



**Serpent River Watershed Monitoring Program
2021 Annual Water Quality Report**

***Submitted to the
Canadian Nuclear Safety Commission
March 31, 2022***

Table of Contents

List of Figures.....	iii
List of Tables.....	iii
List of Appendices.....	iii
1 Introduction.....	4
2 Methodology	5
2.1 2021 Program Requirements	5
2.2 2021 Program Conformance	8
2.3 Field Measurements.....	8
2.4 Data Quality Objectives.....	8
2.5 Changes in Analytical Methods	11
2.6 Reporting of Method Detection Limits.....	11
2.7 Data Screening and Assessment Conventions.....	11
3 Results	12
3.1 Data Quality Results and Assessment	12
3.2 2021 Annual Average Location Results Summary.....	15
3.3 Five-Year Annual Average Trends at Key Locations 2017-2021	16
4 Discussion	19
4.1 Response Monitoring	19
4.2 SRWMP Performance Monitoring Program Changes.....	19
4.3 Changes to Location Classification and Frequency	20
4.4 Representative Public Radiation Dose Estimation.....	20
REFERENCES.....	21

LIST OF FIGURES

Figure 2.1	Serpent River Watershed Water Quality Monitoring Locations	7
Figure 3.1.a.	Annual Average Sulphate Concentrations at SR-01, SR-06, SR-08, and DS-18, 2017-2021	18
Figure 3.1.b.	Annual Average Radium Concentrations at SR-01, SR-06, SR-08, and DS-18, 2017-2021	18
Figure 3.1.c.	Annual Average Uranium Concentrations at SR-01, SR-06, SR-08, and DS-18, 2017-2021	19

LIST OF TABLES

Table 2.1	2021 SRWMP Water Quality Monitoring Requirements.....	6
Table 2.3	SRWMP Field Equipment Models and Accuracy	8
Table 2.4.a.	2021 SRWMP Field Data Quality Objectives	9
Table 2.4.b.	2021 SRWMP Laboratory Methods and Data Quality Objectives	10
Table 3.1	2021 SRWMP Field Quality Control Results Summary.....	14
Table 3.2	2021 SRWMP Location Annual Average Results Summary	17

LIST OF APPENDICES

APPENDIX I	Performance Monitoring Changes 1999 - 2021, Evolution of Programs
APPENDIX II	Flagged Data Results
APPENDIX III	Laboratory QA/QC Results
APPENDIX IV	Field QA/QC Results
APPENDIX V	Location Results

1 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 is prepared every five years in a *State of the Environment Report* (SOE) in compliance with license requirements and in accordance to Canadian Standards Association (CSA) 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)¹ 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 2021, the SRWMP followed the 2020 program modifications recommendations described in the document submission entitled *Cycle 5 Study Design for the SRWMP, SAMP and TOMP* (Cycle 5 Study Design, (Minnow, 2019).

The SRWMP Annual Water Quality Report for 2021 provides water quality data from watershed monitoring locations from January 1, 2021 through December 31, 2021. 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 presents data collected as required by the SAMP and TOMP (RAL, 2022; DMI, 2022). 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 2021 also provides a summary of the data quality management program and water quality results for the period January 1, 2021 through December 31, 2021.

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.

¹ The JRG is a multi-stakeholder committee composed of representatives from the Canadian Nuclear Safety Commission (CNSC), Department of Fisheries and Oceans (DFO), Environment Canada (EC), MECP, Ontario Ministry of Natural Resources and Forestry (MNRF), Ontario Ministry of Labour (MOL) and the Ontario Ministry of Northern Development and Mines (MNDM). The JRG continues to participate in the programs through reviewing study design reports and interpretive reports for the TOMP, the SAMP, and the SRWMP.

2 METHODODOLOGY

2.1 2021 Program Requirements

The 2021 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 and parameters monitored. Figure 2.1 provides a map of the stations included in the water quality monitoring program.

2021 SRWMP Annual Water Quality Report

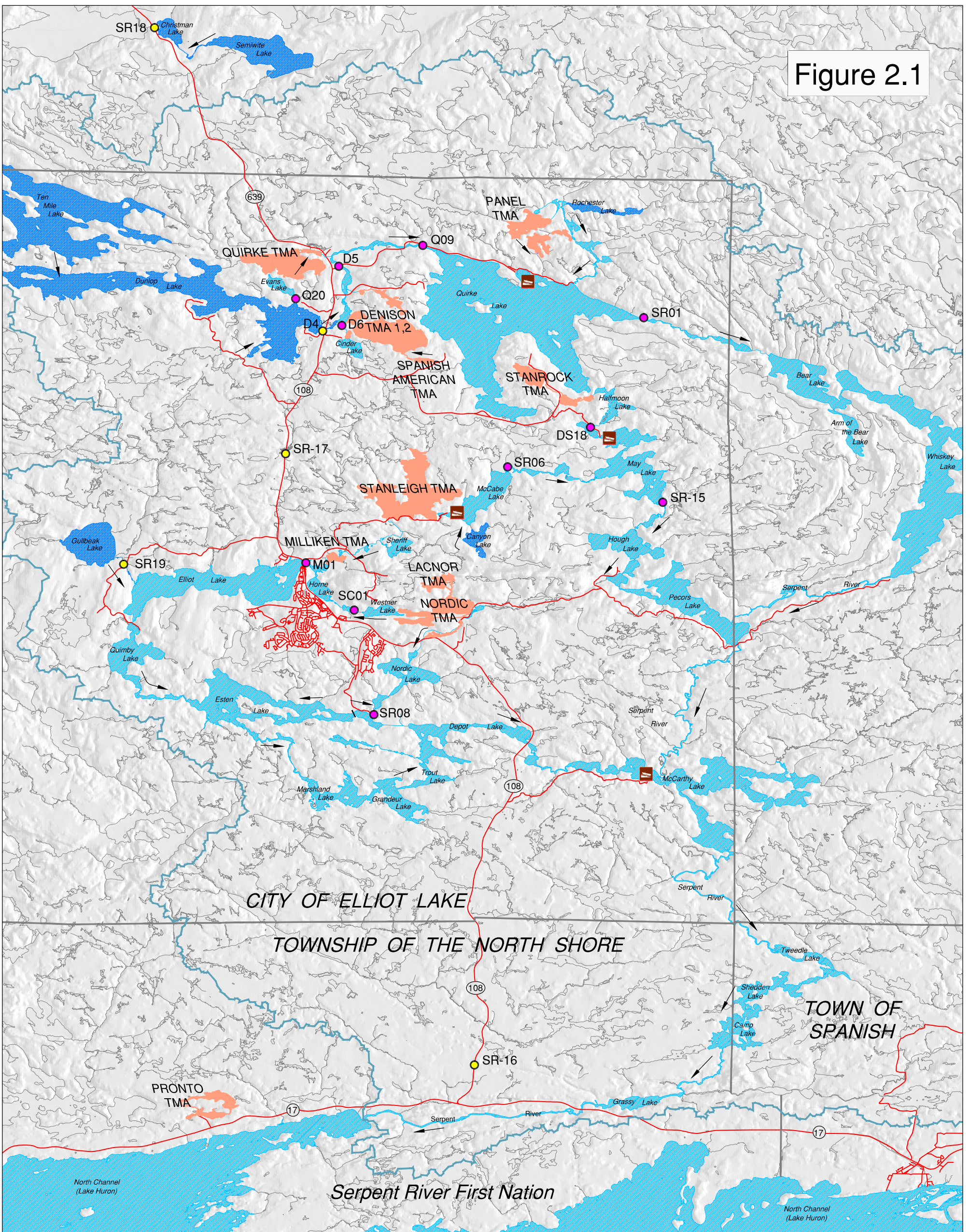
Table 2.1 2021 SRWMP Water Quality Monitoring Requirements

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:

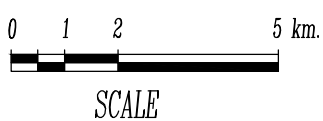
1. Field QA-QC designated stations.
2. Wetland reference locations for the SRWMP and SAMP Cycle 5 Design Study (Minnow 2019).
3. Hardness is an ancillary parameter used to assess manganese and sulphate as both parameters are hardness dependant (Ambient Water Quality Guidelines) (BC ENV 2019)
4. DOC was 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.

Figure 2.1

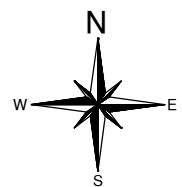


Serpent River Watershed Monitoring Program

Water Sample Collection Locations February 2018



- Tailings Management Areas (TMA).
- Exposure Lakes (included in SRWMP).
- Reference Lakes (included in SRWMP).
- Water Sample Location (Exposure).
- Water Sample Location (Reference).
- Direction of flow.
- Exterior limit of the Serpent River Watershed.



— Produced by Tulloch Geomatics Inc. under Licence with the Ministry of Natural Resources (MNR) © Queens Printer for Ontario, 2005. The watershed as shown is courtesy of the MNR. No endorsement by this Ministry or the Ontario Government is implied by the use of their mapping products.

2.2 2021 Program Conformance

All Cycle 5 sampling, field measurement, and analytical requirements were met during the 2021 reporting period, with the exception of two flow measurements. Although all 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.

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, 2019). Dissolved Organic Carbon (DOC) was added into the monitoring program at the recommendation of the Ontario Ministry of the Environment, Conservation, and Parks (MECP). DOC data is provided in Appendix V for 2021, 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 2021 SRWMP are presented in detail in the *Cycle 5 Study Design* (Table 6.2, Minnow, 2019). Field Staff have been thoroughly 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 2021 SRWMP are presented in detail in the *Cycle 5 Study Design* (Minnow, 2019). Table 2.4.a. provides a summary of field DQOs and Table 2.4.b. provides a summary of laboratory methods, detection limits and DQOs. Data quality assessment results are provided in Section 3.

Table 2.4.a. 2021 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 Parameters³							
Flow	L/s	-	-	method	method	-	30%
pH				0.1	0.01 or 0.02	-	10%
<i>Lake Stations</i>		6.5	-				
<i>Wetland/Streams</i>		-	5.3				
Laboratory Parameters							
Barium	mg/L	1.0	-	0.005	-	0.01	20%
Iron	mg/L	-	-		-		
<i>Lake Stations</i>		-	0.76	0.02	-	0.04	20%
<i>Wetland/Streams</i>		-	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, Appendix 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, Appendix 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 2.4.b. 2021 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					
<i>Lake Stations</i>			0.76		0.02	0.04	10%	20%	20%
<i>Wetland/Streams</i>			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, Appendix 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, Appendix 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)

2.5 Changes in Analytical Methods

After the unexpected closure of Laurentian University's laboratory, Perdue, formerly the Elliot Lake Research Field Station (ELRFS) at the end of April, 2021, samples analyzed for radium-226 were sent to Testmark Laboratories Ltd (Testmark). However, after receipt of historically high radium results at multiple locations and a lack of precision in repeat results, an investigation into the laboratory method for radium-226 was conducted. Testmark's analytical method for radium-226 utilized 7500 Ra-B – Precipitation Method from "Standard Methods for the Examination of Water and Wastewater" (2011), heavily referencing Environmental Protection Agency (EPA) Method 903.0 "Alpha-Emitting Radium Isotopes in Drinking Water" (1980) and EPA Method 900.0 "Gross Alpha and Gross Beta Radioactivity in Drinking Water" (1980). Although Testmark's current method is approved with Canadian Association for Laboratory Accreditation (CALA), the investigation found that Testmark was utilizing an alpha/beta counter and not an alpha spectrometer, essentially counting all alpha particles and reporting them as radium-226. This is problematic when analyzing waters impacted from uranium mines which other alpha emitters can influence results.

Due to the discrepancies in Testmark results, comparison radium-226 samples were sent to SGS laboratories through the month of September to determine accuracy and precision in results. SGS radium-226 analytical method utilizes the Eichrom Application Note AN-1401-10, Rapid determination of Ra226 in Emergency Urine and Water (2018) with use of the Alpha Spectrometry System. Subsequent radium-226 results from SGS indicated consistency with historic results and precision of repeat results were well within the DQO of 20%. Beginning October 01, 2021, radium-226 samples were sent to SGS exclusively.

2.6 Reporting of Method Detection Limits

Program method detection limits (MDLs) are presented in Tables 2.4.a. and 2.4.b. The target MDL for radium-226 (0.005 Bq/L) was not met on all samples analysed from January to April in 2021 due to decreased sample throughput of the analytical laboratory. There was no change in method during this period; however, the laboratory was only able to claim a MDL of 0.007 Bq/L. However, both Testmark and SGS were able to meet the MDL of <0.005 Bq/L, this is reflected in the dataset for 2021 beginning May 2021.

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 \pm 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 2021 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 2.4.a. and 2.4.b. 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 is 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 3.1.a to 3.1.c.

3 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 3.1. Data quality results and assessments are provided in the following sections. It should be noted that due to the closure of Perdue laboratories at Laurentian University and the radium-226 methodology issues at Testmark Laboratories, laboratory QA/QC for radium-226 is reported from SGS beginning October 2021.

3.1.1 Laboratory Quality Assurance and Quality Control

In 2021, all analytical requirements for the SRWMP were contracted to laboratories with Canadian Association for Laboratory Accreditation Inc. (CALA) accreditations. (Appendix III). However, as noted above in Section 3.1, Quality Assurance and Quality Control results will only be reported from SGS.

Detailed laboratory QA/QC results are provided in Appendix III. The 10% objective for QA/QC was met. SGS performed 12836 analyses with 10387 QC checks, which represents 84.4% 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 2021 (Appendix III).

3.1.3 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 quality objective of 20% was achieved for all parameters in all samples (Appendix III).

3.1.6 Analytical Certified Reference Material Performance

Laboratory quality control results confirm that the CRM data quality objective of 20% accuracy was achieved for all parameters in all samples in 2021 (Appendix III).

3.1.7 Field Blank Performance

Field Blank quality control results confirm that SRWMP field blank data quality objectives were achieved in 2021 (Appendix IV).

3.1.8 Field Precision Performance

The radium field precision objective of 20% was exceeded in 2 of 4 samples, at 33% and 57.1%. The exceedances occurred at low concentrations (< 0.021 Bq/L). The exceedances indicate some environmental variability at the time of sampling, but all values are representative of typical values observed at these locations; and therefore, the exceedances do not affect interpretation of radium water quality data. The annual average percent difference was slightly above the DQO at 26%. The lack of precision in these samples may also have been influenced by the inaccuracy of the methodology used by Testmark for radium analysis (see section 2.5 for details) All other field precision quality control results confirm that SRWMP field precision DQO's were achieved in 2021 (Appendix IV).

Table 3.1 2021 SRWMP Field Quality Control Results Summary

QA/QC	pH	SO4 (mg/L)	Ra (T) (Bq/L)	U (mg/L)	Ba (mg/L)	DOC (mg/L)	Fe (mg/L)	Mn (mg/L)	Hardness (mg/L)
MDL ¹	-	0.1	0.005	0.0005	0.005	0.5	0.02	0.002	0.5
Field Blank Statistics									
Count	-	4	4	4	4		4	4	4
Average	-	0.1	0.006	<0.0005	<0.005	<0.5	<0.02	<0.002	<0.5
Max	-	0.2	0.007	<0.0005	<0.005	<0.5	<0.02	<0.002	<0.5
Min	-	<0.1	<0.005	<0.0005	<0.005	<0.5	<0.02	<0.002	<0.5
Field Blank Exceedances									
Criteria ¹	-	0.2	0.01	0.001	0.01	1.0	0.04	0.004	1.0
Exceedance	0	0	0	0	0	0	0	0	0
Field Precision Statistics									
Count	4	4	4	4	4	4	4	2	2
Average	0.0%	0.9%	26.0%	1.2%	5.3%	4.8%	3.2%	3.8%	2.8%
Max	0.0%	2.3%	57.1%	4.7%	14.3%	9.7%	10.0%	8.7%	9.5%
Min	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	0.0%
Field Precision Exceedances									
Criteria ¹	20%	20%	20%	20%	20%	20%	20%	20%	20%
Exceedance	0	0	2	0	0	0	0	0	0

Notes:

¹ Data Quality Objectives taken from Table 6.2 of the Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)

Bold indicates an exceedance in the Data Quality Objectives (DQO's)

3.2 2021 Annual Average Location Results Summary

Annual average concentrations of SRWMP parameters for 2021 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 2021 were better than assessment criteria at all locations (Appendix V).

The annual average iron concentration at M-01 (Sherriff Creek outlet @ HWY 108) appears elevated compared to other SRWMP locations at 0.92 mg/L. However, it remained well below the assessment criteria established for wetland stations (2.49 mg/L, Table 2.4. a) and consistent with reference wetland stations SR-16 and SR-17 (Table 3.2). The 2020 annual average iron concentration at M-01 appears elevated as well (Appendix V), but is attributed to a seasonal spike (5.09 mg/L) in August when persistent upstream beaver activity was observed during a period of warmer, drier conditions and lower water levels. Iron concentrations are generally influenced by the particulate matter within the sample during periods of low flow. The remaining iron concentrations throughout the year were considerably lower (ranging from 0.22 mg/L to 0.51 mg/L) and more typical of expected values when flow is generally higher. This data can be found in the SRWMP Annual Water Quality Report 2020 (RAL, DMI, 2021).

Annual average barium concentrations at SR-06 (McCabe Lake Outlet) and further downstream at SR-15 (May Lake Outlet) have continued to decrease since 2018 (Appendix V) with average concentrations in 2021 at 0.138 mg/L and 0.87 mg/L, respectively (Table 3.2). The decrease is likely associated with the introduction of pre-formed barite at the upstream Stanleigh Effluent Treatment Plant (ETP) in 2018. Prior to 2019, barium concentrations at both SR-06 and SR-15 indicated an increasing trend, which was likely due to the increased barium chloride addition rates required for radium removal upstream at CL-06. The efficacy of the change to pre-formed barite indicates an improvement in radium removal and a reduction of residual barium in the CL-06 effluent and subsequently downstream at SR-06 and SR-15. Details of the preformed barite treatment method and CL-06 data can be found in the 2018, 2019 and 2020 *RAL Annual OCM Reports* (RAL, 2019, 2020, 2021). Although barium concentrations still appear elevated compared to other SRWMP stations, they are well below the assessment criterion (1.0 mg/L) and well below levels considered to be toxic to the aquatic environment (>8.0 mg/L; WHO 2001).

The annual average sulphate concentration at SR-08 (Nordic Lake Outlet) appears elevated (155.0 mg/l) compared to other SRWMP stations. However, as noted in section 2.2, according to the most recent approved water quality guidelines for aquatic life as published by BC ENV, manganese and sulphate are hardness dependent. Toxicity studies for both parameters demonstrated amelioration of toxicity with increasing water hardness and were used to develop new water quality guidelines in the province of British Columbia for these substances. Therefore, based on this information, a specific assessment criterion for sulphate has been established for each station in the SRWMP. In this case, the mean hardness concentration at SR-08 was determined to be 177.0 mg/L (Minnow, 2021) and thus, the resulting criterion for sulphate at this location is 309 mg/L. In 2021, all results at SR-08 fell within BC ENV guidelines for the protection of aquatic life (BC ENV, 2019). 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).

3.3 Five-Year Annual Average Trends at Key Locations 2017-2021

Figures 3.1.a to 3.1.c 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. Furthermore, annual concentrations have been gradually decreasing at all locations over the past five years (Figure 3.1.a), 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, ranging between 140 mg/L – 170 mg/L (Appendix V).

With the exception of DS-18, annual average radium-266 concentrations are significantly lower than the assessment criterion of 0.469 Bq/L (Figure 3.1.b). At station DS-18, annual average radium concentrations appear elevated compared to other annual radium 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 results in the last five years remained well below the assessment criterion of 0.469 Bq/L (ranging from 0.058 Bq/L to 0.221 Bq/L) and well below the Health Canada (2009) drinking water quality standard of 0.5 Bq/L.

Annual average radium-226 concentrations at SR-06 have continued to decrease since 2019 (Appendix V). This is likely associated with an approved alteration in the treatment process for radium-266 removal upstream at the Stanleigh ETP (RAL, 2019, 2020, 2021). Based on review of the five-year annual average data, all radium concentrations have consistently remained below the assessment criterion of 0.469 mg/L and well below Health Canada (2009) drinking water quality standard of 0.5 Bq/L (Figure 3.1.b).

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 3.1.c).

Table 3.2 2021 SRWMP Location Annual Average Results Summary

Parameters			pH	SO ₄ ⁵ (mg/L)	DOC (mg/L)	Ra(T) (Bq/L)	U (mg/L)	Ba (mg/L)	Fe (mg/L)	Mn ⁵ (mg/L)	Hardness mg/L as CaCO ₃
Assessment Criteria ¹	Wetland and lake benchmarks		6.5	128-309		0.469	0.0150	1.000		0.841	-
	Wetland/Stream benchmark ²		5.3						2.49		
	Lake benchmark ³								0.76		
MDL ⁴				0.1		0.005	0.0005	0.005	0.02	0.005	0.5
Location		# of samples collected									
Reference	Type										
D-4	Lake	2	7.0	2.8	2.9	<0.005	<0.0005	0.011	0.02	0.009	8.9
SR-18	Lake	2	6.8	3.5	5.1	0.006	<0.0005	0.046	0.07	0.035	9.8
SR-19	Lake	4	7.0	2.5	5.5	0.007	<0.0005	0.020	0.39	0.056	14.5
SR-16	Wetland/Stream	4	5.9	0.6	13.3	<0.005	<0.0005	0.007	0.94	0.036	7.5
SR-17	Wetland/Stream	4	6.1	1.6	8.7	0.007	<0.0005	0.016	0.97	0.057	9.0
Near Field											
D-5		4	6.9	9.8	3.4	0.052	0.0011	0.068	0.08	0.025	20.9
D-6		4	6.8	27.8	4.3	0.009	<0.0005	0.014	0.20	0.099	37.2
DS-18		4	7.1	44.3	2.8	0.133	0.0009	0.027	0.16	na	58.4
M-01		4	6.6	8.1	5.1	0.028	0.0021	0.016	0.92	na	34.1
Q-09		4	6.8	46.3	3.9	0.073	0.0015	0.077	na	na	55.7
Q-20		1	7.0	18.0	2.7	<0.005	<0.0005	0.018	na	na	35.4
SC-01		1	7.0	18.0	4.5	0.015	<0.0005	0.011	0.13	na	30.1
SR-06		2	7.1	23.5	3.2	0.046	0.0005	0.138	na	na	36.1
Far Field											
SR-15		2	7.0	25.0	3.2	0.047	<0.0005	0.087	0.02	na	42.2
SR-01		1	6.9	36.0	3.0	0.027	0.0011	0.041	na	na	28.9
SR-08		4	7.1	155.0	5.3	0.030	0.0009	0.019	na	na	192.5

Notes:

¹ 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/stream stations: M-01, DS-18, SC-01.

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

⁴ Method Detection Limits as per Table 5.2 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 draft (Minnow, 2020) 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.

na = not applicable. Parameters are not monitored.

Figure 3.1.a. Annual Average Sulphate Concentrations at SR-01, SR-06, SR-08, and DS-18, 2017-2021

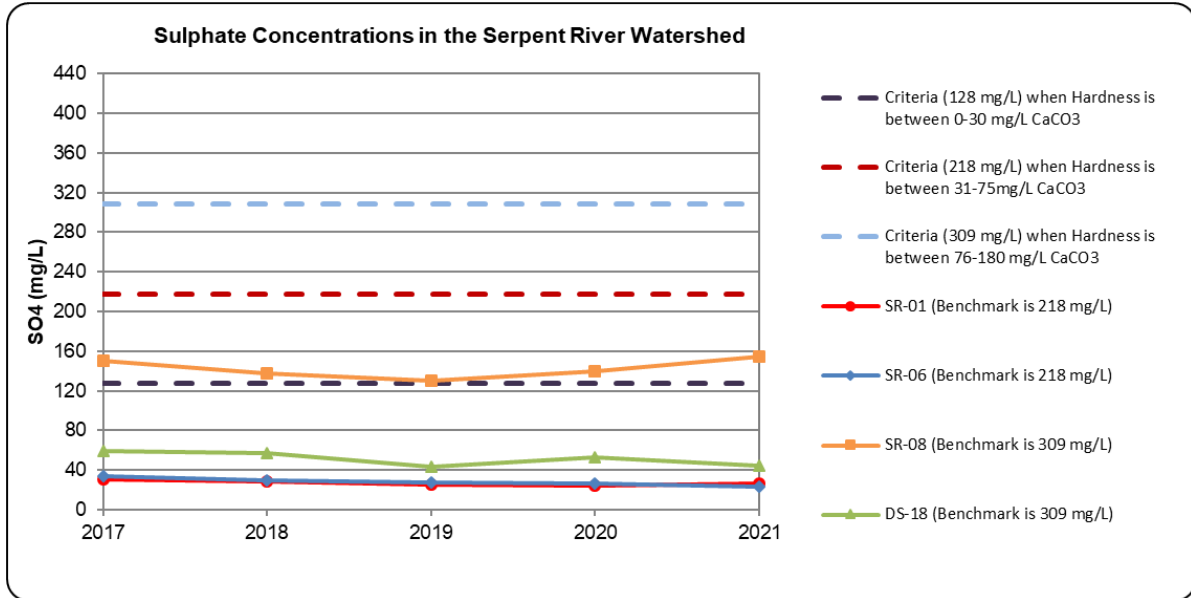


Figure 3.1.b. Annual Average Radium Concentrations at SR-01, SR-06, SR-08, and DS-18, 2017-2021

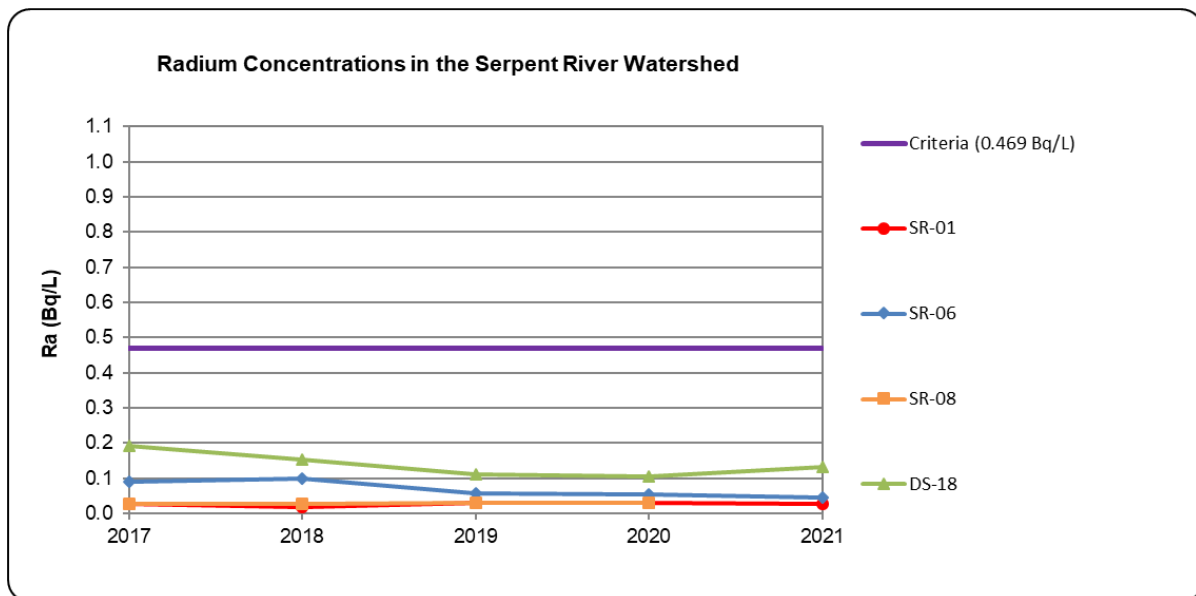
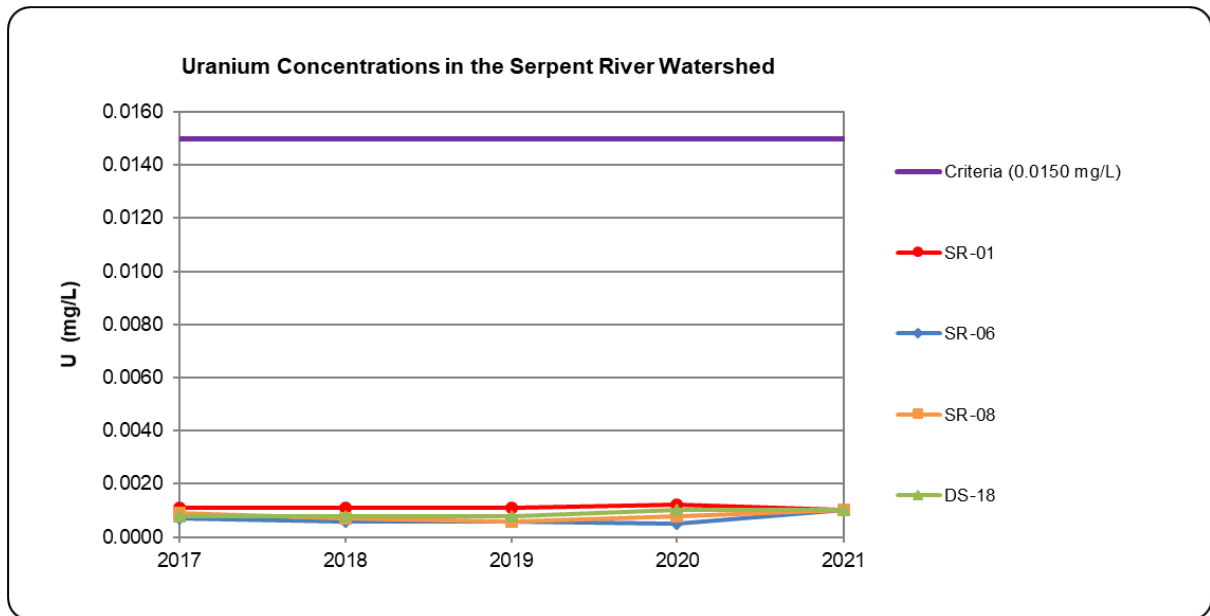


Figure 3.1.c. Annual Average Uranium Concentrations at SR-01, SR-06, SR-08, and DS-18, 2017-2021



4 DISCUSSION

4.1 Response Monitoring

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 three years, particularly at SR-06, the 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 program methodology in 2021. However, in response to the Cycle 4 SOE Report, the CNSC requested a review of the radium-226 benchmark used in the SRWMP for evaluating water quality in the receiving environment. In previous cycles, the Provincial Water Quality Objective (PWQO) value of 1 Becquerels per litre (Bq/L) (OMOE 1994) was used as the benchmark for evaluating radium-226 concentrations in the Serpent River Watershed (SRW). Based on this review, a site-specific water quality objective for radium-226 for the protection of aquatic life was derived. This new site-specific water quality objective is more meaningful specifically for the sampled locations. Going forward, the new approved site-specific water quality benchmark of 0.469 Bq/L for radium-266 will be used for water quality screening within future SRW assessments, rather than the historically used PWQO value of 1.0 Bq/L. Details of the review can be found in the *Cycle 5 Study Design* (Minnow, 2019).

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, 2019 and Minnow, 2016).

4.3 Changes to Location Classification and Frequency

Other than the re-establishment of the SRWMP station SR-15, there were no other changes to location classification or frequencies in 2021. However 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 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 2025 SOE.

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Inc.

2021 SRWMP Annual Water Quality Report

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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	<p>Changes only SRWMP most associated with optimization after first cycle of program was complete:</p> <ul style="list-style-type: none"> • 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		

Cycle 3	Monitoring Framework For Closed Uranium Mines Near Elliot Lake	2009	2005 to 2009	<p>IBMP eliminated based on objectives of program being achieved.</p> <p>TOMP and SAMP:</p> <ul style="list-style-type: none"> • removal of silver, selenium based on performance and removal of conductivity based on redundancy with sulphate; and • DOC, hardness and flow added at selected stations. <p>SRWMP:</p> <ul style="list-style-type: none"> • 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.
	In Basin Monitoring Program, Cycle 3 Study Design	2009		
	Serpent River Watershed Monitoring Program: Cycle 3 Study Design	2009		
	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	<p>Minor changes to TOMP and SAMP.</p> <p>SRWMP:</p> <ul style="list-style-type: none"> • 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		

<p>Cycle 5</p>	<p>Cycle 5 Study Design For the SRWMP, SAMP and TOMP</p>	<p>2019</p>	<p>2015 to 2019</p>	<p>TOMP, SAMP, and SRWMP:</p> <ul style="list-style-type: none"> • improved approach to trend analysis of surface water quality using the non-parametric seasonal Kendall test. <p>SRWMP:</p> <ul style="list-style-type: none"> • 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.
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^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

Report Form: RC8.7.3.01

Location	Analyte	Date	Low	Hi	Result	Comment
D-5	DOC	2021-02-22	2.7	3.5	3.8 mg/L	Result is slightly above the high flag limit, but consistent with historic values. DOC was discontinued in 2014, but re-established in 2020. Will continue to monitor at the current quarterly frequency.
D-6	DOC	2021-02-22	3.2	5.1	5.5 mg/L	Result is slightly above the high flag limit, but consistent with historic values. DOC was discontinued in 2014, but re-established in 2020. Will continue to monitor at the current quarterly frequency.
D-4	hard	2021-11-11	8.5	9.0	9.2 mg/L	Result is slightly above the high flag limit, but consistent with previous values in the last three years.
	SO4	2021-11-11	2.9	2.9	2.8 mg/L	Result is a historic low, but only slightly below the low flag and may possibly be indicating a decreasing trend. Will continue to monitor at the current quarterly frequency.
FBR5	Ra	2021-11-10	0.007	0.007	< 0.005 Bq/L	Result is below the low flag limit, but consistent with a new lower laboratory detection limit.
SR-17	Ra	2021-11-18	0.005	0.010	< 0.005 Bq/L	Result is below the low flag limit, but consistent with a new lower laboratory detection limit.
SR-18	Ra	2021-11-18	0.006	0.009	< 0.005 Bq/L	Result is below the low flag limit, but consistent with a new lower laboratory detection limit.

APPENDIX III
Laboratory QA/QC Results

REPORT CODE: DEN-ANN21

REPORT TITLE: Annual 2021 Denison Data Quality Report

REVISION: 1.0

ISSUED BY:

A handwritten signature in black ink, appearing to read 'D. Stiff'. The signature is written in a cursive style.

Quality Coordinator,
SGS Environmental, Lakefield

AUTHORIZED BY:

A handwritten signature in black ink, appearing to read 'Robert A. ...'. The signature is written in a cursive style.

Technical Manager,
SGS Environmental, Lakefield

DATE: 22 Feb. 2022

Table of Contents

1.	BACKGROUND	3
2.	QUALITY MANAGEMENT SYSTEM.....	3
3.	QUALITY CONTROL PARAMETERS.....	3
4.	NOTABLE OCCURANCES/ACTIONS	3
5.	QC DATA SUMMARY	4
5.1.	Blank Data.....	4
5.2.	Reference Material/Spiked Blank Data	4
5.3.	Duplicate Data	5
5.4.	Spike Duplicate Data	5
5.5.	QC Frequency	6

1. BACKGROUND

SGS Laboratory entered into an agreement with Denison Environmental Services for the analytical lab to provide analysis according to RFT #05-016. Please find below a summary of the laboratory quality management system, key actions taken by the laboratory, as well as a summary of numbers of samples analyzed.

2. QUALITY 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 quality management and the technical aspects of operating a testing laboratory.

The quality 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.

The 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.

3. QUALITY CONTROL PARAMETERS

All QC parameters are taken directly from SGS LIMS. Denison Environmental Services 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.

4. NOTABLE OCCURANCES/ACTIONS

- SGS Environmental, Lakefield laboratory performed 12836 analyses with 10387 QC checks, which represents 84.4% 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

Confidential – Intended only for the person or entity to which it is addressed and may contain confidential and/or privileged material.

5. QC DATA SUMMARY

5.1. Blank Data

Parameter	Unit	Required Limit	Number of Blanks	Mean Blank Result
Acidity	mg/L as CaCO ₃	2	132	2
Silver	mg/L	0.0001	78	<0.0001
Alkalinity	mg/L as CaCO ₃	2	44	<2
Arsenic	mg/L	0.0005	56	<0.0005
Barium	mg/L	0.005	258	<0.005
Cobalt	mg/L	0.0005	195	<0.0005
Copper	mg/L	0.0005	82	<0.0005
DOC	mg/L	0.5	84	<0.5
Iron	mg/L	0.02	242	<0.02
Manganese	mg/L	0.002	207	<0.002
Nickel	mg/L	0.002	82	<0.002
Lead	mg/L	0.00002	82	<0.00002
Ra226	Bq/L	0.005	79	<0.005
Selenium	mg/L	0.0005	83	<0.0005
Sulphate	mg/L	0.1	271	<0.1
Total Dissolved Solids	mg/L	10	0	ND
Total Suspended Solids	mg/L	1	336	<1
Uranium	mg/L	0.0005	200	<0.0005
Zinc	mg/L	0.001	79	<0.001

ND – No Data

5.2. Reference Material/Spiked Blank Data

Parameter	Unit	Number of RM or SB	% Recovery
Acidity	mg/L as CaCO ₃	132	100
Silver	mg/L	78	102
Alkalinity	mg/L as CaCO ₃	44	99.0
Arsenic	mg/L	56	103
Barium	mg/L	258	100
Cobalt	mg/L	195	102
Copper	mg/L	82	101
DOC	mg/L	84	101
Iron	mg/L	242	100
Manganese	mg/L	207	101
Nickel	mg/L	82	101

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Lead	mg/L	82	104
Ra226	Bq/L	81	108
Selenium	mg/L	82	101
Sulphate	mg/L	279	95.8
Total Dissolved Solids	Mg/L	0	ND
Total Suspended Solids	mg/L	336	97.9
Uranium	mg/L	200	98.0
Zinc	mg/L	79	99.5

ND – No Data

5.3. Duplicate Data

Parameter	Unit	RPD* Limit	Number of Duplicates	RPD*
Acidity	mg/L as CaCO ₃	20	132	2.2
Silver	mg/L	20	78	4.3
Alkalinity	mg/L as CaCO ₃	20	44	1.9
Arsenic	mg/L	20	56	4.7
Barium	mg/L	20	258	3.7
Cobalt	mg/L	20	195	4.9
Copper	mg/L	20	82	4.9
DOC	mg/L	20	84	1.6
Iron	mg/L	20	242	4.3
Manganese	mg/L	20	207	3.7
Nickel	mg/L	20	82	4.8
Lead	mg/L	20	82	5.4
Ra226	Bq/L	20	81	6.7
Selenium	mg/L	20	82	6.6
Sulphate	mg/L	20	279	2.9
Total Dissolved Solids	mg/L	20	0	ND
Total Suspended Solids	mg/L	20	336	2.1
Uranium	mg/L	20	200	4.5
Zinc	mg/L	20	79	4.1

*RPD – Relative Percent Difference

ND – No Data

5.4. Spike Duplicate Data

Parameter	Unit	Number of Spike Dups	Mean % Recovery
Silver	mg/L	78	95.7

Confidential – Intended only for the person or entity to which it is addressed and may contain confidential and/or privileged material.

Arsenic	mg/L	56	103
Barium	mg/L	258	101
Cobalt	mg/L	195	102
Copper	mg/L	82	100
DOC	mg/L	84	101
Iron	mg/L	242	104
Manganese	mg/L	207	102
Nickel	mg/L	82	98.9
Lead	mg/L	82	103
Selenium	mg/L	90	103
Sulphate	mg/L	268	94.2
Uranium	mg/L	193	99.0
Zinc	mg/L	76	107

5.5. QC Frequency

Total Number of Blanks:	2590
Total Number of Reference Materials/Spiked Blanks:	2599
Total Number of Duplicate Samples:	2599
Total Number of Spiked Duplicate Samples:	2599
Sum of QC Insertion:	10387
Total Analysis:	12836

APPENDIX IV
Field QA/QC Results

Month	Sample	pH	Sulphate mg/L	Radium (T) Bq/L	Uranium mg/L	Barium mg/L	DOC mg/L	Iron mg/L	Manganese mg/L	Hardness mg/L
2021-05	BSR5	6.8	8.9	0.015	0.0019	0.0130	4.3	0.25	0.0450	28.9
	M-01	6.8	8.7	0.021	0.0019	0.0130	4.3	0.25	0.0440	29.1
	variance	0.0%	2.3%	33.3%	0.0%	0.0%	0.0%	0.0%	2.2%	1%
2021-05	BSD2	6.8	16.0	0.005	< 0.0005	0.0130	4.4	0.16	0.0860	25.3
	D-6	6.8	16.0	0.009	< 0.0005	0.0130	4.0	0.16	0.0850	25.3
	variance	0.0%	0.0%	57.1%	0.0%	0.0%	9.5%	0.0%	1.2%	0%
2021-11	BSR5	6.5	7.7	0.022	0.0022	0.0140	4.9	0.70	0.0700	34.9
	M-01	6.5	7.6	0.022	0.0021	0.0150	5.4	0.72	0.0680	35.2
	variance	0.0%	1.3%	0.0%	4.7%	6.9%	9.7%	2.8%	2.9%	1%
2021-11	BSD2	6.8	50.0	0.007	< 0.0005	0.0130	4.1	0.19	0.1100	53.1
	D-6	6.8	50.0	0.008	< 0.0005	0.0150	4.1	0.21	0.1200	58.4
	variance	0.0%	0.0%	13.3%	0.0%	14.3%	0.0%	10.0%	8.7%	10%
Count		4	4	4	4	4	4	4	4	4
Average		0.0%	0.9%	26.0%	1.2%	5.3%	4.8%	3.2%	3.8%	2.8%
Max		0.0%	2.3%	57.1%	4.7%	14.3%	9.7%	10.0%	8.7%	9.5%
Min		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	0.0%
SRWMP1 Target		20%	20%	20%	20%	20%	20%	20%	20%	20%
# Exceedances		0	0	2	0	0	0	0	0	0

¹ Field Precision 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

Date		pH	Sulphate mg/L	Radium (T) Bq/L	Uranium mg/L	Barium mg/L	DOC mg/L	Iron mg/L	Manganese mg/L	Hardness mg/L
	SRWMP ¹		0.2	0.01	0.001	0.01	1.0	0.04	0.004	1.0
2021.05	FBR5	5.9	< 0.1	< 0.007	< 0.0005	< 0.005	< 0.5	< 0.02	< 0.002	< 0.5
2021.05	FBD2	5.5	< 0.2	< 0.005	< 0.0005	< 0.005	< 0.5	< 0.02	< 0.002	< 0.5
2021.11	FBR5	6.0	< 0.1	< 0.005	< 0.0005	< 0.005	< 0.5	< 0.02	< 0.002	< 0.5
2021.11	FBD2	5.9	< 0.1	< 0.005	< 0.0005	< 0.005	< 0.5	< 0.02	< 0.002	< 0.5
Count		4	4	4	4	4	4	4	4	4
# Exceedances		0	0	0	0	0	0	0	0	0
Average		5.8	< 0.1	< 0.006	< 0.0005	< 0.005	< 0.5	< 0.02	< 0.002	< 0.5
Max		6.0	< 0.2	< 0.007	< 0.0005	< 0.005	< 0.5	< 0.02	< 0.002	< 0.5
Min		5.5	< 0.1	< 0.005	< 0.0005	< 0.005	< 0.5	< 0.02	< 0.002	< 0.5

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

SRWMP ANNUAL WATER QUALITY REPORT 2021
Performance Monitoring Detailed Results 2021

BSD2

Month	DOC mg/L	hard mg/L	pHF	SO4 mg/L	Ra Bq/L	Ba mg/L	Fe mg/L	Mn mg/L
2021-05	4.4	25.3	6.8	16.0	0.005	0.013	0.16	0.086
2021-11	4.1	53.1	6.8	50.0	0.007	0.013	0.19	0.110
Count	2	2	2	2	2	2	2	2
High	4.4	53.1	6.8	50.0	0.007	0.013	0.19	0.110
Low	4.1	25.3	6.8	16.0	0.005	0.013	0.16	0.086
Mean	4.3	39.2	6.8	33.0	0.006	0.013	0.17	0.098
High Limit	11.0		8.5	218.0	0.469	1.000	0.76	0.800
Low Limit			6.5					
Lim Ex	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%

Month	U mg/L
2021-05	<0.0005
2021-11	<0.0005
Count	2
High	<0.0005
Low	<0.0005
Mean	<0.0005
High Limit	0.0150
Low Limit	
Lim Ex	0
10x Lim Ex	0
Frequency	0%

SRWMP ANNUAL WATER QUALITY REPORT 2021
Performance Monitoring Detailed Results 2021

D-4 Dunlop Lake Outlet

Month	DOC mg/L	hard mg/L	pHF	SO4 mg/L	Ra Bq/L	Ba mg/L	Fe mg/L	Mn mg/L
2021-05	2.8	8.7	7.0	2.9	0.005	0.011	<0.02	0.006
2021-11	3.0	9.2	6.9	2.8	<0.005	0.011	0.02	0.011
Count	2	2	2	2	2	2	2	2
High	3.0	9.2	7.0	2.9	0.005	0.011	0.02	0.011
Low	2.8	8.7	6.9	2.8	<0.005	0.011	<0.02	0.006
Mean	2.9	8.9	7.0	2.8	0.005	0.011	0.02	0.009
High Limit	11.0		8.5	128.0	0.469	1.000	0.76	0.841
Low Limit			6.5					
Lim Ex	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%

Month	U mg/L
2021-05	<0.0005
2021-11	<0.0005
Count	2
High	<0.0005
Low	<0.0005
Mean	<0.0005
High Limit	0.0150
Lim Ex	0
10x Lim Ex	0
Frequency	0%

SRWMP ANNUAL WATER QUALITY REPORT 2021
Performance Monitoring Detailed Results 2021

D-6 Cinder Lake Outlet

Month	DOC mg/L	FLOW L/s	hard mg/L	pHF	SO4 mg/L	Ra Bq/L	Ba mg/L	Fe mg/L
2021-02	5.5		24.9	6.9	15.0	<0.007	0.015	0.28
2021-05	4.0	10.00	25.3	6.8	16.0	0.009	0.013	0.16
2021-08	3.7	10.00	40.1	6.7	30.0	0.010	0.013	0.16
2021-11	4.1	10.00	58.4	6.8	50.0	0.008	0.015	0.21
Count	4	4	4	4	4	4	4	4
High	5.5	10.00	58.4	6.9	50.0	0.010	0.015	0.28
Low	3.7	10.00	24.9	6.7	15.0	<0.007	0.013	0.16
Mean	4.3	10.00	37.2	6.8	27.8	0.009	0.014	0.20
High Limit	11.0			8.5	218.0	0.469	1.000	0.76
Low Limit				6.5				
Lim Ex	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%

Month	Mn mg/L	U mg/L
2021-02	0.103	<0.0005
2021-05	0.085	<0.0005
2021-08	0.087	<0.0005
2021-11	0.120	<0.0005
Count	4	4
High	0.120	<0.0005
Low	0.085	<0.0005
Mean	0.099	<0.0005
High Limit	0.841	0.0150
Low Limit		
Lim Ex	0	0
10x Lim Ex	0	0
Frequency	0%	0%

SRWMP ANNUAL WATER QUALITY REPORT 2021
Performance Monitoring Detailed Results 2021

DS-18 Halfmoon Lake Outlet

Month	DOC mg/L	FLOW L/s	hard mg/L	pHF	SO4 mg/L	Ra Bq/L	Ba mg/L	Co mg/L
2021-02	2.8		59.6	7.1	35.0	0.058	0.022	<0.0005
2021-05	2.6	327.10	87.5	7.2	72.0	0.221	0.035	<0.0005
2021-08	2.7	210.00	44.1	7.2	45.0	0.119	0.016	<0.0005
2021-10	3.2	298.60	42.4	7.0	25.0	0.133	0.034	<0.0005
Count	4	4	4	4	4	4	4	4
High	3.2	327.10	87.5	7.2	72.0	0.221	0.035	<0.0005
Low	2.6	210.00	42.4	7.0	25.0	0.058	0.016	<0.0005
Mean	2.8	278.57	58.4	7.1	44.3	0.133	0.027	<0.0005
High Limit	11.0			8.5	309.0	0.469	1.000	0.0025
Low Limit				5.3				
Lim Ex	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%

Month	Fe mg/L	Mn mg/L	U mg/L
2021-02	0.30	0.024	<0.0005
2021-05	0.17	0.009	0.0009
2021-08	0.16	0.011	0.0016
2021-10	0.03	0.004	<0.0005
Count	4	4	4
High	0.30	0.024	0.0016
Low	0.03	0.004	<0.0005
Mean	0.16	0.012	0.0009
High Limit	2.49	0.841	0.0150
Lim Ex	0	0	0
10x Lim Ex	0	0	0
Frequency	0%	0%	0%

SRWMP ANNUAL WATER QUALITY REPORT 202
Performance Monitoring Detailed Results 2021

FBD2

Month	DOC mg/L	hard mg/L	pHF	SO4 mg/L	Ra Bq/L	Ba mg/L	Fe mg/L	Mn mg/L
2021-05	<0.5	<0.5	5.5	<0.2	<0.005	<0.005	<0.02	<0.002
2021-11	<0.5	<0.5	5.9	<0.1	<0.005	<0.005	<0.02	<0.002
Count	2	2	2	2	2	2	2	2
High	<0.5	<0.5	5.9	<0.2	<0.005	<0.005	<0.02	<0.002
Low	<0.5	<0.5	5.5	<0.1	<0.005	<0.005	<0.02	<0.002
Mean	<0.5	<0.5	5.7	<0.2	<0.005	<0.005	<0.02	<0.002
High Limit	11.0		8.5	218.0	0.469	1.000	0.76	0.841
Low Limit			6.5					
Lim Ex	0	0	2	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%

Month	U mg/L
2021-05	<0.0005
2021-11	<0.0005
Count	2
High	<0.0005
Low	<0.0005
Mean	<0.0005
High Limit	0.0150
Lim Ex	0
10x Lim Ex	0
Frequency	0%

SRWMP ANNUAL WATER QUALITY REPORT 2021
Performance Monitoring Detailed Results 2021

SR-01 Quirke Lake Outlet

Month	DOC mg/L	hard mg/L	pHF	SO4 mg/L	Ra Bq/L	Ba mg/L	U mg/L
2021-09	3.0	28.9	6.9	26.0	0.027	0.041	0.0011
Count	1	1	1	1	1	1	1
High	3.0	28.9	6.9	26.0	0.027	0.041	0.0011
Low	3.0	28.9	6.9	26.0	0.027	0.041	0.0011
Mean	3.0	28.9	6.9	26.0	0.027	0.041	0.0011
High Limit	11.0		8.5	218.0	0.469	1.000	0.0150
Low Limit			6.5				
Lim Ex	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%

SRWMP ANNUAL WATER QUALITY REPORT 2021
Performance Monitoring Detailed Results 2021

SR-08 Nordic Lake Outlet

Month	DOC mg/L	hard mg/L	pHF	SO4 mg/L	Ra Bq/L	Ba mg/L	U mg/L
2021-02	4.3	230.0	7.1	170.0	0.024	0.023	0.0009
2021-05	8.6	179.0	7.2	140.0	0.023	0.018	0.0008
2021-08	4.0	182.0	6.9	160.0	0.027	0.017	0.0009
2021-11	4.3	179.0	7.1	150.0	0.044	0.019	0.0011
Count	4	4	4	4	4	4	4
High	8.6	230.0	7.2	170.0	0.044	0.023	0.0011
Low	4.0	179.0	6.9	140.0	0.023	0.017	0.0008
Mean	5.3	192.5	7.1	155.0	0.029	0.019	0.0009
High Limit	11.0		8.5	309.0	0.469	1.000	0.0150
Low Limit			6.5				
Lim Ex	0	0	0	4	0	0	0
10x Lim Ex	0	0	0	0	0	0	0
Frequency	0%	0%	0%	0%	0%	0%	0%

SRWMP ANNUAL WATER QUALITY REPORT 2021
Performance Monitoring Detailed Results 2021

SR-16 Fox Creek @ Hwy 108

Month	DOC mg/L	hard mg/L	pHF	SO4 mg/L	Ra Bq/L	Ba mg/L	Co mg/L	Fe mg/L
2021-02	11.3	10.8	5.6	0.5	<0.007	0.008	0.0007	1.88
2021-05	8.6	5.0	6.3	0.6	<0.005	<0.005	<0.0005	0.22
2021-08	17.1	7.6	5.8	0.3	<0.005	0.008	0.0007	1.21
2021-11	16.3	6.4	6.0	<1.0	<0.005	0.006	<0.0005	0.44
Count	4	4	4	4	4	4	4	4
High	17.1	10.8	6.3	<1.0	<0.007	0.008	0.0007	1.88
Low	8.6	5.0	5.6	0.3	<0.005	<0.005	<0.0005	0.22
Mean	13.3	7.5	5.9	0.6	<0.005	0.007	0.0006	0.94
High Limit			8.5	128.0	0.469	1.000	0.0025	2.49
Low Limit			5.3					
Lim Ex	0	0	0	0	0	0	0	2
10x Lim Ex	0	0	0	0	0	0	0	0
Frequency	0%	0%	0%	0%	0%	0%	0%	0%

Month	Mn mg/L	U mg/L
2021-02	0.059	<0.0005
2021-05	0.010	<0.0005
2021-08	0.050	<0.0005
2021-11	0.024	<0.0005
Count	4	4
High	0.059	<0.0005
Low	0.010	<0.0005
Mean	0.036	<0.0005
High Limit	0.841	0.0150
Low Limit		
Lim Ex	0	0
10x Lim Ex	0	0
Frequency	0%	0%

SRWMP ANNUAL WATER QUALITY REPORT 2021
Performance Monitoring Detailed Results 2021

SR-17 Unnamed Creek Drain Lake 3 @ Hwy 108

Month	DOC mg/L	hard mg/L	pHF	SO4 mg/L	Ra Bq/L	Ba mg/L	Co mg/L	Fe mg/L
2021-02	7.9	12.5	5.8	2.3	<0.007	0.019	0.0014	1.12
2021-05	3.9	6.4	5.9	1.9	0.008	0.013	0.0007	0.63
2021-08	13.0	9.6	6.5	0.6	0.008	0.017	0.0014	1.73
2021-11	10.0	7.5	6.3	1.7	<0.005	0.013	<0.0005	0.41
Count	4	4	4	4	4	4	4	4
High	13.0	12.5	6.5	2.3	0.008	0.019	0.0014	1.73
Low	3.9	6.4	5.8	0.6	<0.005	0.013	<0.0005	0.41
Mean	8.7	9.0	6.1	1.6	0.007	0.016	0.0010	0.97
High Limit			8.5	128.0	0.469	1.000	0.0025	2.49
Low Limit			5.3					
Lim Ex	0	0	0	0	0	0	0	3
10x Lim Ex	0	0	0	0	0	0	0	0
Frequency	0%	0%	0%	0%	0%	0%	0%	0%

Month	Mn mg/L	U mg/L
2021-02	0.099	<0.0005
2021-05	0.038	<0.0005
2021-08	0.073	<0.0005
2021-11	0.019	<0.0005
Count	4	4
High	0.099	<0.0005
Low	0.019	<0.0005
Mean	0.057	<0.0005
High Limit	0.841	0.0150
Low Limit		
Lim Ex	0	0
10x Lim Ex	0	0
Frequency	0%	0%

SRWMP ANNUAL WATER QUALITY REPORT 2021
Performance Monitoring Detailed Results 2021

SR-18 Jim Christ Lake Outlet

Month	DOC mg/L	hard mg/L	pHF	SO4 mg/L	Ra Bq/L	Ba mg/L	Fe mg/L	Mn mg/L
2021-05	4.7	9.6	6.8	3.4	0.007	0.046	0.03	0.008
2021-11	5.4	10.0	6.8	3.5	<0.005	0.046	0.11	0.062
Count	2	2	2	2	2	2	2	2
High	5.4	10.0	6.8	3.5	0.007	0.046	0.11	0.062
Low	4.7	9.6	6.8	3.4	<0.005	0.046	0.03	0.008
Mean	5.1	9.8	6.8	3.5	0.006	0.046	0.07	0.035
High Limit	11.0		8.5	128.0	0.469	1.000	0.76	0.841
Low Limit			6.5					
Lim Ex	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%

Month	U mg/L
2021-05	<0.0005
2021-11	<0.0005
Count	2
High	<0.0005
Low	<0.0005
Mean	<0.0005
High Limit	0.0150
Low Limit	
Lim Ex	0
10x Lim Ex	0
Frequency	0%

SRWMP ANNUAL WATER QUALITY REPORT 2021
Performance Monitoring Detailed Results 2021

SR-19 Inlet to Elliot Lake

Month	DOC mg/L	hard mg/L	pHF	SO4 mg/L	Ra Bq/L	Ba mg/L	Fe mg/L	Mn mg/L
2021-02	5.3	16.9	6.9	3.1	<0.007	0.022	0.32	0.032
2021-05	5.0	12.2	6.9	2.4	0.011	0.017	0.16	0.026
2021-08	5.9	13.8	7.1	2.1	<0.005	0.022	0.69	0.120
2021-11	5.8	15.1	7.1	2.2	<0.005	0.018	0.41	0.046
Count	4	4	4	4	4	4	4	4
High	5.9	16.9	7.1	3.1	0.011	0.022	0.69	0.120
Low	5.0	12.2	6.9	2.1	<0.005	0.017	0.16	0.026
Mean	5.5	14.5	7.0	2.4	0.007	0.020	0.39	0.056
High Limit	11.0		8.5	128.0	0.469	1.000	0.76	0.841
Low Limit			6.5					
Lim Ex	0	0	0	0	0	0	1	0
10x Lim Ex	0	0	0	0	0	0	0	0
Frequency	0%	0%	0%	0%	0%	0%	0%	0%

Month	U mg/L
2021-02	<0.0005
2021-05	<0.0005
2021-08	<0.0005
2021-11	<0.0005
Count	4
High	<0.0005
Low	<0.0005
Mean	<0.0005
High Limit	0.0150
Low Limit	
Lim Ex	0
10x Lim Ex	0
Frequency	0%

**Rio Algom Limited and Denison Mines Inc.
2021 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	6.5	128.0	0.469	0.0150	1.000			0.841	-
	Wetland benchmark ²	5.3					2.49			
	Lake benchmark ³						0.76			
MDL ⁴		0.1	0.1	0.005	0.0005	0.005	0.02	0.002	0.002	0.05
2017		6.8	3.5	< 0.007	< 0.0005	0.013	0.04	0.021	0.021	9.6
2018		6.7	3.4	< 0.007	< 0.0005	0.012	0.04	0.014	0.014	9.3
2019		7.0	3.3	< 0.007	< 0.0005	0.014	0.04	0.018	0.018	8.9
2020		6.8	3.0	2.9	< 0.0005	0.013	0.04	0.014	0.014	8.9
2021		7.0	2.8	2.9	< 0.0005	0.011	0.02	0.009	0.009	8.9

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-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.
2021 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station SR-18

YEAR	pHF	SO ₄ 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					0.76			
MDL ⁴	0.1	0.1	0.005	0.0005	0.005	0.02	0.002	0.002	0.50
2017	6.8	4.0	< 0.007	< 0.0005	0.043	0.07	0.025	0.025	10.4
2018	6.8	4.5	< 0.007	< 0.0005	0.045	0.04	0.011	0.011	9.9
2019	6.9	3.6	< 0.007	< 0.0005	0.051	0.06	0.017	0.017	10.1
2020	6.9	3.5	5.4	< 0.007	0.045	0.07	0.017	0.017	9.6
2021	6.8	3.5	5.1	0.006	0.046	0.07	0.035	0.035	9.8

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-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.
2021 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 6.5	128.0	0.469	0.0150	1.000			0.841	-
	Wetland benchmark ² 5.3					2.49			
	Lake benchmark ³					0.76			
MDL ⁴	0.1	0.1	0.005	0.0005	0.005	0.02	0.002	0.50	
2017	7.0	3.0	0.008	< 0.0005	0.019	0.36	0.031	14.4	
2018	6.7	3.2	0.009	< 0.0005	0.025	0.35	0.060	17.9	
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	0.022	0.38	0.060	15.9	
2021	7.0	2.5	5.5	0.007	< 0.0005	0.020	0.056	14.5	

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-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.
2021 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station SR-16**

YEAR	pHF	SO ₄ 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	6.5	128.0	0.469	0.0150	1.000	2.49	0.841	-	
Wetland and lake benchmarks	5.3					0.76			
Wetland benchmark ²						0.02			
Lake benchmark ³						0.005			
MDL ⁴	0.1	0.1	0.005	0.005	0.005	0.005	0.002	0.5	
2017	5.7	1.1	< 0.007	< 0.0005	0.007	0.94	0.038	7.4	
2018	5.4	1.2	< 0.007	< 0.0005	0.008	0.66	0.043	9.0	
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	0.008	1.12	0.061	7.9	
2021	5.9	0.6	13.3	< 0.005	0.007	0.94	0.036	7.5	

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/stream stations: M-01, DS-18, SC-01

³ Benchmark applies to lake stations: 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).

0.5 indicates exceedance of evaluation criteria value

**Rio Algom Limited and Denison Mines Inc.
2021 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station SR-17**

YEAR		pHF	SO ₄ 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	6.5	128.0	0.469	0.0150	1.000			0.841	-
	Wetland benchmark ²	5.3					2.49			
	Lake benchmark ³						0.76			
MDL ⁴		0.1	0.1	0.005	0.0005	0.005	0.02	0.002	0.002	0.5
2017		5.8	2.8	0.007	< 0.0005	0.022	0.73	0.048	0.048	11.8
2018		5.5	2.4	0.007	< 0.0005	0.027	1.08	0.081	0.081	14.2
2019		6.0	2.5	< 0.007	< 0.0005	0.021	0.59	0.039	0.039	9.7
2020		6.2	1.8	8.6	< 0.007	0.020	1.63	0.074	0.074	10.7
2021		6.1	1.6	8.7	0.007	< 0.0005	0.016	0.057	0.057	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/stream stations: M-01, DS-18, SC-01.
- ³ Benchmark applies to lake stations: 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.
2021 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station D-5**

YEAR	FLOW (L/s)	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		6.5	128.0		0.469	0.0150	1.000		0.841	
Wetland and lake benchmarks								2.49		
Wetland benchmark ²		5.3						0.76		
Lake benchmark ³										
MDL ⁴		0.1	0.1		0.005	0.0005	0.005	0.02	0.002	0.5
2017	4843.0	6.8	11.3		0.040	0.0013	0.045	0.07	0.026	20.5
2018	2065.0	6.7	13.8		0.073	0.0015	0.106	0.07	0.039	26.6
2019	3498.0	6.9	10.3		0.041	0.0010	0.051	0.05	0.024	19.4
2020	3381.7	7.0	10.6	3.1	0.044	0.0013	0.068	0.08	0.028	20.3
2021	1234.5	6.9	9.8	3.4	0.052	0.0011	0.068	0.08	0.025	20.9

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-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.
2021 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station D-6**

YEAR	FLOW (L/s)	pHF	SO ₄ 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	6.5	218.0	0.469	0.0150	1.000			0.841	-
	Wetland benchmark ²	5.3					2.49			
	Lake benchmark ³						0.76			
MDL ⁴		0.1	0.1	0.005	0.0005	0.005	0.02	0.002	0.002	0.5
2017	151.9	6.7	18.8	<	0.007	< 0.0005	0.013	0.19	0.102	28.7
2018	129.3	6.6	34.8		0.015	< 0.0005	0.017	0.82	0.481	49.0
2019	164.7	6.8	22.9		0.009	< 0.0005	0.018	0.82	0.370	35.9
2020	20.0	6.9	21.0	4.2	<	0.007	0.014	0.37	0.146	31.2
2021	10.0	6.8	27.8	4.3	0.009	< 0.0005	0.014	0.20	0.099	37.2

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/stream stations: M-01, DS-18, SC-01
 - ³ Benchmark applies to lake stations: 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.
2021 Serpentine River Watershed Water Quality Monitoring Results
Five Year Annual Average Station BSD2**

YEAR	pHF	SO ₄ 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	6.5	218.0	0.469	0.0150	1.000	2.49	0.841	-	
Wetland benchmark ²	5.3					0.76			
Lake benchmark ³						0.02			
MDL ⁴	0.1	0.1	0.005	0.0005	0.005	0.005	0.002	0.5	
2017	6.7	18.0	< 0.007	< 0.0005	0.013	0.17	0.099	27.2	
2018	6.5	15.0	0.007	< 0.0005	0.012	0.17	0.088	22.8	
2019	6.9	12.4	< 0.007	< 0.0005	0.013	0.17	0.074	20.1	
2020	6.8	20.0	4.3	< 0.0005	0.015	0.35	0.162	31.4	
2021	6.8	33.0	4.3	< 0.0005	0.013	0.17	0.098	39.2	

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-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.
2021 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	6.5	218.0	0.469	0.0150	1.000		0.841	-
	Wetland benchmark ²	5.3					2.49		
	Lake benchmark ³						0.76		
MDL ⁴	0.1	0.1	0.005	0.005	0.0005	0.005	0.02	0.002	0.5
2017	5.2	< 0.1	< 0.007	< 0.0005	< 0.0005	< 0.005	< 0.02	< 0.002	< 0.5
2018	5.6	< 0.1	< 0.007	< 0.0005	< 0.0005	< 0.005	< 0.02	< 0.002	< 0.5
2019	5.8	< 0.1	< 0.007	< 0.0005	< 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

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-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.
2021 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station DS-18**

YEAR	FLOW (L/s)	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	6.5	309.0		0.459	0.0150	1.000		
	Wetland benchmark ²	5.3						2.49	
	Lake benchmark ³							0.76	
MDL ⁴		0.1	0.1	0.005	0.005	0.0005	0.005	0.02	0.5
2017	338.7	6.8	59.8	0.193	0.0008	0.0008	0.017	0.60	83.5
2018	240.9	7.1	56.8	0.152	0.0008	0.0008	0.021	0.28	80.2
2019	248.0	7.1	43.2	0.110	0.0008	0.0008	0.019	0.26	78.0
2020	356.4	7.1	53.0	2.5	0.105	0.0010	0.021	0.35	70.1
2021	278.6	7.1	44.3	2.8	0.133	0.0009	0.027	0.16	58.4

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-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.
2021 Serpentine River Watershed Water Quality Monitoring Results
Five Year Annual Average Station M-01**

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	6.5	218.0	0.469	0.0150	1.000	2.69	0.76	-
Wetland benchmark ²	5.2							
Lake benchmark ³								
MDL ⁴	0.1	0.1	0.005	0.0005	0.005	0.005	0.02	0.5
2017	6.8	10.0	0.016	0.0034	0.015	0.58	0.78	36.3
2018	6.7	8.9	0.015	0.0020	0.015	0.78	0.78	30.0
2019	6.7	8.4	0.017	0.0027	0.016	0.78	0.78	31.2
2020	6.8	7.2	4.9	0.0024	0.018	1.56	1.56	35.4
2021	6.6	8.1	5.1	0.0021	0.016	0.92	0.92	34.1

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-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.
2021 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station BSR5**

YEAR		pH ^F	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	6.5	218.0		0.469	0.0050	1.000		-
	Wetland benchmark ²	5.3						2.49	
	Lake benchmark ³							0.76	
MDL ⁴		0.1	0.1	0.005	0.0005	0.0005	0.005	0.02	0.5
2017		6.8	9.1	0.014	0.0031	0.014	0.014	0.32	34.5
2018		6.8	10.1	0.018	0.0024	0.015	0.015	0.43	33.1
2019		7.0	8.9	0.016	0.0023	0.014	0.014	0.32	31
2020		6.8	8.9	4.6	0.020	0.0026	0.015	0.31	31.4
2021		6.7	8.3	4.6	0.018	0.0021	0.014	0.47	31.9

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-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.
2021 Serpentine 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	2.49	-	
	Wetland benchmark ²					0.76		
	Lake benchmark ³					0.02		0.5
MDL ⁴	0.1	0.1	0.005	0.0005	0.005	0.005	0.02	0.5
2017	5.3	< 0.1	< 0.007	< 0.0005	< 0.005	< 0.02	< 0.5	< 0.5
2018	5.8	< 0.1	< 0.007	< 0.0005	< 0.005	< 0.02	< 0.5	< 0.5
2019	6.0	< 0.1	< 0.007	< 0.0005	< 0.005	< 0.02	< 0.5	< 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

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-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.
2021 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station Q-09**

YEAR	FLOW (L/s)	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	6.5	218.0	0.469	0.0150	1.000	-	
	Wetland benchmark ²	5.3						
	Lake benchmark ³	0.1	0.1	0.005	0.0005	0.005	0.5	
MDL ⁴								
2017	2531.30	6.7	44.8	0.052	0.0015	0.055	55.6	
2018	2160.00	6.7	50.5	0.100	0.0022	0.119	66.6	
2019	3620.00	6.9	47.3	0.051	0.0015	0.064	43.5	
2020	3523.33	6.9	34.0	3.8	0.066	0.0019	0.074	45.6
2021	1318.25	6.8	46.3	3.9	0.073	0.0015	0.077	55.7

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-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.
2021 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station Q-20**

YEAR	FLOW (L/s)	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	6.5	218.0		0.469	0.0150	1.000		
	Wetland benchmark ²	5.3							
	Lake benchmark ³								
MDL ⁴		0.1	0.1	0.005	0.005	0.0005	0.005		
2017	45.0	6.9	19.0	<	0.007	<	0.0005	37.1	
2018	10.0	6.6	19.0	<	0.007	<	0.0005	38.2	
2019	4.0	7.3	19.0		0.008	<	0.0005	39.4	
2020	10.0	6.8	17.0	2.3	<	0.007	<	0.0005	35.7
2021	1.0	7.0	18.0	2.7	<	0.005	<	0.0005	35.4

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-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.
2021 Serpentine River Watershed Water Quality Monitoring Results
Five Year Annual Average Station SC-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	6.5	128.0	0.469	0.0150	1.000		
	Wetland benchmark ²	5.3					2.49	
	Lake benchmark ³						0.76	
MDL ⁴	0.1	0.1	0.005	0.005	0.0005	0.005	0.02	0.5
2017	6.9	16.0	<	0.007	<	0.0005	0.009	0.07
2018	6.6	18.0		0.009	<	0.0005	0.011	0.14
2019	7.3	16.0	<	0.007	<	0.0005	0.011	0.10
2020	7.0	16.0	4.6	0.012	<	0.0005	0.009	0.13
2021	7.0	18.0	4.5	0.015	<	0.0005	0.011	0.13

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-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.
2021 Serpentine River Watershed Water Quality Monitoring Results
Five Year Annual Average Station SR-06**

YEAR	FLOW (L/s)	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	6.5	218.0		0.469	0.0150	1.000	
	Wetland benchmark ²	5.3						
	Lake benchmark ³							
MDL ⁴		0.1	0.1		0.005	0.0005	0.005	0.5
2017	842.1	7.0	35.5		0.089	0.0007	0.606	52.6
2018	515.8	7.0	30.2		0.100	0.0006	0.682	44.7
2019	803.5	7.2	28.0		0.057	0.0006	0.312	36.7
2020	610.2	7.2	26.0	3.2	0.053	0.0005	0.148	36.9
2021	404.8	7.1	23.5	3.2	0.046	0.0005	0.138	36.1

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-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.
2021 Serpent River Watershed Water Quality Monitoring Results
Five Year Annual Average Station SR-15**

YEAR		pH ¹	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	6.5	218.0		0.469	0.0050	1.000		
	Wetland benchmark ²	5.3						2.49	
	Lake benchmark ³							0.76	
MDL ⁴		0.1	0.1		0.005	0.0005	0.005	0.02	0.5
2017		6.9	32.0		0.069	< 0.0005	0.149	<0.02	52.3
2018		7.1	30.3		0.058	< 0.0005	0.213	0.02	44.5
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

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-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.
2021 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	6.5	218.0		0.469	0.0150	1.000	-
Wetland and lake benchmarks	5.3						
Wetland benchmark ²							
Lake benchmark ³							
MDL ⁴	0.1	0.1	0.005	0.005	0.0005	0.005	0.5
2017	6.9	31.0		0.028	0.0011	0.035	38.3
2018	6.7	29.0		0.017	0.0011	0.034	35.4
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

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-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.
2021 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	6.5	309	0.469	0.0150	1.000	-
	Wetland benchmark ²	5.3					
	Lake benchmark ³						
MDL ⁴	0.1	0.005	0.0005	0.005	0.0005	0.005	0.5
2017	7.1	150.0	0.026	0.0009	0.017	0.017	186.3
2018	6.8	137.5	0.028	0.0007	0.019	0.019	184.0
2019	6.8	130.0	0.030	0.0006	0.018	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

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-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