2020 OPERATING CARE & MAINTENANCE ANNUAL REPORT

Denison Mines Inc.

Submitted to the

Canadian Nuclear Safety Commission

March 30, 2021

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March 30, 2021

Mr. Ron Stenson, Senior Project Officer
Canadian Nuclear Safety Commission
Wastes and Decommissioning Division
280 Slater Street
PO Box 1046, Station B
Ottawa, Ontario
K1P 5S9

Dear Mr. Stenson:

RE: Denison Mines Inc. 2020 Operating Care and Maintenance Annual Report

Denison Mines Inc. is pleased to submit the Denison Mines Inc. Operating Care and Maintenance Annual Report for 2020. This document has been completed in accordance with: UMDL-Minemill-Denison.01/indf; and UMDL-Minemill-Stanrock.02/indf; and CofA No. 4-0067-74-766; CofA No. 4-0019-72-006; and CofA No. 4-034-76-006.

Yours truly,

Denison Mines Inc.

Diane Martens

Director of Closed Mines

Enclosure

Distribution

Elliot Lake Joint Review Group for Denison Mines Closed Sites

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1 ORGANIZATIONAL INFORMATION

1.1 Licencee

DENISON MINES INC.
1100-40 University Avenue
Toronto, Ontario
M5G 1T1

1.2 Board of Directors

Table 1.1 contains the list of names and titles of the Directors of Denison Mines Inc. as of December 31, 2020 All persons listed below may be contacted via the licensee address.

Table 1.1 Denison Mines Inc. Directors as of December 31, 2020

Name	Office
David Cates	Director, President and Chief Executive Officer
Gabriel (Mac) McDonald	Director, Executive Vice President and Chief Financial Officer

1.3 List of Officers

Table 1.2 contains the list of names and titles of the Officers of Denison Mines Inc. as of December 31, 2020. All persons listed below may be contacted via the licencee address.

Table 1.2 Denison Mines Inc. Officers as of December 31, 2020

Name	Office
David Cates	Director, President and Chief Executive Officer
Gabriel (Mac) McDonald	Director, Executive Vice President and Chief Financial Officer
Amanda Willett	Vice President Legal and Corporate Secretary
Mary Jo Smith	Director, Internal Audit

2 FINANCIAL GUARANTEES

Federal and Provincial regulations which apply to the decommissioning programs of Denison Mines Inc. (Denison) in Elliot Lake require mine operators to provide adequate and secure resources to meet current and future responsibilities with respect to mine closure and long-term care and maintenance.

All expenditures are funded through a reclamation trust fund where Denison is required to maintain a balance in the trust equivalent to six years of the estimated current annual costs. Current funds are sufficient to meet monitoring costs through 2026.

3 LICENCE AND MONITORING PROGRAM MODIFICATIONS

Denison Closed Mine Sites in Elliot Lake currently operate and are monitored within the scope of work outlined within a licence regulated by the Federal Canadian Nuclear Safety Commission (CNSC). Currently Denison is the licencee for two Uranium Mine Decommissioning Licences:

1) Denison sites (TMA-1 and TMA-2) UMDL-Minemill-Denison.01/indf; and
2) Stanrock site UMDL-Minemill-Stanrock.02/indf

Sample stations that require monitoring under the Licences include:

1) Stollery Lake Settling Pond Outlet (D-2) for Denison TMA-1;
2) Lower Williams Lake (LWL) Settling Pond Outlet (D-3) for Denison TMA-2; and
3) Orient Lake Polishing Pond Outlet (DS-4) for Stanrock TMA.

Provincially, Denison is the permittee for three Compliance Approvals (C of A) regulated by the Ministry of Environment, Conservation and Parks (MECP):

1) Denison Site TMA-1: C of A No. 4-0019-72-006;
2) Denison Site TMA-2 (Lower Williams): C of A No. 4-034-76-006; and
3) Stanrock Site: C of A No. 4-0067-74-766

There were no changes to any of these documents in 2020. A proposed amendment for C of A Denison TMA-1 remains in progress.

A State of the Environment (SOE) Report for the Serpent River Watershed is jointly produced by Denison and Rio Algom Limited (RAL) with Minnow Environmental Inc. (Minnow) every five years. The SOE report includes the monitoring programs for the Serpent River Watershed Monitoring Program (SRWMP), Source Area Monitoring Program (SAMP) and the Tailings Management Area (TMA) Operational Monitoring Program (TOMP). There were approved changes to the SAMP, TOMP and SRWMP in 2019 that included approval from Environment and Climate Change Canada (ECCC) CNSC, Ministry of Labour (MOL), Ministry of Natural Resources and

Forestry (MNRF) and Ministry of Northern Development and Mines (MNDM) which were presented in the *Cycle 5 Study Design for the SRWMP, SAMP and TOMP* (Cycle 5 Design Study) (Minnow, 2019). Changes to the SRWMP were presented in the Cycle 5 Study Design (Minnow 2019). A summary of Cycle 5 is available in Appendix I.

4 METHODOLOGY

4.1 Health and Safety

4.1.1 Health and Safety Injury Statistics

Health and safety in the workplace continue to be of great importance to Denison Mines Inc. In 2020, monthly safety meetings and daily line-ups were completed to provide Denison personnel with safety awareness and a forum to raise issues or concerns. Training for job responsibilities and safety was tracked with a training matrix to ensure comprehensive and timely qualifications for work.

In March 2020, COVID-19 was declared a global pandemic and Canadians were advised to implement safety protocols to limit the spread. Denison responded by developing and implementing standard operating procedures (SOPs) for offices and work sites based on the direction and advice from the Provincial Health Officer (PHO), the Canadian Ministry of Health and the Province of Ontario. The suite of Covid-19 SOPs included *Pandemic workplace procedures Elliot Lake Office*, *Mandatory Use of Mask or Face Covering within Denison Mines Closed Mines Group*, and a *Shop Covid-19 SOP* specific to Elliot Lake work tasks.
The following measures were established for all Elliot Lake locations:

- Office scheduling system to ensure employee distancing and hygiene,
- Provide updated Covid-19 resources to educate employees of symptoms and precautions,
- Adapted work standards to accommodate staff with changes in family and work circumstances,
- Heightened hygiene practices such as providing proper face coverings, personal hand sanitizer, and equipment disinfectant,
- Promote and expect employees to stay home to isolate and receive a negative Covid-19 test result before returning to work,
- Provide resources and support for the maintenance of employee mental health,
- Routine conformance checks to ensure continuation of compliance with local, provincial, and federal government regulations and recommendations.

4.1.2 Gamma Dosimetry

Denison has continued to voluntarily participate in the gamma dosimetry program. The program applies to all employees whose job responsibilities require them to work in and around the Licenced sites, which include the tailings management areas (TMAs). These workers are classified as Nuclear Energy Workers (NEWs). The program does not apply to visitors visiting the sites or employees who do not actively work at the Licenced sites; however, sometimes sub-contractors may be issued visitor badges should the work involve specific earthworks projects over an extended period.

The type of gamma dosimetry badges used are Optically Stimulated Luminescence (OSL) dosimeters, which have a wearing period of three months. Badges are issued in the first calendar month of the year and each quarter going forward. Each worker is issued a pre-labelled badge with its own unique dosimeter number that is designated for each worker. At the end of the

wearing period, the dosimeters are sent to the Radiation Protection Bureau (RPB) Health Canada for processing. The RPB will issue a Radiation Exposure Report to Denison's designate who is thereafter responsible for reviewing the information, reporting any anomalies to workers, and maintaining the company records.

4.1.3 Radon Progeny Monitoring

Radon progeny monitoring at all Denison Effluent Treatment Plants (ETPs) is conducted on a quarterly basis, as part of the quarterly health and safety inspections. Radon results are reported in Working Level (WL) units.

Radon level is measured by calculating alpha radiation from radon decay products. The sample is first collected on membrane filters with an air-sampling pump by walking through the entire ETP over a 5-minute period, simulating a normal work routine. The ETP should be ventilated as per routine work practice before the walkthrough. Alpha radiation is measured with an alpha counter between forty to ninety minutes after the sample has been collected. WL is then calculated based on the counts, count duration, sampling duration, sampling flow rate, decay factor, filter self-absorption value, background count, and efficiency factor.

The reportable action limit for radon exposure at all ETPs is 0.1 WL. To ensure radon levels stay below the reportable action limit, an internal investigation limit of 0.05 WL has been established to trigger a response whereby mitigating measures are implemented in order to ensure worker exposure to radon gas is reduced and controlled. Mitigating measures include but are not limited to the purchase of a radon fan and/or posting signage to employ longer ventilation time before ETP work begins.

The gamma and radon data are then used to calculate individual annual dose estimates for Care and Maintenance workers classified as NEWs. A worker dose estimate report is submitted annually to the CNSC under separate cover.

4.2 Water Quality Monitoring Program

4.2.1 TOMP, SAMP and SRWMP

As part of the closure and decommissioning process, an integrated performance monitoring framework had been developed for Denison and Rio Algom Limited (RAL) sites for water quality monitoring activities through three integrated programs: TOMP, SAMP and SRWMP. These programs have been described in the Cycle 5 Study Design (Minnow, 2019).

4.2.1.1 TMA Operational Monitoring Program (TOMP)

The TOMP was designed to track the performance of the TMAs and generate data used to make decisions for management and compliance of the TMAs. The program included water quality monitoring within the TMA basins and groundwater quality, to reflect the operational and treatment performance. The data collected in the program could be used as references for water quality trend and improvement for Serpent River watershed receiving environment, however the water quality from Denison and Stanrock TMA sites must comply with the regulatory criteria for the effluents from the treatment plants specified in the licences and C of As (Sample points: D-2, D-3 and DS-4).

4.2.1.2 Source Area Monitoring Program (SAMP)

The SAMP was designed to monitor the nature and quantity of potential contaminants being discharged from the TMAs to the Serpent River Watershed. Some monitoring stations for the SAMP program were also the TOMP effluent stations, and requirements have been harmonized to serve both programs. The data collected in the program could be used as references for water quality trend and performance for the Serpent River watershed receiving environment.

4.2.1.3 Serpent River Watershed Monitoring Program (SRWMP)

The SRWMP was designed to provide an integrated monitoring approach to assess the cumulative effects and watershed-level changes over time, in order to evaluate the recovery of the receiving environment following the implementation of the decommissioning plans. The SRWMP assessed water and sediment chemistry, as well as benthic invertebrate communities in downstream and reference lakes within the watershed. Water quality data collected in the program is compared to the benchmarks established for the SRWMP. The objectives of the SRWMP are:

- Evaluation of cumulative effects of mine discharges on the Serpent River Watershed,
- Evaluation of the effectiveness of mine decommissioning plans, and
- Assessment of long-term trends in environmental quality in the watershed.

The SRWMP report was prepared and submitted under a separate cover. Results are not presented in this annual report.

4.2.2 Program Requirements

Water quality monitoring requirements and criteria as per the licences were fulfilled through the approved TOMP, SAMP and SRWMP. The water quality monitoring locations in this report made up part of the Serpent River Watershed (SRW), which is a shared watershed with RAL sites and their monitoring locations. Therefore, to obtain an overall understanding of the data in this report, this report should be read in conjunction with the *Serpent River Watershed Monitoring Program 2020 Annual Water Quality Report* (RAL & Denison, 2021).

The 2020 TOMP and SAMP followed program requirements specific to the following: sampling locations, frequencies, parameters, and analytical protocols. These requirements have been recommended and approved in the Cycle 5 Study Design (Minnow, 2019). Appendix II in this report provides maps of the sampling stations of the water quality program. Tables in Appendix II provide a brief description of each location, the sampling frequency, and parameters monitored, as required by TOMP and SAMP as well as the C of As and decommissioning licenses as identified in Section 3.

4.2.3 Data Quality Objectives

Targeted Detection Limits (TDL) and Data Quality Objectives (DQOs) for TOMP and SAMP requirements were provided in Table 4.2.2 which were derived from the Cycle 5 Study Design for the (Minnow, 2019). Laboratory data quality assessment was provided under a separate cover

in the *Serpent River Watershed Monitoring Program 2020 Annual Water Quality Report* (RAL, DMI, 2021).

4.2.4 Changes in Analytical Methods

There were no changes in analytical methodology in 2020.

4.2.5 Data Screening and Assessment Conventions

Data validation was conducted on TOMP and SAMP water quality data throughout the year. The data validation assessment screening process within the electronic database flagged all data points entered or imported that had values outside a rolling minimum 12 value mean $\pm$ 3 standard deviations. Prior to being accepted in the database, all flagged data was reviewed and validated through a quality assurance process.

As part of the TOMP, field quality assurance and quality control sampling were extended to the groundwater monitoring program in 2006. Data quality assessment involved monthly screening of field duplicate and field blank sample data against TOMP and SAMP DQOs found in Table 4.2.2. Detailed surface water and groundwater quality assurance and quality control (QA/QC) results are included in Appendix III of this report.

Laboratory analyses were contracted to Canadian Association of Laboratory Accreditation (CALA) certified laboratories. Laboratory QA/QC reports were provided under separate cover in the *Serpent River Watershed Monitoring Program 2020 Annual Water Quality Report* (RAL & Denison, 2021).

Flagged data and short-term response plans were reported to the CNSC, MECP and Environment and Climate Change Canada (ECCC) in the monthly water quality report. Monthly data validation of flagged data for 2020 can be found in Appendix III.

Annual water quality reporting was designed to be concise and focused on the presentation of data in a standardized format with limited interpretation. Detailed statistical evaluation of water quality trends are included in the *Serpent River Watershed Cycle 5 (2015-2019) State of the Environment Report (SOE)* (Minnow, 2021). Data validation, as documented in Data Validation Procedures, ensured prompt response to upset conditions or unusual results. Appendix IV includes all 2020 water quality monitoring results with surface water results and five years of groundwater quality results.

Surface water stations within the TMAs, as well as effluent, seepages, and downstream surface water stations were compared to SRWMP benchmarks for receiving water quality. Mine sources (i.e. TOMP and SAMP stations) were not expected to achieve the benchmarks that were set for the receiving environment, but these comparisons were made to identify potential variables or sources of concern relative to the downstream receiving environment. Therefore, water quality data in this report is compared to benchmarks established for the SRWMP (Minnow, 2019). These benchmarks were based on water quality criteria for the protection of aquatic life or the upper range of background concentrations (except for pH for which the lower background range was relevant). The most recent federal and provincial (Ontario) guideline was used to determine these benchmarks (or British Columbia Ministry of Environment (BCMOE) water quality guidelines were applied if none existed). A dose-base site-specific benchmark for radium was also developed, as per CNSC request (Minnow, 2019 Appendix C). In this report, benchmarks are presented in Table 4.2.2.

Table 4.2.2 Water Quality Benchmarks for SRWMP and Data Quality Objectives for TOMP, SAMP and SRWMP

		Assessement Criteria[1]	Data Quality Objectives [2]							
Parameter	**Units**	**Receiving Environment Criteria**	**Targeted Detection Limit**	**Minimum Detectable Difference**	**Field Blank Criteria**	**Laboratory Blank Criteria**	**Field Precision**	**Laboratory Precision**	**Laboratory Spikes**	**Laboratory Accuracy (CRM)**
Field Parameters										
Conductivity	µmho/cm	-	0.1	0.05	-	-	20%	-	-	-
Flow	L/s	-	method	method	-	-	-	-	-	-
pH	pH units		0.1	0.01 or 0.02	-	-	20%	-	-	-
Lake		6.5								
Wetland/stream		5.3								
Laboratory Parameters										
Acidity	mg/L	-	1.0	-	2	2	20%	10%	-	20%
Barium	mg/L	1.0	0.005	-	0.01	0.01	20%	10%	20%	20%
Cobalt	mg/L	0.0025	0.0005	-	0.001	0.001	20%	10%	20%	20%
Iron	mg/L			-	0.04	0.04	20%	10%	20%	20%
Lake		0.76	0.02							
Wetland/stream		2.49	0.02							
Manganese [3]	mg/L	0.841	0.002	-	0.004	0.004	20%	10%	20%	20%
Radium	Bq/L	0.469	0.005	-	0.01	0.01	20%	20%	20%	-
Sulphate [3]	mg/L	128-309	0.1	-	0.2	0.2	20%	10%	20%	20%
TSS	mg/L	-	1	-	2	-	20%	10%	-	20%
Uranium	mg/L	0.0150	0.0005	-	0.001	0.001	20%	10%	20%	20%

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. Table 6.2 Cycle 5 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2019)
3. Sulphate and manganese criteria taken from Table S.2, Appendix S, Cycle 5 State of the Environment Report for the SWRMP, SAMP and TOMP (Minnow 2021). Parameters are hardness dependent.

5 RESULTS AND DISCUSSION

5.1 Health and Safety

5.1.1 Health and Safety Injury Statistics

In 2020, health and safety related training and education continued to be an integral part of monthly safety meetings and daily line-ups for care and maintenance workers working at the Denison Closed Mines Operations in Elliot Lake. All care and maintenance workers continued to hold the following certifications and/or had completed the following training: Workplace Hazardous Materials Information System (WHMIS), Cardiopulmonary Resuscitation (CPR) and First Aid certification, as well as the Annual Radiation Safety training. Many workers also completed additional training and certifications to ensure their qualifications for specialty or specific tasks and jobs related to care and maintenance at the Denison Closed Mines Operations in Elliot Lake were current. Denison ensured that all training and certifications were kept up to date and workers were re-certified and trained when required. There were 0 medical aids in 2020 and two medical aids in 2019. No lost time accidents were reported between 2018 and 2020 at the Elliot Lake sites (Table 5.1.1).

With specific Covid-19 protocols set in place for 2020, all employees were required to isolate and receive a negative test result before returning to work if they exhibited any Covid symptoms. No tested employees had positive test results for the novel coronavirus and all employees continued to work safely under public health guidelines and Denison procedures.

Table 5.1.1 Health & Safety Injury Statistics

Category	2020		2019		2018	
	Number	Frequency	Number	Frequency	Number	Frequency
Medical Aid	0	0.0	2	9.49	0	0.0
Lost Time	0	0	0	0.0	0	0.0
Total	**0**	**0.0**	**2**	**9.49**	**0**	**0.0**
Person-Hours Worked	**39,369**		**42,147**		**45,385**	

Frequency is Calculated as: Number/Person-hours worked *200,000.

5.1.2 Gamma Dosimetry

Dose reports for gamma dosimetry will be provided to the Canadian Nuclear Safety Commission (CNSC) under separate cover.

5.1.3 Radon Progeny Monitoring

There were no radon progeny action level exceedances in 2020. The action level criteria are specific to the Elliot Lake area as indicated in the Control Limit Registry companion document. Working Levels (WLs) of radon progeny continued to test at levels far below the action level criteria of 0.10 WL for Denison TMA-1 ETP (Table 5.1.3.1), Denison LWL (TMA-2) ETP (Table 5.1.3.2) and for Stanrock ETP (Table 5.1.3.3). Quarterly values for individual ETPs are provided in their respective tables.

Table 5.1.3.1 Denison TMA-1 ETP Radon Progeny Monitoring Results 2020

Quarter	Radon (WL)
1	0.0017
2	0.0012
3	0.0023
4	0.0004

Table 5.1.3.2 Denison LWL ETP Radon Progeny Monitoring Results 2020

Quarter	Radon (WL)
1	0.0004
2	0.0078
3	0.0182
4	0.0134

Table 5.1.3.3 Stanrock ETP Radon Progeny Monitoring Results 2020

Quarter	Radon (WL)
1	0.0051
2	0.0184
3	0.0097
4	0.0185

5.2 Water Quality Monitoring Program

The objective of the annual data review was to identify atypical data and to provide evaluation and short-term annual averages at select locations. Changes and anomalies were identified by reviewing and compiling the last five years of annual average data for all TOMP and SAMP locations. Unusual results were routinely investigated in accordance with the *Water Quality Assessment and Response Plan,* which is included in Appendix A of the most recent SOE Report (Minnow Environmental Inc., 2021).

5.2.1 Surface Water Quality

Appendix III contains detailed QA/QC results against DQOs while Appendix IV contains surface water station-specific annual data reported as monthly averages including annual statistics. Surface water quality data was reported monthly to the following regulatory bodies: CNSC, MECP, and ECCC.

All field blank DQOs were met for all parameters in all samples in 2020.

Although all field blank DQOs were met, there were eight field precision exceedance results which did not meet DQOs in 2020 (Table 5.2.1).

First, the TSS field precision DQO of 20% was exceeded in 6 out of the 13 samples, with a maximum result of 67%. The exceedances were indicative of the lack of precision at low TSS concentrations and did not influence performance monitoring data integrity. The annual average for TSS field precision was above the DQO at 31% (Table 5.2.1).

Secondly, the total radium field precision DQO of 20% was exceeded in 1 out of the 13 samples at 21%. The exceedances remained consistent with the variability observed in radium concentrations with each sample taken. All results were within values typically observed at this location and therefore did not affect the interpretation of radium water quality results. Despite one exceedance, the annual average for total radium met the DQO at 10% (Table 5.2.1).

Lastly, the barium field precision DQO of 20% was exceeded in 1 of the 13 samples at 23%. Nonetheless, the annual average percent was within the DQO at 6% (Table 5.2.1).

Table 5.2.1 2020 Surface Water Field Blank and Field Precision Data Summary

	pH	TSS (mg/L)	Hardness (mg/L)	SO4 (mg/L)	Ra(T) Bq/L)	U (mg/L)	Ba (mg/L)	Co (mg/L)	Fe (mg/L)	Mn (mg/L)
Field Blank Statistics										
Count	16	12	12	12	12	12	12	12	12	12
Average	6.4	1	<0.5	0.1	0.007	<0.0005	<0.005	<0.0005	<0.02	<0.002
Max	7.2	1	<0.5	0.2	0.008	<0.0005	<0.005	<0.0005	<0.02	<0.002
Min	5.8	1	<0.5	0.1	<0.007	<0.0005	<0.005	<0.0005	<0.02	<0.002
Field Blank Exceedances										
DQO Criteria [1]		2	1.0	0.2	0.01	0.001	0.01	0.001	0.04	0.004
# Exceedances		0	0	0	0	0	0	0	0	0
Field Duplicate Statistics										
Count	13	13	12	12	13	12	13	12	12	12
Average	0%	31%	2%	2%	10%	2%	6%	2%	5%	4%
Max	0%	67%	7%	6%	21%	4%	23%	12%	18%	13%
Min	0%	0%	0%	0%	1%	0%	0%	0%	0%	2%
Field Precision Exceedances										
DQO Criteria [1]	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
# Exceedances	0	**6**	0	0	**1**	0	**1**	0	0	0

[1] SAMP and TOMP field blank criteria taken from Table 6.2 of the Cycle 5 Study Design for SRWMP, SAMP and TOMP (Minnow, 2019).

Bold Indicates an exceedance of the Blank Criteria

Denison TMA-1

Site-specific water quality monitoring at the Denison TMA-1 facility was completed in accordance with TOMP and SAMP design requirements. Water quality data from all the sites of the monitoring programs were compared to SRWMP benchmarks (Table 4.2.2) to demonstrate changing water quality, identify potential variables or sources of concern relative to the downstream receiving environment as well as to monitor compliance discharge criteria as it relates to treatment performance. Mine sources were not expected to meet benchmarks. The monthly average detailed water quality results are provided in Appendix IV.

Basin performance of TMA-1 was monitored at the ETP influent station D-1 as part of the TOMP program (Table 5.2.1.1a). Acidity, pH, and cobalt levels were consistent over the past 5 years, where pH had remained near neutral, and acidity and cobalt remained near or below their respective Targeted Detection Limits (TDL) (Table 4.2.2). Radium, iron and manganese results are slightly varied and show no trend. Uranium levels also show varied results over the last five years, with the lowest average measured in 2020. Sulphate concentrations have been declining since 2016 with the lowest average recorded in 2020, as predicted.

Table 5.2.1.1a Annual Average Concentrations ETP Influent (D-1)

PARAMETER	Flow (L/s)	ACID mg/L	Hardness mg/L	pH	SO4 mg/L	Ra Bq/L	Ba mg/L	Co mg/L	Fe mg/L	Mn mg/L	U mg/L
2016	41.74	<1	117.2	7.5	83.0	1.622	0.047	0.0006	0.10	0.037	0.0118
2017	53.11	<1	120.6	7.5	78.0	1.764	0.071	<0.0005	0.05	0.013	0.0157
2018	40.87	<1	126.3	7.5	71.0	1.375	0.066	<0.0005	0.12	0.020	0.0166
2019	69.61	<1	123.0	7.7	70.7	1.847	0.049	<0.0005	0.13	0.022	0.0125
2020	81.45	<1	108.7	7.5	57.5	1.607	0.094	<0.0005	0.08	0.028	0.0097
Annual Summary Statistics											
Average	57.36	<1	119.2	7.5	72.0	1.643	0.065	0.0006	0.10	0.024	0.0133
Maximum	81.45	<1	126.3	7.7	83.0	1.847	0.094	0.0006	0.13	0.037	0.0166
Minimum	40.87	<1	108.7	7.5	57.5	1.375	0.047	<0.0005	0.05	0.013	0.0097

Note: Five-year annual average, maximum and minimum statistics

The final point of control at TMA-1 facility was monitored at the Stollery Settling Pond Outlet (station D-2). Review of the annual average concentrations for TOMP and SAMP parameters for the last five years indicated consistent TSS levels and near neutral pH values; both meeting their discharge limits (Table 5.2.1.1b). Radium concentrations also remained well below the grab sample and monthly mean discharge limits, however the annual average is observed to be at its highest level within the past five years. This is not unexpected as the 1995 Environmental Impact Statement (EIS) (Denison 1995) predicted that radium concentrations would increase over time due to decreasing sulphate. Correspondingly, barium levels have risen due to the increase of barium chloride used in effluent treatment to control radium. Uranium concentrations are elevated compared to influent but are generally stable and slightly declining. No toxicity was observed with sub-lethal *Ceriodaphnia dubia* testing, the species most sensitive to uranium concentrations. Iron concentrations were variable and remain below downstream receiving environment benchmarks. Sulphate concentrations are elevated compared to influent water quality concentrations but have been displaying decreasing concentrations over the last five years, as do levels in the influent. (Table 5.2.1.1a).

Table 5.2.1.1b Final Discharge at Stollery Settling Pond Outlet (D-2)

PARAMETER UNITS	Flow (L/s)	Hardness mg/L	pH	SO4 mg/L	TSS mg/L	Ra Bq/L	Ba mg/L	Co mg/L	Fe mg/L	Mn mg/L	U mg/L
2016	42.35	287.8	7.1	227.5	1	0.153	0.206	0.0006	0.22	0.134	0.0396
2017	59.23	305.8	7.3	230.8	1	0.123	0.205	0.0006	0.27	0.157	0.0390
2018	40.31	246.5	7.2	189.8	1	0.161	0.266	0.0006	0.27	0.157	0.0304
2019	70.89	236.1	7.2	179.2	1	0.152	0.338	0.0006	0.22	0.201	0.0325
2020	81.69	214.8	7.2	151.3	1	0.163	0.481	0.0006	0.29	0.170	0.0264
Annual Summary Statistics											
Average	58.89	258.2	7.2	195.7	1	0.150	0.299	0.0006	0.25	0.164	0.0336
Maximum	81.69	305.8	7.3	230.8	1	0.163	0.481	0.0006	0.29	0.201	0.0396
Minimum	40.31	214.8	7.1	151.3	1	0.123	0.205	0.0006	0.22	0.134	0.0264

Note: Five-year annual average, maximum and minimum statistics

Toxicity was monitored for Denison TMA-1 at the final discharge station D-2 (Stollery Settling Pond Outlet) in order to estimate the potential effect that the effluent might have on biological components. Toxicity sampling was completed semi-annually in 2020 as per SAMP requirements and included the following tests: acute *Daphnia magna* and Rainbow Trout and sub lethal *Ceriodaphnia dubia.* In 2020, results confirmed 0% acute mortality/lethality for both *Daphnia magna* and rainbow trout at station D-2 in both sampling events. Additionally, a 100% IC_{25} result for *Ceriodaphnia dubia* was achieved during both sampling events in 2020, signifying a non-toxic effluent for the test organism (Appendix IV).

5.2.1.1.1 Discharge Compliance – Denison TMA-1 Final Discharge

In 2020, TMA-1 effluent quality at the final point of control, D-2, was in compliance with the discharge limits established in the decommissioning licence (Table 5.2.1.1.1).

Table 5.2.1.1.1 2020 TMA-1 Compliance with Discharge Limits at Final Point of Control (D-2)

Month	Samples Required	Number of Times Discharge Limits Were Exceeded					
		pH pH units		TSS mg/L		Ra(T) Bq/L	
		Grab Sample Limit[1]: Upper 9.5 Lower 5.5	Monthly Arithmetic Mean[1]: Upper 9.5 Lower 6.5	Grab Sample Limit[1]: Upper 50 Lower N/A	Monthly Arithmetic Mean[1]: Upper 25 Lower N/A	Grab Sample Limit[1]: Upper 1.11 Lower N/A	Monthly Arithmetic Mean[1]: Upper 0.37 Lower N/A
Jan.	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
Feb.	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
Mar.	5	0 of 5	0 of 1	0 of 5	0 of 1	0 of 5	0 of 1
Apr.	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
May	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
June	5	0 of 5	0 of 1	0 of 5	0 of 1	0 of 5	0 of 1
July	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
Aug.	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
Sept.	5	0 of 5	0 of 1	0 of 5	0 of 1	0 of 5	0 of 1
Oct.	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
Nov.	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
Dec.	5	0 of 5	0 of 1	0 of 5	0 of 1	0 of 5	0 of 1
YTD	52	0 of 52	0 of 12	0 of 52	0 of 12	0 of 52	0 of 12

[1]Limits established in the Licence UMDL-MINEMILL-DENISON.01\indf issued December 15, 2004.

5.2.1.2 Denison Lower Williams Lake (TMA-2)

Site-specific water quality monitoring at the Denison LWL ETP was completed in accordance with TOMP and SAMP requirements. Detailed monthly average results are provided in Appendix IV.

LWL Influent station (D-22) is used to monitor seepage from Dam 1. Review of annual average concentrations for TOMP parameters at this station indicates variability for all parameters other than pH over the last five years. Water quality at D-22 shows near neutral pH values (Table 5.2.1.2a), but does not impact pH levels downstream at the final discharge (Table 5.2.1.2b), values are within the SRWMP benchmark pH limits. Sulphate concentrations are slightly variable and show a decreasing trend over the last five years. Radium, uranium, barium, and cobalt concentrations are variable, but all remained below benchmarks for SRWMP (Table 5.2.1.2a and Table 4.2.2). Iron concentrations in 2020 appear elevated compared to the previous four years. However, this can be attributed to historic confirmed spike (29.5 mg/L) that occurred in July when water levels were very low. All other results in 2020 ranged from 0.17 mg/L to 0.70 mg/L. Iron spikes are typically observed during periods of warm, dry weather and lower water levels. No impacts were observed downstream at the final discharge (Table 5.2.12b)

Table 5.2.1.2a Denison Lower Williams Lake ETP Influent (D-22)

PARAMETER UNITS	pH		Acid mg/L	SO4 mg/L	Ra Bq/L	Ba mg/L	Co mg/L	Fe mg/L	Mn mg/L	U mg/L
2016	6.7	<	1.0	109.0	0.604	0.043	0.0009	5.43	1.603	0.0019
2017	6.7	<	1.0	72.0	0.171	0.023	<0.0005	1.39	0.186	0.0008
2018	6.7	<	1.0	93.0	0.485	0.041	0.0014	5.24	1.315	0.0019
2019	6.7	<	1.0	59.3	0.250	0.029	0.0006	2.54	0.374	0.0008
2020	6.8	<	1.0	40.5	0.319	0.045	0.0009	7.68	1.265	0.0019
Annual Summary Statistics										
Average	6.7	<	1.0	74.8	0.366	0.036	0.0010	4.46	0.949	0.0015
Maximum	6.8	<	1.0	109.0	0.604	0.045	0.0014	7.68	1.603	0.0019
Minimum	6.7	<	1.0	40.5	0.171	0.023	0.0006	1.39	0.186	0.0008

Note: Five-year annual average, maximum and minimum statistics

The final discharge from LWL is monitored near the Denison Access Road at Station D-3. Review of annual average concentrations for TOMP and SAMP demonstrate stable pH values and consistently low TSS concentrations (Table 5.2.1.2b). The annual average radium concentration has been increasing over the past five years, but continue to remain well below the grab sample and monthly mean discharge limits. In response, barium chloride addition rates have been adjusted in the influent for improved radium removal, as evidenced with the increasing barium concentrations shown in Table 5.2.1.2b. These values are not unexpected as increases in radium over time were predicted in the 1995 EIS due to decreasing sulphate concentrations, also reflected in the Table 5.2.1.2b. Uranium concentrations at D-3 are higher than the influent uranium concentrations at D-22 (Table 5.2.1.2a) however, this is likely attributed to a 1959 operational spill that impacted Denison Lower Williams Lake (EIS 1995). Uranium concentrations at D-3 have remained stable and are below levels considered to be toxic to aquatic biota (0.0150

mg/L) (CCME, 2020). Despite some variability, all parameter annual average concentrations consistently meet downstream receiving environment water quality criteria (Table 4.2.2).

Table 5.2.1.2b Lower Williams Final Discharge at Denison Access Road (D-3)

PARAMETER UNITS	Flow (L/s)	Hardness mg/L	pH	SO4 mg/L	TSS mg/L	Ra Bq/L	Ba mg/L	Co mg/L	Fe mg/L	Mn mg/L	U mg/L
2016	6.75	122.2	7.0	82.7	1	0.101	0.211	<0.0005	0.06	0.006	0.0031
2017	15.65	113.8	7.1	68.2	1	0.120	0.228	<0.0005	0.12	0.015	0.0048
2018	6.71	109.7	7.2	65.6	1	0.126	0.282	<0.0005	0.12	0.016	0.0048
2019	11.62	90.3	7.1	53.9	1	0.137	0.321	0.0005	0.21	0.040	0.0038
2020	10.67	83.5	7.1	45.3	1	0.175	0.391	0.0005	0.25	0.047	0.0029
Annual Summary Statistics											
Average	10.28	103.9	7.1	63.1	1	0.132	0.287	0.0005	0.15	0.025	0.0039
Maximum	15.65	122.2	7.2	82.7	1	0.175	0.391	0.0005	0.25	0.047	0.0048
Minimum	6.71	83.5	7.0	45.3	1	0.101	0.211	<0.0005	0.06	0.006	0.0029

Note: Five-year annual average, maximum and minimum statistics

5.2.1.2.1 Discharge Compliance – Lower Williams Final Discharge

In 2020, LWL effluent quality at the final point of control, D-3, was in compliance with the discharge limits established in the decommissioning licence (Table 5.2.1.2.1).

Table 5.2.1.2.1 2020 Lower Williams Compliance with Discharge Limits at Final Point of Control (D-3)

Month	Samples Required	Number of Times Discharge Limits Were Exceeded					
		pH pH units		TSS mg/L		Ra(T) Bq/L	
		Grab Sample Limit[1] Upper 9.5 Lower 5.5	Monthly Arithmetic Mean[1] Upper 9.5 Lower 6.5	Grab Sample Limit[1] Upper 50 Lower N/A	Monthly Arithmetic Mean[1] Upper 25 Lower N/A	Grab Sample Limit[1] Upper 1.11 Lower N/A	Monthly Arithmetic Mean[1] Upper 0.37 Lower N/A
Jan.	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
Feb.	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
Mar.	5	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
Apr.	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
May	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
June	5	0 of 5	0 of 1	0 of 5	0 of 1	0 of 5	0 of 1
July	2	0 of 2	0 of 1	0 of 2	0 of 1	0 of 2	0 of 1
Aug.	3	0 of 3	0 of 1	0 of 3	0 of 1	0 of 3	0 of 1
Sept.	5	0 of 5	0 of 1	0 of 5	0 of 1	0 of 5	0 of 1
Oct.	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
Nov.	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
Dec.	5	0 of 5	0 of 1	0 of 5	0 of 1	0 of 5	0 of 1
YTD	49	0 of 49	0 of 12	0 of 49	0 of 12	0 of 49	0 of 12

[1]Limits established in the Licence UMDL-MINEMILL-DENISON.01/indf issued December 15, 2004.

Stanrock

Discharge, runoff, and seepage from the Stanrock TMA collects into a small holding pond where the ETP Influent station is monitored. Samples were analysed within the holding pond prior to treatment (DS-2) to closely monitor and make treatment adjustments as required to ensure compliant water quality at the final discharge station (DS-4).

A five-year analysis of the annual averages at DS-2 confirms this station to have a low pH with a high acid concentration. The annual average concentrations for most parameters at DS-2 appeared to have slightly decreased compared to 2019 (Table 5.2.1.3a) with cobalt, uranium and manganese concentrations relatively stable over the past five years. Annual average radium and barium concentrations increased slightly in 2020 compared to 2019. (Table 5.2.1.3a).

Table 5.2.1.3a Stanrock Influent (DS-2)

PARAMETER UNITS	Flow (L/s)	ACID mg/L	pH	SO4 mg/L	Ra Bq/L	Ba mg/L	Co mg/L	Fe mg/L	Mn mg/L	U mg/L
2016	45.46	235	2.9	580.0	0.182	0.030	0.0786	45.40	1.724	0.0321
2017	75.87	194	2.8	502.5	0.182	0.018	0.0682	28.80	1.349	0.0270
2018	44.49	231	2.9	595.0	0.231	0.019	0.0787	47.10	2.117	0.0188
2019	64.14	197	2.8	490.0	0.267	0.016	0.0647	33.35	1.305	0.0241
2020	65.76	171	3.1	437.5	0.273	0.019	0.0598	28.38	1.067	0.0150
Annual Summary Statistics										
Average	59.14	206	2.9	521.0	0.227	0.020	0.0700	36.61	1.512	0.0234
Maximum	75.87	235	3.1	595.0	0.273	0.030	0.0787	47.10	2.117	0.0321
Minimum	44.49	171	2.8	437.5	0.182	0.016	0.0598	28.38	1.067	0.0150

Note: Five-year annual average, maximum and minimum statistics

Water quality at the Stanrock Final Point of Control is monitored at Orient Lake Outlet (DS-4). A review of water quality data at DS-4 for the last five years indicated generally stable pH values and TSS levels, comparable to other final discharge stations, that consistently met the discharge limits set out in the licence (Table 5.2.1.3.1). Annual average sulphate and hardness concentrations were consistent with DS-4 final discharge values over the last five years and have displayed a decreasing trend since 2016 (Table 5.2.1.3b). All metal concentrations consistently met receiving environment benchmarks for SRWMP. Uranium and radium concentrations were relatively low, and radium continued to remain well below the monthly mean discharge criteria of 0.37 Bq/L set in the decommissioning licence. All other parameters appeared to be relatively stable over time with no deviates of concern observed in the five-year annual average dataset (Appendix lV).

Table 5.2.1.3b Orient Lake Outlet Stanrock Final Point of Control (DS-4)

PARAMETER UNITS	Flow (L/s)	Hardness	pH	SO4 mg/L	TSS mg/L	Ra Bq/L	Ba mg/L	Co mg/L	Fe mg/L	Mn mg/L	U mg/L
2016	27.33	300.0	7.1	262.5	1	0.073	0.047	0.0006	0.10	0.044	0.0043
2017	60.27	331.8	7.2	277.5	1	0.072	0.045	0.0006	0.17	0.044	0.0042
2018	25.58	303.8	7.1	248.3	1	0.081	0.065	0.0006	0.15	0.052	0.0042
2019	42.06	294.7	7.2	251.7	1	0.083	0.060	0.0005	0.14	0.045	0.0046
2020	43.42	279.6	7.0	224.2	1	0.086	0.067	0.0005	0.13	0.040	0.0038
Annual Summary Statistics											
Average	39.73	302.0	7.1	252.8	1	0.079	0.057	0.0006	0.14	0.045	0.0042
Maximum	60.27	331.8	7.2	277.5	1	0.086	0.067	0.0006	0.17	0.052	0.0046
Minimum	25.58	279.6	7.0	224.2	1	0.072	0.045	0.0005	0.10	0.040	0.0038

Note: Five-year annual average, maximum and minimum statistics

Toxicity was monitored for the Stanrock site at the final discharge (DS-4) as per SAMP requirements. In 2020, toxicity testing was done in the spring and fall, and included the same tests that were completed at the Denison TMA-1 final effluent (D-2). Results of the 2020 toxicity tests at DS-4 confirmed 0% acute lethality for both *Daphnia magna* and rainbow trout for both sampling events (Appendix IV). Furthermore, a 100% IC_{25} result for *Ceriodaphnia dubia* was confirmed in both the spring and fall sampling events at DS-4 (Appendix IV). Overall, results are indicative of a non-toxic effluent for aquatic life.

5.2.1.2.2 *Discharge Compliance – Stanrock Final Discharge*

In 2020, Stanrock TMA effluent quality at the final point of control (DS-4), met the discharge criteria established in the decommissioning licence (Table 5.2.1.3.1).

Table 5.2.1.3.1 2020 Stanrock TMA Compliance with Discharge Limits at Final Point of Control (DS-4)

Month	Samples Required	Number of Times Discharge Limits Were Exceeded					
		pH pH units		TSS mg/L		Ra(T) Bq/L	
		Grab Sample Limit[1]: Upper 9.5 Lower 5.5	Monthly Arithmetic Mean[1]: Upper 9.5 Lower 6.5	Grab Sample Limit[1]: Upper 50 Lower N/A	Monthly Arithmetic Mean[1]: Upper 25 Lower N/A	Grab Sample Limit[1]: Upper 1.11 Lower N/A	Monthly Arithmetic Mean[1]: Upper 0.37 Lower N/A
Jan.	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
Feb.	4	0 of 5	0 of 1	0 of 5	0 of 1	0 of 5	0 of 1
Mar.	5	0 of 5	0 of 1	0 of 5	0 of 1	0 of 5	0 of 1
Apr.	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
May	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
June	5	0 of 5	0 of 1	0 of 5	0 of 1	0 of 5	0 of 1
July	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
Aug.	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
Sept.	5	0 of 5	0 of 1	0 of 5	0 of 1	0 of 5	0 of 1
Oct.	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
Nov.	4	0 of 4	0 of 1	0 of 4	0 of 1	0 of 4	0 of 1
Dec.	5	0 of 5	0 of 1	0 of 5	0 of 1	0 of 5	0 of 1
YTD	52	0 of 52	0 of 12	0 of 52	0 of 12	0 of 52	0 of 12

[1]Limits established in the Licence UMDL-Minemill-Stanrock.02/indf issued September, 2010.

5.2.2 Groundwater Quality

Field quality assurance and quality control sampling was extended to the groundwater monitoring program in 2006. Detailed groundwater QA/QC results against DQOs are included in Appendix III and groundwater station-specific five-year annual data are included in Appendix IV. The 2020 groundwater field blank and field precision data summary is presented in Table 5.2.2.

The field precision DQOs were met for all parameters in all samples in 2020.

Although all precision DQOs were met, there were two field blank exceedances which did not meet DQOs in 2020 (Table 5.2.2).

Additionally, the acidity blank DQO criteria of 2 mg/L was exceeded in 2 of the 3 samples, with a maximum result of 4 mg/L (Table 5.2.2). However, acidity concentrations at these locations (BH91-SG2A and BH98-15A) are much higher at 2420 mg/L and 1170 mg/L, respectively; therefore, the exceedances do not impact interpretation of groundwater iron results. The annual average field blank for acidity was slightly above the DQO at 3.0 mg/L.

Table 5.2.2 2020 Groundwater Field Blank and Field Precision Data Summary

		pH pH units	SO_4 mg/L	Acidity mg/L	Fe mg/L
Field Blank Statistics					
	Count	3	3	3	3
	Average	6.4	0.7	3	0.02
	Min	6.3	<0.1	1	<0.02
	Max	6.5	0.2	4	0.02
Field Blank Exceedances					
	DQO Criteria[1]	-	0.2	2	0.04
	# Exceedances	0	1	**2**	0
Field Precision Statistics					
	Count	3	3	3	3
	Average	0%	8%	1%	5%
	Min	0%	0%	0%	1%
	Max	18%	12%	5%	7%
Field Precision Exceedances					
	DQO Criteria[1]	20%	20%	20%	20%
	# Exceedances	0	0	0	0

[1]Field criteria taken from Table 6.2 of the Cycle 5 Study Design for SRWMP, SAMP and TOMP (Minnow Environmental Inc., 2019)

Bold indicates an exceedance of the criteria

5.2.2.1 Denison TMA-1 Groundwater Results

Review of the data at the east end of TMA-1, downstream of Dam 17 on the North Abutment at monitoring stations BH91 D1A and BH91 D1B for the last five years indicated elevated iron and sulphate concentrations in the deeper well station BH91 D1A (total depth = 218.00 ft), compared to the lower concentrations near the surface overall at BH91 D1B (total depth = 149.20 ft) (Appendix IV). Acidity concentrations at both monitoring stations remain low compared to other stations in the program and were near or below the TDL (Table 4.2.2). Furthermore, pH was near neutral at both stations and sulphate levels have increased slightly from the year prior. No samples were collected at station BH91 D1B in 2018 and 2019 and BH91 D1A in 2019 due to lack of recharge, therefore, 2020 results could only be compared to previous years.

Groundwater quality downstream of Dam 17 in the North Valley (BH91 D3A and BH91 D3B) could be characterized by having stable pH values with relatively high acidity, iron, and sulphate concentrations. Concentrations of most measured parameters at these stations were variable over the past five years with acidity at both stations showing a declined. Sulphate and iron concentrations are lower in 2020 compared to 2019 at BH91 D3A, but at BH91 D3B they have increased slightly since 2019.

Downstream of Dam 10 (BH91 DG4B) groundwater was characterized by near neutral pH, variable sulphate concentrations, and historically low acidity over the past five years (Appendix IV). Iron concentrations have been variable and have increased over 2019 to 2020. Acidity and sulphate concentrations have also risen at this station in 202 compared to 2019.

5.2.2.2 Denison Lower Williams Lake

A review of the last five years of groundwater monitoring results downstream of Dam 1 on the North Ridge (BH91 D9A) indicated relatively stable and near neutral pH levels. Acidity concentrations have generally deceased over the past five years. (Appendix IV). Sulphate concentrations appeared to be elevated at this station over the last five years compared to other GW stations. Although variable, iron and sulphate concentrations are generally stable and are within the range of measured data over the past five years.

5.2.2.3 Stanrock

Groundwater quality was measured at Stanrock downstream of the following dams: Dam A (BH91 SG1A), Dam B (BH98-16A), and Dam C (BH98-15A).

Dam A groundwater was characterized by low pH with elevated sulphate, acidity, and iron concentrations (Appendix IV). Although concentrations were elevated compared to other monitoring wells, overall, concentrations of most of these parameters have been decreasing over time in groundwater downstream of Dam A, with a small increase in sulphate and acidity in 2020 compared to 2019.

Dam B groundwater quality was similar to Dam A, with a lower pH and elevated sulphate, acidity and iron concentrations (Appendix IV). All parameters appeared to have decreased since 2017 and have stabilized with minor fluctuations.

Groundwater quality monitored downstream of Dam C at BH98 15A showed the lowest values of all parameters, generally (Appendix IV). Acidity, iron and sulphate appear stable over the last five years with sulphate having a slight increase in 2020 compared to 2019.

5.2.3 Porewater Quality

Porewater quality at the Stanrock site was monitored upstream of Dam A at the following stations: ST3 P3 (total depth = 5.94 m), ST3 P5 (total depth = 2.64 m), ST3 P6 (total depth = 11.58 m), and ST3 P8 (total depth = 20.91m), and upstream of Dam D at BH91 SG2A (total depth = 33.31 m), BH91 SG2D (total depth = 4.39 m).

Assessment of the porewater quality data at the above mentioned stations show low pH values as well as elevated acidity, sulphate, and iron concentrations (Appendix IV). Concentrations of acidity, iron, and sulphate were higher at deeper well locations (i.e. ST3 P6 and ST3 P8), with lower concentrations in the shallower wells (ST3 P3 and ST3 P5). ST3 P3 showed stable parameters with slightly higher values than the past year in all area. ST3 P5 showed generally stable parameters over the past five years. ST3 P6 also shows a stable trend over the past five years with an increase in sulphate concentrations in 2020. Station ST3 P8 has the highest concentrations of acidity, sulphate and iron of the wells, but all these parameters show a gradual decreasing trend over the past five years.

Monitoring wells located downstream of Dam D had not collected data over the last five years due to no recharge of the wells, with the exception of BH91 SG2A. Porewater quality results obtained at this station was generally consistent over the last five years, with elevated concentrations of iron, acidity and sulphate. This is very similar to all other monitoring stations at Stanrock (Appendix IV). Data from 2019 was not collected from this site due to a lack of recharge. Acidity concentrations have declined since 2018 while iron and sulphate are stable.

5.3 Site Specific Maintenance and Operations Program

Site-specific program reports are provided in the following sections in accordance with the TOMP and SAMP Annual Reporting Requirements. Each section provides the following information:

- Summary of Tailings Management Area (TMA) Maintenance
- Summary of Effluent Treatment Plant (ETP) Operations

5.3.1 Denison TMA-1

5.3.1.1 TMA Maintenance

Routine inspections and preventative maintenance were performed at the Denison TMA-1 as required. Any equipment that was able to be repaired either on-site or sent out was done so, and anything that was damaged or worn beyond repair was replaced with a new unit. All maintenance was completed to ensure continued efficiency and safe operations on site. Furthermore, proper calibrations of monitoring equipment were conducted on a consistent basis and recorded accordingly.

Additional maintenance activities for Denison TMA-1 site completed in 2020 are as follows:

- A flushing system was installed on site to efficiently clean the barium chloride treatment system to reduce the chance of build-up and obstruction.

5.3.1.2 ETP Operations

The ETP located at the Denison TMA-1 spillway (D-1) operated for 278 days in 2020 (Table 5.3.1.2.1). The ETP treated approximately 2,568,000,000L of water, with a monthly average daily plant flow of 107 L/s. The total amount of barium chloride that was used for treatment was 15,431kg. Sodium hydroxide (NaOH) was not utilized in 2020 because pH was not a concern at D-2 (Table 5.3.1.2.1). Nine kg of caustic soda was used during the month of January in 2020. An estimated 2,609,000,000 L was discharged from the final point of control at the Stollery Lake Settling Pond Outlet (D-2). Although the plant only operated for 278 days, discharge at D-2 occurred for 366 days in 2020 (Table 5.3.1.2.1). Annual monthly average daily discharge flow was 83 L/s.

5.3.1.2.1 Operating Summary

In 2020, the TMA-1 ETP operated every month other than July and August. The plant ran for 12 days in June and 22 days in September, with full operations occurring during every other month. Siphons were used to draw from the TMA to ensure the pond level remained below maximum spillway elevation as well as to maintain a controlled release of water from TMA-1. This controlled release of water from TMA-1 ensured the maximization of radium settling in the Stollery Lake Settling Pond, especially during times of high precipitation. All obstacles preventing orderly operations were resolved in a timely fashion with no repercussion and were considered to be routine maintenance.

Table 5.3.1.2.1 2020 TMA-1 Effluent Treatment Plant Flow Rates, Operating Days, and Discharge Days

ITEM	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	Y.T.D. 2020	Y.T.D. 2019
PLANT OPERATIONS														
Operating Days	31	29	31	30	31	12	0	0	22	31	30	31	278	220
Maximum Daily Plant Flow (L/s D-1)	188	158	149	146	108	104	0	0	44	188	188	108	188	197
Minimum Daily Plant Flow (L/s @ D-1)	48	148	129	60	97	1	0	0	43	38	109	35	0	0
Monthly Average Daily Plant Flow (L/s @ D-1)	120	154	139	102	102	91	0	0	43	84	158	52	107	115
Total Volume Treated (ML)	322	385	373	265	274	94	0	0	82	224	410	138	2568	2192
Barium Chloride Consumption														
total kg/month	1941	2318	2322	1659	1654	593	0	0	503	1355	2457	629	15431	11207
monthly average mg/litre	6.03	6.02	6.22	6.26	6.03	6.32	0.00	0.00	6.13	6.04	6.00	4.55	6.01	5.11
Caustic Soda Consumption														
total kg/month	9	0	0	0	0	0	0	0	0	0	0	0	9	0
monthly average mg/litre	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EFFLUENT														
Discharge Days	31	29	31	30	31	30	31	31	30	31	30	31	366	365
Maximum Daily Discharge Flow (L/s D-2)	97	133	133	163	129	91	17	19	66	180	187	123	187	340
Minimum Daily Discharge Flow (L/s D-2)	97	97	91	72	87	14	9	9	10	23	183	46	9	9
Monthly Average Daily Discharge Flow (L/s D-2)	97	112	108	117	110	42	12	14	48	76	185	74	83	71
Total Volume Discharged (ML)	260	281	289	303	293	108	33	36	124	204	479	198	2609	2229

5.3.2 Denison Lower Williams Lake

5.3.2.1 TMA Maintenance

Routine inspections and preventative maintenance were performed at the Denison Lower Williams Lake site as required. Any equipment that was able to be repaired either on-site or sent out was done so, and anything that was damaged or worn beyond repair was replaced with a new unit. All maintenance was completed to ensure continued efficiency and safe operations on site. Furthermore, proper calibrations of monitoring equipment were conducted on a consistent basis and recorded accordingly. No additional maintenance was required to be completed.

5.3.2.2 Summary of ETP Operations

The ETP located at the Denison Lower Williams Lake station (D-22) operated for 366 days in 2020 (Table 5.3.1.2.1). The ETP treated approximately 346,000,000 L of water, with a monthly average daily plant flow of 11 L/s. The total amount of barium chloride that was used for treatment was 678 kg. An estimated 346,000,000 L was discharged from the final point of control (D-3) and took place for 349 days of 2020. Annual monthly average daily discharge flow was 11 L/s (Table 5.3.2.2.1).

5.3.2.2.1 Operating Summary

In 2020, the Denison Lower Williams Lake ETP operated every day of every month. Treatment conditions at LWL were for the sole purpose of controlling radium levels in the effluent. Neutralization treatment has not been required at this site since 2002. Flow to the ETP continued year-round, the treatment plant continued to run all year and discharge occurred on 345 days in 2020.

Table 5.3.2.2.1 2020 Lower Williams Lake ETP Flow Rates, Operating Days, and Discharge Days

ITEM	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	Y.T.D. 2020	Y.T.D. 2019
PLANT OPERATIONS														
Operating Days	31	29	31	30	31	30	31	31	30	31	30	31	366	365
Maximum Daily Plant Flow (L/s @ D-22)	8	3	56	72	6	2	3	6	28	62	35	7	72	113
Minimum Daily Plant Flow (L/s @ D-22)	1	2	2	15	2	1	1	1	4	3	6	2	1	1
Monthly Average Daily Plant Flow (L/s @ D-22)	4	2	18	37	4	2	2	3	14	27	16	4	11	11
Total Volume Treated (ML)	9	6	47	97	9	4	5	9	36	72	41	12	346	354
Barium Chloride Consumption														
total kg/month	45	39	47	49	44	41	41	43	51	76	99	103	678	526
monthly average mg/litre	4.83	6.84	1.00	0.51	4.69	10.55	7.65	4.82	1.43	1.06	2.43	8.76	2	1
Caustic Soda Consumption														
total kg/month	0	0	0	0	0	0	0	0	0	0	0	0	0	0
monthly average mg/litre	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EFFLUENT														
Discharge Days	31	29	31	30	31	30	14	31	30	31	30	31	349	326
Maximum Discharge Flow (L/s @ D-3)	8	3	56	72	6	2	3	6	28	62	35	7	72	113
Minimum Discharge Flow (L/s @ D-3)	1	2	2	15	2	< 1	1	1	4	3	6	2	1	1
Monthly Average Discharge Flow (L/s @ D-3)	4	2	18	37	4	2	2	3	14	27	16	4	11	12
Total Volume Discharged (ML)	9	6	47	97	9	4	2	9	36	72	41	12	343	349

5.3.3 Stanrock TMA

5.3.3.1 TMA Maintenance

Routine inspections and preventative maintenance were performed at the Denison Stanrock TMA site as required. Any equipment that was able to be repaired either on-site or sent out was done so, and anything that was damaged or worn beyond repair was replaced with a new unit. All maintenance was completed to ensure continued efficiency and safe operations on site. Furthermore, proper calibrations of monitoring equipment were conducted on a consistent basis and recorded accordingly.

Additional maintenance to the Denison Stanrock TMA completed in 2020 are as follows:

- As per CNSC recommendations, additional rip rap was added to the Dam G spillway,
- Support beams and railings were installed at the Beaver Lake siphon inlet,
- A safety rail was installed at the DS-1 weir to support worker safety during sampling.

5.3.3.2 Summary of ETP Operations

The Stanrock ETP operated periodically throughout the year for the purpose of stabilizing pH and radium levels. The ETP, which was monitored at station DS-2, operated a total of 183 days, with an average daily plant flow of 134 L/s. Throughout 2020, an estimated 2,114,000,000 L of water were treated with barium chloride and lime addition. In 2020, 1221 kg of barium chloride and 153.03 dry tonnes of lime were used at the Stanrock ETP. In total, 1,399,000,000 L were discharged from the final point of control (DS-4), over a total of 366 days. Monthly average daily discharge flow at DS-4 was 44 L/s for 2020 (Table 5.3.3.2.1).

5.3.3.2.1 Operating Summary

The Stanrock ETP operated as required throughout the year to maintain discharge compliance and control of the Holding Pond water levels. Operating days within each month ranged from 4 - 28 days, operating in all of the 12 months of the reporting year. Most of the operating days were during spring and fall as runoff and rainfall conditions were most often present during these times of the year (Table 5.3.3.2.1). High water levels throughout the spring can cause overflow of Beaver Lake into the Moose Lake Settling Pond. To help neutralize the acidity entering the Moose Lake Settling Pond, caustic soda is dispensed into Orient Creek. This practice was not required in 2020 and no amount of caustic soda was added to Orient Creek.

Table 5.3.3.2.1 2020 Stanrock ETP Flow Rates, Operating Days, and Discharge Days

ITEM	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	Y.T.D. 2020	Y.T.D. 2019
PLANT OPERATIONS														
Operating Days	14	11	17	28	18	4	8	3	15	23	26	16	183	181
Maximum Daily Plant Flow (L/s @ DS-2)	147	150	166	216	226	130	140	160	174	188	157	126	226	190
Minimum Daily Plant Flow (L/s @ DS-2)	108	107	103	109	99	103	102	113	76	75	85	81	75	65
Monthly Average Daily Plant Flow (L/s @ DS-2)	128	131	138	177	156	116	121	138	139	119	108	103	134	130
Total Volume Treated (ML)	155	125	203	429	243	40	84	36	180	236	242	142	2114	2038
Barium Chloride Consumption														
total kg/month	42	30	72	196	78	20	25	11	120	284	255	88	1221	938
monthly average mg/litre	0.27	0.24	0.35	0.46	0.32	0.50	0.30	0.31	0.67	1.20	1.05	0.62	0.58	0.46
Lime Consumption														
total dry tonnes/month	12.28	9.18	18.69	25.85	13.93	1.93	4.38	2.36	12.40	25.11	20.05	6.87	153.03	166.15
monthly average g/litre	0.08	0.07	0.09	0.06	0.06	0.05	0.05	0.07	0.07	0.11	0.08	0.05	0.07	0.08
NEUTRALIZATION														
Lime Consumption														
Beaver Lake total dry tonnes/month	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Site total including ETP Operations	12.28	9.18	18.69	25.85	13.93	1.93	4.38	2.36	12.40	25.11	20.05	6.87	153.03	166.2
Caustic Soda Consumption														
Orient Creek total kg/month	0	0	0	0	0	0	0	0	0	0	0	0	0	124
EFFLUENT														
Discharge Days	31	29	31	30	31	30	31	31	30	31	30	31	366	365
Maximum Daily Discharge Flow (L/s @ DS-4)	35	35	172	232	105	3	9	3	130	136	172	35	232	254
Minimum Daily Discharge Flow (L/s @ DS-4)	21	9	13	47	2	1	1	2	9	17	47	9	1	1
Monthly Average Daily Discharge Flow (L/s @ DS-	29	20	59	151	32	2	6	2	44	81	86	21	44	41
Total Volume Discharged (ML)	78	49	159	390	85	6	15	6	115	217	223	57	1399	1291

6 REFERENCES

Minnow Environmental Inc. and Beak International Incorporated, 2001. Serpent River Watershed Monitoring Program – 1999 Study. April 2001.

Minnow Environmental Inc., 2019. The Cycle 5 Study Design for the SRWMP, SAMP and TOMP. Prepared for Rio Algom Limited and Denison Mines Inc. February 2019.

Minnow Environmental Inc., 2021. Serpent River Watershed Cycle 5 (2014 to 2019) State of the Environment Report. Prepared for Rio Algom Limited and Denison Mines Inc. March 2021.

Denison Mines Inc. and Rio Algom Limited. Serpent River Watershed Monitoring Program 2019 Annual Water Quality Report. (Rio Algom Limited and Denison Mines Inc.) March 2020.

APPENDIX I
Summary of Cycle 5

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

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

Cycle 3	Monitoring Framework For Closed Uranium Mines Near Elliot Lake	2009	2005 to 2009	**IBMP** eliminated based on objectives of program being achieved. **TOMP and SAMP:** • removal of silver, selenium based on performance and removal of conductivity based on redundancy with sulphate; and • DOC, hardness and flow added at selected stations. **SRWMP:** • removal of selenium and sliver based on performance; • removal of station SR-12, ELO, SR-09, SR-15, SR-02, SR-03, SR-11, P-01, QL-01 and SR-16 and SR-17 based on performance; • monthly monitoring frequency reduced to quarterly; • sediment and benthic monitoring removed from Whiskey, Evans and Cinder lakes based on redundancy; • depositional streams (Q-20, D-6, SR-06, M-01 and SR-08) based on very high natural variability masking results; and • fishing in McCabe Lake and fish tissue monitoring eliminated based on performance.
	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	Minor changes to **TOMP** and **SAMP**. **SRWMP**: • elimination of reference stations SR-05, P-222 and SR-14; • removal of cobalt as substance for monitoring, addition of DOC; • far-field lakes removed from the program (Hough, Pecors, and McCarthy); • removal of Rochester Lake as a sediment and benthic reference area; and • reduction in benthic and sediment sampling to 1/10 years based on measured deposition rates.
	Serpent River Watershed Cycle 4 State of the Environment	2016		

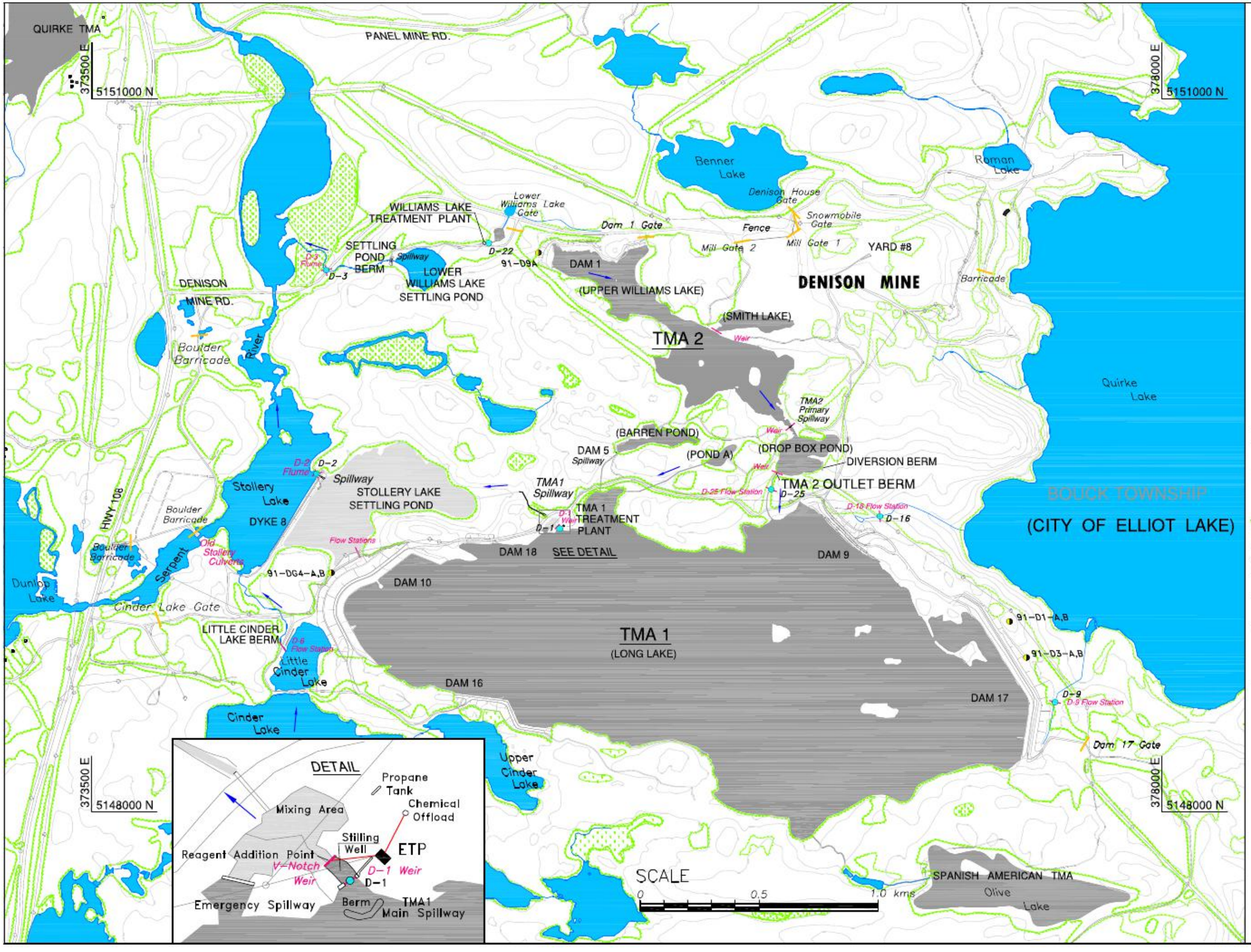
Cycle 5	Cycle 5 Study Design For the SRWMP, SAMP and TOMP	2019	2015 to 2019	**TOMP, SAMP, and SRWMP**: • improved approach to trend analysis of surface water quality using the non-parametric seasonal Kendall test. **SRWMP**: • improved approach to calculate benchmark upper limit of background water quality values have previously been calculated based on the upper 95th percentile of values collect across all five years (rather than annual means); • use of a Serpent River Watershed site-specific dose-based radium-226 benchmark for assessment of water quality; • addition of a lake-specific dose-based radium-226 benchmark for assessment of sediment quality; and • sediment and benthic monitoring removed from Elliot Lake based on improvements in water quality, negligible mine-related sediment toxicity, and gradual improvement in benthic invertebrate communities.

[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
Site Maps, Sampling Requirements



DENISON MINES

Denison Mines Inc.
Denison
SAMPLE LOCATION MAP

Rev. 2011-00
File 3.2.1
March 2011

Legend

- water covered tailings.
- settling ponds.
- surface water sample location.
- groundwater sample location.
- flow direction.
- roads or trails.
- power line.
- flow station or weir.
- pipeline.
- gate.
- wetlands.

Notes

- OBM © Queens Printer for Ontario, 2008.
- Mine structures and property limits were derived from Denison Mines records.
- Mapping export parameters = NAD83 WGS_1984_UTM Zone_17N (Central Meridian = 81°W).
- Contour Interval = 10 metres.

Issued on: _____

Issued by: _____

Denison Responsible Authority

Denison Mines Inc.
Stanrock Site
SAMPLE LOCATION MAP

Rev. 2011-00
March 2011

SCALE 0 0.5 kms

N W E S

5148000 N
381000 E

NELSON LAKE QUARRY
Nelson Lake
Main Gate
STANROCK MINE
Canmet Gate
Quellette Lake
Quirke Lake
Dam A Gate

TMA
DAM 'A'
DAM 'B'
DAM 'C'
DAM 'D'
DAM 'G'
DAM 'J'
DAM 'L'
DAM 'M'
DAM 'K'
DAM 'F'

BH98-16A
DS-12 Weir
DS-12
COLLECTION POND PUMP HOUSE
DS-13 Weir
DS-13
ST-3A
ST-3A Weir
SPILLWAY
BH98-15A
BH91-SG2A,D
PN-ST3
HEADPOND
BH91-SG1
DS-11
DS-11 Weirs
DS-11 Weir
RUNOFF COLLECTION POND
PUMP HOUSE
DS-16
ST-3
ST-1
DS-16 Weir
ST-4
Beaver Lake Siphon Line
L Dam G Pumping Line
DS-14
BH91-SG3A,B
ST-1A Weir
ST-1A
Beaver Lake
HOLDING POND
TREATMENT PLANT
DS-3
SPILLWAY DS-2
MOOSE LAKE SETTLING POND
DS-5
DS-5 Flume
STANROCK ROAD
Moose Lake Gate
BUCKLES TOWNSHIP
Halfmoon Wetland
DS-4 Weir
DS-4
OUTLET BERM
BERMS
Halfmoon Lake
ORIENT LAKE POLISHING POND
DS-1 Weir
DS-1
SPILLWAY
SPILLWAY
BH98-17A
DS-6 Weir
DS-6
384000 E
5146000 N

Legend

- vegetated tailings.
- collection or settling ponds.
- surface water sample location.
- groundwater sample location.
- flow direction.
- roads or trails.
- power line.
- siphon line.
- pipeline.
- wetlands.
- exposed bedrock

Notes

- OBM © Queens Printer for Ontario, 2007.
- Mine structures and property limits were derived from Denison Mines records.
- Mapping export parameters = NAD83 WGS_1984_UTM Zone_17N (Central Meridian = 81°W).

Issued on: _____
Issued by: _____
Denison Responsible Authority

Stanrock C of A
Performance Monitoring

Sampling Station	Location / Description	Coordinates	Purpose	Flow	pH	Conductivity	Sulphate	^{226}Radium (Total)	Acidity	Alkalinity	Hardness	DOC	Iron	SAMP METALS			
														Barium	Cobalt	Manganese	Uranium
DS-11	Seepage of Dam A	N 5146624 E 381977 N 5146692 E 382006	MOE	4	4	4											
DS-12	Seepage of Dam B	N 5147007 E 380926	MOE	4	4	4											
DS-13	Seepage of Dam C	N 5146909 E 381145 N 5146841 E 381158	MOE	4	4	4											
DS-14	Seepage of Dam AD	N 5146658 E 381360	MOE	4	4	4											
DS-18	Halfmoon Lake Outlet	N 5145050 E 383761	MOE	4	4		4	4					4	4	4	4	4
ST-1	Downstream of Dam G	N 5146648 E 380709	MOE		4	4											
ST-1A	Dam J at toe of dam	N 5146524 E 381229	MOE		4	4											
ST-3	Downstream of Dam G	N 5146671 E 380699	MOE		4	4											
ST-3A	Dam G at Toe of Dam	N 5146867 E 380850	MOE		4	4											
ST-4	Within Quirke Lake Delta	N 5146606 E 380354	MOE		4	4	4	4	4	4	4	4	4	4	4	4	4

Denison Groundwater
Performance Monitoring

Sampling Station	Location / Description	Coordinates	Type	Purpose	Elevation	Conductivity	pH	Acidity	Iron
BH91-D1	Dam 17 North Abutment	N 5148801 E 377359	Groundwater (2 wells)	TOMP	2	2	2	2	2
BH91-D3	Dam 17 North Valley, Toe	N 5148649 E 377430	Groundwater (2 wells)	TOMP	2	2	2	2	2
BH91-D9	Dam 1 North Ridge, Toe	N 5150352 E 375379	Groundwater (1 well)	TOMP	1	1	1	1	1
BH91-DG4	Below Dam 10	N 5149006 E 374508	Groundwater (1 well)	TOMP	1	1	1	1	1
BH91-SG2	Upstream of Dam D	N 5146809 E 381477	Porewater (2 wells)	TOMP	2	2	2	2	2
PN-ST3	Upstream of Dam A	N 5146853 E 381897	Porewater (4 wells)	TOMP	4	4	4	4	4
BH91-SG1	Downstream of Dam A	N 5146749 E 382014	Groundwater (1 well)	TOMP	1	1	1	1	1
BH91-SG3	Downstream of Dam D	N 5146669 E 381444	Groundwater (2 wells)	TOMP	2	2	2	2	2
BH98-15	Downstream of Dam C	N 5146851 E 381177	Groundwater (1 well)	TOMP	1	1	1	1	1
BH98-16	Downstream of Dam B	N 5147093 E 380933	Groundwater (1 well)	TOMP	1	1	1	1	1

Denison TOMP/SAMP
Surface Water Performance Monitoring

Sampling Station	Location / Description	Coordinates	Purpose	Elevation	Flow	pH	Conductivity	Sulphate	^{226}Radium (Total)	TSS	Acidity	Hardness	DOC	Iron	SAMP METALS				Toxicity		
															Barium	Cobalt	Manganese	Uranium	Acute *Rainbow Trout*	Acute *Daphnia magna*	Chronic *Ceriodaphnia dubia*
D-1	TMA-1 Overflow	N 5149191 E 375468	TOMP	52	261	261		4	12		4			4	4	4	4	4			
D-2	TMA-1 Stollery Lake Overflow	N 5149421 E 374446	TOMP		261	52			52	52											
D-3	TMA-2 Effluent	N 5150280 E 374485	TOMP		261	52			52	52											
D-22	TMA-2 ETP Influent	N 5150391 E 375169	TOMP			52		4	12					4	4	4	4	4			
D-25	TMA-2 Overflow into TMA-1	N 5149357 E 376357	TOMP			2		2	2		2			2							
DS-1	Stanrock Moose Lake Outlet to Orient Lake	N 5146185 E 383401	TOMP		52	52			4												
DS-2	Stanrock ETP Influent	N 5146416 E 382437	TOMP		261	261		4	12		4			4	4	4	4	4			
DS-3	Stanrock ETP Effluent	N 5146424 E 382483	TOMP			261			12												
DS-4	Stanrock Final Discharge @ Orient Lake Outlet	N 5146327 E 383888	TOMP		52	52			52	52											
DS-5	Orient Creek Discharge into Moose Lake	N 5145956 E 382549	TOMP		4	4	4														
DS-6	Moose Lake Narrows upstream of Dam K	N 5146062 E 383194	TOMP		52	52															
Denison TOMP Sites Sample Subtotal					1256	1153		14	210	156	10			14	12	12	12	12	0	0	0
D-2	TMA-1 Stollery Lake Overflow	N 5149421 E 374446	SAMP		52	52		12	12			12	12	12	12	12	12	12	2	2	2
D-3	TMA-2 Effluent	N 5150280 E 374485	SAMP		52	52		12	12			12	12	12	12	12	12	12			
D-9	Denison TMA-1; Dam 9 Seepage	N 5148462 E 377550	SAMP		4	4		4	4			4	4	4	4	4	4	4			
D-16	Denison TMA-1; Dam 17 Seepage	N 5149244 E 376814	SAMP		4	4		4	4			4	4	4	4	4	4	4			
DS-4	Stanrock Final Discharge @ Orient Lake Outlet	N 5146327 E 383888	SAMP		52	52		12	12			12	12	12	12	12	12	12	2	2	2
DS-16	Stanrock TMA; Quirke Lake Delta	N 5146663 E 380417	SAMP		4	4		4	4			4	4	4	4	4	4	4			
Denison SAMP Sites Sample Subtotal					168	168		48	48	0	0			48	48	48	48	48	4	4	4
Denison Total Samples					1424	1321		62	258	156	10	48	48	62	60	60	60	60	4	4	4
FB	Field Blank							12	12	12		4	4	12	12	12	12	12			
BS	Blind Sample							12	12	12		4	4	12	12	12	12	12			
QA/QC Samples Required based on 2002 operating days.								4.6	19.7	14.4	0.4	5.0	5.0	5.4	5.4	5.4	5.4	5.4			

APPENDIX III
Flagged Data & QA/QC Results

Location	Analyte	Date	Low	Hi	Result	Comment
D-3	TSS	2020-01-21	0	2	3 mg/L	Result is slightly above the high flag limit, but still consistent with previous values in the last year.
DS-1	pH	2020-04-06	6.3	8.3	9.3	Results are above the high flag limits but consistent with Increased flow under ice cover, which causes short-circuiting and reduced retention time.
		2020-04-07	6.3	8.3	9.0	
		2020-04-08	6.3	8.3	9.1	
DS-11	CONDF	2020-04-15	230.0	539.7	188.1 µmho/cm	Result is a historic low confirmed by repeat measurement, but consistent with heavy rain, snowmelt and dilution at the time of sampling. The result is also consistent with a gradually decreasing trend in concentrations.
DS-12	CONDF	2020-04-15	310.8	638.4	233.4 µmho/cm	Result is a historic low confirmed by repeat measurement, but consistent with heavy rain, snowmelt and dilution at the time of sampling. The result is also consistent with a gradually decreasing trend in concentrations.

Location	Analyte	Date	Low	Hi	Result	Comment
DS-12	FLOW	2020-04-15	0	2.5	4.0 L/s	Result is above the high flag limit, but consistent with heavy rain and snowmelt.
DS-3	pH	2020-04-07	10.1	11.4	9.9	Results are below the low flag limits, but consistent with operational adjustments in pH set point made in response to increased flow under ice cover to ensure pH compliance in the final discharge, DS-4.
		2020-04-08	10.1	11.4	9.8	
		2020-04-09	10.1	11.4	10.0	
DS-4	FLOW	2020-04-07	0	201	232 L/s	Results are above the high flag limits, but consistent with seasonal values during heavy rain and snowmelt.
		2020-04-14	0	201	232 L/s	
	hard	2020-04-14	175	397	153 mg/L	Results are below the low flag limit, but consistent with seasonal lows and dilution during periods of heavy rain and ice melt.
	SO4	2020-04-14	160	328	130 mg/L	
DS-5	FLOW	2020-04-15	0	17.0	17.4 L/s	Result is above the high flag limit, but consistent with seasonal values during heavy rain and snowmelt.

Location	Analyte	Date	Low	Hi	Result		Comment
	pH	2020-04-15	3	4	4.6		Result is above the high flag limit, but consistent with increased flow and dilution.
ST-1	pH	2020-04-15	4	5	5.3		Result is above the high flag limit, but consistent with increased flow and dilution.
DS-6	FLOW	2020-05-01	0	318	390	L/s	Result is above the high flag limit, but still consistent with seasonal highs during rain and Spring freshet.
D-3	Fe	2020-06-09	0	0.51	0.56	mg/L	Result is slightly above the high flag limit, but still consistent with previous values in the last year.
	TSS	2020-06-23	0	2	6	mg/L	Result is a 9-year high, likely due to low flow (<1.0 L/s) at the time of sampling. No impact was observed on other parameter concentrations and by the following week, TSS decreased to <1.0 mg/L.
D-16	U	2020-07-14	0.0005	0.0005	0.0007	mg/L	Result is a six-year high confirmed by repeat analysis, but only slightly above the high flag limit. Will continue to monitor at the current quarterly frequency.

Location	Analyte	Date	Low	Hi	Result	Comment
D-22	Ba	2020-07-14	0	0.083	0.118 mg/L	Results are historic highs confirmed by repeat analysis, but still consistent with seasonal spikes observed during drier conditions and low water levels.
	Fe	2020-07-14	0	16.85	29.50 mg/L	
	Mn	2020-07-14	0	3.321	4.700 mg/L	
	U	2020-07-14	0	0.005	0.0061 mg/L	Result is above the high flag limit confirmed by repeat analysis, but still consistent with previous values in the last five years.
	Ra	2020-07-14	0	1.318	1.452 Bq/L	Result is above the high flag limits, but consistent with previous values in the last two years.
D-3	Co	2020-07-28	0.0004	0.0006	0.0007 mg/L	Result is above the high flag limit, but consistent with previous values in the last year.
D-3	Ra	2020-07-28	0.047	0.247	0.255 Bq/L	Result is slightly above the high flag limit, but consistent with seasonal spikes observed during periods of very low flow (1.0 L/s). However in response, barium chloride addition rates were increased upstream and by the following week, concentrations decreased to 0.196 Bq/L.

Location	Analyte	Date	Low	Hi	Result		Comment
DS-1	Ra	2020-07-14	0	0.067	0.079	Bq/L	Result is a 10-year high, but only slightly above the high flag limit. The increase was likely influenced by low flow beaver activity in the area that may have caused some disturbance in the settling pond. Will continue to monitor at the current quarterly frequency.
DS-11	CONDF	2020-07-15	138	599	653	µmho/cm	Result is above the high flag limit, but consistent with previous values in the two years.
DS-2	Ba	2020-07-21	0.002	0.032	0.038	mg/L	Result is above the high flag limit, but consistent with previous values in the four years.
DS-4	Mn	2020-07-14	0.013	0.071	0.085	mg/L	Result is above the high flag limit, but consistent with previous values in the last two years.
D-25	FLOW	2020-09-08	0	23.6	44.6	L/s	Result is above the high flag limit, but consistent with seasonal values and heavy rain.
D-3	Ra	2020-09-08	0.0452	0.244	0.308	Bq/L	Results are above the high flag limits, but still consistent with previous values in the last year. Operational adjustments made in response reduced radium concentrations to 0.229 Bq/L by the following week.
		2020-09-15	0.0452	0.244	0.285	Bq/L	

Location	Analyte	Date	Low	Hi	Result	Comment
BSDST	Co	2020-10-13	0	0.0007	0.0010 mg/L	Results are slightly above the high flag limits, but consistent with previous values in the last year and consistent with the primary sample.
	Mn	2020-10-13	0	0.345	0.361 mg/L	
D-16	FLOW	2020-10-27	0	2.6	3.0 L/s	Result is slightly above the high flag limit, but consistent with seasonal values during Fall rain.
D-2	Co	2020-10-13	0	0.0008	0.0011 mg/L	Results are slightly above the high flag limits, but consistent with previous values in the last year and consistent with the duplicate sample.
	Mn	2020-10-13	0	0.350	0.367 mg/L	
D-3	FLOW	2020-10-27	0	60.1	62.0 L/s	Result is slightly above the high flag limit, but consistent with seasonal values during Fall rain.
D-9	FLOW	2020-10-27	0	6.3	7.0 L/s	Result is slightly above the high flag limit, but consistent with seasonal values during Fall rain.
DS-1	FLOW	2020-10-23	0	247.1	385.0 L/s	Result is above the high flag limit, but consistent with a significant rain event that occurred over a short period of time (< 12 hours).

Location	Analyte	Date	Low	Hi	Result		Comment
DS-3	BaCl2T	2020-10-28	0.0	245.6	283.85	kg/month	Results are above the high flag limits, but consistent with operational adjustments in treatment dosage rates made in response to increased flow and rising radium concentrations in the final discharge (DS-4).
	CaO	2020-10-23	0	1.93	2.13	tonnes/day	Results are above the high flag limits, but consistent with operational adjustements in treatment due to increased flow.
		2020-10-24	0	1.93	2.63	tonnes/day	
DS-6	FLOW	2020-10-23	0	311.2	653	L/s	Result is above the high flag limit, but consistent with a significant rain event that occurred over a short period of time (< 12 hours).
DS-3	BaCl2D	2020-11-13	0	14.4	15.1	kg/day	Results are slightly above the high flag limit, but consistent with operational adjustments made in response to slightly elevated radium in the final discharge (DS-4).
		2020-11-18	0	14.4	15.1	kg/day	

Location	Analyte	Date	Low	Hi	Result	Comment
DS-4	Ba	2020-11-17	0.030	0.090	0.093 mg/L	Result is slightly above the high flag limit, but consistent with increased treatment due to slightly elevated radium.
	TOXDM	2020-11-17	0	0	3.3 %	Result is slightly above the high flag limit. However, no mortality was observed in 100% effluent in the Rainbow Trout and no impact was observed with Ceriodaphnia Dubia. Will continue to monitor at the current semi-annual frequency.

SAMP and TOMP DATA QUALITY REPORTING
Field Blank 2020
Revision 2020-01

Denison Mines

Registry: RC8.5.4-02

	Date	pH	Acidity mg/L	TSS mg/L	Hardness mg/L as CaCO3	Uranium mg/L	Sulphate mg/L	Radium Bq/L	Barium mg/L	Cobalt mg/L	Iron mg/L	Manganese mg/L
Blank Criteria												
	SAMP [1]	-	1.0	-	1.0	0.001	0.2	0.01	0.01	0.001	0.04	0.004
	TOMP [1]	-	-	2	-	0.001	0.2	0.01	0.01	0.001	0.04	0.004
FBDST	2020.01	5.9		1	< 0.5	< 0.0005	< 0.1	< 0.007	< 0.005	< 0.0005	< 0.02	< 0.002
FBDST2	2020.01	5.9	1.0									
FBDST	2020.02	6.0		1	< 0.5	< 0.0005	< 0.1	< 0.007	< 0.005	< 0.0005	< 0.02	< 0.002
FBDST	2020.03	6.6		1	< 0.5	< 0.0005	< 0.1	< 0.007	< 0.005	< 0.0005	< 0.02	< 0.002
FBDST	2020.04	5.9		1	< 0.5	< 0.0005	< 0.1	< 0.007	< 0.005	< 0.0005	< 0.02	< 0.002
FBDST2	2020.04	5.9	**3.0**									
FBDST	2020.05	5.8		1	< 0.5	< 0.0005	< 0.1	< 0.007	< 0.005	< 0.0005	< 0.02	< 0.002
FBDST	2020.06	7.2		1	< 0.5	< 0.0005	< 0.1	< 0.007	< 0.005	< 0.0005	< 0.02	< 0.002
FBDST	2020.07	7.1		1	< 0.5	< 0.0005	< 0.1	0.008	< 0.005	< 0.0005	< 0.02	< 0.002
FBDST2	2020.07	7.2	1.0									
FBDST	2020.08	6.3		1	< 0.5	< 0.0005	0.2	< 0.007	< 0.005	< 0.0005	< 0.02	< 0.002
FBDST	2020.09	6.8		1	< 0.5	< 0.0005	< 0.1	< 0.007	< 0.005	< 0.0005	< 0.02	< 0.002
FBDST	2020.10	6.8		1	< 0.5	< 0.0005	< 0.1	< 0.007	< 0.005	< 0.0005	< 0.02	< 0.002
FBDST2	2020.10	5.9	**2.0**									
FBDST	2020.11	6.8		1	< 0.5	< 0.0005	< 0.1	< 0.007	< 0.005	< 0.0005	< 0.02	< 0.002
FBDST	2020.12	7.0		1	< 0.5	< 0.0005	< 0.1	< 0.007	< 0.005	< 0.0005	< 0.02	< 0.002
Count		16	4	12	12	12	12	12	12	12	12	12
# Exceedances		0	1	0	0	0	0	0	0	0	0	0
Average		6.4	1.8	1	< 0.5	< 0.0005	0.1	0.007	< 0.005	< 0.0005	< 0.02	< 0.002
Max		7.2	3.0	1	< 0.5	< 0.0005	0.2	0.008	< 0.005	< 0.0005	< 0.02	< 0.002
Min		5.8	1.0	1	< 0.5	< 0.0005	0.1	0.007	< 0.005	< 0.0005	< 0.02	< 0.002

[1] ield criteria taken from Table 6.2 of the Cycle 5 Study Design for SRWMP, SAMP and TOMP (Minnow, 2019)

Bold Indicates an exceedance of the Blank Criteria

Issued by: Mark Smith, Environmental Manager

Issued on: January 01, 2020
Expires on: January 01, 2020

SAMP and TOMP DATA QUALITY REPORTING
Field Precision 2020
Revision 2020-01

Denison Mines

Registry: RC8.5.4-02

Location	Date	pH	TSS mg/L	Hardness mg/L	Sulphate mg/L	Radium (total) Bq/L	Uranium mg/L	Barium mg/L	Cobalt mg/L	Iron mg/L	Manganese mg/L
D-2	2020.01	7.1	2	202.0	130.0	0.209	0.0200	0.704	0.0005	0.47	0.138
BSDST		7.1	2	216.0	130.0	0.255	0.0209	0.708	0.0005	0.48	0.142
variance		0%	0%	7%	0%	20%	4%	1%	0%	2%	3%
D-2	2020.02	7.0	1	158.0	97.0	0.272	0.0150	0.740	< 0.0005	0.33	0.103
BSDST		7.0	1	156.0	100.0	0.270	0.0150	0.814	< 0.0005	0.35	0.101
variance		0%	0%	1%	3%	1%	0%	10%	0%	6%	2%
D-2	2020.03	7.0	1	167.0	110.0	0.253	0.0161	0.686	< 0.0005	0.46	0.108
BSDST		7.0	2	167.0	110.0	0.266	0.0165	0.686	< 0.0005	0.46	0.102
variance		0%	**67%**	0%	0%	5%	2%	0%	0%	0%	6%
D-2	2020.04	6.8	1	137.0	89.0	0.346	0.0105	1.130	< 0.0005	0.44	0.118
BSDST		6.8	2	136.0	89.0	0.367	0.0108	1.110	< 0.0005	0.44	0.116
variance		0%	**67%**	1%	0%	6%	3%	2%	0%	0%	2%
D-2	2020.05	7.3	1	222.0	170.0	0.155	0.0277	0.419	0.0006	0.28	0.296
BSDST		7.3	1	226.0	160.0	0.177	0.0288	0.445	0.0006	0.29	0.305
variance		0%	0%	2%	6%	13%	4%	6%	0%	4%	3%
D-2	2020.06	7.7	1	188.0	140.0	0.139	0.0228	0.496	< 0.0005	0.18	0.183
BSDST		7.7	1	196.0	140.0	0.140	0.0228	0.470	< 0.0005	0.15	0.171
variance		0%	0%	4%	0%	1%	0%	5%	0%	18%	7%
D-2	2020.07	7.4	< 1	266.0	180.0	0.072	0.0293	0.264	< 0.0005	0.14	0.130
BSDST		7.4	2	259.0	180.0	0.081	0.0293	0.209	< 0.0005	0.13	0.125
variance		0%	**67%**	3%	0%	12%	0%	**23%**	0%	7%	4%
D-2	2020.08	7.4	1	252.0	190.0	0.037	0.0324	0.142	< 0.0005	0.09	0.067
BSDST		7.4	1	256.0	190.0	0.031	0.0332	0.143	< 0.0005	0.09	0.059
variance		0%	0%	2%	0%	18%	2%	1%	0%	0%	13%
D-2	2020.09	7.2	2	285.0	200.0	0.102	0.0370	0.148	< 0.0005	0.17	0.134
BSDST		7.2	2	287.0	200.0	0.100	0.0374	0.155	< 0.0005	0.18	0.137
variance		0%	0%	1%	0%	2%	1%	5%	0%	6%	2%

Issued by: Mark Smith, Environmental Manager

Issued on: January 01, 2020
Expires on: December 31, 2020

Location	Date	pH	TSS	Hardness	Sulphate	Radium (total)	Uranium	Barium	Cobalt	Iron	Manganese
			mg/L	mg/L	mg/L	Bq/L	mg/L	mg/L	mg/L	mg/L	mg/L
D-2	2020.10	7.3	2	282.0	210.0	0.199	0.0430	0.269	0.0011	0.33	0.367
BSDST		7.3	1	283.0	200.0	0.227	0.0436	0.235	0.0010	0.30	0.361
variance		0%	**67%**	0%	5%	13%	1%	13%	10%	10%	2%
D-2	2020.11	7.2	< 1			0.166		0.435			
BSDST		7.2	1			0.183		0.426			
variance		0%	0%			10%		2%			
D-2	2020.11	7.2	2	224.0	170.0	0.105	0.0331	0.504	0.0009	0.37	0.246
BSDST		7.2	1	217.0	160.0	0.129	0.0328	0.486	0.0008	0.37	0.238
variance		0%	**67%**	3%	6%	**21%**	1%	4%	12%	0%	3%
D-2	2020.12	7.2	2	194.0	130.0	0.194	0.0303	0.543	0.0005	0.24	0.146
BSDST		7.2	1	205.0	130.0	0.219	0.0299	0.539	0.0005	0.25	0.155
variance		0%	**67%**	6%	0%	12%	1%	1%	0%	4%	6%
Count		13	13	12	12	13	12	13	12	12	12
Average		0%	31%	2%	2%	10%	2%	6%	2%	5%	4%
Max		0%	67%	7%	6%	21%	4%	23%	12%	18%	13%
Min		0%	0%	0%	0%	1%	0%	0%	0%	0%	2%
Criteria[1]		20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
# Exceedances		0	6	0	0	1	0	1	0	0	0

[1] SAMP and TOMP field precision criteria taken from Table 2.11 State of The Environment Report (SOE) (Minnow, 2011)

Bold Indicates an exceedance of the field precision criteria

SAMP and TOMP DATA QUALITY REPORTING
Field Blank
Revision 2020.01

Report Form: RF8.5.4-01

Date			Acidity	Sulphate	pHF	Iron
			mg/L as CaCO3	mg/L		mg/L
Blank Criteria		TOMP [1]	2			0.04
2020.08	FBD-GW2		**4.0**	0.1	6.5	< 0.02
2020.08	FBD-GW4		**3.0**	0.2	6.4	< 0.02
2020.08	FBD-GW3		1.0	< 0.1	6.3	0.02
Count			3	3	3	3
# Exceedances			**2**	0	0	0
Average			3	0.1	6.4	0.02
Max			4	0.2	6.5	0.02
Min			1	0.1	6.3	0.02

[1] Field criteria taken from Table 6.2 of the Cycle 5 Study Design for SRWMP, SAMP and TOMP (Minnow, 2019)

Bold Indicates an exceedance of the Blank Criteria

Issued on: January 01, 2020
Expires on: December 31, 2020

SAMP and TOMP DATA QUALITY REPORTING
Groundwater Field Precision
Revision 2020.01

Denison Mines

Registry: RF8.5.4-02

Location	Date	pHF	Sulphate	Acidity	Iron
			mg/L	mg/L	mg/L
98-15A	2020.08	5.9	2800.0	1170.0	718.00
BSD-GW2		5.9	2400.0	1160.0	654.00
variance		1%	15%	1%	9%
BH91 DG4B	2020.08	6.3	780.0	2.0	21.20
BSD-GW3		6.3	720.0	< 1.0	20.10
variance		0%	8%	**67%**	5%
BH91 SG2A	1900.01	6.4	4500.0	2420.0	1320.00
BSD-GW4		6.4	4500.0	2407.0	1340.00
variance		**0%**	**0%**	**1%**	**2%**
Count		3	3	3	3
Average		0%	8%	23%	5%
Min		1%	15%	67%	9%
Max		0%	0%	1%	2%
Criteria1		20%	20%	20%	20%
# Exceedances		0	0	**1**	0

[1] Field criteria taken from Table 6.2 of the Cycle 5 Study Design for SRWMP, SAMP and TOMP (Minnow, 2019)

Issued on: January 01, 2020
Expires on: December 31, 2020

APPENDIX IV
Water Quality Results

Denison Mines Inc. Elliot Lake Division
2020 Denison Tailings Management Area
Groundwater Performance Monitoring Results

Station: BH91 D1A 218.00 ft

Parameter	Elevation[A]	Field pH	Sulphate	Acidity	Iron
Units	m	pH units	mg/L	mg/L	mg/L
2016	360.60	6.8	790.0	<1	32
2017	363.16	7.3	830.0	<1	33.6
2018	359.89	6.9	770.0	<1	22.2
2019	360.41	No sample collected (no recharge)			
2020	360.74	6.9	780	<1	27.3

Station: BH91 D1B 149.20 ft

Parameter	Elevation[A]	Field pH	Sulphate	Acidity	Iron
Units	m	pH units	mg/L	mg/L	mg/L
2016	360.75	7.6	570.0	<1	0.02
2017	363.67	7.3	620.0	<1	1.73
2018	360.34	No sample collected (no recharge)			
2019	360.96	No sample collected (no recharge)			
2020	361.24	7.4	680	<1	0.02

Station: BH91 D3A 159.00 ft

Parameter	Elevation[A]	Field pH	Sulphate	Acidity	Iron
Units	m	pH units	mg/L	mg/L	mg/L
2016	361.07	6.5	1800.0	223	190
2017	363.62	6.6	1600.0	176	190
2018	361.17	6.6	1700.0	209	205
2019	361.37	No sample collected (no recharge)			
2020	361.78	6.6	1600	157	151

Station: BH91 D3B 69.00 ft

Parameter	Elevation[A]	Field pH	Sulphate	Acidity	Iron
Units	m	pH units	mg/L	mg/L	mg/L
2016	370.37	6.3	1300.0	245	125
2017	370.99	6.4	1400.0	215	171
2018	370.20	6.6	1500.0	204	185
2019	370.26	6.6	1400.0	228	140
2020	370.57	6.6	1600.0	207	148

Denison Mines Inc. Elliot Lake Division
2020 Denison Tailings Management Area
Groundwater Performance Monitoring Results

Station: BH91 D9A 72.20 ft

Parameter	Elevation[A]	Field pH	Sulphate	Acidity	Iron
Units	m	pH units	mg/L	mg/L	mg/L
2016	395.64	6.3	1800.0	224	189
2017	396.25	6.6	1600.0	238	223
2018	396.04	6.6	1600.0	220	202
2019	396.12	6.5	1500.0	196	201
2020	395.94	6.6	1600.0	178	199

Station: BH91 DG4B 35.80 ft

Parameter	Elevation[A]	Field pH	Sulphate	Acidity	Iron
Units	m	pH units	mg/L	mg/L	mg/L
2016	358.49	6.2	700.0	<1	10.4
2017	358.40	6.2	730.0	<1	21.9
2018	358.28	6.6	560.0	<1	13.9
2019	358.52	6.2	670.0	<1	13.8
2020	358.59	6.3	780.0	2	21.2

Denison Mines Inc. Elliot Lake Division
2020 Stanrock Tailings Management Area
Groundwater Performance Monitoring Results

BH91 SG1A 5.49 m

Parameter	Elevation	Field pH	Sulphate	Acidity	Iron
Units	m	pH units	mg/L	mg/L	mg/L
2016	387.90	4.2	4600.0	3360	1440
2017	387.98	4.0	3800.0	3110	1600
2018	387.68	4.1	2900.0	3540	875
2019	387.81	4.1	2900.0	2270	1270
2020	387.78	4.1	3200.0	2370	1050

BH91 SG2A 33.31 m

Parameter	Elevation	Field pH	Sulphate	Acidity	Iron
Units	m	pH units	mg/L	mg/L	mg/L
2016	400.48	6.0	4000.0	2260	1160
2017	401.22	6.3	4400.0	2450	1450
2018	400.96	6.4	4500.0	3140	1280
2019	400.54	No sample collected (no recharge)			
2020	400.56	6.4	4500.0	2420.0	1320.0

BH91 SG2D 4.39 m

Parameter	Elevation	Field pH	Sulphate	Acidity	Iron
Units	m	pH units	mg/L	mg/L	mg/L
2016	404.52	No sample collected (no recharge)			
2017	404.39	No sample collected (no recharge)			
2018	404.29	No sample collected (no recharge)			
2019	404.76	No sample collected (no recharge)			
2020	404.82	No sample collected (no recharge)			

Denison Mines Inc. Elliot Lake Division
2020 Stanrock Tailings Management Area
Groundwater Performance Monitoring Results

BH91 SG3A 8.78 m

Parameter	Elevation	Field pH	Sulphate	Acidity	Iron
Units	m	pH units	mg/L	mg/L	mg/L
2016	399.29	No sample collected (no recharge)			
2017	399.69	No sample collected (no recharge)			
2018	399.39	No sample collected (no recharge)			
2019	399.75	No sample collected (no recharge)			
2020	400.07	No sample collected (no recharge)			

BH91 SG3B 5.85 m

Parameter	Elevation	Field pH	Sulphate	Acidity	Iron
Units	m	pH units	mg/L	mg/L	mg/L
2016	398.81	No sample collected (no recharge)			
2017	399.22	3.9	1700.0	901.0	295.0
2018	399.01	No sample collected (no recharge)			
2019	399.43	No sample collected (no recharge)			
2020	399.72	No sample collected (no recharge)			

Denison Mines Inc. Elliot Lake Division
2020 Stanrock Tailings Management Area
Groundwater Performance Monitoring Results

BH98 15A 7.86 m

Parameter	Elevation	Field pH	Sulphate	Acidity	Iron
Units	m	pH units	mg/L	mg/L	mg/L
2016	392.24	6.0	2600.0	1130	626
2017	392.21	5.4	2400.0	1040	651
2018	392.24	6.2	2400.0	1080	601
2019	392.03	6.0	2400.0	1130	504
2020	392.24	5.9	2800.0	1170	718

BH98 16A 5.49 m

Parameter	Elevation	Field pH	Sulphate	Acidity	Iron
Units	m	pH units	mg/L	mg/L	mg/L
2016	396.15	5.7	3900.0	1880	1240
2017	396.35	5.6	4900.0	2660	2140
2018	396.43	5.7	3400.0	2060	1080
2019	396.58	5.8	3500.0	2190	1300
2020	395.68	5.7	3700.0	2050	1220

Denison Mines Inc. Elliot Lake Division
2020 Stanrock Tailings Management Area
Groundwater Performance Monitoring Results

PN ST3 P3 5.94 m

Parameter	Elevation	Field pH	Sulphate	Acidity	Iron
Units	m	pH units	mg/L	mg/L	mg/L
2016	404.17	5.9	2100.0	1030	589
2017	404.61	5.8	2800.0	1280	771
2018	404.25	5.9	3000.0	1560	767
2019	404.29	5.6	2800.0	1610	887
2020	404.32	5.8	3200.0	1930	979

PN ST3 P5 2.64 m

Parameter	Elevation	Field pH	Sulphate	Acidity	Iron
Units	m	pH units	mg/L	mg/L	mg/L
2016	404.18	3.6	2800.0	2200	1070
2017	404.08	3.2	3000.0	1850	827
2018	403.85	3.4	3200.0	1700	668
2019	404.30	3.2	3000.0	2130	1070
2020	404.33	3.3	3400.0	2050	996

PN ST3 P6 11.58 m

Parameter	Elevation	Field pH	Sulphate	Acidity	Iron
Units	m	pH units	mg/L	mg/L	mg/L
2016	404.06	6.2	5200.0	3970	2030
2017	404.54	6.0	5400.0	4050	2370
2018	404.37	6.1	5900.0	4540	2400
2019	404.14	5.9	5400.0	4430	2580
2020	404.25	5.9	7100.0	4690	2670

PN ST3 P8 20.91 m

Parameter	Elevation	Field pH	Sulphate	Acidity	Iron
Units	m	pH units	mg/L	mg/L	mg/L
2016	401.89	5.8	11000.0	9630	5810
2017	402.68	4.9	11000.0	9550	5480
2018	402.38	4.9	11000.0	9010	4790
2019	402.29	5.6	9300.0	8210	4730
2020	402.37	5.3	9500.0	7780	4770

2020 Performance Monitoring Results
Monthly Average YTD Results

BSDST

Month	FLOW	pH	SO4	TSS	Ra	Ba	Co	Fe
	L/s		mg/L	mg/L	Bq/L	mg/L	mg/L	mg/L
2020-01	97.00	7.1	130.0	2	0.255	0.708	0.0005	0.48
2020-02	133.00	7.0	100.0	1	0.270	0.814	<0.0005	0.35
2020-03	97.00	7.0	110.0	2	0.266	0.686	<0.0005	0.46
2020-04	163.00	6.8	89.0	2	0.367	1.110	<0.0005	0.44
2020-05	129.00	7.3	160.0	1	0.177	0.445	0.0006	0.28
2020-06	75.00	7.7	140.0	1	0.140	0.470	<0.0005	0.15
2020-07	9.00	7.4	180.0	2	0.081	0.209	<0.0005	0.13
2020-08	19.00	7.4	190.0	1	0.031	0.143	<0.0005	0.09
2020-09	46.00	7.2	200.0	2	0.100	0.155	<0.0005	0.18
2020-10	23.00	7.3	200.0	1	0.227	0.235	0.0010	0.30
2020-11	183.00	7.2	160.0	1	0.129	0.486	0.0008	0.37
2020-12	73.47	7.2	130.0	1	0.219	0.539	0.0005	0.25
Count	12	12	12	12	12	12	12	12
High	183.00	7.7	200.0	2	0.367	1.110	0.0010	0.48
Low	9.00	6.8	89.0	1	0.031	0.143	<0.0005	0.09
Mean	87.29	7.2	149.1	1	0.189	0.500	0.0006	0.29

Month	Mn	U
	mg/L	mg/L
2020-01	0.142	0.0209
2020-02	0.101	0.0150
2020-03	0.102	0.0165
2020-04	0.116	0.0108
2020-05	0.305	0.0288
2020-06	0.171	0.0228
2020-07	0.125	0.0293
2020-08	0.059	0.0332
2020-09	0.137	0.0374
2020-10	0.361	0.0436
2020-11	0.238	0.0328
2020-12	0.155	0.0299
Count	12	12
High	0.361	0.0436
Low	0.059	0.0108
Mean	0.168	0.0267

2020 Performance Monitoring Results
Monthly Average YTD Results

D-1: Denison TMA-1 Overflow (Influent and ETP Operations)

Month	ACID	BaCl2T	ELEV	FLOW	NaOHT	ODays	pH	SO4
	mg/L	kg/month	m	L/s	kg/month	day		mg/L
2020-01	<1	1941.00	387.19	120.10	9.00	31	7.2	70.0
2020-02		2318.00	387.11	153.79	0.00	29	7.1	
2020-03		2322.00	386.99	139.42	0.00	31	7.1	
2020-04	<1	1659.00	387.01	102.27	0.00	30	7.0	56.0
2020-05		1654.00	387.07	102.45	0.00	31	7.8	
2020-06		593.00	386.89	39.23	0.00	12	8.6	
2020-07		0.00	386.80	0.00	0.00	0		
2020-08		0.00	386.80	0.00	0.00	0		
2020-09	<1	502.90	386.90	31.63	0.00	22	7.8	53.0
2020-10	<1	1355.20	386.98	83.71	0.00	31	7.6	51.0
2020-11		2456.70	387.08	158.07	0.00	30	7.6	
2020-12		628.80	387.05	51.55	0.00	31	7.7	
Count	4	12	52	366	12	12	12	4
High	<1	2456.70	387.21	188.00	9.00	31	8.6	70.0
Low	<1	0.00	386.77	0.00	0.00	0	7.0	51.0
Mean	<1	1285.88	386.99	81.45	0.75	23	7.5	57.5

Month	Ra	Ba	Co	Fe	Mn	U
	Bq/L	mg/L	mg/L	mg/L	mg/L	mg/L
2020-01	1.755	0.073	<0.0005	0.04	0.004	0.0117
2020-02	1.677					
2020-03	1.790					
2020-04	1.724	0.069	<0.0005	0.05	0.026	0.0083
2020-05	1.495					
2020-06	1.485					
2020-09	1.631	0.070	<0.0005	0.04	0.019	0.0101
2020-10	1.493	0.075	<0.0005	0.04	0.014	0.0096
2020-11	1.436					
2020-12	1.585					
Count	10	4	4	4	4	4
High	1.790	0.075	<0.0005	0.05	0.026	0.0117
Low	1.436	0.069	<0.0005	0.04	0.004	0.0083
Mean	1.607	0.072	<0.0005	0.05	0.016	0.0099

2020 Performance Monitoring Results
Monthly Average YTD Results

D-16: Denison TMA-1 Dam 17 Seepage

Month	FLOW L/s	hard mg/L	pH	SO4 mg/L	Ra Bq/L	Ba mg/L	Co mg/L	Fe mg/L
2020-01		258.0	6.6	200.0	0.016	0.026	0.0010	4.13
2020-05	1.00	194.0	6.5	150.0	<0.007	0.021	<0.0005	0.41
2020-07	0.24	338.0	6.6	210.0	0.027	0.039	0.0046	11.50
2020-10	3.00	105.0	6.7	83.0	0.010	0.023	0.0008	0.45
Count	4	4	4	4	4	4	4	4
High	3.00	338.0	6.7	210.0	0.027	0.039	0.0046	11.50
Low	0.24	105.0	6.5	83.0	<0.007	0.021	<0.0005	0.41
Mean	1.41	223.8	6.6	160.8	0.015	0.027	0.0017	4.12

Month	Mn mg/L	U mg/L
2020-01	0.948	<0.0005
2020-05	0.473	<0.0005
2020-07	5.380	0.0007
2020-10	0.306	<0.0005
Count	4	4
High	5.380	0.0007
Low	0.306	<0.0005
Mean	1.777	0.0006

2020 Performance Monitoring Results
Monthly Average YTD Results

D-2: Denison TMA-1 Stollery Lake Settling Pond Outlet (Final Discharge)

Month	DDays	FLOW	hard	pH	SO4	TSS	TOXCD	TOXDM
	day	L/s	mg/L		mg/L	mg/L	IC25	%
2020-01	31	97.00	202.0	7.0	130.0	2		
2020-02	29	112.25	158.0	6.8	97.0	1		
2020-03	31	108.00	167.0	6.9	110.0	1		
2020-04	30	117.00	137.0	7.0	89.0	1		
2020-05	31	109.50	222.0	7.1	170.0	1		
2020-06	30	41.60	188.0	7.5	140.0	1	100	0
2020-07	31	12.25	266.0	7.2	180.0	1		
2020-08	31	13.50	252.0	7.3	190.0	1		
2020-09	30	47.96	285.0	7.3	200.0	1		
2020-10	31	76.25	282.0	7.3	210.0	1		
2020-11	30	184.88	224.0	7.3	170.0	2	100	0
2020-12	31	73.91	194.0	7.2	130.0	1		
Count	12	52	12	52	12	52	2	2
High	31	187.00	285.0	7.7	210.0	2	100	0
Low	29	9.00	137.0	6.7	89.0	<1	100	0
Mean	31	81.69	214.8	7.2	151.3	1	100	0

Month	TOXRT	Ra	Ba	Co	Fe	Mn	U
	%	Bq/L	mg/L	mg/L	mg/L	mg/L	mg/L
2020-01		0.219	0.704	0.0005	0.47	0.138	0.0200
2020-02		0.246	0.740	<0.0005	0.33	0.103	0.0150
2020-03		0.264	0.686	<0.0005	0.46	0.108	0.0161
2020-04		0.290	1.130	<0.0005	0.44	0.118	0.0105
2020-05		0.153	0.419	0.0006	0.28	0.296	0.0277
2020-06	0	0.115	0.496	<0.0005	0.18	0.183	0.0228
2020-07		0.053	0.264	<0.0005	0.14	0.130	0.0293
2020-08		0.036	0.142	<0.0005	0.09	0.067	0.0324
2020-09		0.078	0.148	<0.0005	0.17	0.134	0.0370
2020-10		0.213	0.269	0.0011	0.33	0.367	0.0430
2020-11	0	0.156	0.504	0.0009	0.37	0.246	0.0331
2020-12		0.141	0.543	0.0005	0.24	0.146	0.0303
Count	2	52	12	12	12	12	12
High	0	0.346	1.130	0.0011	0.47	0.367	0.0430
Low	0	0.025	0.142	<0.0005	0.09	0.067	0.0105
Mean	0	0.163	0.504	0.0006	0.29	0.170	0.0264

2020 Performance Monitoring Results
Monthly Average YTD Results

D-22: Denison TMA-2 ETP (Influent and ETP Operations)

Month	ACID	BaCl2T	ODays	pH	SO4	Ra	Ba	Co
	mg/L	kg/month	day		mg/L	Bq/L	mg/L	mg/L
2020-01	<1	45.30	31	6.8	81.0	0.121	0.026	<0.0005
2020-02		38.57	29	6.9		0.090		
2020-03		47.00	31	6.6		0.104		
2020-04	<1	48.88	30	6.8	16.0	0.023	0.011	<0.0005
2020-05		44.00	31	6.7		0.059		
2020-06		41.00	30	6.8		0.955		
2020-07	<1	41.00	31	6.7	31.0	1.452	0.118	0.0020
2020-08		43.00	31	6.8		0.341		
2020-09		51.10	30	6.9		0.038		
2020-10	<1	75.90	31	6.9	34.0	0.034	0.025	<0.0005
2020-11		99.20	30	6.8		0.081		
2020-12		103.20	31	6.7		0.529		
Count	4	12	12	52	4	12	4	4
High	<1	103.20	31	7.0	81.0	1.452	0.118	0.0020
Low	<1	38.57	29	6.5	16.0	0.023	0.011	<0.0005
Mean	<1	56.51	31	6.8	40.5	0.319	0.045	0.0009

Month	Fe	Mn	U
	mg/L	mg/L	mg/L
2020-01	0.70	0.223	<0.0005
2020-04	0.17	0.030	<0.0005
2020-07	29.50	4.700	0.0061
2020-10	0.34	0.107	<0.0005
Count	4	4	4
High	29.50	4.700	0.0061
Low	0.17	0.030	<0.0005
Mean	7.68	1.265	0.0019

2020 Performance Monitoring Results
Monthly Average YTD Results

D-25: Denison TMA-2 Overflow into TMA-1

Month	ACID mg/L	pH	SO4 mg/L	Ra Bq/L	Fe mg/L
2020-04	<1	7.2	35.0	0.325	0.23
2020-10	<1	7.4	80.0	0.312	0.14
Count	2	2	2	2	2
High	<1	7.4	80.0	0.325	0.23
Low	<1	7.2	35.0	0.312	0.14
Mean	<1	7.3	57.5	0.319	0.19

2020 Performance Monitoring Results
Monthly Average YTD Results

D-3: Denison TMA-2 Effluent (Final Discharge)

Month	DDays	FLOW	hard	pH	SO4	TSS	Ra	Ba
	day	L/s	mg/L		mg/L	mg/L	Bq/L	mg/L
2020-01	31	3.50	111.0	7.2	66.0	2	0.160	0.491
2020-02	29	2.25	111.0	7.0	69.0	1	0.132	0.388
2020-03	31	17.60	121.0	7.0	72.0	1	0.114	0.288
2020-04	30	37.25	35.4	7.1	22.0	1	0.107	0.225
2020-05	31	3.50	63.5	7.0	34.0	1	0.108	0.309
2020-06	30	1.20	35.6	7.1	14.0	2	0.152	0.130
2020-07	14	1.00	88.9	6.9	43.0	1	0.224	0.368
2020-08	31	2.50	104.0	7.1	55.0	1	0.209	0.409
2020-09	30	13.80	110.0	7.2	54.0	1	0.268	0.604
2020-10	31	26.75	99.3	7.1	49.0	1	0.228	0.469
2020-11	30	15.75	56.0	7.2	29.0	1	0.201	0.410
2020-12	31	4.40	65.7	7.2	36.0	1	0.219	0.598
Count	12	52	12	52	12	49	49	12
High	31	72.00	121.0	7.4	72.0	6	0.308	0.604
Low	14	0.00	35.4	6.7	14.0	<1	0.075	0.130
Mean	29	10.67	83.5	7.1	45.3	1	0.175	0.391

Month	Co	Fe	Mn	U
	mg/L	mg/L	mg/L	mg/L
2020-01	<0.0005	0.26	0.045	0.0032
2020-02	<0.0005	0.18	0.065	0.0044
2020-03	<0.0005	0.20	0.111	0.0046
2020-04	<0.0005	0.22	0.030	0.0008
2020-05	<0.0005	0.12	0.011	0.0013
2020-06	<0.0005	0.56	0.085	0.0008
2020-07	0.0007	0.50	0.085	0.0022
2020-08	<0.0005	0.09	0.010	0.0041
2020-09	<0.0005	0.14	0.019	0.0050
2020-10	<0.0005	0.12	0.018	0.0043
2020-11	<0.0005	0.26	0.027	0.0017
2020-12	<0.0005	0.30	0.054	0.0027
Count	12	12	12	12
High	0.0007	0.56	0.111	0.0050
Low	<0.0005	0.09	0.010	0.0008
Mean	0.0005	0.25	0.047	0.0029

2020 Performance Monitoring Results
Monthly Average YTD Results

D-9: Denison TMA-1 Dam 9 Seepage

Month	FLOW	hard	pH	SO4	Ra	Ba	Co	Fe
	L/s	mg/L		mg/L	Bq/L	mg/L	mg/L	mg/L
2020-01		644.0	7.0	490.0	<0.007	0.018	0.0027	1.18
2020-05	2.80	581.0	7.0	470.0	<0.007	0.020	0.0018	0.38
2020-07	1.10	914.0	6.9	740.0	0.008	0.020	0.0032	0.50
2020-10	7.00	287.0	7.0	220.0	<0.007	0.013	0.0010	0.36
Count	4	4	4	4	4	4	4	4
High	7.00	914.0	7.0	740.0	0.008	0.020	0.0032	1.18
Low	1.10	287.0	6.9	220.0	<0.007	0.013	0.0010	0.36
Mean	3.63	606.5	7.0	480.0	0.007	0.018	0.0022	0.61

Month	Mn	U
	mg/L	mg/L
2020-01	1.720	0.0194
2020-05	1.150	0.0176
2020-07	1.540	0.0197
2020-10	0.622	0.0083
Count	4	4
High	1.720	0.0197
Low	0.622	0.0083
Mean	1.258	0.0163

2020 Performance Monitoring Results
Monthly Average YTD Results

DS-1: Stanrock Moose Lake Settling Pond Outlet to Orient Lake Polishing Pond

Month	FLOW	pH	Ra
	L/s		Bq/L
2020-01	33.25	7.1	0.037
2020-02	26.00	6.9	
2020-03	58.20	7.3	
2020-04	136.25	8.1	0.039
2020-05	46.50	7.4	
2020-06	1.80	7.3	
2020-07	12.75	7.3	0.079
2020-08	1.00	7.4	
2020-09	43.00	7.3	
2020-10	92.75	7.2	0.035
2020-11	85.00	7.3	
2020-12	20.20	7.4	
Count	52	52	4
High	212.00	9.0	0.079
Low	<1.00	6.7	0.035
Mean	45.19	7.3	0.048

2020 Performance Monitoring Results
Monthly Average YTD Results

DS-16: Stanrock TMA, Seepage from Dam M at Quirke Lake Delta

Month	FLOW	hard	pH	SO4	Ra	Ba	Co	Fe
	L/s	mg/L		mg/L	Bq/L	mg/L	mg/L	mg/L
2020-03	0.30	25.6	6.6	15.0	<0.007	0.011	<0.0005	0.06
2020-06	0.00							
2020-09	0.00							
2020-10	0.10	34.9	6.7	22.0	<0.007	0.014	<0.0005	0.07
Count	4	2	4	2	2	2	2	2
High	0.30	34.9	6.7	22.0	<0.007	0.014	<0.0005	0.07
Low	0.00	25.6	6.6	15.0	<0.007	0.011	<0.0005	0.06
Mean	0.10	30.3	6.7	18.5	<0.007	0.013	<0.0005	0.06

Month	Mn	U
	mg/L	mg/L
2020-03	0.016	<0.0005
2020-10	0.016	<0.0005
Count	2	2
High	0.016	<0.0005
Low	0.016	<0.0005
Mean	0.016	<0.0005

2020 Performance Monitoring Results
Monthly Average YTD Results

DS-2: Stanrock ETP Influent

Month	ACID	FLOW	Freeboard(m)	pH	SO4	Ra	Ba	Co
	mg/L	L/s	m		mg/L	Bq/L	mg/L	mg/L
2020-01	258	57.71	1.1932	3.1	630.0	0.221	0.012	0.0972
2020-02		49.72	1.2047	3.1		0.166		
2020-03		75.81	1.1759	2.9		0.154		
2020-04	81	165.47	1.5280	3.6	200.0	0.160	0.014	0.0276
2020-05		90.65	1.5140	3.2		0.154		
2020-06		15.43	1.5327	3.0		0.216		
2020-07	169	31.32	1.4732	2.9	450.0	0.545	0.038	0.0471
2020-08		13.37	1.5658	2.8		0.756		
2020-09		60.03	1.4250	3.0		0.291		
2020-10	176	84.45	1.3967	2.8	470.0	0.228	0.012	0.0674
2020-11		93.27	1.4145	3.2		0.183		
2020-12		53.13	1.2389	3.0		0.203		
Count	4	366	363	12	4	12	4	4
High	258	226.00	2.1400	3.6	630.0	0.756	0.038	0.0972
Low	81	0.00	0.7800	2.8	200.0	0.154	0.012	0.0276
Mean	171	65.76	1.3692	3.1	437.5	0.273	0.019	0.0598

Month	Fe	Mn	U
	mg/L	mg/L	mg/L
2020-01	57.60	1.240	0.0244
2020-04	17.80	0.317	0.0080
2020-07	17.70	1.470	0.0092
2020-10	20.40	1.240	0.0182
Count	4	4	4
High	57.60	1.470	0.0244
Low	17.70	0.317	0.0080
Mean	28.38	1.067	0.0150

2020 Performance Monitoring Results
Monthly Average YTD Results

DS-3: Stanrock pH Probe Control (ETP Operations)

Month	BaCl2T kg/month	CaOT tonnes/mth.	NaOHT kg/month	ODays day	pH
2020-01	42.20	12.20	0.00	14	10.9
2020-02	30.30	9.18	0.00	11	10.7
2020-03	72.00	18.69	0.00	17	10.7
2020-04	196.33	25.85	0.00	28	10.6
2020-05	78.00	17.00	0.00	18	10.8
2020-06	20.00	2.00	0.00	4	10.7
2020-07	25.00	4.40	0.00	8	10.8
2020-08	11.00	2.40	0.00	3	10.8
2020-09	119.50	12.40	0.00	15	10.8
2020-10	283.85	25.11	0.00	23	10.7
2020-11	254.60	20.10	0.00	26	10.9
2020-12	88.30	6.90	0.00	16	10.8
Count	12	12	12	12	279
High	283.85	25.85	0.00	28	12.0
Low	11.00	2.00	0.00	3	9.8
Mean	101.76	13.02	0.00	15	10.8

2020 Performance Monitoring Results
Monthly Average YTD Results

DS-4: Stanrock Orient Lake Polishing Pond Outlet (Final Discharge)

Month	DDays	FLOW	hard	pH	SO4	TSS	TOXCD	TOXDM
	day	L/s	mg/L		mg/L	mg/L	IC25	%
2020-01	31	29.00	319.0	7.0	250.0	2		
2020-02	29	19.50	268.0	6.9	240.0	2		
2020-03	31	59.40	306.0	6.9	250.0	1		
2020-04	30	150.50	153.0	7.1	130.0	1		
2020-05	31	31.75	275.0	7.0	210.0	1		
2020-06	30	2.20	266.0	7.0	230.0	1	100	0
2020-07	31	5.50	328.0	7.0	240.0	1		
2020-08	31	2.25	303.0	7.0	240.0	1		
2020-09	30	44.40	318.0	7.1	240.0	1		
2020-10	31	81.00	305.0	7.1	230.0	1		
2020-11	30	86.00	247.0	7.1	220.0	2	100	3
2020-12	31	21.20	267.0	7.1	210.0	1		
Count	12	52	12	52	12	52	2	2
High	31	232.00	328.0	7.4	250.0	3	100	3
Low	29	1.00	153.0	6.7	130.0	<1	100	0
Mean	31	43.42	279.6	7.0	224.2	1	100	2

Month	TOXRT	Ra	Ba	Co	Fe	Mn	U
	%	Bq/L	mg/L	mg/L	mg/L	mg/L	mg/L
2020-01		0.049	0.073	<0.0005	0.18	0.040	0.0020
2020-02		0.057	0.062	<0.0005	0.08	0.042	0.0028
2020-03		0.056	0.062	<0.0005	0.11	0.045	0.0030
2020-04		0.041	0.071	<0.0005	0.23	0.035	0.0007
2020-05		0.066	0.068	<0.0005	0.07	0.039	0.0031
2020-06	0	0.108	0.066	<0.0005	0.07	0.031	0.0028
2020-07		0.137	0.054	<0.0005	0.04	0.085	0.0022
2020-08		0.136	0.051	<0.0005	0.10	0.050	0.0053
2020-09		0.144	0.047	<0.0005	0.15	0.030	0.0091
2020-10		0.102	0.043	<0.0005	0.11	0.019	0.0089
2020-11	0	0.060	0.093	0.0005	0.27	0.029	0.0028
2020-12		0.065	0.115	<0.0005	0.14	0.032	0.0029
Count	2	52	12	12	12	12	12
High	0	0.171	0.115	0.0005	0.27	0.085	0.0091
Low	0	0.028	0.043	<0.0005	0.04	0.019	0.0007
Mean	0	0.086	0.067	0.0005	0.13	0.040	0.0038

2020 Performance Monitoring Results
Monthly Average YTD Results

DS-5: Stanrock Orient Creek Discharge into Moose Lake

Month	CONDF	FLOW	Head(ft)	pH
	µmho/cm	L/s	ft	
2020-01	117.9			4.1
2020-04	39.8	17.44	0.3	4.6
2020-07		0.00	0.0	
2020-10	84.8	13.78	0.3	4.0
Count	4	4	3	4
High	117.9	17.44	0.3	4.6
Low	39.8	0.00	0.0	4.0
Mean	80.8	10.41	0.2	4.2

2020 Performance Monitoring Results
Monthly Average YTD Results

DS-6: Stanrock Moose Lake Settling Pond Narrows, Upstream of DS-1

Month	FLOW L/s	pH
2020-01	45.50	7.3
2020-02	19.00	7.8
2020-03	63.20	7.4
2020-04	181.00	8.0
2020-05	46.50	7.9
2020-06	0.00	
2020-07	12.75	7.8
2020-08	0.00	
2020-09	56.00	7.4
2020-10	90.00	7.5
2020-11	115.25	7.6
2020-12	17.20	7.9
Count	52	52
High	292.00	8.8
Low	0.00	7.0
Mean	52.35	7.6

2020 Performance Monitoring Results
Monthly Average YTD Results

FBDST

Month	pH	SO4	TSS	Ra	Ba	Co	Fe	Mn
		mg/L	mg/L	Bq/L	mg/L	mg/L	mg/L	mg/L
2020-01	5.9	<0.1	<1	<0.007	<0.005	<0.0005	<0.02	<0.002
2020-02	6.0	<0.1	<1	<0.007	<0.005	<0.0005	<0.02	<0.002
2020-03	6.6	<0.1	<1	<0.007	<0.005	<0.0005	<0.02	<0.002
2020-04	5.9	<0.1	<1	<0.007	<0.005	<0.0005	<0.02	<0.002
2020-05	5.8	<0.1	<1	<0.007	<0.005	<0.0005	<0.02	<0.002
2020-06	7.2	<0.1	<1	<0.007	<0.005	<0.0005	<0.02	<0.002
2020-07	7.1	<0.1	<1	0.008	<0.005	<0.0005	<0.02	<0.002
2020-08	6.3	0.2	<1	<0.007	<0.005	<0.0005	<0.02	<0.002
2020-09	6.8	<0.1	1	<0.007	<0.005	<0.0005	<0.02	<0.002
2020-10	6.8	<0.1	<1	<0.007	<0.005	<0.0005	<0.02	<0.002
2020-11	7.0	<0.1	<1	<0.007	<0.005	<0.0005	<0.02	<0.002
2020-12	7.0	<0.1	<1	<0.007	<0.005	<0.0005	<0.02	<0.002
Count	12	12	12	12	12	12	12	12
High	7.2	0.2	1	0.008	<0.005	<0.0005	<0.02	<0.002
Low	5.8	<0.1	<1	<0.007	<0.005	<0.0005	<0.02	<0.002
Mean	6.5	0.1	1	0.007	<0.005	<0.0005	<0.02	<0.002

Month	U
	mg/L
2020-01	<0.0005
2020-02	<0.0005
2020-03	<0.0005
2020-04	<0.0005
2020-05	<0.0005
2020-06	<0.0005
2020-07	<0.0005
2020-08	<0.0005
2020-09	<0.0005
2020-10	<0.0005
2020-11	<0.0005
2020-12	<0.0005
Count	12
High	<0.0005
Low	<0.0005
Mean	<0.0005

2020 Performance Monitoring Results
Monthly Average YTD Results

DS-11: Stanrock Seepage of Dam A

Month	CONDF µmho/cm	FLOW L/s	pH
2020-01	339.8	0.32	6.1
2020-04	188.1	0.67	6.8
2020-07	653.0	0.22	6.5
2020-10	300.6	0.62	6.7
Count	4	4	4
High	653.0	0.67	6.8
Low	188.1	0.22	6.1
Mean	370.4	0.46	6.5

2020 Performance Monitoring Results
Monthly Average YTD Results

DS-12: Stanrock Seepage from Dam B

Month	CONDF µmho/cm	FLOW L/s	pH
2020-01	539.0	0.40	3.8
2020-04	233.4	4.00	3.5
2020-07		0.00	
2020-10	348.5	0.95	4.3
Count	4	4	4
High	539.0	4.00	4.3
Low	233.4	0.00	3.5
Mean	373.6	1.34	3.9

2020 Performance Monitoring Results
Monthly Average YTD Results

DS-13: Stanrock Seeoage from Dam C

Month	CONDF µmho/cm	FLOW L/s	pH
2020-01	654.0	0.03	6.7
2020-04	273.7	0.20	7.0
2020-07	936.0	0.04	6.6
2020-10	432.1	0.16	6.7
Count	4	4	4
High	936.0	0.20	7.0
Low	273.7	0.03	6.6
Mean	574.0	0.11	6.7

2020 Performance Monitoring Results
Monthly Average YTD Results

DS-14: Stanrock Seepage from Dam D

Month	CONDF µmho/cm	FLOW L/s	pH
2020-01		0.00	
2020-04		0.00	
2020-07		0.00	
2020-10		0.00	
Count	4	4	4
High		0.00	
Low		0.00	
Mean		0.00	

2020 Performance Monitoring Results
Monthly Average YTD Results

ST-1: Stanrock Downstream of Dam G

Month	CONDF µmho/cm	pH
2020-01	65.9	4.5
2020-04	37.1	5.3
2020-07		
2020-10	62.9	4.8
Count	4	4
High	65.9	5.3
Low	37.1	4.5
Mean	55.3	4.9

2020 Performance Monitoring Results
Monthly Average YTD Results

ST-1A: Stanrock Seepage from Dam J at Toe of Dam

Month	CONDF µmho/cm	FLOW L/s	pH
2020-01		0.00	
2020-04	29.9	<1.00	5.7
2020-07		0.00	
2020-10	113.8	0.15	4.1
Count	4	4	4
High	113.8	<1.00	5.7
Low	29.9	0.00	4.1
Mean	71.8	0.29	4.9

2020 Performance Monitoring Results
Monthly Average YTD Results

ST-3: Stanrock Downstream of Dam G

Month	CONDF µmho/cm	pH
2020-01	648.0	3.7
2020-04	233.1	3.6
2020-07		
2020-10	672.0	3.3
Count	4	4
High	672.0	3.7
Low	233.1	3.3
Mean	517.7	3.5

2020 Performance Monitoring Results
Monthly Average YTD Results

ST-3A: Stanrock Dam G Toe of Dam

Month	CONDF µmho/cm	FLOW L/s	pH
2020-01	970.0	0.17	4.2
2020-04	526.0	0.20	5.0
2020-07	1880.0	0.25	3.3
2020-10	896.0	0.19	4.0
Count	4	4	4
High	1880.0	0.25	5.0
Low	526.0	0.17	3.3
Mean	1068.0	0.20	4.1

2020 Performance Monitoring Results
Monthly Average YTD Results

ST-4: Stanrock within Quirke Lake Delta

Month	CONDF µmho/cm	hard mg/L	pH	SO4 mg/L	Ra Bq/L	Ba mg/L	Co mg/L	Fe mg/L
2020-02	57.9	34.8	7.0	27.0	0.026	0.046	<0.0005	0.07
2020-05	71.2	38.4	6.9	26.0	0.021	0.039	<0.0005	0.03
2020-08	72.3	37.2	6.9	27.0	0.038	0.046	<0.0005	0.03
2020-10	76.4	34.9	7.0	25.0	0.028	0.044	<0.0005	0.02
Count	4	4	4	4	4	4	4	4
High	76.4	38.4	7.0	27.0	0.038	0.046	<0.0005	0.07
Low	57.9	34.8	6.9	25.0	0.021	0.039	<0.0005	0.02
Mean	69.4	36.3	7.0	26.3	0.028	0.044	<0.0005	0.04

Month	Mn mg/L	U mg/L
2020-02	0.007	0.0012
2020-05	0.006	0.0012
2020-08	0.006	0.0011
2020-10	0.006	0.0014
Count	4	4
High	0.007	0.0014
Low	0.006	0.0011
Mean	0.006	0.0012

2020 Performance Monitoring Results
Monthly Average YTD Results

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
2020-02	11.8	8.8	5.9	0.8	<0.007	0.008	<0.0005	1.17
2020-05	11.0	7.0	6.4	0.8	<0.007	0.008	0.0017	1.63
2020-08	15.9	10.0	6.0	0.5	<0.007	0.009	0.0008	1.33
2020-11	11.6	6.0	6.4	1.2	<0.007	<0.005	<0.0005	0.36
Count	4	4	4	4	4	4	4	4
High	15.9	10.0	6.4	1.2	<0.007	0.009	0.0017	1.63
Low	11.0	6.0	5.9	0.5	<0.007	<0.005	<0.0005	0.36
Mean	12.6	7.9	6.2	0.8	<0.007	0.008	0.0009	1.12
High Limit				128.0	0.469	1.000	0.0025	2.49
Low Limit			5.3					
Lim Ex	0	0	0	0	0	0	0	3
Frequency	0%	0%	0%	0%	0%	0%	0%	75%
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
2020-02	0.036	<0.0005
2020-05	0.135	<0.0005
2020-08	0.060	<0.0005
2020-11	0.014	<0.0005
Count	4	4
High	0.135	<0.0005
Low	0.014	<0.0005
Mean	0.061	<0.0005
High Limit	0.841	0.0150
Low Limit		
Lim Ex	0	0
Frequency	0%	0%
10x Lim Ex	0	0
Frequency	0%	0%

2020 Performance Monitoring Results
Monthly Average YTD Results

SR-17 Unnamed Creek Drain Lake 3 @ Hwy 108

Month	DOC	hard	pHF	SO4	Ra	Ba	Co	Fe
	mg/L	mg/L		mg/L	Bq/L	mg/L	mg/L	mg/L
2020-02	8.1	10.7	5.8	2.1	<0.007	0.021	0.0009	0.77
2020-05	8.6	9.7	6.4	2.1	<0.007	0.022	0.0015	1.68
2020-08	9.7	16.5	6.2	0.6	<0.008	0.027	0.0023	3.72
2020-11	8.1	6.0	6.5	2.5	<0.007	0.010	<0.0005	0.35
Count	4	4	4	4	4	4	4	4
High	9.7	16.5	6.5	2.5	<0.008	0.027	0.0023	3.72
Low	8.1	6.0	5.8	0.6	<0.007	0.010	<0.0005	0.35
Mean	8.6	10.7	6.2	1.8	<0.007	0.020	0.0013	1.63
High Limit				128.0	0.469	1.000	0.0025	2.49
Low Limit			5.3					
Lim Ex	0	0	0	0	0	0	0	3
Frequency	0%	0%	0%	0%	0%	0%	0%	75%
10x Lim Ex	0	0	0	0	0	0	0	0
Frequency	0%	0%	0%	0%	0%	0%	0%	0%

Month	Mn	U
	mg/L	mg/L
2020-02	0.062	<0.0005
2020-05	0.079	<0.0005
2020-08	0.133	<0.0005
2020-11	0.021	<0.0005
Count	4	4
High	0.133	<0.0005
Low	0.021	<0.0005
Mean	0.074	<0.0005
High Limit	0.841	0.0150
Low Limit		
Lim Ex	0	0
Frequency	0%	0%
10x Lim Ex	0	0
Frequency	0%	0%

2020 Performance Monitoring Results
Monthly Average YTD Results