2023 Serpent River Watershed Monitoring Program Annual Water Quality Report

Year 4 of Cycle 5
Submitted to the Canadian Nuclear Safety Commission on behalf of Rio Algom Limited, and Denison Mines Inc

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Joint Review Group for the Serpent River Watershed Monitoring Program 2024

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Contents

List of Figures

List of Tables

List of Appendices

1.0 Introduction

As part of the closure and decommissioning process, Rio Algom Limited (RAL) and Denison Mines Inc. (DMI) developed a focused and integrated performance monitoring network for legacy sites within the Serpent River Watershed (SRW). The comprehensive monitoring and management strategy clearly defined and delineated the purpose for all monitoring activities through three integrated programs: the Tailings Management Area (TMA) Operational Monitoring Program (TOMP), the Source Area Monitoring Program (SAMP), and the Serpent River Watershed Monitoring Program (SRWMP) (Minnow Environmental Inc. (Minnow), 2019). An integrated assessment of the results from the monitoring programs has been prepared every five years in a State of the Environment Report (SOE) in compliance with license requirements and in accordance with Canadian Standards Association (CSA) standard N288.4-10 (2010). The regulatory review of the most recent SOE (Cycle 5, inclusive of data from January 1, 2015 – December 31, 2019) was submitted to the Joint Regulatory Review Group (JRG) on March 31, 2021.

The SRWMP was initiated in 1999 as a joint initiative of RAL and DMI with the objectives of evaluating the effectiveness of mine decommissioning plans and assessing long-term environmental water quality trends in the watershed (Beak International Incorporated (Beak, 1999).

Evolution of the program, key outcomes, program modification decisions, and associated references are summarized in Appendix I. In 2023, the SRWMP followed the 2020 program modifications recommendations described in the Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Cycle 5 Study Design, (Minnow, 2019).

The SRWMP Annual Water Quality Report for 2023 provides water quality data from watershed monitoring locations from January 1, 2023, through December 31, 2023, summarizing Year 4 of Cycle 5 of the monitoring program. This report should be read in conjunction with the Annual Operating Care and Maintenance (OCM) reports, prepared independently by each company, which provides a summary of operational activities completed at the facilities as well as data collected as required by the SAMP and TOMP (RAL, 2024; DMI, 2024). The objective of the SRWMP annual data review is to identify anomalous data and evaluate short-term data trends at key locations. Step changes and anomalies are identified in this report by reviewing and compiling the last five years of annual average data for all SRWMP monitoring locations and reviewing the information for any noticeable changes. Significant changes and unusual results are investigated in accordance with the Water Quality Assessment and Response Plan, which is found in Appendix A of the most recent SOE Report (Minnow, 2021).

The SRWMP Annual Water Quality Report for 2023 also provides a summary of the data quality management program and water quality results for the period January 1, 2023, through December 31, 2023.

As part of the 2015 SOE review, the Canadian Nuclear Safety Commission (CNSC) instructed RAL and DMI to include annual reporting of a representative radiation dose to the public associated with their closed uranium mine sites in the SRW. Details on this topic are discussed in Section 4.4 of this report.

2.0 Methodology

2.1 Program Requirements

The 2023 SRWMP followed program requirements (sampling locations, frequencies, parameters, and analytical protocols) as approved in the Cycle 5 Study Design (Minnow, 2019). Table 2-1 provides a brief

description of each monitoring location, the frequency of monitoring and parameters monitored. Figure 2-1 provides a map of the stations included in the water quality monitoring program.

Table 2-1 2023 SRWMP Water Quality Monitoring Requirements

Sampling Station	Location / Description	Sample Type	Purpose	Flow (L/s)	Field pH	Sulphate (mg/L)	Radium-226 (Bq/L total)	Uranium (mg/L)	Barium (mg/L)	Iron (mg/L)	Manganese (mg/L)	Hardness[3] (mg/L)	DOC[4] (mg/L)
SR-16[2]	Fox Creek at Highway 108	Wetland/stream reference	SRWMP/SAMP		4	4	4	4	4	4	4	4	4
SR-17[2]	Unnamed Creek Drain Lake 3 @ Hwy 108	Wetland/stream reference	SRWMP/SAMP		4	4	4	4	4	4	4	4	4
SR-18	Outlet of Jim Christ Lake	Lake reference	SRWMP		2	2	2	2	2	2	2	2	2
SR-19	Inlet to Elliot Lake	Lake reference	SRWMP		4	4	4	4	4	4	4	2	2
SR-08	Nordic Lk Outlet	far field	SRWMP/MECP[5]		4	4	4	4	4			4	4
SR-15	May Lake Outlet	far field	SRWMP	2	2	2	2	2	2	2		2	2
M-01[1]	Sherriff Ck @ Hwy 108	near field	SRWMP		4	4	4	4	4	4		4	4
Q-09	Serpent River Below Q Effluent	near field	SRWMP	4	4	4	4	4	4			4	4
Q-20	Evans Lk Outlet to Dunlop Lk	near field	SRWMP	1	1	1	1	1	1			1	1
SC-01	Westner Lk Outlet	near field	SRWMP/MECP[5]		1	1	1	1	1	1		1	1
SR-06	McCabe Lk Outlet	near field	SRWMP	2	2	2	2	2	2			2	2
FBR5	Field Blank Rio	QA/QC	SRWMP		2	2	2	2	2	2		2	2
BSR5	Blind Sample Rio	QA/QC	SRWMP		2	2	2	2	2	2		2	2
Rio Algom total excluding field blanks & blind samples				**9**	**32**	**32**	**32**	**32**	**32**	**21**	**14**	**30**	**30**
D-4	Dunlop Lk Outlet	Lake reference	SRWMP		2	2	2	2	2	2	2	2	2
D-5	Serpent R. between Q and D	near field	SRWMP	4	4	4	4	4	4			4	4
D-6[1]	Cinder Lk Outlet	near field	SRWMP	4	4	4	4	4	4	4	4	4	4
DS-18	Halfmoon Lk Outlet	near field	SRWMP/MECP	4	4	4	4	4	4	4		4	4
SR-01	Quirke Lk Outlet	far field	SRWMP		1	1	1	1	1			1	1
FBD2	Field Blank Denison	QA/QC	SRWMP		2	2	2	2	2	2	2	2	2
BSD2	Blind Sample Denison	QA/QC	SRWMP		2	2	2	2	2	2	2	2	2
Denison total excluding field blanks & blind samples				**12**	**15**	**15**	**15**	**15**	**15**	**10**	**6**	**15**	**15**
Total QA/QC samples				0	8	8	8	8	8	8	4	8	8
TOTAL SAMPLES				**21**	**47**	**47**	**47**	**47**	**47**	**31**	**20**	**45**	**45**
QA/QC Fraction of Total				0%	17%	17%	17%	17%	17%	26%	20%	18%	18%

Notes:

1. Field QA-QC designated stations.
2. Wetland reference locations for the SRWMP and SAMP Cycle 5 Design Study (Minnow 2019).
3. Hardness is an ancillary parameter used to assess manganese and sulphate as both parameters are hardness dependant (Ambient Water Quality Guidelines) (BC ENV 2019)
4. DOC was added as a qualifier for iron as per the proposed Federal Water Quality Guideline (ECCC, 2019).
5. Ontario Ministry of the Environment, Conservation and Parks (MECP) required sampling as per Nordic Environmental Compliance Approval, NUMBER: 0001118756. rev .01, Sept, 2020.

2.2 Program Conformance

All Cycle 5 sampling requirements were met during the 2023 reporting period, with the exception of 2 flow measurements. Although the samples were collected, flow could not be measured at D-6 and DS-18 in February due to thick ice build-up across the channels. This is consistent with the 2022 conformance at the same 2 locations, both having limited access due to ice build-up in the winter months.

Hardness continues to be monitored as an ancillary parameter at all SRWMP stations. According to the Approved Water Quality Guidelines for Aquatic Life, Wildlife & Agriculture from the British Columbia Ministry of Environment & Climate Change Strategy (BC ENV), manganese and sulphate guidelines are hardness dependent (BC ENV, 2020). Dissolved organic carbon (DOC) was added to the monitoring program at the recommendation of the Ontario Ministry of the Environment, Conservation, and Parks (MECP) as it can modify iron toxicity. DOC data is provided in Appendix V for 2023, however, it has not been used for iron assessment in this report, as the upper level of background for iron is higher than federal guidelines. Changes to the program are discussed in further detail in Section 4.2.

2.3 Field Measurements

Field measurement requirements and protocols for the 2023 SRWMP are presented in detail in the Cycle 5 Study Design (Table 6.2, Minnow, 2019). Field Staff have been trained and have reviewed procedures associated with the proper calibration and use of field equipment for the measurement of field parameters. The models and accuracy for equipment used in measuring SRWMP field parameters are provided in Table 2-3.

Table 2-3 SRWMP Field Equipment Models and Accuracy

Parameter	Meter	Accuracy	Unit
pH	YSI Pro 10	+/- 0.02	pH units
Flow	Global Flow Probe	0.1	feet per second

2.4 Data Quality Objectives

Field and laboratory data quality objectives (DQOs) for the 2023 SRWMP are presented in detail in the *Cycle 5 Study Design* (Minnow, 2019). Table 2-4a provides a summary of field DQOs, and Table 2-4b provides a summary of laboratory methods, detection limits and DQOs. Data quality assessment results are provided in Section 3.

2.5 Changes in Analytical Methods

There were no changes to analytical methods in 2023.

2.6 Reporting of Methods Detection Limits

Program method detection limits (MDLs) are presented in Tables 2-4a and 2-4b.

Table 2-4a 2023 SRWMP Field Data Quality Objectives

Parameter	Units	Assessment Criteria [1]		Data Quality Objectives[2]			
		PWQO BCMOE	Background	Detection Limit	Minimum [3] Detectable Difference	Field Blank Criteria	Field Precision
Field Parameters[3]							
Flow	L/s	-	-	method	method	-	30%
pH				0.1	0.01 or 0.02	-	10%
Lake Stations		6.5	-				
Wetland/Streams		-	5.3				
Laboratory Parameters							
Barium	mg/L	1.0	-	0.005	-	0.01	20%
Iron	mg/L	-	-		-		
Lake Stations		-	0.76	0.02	-	0.04	20%
Wetland/Streams		-	2.49	0.02	-	0.04	20%
Manganese [4]	mg/L	0.841	-	0.002	-	0.004	20%
Radium (total)	Bq/L	0.469[5]	-	0.005	-	0.01	20%
Sulphate [4]	mg/L	128-429[4]	-	0.1	-	0.2	20%
Uranium	mg/L	0.015	-	0.0005	-	0.001	20%
Hardness	mg/L	-	-	0.5	-	1.0	20%

Notes:

1. Table S.1, Apprendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)
2. Table 6.2 Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)
3. Minimum detectable difference as identified in instrument manual
4. Table S.2, Apprendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

5 The dose-base site-specific benchmark for radium is selected, as per CNSC request and is detailed in Section 5.2.5.2, of the Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

Table 2-4b 2023 SRWMP Laboratory Methods and Data Quality Objectives

Parameter	Units	Assessment Criteria [1]		Laboratory Data Quality Objectives[2]					
		PWQO BCMOE	Background	Method	Detection Limit	Laboratory Blank	Precision	Spikes	Accuracy (CRM)
Barium	mg/L	1.0	-	ICP-MS	0.005	0.01	10%	20%	20%
Iron	mg/L	-		ICP-OES					
Lake Stations			0.76		0.02	0.04	10%	20%	20%
Wetland/Streams			2.49		0.02	0.04	10%	20%	20%
Manganese [3]	mg/L	0.841	-	ICP-MS	0.002	0.004	10%	20%	20%
Radium (total)	Bq/L	0.469[4]	-	Alpha Spectroscopy	0.005	0.01	20%	20%	-
Sulphate [3]	mg/L	128-429	-	Ion Chromatography	0.1	0.2	10%	20%	20%
Uranium	mg/L	0.015	-	ICP-MS	0.0005	0.001	10%	20%	20%
Hardness	mg/L	-	-	ICP-OES	0.5	0.1	10%	-	-

Notes:

1. Table S.1, Apprendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)
2. Table 6.2 Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)
3. Table S.2, Apprendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)
4. The dose-base site-specific benchmark for radium is selected, as per CNSC request and is detailed in Section 5.2.5.2, of the Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

2.7 Data Screening and Assessment Conventions

Data validation was conducted on SRWMP water quality data throughout the year. The assessment screening process flags all data points outside a rolling minimum 12 value mean ± 3 standard deviations.

Flagged data and short-term response plans for the SRWMP are reported quarterly to regulatory agencies as part of the water quality report. Data validation of "flagged data" for the year 2023 can be found in Appendix II.

Annual water quality reporting is designed to be concise and focused on the presentation of data in a standardized format with limited interpretation, as per Section 14.2 of the Implementation Document (Beak, 1999c). Data validation ensures prompt response to upset conditions or unusual results, as documented in Data Validation Procedures in conjunction with Water Quality Assessment and Response Plan, which is included in Appendix B of the SOE (Minnow, 2021). Assessment criteria as outlined in Table 2-4a and Table 2-4b of this report, are standardized to benchmarks selected, rationalized, and presented in Appendix S, Tables S.1 and S.2 of the Cycle 5 SOE (Minnow, 2021).

Approved program modifications implemented in January of 2020 focused water quality monitoring on lakes located immediately downstream of the decommissioned TMAs. An in-depth and detailed statistical evaluation of water quality trends has been included in the SOE produced every five years (Minnow 2009, 2011, 2017, 2021).

A SRWMP location summary of all annual average concentrations is reviewed and compared to assessment criteria in this report in Table 3-2. In addition, the most recent five-year annual concentrations of mine indicator parameters at key downstream locations are reviewed in this report in Figures 3-1a to 3-1c.

3.0 Results

3.1 Data Quality Results and Assessment

Detailed laboratory quality assurance and quality control (QA/QC) results are provided in Appendix III, and detailed field QA/QC results are provided in Appendix IV. Field quality control results are summarized in Table 3-1a and Table. 3-1b. Data quality results and assessments are provided in the following sections.

3.1.1 Laboratory Quality Assurance and Quality Control

In 2023, all analytical requirements for the SRWMP were contracted to laboratories with Canadian Association for Laboratory Accreditation Inc. (CALA) accreditations. (Appendix III).

Detailed laboratory QA/QC results are provided in Appendix III. The 10% objective for QA/QC was met. SGS performed 19907 analyses with 3441 QC checks, which represents 17.3% QC for sample analysis (Appendix III).

3.1.2 Quality Assurance and Quality Control Resolution of Key Issues

There were no major issues with laboratory analysis requiring resolution in 2023 (Appendix III).

3.2.3 Analytical Blank Performance

Laboratory quality control results confirm that blank data quality objectives were met for all parameters in all samples (Appendix III).

3.1.4 Analytical Duplicate Performance

Laboratory quality control results confirm that duplicate data quality objectives of 20% for radium and 10% for all other remaining parameters were achieved in all samples (Appendix III).

3.1.5 Analytical Laboratory Spike Performance

Laboratory quality control results confirm that the spike data achieved for all parameters in all samples (Appendix III).

3.1.6 Analytical Certified Reference Material Performance

Laboratory quality control results confirm that the certified reference material (CRM) data quality objective of 20% accuracy was achieved for all parameters in all samples in 2023 (Appendix III).

3.1.7 Field Blank Performance

Field Blank water quality control results (Appendix IV) confirm that SRWMP field blank data quality objectives (DQO's) were achieved in 2023 (Table 3-1a).

3.1.8 Field Precision Performance

The radium-226 field precision objective of 20% was exceeded in 3 of 6 samples, at 62%, 120%, and 67%. The exceedances occurred at low concentrations (≤ 0.020 Bq/L). High variability in precision at very low concentrations is not uncommon and variability may be artificially high. All values are representative of typical values observed at these locations; and therefore, the exceedances do not affect interpretation of radium-226 water quality data. The annual average percent difference was above the DQO at 43%. All other parameters fell well below the field precision objectives of 20%.

Table 3-1a 2023 SRWMP Field Blank Results Summary

	DOC (mg/L)	Hard (mg/L)	SO4 (mg/L)	Ra (Bq/L)	U (mg/L)	Ba (mg/L)	Fe (mg/L)	Mn (mg/L)
Field Blank Statistics								
Count	6	6	6	6	6	6	6	6
Average	<0.5	0.17	<0.2	0.006	<0.0005	<0.005	<0.02	<0.002
Max	<0.5	0.41	<0.2	0.008	<0.0005	<0.005	<0.02	<0.002
Min	<0.5	<0.05	<0.2	<0.005	<0.0005	<0.005	<0.02	<0.002
Field Blank Exceedances								
Criteria	1	1	0.2	0.01	0.001	0.01	0.04	0.004
# Exceedances	0	0	0	0	0	0	0	0

Table 3-1b 2023 SRWMP Field Precision Results Summary

	DOC (mg/L)	Hard (mg/L)	SO4 (mg/L)	Ra (Bq/L)	U (mg/L)	Ba (mg/L)	Fe (mg/L)	Mn (mg/L)
Field Precision Statistics								
Count	6	6	6	6	6	6	6	6
Average	2%	2%	2%	43%	1%	2%	5%	2%
Max	9%	4%	7%	120%	2%	4%	12%	4%
Min	0%	1%	0%	0%	0%	0%	0%	0%
Field Precision Exceedances								
Criteria	20%	20%	20%	20%	20%	20%	20%	20%
# Exceedances	0	0	0	**3**	0	0	0	0

3.2 Annual Average Location Results Summary

Annual average concentrations of SRWMP parameters for 2023 in comparison to the Cycle 5 SOE (Minnow, 2021) receiving environment assessment criteria are provided in Table 3-2. Annual detailed results and five-year summaries of annual average concentrations in comparison to assessment criteria are provided in Appendix V.

Water quality throughout the Serpent River Watershed continues to meet and remain well below the assessment criteria established for the protection of aquatic life. Annual average concentrations for all parameters in 2023 were less than the assessment criteria at all locations and pH was within the assessment range apart from D-4 with a pH of 6.4, slightly below the assessment range for lakes (Appendix V).

The annual average sulphate concentration at SR-08 (Nordic Lake Outlet) is elevated (122.0 mg/l) compared to other SRWMP stations. However, the sulphate benchmark for SRWMP sites is dependent on specific water hardness at the sample location (BC ENV 2020). Based on an annual average hardness of 149.3 mg/L in 2023 at SR-08, the resulting criterion for sulphate is 309 mg/L. In 2023, all sulphate results at SR-08 fell within BC ENV guidelines for the protection of aquatic life (BC ENV, 2020). Sulphate assessment criteria for individual stations and detailed results are included in Appendix V, as well as Table S-1, Appendix S, of the Cycle 5 SOE for the SRWMP, SAMP, and TOMP (Minnow, 2021).

The annual average manganese concentration at D-6, appears elevated compared to other SRWMP locations at 0.267 mg/L; however, considering the annual average water hardness of 91.9 mg/L, the manganese average concentration is well below the BC ENV chronic toxicity guideline of 0.8 mg/L for the protection of aquatic biota. In addition, individual hardness results in 2023 ranged from 14.8 mg/L to 295.0 mg/L and individual manganese results ranged from 0.018 mg/L to 0.895 mg/L (Appendix V), demonstrating that all manganese concentrations remained well below the acute protection guideline of 1.1 mg/L (BC ENV, 2020). No accumulation was observed downstream at D-5 where the manganese annual average concentration was 0.028 mg/L.

Table 3-2 2023 SRWMP Location Annual Average Results Summary

Parameters			pH	SO_4[3] (mg/L)	DOC (mg/L)	Ra (mg/L)	U (mg/L)	Ba (mg/L)	Fe (mg/L)	Mn[3] (mg/L)	Hardness mg/L as $CaCO_3$
Assessment Criteria[1]	Wetland and Lake Benchmark			**128-309**		**0.469**	**0.015**	**1.00**		**0.841**	
	Wetland/Stream Benchmark		**5.3**						**2.49**		
	Lake Benchmark		**6.5**						**0.76**		
MDL[2]				0.1		0.005			0.02	0.005	
Location		# of Samples Collected									
Reference	**Type**										
D-4	Lake	3	**6.4**	2.9	3.0	<0.005	<0.0005	0.011	0.04	0.021	9.0
SR-18	Lake	2	7.0	3.3	5.5	<0.005	<0.0005	0.044	0.05	0.016	10.6
SR-19	Lake	4	6.7	3.0	5.5	<0.005	<0.0005	0.023	0.38	0.053	17.1
SR-16	Wetland/Stream	4	6.1	2.0	15.9	<0.005	<0.0005	0.010	1.34	0.111	10.4
SR-17	Wetland/Stream	4	6.2	2.1	8.7	0.006	<0.0005	0.022	1.25	0.058	13.0
Near Field											
D-5	Lake	4	6.6	15.6	3.8	0.087	0.0014	0.085	N/A	0.028	26.1
D-6	Wetland/Stream	4	6.6	72.4	4.1	<0.005	<0.0005	0.017	0.33	0.267	91.9
DS-18	Wetland/Stream	4	6.7	31.2	2.5	0.089	0.0012	0.017	0.20	N/A	65.6
M-01	Wetland/Stream	4	6.8	11.5	5.8	0.018	0.0021	0.017	0.58	N/A	42.7
Q-09	Lake	4	6.8	80.0	3.8	0.084	0.0023	0.129	N/A	N/A	95.6
Q-20	Lake	1	7.1	18.7	2.6	<0.005	<0.0005	0.019	N/A	N/A	39.7
SC-01	Lake	1	7.4	27.0	11.7	0.026	<0.0005	0.014	0.40	N/A	34.8
SR-06	Lake	2	6.5	11.6	3.2	0.044	0.0004	0.147	N/A	N/A	35.5
Far Field											
SR-15	Wetland/Stream	2	6.8	14.2	3.3	0.024	<0.0005	0.062	0.02	N/A	37.0
SR-01	Lake	1	7.5	27.0	3.1	0.022	0.0012	0.043	N/A	N/A	35.6
SR-08	Lake	4	6.9	122.0	4.3	0.026	0.0008	0.017	N/A	N/A	149.3

[1] Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP, and TOMP draft (Minnow 2020)
[2] Method Detection Limits as per Table 5.2 Cycle 5 Study Design for the SRWMP, SAMP, and TOMP (Minnow, 2019)
[3] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 state of the Environment Report for the SRWMP, SAMP and TOMP draft (Minnow, 2020) Parameters are Hardness dependent.
Variance in number of significant figures reflect MDLs at the time of reporting. In 2006, laboratory reported MDLs were standardized to achieve consistency and meet program requirements.
Bold indicates exceedance of evaluation criteria value.
N/A = not applicable. Parameters are not monitored.

3.3 Five-Year Annual Average Trends at Key Locations

Figures 3-3a to 3-3c show five-year trends of annual average concentrations for the mine-related parameters sulphate, radium-226, and uranium at the following key locations:

• SR-01, Quirke Lake Outlet.

• SR-06, McCabe Lake Outlet.

• SR-08, Nordic Lake Outlet.

• DS-18, Halfmoon Lake Outlet.

Based on a review of five years of data, annual sulphate concentrations at all key lake outlets are well below the assessment criterion of between 128-309 mg/L as established for each station. Annual concentrations have remained stable at all locations over the past five years (Figure 3-3a), with the exception of SR-08 (Nordic Lake Outlet) where a slight increase was observed in 2021; however, all results remained well below the assessment criterion of 309 mg/L. This data can be found in the SRWMP Annual Water Quality Report 2021 (RAL, DMI, 2022).

Annual average radium-226 concentrations are much lower than the assessment criterion of 0.469 Bq/L (Figure 3-3b). At station DS-18, annual average radium concentrations appear slightly elevated compared to other annual average radium-226 concentrations in the last five years (Appendix V). This may be indicative of flushing through the historic tailings spill upstream in the Halfmoon wetland area; however, all DS-18 results in the last five years remained well below the assessment criterion of 0.469 Bq/L and well below the Health Canada (2009) drinking water quality standard of 0.5 Bq/L.

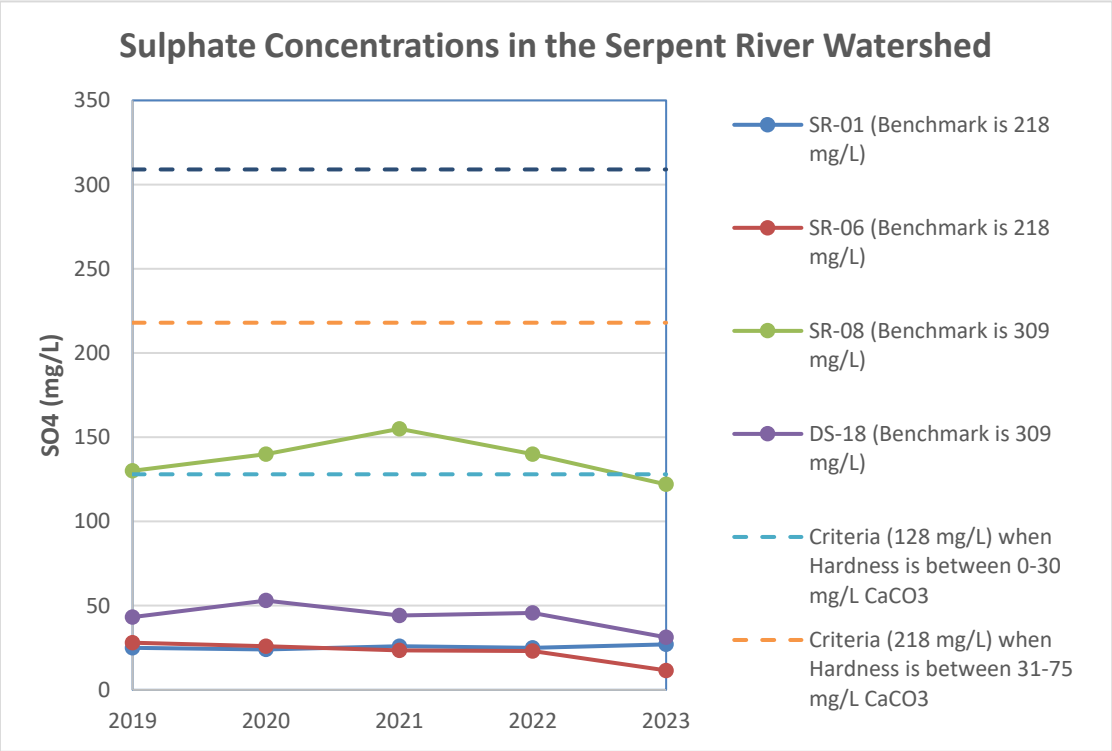

Figure 3-3a Annual Average Sulphate Concentrations at SR-01, SR-06, SR-08, and DS-18, 2019-2023

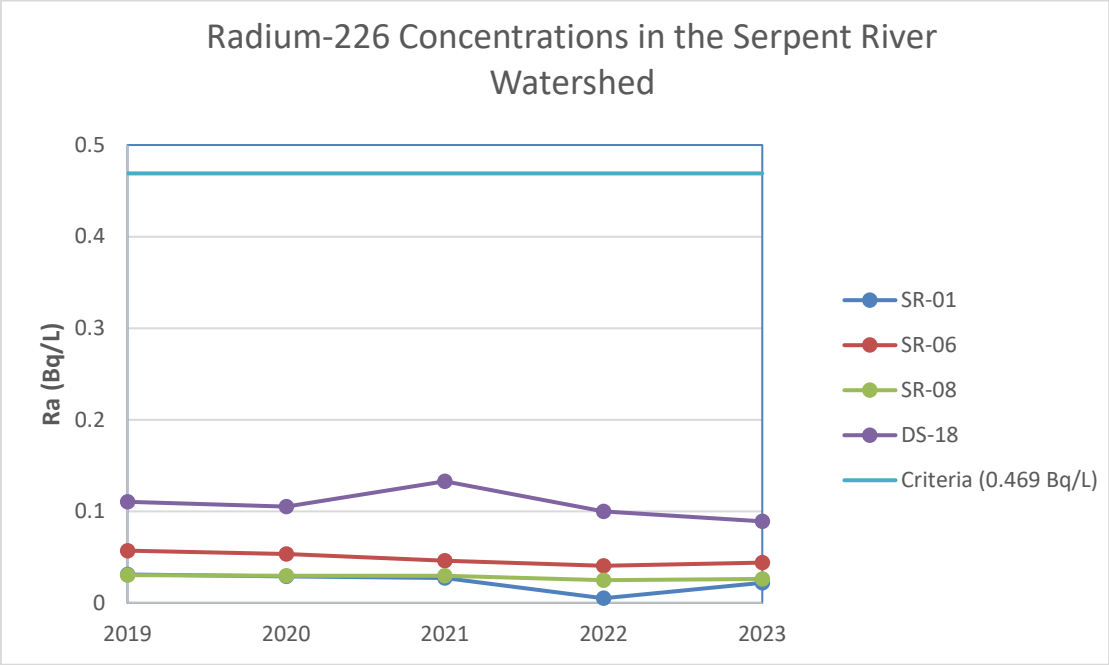

Figure 3-3b Annual Average Radium-226 Concentrations at SR-01, SR-06, SR-08, and DS-18, 2019-2023

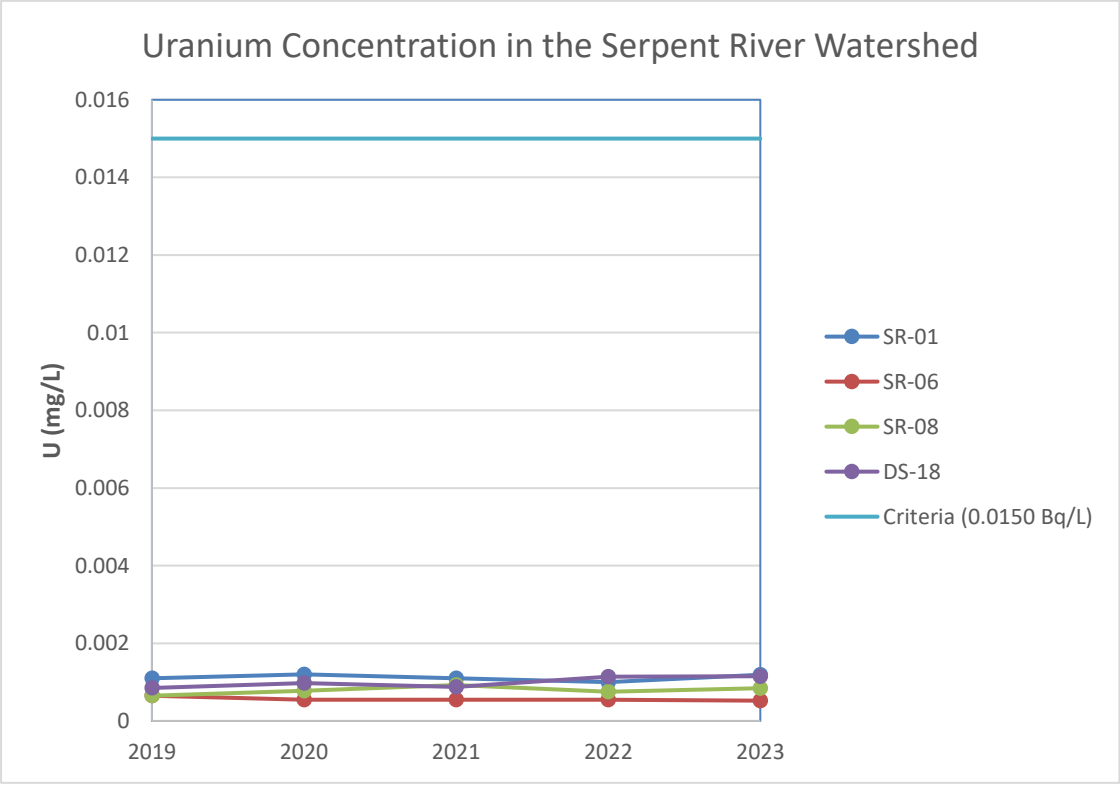

Figure 3-3c Annual Average Uranium Concentrations at SR-01, SR-06, SR-08, and DS-18, 2019-2023

Annual average uranium concentrations at all four key lake locations appear to be relatively stable and were more than an order of magnitude below the assessment criteria of 0.0150 mg/L (Figure 3-3c).

4.0 Discussion

4.1 Response Monitoring

SRWMP surface water results demonstrate that water quality concentrations are stable, continue to meet assessment criteria, and demonstrate that the area is continuing to recover since the decommissioning of the mines in the area.

Beginning in 2016, monitoring at the outlet of May Lake (SR-15) was voluntarily re-established in response to gradually increasing barium and radium concentrations upstream at the outlet of McCabe Lake (SR-06); it was previously removed in the SRWMP Cycle 3 Study Design (Minnow 2009). Although annual average concentrations have decreased substantially in the last four years, particularly at SR-06, station SR-15 was re-established in the monitoring program as per the Cycle 5 Study Design (beginning 2020) to aid in the assessment of any long-term impacts to the receiving environment (Appendix V).

4.2 SRWMP Performance Monitoring Program Changes

There were no changes to the performance monitoring program in 2023. As described in the Cycle 5 Study Design (Minnow 2019), the newly approved site-specific water quality benchmark for radium-226 (0.469 Bq/L) for the protection of aquatic life, continues to be used to evaluate the SRW.

As previously mentioned in Section 2.2, after review of the Cycle 5 Study Design (Minnow, 2019), the MECP recommended adding DOC to the SRWMP monitoring program. This was in anticipation of a new federal environmental water quality guideline for iron currently posted for public review, which includes DOC and pH as toxicity modifiers. In addition, hardness continues to be monitored as an ancillary parameter to all SRWMP stations as it assists in the interpretation of water quality concentrations for manganese and sulphate, as discussed in the approved Cycle 4 Study Design for the SRWMP, SAMP and TOMP (BC ENV, 2020 and Minnow, 2016).

4.3 Changes to Location Classification and Frequency

As noted in the Cycle 5 SOE, station D-6 is located in a habitat more characteristic of a wetland area, not a lake. Under this classification, D-6 was assessed based on wetland benchmarks (Photo set S.1, Appendix S, Minnow, 2021).

4.4 Representative Public Radiation Dose Estimation

The CNSC requested that RAL and DMI provide annual reporting of the radiation dose to the public associated with the closed uranium mine sites in the Serpent River Watershed. Historically, estimates of the public dose had been based on the use of very conservative values to demonstrate that public dose in the vicinity of Elliot Lake did not exceed the upper dose limit. Measurements of radon and gamma radiation collected during mine operations resulted in dose estimates less than 5% of the annual public dose limit of 1 mSv/a.

However, to determine an updated and more realistic representative annual public dose estimation for a person residing in Elliot Lake, a design monitoring program to support public dose estimation was prepared in early 2016. Details of the design program were provided in the document Preliminary Design Monitoring Program to Support Public Dose Estimation (Ecometrix Incorporated (Ecometrix), 2016,

2017), which was included as an appendix in the SRWMP Annual Water Quality Report 2016 (RAL, DMI, 2017).

All components of the design monitoring program were completed in 2019 and it was concluded that the updated public dose is 0.01 mSv/a, two orders of magnitude lower than the regulatory public dose limit of 1 mSv/a. Details of the design monitoring program and the subsequent results are included in Appendix U of the Cycle 5 SOE (Minnow, 2021).

The public dose estimate will be reviewed, and if required, updated as part of the Cycle 6 SOE.

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Appendix I

Performance Monitoring Changes 1999 - 2021, Evolution of Programs

Summary of Changes to the Elliot Lake Monitoring Programs (IBMP, TOMP, SAMP, and SRWMP) and Associated Documents[b]

Cycle	Report Title	Year	Period Covered	Descriptions of Changes to the Monitoring Programs within Each Cycle
Cycle 1	Serpent River Watershed Monitoring Program Framework Document	1999	historical monitoring data	**IBMP, TOMP, SAMP, and SRWMP** were developed based on program objectives and existing monitoring data collected over the period of operations and decommissioning.
	In-Basin Monitoring Program Report	1999		
	Serpent River Watershed and In-Basin Monitoring Program – Implementation Document	1999		
	Serpent River Watershed Monitoring Program -1999 Study	2001	1999 to 2000	
	In-Basin Monitoring Program for the Uranium Tailings Areas - 1999 Study	2001		
Cycle 2	Overview of Elliot Lake Monitoring Programs and Source Area Monitoring Program Design	2002	2000 to 2004	**Changes only SRWMP** most associated with optimization after first cycle of program was complete: • monitoring substances reduced to mine indicator parameters (barium, cobalt, DOC, iron, manganese, radium-226, selenium, silver, sulphate and uranium); • addition of two lake reference stations (Summers and Semiwite lakes) and 3 stream reference areas (SR-16, SR-17 and SR-18); • removal of shallow lakes for sediment and benthic sampling (Westner, Grassy, Halfmoom, Upper Cinder and Horne lakes); • removal of some stream sediment and benthic stations (D-15, SC-03 and SR-07); • removal of Depot Lake and Serpent Harbour; addition of May Lake; • the transfer of some SRWMP stations to SAMP or TOMP (N-12, ECA-131, P-11, MPE and Q-23); and • fish health assessment eliminated based on performance, fish community assessment added for McCabe Lake and fish tissue monitoring reduced in scope based on performance.
	TMA Operational Monitoring Program Design (TOMP)	2002		
	Cycle 2 Study Design – Serpent River Watershed and In- Basin Monitoring Programs	2004		
	Serpent River Watershed Monitoring Program: Cycle 2 Interpretive Report	2005		
	Serpent River In-Basin Monitoring Program: Cycle 2 Interpretive Report - 2004 Study	2005		
	Serpent River Watershed State of the Environment	2009		
	Monitoring Framework For Closed Uranium Mines Near Elliot Lake	2009		**IBMP** eliminated based on objectives of program being achieved. **TOMP and SAMP:** • removal of silver, selenium based on performance and removal of conductivity based on redundancy with sulphate; and
	In Basin Monitoring Program, Cycle 3 Study Design	2009		

Cycle 3	Serpent River Watershed Monitoring Program: Cycle 3 Study Design	2009	2005 to 2009	• DOC, hardness and flow added at selected stations. **SRWMP:** • removal of selenium and sliver based on performance; • removal of station SR-12, ELO, SR-09, SR-15, SR-02, SR-03, SR-11, P-01, QL-01 and SR-16 and SR-17 based on performance; • monthly monitoring frequency reduced to quarterly; • sediment and benthic monitoring removed from Whiskey, Evans and Cinder lakes based on redundancy; • depositional streams (Q-20, D-6, SR-06, M-01 and SR-08) based on very high natural variability masking results; and • fishing in McCabe Lake and fish tissue monitoring eliminated based on performance.
	Source Area Monitoring Program Revised Study Design	2009		
	Tailing Management Area Monitoring Program (TOMP) Revised Study Design	2009		
	Serpent River Watershed State of the Environment Report	2011		
Cycle 4	Cycle 4 Study Design For the SRWMP, SAMP and TOMP	2014[a]	2010 to 2014	Minor changes to **TOMP** and **SAMP**. **SRWMP**: • elimination of reference stations SR-05, P-222 and SR-14; • removal of cobalt as substance for monitoring, addition of DOC; • far-field lakes removed from the program (Hough, Pecors, and McCarthy); • removal of Rochester Lake as a sediment and benthic reference area; and • reduction in benthic and sediment sampling to 1/10 years based on measured deposition rates.
	Serpent River Watershed Cycle 4 State of the Environment	2016		
Cycle 5	Cycle 5 Study Design For the SRWMP, SAMP and TOMP	2019	2015 to 2019	**TOMP, SAMP, and SRWMP**: • improved approach to trend analysis of surface water quality using the non-parametric seasonal Kendall test. **SRWMP**: • improved approach to calculate benchmark upper limit of background water quality values have previously been calculated based on the upper 95th percentile of values collect across all five years (rather than annual means); • use of a Serpent River Watershed site-specific dose-based radium-226 benchmark for assessment of water quality; • addition of a lake-specific dose-based radium-226 benchmark for assessment of sediment quality; and • sediment and benthic monitoring removed from Elliot Lake based on improvements in water quality, negligible mine-related sediment toxicity, and gradual improvement in benthic invertebrate communities.
	Serpent River Watershed Cycle 5 State of the Environment	2021		

[a] Study Design was submitted to CNSC and JRG in 2014 but reissued with agency comments in 2016.

Notes: IBMP = In Basin Monitoring Program. TOMP = Tailings Management Area Monitoring Program. SAMP = Source Area Monitoring Program. SRWMP = Serpent River Watershed Monitoring Program.

[b] Table 1.2, Cycle 5 State of the Environment Report, Minnow, 2021

Appendix II

Flagged Data Results

Flagged Data Report Form

2023 Annual Report

Station	Analyte	Date	Low	High	Flag	Result	Unit	Comment
SR-19	pH field	2023-05-10	6.7	7.2	Low	6.5	pH	Result is a 5-year low but only slightly lower than the low flag lmit. Will continue to monitor at current qurterly frequency.
SR-19	pH field	2023-10-30	6.7	7.2	High	7.3	pH	Result if flagging high but has been higher in previous years. In the last 5 years, pH is trending down. Will continue to monitor at current frequency.

Appendix III

Laboratory QA/QC Results

REPORT CODE: *BHP-ANN23*

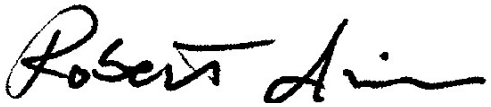
REPORT TITLE: *Annual 2023 BHP Data Quality Report*

REVISION: *1.0*

ISSUED BY:

Quality Coordinator,
SGS Environmental, Lakefield

AUTHORIZED BY:



Technical Manager,
SGS Environmental, Lakefield

DATE: *06 Feb. 2024*

Table of Contents

1. MANAGEMENT SYSTEM

SGS Environmental, Lakefield is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation (CALA), for specific tests listed in the scope of accreditation. ISO/IEC 17025 addresses both the management system and the technical aspects of operating a testing laboratory.

The management system at SGS Environmental consists of a documented quality system, which is directed by the Quality Coordinator who is independent of the production area. All appropriate documentation (quality manual, methods, written instructions, standard operating procedures, and data approval criteria) is in place and includes both general and method specific quality control requirements.

Quality control procedures include duplicate samples, spiked blanks, spiked replicates, reagent/instrument blanks, preparation control samples, certified reference material analysis, and instrument control samples, as appropriate for the individual methods. Matrix matching of reference materials to samples is always attempted. Frequency of insertion of control samples is method specific and follows legislated guidelines. A summary of the quality control recoveries is presented in the tables following.

2. QUALITY CONTROL PARAMETERS

All QC parameters are taken directly from SGS LIMS. BHP samples are processed as part of our “worksheet” batch system. A compilation of all QC data appropriate to the parameters tested has been compiled below.

3. NOTABLE OCCURANCES/ACTIONS

- Data compiled from September 2023 to December 2023
- SGS Environmental, Lakefield laboratory performed 19907 analyses with 3441 QC checks, which represents 17.3% QC for sample analysis. **Corrective Action**: N/A
- All blank data results were within the data quality objectives. **Corrective Action**: N/A
- All CRM/spike blank data results were within the data quality objectives. **Corrective Action**: N/A
- No duplicate value exceeded the data quality objectives. **Corrective Action:** N/A
- No spike duplicates fell outside of the data quality objectives. **Corrective Action**: N/A

4. QC DATA SUMMARY

4.1. Blank Data

Parameter	Unit	Required Limit	Number of Blanks	Mean Blank Result
Acidity	mg/L as CaCO3	2	57	2.1

Silver	mg/L	0.0001	44	<0.0001
Alkalinity	mg/L as CaCO3	2	33	2
Arsenic	mg/L	0.0005	44	<0.0005
Barium	mg/L	0.005	52	<0.005
Cobalt	mg/L	0.0005	44	<0.0005
Copper	mg/L	0.0005	46	<0.0005
DOC	mg/L	0.5	53	<0.5
Iron	mg/L	0.02	45	<0.02
Manganese	mg/L	0.002	45	<0.002
Nickel	mg/L	0.002	45	<0.002
Lead	mg/L	0.00002	44	<0.00002
Ra226	Bq/L	0.005	69	<0.005
Selenium	mg/L	0.0005	44	<0.0005
Sulphate	mg/L	0.1	83	<0.1
Total Dissolved Solids	mg/L	10	16	<10
Total Suspended Solids	mg/L	1	87	<1
Uranium	mg/L	0.0005	45	<0.0005
Zinc	mg/L	0.001	45	<0.001

4.2. Reference Material/Spiked Blank Data

Parameter	Unit	Number of RM or SB	% Recovery
Acidity	mg/L as CaCO3	57	97.5
Silver	mg/L	44	100.1
Alkalinity	mg/L as CaCO3	33	97.9
Arsenic	mg/L	44	100.1
Barium	mg/L	52	99.5
Cobalt	mg/L	44	99.6
Copper	mg/L	46	101.1
DOC	mg/L	53	100.9
Iron	mg/L	45	99.9
Manganese	mg/L	45	99.8
Nickel	mg/L	45	100.5
Lead	mg/L	44	99.9
Ra226	Bq/L	69	85.3
Selenium	mg/L	44	99.1
Sulphate	mg/L	83	98.0
Total Dissolved Solids	Mg/L	0	ND
Total Suspended Solids	mg/L	87	97.2

Uranium	mg/L	45	100.6
Zinc	mg/L	45	101.1

ND – No Data

4.3. Duplicate Data

Parameter	Unit	RPD* Limit	Number of Duplicates	RPD*
Acidity	mg/L as CaCO3	20	57	ND
Silver	mg/L	20	44	ND
Alkalinity	mg/L as CaCO3	20	33	1.7
Arsenic	mg/L	20	44	7.0
Barium	mg/L	20	52	2.6
Cobalt	mg/L	20	44	4.5
Copper	mg/L	20	46	5.0
DOC	mg/L	20	53	8.2
Iron	mg/L	20	45	4.4
Manganese	mg/L	20	45	2.6
Nickel	mg/L	20	45	3.1
Lead	mg/L	20	44	5.6
Ra226	Bq/L	20	69	10.0
Selenium	mg/L	20	44	9.2
Sulphate	mg/L	20	83	2.3
Total Dissolved Solids	mg/L	20	16	4.5
Total Suspended Solids	mg/L	20	87	1.7
Uranium	mg/L	20	45	3.2
Zinc	mg/L	20	45	4.2

*RPD – Relative Percent Difference

ND – No Data

4.4. Spike Duplicate Data

Parameter	Unit	Number of Spike Dups	Mean % Recovery
Silver	mg/L	44	86.2
Arsenic	mg/L	44	102.4
Barium	mg/L	52	99.0
Cobalt	mg/L	44	98.3
Copper	mg/L	46	101.8
DOC	mg/L	53	102.3
Iron	mg/L	45	101.8

Manganese	mg/L	45	103.6
Nickel	mg/L	45	100.8
Lead	mg/L	44	97.7
Selenium	mg/L	44	107.2
Sulphate	mg/L	83	107.2
Uranium	mg/L	45	98.9
Zinc	mg/L	45	105.5

4.5. QC Frequency

Total Number of Blanks:	941
Total Number of Reference Materials/Spiked Blanks:	925
Total Number of Duplicate Samples:	941
Total Number of Spiked Duplicate Samples:	634
Sum of QC Insertion:	**3441**
Total Analysis:	**19907**

Appendix IV

Field QA/QC Results

SRWMP Data Quality Reporting
Field Precision 2023

		Barium	DOC	Hardness	Iron	Manganese	Radium	Sulfate	Uranium
		mg/l	mg/l	mg/l	mg/l	mg/l	Bq/l	mg/l	mg/l
Date	**Sample**								
2023-05-18	BSD2	0.0122	4.1	22.8	0.173	0.0796	0.005	14.0	0.0005
	D-6	0.0121	4.1	23.0	0.153	0.0800	0.005	14.0	0.0005
	Variance	1%	0%	1%	12%	1%	0%	0%	0%
2023-05-18	BSR5	0.0142	4.9	28.4	0.409	0.0505	0.010	8.6	0.00178
	M-01	0.0138	4.5	28.2	0.384	0.0492	0.019	9.0	0.00179
	Variance	3%	9%	1%	6%	3%	**62%**	5%	1%
2023-08-15	BSR5	0.0157	6.3	50.8	0.618	0.1820	0.020	4.1	0.00224
	M-01	0.0161	6.3	52.0	0.616	0.1750	0.005	4.4	0.00229
	Variance	3%	0%	2%	0%	4%	**120%**	7%	2%
2023-08-17	BSD2	0.0335	3.4	290.0	0.946	0.8980	0.010	240.0	0.0005
	D-6	0.0335	3.3	295.0	0.867	0.8950	0.005	240.0	0.0005
	Variance	0%	3%	2%	9%	0%	**67%**	0%	0%
2023-11-01	BSR5	0.0183	6.4	46.9	0.558	0.0816	0.014	9.2	0.00167
	M-01	0.0188	6.5	47.7	0.558	0.0814	0.015	9.4	0.00167
	Variance	3%	2%	2%	0%	0%	7%	2%	0%
2023-11-15	BSD2	0.0116	4.2	31.2	0.085	0.0422	0.005	27.0	0.0005
	D-6	0.0121	4.2	32.4	0.086	0.0429	0.005	27.0	0.0005
	Variance	4%	0%	4%	1%	2%	0%	0%	0%
	Count	6	6	6	6	6	6	6	6
	Average	2%	2%	2%	5%	2%	43%	2%	1%
	Maximum	4%	9%	4%	12%	4%	120%	7%	2%
	Minimum	0%	0%	1%	0%	0%	0%	0%	0%
	Criteria[1]	20%	20%	20%	20%	20%	20%	20%	20%
	Exceedances	0	0	0	0	0	3	0	0

1 Field Blank criteria as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)
Bold indicates an exceedance in the field precision criteria

SRWMP Data Quality Reporting
Field Blanks 2023

		Barium	DOC	Hardness	Iron	Manganese	Radium	Sulfate	Uranium
		mg/l	mg/l	mg/l	mg/l	mg/l	Bq/l	mg/l	mg/l
Date	**Sample**								
2023-05-18	FBD2	<0.005	<0.5	<0.05	<0.02	<0.002	<0.005	<0.2	<0.0005
2023-05-18	FBR5	<0.005	<0.5	<0.05	<0.02	<0.002	<0.005	<0.2	<0.0005
2023-08-15	FBR5	<0.005	<0.5	0.25	<0.02	<0.002	0.008	<0.2	<0.0005
2023-08-17	FBD2	<0.005	<0.5	0.22	<0.02	<0.002	<0.005	<0.2	<0.0005
2023-11-01	FBR5	<0.005	<0.5	0.41	<0.02	<0.002	<0.005	<0.2	<0.0005
2023-11-15	FBD2	<0.005	<0.5	<0.05	<0.02	<0.002	<0.005	<0.2	<0.0005
	Count	6	6	6	6	6	6	6	6
	Average	<0.005	<0.5	0.17	<0.02	<0.002	0.006	<0.2	<0.0005
	Maximum	<0.005	<0.5	0.41	<0.02	<0.002	0.008	<0.2	<0.0005
	Minimum	<0.005	<0.5	<0.05	<0.02	<0.002	<0.005	<0.2	<0.0005
	Criteria[1]	0.01	1	1	0.04	0.004	0.01	0.02	0.001
	Exceedances	0	0	0	0	0	0	0	0

1 Field Blank criteria as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)
Bold indicates an exceedance in the Field Blank criteria

Appendix V

Location Results

D-6 Cinder Lake Outlet

Quarterly Sample	Barium mg/l	Dissolved organic carbon mg/l	Flow l/s	Hardness mg/l	Iron mg/l	Manganese mg/l	pH (Field) pH	Radium Bq/l	Sulfate mg/l	Uranium mg/l
2023-02-23	0.0116	4.7	*	17.1	0.201	0.0515	6.2	<0.005	8.7	<0.0005
2023-05-18	0.0121	4.1	64.00	23.0	0.153	0.0800	6.7	<0.005	14.0	<0.0005
2023-08-17	0.0335	3.3	0.50	295.0	0.867	**0.8950**	6.5	<0.005	**240.0**	<0.0005
2023-11-15	0.0121	4.2	296.86	32.4	0.086	0.0429	6.8	<0.005	27.0	<0.0005
Count	4	4	3	4	4	4	4	4	4	4
High	0.0335	4.7	296.86	295.0	0.867	0.8950	6.8	<0.005	240.0	<0.0005
Low	0.0116	3.3	0.50	17.1	0.086	0.0429	6.2	<0.005	8.7	<0.0005
Mean	0.0173	4.1	120.45	91.9	0.327	0.2674	6.6	<0.005	72.4	<0.0005
High Limit	1				2.49	0.841	8.5	0.469	218	0.015
Low Limit							5.3			
Lim Ex	0				0	1	0	0	1	0
Frequency	0%				0%	25%	0%	0%	25%	0%
10x Lim Ex	0				0	0	0	0	0	0
Frequency	0%				0%	0%	0%	0%	0%	0%

* Flow not measured due to ice cover

BSD2

Quarterly Sample	Barium mg/l	Dissolved organic carbon mg/l	Hardness mg/l	Iron mg/l	Manganese mg/l	pH (Field) pH	Radium Bq/l	Sulfate mg/l	Uranium mg/l
2023-05-18	0.0122	4.1	22.8	0.173	0.0796	6.7	<0.005	14	<0.0005
2023-08-17	0.0335	3.4	290.0	0.946	**0.8980**	6.5	0.010	**240**	<0.0005
2023-11-15	0.0116	4.2	31.2	0.085	0.0422	6.8	0.005	27	<0.0005
Count	3	3	3	3	3	3	3	3	3
High	0.0335	4.2	290.0	0.946	0.8980	6.8	0.010	240	<0.0005
Low	0.0116	3.4	22.8	0.085	0.0422	6.5	0.005	14	<0.0005
Mean	0.0191	3.9	114.7	0.401	0.3399	6.7	0.008	94	<0.0005
High Limit	1			2.49	0.841	8.5	0.469	218	0.015
Low Limit						5.3			
Lim Ex	0			0	1	0	0	1	0
Frequency	0%			0%	33%	0%	0%	33%	0%
10x Lim Ex	0			0	0	0	0	0	0
Frequency	0%			0%	0%	0%	0%	0%	0%

BSR5

Quarterly Sample	Barium mg/l	Dissolved organic carbon mg/l	Hardness mg/l	Iron mg/l	pH(Field) pH	Radium Bq/l	Sulfate mg/l	Uranium mg/l
2023-05-18	0.0142	4.9	28.4	0.409	6.8	0.010	8.6	0.00178
2023-08-15	0.0157	6.3	50.8	0.618	6.6	0.020	4.1	0.00224
2023-11-01	0.0183	6.4	46.9	0.558	7.2	0.014	9.2	0.00167
Count	3	3	3	3	3	2	3	2
High	0.0183	6.4	50.8	0.618	7.2	0.020	9.2	0.00224
Low	0.0142	4.9	28.4	0.409	6.6	0.010	4.1	0.00167
Mean	0.0161	5.9	42.0	0.528	6.9	0.015	7.3	0.00190
High Limit	1			2.49	8.5	0.469	218	0.015
Low Limit					5.3			
Lim Ex	0			0	0	0	0	0
Frequency	0%			0%	0%	0%	0%	0%
10x Lim Ex	0			0	0	0	0	0
Frequency	0%			0%	0%	0%	0%	0%

D-5 Serpent River between Denison & Quirke TMAs

Quarterly Sample	Barium mg/l	Dissolved organic carbon mg/l	Flow l/s	Hardness mg/l	Manganese mg/l	pH (Field) pH	Radium Bq/l	Sulfate mg/l	Uranium mg/l
2023-02-24	0.0674	3.8	3400	32.1	0.0320	**6.3**	0.032	19.0	0.00220
2023-05-11	0.0375	3.2	8260	14.8	0.0175	**6.0**	<0.005	7.3	0.00064
2023-08-14	0.1490	4.5	235	23.7	0.0403	**6.4**	0.092	8.9	0.00137
2023-11-15	0.0841	3.6	1430	33.6	0.0225	7.6	0.137	27.0	0.00128
Count	4	4	4	4	4	4	4	4	4
High	0.1490	4.5	8260	33.6	0.0403	7.6	0.137	27.0	0.00220
Low	0.0375	3.2	235	14.8	0.0175	6.0	0.032	7.3	0.00064
Mean	0.0845	3.8	3331	26.1	0.0281	6.6	0.087	15.6	0.00137
High Limit	1				0.841	8.5	0.469	128	0.015
Low Limit						6.5			
Lim Ex	0				0	3	0	0	0
Frequency	0%				0%	75%	0%	0%	0%
10x Lim Ex	0				0	0	0	0	0
Frequency	0%				0%	0%	0%	0%	0%

DS-18 Halfmoon Lake Outlet

Quarterly Sample	Barium mg/l	Dissolved organic carbon mg/l	Flow l/s	Hardness mg/l	Iron mg/l	pH (Field) pH	Radium Bq/l	Sulfate mg/l	Uranium mg/l
2023-02-14	0.0205	2.2	*	91.2	0.190	6.9	0.142	65.0	0.00180
2023-05-25	0.0245	2.2	135.0	75.4	0.142	6.3	0.102	5.8	0.00058
2023-08-23	0.0121		27.6	47.7	0.246	6.4	0.048	27.0	0.00102
2023-11-07	0.0114	3.0	153.0	48.1	0.208	7.4	0.064	27.0	0.00121
Count	4	3	3	4	4	4	4	4	4
High	0.0245	3.0	153.0	91.2	0.246	7.4	0.142	65.0	0.00180
Low	0.0114	2.2	27.6	47.7	0.142	6.3	0.048	5.8	0.00058
Mean	0.0171	2.5	105.2	65.6	0.197	6.7	0.089	31.2	0.00115
High Limit	1				2.49	8.5	0.469	309	0.015
Low Limit						5.3			
Lim Ex	0				0	0	0	0	0
Frequency	0%				0%	0%	0%	0%	0%
10x Lim Ex	0				0	0	0	0	0
Frequency	0%				0%	0%	0%	0%	0%

* Flow not measured due to ice cover

FBD2

Quarterly Sample	Barium mg/l	Dissolved organic carbon mg/l	Hardness mg/l	Iron mg/l	Manganese mg/l	pH (Field) pH	Radium Bq/l	Sulfate mg/l	Uranium mg/l
2023-05-18	<0.005	<0.5	<0.05	<0.02	<0.002	5.9	<0.005	<0.1	<0.0005
2023-08-17	<0.005	<0.5	0.22	<0.02	<0.002	5.6	<0.005	<0.2	<0.0005
2023-11-15	<0.005	<0.5	<0.05	<0.02	<0.002	7.0	<0.005	<0.2	<0.0005
Count	3	3	3	3	3	3	3	3	3
High	<0.005	<0.5	0.22	<0.02	<0.002	7.0	<0.005	<0.2	<0.0005
Low	<0.005	<0.5	<0.05	<0.02	<0.002	5.6	<0.005	<0.1	<0.0005
Mean	<0.005	<0.5	0.09	<0.02	<0.002	6.2	<0.005	<0.2	<0.0005
High Limit	1			2.49	0.841	8.5	0.469	218	0.015
Low Limit						5.3			
Lim Ex	0			0	0	0	0	0	0
Frequency	0%			0%	0%	0%	0%	0%	0%
10x Lim Ex	0			0	0	0	0	0	0
Frequency	0%			0%	0%	0%	0%	0%	0%

FBR5

Quarterly Sample	Barium mg/l	Dissolved organic carbon mg/l	Hardness mg/l	Iron mg/l	pH (Field) pH	Radium Bq/l	Sulfate mg/l	Uranium mg/l
2023-05-18	<0.005	<0.5	<0.05	<0.02	5.8	<0.005	<0.1	<0.0005
2023-08-15	<0.005	<0.5	0.25	<0.02	5.4	0.008	<0.2	<0.0005
2023-11-01	<0.005	<0.5	0.41	<0.02	7.8	<0.005	<0.2	<0.0005
Count	3	3	3	3	3	3	3	3
High	<0.005	<0.5	0.41	<0.02	7.8	0.008	<0.2	<0.0005
Low	<0.005	<0.5	0.25	<0.02	5.4	<0.005	<0.1	<0.0005
Mean	<0.005	<0.5	0.33	<0.02	6.3	<0.005	<0.2	<0.0005
High Limit	1			2.49	8.5	0.469	218	0.015
Low Limit					5.3			
Lim Ex	0			0	0	0	0	0
Frequency	0%			0%	0%	0%	0%	0%
10x Lim Ex	0			0	0	0	0	0
Frequency	0%			0%	0%	0%	0%	0%

M-01 Sherriff Creek @ Hwy 108

Quarterly Sample	Barium mg/l	Dissolved organic carbon mg/l	Hardness mg/l	Iron mg/l	pH (Field) pH	Radium Bq/l	Sulfate mg/l	Uranium mg/l
2023-02-16	0.0175	5.8	43.0	0.742	6.7	0.019	23.0	0.00260
2023-05-18	0.0138	4.5	28.2	0.384	6.8	0.019	9.0	0.00179
2023-08-15	0.0161	6.3	52.0	0.616	6.6	<0.005	4.4	0.00229
2023-11-01	0.0188	6.5	47.7	0.558	7.2	0.015	9.4	0.00167
Count	4	4	4	4	4	3	4	3
High	0.0188	6.5	52.0	0.742	7.2	0.019	23.0	0.00260
Low	0.0138	4.5	28.2	0.384	6.6	0.015	4.4	0.00167
Mean	0.0166	5.8	42.7	0.575	6.8	0.018	11.5	0.00209
High Limit	1			2.49	8.5	0.469	218	0.015
Low Limit					5.3			
Lim Ex	0			0	0	0	0	0
Frequency	0%			0%	0%	0%	0%	0%
10x Lim Ex	0			0	0	0	0	0
Frequency	0%			0%	0%	0%	0%	0%

Q-09 Serpent River Below Quirke TMA Effluent

Quarterly Sample	Barium mg/l	Dissolved organic carbon mg/l	Flow l/s	Hardness mg/l	pH (Field) pH	Radium Bq/l	Sulfate mg/l	Uranium mg/l
2023-02-22	0.0528	3.8	3450	81.3	7.5	0.037	66	0.00277
2023-05-11	0.0393	3.5	8350	21.2	**6.0**	0.025	14	0.00101
2023-08-14	0.2810	4.1	285	128.0	6.5	0.173	110	0.00260
2023-11-01	0.1420	3.6	1010	152.0	7.1	0.100	130	0.00294
Count	4	4	4	4	4	4	4	4
High	0.2810	4.1	8350	152.0	7.5	0.173	130	0.00294
Low	0.0393	3.5	285	21.2	6.0	0.025	14	0.00101
Mean	0.1288	3.8	3274	95.6	6.8	0.084	80	0.00233
High Limit	1				8.5	0.469	218	0.015
Low Limit					6.5			
Lim Ex	0				1	0	0	0
Frequency	0%				25%	0%	0%	0%
10x Lim Ex	0				0	0	0	0
Frequency	0%				0%	0%	0%	0%

Q-20 Evans Lake Outlet to Dunlop Lake

Quarterly Sample	Barium mg/l	Dissolved organic carbon mg/l	Flow l/s	Hardness mg/l	pH (Field) pH	Radium Bq/l	Sulfate mg/l	Uranium mg/l
2023-05-10	0.0196	2.1	9600	37.5	6.4	<0.005	17	<0.0005
2023-10-31	0.0187	3.0	0	43.2	7.4	<0.005	20	<0.0005
Count	2	2	2	2	2	2	2	2
High	0.0196	3.0	9600	43.2	7.4	<0.005	20	<0.0005
Low	0.0187	2.1	0	37.5	6.4	<0.005	17	<0.0005
Mean	0.0191	2.6	4800	40.4	6.9	<0.005	19	<0.0005
High Limit	1				8.5	0.469	218	0.015
Low Limit					6.5			
Lim Ex	0				0	0	0	0
Frequency	0%				0%	0%	0%	0%
10x Lim Ex	0				0	0	0	0
Frequency	0%				0%	0%	0%	0%

SC-01 Westner Lake Outlet

Quarterly Sample	Barium mg/l	Dissolved organic carbon mg/l	Hardness mg/l	Iron mg/l	pH (Field) pH	Radium Bq/l	Sulfate mg/l	Uranium mg/l
2023-10-30	0.0138	11.7	34.8	0.404	7.4	0.026	27	<0.0005
Count	1	1	1	1	1	1	1	1
High	0.0138	11.7	34.8	0.404	7.4	0.026	27	<0.0005
Low	0.0138	11.7	34.8	0.404	7.4	0.026	27	<0.0005
Mean	0.0138	11.7	34.8	0.404	7.4	0.026	27	<0.0005
High Limit	1			2.49	8.5	0.469	128	0.015
Low Limit					5.3			
Lim Ex	0			0	0	0	0	0
Frequency	0%			0%	0%	0%	0%	0%
10x Lim Ex	0			0	0	0	0	0
Frequency	0%			0%	0%	0%	0%	0%

SR-01 Quirke Lake Outlet

Quarterly Sample	Barium mg/l	Dissolved organic carbon mg/l	Hardness mg/l	pH (Field) pH	Radium Bq/l	Sulfate mg/l	Uranium mg/l
2023-09-28	0.0434	3.1	35.6	7.5	0.022	27	0.00119
Count	1	1	1	1	1	1	1
High	0.0434	3.1	35.6	7.5	0.022	27	0.00119
Low	0.0434	3.1	35.6	7.5	0.022	27	0.00119
Mean	0.0434	3.1	35.6	7.5	0.022	27	0.00119
High Limit	1			8.5	0.469	218	0.015
Low Limit				6.5			
Lim Ex	0			0	0	0	0
Frequency	0%			0%	0%	0%	0%
10x Lim Ex	0			0	0	0	0
Frequency	0%			0%	0%	0%	0%

SR-06 McCabe Lake Outlet

Quarterly Sample	Barium mg/l	Dissolved organic carbon mg/l	Flow l/s	Hardness mg/l	pH (Field) pH	Radium Bq/l	Sulfate mg/l	Uranium mg/l
2023-05-25	0.152	2.9	626.0	33.9	**6.2**	0.042	2.1	<0.0005
2023-11-02	0.142	3.5	11.7	37.1	6.7	0.046	21.0	0.00056
Count	2	2	2	2	2	2	2	2
High	0.152	3.5	626.0	37.1	6.7	0.046	21.0	0.00056
Low	0.142	2.9	11.7	33.9	6.2	0.042	2.1	0.00056
Mean	0.147	3.2	318.9	35.5	6.5	0.044	11.6	0.00040
High Limit	1				8.5	0.469	218	0.015
Low Limit					6.5			
Lim Ex	0				1	0	0	0
Frequency	0%				50%	0%	0%	0%
10x Lim Ex	0				0	0	0	0
Frequency	0%				0%	0%	0%	0%

SR-08 Nordic Lake Outlet

Quarterly Sample	Barium mg/l	Dissolved organic carbon mg/l	Hardness mg/l	pH (Field) pH	Radium Bq/l	Sulfate mg/l	Uranium mg/l
2023-02-08	0.0217	4.4	191	7.1	0.035	160	0.00100
2023-05-10	0.0162	3.8	117	6.7	0.022	98	0.00080
2023-08-15	0.0142	4.6	142	**6.4**	0.028	110	0.00069
2023-10-30	0.0158	4.2	147	7.4	0.020	120	0.00088
Count	4	4	4	4	4	4	4
High	0.0217	4.6	191	7.4	0.035	160	0.00100
Low	0.0142	3.8	117	6.4	0.020	98	0.00069
Mean	0.0170	4.3	149	6.9	0.026	122	0.00084
High Limit	1			8.5	0.469	309	0.015
Low Limit				6.5			
Lim Ex	0			1	0	0	0
Frequency	0%			25%	0%	0%	0%
10x Lim Ex	0			0	0	0	0
Frequency	0%			0%	0%	0%	0%

SR-15 May Lake Outlet

Quarterly Sample	Barium mg/l	Dissolved organic carbon mg/l	Hardness mg/l	Iron mg/l	pH (Field) pH	Radium Bq/l	Sulfate mg/l	Uranium mg/l
2023-05-25	0.0602	3.0	38.1	0.025	6.3	0.024	2.3	<0.0005
2023-11-14	0.0636	3.6	35.9	0.013	7.3	0.023	26.0	<0.0005
Count	2	2	2	2	2	2	2	2
High	0.0636	3.6	38.1	0.025	7.3	0.024	26.0	<0.0005
Low	0.0602	3.0	35.9	0.013	6.3	0.023	2.3	<0.0005
Mean	0.0619	3.3	37.0	0.019	6.8	0.024	14.2	<0.0005
High Limit	1			2.49	8.5	0.469	218	0.015
Low Limit					5.3			
Lim Ex	0			0	0	0	0	0
Frequency	0%			0%	0%	0%	0%	0%
10x Lim Ex	0			0	0	0	0	0
Frequency	0%			0%	0%	0%	0%	0%

D-4 Dunlop Lake Outlet

Quarterly Sample	Barium mg/l	Dissolved organic carbon mg/l	Hardness mg/l	Iron mg/l	Manganese mg/l	pH (Field) pH	Radium Bq/l	Sulfate mg/l	Uranium mg/l
2023-05-11	0.0112	3.0	9.1	0.046	0.0139	**5.9**	<0.005	3.0	<0.0005
2023-08-14	0.0115	3.1	9.6	0.045	0.0220	**6.4**	<0.005	2.7	<0.0005
2023-11-15	0.0107	3.0	8.2	0.038	0.0270	6.9	<0.005	3.0	<0.0005
Count	3	3	3	3	3	3	3	3	3
High	0.0115	3.1	9.6	0.046	0.0270	6.9	<0.005	3.0	<0.0005
Low	0.0107	3.0	8.2	0.038	0.0139	5.9	<0.005	2.7	<0.0005
Mean	0.0111	3.0	9.0	0.043	0.0210	6.4	<0.005	2.9	<0.0005
High Limit	1			0.76	0.841	8.5	0.469	128	0.015
Low Limit						6.5			
Lim Ex	0			0	0	2	0	0	0
Frequency	0%			0%	0%	67%	0%	0%	0%
10x Lim Ex	0			0	0	0	0	0	0
Frequency	0%			0%	0%	0%	0%	0%	0%

SR-16 Fox Creek @ Hwy 108

Quarterly Sample	Barium mg/l	Dissolved organic carbon mg/l	Hardness mg/l	Iron mg/l	Manganese mg/l	pH (Field) pH	Radium Bq/l	Sulfate mg/l	Uranium mg/l	Cobalt mg/l
2023-02-22	0.00745	15.8	9.1	0.800	0.034	5.8	<0.005	2.4	<0.0005	0.00050
2023-05-10	0.00565	10.5	6.0	0.345	0.021	5.7	<0.005	1.3	<0.0005	0.00050
2023-08-16	0.02040	15.9	16.4	**3.510**	0.340	6.3	<0.005	2.0	<0.0005	**0.00375**
2023-10-30	0.00833	21.2	10.2	0.704	0.049	6.7	<0.005	2.2	<0.0005	0.00051
Count	4	4	4	4	4	4	4	4	4	4
High	0.02040	21.2	16.4	3.510	0.340	6.7	<0.005	2.4	<0.0005	0.00375
Low	0.00565	10.5	6.0	0.345	0.021	5.7	<0.005	1.3	<0.0005	0.00050
Mean	0.01046	15.9	10.4	1.340	0.111	6.1	<0.005	2.0	<0.0005	0.00132
High Limit	1			2.49	0.841	8.5	0.469	128	0.015	0.0025
Low Limit						5.3				
Lim Ex	0			1	0	0	0	0	0	1
Frequency	0%			25%	0%	0%	0%	0%	0%	25%
10x Lim Ex	0			0	0	0	0	0	0	0
Frequency	0%			0%	0%	0%	0%	0%	0%	0%

SR-17 Unnamed Creek Drain Lake 3 @ HWY 108

Quarterly Sample	Barium mg/l	Dissolved organic carbon mg/l	Hardness mg/l	Iron mg/l	Manganese mg/l	pH (Field) pH	Radium Bq/l	Sulfate mg/l	Uranium mg/l	Cobalt mg/l
2023-02-22	0.0213	7.9	12.8	0.728	0.0546	6.1	<0.005	2.9	<0.0005	0.00088
2023-05-10	0.0136	7.0	6.6	0.378	0.0220	5.8	0.005	2.5	<0.0005	0.00049
2023-08-17	0.0290	8.4	16.7	**3.330**	0.1030	5.7	0.006	0.5	<0.0005	0.00172
2023-10-31	0.0235	11.3	15.8	0.547	0.0507	7.1	<0.005	2.3	<0.0005	0.00075
Count	4	4	4	4	4	4	4	4	4	4
High	0.0290	11.3	16.7	3.330	0.1030	7.1	0.006	2.9	<0.0005	0.00172
Low	0.0136	7.0	6.6	0.378	0.0220	5.7	0.005	0.5	<0.0005	0.00049
Mean	0.0219	8.7	13.0	1.246	0.0576	6.2	0.006	2.1	<0.0005	0.00096
High Limit	1			2.49	0.841	8.5	0.469	128	0.015	0.0025
Low Limit						5.3				
Lim Ex	0			1	0	0	0	0	0	0
Frequency	0%			25%	0%	0%	0%	0%	0%	0%
10x Lim Ex	0			0	0	0	0	0	0	0
Frequency	0%			0%	0%	0%	0%	0%	0%	0%

SR-18 Jim Christ Lake Outlet

Quarterly Sample	Barium mg/l	Dissolved organic carbon mg/l	Hardness mg/l	Iron mg/l	Manganese mg/l	pH (Field) pH	Radium Bq/l	Sulfate mg/l	Uranium mg/l
2023-05-10	0.0421	5.3	9.3	0.053	0.0100	6.6	<0.005	2.9	<0.0005
2023-10-31	0.0459	5.6	12.0	0.045	0.0211	7.3	<0.005	3.7	<0.0005
Count	2	2	2	2	2	2	2	2	2
High	0.0459	5.6	12.0	0.053	0.0211	7.3	<0.005	3.7	<0.0005
Low	0.0421	5.3	9.3	0.045	0.0100	6.6	<0.005	2.9	<0.0005
Mean	0.0440	5.5	10.6	0.049	0.0156	7.0	<0.005	3.3	<0.0005
High Limit	1			0.76	0.841	8.5	0.469	128	0.015
Low Limit						6.5			
Lim Ex	0		0	0	0	0	0	0	0
Frequency	0%		0%	0%	0%	0%	0%	0%	0%
10x Lim Ex	0		0	0	0	0	0	0	0
Frequency	0%		0%	0%	0%	0%	0%	0%	0%

SR-19 Inlet to Elliot Lake

Quarterly Sample	Barium mg/l	Dissolved organic carbon mg/l	Hardness mg/l	Iron mg/l	Manganese mg/l	pH (Field) pH	Radium Bq/l	Sulfate mg/l	Uranium mg/l
2023-02-08	0.0226	6.1	16.3	0.279	0.0200	6.8	<0.005	2.7	<0.0005
2023-05-10	0.0178	4.7	13.7	0.146	0.0270	6.5	<0.005	2.5	<0.0005
2023-08-15	0.0310	4.1	23.2	0.715	0.1310	**6.1**	<0.005	3.0	<0.0005
2023-10-30	0.0215	6.9	15.0	0.369	0.0336	7.3	<0.005	3.6	<0.0005
Count	4	4	4	4	4	4	4	4	4
High	0.0310	6.9	23.2	0.715	0.1310	7.3	<0.005	3.6	<0.0005
Low	0.0178	4.1	13.7	0.146	0.0200	6.1	<0.005	2.5	<0.0005
Mean	0.0232	5.5	17.1	0.377	0.0529	6.7	<0.005	3.0	<0.0005
High Limit	1			2.49	0.841	8.5	0.469	128	0.015
Low Limit						6.5			
Lim Ex	0		0	0	0	1	0	0	0
Frequency	0%		0%	0%	0%	25%	0%	0%	0%
10x Lim Ex	0		0	0	0	0	0	0	0
Frequency	0%		0%	0%	0%	0%	0%	0%	0%

Rio Algom Limited and Denison Mines Inc.
2023 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station D-4

YEAR		pHF	SO4 [5] (mg/L)	DOC (mg/L)	Ra (Bq/L)	U (mg/L)	Ba (mg/L)	Fe (mg/L)	Mn [5] (mg/L)	Hardness (mg/L)
Assessment Criteria [1]	Wetland and lake benchmarks		128.0		0.469	0.0150	1.000		0.841	-
	Wetland benchmark [2]	5.3						2.49		
	Lake benchmark [3]	6.5						0.76		
MDL [4]		0.1	0.1		0.005	0.0005	0.005	0.02	0.002	0.05
2019		7.0	3.3		< 0.007	< 0.0005	0.014	0.04	0.018	8.9
2020		6.8	3.0	2.9	< 0.007	< 0.0005	0.013	0.04	0.014	8.9
2021		7.0	2.8	2.9	0.005	< 0.0005	0.011	0.02	0.009	8.9
2022		6.7	3.0	2.8	< 0.005	< 0.0005	0.013	0.06	0.019	9.8
2023		6.4	2.9	3.0	< 0.005	< 0.0005	0.011	0.04	0.021	9.0

Notes:

[1] Assessment criteria as per Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

[2] Benchmark applies to wetland stations: M-01, DS-18, SC-01.

[3] Benchmark applies to lake stations: D-4, D-5, D-6, Q-09, Q-20, SR-01, SR-06, SR-08.

[4] Method Detection Limits as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

[5] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021). Parameters are hardness Variation in number of significant figures reflect MDL's at the time of reporting. In 2006, laboratory reported MDL's were standardized to achieve consistency and meet program requirements, as per Cycle 2 Interpretive Report (Minnow 2005).

Bold indicates exceedance of evaluation criteria value

Rio Algom Limited and Denison Mines Inc.
2023 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station SR-18

YEAR		pHF	SO4 [5] (mg/L)	DOC (mg/L)	Ra (Bq/L)	U (mg/L)	Ba (mg/L)	Fe (mg/L)	Mn [5] (mg/L)	Hardness (mg/L)
Assessment Criteria [1]	Wetland and lake benchmarks		128.0		0.469	0.0150	1.000		0.841	-
	Wetland benchmark [2]	5.3						2.49		
	Lake benchmark [3]	6.5						0.76		
MDL [4]		0.1	0.1		0.005	0.0005	0.005	0.02	0.002	0.50
2019		6.9	3.6		< 0.007	< 0.0005	0.051	0.06	0.017	10.1
2020		6.9	3.5	5.4	< 0.007	< 0.0005	0.045	0.07	0.017	9.6
2021		6.8	3.5	5.1	0.006	< 0.0005	0.046	0.07	0.035	9.8
2022		7.0	4.2	11.8	< 0.005	< 0.0005	0.081	0.25	0.015	10.7
2023		7.0	3.3	5.5	< 0.005	< 0.0005	0.044	0.05	0.016	10.6

Notes:

[1] Assessment criteria as per Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

[2] Benchmark applies to wetland stations: M-01, DS-18, SC-01.

[3] Benchmark applies to lake stations: D-4, D-5, D-6, Q-09, Q-20, SR-01, SR-06, SR-08.

[4] Method Detection Limits as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

[5] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021). Parameters are hardness dependent.

Variation in number of significant figures reflect MDL's at the time of reporting. In 2006, laboratory reported MDL's were standardized to achieve consistency and meet program requirements, as per Cycle 2 Interpretive Report (Minnow 2005).

Bold indicates exceedance of evaluation criteria value

Rio Algom Limited and Denison Mines Inc.
2023 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station SR-19

YEAR		pHF	SO4 [5] (mg/L)	DOC (mg/L)	Ra (Bq/L)	U (mg/L)	Ba (mg/L)	Fe (mg/L)	Mn [5] (mg/L)	Hardness (mg/L)
Assessment Criteria [1]	Wetland and lake benchmarks		128.0		0.469	0.0150	1.000		0.841	-
	Wetland benchmark [2]	5.3						2.49		
	Lake benchmark [3]	6.5						0.76		
MDL [4]		0.1	0.1		0.005	0.0005	0.005	0.02	0.002	0.50
2019		6.8	2.9		< 0.007	< 0.0005	0.023	0.30	0.039	14.7
2020		7.0	2.6	4.8	< 0.007	< 0.0005	0.022	0.38	0.060	15.9
2021		7.0	2.5	5.5	0.007	< 0.0005	0.020	0.39	0.056	14.5
2022		6.8	2.7	5.5	< 0.005	< 0.0005	0.023	0.44	0.057	16.6
2023		6.7	3.0	5.5	< 0.005	< 0.0005	0.023	0.38	0.053	17.1

Notes:

[1] Assessment criteria as per Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

[2] Benchmark applies to wetland stations: M-01, DS-18, SC-01.

[3] Benchmark applies to lake stations: D-4, D-5, D-6, Q-09, Q-20, SR-01, SR-06, SR-08.

[4] Method Detection Limits as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

[5] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021). Parameters are hardness dependent.

Variation in number of significant figures reflect MDL's at the time of reporting. In 2006, laboratory reported MDL's were standardized to achieve consistency and meet program requirements, as per Cycle 2 Interpretive Report (Minnow 2005).

Bold indicates exceedance of evaluation criteria value

Rio Algom Limited and Denison Mines Inc.
2023 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station SR-16

YEAR		pHF	SO4 [5] (mg/L)	DOC (mg/L)		Ra (Bq/L)		U (mg/L)	Ba (mg/L)	Fe (mg/L)	Mn [5] (mg/L)	Hardness (mg/L)
Assessment Criteria [1]	Wetland and lake benchmarks		128.0			0.469		0.0150	1.000		0.841	-
	Wetland benchmark [2]	5.3								2.49		
	Lake benchmark [3]	6.5								0.76		
MDL [4]		0.1	0.1			0.005		0.0005	0.005	0.02	0.002	0.50
2019		5.8	1.1		<	0.007	<	0.0005	0.007	0.80	0.034	7.7
2020		6.2	0.8	12..6	<	0.007	<	0.0005	0.008	1.12	0.061	7.9
2021		5.9	0.6	13.3	<	0.005	<	0.0005	0.007	0.94	0.036	7.5
2022		5.7	0.4	13.2		0.006	<	0.0005	0.007	0.91	0.037	8.3
2023		6.1	2.0	15.9	<	0.005	<	0.0005	0.010	1.34	0.111	10.4

Notes:

[1] Assessment criteria as per Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

[2] Benchmark applies to wetland stations: M-01, DS-18, SC-01.

[3] Benchmark applies to lake stations: D-4, D-5, D-6, Q-09, Q-20, SR-01, SR-06, SR-08.

[4] Method Detection Limits as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

[5] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021). Parameters are hardness dependent.

Variation in number of significant figures reflect MDL's at the time of reporting. In 2006, laboratory reported MDL's were standardized to achieve consistency and meet program requirements, as per Cycle 2 Interpretive Report (Minnow 2005).

Bold indicates exceedance of evaluation criteria value

Rio Algom Limited and Denison Mines Inc.
2023 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station SR-17

YEAR		pHF	SO4 [5] (mg/L)	DOC (mg/L)		Ra (Bq/L)		U (mg/L)	Ba (mg/L)	Fe (mg/L)	Mn [5] (mg/L)	Hardness (mg/L)
Assessment Criteria [1]	Wetland and lake benchmarks		128.0			0.469		0.0150	1.000		0.841	-
	Wetland benchmark [2]	5.3								2.49		
	Lake benchmark [3]	6.5								0.76		
MDL [4]		0.1	0.1			0.005		0.0005	0.005	0.02	0.002	0.50
2019		6.0	2.5		<	0.007	<	0.0005	0.021	0.59	0.039	9.7
2020		6.2	1.8	8.6	<	0.007	<	0.0005	0.020	1.63	0.074	10.7
2021		6.1	1.6	8.7		0.007	<	0.0005	0.016	0.97	0.057	9.0
2022		6.3	2.0	8.7	<	0.000	<	0.0005	0.019	1.01	0.060	11.0
2023		6.2	2.1	8.7		0.006	<	0.0005	0.022	1.25	0.058	13.0

Notes:

[1] Assessment criteria as per Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

[2] Benchmark applies to wetland stations: M-01, DS-18, SC-01.

[3] Benchmark applies to lake stations: D-4, D-5, D-6, Q-09, Q-20, SR-01, SR-06, SR-08.

[4] Method Detection Limits as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

[5] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021). Parameters are hardness dependent.

Variation in number of significant figures reflect MDL's at the time of reporting. In 2006, laboratory reported MDL's were standardized to achieve consistency and meet program requirements, as per Cycle 2 Interpretive Report (Minnow 2005).

Bold indicates exceedance of evaluation criteria value

Rio Algom Limited and Denison Mines Inc.
2023 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station D-5

YEAR		pHF	SO4 [5] (mg/L)	DOC (mg/L)	Ra (Bq/L)	U (mg/L)	Ba (mg/L)	Hardness (mg/L)
Assessment Criteria [1]	Wetland and lake benchmarks		128.0		0.469	0.0150	1.000	-
	Wetland benchmark [2]	5.3						
	Lake benchmark [3]	6.5						
MDL [4]		0.1	0.1		0.005	0.0005	0.005	0.05
2019		6.9	10.3		0.041	0.0010	0.051	19.4
2020		7.0	10.6	3.1	0.044	0.0013	0.068	20.3
2021		6.9	9.8	3.4	0.052	0.0011	0.068	20.9
2022		6.8	16.4	3.7	0.063	0.0013	0.072	29.5
2023		6.6	15.6	3.8	0.087	0.0014	0.085	26.1

Notes:

[1] Assessment criteria as per Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

[2] Benchmark applies to wetland stations: M-01, DS-18, SC-01.

[3] Benchmark applies to lake stations: D-4, D-5, D-6, Q-09, Q-20, SR-01, SR-06, SR-08.

[4] Method Detection Limits as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

[5] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021). Parameters are hardness dependent. Variation in number of significant figures reflect MDL's at the time of reporting. In 2006, laboratory reported MDL's were standardized to achieve consistency and meet program requirements, as per Cycle 2 Interpretive Report (Minnow 2005).

Bold indicates exceedance of evaluation criteria value

Rio Algom Limited and Denison Mines Inc.
2023 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station D-6

YEAR		pHF	SO4 [5] (mg/L)	DOC (mg/L)		Ra (Bq/L)		U (mg/L)	Ba (mg/L)	Fe (mg/L)	Mn [5] (mg/L)	Hardness (mg/L)
Assessment Criteria [1]	Wetland and lake benchmarks		218.0			0.469		0.0150	1.000		0.841	-
	Wetland benchmark [2]	5.3								2.49		
	Lake benchmark [3]	6.5								0.76		
MDL [4]		0.1	0.1			0.005		0.0005	0.005	0.02	0.002	0.50
2019		6.8	22.9			0.009	<	0.0005	0.018	0.82	0.370	35.9
2020		6.9	21.0	4.2	<	0.007	<	0.0005	0.014	0.37	0.146	31.2
2021		6.8	27.8	4.3		0.009	<	0.0005	0.014	0.20	0.099	37.2
2022		6.6	28.0	4.3	<	0.005	<	0.0005	0.013	0.16	0.101	38.3
2023		6.6	72.4	4.1	<	0.005	<	0.0005	0.017	0.33	0.267	91.9

Notes:

[1] Assessment criteria as per Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

[2] Benchmark applies to wetland stations: M-01, DS-18, SC-01.

[3] Benchmark applies to lake stations: D-4, D-5, D-6, Q-09, Q-20, SR-01, SR-06, SR-08.

[4] Method Detection Limits as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

[5] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021). Parameters are hardness dependent.

Variation in number of significant figures reflect MDL's at the time of reporting. In 2006, laboratory reported MDL's were standardized to achieve consistency and meet program requirements, as per Cycle 2 Interpretive Report (Minnow 2005).

Bold indicates exceedance of evaluation criteria value

Rio Algom Limited and Denison Mines Inc.
2023 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station BSD2

YEAR		pHF	SO4 [5] (mg/L)	DOC (mg/L)	Ra (Bq/L)	U (mg/L)	Ba (mg/L	Fe (mg/L)	Mn [5] (mg/L)	Hardness (mg/)
Assessment Criteria [1]	Wetland and lake benchmarks		218.0		0.469	0.0150	1.000		0.841	-
	Wetland benchmark [2]	5.3						2.49		
	Lake benchmark [3]	6.5						0.76		
MDL [4]		0.1	0.1		0.005	0.0005	0.005	0.02	0.002	0.5
2019		6.9	12.4		< 0.007	< 0.0005	0.013	0.17	0.074	20.1
2020		6.8	20.0	4.3	< 0.007	< 0.0005	0.015	0.35	0.162	31.4
2021		6.8	33.0	4.3	0.006	< 0.0005	0.013	0.17	0.098	39.2
2022		6.5	27.0	4.0	< 0.005	< 0.0005	0.013	0.18	0.087	38.8
2023		6.7	94.0	3.9	0.008	< 0.0005	0.020	0.40	0.340	114.7

Notes:

[1] Assessment criteria as per Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

[2] Benchmark applies to wetland stations: M-01, DS-18, SC-01.

[3] Benchmark applies to lake stations: D-4, D-5, D-6, Q-09, Q-20, SR-01, SR-06, SR-08.

[4] Method Detection Limits as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

[5] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021). Parameters are hardness dependent.

Variation in number of significant figures reflect MDL's at the time of reporting. In 2006, laboratory reported MDL's were standardized to achieve consistency and meet program requirements, as per Cycle 2 Interpretive Report (Minnow 2005).
Bold indicates exceedance of evaluation criteria value

Rio Algom Limited and Denison Mines Inc.
2023 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station FBD2

YEAR		pHF	SO4 [5] (mg/L)	DOC (mg/L)	Ra (Bq/L)	U (mg/L)	Ba (mg/L)	Fe (mg/L)	Mn [5] (mg/L)	Hardness mg/L
Assessment Criteria [1]	Wetland and lake benchmarks		218.0		0.469	0.0150	1.000		0.841	-
	Wetland benchmark [2]	5.3						2.49		
	Lake benchmark [3]	6.5						0.76		
MDL [4]		0.1	0.1		0.005	0.0005	0.005	0.02	0.002	0.5
2019		5.8	< 0.1		< 0.007	< 0.0005	< 0.005	< 0.02	< 0.002	< 0.5
2020		6.0	< 0.1	< 0.5	< 0.007	< 0.0005	< 0.005	< 0.02	< 0.002	< 0.5
2021		5.7	< 0.2	< 0.5	< 0.005	< 0.0005	< 0.005	< 0.02	< 0.002	< 0.5
2022		6.0	< 0.1	< 0.5	< 0.005	< 0.0005	< 0.005	< 0.02	0.003	<0.5
2023		6.2	< 0.2	< 0.5	< 0.005	< 0.0005	< 0.005	< 0.02	< 0.002	0.1

Notes:

[1] Assessment criteria as per Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

[2] Benchmark applies to wetland stations: M-01, DS-18, SC-01.

[3] Benchmark applies to lake stations: D-4, D-5, D-6, Q-09, Q-20, SR-01, SR-06, SR-08.

[4] Method Detection Limits as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

[5] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021). Parameters are hardness dependent.

Variation in number of significant figures reflect MDL's at the time of reporting. In 2006, laboratory reported MDL's were standardized to achieve consistency and meet program requirements, as per Cycle 2 Interpretive Report (Minnow 2005).

Bold indicates exceedance of evaluation criteria value

Rio Algom Limited and Denison Mines Inc.
2023 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station DS-18

YEAR		pHF	SO4 [5] (mg/L)	DOC (mg/L)	Ra (Bq/L)	U (mg/L)	Ba (mg/L)	Fe (mg/L)	Hardness mg/L
Assessment Criteria [1]	Wetland and lake benchmarks		309.0		0.469	0.0150	1.000		-
	Wetland benchmark [2]	5.3						2.49	
	Lake benchmark [3]	6.5						0.76	
MDL [4]		0.1	0.1		0.005	0.0005	0.005	0.02	0.5
2019		7.1	43.2		0.110	0.0008	0.019	0.26	78.0
2020		7.1	53.0	2.5	0.105	0.0010	0.021	0.35	70.1
2021		7.1	44.3	2.8	0.133	0.0009	0.027	0.16	58.4
2022		7.0	45.8	2.6	0.100	0.0011	0.019	0.17	63.4
2023		6.7	31.2	2.5	0.089	0.0012	0.017	0.20	65.6

Notes:

[1] Assessment criteria as per Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

[2] Benchmark applies to wetland stations: M-01, DS-18, SC-01.

[3] Benchmark applies to lake stations: D-4, D-5, D-6, Q-09, Q-20, SR-01, SR-06, SR-08.

[4] Method Detection Limits as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

[5] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021). Parameters are hardness dependent.

Variation in number of significant figures reflect MDL's at the time of reporting. In 2006, laboratory reported MDL's were standardized to achieve consistency and meet program requirements, as per Cycle 2 Interpretive Report (Minnow 2005).

Bold indicates exceedance of evaluation criteria value

Rio Algom Limited and Denison Mines Inc.
2023 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station M-01

YEAR		pHF	SO4 [5] (mg/L)	DOC (mg/L)	Ra (Bq/L)	U (mg/L)	Ba (mg/L)	Fe (mg/L)	Hardness mg/L
Assessment Criteria [1]	Wetland and lake benchmarks		218.0		0.469	0.0150	1.000		-
	Wetland benchmark [2]	5.3						2.49	
	Lake benchmark [3]	6.5						0.76	
MDL [4]		0.1	0.1		0.005	0.0005	0.005	0.02	0.5
2019		6.7	8.4		0.017	0.0027	0.016	0.78	31.2
2020		6.8	7.2	4.9	0.029	0.0024	0.018	1.57	35.4
2021		6.6	8.1	5.1	0.028	0.0021	0.016	0.92	34.1
2022		6.7	9.1	6.0	0.019	0.0030	0.016	0.95	35.8
2023		6.8	11.5	5.8	0.018	0.0021	0.017	0.58	42.7

Notes:

[1] Assessment criteria as per Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

[2] Benchmark applies to wetland stations: M-01, DS-18, SC-01.

[3] Benchmark applies to lake stations:D-4, D-5, D-6, Q-09, Q-20, SR-01, SR-06, SR-08.

[4] Method Detection Limits as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

[5] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021). Parameters are hardness dependent.

Variation in number of significant figures reflect MDL's at the time of reporting. In 2006, laboratory reported MDL's were standardized to achieve consistency and meet program requirements, as per Cycle 2 Interpretive Report (Minnow 2005).

Bold indicates exceedance of evaluation criteria value

Rio Algom Limited and Denison Mines Inc.
2023 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station BSR5

YEAR		pHF	SO4 [5] (mg/L)	DOC (mg/L)	Ra (Bq/L)	U (mg/L)	Ba (mg/L)	Fe (mg/L)	Hardness mg/L
Assessment Criteria [1]	Wetland and lake benchmarks		218.0		0.469	0.0150	1.000		-
	Wetland benchmark [2]	5.3						2.49	
	Lake benchmark [3]	6.5						0.76	
MDL [4]		0.1	0.1		0.005	0.0005	0.005	0.02	0.5
2019		6.7	8.4		0.017	0.0027	0.016	0.78	31.2
2020		6.8	7.2	4.9	0.029	0.0024	0.018	1.57	35.4
2021		6.6	8.1	5.1	0.028	0.0021	0.016	0.92	34.1
2022		6.7	9.1	6.0	0.019	0.0030	0.016	0.95	35.8
2023		6.9	7.3	5.9	0.015	0.0019	0.016	0.53	42.0

Notes:

[1] Assessment criteria as per Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

[2] Benchmark applies to wetland stations: M-01, DS-18, SC-01.

[3] Benchmark applies to lake stations: D-4, D-5, D-6, Q-09, Q-20, SR-01, SR-06, SR-08.

[4] Method Detection Limits as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

[5] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021). Parameters are hardness dependent.

Variation in number of significant figures reflect MDL's at the time of reporting. In 2006, laboratory reported MDL's were standardized to achieve consistency and meet program requirements, as per Cycle 2 Interpretive Report (Minnow 2005).

Bold indicates exceedance of evaluation criteria value

Rio Algom Limited and Denison Mines Inc.
2023 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station FBR5

YEAR		pHF	SO4 [5] (mg/L)	DOC (mg/L)	Ra (Bq/L)	U (mg/L)	Ba (mg/L)	Fe (mg/L)	Hardness mg/L
Assessment Criteria [1]	Wetland and lake benchmarks		218.0		0.469	0.0150	1.000		-
	Wetland benchmark [2]	5.3						2.49	
	Lake benchmark [3]	6.5						0.76	
MDL [4]		0.1	0.1		0.005	0.0005	0.005	0.02	0.5
2019		6.0	< 0.1		< 0.007	< 0.0005	< 0.005	< 0.02	< 0.5
2020		5.9	< 0.1	< 0.5	< 0.007	< 0.0005	< 0.005	< 0.02	< 0.5
2021		6.0	< 0.1	< 0.5	< 0.006	< 0.0005	< 0.005	< 0.02	< 0.5
2022		6.3	< 0.1	< 0.5	< 0.005	< 0.0005	< 0.005	< 0.02	< 0.5
2023		6.3	< 0.2	< 0.5	< 0.005	< 0.0005	< 0.005	< 0.02	<0.5

Notes:

[1] Assessment criteria as per Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

[2] Benchmark applies to wetland stations: M-01, DS-18, SC-01.

[3] Benchmark applies to lake stations: D-4, D-5, D-6, Q-09, Q-20, SR-01, SR-06, SR-08.

[4] Method Detection Limits as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

[5] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021). Parameters are hardness dependent.

Variation in number of significant figures reflect MDL's at the time of reporting. In 2006, laboratory reported MDL's were standardized to achieve consistency and meet program requirements, as per Cycle 2 Interpretive Report (Minnow 2005).

Bold indicates exceedance of evaluation criteria value

Rio Algom Limited and Denison Mines Inc.
2023 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station SR-15

YEAR		pHF	SO4[5] (mg/L)	DOC (mg/L)	Ra (Bq/L)	U (mg/L)	Ba (mg/L)	Hardness (mg/L)
Assessment Criteria [1]	Wetland and lake benchmarks		218.0		0.469	0.0150	1.000	
	Wetland benchmark [2]	5.3						
	Lake benchmark [3]	6.5						
MDL [4]		0.1	0.1		0.005	0.0005	0.005	0.5
2019		6.9	47.3		0.051	0.0015	0.064	43.5
2020		6.9	34.0	3.8	0.066	0.0019	0.074	45.6
2021		6.8	46.3	3.9	0.073	0.0015	0.077	55.7
2022		6.7	65.5	3.9	0.067	0.0018	0.077	81.2
2023		6.8	80.0	3.8	0.084	0.0023	0.129	95.6

Notes:

[1]Assessment criteria as per Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

[2] Benchmark applies to wetland stations: M-01, DS-18, SC-01.

[3] Benchmark applies to lake stations: D-4, D-5, D-6, Q-09, Q-20, SR-01, SR-06, SR-08.

[4] Method Detection Limits as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

[5] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021). Parameters are hardness dependent.

Variation in number of significant figures reflect MDL's at the time of reporting. In 2006, laboratory reported MDL's were standardized to achieve consistency and meet program requirements, as per Cycle 2 Interpretive Report (Minnow 2005).

Bold indicates exceedance of evaluation criteria value

Rio Algom Limited and Denison Mines Inc.
2023 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station SR-15

YEAR		pHF	SO_4[5] (mg/L)	DOC (mg/L)		Ra (Bq/L)		U (mg/L)	Ba (mg/L)	Hardness (mg/L)
Assessment Criteria [1]	Wetland and lake benchmarks		218.0			0.469		0.0150	1.000	
	Wetland benchmark [2]	5.3								
	Lake benchmark [3]	6.5								
MDL [4]		0.1	0.1			0.005		0.0005	0.005	0.5
2019		7.3	19.0			0.008	<	0.0005	0.02	39.4
2020		6.8	17.0	2.3	<	0.007	<	0.0005	0.019	35.7
2021		7.0	18.0	2.7	<	0.005	<	0.0005	0.018	35.4
2022		6.9	18.0	2.6	<	0.005	<	0.0005	0.018	36.1
2023		6.9	19.0	2.6	<	0.005	<	0.0005	0.019	40.4

Notes:

[1] Assessment criteria as per Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

[2] Benchmark applies to wetland stations: M-01, DS-18, SC-01.

[3] Benchmark applies to lake stations: D-4, D-5, D-6, Q-09, Q-20, SR-01, SR-06, SR-08.

[4] Method Detection Limits as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

[5] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021). Parameters are hardness dependent.

Variation in number of significant figures reflect MDL's at the time of reporting. In 2006, laboratory reported MDL's were standardized to achieve consistency and meet program requirements, as per Cycle 2 Interpretive Report (Minnow 2005).

Bold indicates exceedance of evaluation criteria value

Rio Algom Limited and Denison Mines Inc.
2023 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station SR-15

YEAR		pHF	SO_4[5] (mg/L)	DOC (mg/L)		Ra (Bq/L)	U (mg/L)	Ba (mg/L)	Fe (mg/L)	Hardness (mg/L)
Assessment Criteria [1]	Wetland and lake benchmarks		128.0			0.469	0.0150	1.000		
	Wetland benchmark [2]	5.3							2.49	
	Lake benchmark [3]	6.5							0.76	
MDL [4]		0.1	0.1			0.005	0.0005	0.005	0.02	0.5
2019		7.3	16.0		<	0.007	< 0.0005	0.011	0.10	29.1
2020		7.0	16.0	4.6		0.012	< 0.0005	0.009	0.13	25.3
2021		7.0	18.0	4.5		0.015	< 0.0005	0.011	0.13	30.1
2022		6.6	26.0	7.8		0.014	< 0.0005	0.014	0.17	37.7
2023		7.4	27.0	11.7		0.026	< 0.0005	0.014	0.40	34.8

Notes:

[1]Assessment criteria as per Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

[2] Benchmark applies to wetland stations: M-01, DS-18, SC-01.

[3] Benchmark applies to lake stations: D-4, D-5, D-6, Q-09, Q-20, SR-01, SR-06, SR-08.

[4] Method Detection Limits as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

[5] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021). Parameters are hardness dependent.

Variation in number of significant figures reflect MDL's at the time of reporting. In 2006, laboratory reported MDL's were standardized to achieve consistency and meet program requirements, as per Cycle 2 Interpretive Report (Minnow 2005).

Bold indicates exceedance of evaluation criteria value

Rio Algom Limited and Denison Mines Inc.
2023 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station SR-15

YEAR		pHF	SO_4[5] (mg/L)	DOC (mg/L)	Ra (Bq/L)	U (mg/L)	Ba (mg/L)	Hardness (mg/L)
Assessment Criteria [1]	Wetland and lake benchmarks		218.0		0.469	0.0150	1.000	
	Wetland benchmark [2]	5.3						
	Lake benchmark [3]	6.5						
MDL [4]		0.1	0.1		0.005	0.0005	0.005	0.5
2019		7.2	28.0		0.057	0.0006	0.312	36.7
2020		7.2	26.0	3.2	0.053	0.0005	0.148	36.9
2021		7.1	23.5	3.2	0.046	0.0005	0.138	36.1
2022		6.7	23.0	3.0	0.041	0.0005	0.124	35.0
2023		6.5	11.6	3.2	0.044	0.0004	0.147	35.5

Notes:

[1]Assessment criteria as per Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

[2] Benchmark applies to wetland stations: M-01, DS-18, SC-01.

[3] Benchmark applies to lake stations: D-4, D-5, D-6, Q-09, Q-20, SR-01, SR-06, SR-08.

[4] Method Detection Limits as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

[5] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021). Parameters are hardness dependent.

Variation in number of significant figures reflect MDL's at the time of reporting. In 2006, laboratory reported MDL's were standardized to achieve consistency and meet program requirements, as per Cycle 2 Interpretive Report (Minnow 2005).

Bold indicates exceedance of evaluation criteria value

Rio Algom Limited and Denison Mines Inc.
2023 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station SR-15

YEAR		pHF	SO4[5] (mg/L)	DOC (mg/L)	Ra (Bq/L)	U (mg/L)	Ba (mg/L)	Fe (mg/L)	Hardness (mg/L)
Assessment Criteria [1]	Wetland and lake benchmarks		218.0		0.469	0.0150	1.000		
	Wetland benchmark [2]	5.3						2.49	
	Lake benchmark [3]	6.5						0.76	
MDL [4]		0.1	0.1		0.005	0.0005	0.005	0.02	0.5
2019		7.2	27.0		0.049	< 0.0005	0.146	0.02	39.0
2020		7.2	27.0	3.3	0.044	< 0.0005	0.103	0.03	40.6
2021		7.0	25.0	3.2	0.047	< 0.0005	0.087	0.02	42.2
2022		6.8	25.0	3.5	0.053	< 0.0005	0.065	0.02	39.1
2023		6.8	14.2	3.3	0.024	< 0.0005	0.062	0.02	37.0

Notes:

[1]Assessment criteria as per Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

[2] Benchmark applies to wetland stations: M-01, DS-18, SC-01.

[3] Benchmark applies to lake stations: D-4, D-5, D-6, Q-09, Q-20, SR-01, SR-06, SR-08.

[4] Method Detection Limits as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

[5] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021). Parameters are hardness dependent.

Variation in number of significant figures reflect MDL's at the time of reporting. In 2006, laboratory reported MDL's were standardized to achieve consistency and meet program requirements, as per Cycle 2 Interpretive Report (Minnow 2005).

Bold indicates exceedance of evaluation criteria value

Rio Algom Limited and Denison Mines Inc.
2023 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station SR-01

YEAR		pHF	SO4 [5] (mg/L)	DOC (mg/L)		Ra (Bq/L)	U (mg/L)	Ba (mg/L)	Hardness (mg/L)
Assessment Criteria [1]	Wetland and lake benchmarks		218.0			0.469	0.0150	1.000	-
	Wetland benchmark [2]	5.3							
	Lake benchmark [3]	6.5							
MDL [4]		0.1	0.1			0.005	0.0005	0.005	0.5
2019		7.0	25.0			0.031	0.0011	0.039	36.6
2020		6.8	24.0	3.4		0.029	0.0012	0.042	34.3
2021		6.9	26.0	3.0		0.027	0.0011	0.041	28.9
2022		6.4	25.0	3.1	<	0.005	0.0010	0.042	37.8
2023		7.5	27.0	3.1		0.022	0.0012	0.043	35.6

Notes:

[1] Assessment criteria as per Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

[2] Benchmark applies to wetland stations: M-01, DS-18, SC-01.

[3] Benchmark applies to lake stations: D-4, D-5, D-6, Q-09, Q-20, SR-01, SR-06, SR-08.

[4] Method Detection Limits as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

[5] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021). Parameters are hardness dependent.

Variation in number of significant figures reflect MDL's at the time of reporting. In 2006, laboratory reported MDL's were standardized to achieve consistency and meet program requirements, as per Cycle 2 Interpretive Report (Minnow 2005).

Bold indicates exceedance of evaluation criteria value

Rio Algom Limited and Denison Mines Inc.
2023 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station SR-08

YEAR		pHF	SO4 [5] (mg/L)	DOC (mg/L)	Ra (Bq/L)	U (mg/L)	Ba (mg/L)	Hardness (mg/L)
Assessment Criteria [1]	Wetland and lake benchmarks		309		0.469	0.0150	1.000	-
	Wetland benchmark [2]	5.3						
	Lake benchmark [3]	6.5						
MDL [4]		0.1			0.005	0.0005	0.005	0.5
2019		6.8	130.0		0.030	0.0006	0.018	164.0
2020		6.8	140.0	4.0	0.029	0.0008	0.019	173.8
2021		7.1	155.0	5.3	0.030	0.0009	0.019	192.5
2022		6.8	135.0	4.1	0.025	0.0008	0.018	161.3
2023		6.9	122.0	4.3	0.026	0.0008	0.017	149.0

Notes:

[1] Assessment criteria as per Table S.1, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021)

[2] Benchmark applies to wetland stations: M-01, DS-18, SC-01.

[3] Benchmark applies to lake stations: D-4, D-5, D-6, Q-09, Q-20, SR-01, SR-06, SR-08.

[4] Method Detection Limits as per Table 6.2, Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

[5] Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SRWMP, SAMP and TOMP (Minnow, 2021). Parameters are hardness dependent.

Variation in number of significant figures reflect MDL's at the time of reporting. In 2006, laboratory reported MDL's were standardized to achieve consistency and meet program requirements, as per Cycle 2 Interpretive Report (Minnow 2005).

Bold indicates exceedance of evaluation criteria value