17:00	1.67	1.52	0	1	2	3	1.97
DLO2-18-GN-10	560982	7912041	91.4	18-Aug-18	18-Aug-18	15:55	17:20	1.42	1.30	1	1	1	3	2.32
DLO2-18-GN-11	560787	7912249	91.4	18-Aug-18	18-Aug-18	16:25	17:45	1.33	1.22	2	1	1	4	3.28
Total									20.35	17	43	25	85	3.98

Note: Catch-per-unit-effort (CPUE) represents the number of fish captured per 100 m-hours of net.

Table G.23: Arctic Charr Measurements from Fish Captured at Sheardown Lake SE by Gill Netting, Mary River Project CREMP, August 2018

Specimen ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Fulton's Condition Factor (K)
DLO2-18-AC-01	2	38.7	41.9	570	0.983
DLO2-18-AC-02	2	35.9	38.9	320	0.692
DLO2-18-AC-03	2	18.3	19.7	53	0.857
DLO2-18-AC-04	1½	19.2	20.2	61	0.855
DLO2-18-AC-05	1½	24.6	26.6	132	0.887
DLO2-18-AC-06	3	41.2	44.9	625	0.894
DLO2-18-AC-07	3	39.0	41.7	485	0.818
DLO2-18-AC-08	3	42.1	45.9	710	0.952
DLO2-18-AC-09	2	33.2	36.0	365	0.997
DLO2-18-AC-10	2	32.7	35.7	320	0.915
DLO2-18-AC-11	2	34.4	37.4	405	0.995
DLO2-18-AC-12	2	30.5	32.7	249	0.878
DLO2-18-AC-13	1½	38.0	41.4	470	0.857
DLO2-18-AC-14	1½	36.3	40.2	450	0.941
DLO2-18-AC-15	3	38.2	41.4	495	0.888
DLO2-18-AC-16	3	36.6	39.7	430	0.877
DLO2-18-AC-18	3	35.5	38.6	420	0.939
DLO2-18-AC-18	3	30.0	32.5	250	0.926
DLO2-18-AC-19	3	34.3	37.4	400	0.991
DLO2-18-AC-20	3	36.9	40.3	495	0.985
DLO2-18-AC-21	2	38.8	42.1	575	0.984
DLO2-18-AC-22	2	35.2	38.1	420	0.963
DLO2-18-AC-23	2	33.8	36.6	395	1.023
DLO2-18-AC-24	2	37.3	40.7	470	0.906
DLO2-18-AC-25	2	38.8	42.0	545	0.933
DLO2-18-AC-26	2	33.2	36.7	330	0.902
DLO2-18-AC-27	3	38.0	41.4	490	0.893
DLO2-18-AC-28	3	36.0	40.2	325	0.697
DLO2-18-AC-29	3	36.4	39.8	430	0.892
DLO2-18-AC-30	3	42.0	45.7	580	0.783
DLO2-18-AC-31	3	38.6	42.5	565	0.982
DLO2-18-AC-32	3	36.6	39.7	450	0.918
DLO2-18-AC-33	1½	33.0	35.7	330	0.918
DLO2-18-AC-34	1½	36.3	39.2	435	0.909
DLO2-18-AC-35	1½	34.8	38.5	405	0.961
DLO2-18-AC-36	2	31.5	34.1	305	0.976
DLO2-18-AC-37	2	41.2	44.5	600	0.858
DLO2-18-AC-38	2	40.3	44.0	585	0.894
DLO2-18-AC-39	2	35.5	38.7	455	1.017
DLO2-18-AC-40	2	37.0	41.0	480	0.948
DLO2-18-AC-41	2	40.8	44.0	535	0.788
DLO2-18-AC-42	2	33.3	36.1	355	0.961
DLO2-18-AC-43	2	32.0	34.7	289	0.882
DLO2-18-AC-44	2	44.9	48.5	945	1.044
DLO2-18-AC-45	3	27.7	30.0	213	1.002
DLO2-18-AC-46	1½	27.9	30.2	204	0.939

Table G.23: Arctic Charr Measurements from Fish Captured at Sheardown Lake SE by Gill Netting, Mary River Project CREMP, August 2018

Specimen ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Fulton's Condition Factor (K)
DLO2-18-AC-47	1½	36.6	39.7	465	0.948
DLO2-18-AC-48	2	36.6	40.2	415	0.846
DLO2-18-AC-49	2	25.2	27.3	132	0.825
DLO2-18-AC-50	2	38.3	41.3	485	0.863
DLO2-18-AC-51	2	36.5	40.1	500	1.028
DLO2-18-AC-52	2	40.2	43.5	585	0.900
DLO2-18-AC-53	2	37.5	40.4	450	0.853
DLO2-18-AC-54	2	27.9	30.4	211	0.972
DLO2-18-AC-55	2	34.5	37.4	420	1.023
DLO2-18-AC-56	2	26.5	30.9	194	1.042
DLO2-18-AC-57	2	35.5	38.4	385	0.861
DLO2-18-AC-58	2	35.7	38.8	405	0.890
DLO2-18-AC-59	1½	27.4	29.5	184	0.894
DLO2-18-AC-60	3	40.6	43.8	655	0.979
DLO2-18-AC-61	3	41.4	45.1	572	0.806
DLO2-18-AC-62	3	39.8	43.3	470	0.746
DLO2-18-AC-63	2	34.5	37.3	375	0.913
DLO2-18-AC-64	2	41.4	44.8	655	0.923
DLO2-18-AC-65	2	35.2	38.7	465	1.066
DLO2-18-AC-66	2	34.5	37.5	410	0.998
DLO2-18-AC-67	2	33.5	36.5	375	0.997
DLO2-18-AC-68	3	39.0	42.2	545	0.919
DLO2-18-AC-69	3	40.2	43.4	520	0.800
DLO2-18-AC-70	3	34.2	37.5	395	0.987
DLO2-18-AC-71	1½	39.5	42.7	535	0.868
DLO2-18-AC-72	1½	41.0	43.9	525	0.762
DLO2-18-AC-73	1½	37.5	40.9	500	0.948
DLO2-18-AC-74	1½	36.1	39.0	435	0.925
DLO2-18-AC-75	2	36.4	39.5	455	0.943
DLO2-18-AC-76	3	38.1	41.0	515	0.931
DLO2-18-AC-77	3	37.2	40.2	435	0.845
DLO2-18-AC-78	2	27.1	29.7	185	0.930
DLO2-18-AC-79	1½	26.4	28.6	161	0.875
DLO2-18-AC-80	2	28.4	31.0	203	0.886
DLO2-18-AC-81	3	42.3	45.2	775	1.024
DLO2-18-AC-82	3	36.2	39.4	465	0.980
DLO2-18-AC-83	2	36.0	39.7	415	0.889
DLO2-18-AC-84	1½	41.0	44.3	640	0.929
DLO2-18-AC-85	1½	36.2	39.0	405	0.854
Overall Catch Summary	Sample Size (N)	85	85	85	85
	Average	35.4	38.5	427	0.915
	Median	36.3	39.7	435	0.918
	Standard Deviation	5.0	5.5	155	0.076
	Standard Error	0.5	0.6	16.83	0.008
	Minimum	18.3	19.7	53	0.692
	Maximum	44.9	48.5	945	1.066

Table G.24: Results of Littoral/Profundal Arctic Charr Health Endpoint Statistical Comparisons between 2018 Sheardown Lake SE (DLO-02) and 2018 Reference Lake 3 (REF) Data, and for Sheardown Lake SE between 2018 and the Mine Baseline Period (2006 to 2013), Mary River Project 2018 CREMP

Comparison	Indicator	Endpoint	Variables		Sample Size		Test	ANCOVA Model Statistics			Summary Statistics ^b			Test P-value	Magnitude of Difference (%) ^{c,d}
			Response	Covariate	REF 2018 or DLO-02 Base	DLO-02 2018		Interaction Model	Parallel Slope Model	Covariate Value for Comparisons ^a					
								Interaction P-value	Covariate P-value		Statistic	REF 2018 or DLO-02 Base	DLO-02 2018		
Sheardown Lake SE versus Reference Lake 3, 2018	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	34	85	K-S	-	-	-	-	-	-	0.042	-28
	Body Size	Fork Length	Fork Length (cm)	-	34	85	M-W	-	-	-	Median	34.5	36.3	0.469	5.1
		Body Weight	Body Weight (g)	-	34	85	M-W	-	-	-	Median	331	435	0.158	31
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	34	85	ANCOVA	0.355	<0.001	35.7	Adjusted Mean	408	438	<0.001	7.4
Sheardown Lake SE 2018 versus Baseline	Survival	Length Frequency Distribution	Fork Length (cm)	-	90	85	K-S	-	-	-	-	-	-	<0.001	31
	Body Size	Fork Length	Fork Length (cm)	-	90	85	M-W	-	-	-	Median	37.9	36.3	<0.001	-4.1
		Body Weight	Body Weight (g)	-	90	85	M-W	-	-	-	Median	517	435	<0.001	-16
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	90	85	ANCOVA	0.016	<0.001	36.4	Adjusted Mean	488	452	<0.001	-7.3
					89 ^e	85	ANCOVA	0.062	<0.001	36.4	Adjusted Mean	484	450	<0.001	-7.0

Area P-value < 0.1 or Interaction P-value < 0.05

Absolute Magnitude of Difference ≥ 10% for Condition (EEM effect endpoint)

^a The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

^b The median, mean (geometric mean for log₁₀-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted mean values from the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction was detected.

^c The magnitude of difference calculated as: [(exposed area mean - reference area mean) / reference area mean] x 100. When there is a significant interaction in the ANCOVA, the magnitude of difference is calculated at the minimum and maximum values of overlap in covariate values as : [(exposed area predicted mean - reference area predicted mean) / reference area predicted mean] x 100.

^d Calculated as the maximum difference in the cumulative relative frequency distributions (CRFD) between areas. A negative difference implies that the exposed area has more fish less than the length where the maximum difference in CFRDs was observed. A positive difference implies that the exposed area has fewer fish less than the length where the maximum difference in CFRDs was observed.

^e One outlier (Fish ID:SDSE-08-005. 17; Studentized residual = 4.3) was removed from the analysis.

Table G.25: Arctic Charr Measurements from Fish Captured at Mary Lake by Electrofishing, Mary River Project CREMP, August 2018

Specimen ID	Fork Length (cm)	Total Length (cm)	Total Weight (g)	Age (years)	Fulton's Condition Factor (K)
BLO-18-ACJ-01	4.0	4.2	0.529	0	0.827
BLO-18-ACJ-02	7.7	8.1	3.924	1	0.860
BLO-18-ACJ-03	7.1	7.4	3.154	1	0.881
BLO-18-ACJ-04	4.6	4.8	0.961	0	0.987
BLO-18-ACJ-05	11.9	12.8	14.309	3	0.849
BLO-18-ACJ-06	8.8	9.4	5.743	2	0.843
BLO-18-ACJ-07	5.8	6.0	1.492	1	0.765
BLO-18-ACJ-08	9.8	10.5	8.863	3	0.942
BLO-18-ACJ-09	4.1	4.3	0.557	0	0.808
BLO-18-ACJ-10	8.4	8.8	4.463	2	0.753
BLO-18-ACJ-11	3.0	3.1	0.242	-	0.896
BLO-18-ACJ-12	6.1	6.4	2.209	-	0.973
BLO-18-ACJ-13	8.2	8.6	4.241	-	0.769
BLO-18-ACJ-14	6.4	6.7	2.069	-	0.789
BLO-18-ACJ-15	4.2	4.4	0.664	-	0.896
BLO-18-ACJ-16	5.8	6.0	1.729	-	0.886
BLO-18-ACJ-17	8.0	8.5	5.427	-	1.060
BLO-18-ACJ-18	6.5	6.7	2.416	-	0.880
BLO-18-ACJ-19	6.1	6.3	2.187	-	0.964
BLO-18-ACJ-20	3.8	4.0	0.478	-	0.871
BLO-18-ACJ-21	5.7	5.9	1.395	-	0.753
BLO-18-ACJ-22	5.4	5.7	1.476	-	0.937
BLO-18-ACJ-23	6.3	6.6	2.132	-	0.853
BLO-18-ACJ-24	5.8	6.1	1.559	-	0.799
BLO-18-ACJ-25	2.9	3.0	0.200	-	0.820
BLO-18-ACJ-26	4.1	4.3	0.546	-	0.792
BLO-18-ACJ-27	6.9	7.2	2.921	-	0.889
BLO-18-ACJ-28	7.1	7.4	2.961	-	0.827
BLO-18-ACJ-29	5.4	5.6	1.878	-	1.193
BLO-18-ACJ-30	10.8	11.2	10.532	-	0.836
BLO-18-ACJ-31	6.9	7.2	2.651	-	0.807
BLO-18-ACJ-32	5.5	5.7	1.587	-	0.954
BLO-18-ACJ-33	6.1	6.3	1.775	-	0.782
BLO-18-ACJ-34	6.4	6.7	2.271	-	0.866
BLO-18-ACJ-35	5.6	5.8	1.613	-	0.918
BLO-18-ACJ-36	6.2	6.5	2.057	-	0.863
BLO-18-ACJ-37	4.2	4.4	0.693	-	0.935
BLO-18-ACJ-38	7.4	7.7	3.823	-	0.943
BLO-18-ACJ-39	6.5	6.8	2.495	-	0.909
BLO-18-ACJ-40	5.8	6.0	1.899	-	0.973
BLO-18-ACJ-41	6.3	6.5	2.315	-	0.926
BLO-18-ACJ-42	7.4	7.6	4.339	-	1.071
BLO-18-ACJ-43	6.9	7.2	3.015	-	0.918
BLO-18-ACJ-44	5.2	5.5	1.532	-	1.090
BLO-18-ACJ-45	6.2	6.4	1.976	-	0.829
BLO-18-ACJ-46	5.4	5.6	1.457	-	0.925

Table G.25: Arctic Charr Measurements from Fish Captured at Mary Lake by Electrofishing, Mary River Project CREMP, August 2018

Specimen ID	Fork Length (cm)	Total Length (cm)	Total Weight (g)	Age (years)	Fulton's Condition Factor (K)
BLO-18-ACJ-47	7.3	7.6	3.956	-	1.017
BLO-18-ACJ-48	7.6	8.0	3.610	-	0.822
BLO-18-ACJ-49	7.4	7.7	3.560	-	0.879
BLO-18-ACJ-50	4.9	5.1	1.091	-	0.927
BLO-18-ACJ-51	6.4	6.6	2.086	-	0.796
BLO-18-ACJ-52	3.5	3.7	0.374	-	0.872
BLO-18-ACJ-53	5.7	6.0	1.632	-	0.881
BLO-18-ACJ-54	6.8	7.1	3.023	-	0.961
BLO-18-ACJ-55	6.3	6.6	2.449	-	0.979
BLO-18-ACJ-56	8.4	8.8	4.847	-	0.818
BLO-18-ACJ-57	3.8	4.0	0.496	-	0.904
BLO-18-ACJ-58	3.0	3.1	0.240	-	0.889
BLO-18-ACJ-59	9.5	9.9	6.301	-	0.735
BLO-18-ACJ-60	8.0	8.5	5.642	-	1.102
BLO-18-ACJ-61	5.8	6.0	1.655	-	0.848
BLO-18-ACJ-62	6.4	6.7	2.109	-	0.805
BLO-18-ACJ-63	5.8	6.1	1.563	-	0.801
BLO-18-ACJ-64	6.4	6.6	1.930	-	0.736
BLO-18-ACJ-65	5.4	5.6	1.272	-	0.808
BLO-18-ACJ-66	3.7	3.9	0.502	-	0.991
BLO-18-ACJ-67	8.1	8.4	4.485	-	0.844
BLO-18-ACJ-68	6.7	7.0	3.252	-	1.081
BLO-18-ACJ-69	5.8	6.0	1.996	-	1.023
BLO-18-ACJ-70	3.6	3.8	0.528	-	1.132
BLO-18-ACJ-71	6.5	6.7	2.599	-	0.946
BLO-18-ACJ-72	6.9	7.2	2.475	-	0.753
BLO-18-ACJ-73	5.5	5.8	1.467	-	0.882
BLO-18-ACJ-74	8.2	8.5	5.142	-	0.933
BLO-18-ACJ-75	5.8	6.1	1.882	-	0.965
BLO-18-ACJ-76	6.3	6.5	2.129	-	0.851
BLO-18-ACJ-77	5.9	6.1	1.746	-	0.850
BLO-18-ACJ-78	8.0	8.4	4.613	-	0.901
BLO-18-ACJ-79	6.5	6.8	2.259	-	0.823
BLO-18-ACJ-80	6.2	6.4	2.082	-	0.874
BLO-18-ACJ-81	5.0	5.2	1.148	-	0.918
BLO-18-ACJ-82	8.0	8.5	4.562	-	0.891
BLO-18-ACJ-83	5.5	5.7	1.367	-	0.822
BLO-18-ACJ-84	8.5	8.9	4.478	-	0.729
BLO-18-ACJ-85	8.4	8.9	4.788	-	0.808
BLO-18-ACJ-86	4.8	5.0	1.071	-	0.968
BLO-18-ACJ-87	5.6	5.8	1.314	-	0.748
BLO-18-ACJ-88	7.0	7.3	3.088	-	0.900
BLO-18-ACJ-89	6.6	6.8	2.654	-	0.923
BLO-18-ACJ-90	7.2	7.5	3.241	-	0.868
BLO-18-ACJ-91	8.4	8.7	4.692	-	0.792
BLO-18-ACJ-92	6.3	6.5	1.916	-	0.766

Table G.25: Arctic Charr Measurements from Fish Captured at Mary Lake by Electrofishing, Mary River Project CREMP, August 2018

Specimen ID		Fork Length (cm)	Total Length (cm)	Total Weight (g)	Age (years)	Fulton's Condition Factor (K)
BLO-18-ACJ-93		5.8	6.0	1.516	-	0.777
BLO-18-ACJ-94		6.6	6.8	2.538	-	0.883
BLO-18-ACJ-95		4.2	4.4	0.669	-	0.903
BLO-18-ACJ-96		5.1	5.3	1.242	-	0.936
BLO-18-ACJ-97		6.0	6.3	1.809	-	0.838
BLO-18-ACJ-98		5.8	6.0	1.663	-	0.852
BLO-18-ACJ-99		6.4	6.6	2.159	-	0.824
BLO-18-ACJ-100		5.7	5.9	1.618	-	0.874
BLO-18-ACJ-101		6.3	6.5	2.157	-	0.863
BLO-18-ACJ-102		5.7	5.9	1.856	-	1.002
BLO-18-ACJ-103		5.7	5.9	1.397	-	0.754
Overall Catch Summary	Sample Size (N)	103	103	103	10.0	103
	Average	6.3	6.5	2.570	1.3	0.883
	Median	6.2	6.5	2.069	1.0	0.874
	Standard Deviation	1.6	1.7	2.079	1.2	0.092
	Standard Error	0.2	0.2	0.205	0.4	0.009
	Minimum	2.9	3.0	0.200	0.0	0.729
	Maximum	11.9	12.8	14.309	3.0	1.193
Young-of-the-Year Catch Summary	proportion of YOY	14%				
	Sample Size (N)	14	14	14	2	14
	Average	3.7	3.9	0.480	0	0.895
	Median	3.8	4.0	0.515	0	0.893
	Standard Deviation	0.5	0.5	0.160	0	0.086
	Standard Error	0.1	0.1	0.043	0	0.023
	Minimum	2.9	3.0	0.200	0	0.792
	Maximum	4.2	4.4	0.693	0	1.132

Table G.26: Results of Nearshore Arctic Charr Young-of-the-Year (YOY) and Non-YOY Health Endpoint Statistical Comparisons between Mary Lake (BLO) and Reference Lake 3 (REF), Mary River Project CREMP, August 2018

Group	Indicator	Endpoint	Variables		Sample Size		Test	ANCOVA Model Statistics			Summary Statistics ^b			Test P-value	Magnitude of Difference (%) ^{c,d}
			Response	Covariate	REF	BLO		Interaction Model	Parallel Slope Model	Covariate Value for Comparisons ^a					
								Interaction P-value	Covariate P-value		Statistic	REF	BLO		
All Fish	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	100	103	K-S	-	-	-	-	-	-	0.024	-21
YOY	Body Size	Fork Length	Fork Length (cm)	-	8	14	tequal	-	-	-	Mean	3.4	3.7	0.106	11
		Body Weight	Body Weight (g)	-	8	14	tequal	-	-	-	Mean	0.334	0.480	0.0555	44
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	8	14	ANCOVA	0.485	<0.001	3.56	Adjusted Mean	0.382	0.414	0.127	8
Non-YOY	Survival	Length Frequency Distribution	Fork Length (cm)	-	92	89	K-S	-	-	-	-	-	-	0.002	-28
	Body Size	Fork Length	Fork Length (cm)	-	92	89	M-W	-	-	-	Median	5.8	6.4	0.0138	10
		Body Weight	Body Weight (g)	-	92	89	M-W	-	-	-	Median	1.83	2.16	0.129	18
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	92	89	ANCOVA	0.0202	<0.001	6.38	Adjusted Mean	2.62	2.42	<0.001	-8

Area P-value < 0.1 or Interaction P-value < 0.05

Absolute Magnitude of Difference ≥ 10% for Condition (EEM effect endpoint)

^a The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

^b The median, mean (geometric mean for log₁₀-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted mean values from the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction was detected.

^c The magnitude of difference calculated as: [(exposed area mean - reference area mean) / reference area mean] x 100. When there is a significant interaction in the ANCOVA, the magnitude of difference is calculated at the minimum and maximum values of overlap in covariate values as : [(exposed area predicted mean - reference area predicted mean) / reference area predicted mean] x 100.

^d Calculated as the maximum difference in the cumulative relative frequency distributions (CRFD) between areas. A negative difference implies that the exposed area has more fish less than the length where the maximum difference in CFRDs was observed. A positive difference implies that the exposed area has fewer fish less than the length where the maximum difference in CFRDs was observed.

Table G.27: Arctic Charr Estimated Sample Sizes to Detect Various Effect Sizes as a Percentage Change in Respective Fish Health Endpoints at Mary Lake (BLO) Using 2018 Data Relative to Reference Lake 3 Data (2018) or Mary Lake Baseline Data (2006 to 2013) with $\alpha=\beta=0.1$, Mary River Project 2018 CREMP

Comparison	Group	Indicator	Endpoint	Variables		Test ^c	S ^a	COV (%) ^b	Minimum Sample Size to Detect an Effect Size (% Increase/Decrease Relative to Reference) with α=β=0.1										
				Response	Covariate				log(Response)	5%	10%	20%	25%	30%	33%	40%	50%	100%	
										-5%	-9%	-17%	-20%	-23%	-25%	-29%	-33%	-50%	
										Response	±5%	±10%	±20%	±25%	±30%	±33%	±40%	±50%	±100%
Nearshore Arctic Charr (Electrofishing) versus Ref. Lake 3, 2018 Data	Non-YOY	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.08398	4.61	Response	19	6	4	3	3	3	3	3	3	3
			Body Weight	Body Weight (g)	-	M-W	0.25654	1.3	Response	4	3	3	3	3	3	3	3	3	3
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.04629	-	log10(Response)	84	24	8	6	5	5	4	4	3	3
Littoral/Profundal Arctic Charr (Gill Netting) versus Ref. Lake 3, 2018 Data	All fish	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.0637	6.24	Response	33	10	4	4	4	3	3	3	3	3
			Body Weight	Body Weight (g)	-	M-W	0.191	1.72	Response	5	3	3	3	3	3	3	3	3	3
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0364	-	log10(Response)	53	15	6	5	4	4	4	3	3	3
Littoral/Profundal Arctic Charr (Gill Netting) 2018 versus Baseline	All fish	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.0912	4.93	Response	21	7	4	3	3	3	3	3	3	3
			Body Weight	Body Weight (g)	-	M-W	0.265	1.41	Response	4	3	3	3	3	3	3	3	3	3
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0529	-	log10(Response)	109	30	10	7	6	5	5	4	3	3

^a Pooled standard deviation of the regression residuals

^b Coefficient of variation (pooled standard deviation/reference mean)×100%

^c Sample size estimates for the M-W test were estimated based for a two-sample t-test using sample sizes multiplied by 0.864. The 0.864 is the lower bound of the asymptotic relative efficiency of the Mann-Whitney test and the two-sample t-test (Hodges and Lehmann 1956). Estimates were generated for the response variable on the untransformed and log₁₀-transformed scales and the lowest sample size is reported.

Table G.28: Gill Netting Catch Records for Mary Lake, Mary River Project CREMP, August 2018

Gill Net Set ID	Location (NAD83, UTM Zone 17W)		Length (m)	Set Date	Lift Date	Set Time	Lift Time	Fishing Hours	Effort (m*hrs/100 m)	Arctic Charr Catch per Mesh Size			Total Catch	CPUE
	Easting	Northing								1½"	2"	3"		
BLO-18-GN-01	554769	7906099	91.44	19-Aug-18	19-Aug-18	12:10	16:30	4.33	3.96	1	5	7	13	3.28
BLO-18-GN-02	554856	7906040	91.44	19-Aug-18	19-Aug-18	12:25	15:15	2.83	2.59	1	15	8	24	9.26
BLO-18-GN-03	554936	7906040	91.44	20-Aug-18	20-Aug-18	12:35	15:05	2.50	2.29	2	8	11	21	9.19
BLO-18-GN-04	556169	7903786	91.44	20-Aug-18	20-Aug-18	12:55	15:25	2.50	2.29	0	3	8	11	4.81
BLO-18-GN-05	556144	7903878	91.44	20-Aug-18	20-Aug-18	13:05	15:35	2.50	2.29	0	9	5	14	6.12
BLO-18-GN-06	554769	7906099	91.44	19-Aug-18	19-Aug-18	15:10	18:00	2.83	2.59	1	11	26	38	14.67
BLO-18-GN-07	554856	7906040	91.44	19-Aug-18	19-Aug-18	16:10	18:30	2.33	2.13	0	3	5	8	3.75
Total									18.14	5	54	70	129	7.30

Note: Catch-per-unit-effort (CPUE) represents the number of fish captured per 100 m·hours of net.

Table G.29: Arctic Charr Measurements from Fish Captured at Mary Lake by Gill Netting, Mary River Project CREMP, August 2018

Specimen ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Fulton's Condition Factor
BLO-18-AC-01	3	40.4	43.7	535	0.811
BLO-18-AC-02	3	39.7	43.2	485	0.775
BLO-18-AC-03	2	39.6	43.4	550	0.886
BLO-18-AC-04	3	40.9	44.6	555	0.811
BLO-18-AC-05	3	38.4	42.4	510	0.901
BLO-18-AC-06	3	39.8	43.3	480	0.761
BLO-18-AC-07	3	38.1	42.3	510	0.922
BLO-18-AC-08	3	39.5	43.1	515	0.836
BLO-18-AC-09	2	37.9	40.4	455	0.836
BLO-18-AC-10	2	37.1	39.7	415	0.813
BLO-18-AC-11	2	38.4	41.4	525	0.927
BLO-18-AC-12	2	39.4	42.1	560	0.916
BLO-18-AC-13	1.5	40.5	44.2	590	0.888
BLO-18-AC-14	3	36.3	39.7	405	0.847
BLO-18-AC-15	3	36.5	39.2	440	0.905
BLO-18-AC-16	3	37.1	39.6	425	0.832
BLO-18-AC-17	3	40.9	44.1	605	0.884
BLO-18-AC-18	3	36.3	39.0	370	0.774
BLO-18-AC-19	3	34.9	37.9	395	0.929
BLO-18-AC-20	3	41.2	45.1	485	0.694
BLO-18-AC-21	3	39.5	42.9	505	0.819
BLO-18-AC-22	2	41.3	45.1	640	0.909
BLO-18-AC-23	2	32.1	35.7	330	0.998
BLO-18-AC-24	2	38.5	41.2	450	0.789
BLO-18-AC-25	2	32.4	35.1	320	0.941
BLO-18-AC-26	2	38.3	41.2	465	0.828
BLO-18-AC-27	2	38.6	41.6	545	0.948
BLO-18-AC-28	2	38.6	41.6	460	0.800
BLO-18-AC-29	2	36.9	39.4	410	0.816
BLO-18-AC-30	2	39.6	42.5	545	0.878
BLO-18-AC-31	2	39.3	42.5	465	0.766
BLO-18-AC-32	2	38.6	42.0	475	0.826
BLO-18-AC-33	2	33.1	36.9	355	0.979
BLO-18-AC-34	2	39.3	42.5	515	0.848
BLO-18-AC-35	2	39.0	41.9	495	0.834
BLO-18-AC-36	2	38.4	42.1	495	0.874
BLO-18-AC-37	1.5	38.3	41.6	495	0.881
BLO-18-AC-38	3	46.8	50.7	835	0.815
BLO-18-AC-39	3	37.7	41.1	505	0.942
BLO-18-AC-40	3	41.2	45.5	650	0.929
BLO-18-AC-41	3	34.6	37.2	380	0.917
BLO-18-AC-42	3	38.8	42.1	560	0.959
BLO-18-AC-43	3	37.6	40.7	455	0.856
BLO-18-AC-44	3	40.5	44.0	505	0.760
BLO-18-AC-45	3	41.7	45.2	650	0.896

Table G.29: Arctic Charr Measurements from Fish Captured at Mary Lake by Gill Netting, Mary River Project CREMP, August 2018

Specimen ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Fulton's Condition Factor
BLO-18-AC-46	3	38.7	41.6	455	0.785
BLO-18-AC-47	3	39.5	42.6	545	0.884
BLO-18-AC-48	3	37.5	39.6	460	0.872
BLO-18-AC-49	2	38.8	42.1	545	0.933
BLO-18-AC-50	2	36.1	39.3	455	0.967
BLO-18-AC-51	2	38.1	40.9	455	0.823
BLO-18-AC-52	2	37.2	40.8	460	0.894
BLO-18-AC-53	2	34.6	37.4	380	0.917
BLO-18-AC-54	2	38.5	42.3	485	0.850
BLO-18-AC-55	2	39.4	42.8	530	0.867
BLO-18-AC-56	2	42.9	45.9	730	0.925
BLO-18-AC-57	1.5	36.8	40.2	445	0.893
BLO-18-AC-58	1.5	37.0	39.9	505	0.997
BLO-18-AC-59	3	37.8	41.1	510	0.944
BLO-18-AC-60	3	40.7	44.3	610	0.905
BLO-18-AC-61	3	41.3	44.5	550	0.781
BLO-18-AC-62	3	39.8	43.3	540	0.857
BLO-18-AC-63	3	41.2	46.1	605	0.865
BLO-18-AC-64	3	47.5	51.1	975	0.910
BLO-18-AC-65	3	36.9	39.4	440	0.876
BLO-18-AC-66	3	39.0	41.6	470	0.792
BLO-18-AC-67	2	35.4	38.1	455	1.026
BLO-18-AC-68	2	34.1	37.2	370	0.933
BLO-18-AC-69	2	41.5	35.0	590	0.825
BLO-18-AC-70	3	69.2	73.6	2,800	0.845
BLO-18-AC-71	3	45.0	49.2	750	0.823
BLO-18-AC-72	3	29.7	32.6	260	0.992
BLO-18-AC-73	3	40.5	43.6	555	0.835
BLO-18-AC-74	3	41.5	44.2	630	0.881
BLO-18-AC-75	2	36.2	39.1	450	0.949
BLO-18-AC-76	2	39.2	42.0	450	0.747
BLO-18-AC-77	2	40.2	43.3	605	0.931
BLO-18-AC-78	2	32.6	35.2	320	0.924
BLO-18-AC-79	2	39.2	42.7	520	0.863
BLO-18-AC-80	2	50.1	54.0	1,150	0.915
BLO-18-AC-81	2	41.5	45.4	560	0.784
BLO-18-AC-82	2	34.9	38.1	450	1.059
BLO-18-AC-83	2	40.6	43.5	625	0.934
BLO-18-AC-84	3	37.5	40.8	490	0.929
BLO-18-AC-85	3	39.9	43.3	435	0.685
BLO-18-AC-86	3	36.5	39.6	465	0.956
BLO-18-AC-87	3	39.5	43.1	625	1.014
BLO-18-AC-88	3	36.9	40.1	450	0.896
BLO-18-AC-89	3	39.5	42.5	545	0.884
BLO-18-AC-90	3	36.6	39.8	490	0.999

Table G.29: Arctic Charr Measurements from Fish Captured at Mary Lake by Gill Netting, Mary River Project CREMP, August 2018

Specimen ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Fulton's Condition Factor
BLO-18-AC-91	3	38.9	42.0	470	0.798
BLO-18-AC-92	3	39.0	42.6	525	0.885
BLO-18-AC-93	3	37.2	39.7	480	0.932
BLO-18-AC-94	3	35.8	38.2	410	0.894
BLO-18-AC-95	3	38.6	41.2	515	0.895
BLO-18-AC-96	3	40.1	43.5	540	0.837
BLO-18-AC-97	3	39.8	43.9	550	0.872
BLO-18-AC-98	2	40.5	44.2	560	0.843
BLO-18-AC-99	2	36.8	39.8	410	0.823
BLO-18-AC-100	2	40.0	43.5	560	0.875
Overall Catch Summary	Sample Size (N)	100	100	100	100
	Average	39.0	42.1	535	0.876
	Median	38.8	42.1	500	0.881
	Standard Deviation	4.2	4.5	258	0.070
	Standard Error	0.4	0.5	26	0.007
	Minimum	29.7	32.6	260	0.685
	Maximum	69.2	73.6	2,800	1.059

Table G.30: Results of Littoral/Profundal Arctic Charr Health Endpoint Statistical Comparisons between 2018 Mary Lake (BLO) and 2018 Reference Lake 3 (REF) Data, and for Mary Lake between 2018 and the Mine Baseline Period (2006 to 2013), Mary River Project 2018 CREMP

Comparison	Indicator	Endpoint	Variables		Sample Size		Test	ANCOVA Model Statistics			Summary Statistics ^b			Test P-value	Magnitude of Difference (%) ^{c,d}
			Response	Covariate	REF 2018 or BLO Base	BLO 2018		Interaction Model	Parallel Slope Model	Covariate Value for Comparisons ^a					
											Interaction P-value	Covariate P-value	Statistic		
Mary Lake versus Reference Lake 3, 2018	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	34	100	K-S	-	-	-	-	-	-	<0.001	-59
	Body Size	Fork Length	Fork Length (cm)	-	34	100	M-W	-	-	-	Median	34.5	38.8	<0.001	12
		Body Weight	Body Weight (g)	-	34	100	M-W	-	-	-	Median	331	500	<0.001	51
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	34	100	ANCOVA	0.002	<0.001	38.5	Adjusted Mean	499	514	0.089	2.9
Mary Lake 2018 versus Baseline	Survival	Length Frequency Distribution	Fork Length (cm)	-	161	100	K-S	-	-	-	-	-	-	0.017	20
	Body Size	Fork Length	Fork Length (cm)	-	161	100	M-W	-	-	-	Median	39.2	38.8	0.684	-1.0
		Body Weight	Body Weight (g)	-	161	100	M-W	-	-	-	Median	550	500	0.360	-9.1
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	161	100	ANCOVA	0.326	<0.001	37.9	Adjusted Mean	521	507	0.073	-2.8

Area P-value < 0.1 or Interaction P-value < 0.05

Absolute Magnitude of Difference ≥ 10% for Condition (EEM effect endpoint)

^a The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

^b The median, mean (geometric mean for log₁₀-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted mean values from the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction was detected.

^c The magnitude of difference calculated as: [(exposed area mean - reference area mean) / reference area mean] x 100. When there is a significant interaction in the ANCOVA, the magnitude of difference is calculated at the minimum and maximum values of overlap in covariate values as : [(exposed area predicted mean - reference area predicted mean) / reference area predicted mean] x 100.

^d Calculated as the maximum difference in the cumulative relative frequency distributions (CRFD) between areas. A negative difference implies that the exposed area has more fish less than the length where the maximum difference in CFRDs was observed. A positive difference implies that the exposed area has fewer fish less than the length where the maximum difference in CFRDs was observed.

APPENDIX H

SUPPORTING CORRESPONDENCE



2 Lamb Street
Georgetown, Ontario
L7G 3M9
Tel: 905-873-3371
Fax: 905-873-6370

March 17, 2016

Mr. Jim Millard
Environmental Manager
Baffinland Iron Mines Corporation
Mary River Project
2275 Upper Middle Road East, Suite 300
Burlington, Ontario L6H 0C3

Dear Mr. Millard,

Re: Mary River Project CREMP Recommendations for Future Monitoring

In 2015, the Mary River Project CREMP was implemented to evaluate potential mine-related influences on chemical and biological conditions at aquatic environments located near the mine following the first full year of mine operation. The 2015 study was conducted with no deviations from the original CREMP study design (KP 2014; NSC 2014). The key findings of the CREMP suggested a mine-related influence to water and/or sediment quality at Camp Lake system water bodies, and to water quality at a tributary to Sheardown Lake, but no influence to water and sediment quality of Sheardown Lake, Mary River and Mary Lake. In addition, no adverse mine-related influences on phytoplankton, benthic invertebrates or fish (Arctic charr) populations were indicated at any of the Camp Lake, Sheardown Lake and Mary River/Mary Lake systems based on comparisons to reference conditions and to baseline information.

The CREMP was designed as an iterative system of monitoring and interpretation stages, with the results of previous studies used to inform the direction of future monitoring. Therefore, based on the results of the 2015 study, this letter outlines 19 recommendations for modifications of the CREMP design. The suggested modifications are not only intended to provide greater efficiencies to the program, but will also improve the ability of the program to meet the overall objectives (i.e., to evaluate short- and long-term effects of the project on aquatic ecosystems). Accordingly, the following recommendations applicable to stream water quality monitoring, lake water quality monitoring, stream sediment quality and benthic invertebrate community monitoring, lake sediment and benthic invertebrate community sampling and lake fish population monitoring are provided in separate sub-sections herein.

Stream Water Quality Monitoring

- 1) **Discontinue water quality monitoring at Station L1-09 (Camp Lake Tributary 1).** Currently, four water quality monitoring stations are located on the main stem of Camp Lake Tributary 1 (CLT1), with Stations L1-09 and L1-05 both located on the portion of the main stem between the confluence with the north branch and the mine tote road crossing. Monitoring conducted during the 2015 CREMP indicated that water chemistry at these stations was very similar, which can be expected since no sources of dilution occur between these stations. Therefore, the monitoring of two stations within this segment of the CLT1 is redundant.
- 2) **Add a water quality monitoring station to the lower Tom River.** Currently, water quality monitoring stations are located in the tributary exiting Camp Lake (Station J0-01) and on the Tom River upstream of the confluence with this tributary (Station I0-01), but not on the Tom River downstream of this confluence. Therefore, the addition of a water quality monitoring station on the Tom River downstream of the Camp Lake outlet stream confluence would provide information on potential mine-related influence on water quality of the Tom River (Figure 1).
- 3) **Add a water quality monitoring station to each of Sheardown Lake Tributary 12 and Sheardown Lake Tributary 9.** Although benthic invertebrate community sampling is conducted at both of these Sheardown Lake tributaries, no water quality monitoring is conducted on either tributary. Therefore, the addition of a water quality monitoring station on the lower segment of each of these tributaries would provide supporting information important to the interpretation of potential mine-related effects to benthic invertebrate communities of these tributaries (Figure 1).
- 4) **Discontinue water quality monitoring at Station D1-05 (Sheardown Lake Tributary 1).** Currently, two water quality monitoring stations, upstream Station D1-05 and downstream Station D1-00, are located on Sheardown Lake Tributary 1 (SDLT1). Water quality monitoring data collected at the downstream station is sufficient for evaluating mine related effects to water quality of SDLT1. Therefore, water quality monitoring at upstream station D1-05 does not provide additional information important to evaluating effects at SDLT1.
- 5) **Discontinue water quality monitoring at upstream Mary River Stations G0-09A and G0-09B.** The G0-09 series of stations, including G0-09A, G0-09 and G0-09B, are located on Mary River well upstream of the area of mine influence, and thus act as reference stations. Due to the close proximity of all three G0-09 series stations to one another, the water quality data provided from all three stations is redundant. The sampling of a single station at this upstream area is sufficient for interpreting potential effects of the Mary River Project on water quality of Mary River.

- 6) **Discontinue water quality monitoring at Station C0-01 (Mary River).** Because no substantial sources of dilution to Mary River occur between the current C0-05 and C0-01 water quality monitoring stations, Station C0-01 does not provide any additional, useful, information for the evaluation of potential mine influence on Mary River or Mary Lake.

Lake Water Quality Monitoring

- 7) **Reduce the number of water quality monitoring stations to three (3) in each of Camp, Sheardown NW and Sheardown SE lakes, and four (4) in Mary Lake.** No consistent spatial differences in water chemistry were evident in any of the mine-exposed or reference lakes in 2015, nor during any of the baseline studies. In addition, *in-situ* water quality profile data collected in 2015 indicates that all lakes are generally well mixed both laterally and vertically, and as a result, water chemistry is likely to be relatively uniform throughout these lakes during most sampling conditions. Therefore, the sampling of several water quality monitoring stations within these lakes is redundant. Accordingly, it is recommended that for each study lake, only three existing water quality monitoring stations be sampled at each lake using the locations provided in the table below and illustrated in Figure 2.

Lake	Station ID	Depth (m)	Description
Reference Lake 3	REF03-01	15.1	East end of southeast basin
	REF03-02	30.4	Centre of southeast basin
	REF03-03	37.5	Centre of northwest basin
Camp Lake	JLO-02	12.3	Littoral station near primary lake inlet (CLT1, CLT2)
	JLO-07	32.7	Deep basin, near centre of lake
	JLO-09	14.3	Near lake outlet
Sheardown Lake NW	DD-Hab9-Stn1	10.3	Near inlet from SDLT1
	DLO-01-2	17.5	Deep location, near centre of northwest basin
	DLO-01-7	11.4	Near lake outlet
Sheardown Lake SE	DLO-02-6	7.1	Near inlet from Sheardown Lake NW
	DLO-02-3	13.7	Deep location, near centre of southeast basin
	DLO-02-4	8.05	Near inlet from SDLT9
Mary Lake	BLO-1A	14.65	Deepest location at the north basin
	BLO-5	21	Near inlet from Mary River
	BLO-9	30	Deepest location at the south basin
	BLO-6	6.8	Near lake outlet

- 8) **Conduct water quality profiling at only a single station in each of Camp, Sheardown NW and Sheardown SE lakes, and two stations at Mary Lake.** No consistent spatial differences in *in-situ* water quality depth profiles were evident among stations at each mine-exposed and reference lake in 2015, nor would they be expected under typical mixing patterns driven by density gradients (Wetzel 2001). Therefore, it is recommended that water quality profiling be conducted only at the main (i.e., deepest) basin of each study lake, except at Mary Lake where water quality profiling is recommended at the north and south basins, to provide information on lake stratification. Stations recommended for the implementation of water quality profiling include:

Camp Lake Station JL0-07;
Sheardown Lake NW Station DL0-01-2;
Sheardown Lake SE Station DL0-02-3;
Mary Lake (north basin) Station BL0-1A;
Mary Lake (south basin) Station BL0-9; and,
Reference Lake 3 (northwest basin) Station REF03-3.

- 9) **Collect water samples only from mid-water column at each lake water quality monitoring station.** Currently, water chemistry and chlorophyll a samples are collected from approximately 1 m below the surface and 1 m above the bottom at each lake monitoring station (i.e., 2 samples per station). Water chemistry data collected during the 2015 CREMP, as well as during baseline studies, has generally shown only minor (i.e., <2-fold higher) differences in water chemistry and chlorophyll a concentrations between the surface and bottom at each station. Therefore, the collection of a single water sample from approximately mid-column will be sufficient for evaluating average water quality conditions at each lake water quality monitoring station unless it is determined that the lake is thermally (or otherwise) stratified, in which case the same sampling convention from previous studies will be applied (i.e., top-bottom). Interpretation of *in-situ* water quality profile data collected at the main basin of the lake will be used as the basis for determination of whether one or two water samples will be collected from each respective lake station during each winter, summer or fall sampling event.

Stream Sediment and Benthic Invertebrate Community Monitoring

- 10) **Discontinue stream sediment quality monitoring as part of the CREMP.** Stream sediment sampling was included in the Mary River Project CREMP to provide qualitative information to support the lake sediment quality data analysis (KP 2014, 2015). Streams and rivers in the Mary River Project local study area (LSA) contain very limited depositional habitat suitable for the collection of fine sediments. The general absence of any substantial accumulation of fine sediments within these watercourses precluded any meaningful assessment of potential mine-related influences on sediment quality within, along and/or between watercourses during the 2015 CREMP, as well as during baseline studies (KP

2015). Because the current sediment sampling program provides no ecologically meaningful information considered useful for the evaluation of potential mine-related effects, it is recommended that stream sediment sampling be discontinued.

11) Add a benthic invertebrate community study area to the CLT1 upper main stem.

Elevated concentrations of chloride, iron, nitrate and other parameters were observed at the upper main stem area of CLT1 (Station L2-03) in 2015 compared to reference conditions and the mine baseline period, with iron concentrations above water quality guidelines and AEMP benchmarks at this area. Mine-related influence on water quality of CLT1 was consistent with blasting/quarrying activity at the QRM2 pit. Therefore, the addition of a benthic invertebrate community study area to CLT1 near Station L2-03 is recommended to evaluate potential biological effects associated with mine activity in the upper portion of the CLT1 watershed. The benthic invertebrate community sampling will follow the same approach as that employed elsewhere for the stream program (Figure 3).

12) Discontinue benthic invertebrate community sampling at the two upper reaches of Sheardown Lake Tributary 1 (SDLT1).

Currently, three benthic invertebrate community study areas are situated on SDLT1. Similar to sampling conducted at Sheardown Lake Tributary 9 and Tributary 12, one study area is sufficient for evaluating mine related effects to the benthic invertebrate community of SDLT1. This study area should be situated at the lower creek reach (Reach 1) to provide temporal continuity with previous studies, and because water chemistry data is also collected at this location (i.e., Station D1-00).

13) Add a stream reference benthic invertebrate community study area.

No stream reference study area has been established for the stream benthic invertebrate community component of the CREMP (NSC 2014). Therefore, in order to provide a stronger basis for evaluating mine-related effects to biota residing in the mine-exposed tributaries of Camp and Sheardown lakes, it is recommended that a reference study area be incorporated into the program. The ideal reference area should share similar habitat features with the mine-exposed tributaries (e.g., similar width, water velocity, substrate size, etc.) and be outside the area of mine influence. It is recommended that one of the watercourses used as a lotic reference for water monitoring (i.e., CLT-REF4, MRY-REF2, MRY-REF3) also serve as a reference area for the stream benthic invertebrate community assessment (Figure 3). The determination of the most suitable reference watercourse, based on similarity in habitat characteristics to the mine-exposed tributaries, can be selected during the next CREMP biological field study (i.e., August 2016).

Lake Sediment and Benthic Invertebrate Community Monitoring

14) Consider updating the AEMP sediment quality benchmarks.

On average, arsenic, copper and iron concentrations were elevated above respective AEMP sediment quality benchmarks within Reference Lake 3 littoral and/or profundal station sediment during the 2015 CREMP. In turn, this suggested that the AEMP benchmarks for these metals may

be overly conservative. Because reference lake information had not been available at the time of AEMP benchmark development, it is recommended that reference sediment quality data be factored into the derivation of AEMP benchmarks for arsenic, copper and iron to improve the applicability of these benchmarks as a tool for evaluating potential mine effects for the Mary River Project CREMP.

- 15) **Focus the lake benthic invertebrate community (benthic) survey only on the littoral zone.** Benthic invertebrate density, richness and relative abundance of dominant groups, including metal-sensitive taxa, differed significantly between littoral (shallow) and profundal (deep) stations of the reference lake during the 2015 CREMP, which is consistent with general distribution patterns of benthic invertebrates with depth in lakes (Ward 1992). Thus, the sampling of benthic invertebrates at profundal depths limits the ability to evaluate the occurrence and/or magnitude, of mine-related effects on biota due to natural factors being more important drivers of community structure than mine-related contaminants of concern at these depths (e.g., naturally lower oxygen and food resources with depth). Therefore, it is recommended that benthic sampling at mine-exposed lakes focus solely on littoral sampling depth (i.e., approximately 8 – 10 m depth). Consistent with Environmental Effects Monitoring (EEM) guidance under the Metal Mining Effluent Regulations (MMER), it is recommended that five stations be sampled at each mine-exposed lake (Environment Canada 2012) at littoral sampling depths. To the extent possible, the littoral sampling stations will be established at existing benthic stations at Camp, Sheardown NW, Sheardown SE and Mary mine-exposed lakes, as well as at Reference Lake 3 (Figures 2 and 3). However, in some cases, new stations will be need to be established to ensure sufficient coverage of the lake, and to ensure that substrate properties are comparable among and within lakes. Under this recommendation, benthic sampling would be discontinued at all profundal stations, resulting in a total of 25 lake benthic stations in the CREMP rather than 50 currently (Figures 2 and 3).
- 16) **Harmonize the lake sediment quality and benthic invertebrate community monitoring stations.** Currently, sediment chemistry data is not collected at all benthic invertebrate community sampling stations, limiting the ability to establish linkages between sediment metal concentrations and potential effects on benthic invertebrates. Therefore, it is recommended that sediment samples be collected at all benthic invertebrate community stations and analyzed for particle size, total organic carbon (TOC), and total metals concentrations as part of the CREMP.
- 17) **Restructure the lake sediment quality monitoring program to reflect changes in the benthic invertebrate community survey sampling station locations.** To accommodate the recommended changes to the lake benthic invertebrate community survey, it is recommended that sediment quality monitoring station locations be re-located to the same five littoral benthic sampling depths/stations per lake discussed above (Recommendation 15). In addition, to maintain proper coverage of each study lake and

ensure temporal continuity, it is recommended that three profundal sediment sampling stations be maintained in the program for each mine-exposed lake, resulting in a total of eight sediment quality monitoring stations at all mine-exposed lakes except Sheardown Lake SE, where the majority of the lake is less than 12 m deep (i.e., representative of littoral habitat). Under this approach, the total number of sediment quality monitoring stations sampled would be reduced from 33 currently to 29. The profundal sediment quality stations recommended for inclusion in the CREMP are provided in the table below, and are shown on Figures 2 and 3.

Lake	Station ID	Depth (m)	Sediment Profundal Station Description
Camp Lake	JLO-14	26.5	Central basin – east (inlet area)
	JLO-07	32.7	Central basin – middle
	JLO-11	28.8	Central basin – west (outlet area)
Sheardown Lake NW	DLO-01-5	23.1	Central basin – north
	DLO-01	20.8	Central basin – middle
	DLO-01-2	18.6	Central basin – south
Mary Lake	BLO-12	21.7	South basin – near Mary River inlet
	BLO-10	18.7	South basin – middle
	BLO-08	26.7	South basin – near lake outlet

Lake Fish Population Monitoring

- 18) **Reduce the non-lethal adult Arctic charr sample size to 50 fish per lake.** The adult Arctic charr fish population survey currently targets 100 fish from each study lake using a ‘non-lethal’ sampling approach (KP 2014, 2015). Based on data acquired during the 2015 CREMP, power analysis indicated that total sample sizes can be reduced by half (i.e., 50 fish) while still maintaining the ability to detect changes between lakes and/or between study periods with sufficient power. Therefore, it is recommended that sample sizes for adult Arctic charr be reduced from 100 to 50 in future CREMP studies. By doing so, the number of incidental mortalities would be reduced substantially. A total of 57 adult Arctic charr incidental mortalities were encountered during the 2015 CREMP under normal sampling conditions, and therefore, by reducing the amount of effort applied, the number of incidental mortalities may be reduced to less than 25 without affecting the ability of the program to meet study objectives.
- 19) **Focus the current collection gear for optimal capture rates for adult Arctic charr.** Currently, gang index gill nets with net mesh sizes ranging from 25 – 127 mm are prescribed to capture adult Arctic charr at all study lakes under the CREMP (NSC 2014, 2015). During the 2015 CREMP, the majority of Arctic charr were captured in net mesh

sizes ranging from 38 – 64 mm, which was also similar to the most efficient mesh size used to capture adult Arctic charr during the previous baseline studies. Therefore, it is recommended that the 38 – 64 mm mesh size be adopted as the 'standard' size used to collect fish samples for the CREMP. In doing so, it is anticipated that fewer incidental mortalities will be encountered (e.g., reduced handling time) and additional sampling efficiencies will be gained.

As mentioned previously, we believe the 19 suggested modifications outlined above will not only provide greater efficiencies to the CREMP, but are also scientifically defensible and will maintain and, in some cases, improve the ability of the program to meet the overall objectives set out under the AEMP. Should you have any questions, or require additional supporting information regarding these recommendations, please do not hesitate to contact me.

Sincere regards,

Minnow Environmental Inc.

A handwritten signature in blue ink, appearing to read 'Paul LePage', is positioned above the printed name.

Paul LePage, M.Sc.
Senior Project Manager

Technical Memorandum

Date: April 11, 2018

To: Andrew Vermeer, Christopher Murray, and William Bowden

From: Paul LePage, Minnow Environmental Inc.

RE: **Statistical Approach for Determining Water Quality Monitoring Sample Sizes at Lakes Sampled Under the CREMP**

Introduction

Following the completion of the first Core Receiving Environment Monitoring Program (CREMP) study conducted after start-up of the Mary River Project mine operations, it was recommended that the number of water chemistry monitoring stations be reduced to three in each of Camp, Sheardown NW, and Sheardown SE lakes, and to four in Mary Lake (Minnow 2016). The rationale for this recommendation was that no consistent spatial differences in water chemistry were evident at any of the CREMP mine-exposed or reference lakes after commercial mine start-up in 2015, nor during pre-mining baseline studies. In addition, *in situ* water quality profile data indicated that all CREMP study lakes were generally well mixed, and as a result, spatially within each lake, water chemistry has been relatively uniform from the lake inlet to the outlet. Due to the limited spatial variability in water chemistry among stations within each lake, the sampling of five or more water quality monitoring stations within the lakes sampled for the CREMP was thus considered redundant (Minnow 2016).

During the Baffinland Iron Mines Corporation (Baffinland) Freshwater Workshop held in Iqaluit, Nunavut November 8th – 9th, 2017, Minnow proposed a two-way analysis-of-variance (ANOVA) model to evaluate lake-specific significant changes in water chemistry between baseline and mine operational periods (i.e., before-after analysis). Included as part of this approach was the use of power analysis to determine an appropriate number of sampling stations that would be required from each study lake in each year to be able to assess for significant changes in water chemistry between baseline and individual years of mine operation. This technical memorandum outlines the recommended before-after statistical approach that can be used to determine changes in water chemistry at lakes potentially influenced by the Mary River Project mine operations, as well as background information, methods, and results of power analysis conducted using data subject to the proposed before-after statistical approach.

Proposed Statistical Model to Evaluate Mine-Related Changes in Water Quality

The study design for the CREMP outlined a water chemistry sampling approach that included the collection of samples from at least five stations per mine-exposed lake during each of three seasons each year (i.e., 15 samples per year per lake). No statistical approach to evaluating temporal changes in water chemistry was indicated in the CREMP study design (KP 2014a), although a mixed linear effects model was suggested as a potential approach to compare annual parameter concentrations from years of mine operation (e.g., 2015 and onwards) to concentrations during the mine baseline period (2006 – 2013 data; KP 2014b). The general approach to the temporal analysis of lake water chemistry data proposed by KP (2014b) focused on station-specific changes over time. However, for the reasons stated above, data collected following commercial mine start-up have since indicated that a lake-specific analysis is appropriate for evaluating temporal changes in water chemistry (Minnow 2016). The transition from a station-specific to a lake-specific approach for assessing changes in water chemistry requires fewer number of lake water quality monitoring stations without losing the ability of the CREMP to detect mine-related influences on lake water chemistry over time. This premise provides the basis for the recommended statistical approach described below for evaluating mine-related changes in water quality at CREMP study lakes over time.

The recommended approach to assess changes in water quality between mine-operational and baseline periods provided herein and proposed by Minnow (2016) is a two-way ANOVA hypothesis test with factors Year and Season conducted separately for each mine-exposed lake. Parameters considered for the analysis should include those that have been shown to exceed water quality guidelines or AEMP benchmarks, and/or parameters that have shown higher mean concentrations over time based on visual evaluation of plotted data, at each individual lake. For this hypothesis test, if the interaction between Year and Season is not statistically significant (i.e., the difference in parameter concentration among years is consistent among winter, summer and fall seasons) then an appropriate ANOVA model will be used to assess an among-year difference in parameter concentration. In the event that the latter ANOVA hypothesis test indicates a significant among-year difference in parameter concentration, then *post-hoc* contrasts will be conducted to test the following hypotheses for a temporal change:

- Linear trend;
- Step Change after year 1: (mean in year 1 = mean for years 2,3,4);
- Step Change after year 2: (mean in years 1 and 2 = mean for years 3 and 4); and,
- Step Change after year 3: (mean in years 1, 2, 3 = mean for year 4).

These four contrasts will be conducted to assess temporal change, and if any of these models indicate a significant difference, the model with the best fit (i.e., lowest p-value) will be used to



describe the type of temporal change as defined above. A significant interaction shown between Year and Season will indicate no consistent temporal change in parameter concentrations among seasons, necessitating that the data be evaluated separately by season using the same general sequence for the determination as provided above. Representative outputs using this approach are provided for Camp Lake total aluminum and total uranium concentration data in Annex 1.

Determination of Appropriate Station Number for the Recommended Before-After Analysis

In experimental design, power analysis is an important set of procedures and formulas that allows the determination of suitable sample sizes required to detect an effect of a given size with a given degree of confidence (given an assumed true difference between groups). Power analysis of lake water chemistry data was conducted as part of the Baffinland baseline studies to assist with the determination of appropriate sample sizes (i.e., number of stations) during development of the Mary River Project mine site CREMP (Baffinland 2014; KP 2014a,b). This original power analysis was used to estimate the number of samples required to statistically demonstrate a significant change in parameter concentrations between the baseline period (i.e., prior to the initiation of commercial mine operation) and following mine start-up at individual stations in each of the four mine-exposed lakes located adjacent to the Mary River Project mine site (i.e., Camp, Sheardown NW, Sheardown SE, and Mary lakes). Briefly, this analysis indicated that as few as five water chemistry samples would be sufficient to determine a significant change in concentrations of five potential mine indicator metals (aluminum, arsenic, cadmium, copper and iron) at each individual station following mine start-up compared to the baseline period (KP 2014b).

As indicated in the original review of baseline water quality data by KP (2014b), once data from the commercial mine operation period becomes available, alternative statistical models to test for differences in parameter concentrations between baseline and mine-operational periods becomes warranted and can trigger the requirement to review experimental sample sizes. The approach recommended herein to evaluate water chemistry changes at CREMP study lakes (i.e., two-way ANOVA) assesses for changes at a lake-specific level, rather than at a station-specific level from which the original study design was based. Therefore, an updated power analysis must now be used to determine a suitable number of samples (i.e., stations) required from each CREMP study lake to allow detection of changes in concentrations of mine-related parameters compared to the baseline period based on the recommended ANOVA model. For the power analysis, the ANOVA hypothesis test is used to determine if there is a significant difference in mine-related parameter concentrations among years, or stated differently, whether mean parameter concentrations in each year are equal:

e.g., $H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4$ where μ_i = the mean parameter concentration in year i



Two types of statistical errors can result during a hypothesis test as a result of chance. A Type I error, defined as α , occurs when the ANOVA hypothesis test (i.e., H_0 above) indicates a difference among samples (in this case, annual parameter concentrations) when in fact there is truly no difference among years. A Type II error, defined as β , occurs when the hypothesis test indicates no difference among years when there is truly a difference between at least two years of data. In environmental monitoring, α and β are typically set equal to each other (e.g., Environment Canada, 2012) to set the risk to industry (Type I error: concluding there is an effect when in fact there isn't) equal to the risk to the environment (Type II error: concluding there is no effect when in fact there is). To conduct a power analysis to determine the number of samples required to detect a change, the following parameters must be defined:

- The magnitude of the change that we wish to define as being significant (referred to as the critical effect size);
- The variability expected in the data;
- Probability of Type I error (α); and,
- Probability of Type II error (β).

Critical effect sizes (CES) have not been formally defined in the literature for assessing differences in water quality parameter concentrations. However, in biological studies, CES have been defined as a two standard deviation (± 2 SD) change between mine-exposed and reference areas (Environment Canada, 2012). By definition, ninety-five percent (95%) of data values fall within ± 2 SD of the mean for normally distributed data. In other words, a magnitude change of ± 2 SD is equivalent to the mean of one group falling outside of the range of 95% of the data for another group. This magnitude of change could be considered relevant for assessing a temporal change in water quality and was used as the CES (or magnitude of effect) for power analysis of Camp Lake water chemistry data conducted herein¹. Because the CES of ± 2 SD is defined based on the observed variability in the data, no measure of variability was required in this power analysis. Consistent with Environment Canada (2012) recommendations for environmental monitoring, Type I (α) and II (β) errors were set equally to 0.1 for the power analysis.

The statistical comparison of the Year term in a two-way ANOVA is equivalent (with the exception of a loss of two degrees of freedom for the Season term) to the use of a one-way ANOVA on Year after adjusting for differences in season. Therefore, the power analysis conducted herein applied to the data as described in the description of power analysis provided above. Data collected at

¹ The CREMP study design water quality baseline analysis used halfway between the station baseline mean and the AEMP benchmark as the CES for power analysis of the baseline data (KP 2014b). Although this same definition for CES can be applied to the approach recommended in this technical memorandum, application of a ± 2 SD of the mean baseline to define CES allows analysis of those parameters to which AEMP benchmarks have not been developed.



Camp Lake from operational and baseline periods were used to estimate the sample size required to detect a ± 2 SD (within year and season pooled SD; Table 1) change among years in selected parameter concentrations using ANOVA with α and β set equally at 0.1. Based on this analysis, a minimum sample size of 7 samples per year was determined to be sufficient for lake-specific detection of a ± 2 SD change in parameter concentrations over time. However, in order to have an equal number of samples collected at each lake per season, and to accommodate the loss of two degrees of freedom for the Season term in the two-way ANOVA, a sample size of 9 samples per year (water samples collected at three stations on three separate occasions, winter, summer and fall, per year) is proposed for Camp, Sheardown NW and Sheardown SE lakes. At Mary Lake, a sample size of 9 samples per year is proposed for the south basin (water samples collected at three stations on three separate occasions, winter, summer and fall, per year), with an additional 3 samples collected each year collected over the same three seasonal sampling events at the north basin.

Table 1: Estimates of the Magnitude of a 2 SD Change for Select Parameters Using the Camp Lake Baseline Data

Parameter	Units	2 Standard Deviations (SD)
Chloride	mg/L	1.5
Sulphate	mg/L	1
Total Aluminum	$\mu\text{g/L}$	5.3
Total Copper	$\mu\text{g/L}$	1.8
Total Iron	$\mu\text{g/L}$	-
Total Manganese	$\mu\text{g/L}$	0.5
Total Molybdenum	$\mu\text{g/L}$	0.049
Total Nickel	$\mu\text{g/L}$	0.39
Total Potassium	mg/L	0.12
Total Sodium	mg/L	0.2
Total Strontium	$\mu\text{g/L}$	2.1
Total Uranium	$\mu\text{g/L}$	0.16
Dissolved Aluminum	mg/L	-
Dissolved Manganese	mg/L	0.0008

Notes: “-” = estimate could not be made due to the high proportion of values below the detection limit. Estimates of the SD were conducted using the Kaplan-Meier method (Helsel 2012) to accommodate values below the laboratory reportable detection limit.



Conclusion

Using the statistical approach provided herein for determining the occurrence of significant changes in water chemistry over time in the CREMP study lakes and subsequent power analysis, the collection of water samples from three stations per mine-exposed lake, three times per calendar year (winter, summer and fall), is sufficient to statistically evaluate annual changes in lake water chemistry with high statistical power. This analysis corroborated the Minnow (2016) proposal that reducing the number of CREMP water chemistry monitoring stations to three in each of Camp, Sheardown NW and Sheardown SE lakes, and to four in Mary Lake, would not compromise the ability of the CREMP to track mine-related influences on water quality of these lakes.

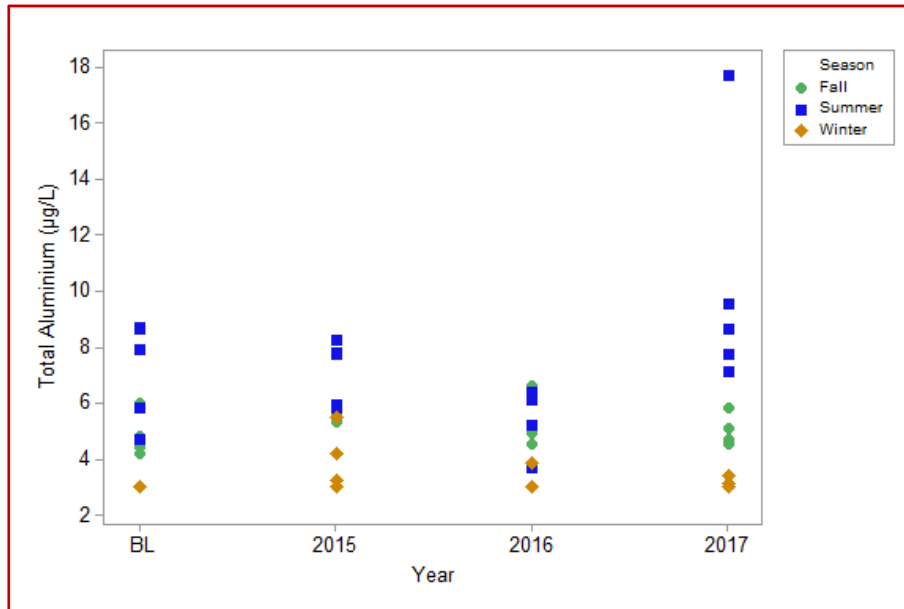
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Annex 1

Example 1: Camp Lake total aluminum concentration two-way ANOVA. Step 1: The interaction term between year and season was shown to be significant (p-value of 0.021 was less than a 0.1 level of significance) indicating that aluminum concentrations from at least one season differed among mine baseline (BL) and mine-operational years.



**Year x Season
p-value = 0.021**

Step 2: Subsequent ANOVA of Camp Lake total aluminum concentrations over individual seasons indicated that aluminum concentrations did not differ significantly over time during fall and winter sampling seasons, but did differ significantly among study periods in summer (using a 0.1 p-value level of significance).

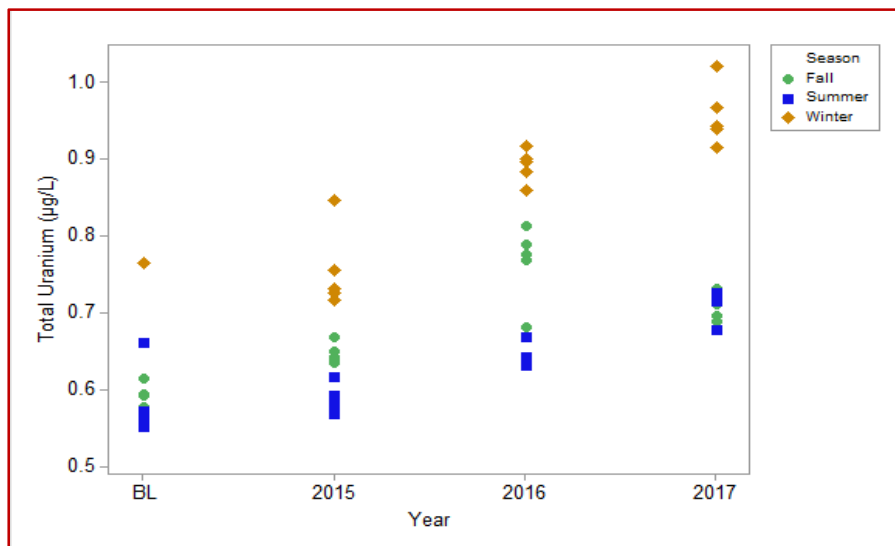
Season	P-value (YEAR)
Summer	0.053
Fall	0.320
Winter	0.378

Step 3: *Post hoc* analysis of the Camp Lake total aluminum concentrations during summer indicated a significant step change (increase) occurred after 2016. Notably, no significant change in summer aluminum concentrations was indicated over baseline, 2015, and 2016 periods.

Hypothesis <i>Post Hoc</i> Contrasts	Summer P-value
Linear	0.408
Step after BL	0.698
Step after 2015	0.585
Step after 2016	0.004



Example 2: Camp Lake total uranium concentration two-way ANOVA. Step 1: The interaction term between year and season was shown to be significant (p-value of 0.021 was less than a 0.1 level of significance) indicating that aluminum concentrations from at least one season differed among mine baseline (BL) and mine-operational years.



**Year x Season
p-value < 0.001**

Step 2: Subsequent ANOVA of Camp Lake total uranium concentrations over individual seasons indicated that uranium concentrations differed significantly over time for all summer, fall, and winter sampling seasons (using a 0.1 p-value level of significance).

Season	P-value (YEAR)
Summer	< 0.001
Fall	< 0.001
Winter	< 0.001

Step 3: *Post hoc* analysis of the Camp Lake total uranium concentrations for the winter data indicated a significant change (increase) has occurred since the baseline period. The model with the best fit (i.e., lowest p-value) indicated that a significant step change after 2015 most appropriately described the type of temporal change for uranium over time during winter sampling. Camp Lake uranium concentrations temporal post hoc analysis results for summer and fall seasons also indicated a significant step change after 2015 (values not shown here).

Hypothesis <i>Post Hoc Contrasts</i>	Winter P-value
Linear	0.042
Step after BL	0.081
Step after 2015	< 0.001
Step after 2016	0.007

