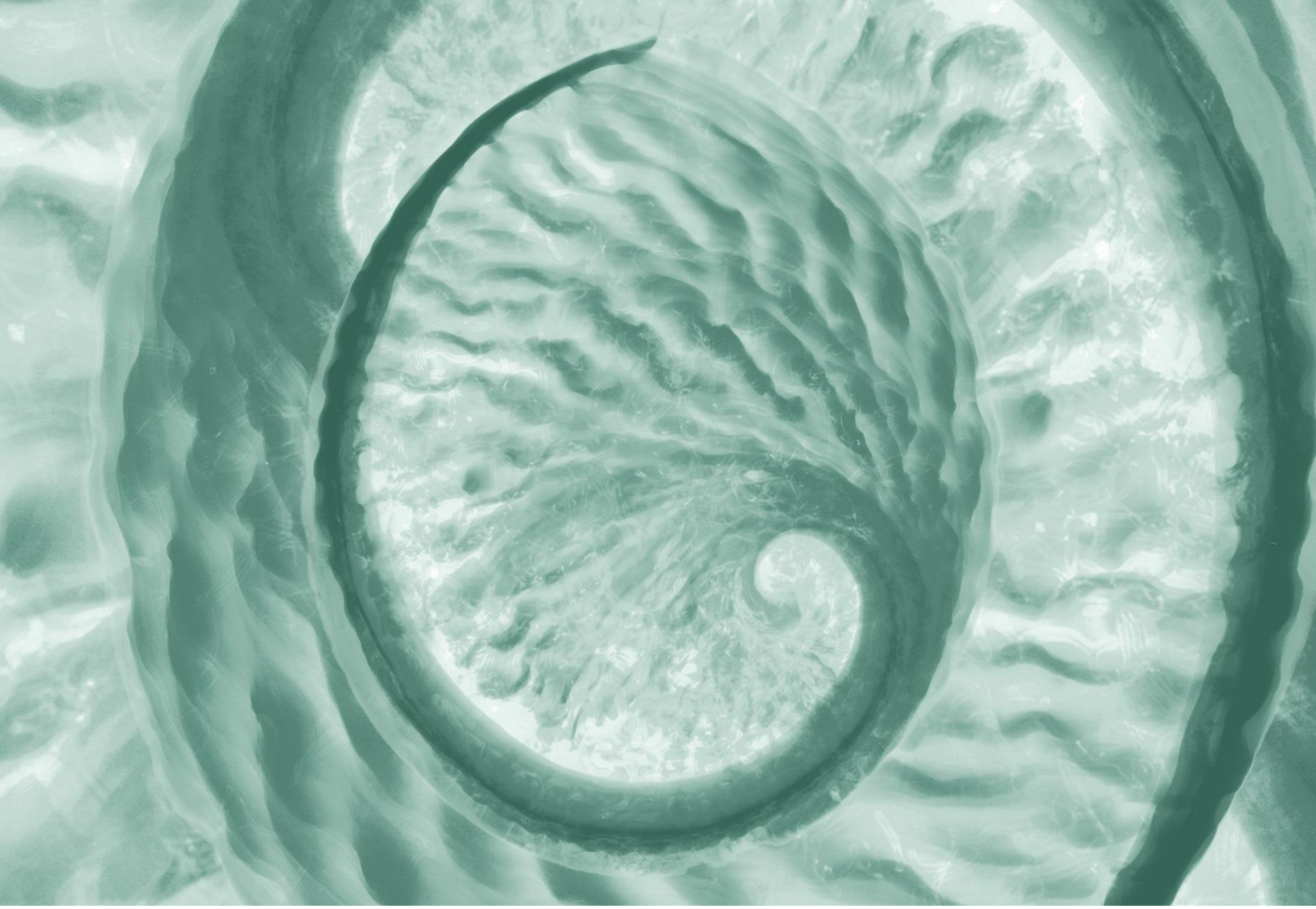

Diavik Diamond Mine

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2019 Environmental Air Quality Monitoring Report – Dustfall

July 2020

Project No.: 0207514-0022

The business of sustainability

ERM

July 2020

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2019 Environmental Air Quality Monitoring Report – Dustfall

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EXECUTIVE SUMMARY

Diavik Diamond Mines (2012) Inc. has been collecting and reporting air quality related data since initial site construction in 2001. In June of 2013, Diavik Diamond Mines submitted an Environmental Air Quality Monitoring Plan (EAQMP) to the Environmental Monitoring Advisory Board. The components of the EAQMP include dust deposition (dustfall) monitoring (as part of the Aquatic Effects Monitoring Program (AEMP)), a snow core program (as part of the AEMP), reporting to the National Pollutant Release Inventory (NPRI), and reporting to the national greenhouse gas reporting program (GHGRP). This report presents an updated Environmental Air Quality Monitoring Report for the Diavik Diamond Mine for the calendar year 2019.

In 2019, dustfall was monitored at 14 dustfall gauges and 31 snow survey stations located at varying distances and directions from the mine. Snow water chemistry was measured at 23 of the snow survey stations and compared to effluent quality criteria (EQC) set out in the Wek'èezhìi Land and Water Board (WLWB) Water Licence W2015L2-0001. The comparison between snow water chemistry and the EQC is made only as a general performance indicator; the EQC apply to effluent water quality and not to snow water.

Annual dustfall estimated from each of the 14 dustfall gauges ranged from 65 to 982 $mg/dm^2/y$ in 2019. The annualized dustfall rates estimated from the 2019 snow survey data ranged from 12 to 1,114 $mg/dm^2/y$. All of the annualized dustfall rates estimated from dustfall gauges and snow surveys were less than 5.27 $mg/dm^2/day$ (1,922 $mg/dm^2/y$), the non-residential Alberta Ambient Air Quality Guideline for dustfall (Alberta Environment and Parks 2019). Observed dustfall rates at the Dust 3, Dust 10, Dust 11, and SS1-1 stations were higher than 1.77 $mg/dm^2/day$ (645 $mg/dm^2/y$), the residential Alberta Ambient Air Quality Guideline for dustfall. This Guideline is used only as a general performance indicator. Dustfall rates in 2019 were generally within the range of historical data collected for the Mine.

Because the dustfall gauges continuously collect dust throughout the year, and the snow surveys are only representative of dustfall accumulated over the snow cover period, the reported annual dustfall results from the dustfall gauges are expected to provide a better estimate of annual dustfall compared to snow survey results for similar geographic areas. However, results obtained from both methods showed similar spatial patterns, with dustfall generally decreasing with distance away from the Mine.

Snow water chemistry analysis of interest included those variables with effluent quality criteria (EQC; i.e., aluminum, ammonia, arsenic, cadmium, chromium, copper, lead, nickel, nitrite, and zinc). All 2019 sample concentrations were less than their associated reference levels as specified by the "maximum concentration of any grab sample" in Water Licence W2015L2-0001.

The Mine reported criteria air contaminant (CAC) emissions as part of the annual NPRI submission and emissions were estimated using published emission factors. Compared to 2018, 2019 emissions of carbon monoxide (CO) and volatile organic compounds (VOC) decreased by 14% and 19% respectively. Sulphur dioxide (SO_2) emissions in 2019 decreased by 9% (5.2 tonnes total SO_2 emissions) relative to 2018 (5.7 tonnes total SO_2 emissions). The decrease in SO_2 emissions was due to decreased waste incineration and decreased waste oil burned in 2019. NO_x emissions were relatively consistent between 2018 and 2019. There was a decrease of 13% to 19% in total particulate matter (TPM), particulate matter ≤ 10 µm in diameter (PM_{10}) and particulate matter ≤ 2.5 µm in diameter ($PM_{2.5}$) emissions in 2019 compared to 2018 due to decreases in road traffic, incineration, and waste oil burned, and due to an increase in the number of days with more than 2 mm of precipitation.

The Mine reported greenhouse gas (GHG) emissions as part of the annual national Greenhouse Gas Emissions Reporting Program (GHGRP) submission, and carbon dioxide equivalent (CO_2e) emissions were estimated using published emission factors and 100-year global warming potential (GWP) ratios. Starting for 2017 reporting, the GHGRP was changed to require all facilities to report if they emit the equivalent of 10,000 tonnes of CO_2e (tCO_2e) or more per year, compared to the previous 50,000 tCO_2e per year threshold.

Mine GHG emissions of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) totaled 200,883 tCO_2e in 2019, a 8.3% decrease from 2018 due to decreased diesel usage for heavy mine equipment, boilers, and furnaces. GHG emissions at the Mine in 2019 were from stationary equipment fuel combustion (75%) and mobile equipment fuel combustion (25%). In 2019, the Mine's 9.2 megawatt wind farm helped to reduce the Mine's GHG footprint by generating 17.5 gigawatt-hours of electricity which saved 4.1 million litres of diesel fuel and thereby prevented the direct release of 10,991 tCO_2e.

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ACRONYMS AND ABBREVIATIONS

Terminology used in this document is defined where it is first used. The following list will assist readers who may choose to review only portions of the document.

AEMP	Aquatic Effects Monitoring Program
BC	British Columbia
BC ENV	British Columbia Ministry of Environment and Climate Change
CAC	Criteria air contaminants
CEPA	*Canadian Environmental Protection Act*
CH_4	Methane
cm	Centimetre
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
d	Day
DDMI	Diavik Diamond Mines (2012) Inc.
dm^2	Square decimetre
Dustfall	Dust deposition
EA	Environmental Agreement
EAQMP	Environmental Air Quality Monitoring Plan
ECCC	Environment and Climate Change Canada
EMAB	Environmental Monitoring Advisory Board
EMS	Environmental Management System
ENR	Department of Environment and Natural Resources
EQC	Effluent quality criteria
ERM	ERM Consultants Canada Ltd.
GHG	Greenhouse gas
GHGRP	Greenhouse Gas Emissions Reporting Program
GNWT	Government of the Northwest Territories
GWP	Global warming potentials
L	Litre
m	Metre
Maxxam	Maxxam Analytics

mg	Milligram
N_2O	Nitrous oxide
NH_3	Ammonia
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NPRI	National Pollutant Release Inventory
O_3	Ozone
PM_{10}	Particulate matter ≤ 10 µm in diameter
$PM_{2.5}$	Particulate matter ≤ 2.5 µm in diameter
QA/QC	Quality assurance and quality control
SO_2	Sulphur dioxide
SOP	Standard operating procedure
SO_x	Oxides of sulphur
t	Tonne (1,000 kg)
tCO_2e	Tonne of carbon dioxide equivalent
the Mine	Diavik Diamond Mine
VOC	Volatile organic compounds
WLWB	Wek’èezhìi Land and Water Board
µg	Microgram
y	Year

1. INTRODUCTION

Diavik Diamond Mines (2012) Inc. (DDMI) has been collecting and reporting air quality related data since initial site construction in 2001. In June of 2013, DDMI submitted an Environmental Air Quality Monitoring Plan (EAQMP) to the Environmental Monitoring Advisory Board (EMAB). The EAQMP was developed to address Article 7.2 (a) of the Environmental Agreement (EA; DDMI 2000). The EAQMP and its results are not part of a Regulatory Instrument but are subject to review by EMAB and the Parties identified under EA Article 7.5.

The purpose of this report is to provide a summary of the 2019 air quality monitoring and emissions data in relation to the Diavik Diamond Mine's (hereafter referred to as the Mine) operational activities. This *2019 Environmental Air Quality Monitoring Report* summarizes air quality observations from the following programs conducted at the Mine:

- Dustfall Monitoring as part of the Aquatic Effects Monitoring Program (AEMP);
- Snow Core Program as part of the AEMP;
- Emission Monitoring and Reporting to the Environment and Climate Change Canada (ECCC) National Pollutant Release Inventory (NPRI); and
- Greenhouse Gas (GHG) Monitoring and Reporting to ECCC.

In 2019, the primary sources of fugitive dust were associated with unpaved road and airstrip usage, and construction and mining activities at A21. Major waste rock material transfers in 2019 included the use of haul roads to move waste rock (7,644,984 tonnes) and kimberlite ore to the crusher (2,454,964 tonnes). Another source of fugitive dust is truck traffic along the ice road to the Mine. To suppress dust generation, roads, parking areas and the plant site were watered during the summer as needed. The Underground Mine production in 2019 continued at A154 and A418, as well as stripping and production at the A21 open pit. Fugitive dust generation is expected to be greatest during snow-free periods where and when there is site activity. It was expected that the highest fugitive dust generation and resulting dustfall occurred in areas closest to the roads, the airstrip, and mine footprint such as near A21 between May and September.

In 2019, the predominant winds at the site were from the northwest and east, although winds in general can be described as omnidirectional. Therefore, the expectation is that airborne material will be deposited in all directions around the mine, possibly with higher amounts to the southeast and to the west of the mine.

2. DUSTFALL MONITORING

Community interest in the possible effects of dust deposition (dustfall) on wildlife and aquatic environments is the basis of the focus of DDMI's EAQMP on dustfall. Dustfall is the deposition of airborne particulate matter on vegetation, snow and water, and it is monitored using dustfall collection gauges and snow cores.

In accordance with the EA and the requirement associated with the Aquatic Effects Monitoring Program (AEMP), a dust monitoring program was initiated in 2001 and has gone through various changes since then. The program was designed to achieve the following objectives:

- determine dustfall rates at various distance from the Mine footprint; and
- determine the chemical characteristics of dustfall that may be deposited onto, and subsequently into, Lac de Gras as a result on mining activities, in support of the AEMP.

In 2019, the dustfall program incorporated three monitoring components, with sampling conducted at varying distances from the Mine infrastructure (13 m to 4,646 m):

- dustfall gauges (12 monitoring and two control stations);
- dustfall from snow surveys (24 monitoring, three control, and four control-assessment locations); and
- snow water chemistry from snow surveys (16 monitoring, three control, and four control-assessment locations).

Additional information, data and figures can be found in the full *Diavik Diamond Mine: 2019 Dust Deposition Report* (Appendix A; ERM 2020).

2.1 Dustfall Gauges

Dustfall gauges were placed at 14 stations (including two control stations) around the Mine at distances ranging from approximately 13 m to 4,646 m from mining operations (Table 2.1-1 and Figure 2.1-1). Each gauge collected dustfall year-round, with samples collected approximately every three months. The average total sampling period for the 12 year-round locations was 361 days.

Dustfall gauge stations consisted of a hollow brass cylinder (52 centimeter (cm) length, 12.5 cm inner diameter) housed in a Nipher snow gauge (Photo 2.1-1). The cylinder collected dustfall, while the Nipher snow gauge reduced air turbulence around the gauge to increase dustfall gauge efficiency. At the end of each sampling period, the cylinder was exchanged with an empty, clean cylinder and content of the retrieved cylinder was processed in the DDMI environment laboratory to determine the mass of collected dustfall. This processing involved filtration, drying and weighing of samples as specified in the standard operating procedures (SOPs) ENVR-508-0112 and ENVR-303-0112 (see Appendices E and G of the *Diavik Diamond Mine: 2019 Dust Deposition Report*).

Once the mass of collected dustfall at a station was measured, the mean daily dustfall rate over the collection period was calculated as:

$$D = \frac{M}{A*T} \quad \text{[Equation 1]}$$

where:

D = mean daily dustfall rate (mg/dm^2/d) during time period T
M = mass of dustfall collected (mg) during time period T
A = surface area of dustfall gauge collection cylinder orifice (dm^2; approximately 1.227 dm^2)
T = number of days of dustfall collection (d)

Table 2.1-1: Dustfall and Snow Water Chemistry Sampling Locations, Diavik Diamond Mine, 2019

Station ID	2019 Sampling Dates	Total Sample Exposure Duration (days)	UTM Coordinates[1] (m)		Approx. Distance from Mining Operations (m)	Surface Description	Snow Water Chemistry Sampled[2]
			Easting	Northing			
Dustfall Gauges							
Dust 1	Dec. 28 (2018; start), Apr. 8, Jun. 26, Sep. 30, Dec. 26	363	533964	7154321	70	Land	n/a
Dust 2A	Jan. 3 (start), Apr. 7, Jun. 25, Sep. 29, Dec. 28	359	535678	7151339	425	Land	n/a
Dust 3	Dec. 28 (2018; start), Apr.3, Jun. 26, Sep. 30, Dec. 26	363	535024	7151872	22	Land	n/a
Dust 4	Dec 28 (2018; start), Apr.6, Jun. 27, Sep. 28, Dec. 26	363	531397	7152127	173	Land	n/a
Dust 5	Jan. 2 (start), Apr. 6, Jun. 25, Sep. 29, Dec. 28	360	535696	7155138	1,183	Land	n/a
Dust 6	Dec. 28 (2018; start), Apr. 3, Jun. 26, Sep. 30, Dec. 26	363	537502	7152934	13	Land	n/a
Dust 7	Jan. 3 (start), Apr. 5, Jun. 25, Sep. 29, Dec. 27	358	536819	7150510	1,147	Land	n/a
Dust 8	Jan. 2 (start), Apr. 6, Jun. 25, Sep. 29, Dec. 28	360	531401	7154146	1,213	Land	n/a
Dust 9	Jan. 4 (start), Apr. 4, Jun. 25, Sep. 29, Dec. 27	357	541204	7152154	3,796	Land	n/a
Dust 10	Dec. 28 (2018; start), Apr. 5, Jun. 27, Sep. 30, Dec. 26	363	532908	7148924	46	Land	n/a
Dust 11	Jan. 3 (start), Apr. 5, Jun. 25, Sep. 29, Dec. 28	359	531493	7150156	747	Land	n/a
Dust 12	Jan. 3 (start), Apr. 6, Jun. 25, Sep. 29, Dec. 28	359	529323	7151191	2,326	Land	n/a
Dust C1	Jan. 4 (start), Apr. 5, Jun. 25, Sep. 29, Dec. 27	357	534979	7144270	4,646	Land	n/a
Dust C2	Jan. 3 (start), Apr. 6, Jun. 26, Sep. 29, Dec. 28	359	528714	7153276	3,031	Land	n/a

Station ID	2019 Sampling Dates	Total Sample Exposure Duration (days)	UTM Coordinates[1] (m)		Approx. Distance from Mining Operations (m)	Surface Description	Snow Water Chemistry Sampled[2]
			Easting	Northing			
Snow Surveys							
SS1-1	Apr. 6	215	533912	7154298	30	Land	
SS1-2	Apr. 6	215	533909	7154382	115	Land	
SS1-3[3]	Apr. 6	215	533975	7154514	260	Land	
SS1-4	Apr. 6	155	534489	7155083	899	Ice	✓
SS1-5	Apr. 6	155	535096	7156290	2,175	Ice	✓
SS2-1[4]	Apr. 7	156	537550	7153476	145	Ice	✓
SS2-2[5]	Apr. 7	156	537835	7153489	427	Ice	✓
SS2-3	Apr. 4	153	538492	7153940	1,194	Ice	✓
SS2-4	Apr. 4	153	539169	7154694	2,164	Ice	✓
SS3-4	Apr. 7	156	536585	7151002	585	Ice	✓
SS3-5	Apr. 7	156	537676	7150832	1,325	Ice	✓
SS3-6	Apr. 7	156	536308	7151578	35	Ice	✓
SS3-7	Apr. 7	156	536343	7151359	239	Ice	✓
SS3-8	Apr. 7	156	536696	7150809	826	Ice	✓
SS4-1[6]	Apr. 4	213	531497	7152209	61	Land	
SS4-2	Apr. 4	213	531361	7152258	196	Land	
SS4-3	Apr. 4	213	531328	7152476	335	Land	
SS4-4	Apr. 4	153	531147	7153165	1,022	Ice	✓
SS4-5	Apr. 4	153	531405	7154124	1,214	Ice	✓
SS5-1	Apr. 5	214	533143	7148934	26	Land	
SS5-2	Apr. 5	214	533141	7148899	55	Land	
SS5-37	Apr. 5	154	533155	7148687	259	Ice	✓
SS5-4	Apr. 5	154	533138	7147947	941	Ice	✓
SS5-5	Apr. 5	154	533141	7146959	1,894	Ice	✓

Station ID	2019 Sampling Dates	Total Sample Exposure Duration (days)	UTM Coordinates[1] (m)		Approx. Distance from Mining Operations (m)	Surface Description	Snow Water Chemistry Sampled[2]
			Easting	Northing			
Control-1[8]	Apr. 5	214	534941	7144103	4,802	Land	✓[9]
Control-2	Apr. 6	215	528714	7153307	3,042	Land	✓[9]
Control-3	Apr. 5	214	538636	7148753	3,550	Land	✓[9]
FFA-4	May 8	187	503724	7154100	27,909	Ice	
FFB-4	May 5	184	515668	7150029	16,004	Ice	
FF1-2	May 4	183	526547	7159040	7,614	Ice	
LDS-2	Apr. 26	175	546443	7161147	11,897	Ice	

Notes:

[1] UTM Zone 12W, NAD83.

[2] n/a = not applicable.

[3] Duplicate sample for dustfall snow surveys was collected at station SS1-3 (SS1-3-4 & SS1-3-5).

[4] Blank samples were collected at station SS2-1 (SS2-1-1 & SS2-1-1B).

[5] Duplicate samples for dustfall snow surveys and snow water chemistry were collected at station SS2-2 (SS2-2-4 & SS2-2-5).

[6] Duplicate sample for dustfall snow surveys was collected at station SS4-1 (SS4-1-4 & SS4-1-5).

[7] Duplicate sample for snow water chemistry was collected at station SS5-3 (SS5-3-4 & SS5-3-5).

[8] Duplicate sample for snow water chemistry was collected at Control-1 station (Control-1-4 & Control-1-5).

[9] Snow water chemistry was sampled over ice, adjacent to the on-land control station; see Section 2.3 for further details.

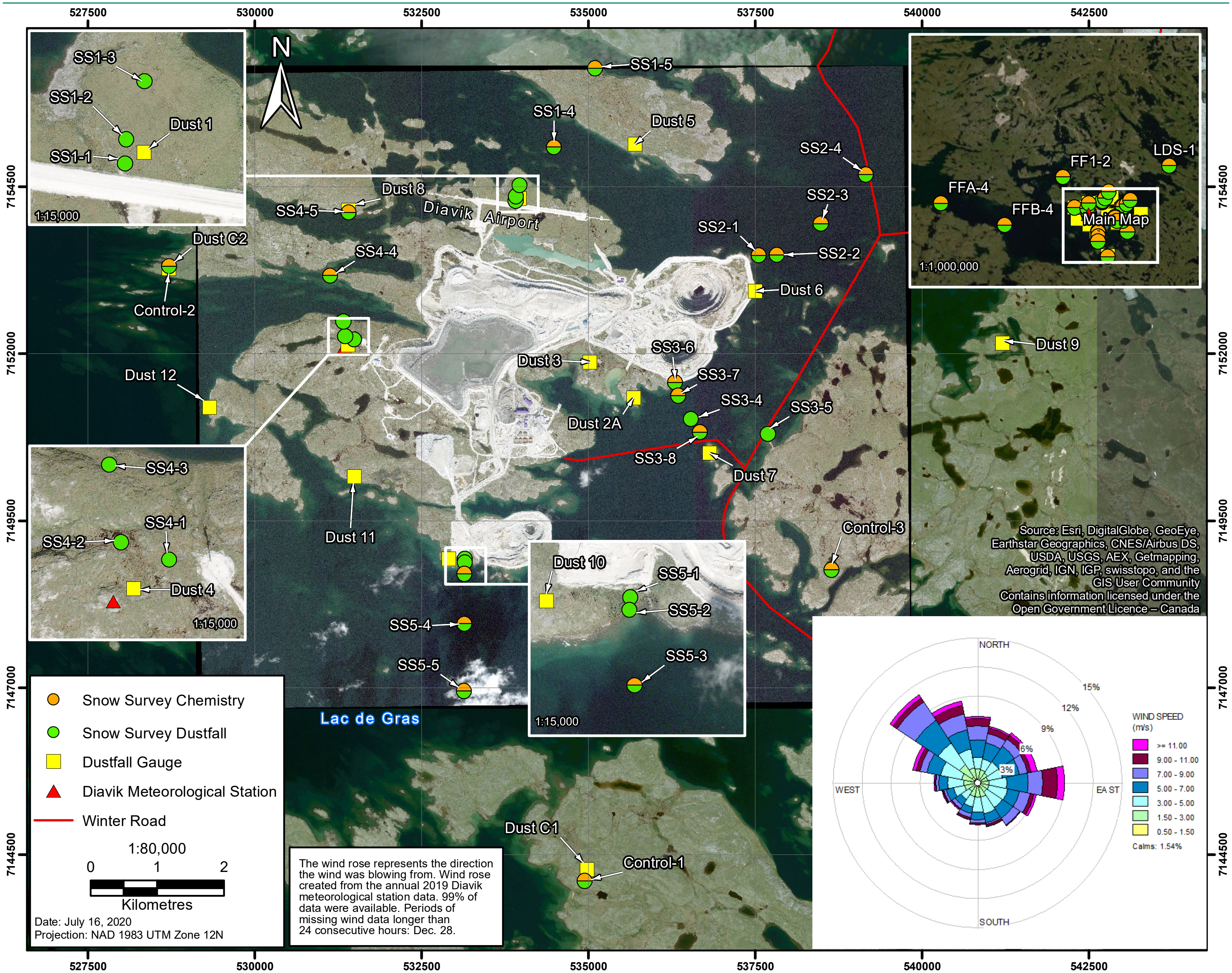

Figure 2.1-1: Dustfall Gauge and Snow Survey Locations, Diavik Diamond Mine, 2019

Photo 2.1-1: Dustfall gauge during sample collection. The dustfall gauge consisted of a hollow brass cylinder (centre) housed inside a Nipher snow gauge (right).

The mean daily dustfall rate (mg/dm^2/d) was then multiplied by 365 days to estimate the mean annual dustfall rate (mg/dm^2/y).

The Northwest Territories has no guidelines or objectives for dustfall deposition. The estimated dustfall rates are compared to the Alberta Ambient Air Quality Guidelines for dustfall (Table 2.1-2; Alberta Environment and Parks 2019), which are used only as general performance indicators and are not a regulatory requirement in compliance evaluation. The Alberta Ambient Air Quality Guidelines for dustfall include a guideline for residential and recreation areas (53 mg/dm^2 per 30 days) and a guideline for commercial and industrial areas where higher dustfall rates are expected (158 mg/dm^2 per 30 days). To compare against the Alberta Ambient Air Quality Guidelines, the daily and annual thresholds are calculated based on the 30-day objectives. The daily threshold ranged from 1.77 mg/dm^2/d to 5.27 mg/dm^2/d, while the annual threshold ranged from 646 to 1924 mg/dm^2/y. Snow water chemistry data were compared to effluent quality criteria (EQC) set out in Wek'èezhìi Land and Water Board (WLWB) Water Licence W2015L2-0001 (formerly W2007L2-0003). DDMI compares the snow water chemistry data to the EQC only as a general performance indicator. There is no intention or requirement that these samples must meet the EQC.

Table 2.1-2: Dustfall and Snow Water Chemistry Reference Values

Parameter	Value	Unit	Comment	Source
Dustfall Rate	53-158	mg/dm^2/ 30 day	Alberta Ambient Air Quality Guidelines for dustfall	Alberta Environment and Parks, 2019
Aluminum-Total	3,000	µg/L	Max. grab sample concentration	W2015L2-0001
Ammonia-N	12,000	µg/L	Max. grab sample concentration	W2015L2-0001
Arsenic-Total	100	µg/L	Max. grab sample concentration	W2015L2-0001
Cadmium-Total	3	µg/L	Max. grab sample concentration	W2015L2-0001
Chromium-Total	40	µg/L	Max. grab sample concentration	W2015L2-0001

Parameter	Value	Unit	Comment	Source
Copper-Total	40	µg/L	Max. grab sample concentration	W2015L2-0001
Lead-Total	20	µg/L	Max. grab sample concentration	W2015L2-0001
Nickel-Total	100	µg/L	Max. grab sample concentration	W2015L2-0001
Nitrite-N	2,000	µg/L	Max. grab sample concentration	W2015L2-0001
Zinc-Total	20	µg/L	Max. grab sample concentration	W2015L2-0001

2.2 Dustfall Snow Surveys

Dustfall snow surveys were performed at 24 monitoring stations, three control stations, and four control-assessment stations along five transects around the Mine (Table 2.1-1 and Figure 2.1-1). Across stations, the distance from mining operations ranged from approximately 26 m to 2,175 m for the monitoring stations, from 3,042 m to 4,802 m for the control stations, and from 7,614 m to 27,909 m for the control-assessment stations. In 2019, the average total sampling period for the monitoring stations was 214 days for the land-based stations and 155 days for the ice-based stations (control and control-assessment stations not included). The start dates correspond to the first snowfall for the land-based stations (September 3, 2018), and shortly after ice freeze up for the ice-based stations (November 2, 2018).

At each snow survey station, a snow corer was used to drill into the snow pack to retrieve a cylindrical snow core (6.1 cm inner diameter; Photo 2.2-1). Cores were extracted at each station and composited in the field to ensure a representative snow sample was obtained for the station. A minimum of three snow cores were collected at each (land and ice) of the snow sampling stations, as outlined in the Snow Core Survey SOP (ENVR-512-0213; see Appendix F of the *Diavik Diamond Mine: 2019 Dust Deposition Report*). Composited samples were bagged and brought to the DDMI environment lab for processing as specified in the Snow Core Survey SOP (ENVR-512-0213) and the Quality Assurance/Quality Control SOP (ENVR-303-0112; see Appendix G of the *Diavik Diamond Mine: 2019 Dust Deposition Report*). Processing of snow cores involved filtration, drying in a high heat oven, and weighing. For quality assurance and control (QA/QC), duplicate samples were collected at stations SS1-3, SS2-2, and SS4-1.

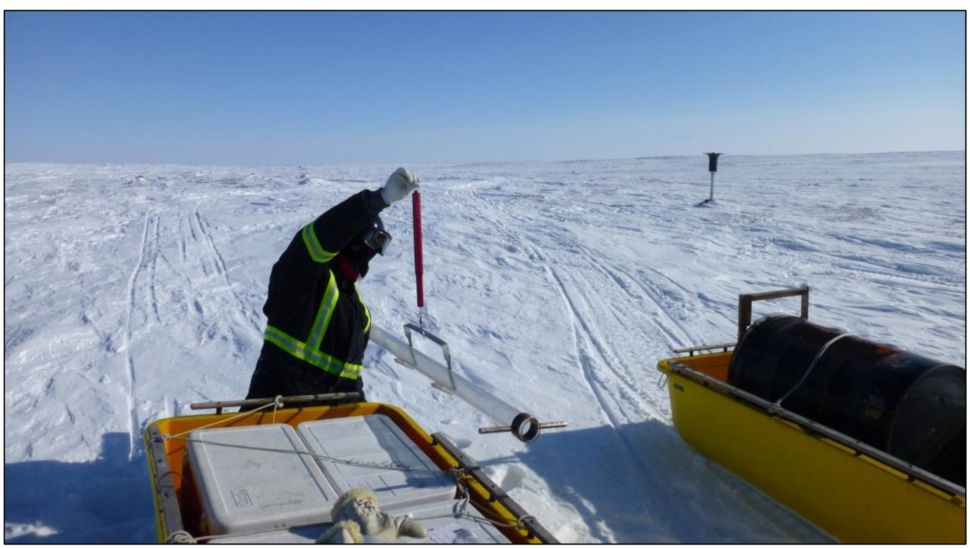

Photo 2.2-1: Snow core sample being weighed, with dustfall gauge in background.

The mean daily dustfall rate (mg/dm^2/d) was then calculated over the collection period using Equation 1, with surface area (A) equal to the surface area of the snow corer tube orifice (0.2922 dm^2) multiplied by the number of snow cores used for the composited sample at the station. The mean annual dustfall rate (mg/dm^2/y) was estimated by multiplying the mean daily dustfall rate by 365 days.

Dustfall rates were compared to the Alberta Ambient Air Quality Guidelines for dustfall (Table 2.1-2), which served as general performance indicators only.

2.3 Snow Water Chemistry

Snow water chemistry analysis was performed on snow cores extracted from 23 locations, including 16 dustfall snow survey stations located on ice, three samples taken on ice adjacent to the three control locations, and four control-assessment stations located on ice (Table 2.1-1 and Figure 2.1-1). In 2019, the distance from mining operations to the snow survey stations ranged from approximately 35 m to 2,175 m; this distance ranged from 3,042 m to 4,802 m and from 7,614 m to 27,909 m for the control stations and for the control-assessment stations, respectively. The average total sampling period in 2019 for the snow survey stations was 155 days (control and control-assessment stations not included). At each station located over water, cores were collected for chemistry analysis immediately after the dustfall snow cores were extracted.

Snow water chemistry cores were extracted using a snow corer in accordance with the method for dustfall snow survey core extraction. A minimum of three cores at each site were extracted and composited to obtain the 3 L of snow water required for the laboratory chemical analysis. Snow cores were then processed and prepared for shipment to Maxxam Analytics (Maxxam) where the chemical analysis was performed. For QA/QC purposes, duplicate samples were collected at stations SS2-2, SS5-3, and Control-1 station. An equipment blank sample was collected at station SS2-1. The methodology for snow water chemistry sampling is detailed in SOP ENVR-512-0213 (see Appendix F of the *Diavik Diamond Mine: 2019 Dust Deposition Report*).

Effluent Quality Criteria (EQC), including “maximum average concentration” and “maximum concentration of any grab sample,” are stipulated in DDMI’s Water Licence (W2015L2-0001) for aluminum, ammonia, arsenic, cadmium, chromium, copper, lead, nickel, nitrite, and zinc (Table 2.1-2). Snow water chemistry results for these variables were compared to the “maximum concentration of any grab sample.” These results are also presented as part of DDMI’s AEMP report.

2.4 Results

Dustfall and snow water chemistry results were grouped into zones based on their relative distance from the mine footprint (Table 2.4-1). Although station groupings into zones were first established at the outset of the program, these groupings were re-established in 2013 using satellite imagery of the site.

Table 2.4-1: Dustfall Results, Diavik Diamond Mine, 2019

Zone ID (m)	Number of Stations in Zone	2019 Dustfall (mg/dm^2/y) from Dustfall Gauges and Dustfall Snow Surveys			
		Median	Mean	Maximum	Minimum
0 - 100	9	381	506	1,114	164
101 - 250	5	371	282	432	34
251 - 1,000	10	248	265	667	32
1,001 - 2,500	11	98	114	298	40
> 2,500	1	84	-	-	-

Zone ID (m)	Number of Stations in Zone	2019 Dustfall ($mg/dm^2/y$) from Dustfall Gauges and Dustfall Snow Surveys			
		Median	Mean	Maximum	Minimum
Control	5	73	73	115	28
Control-assessment	4	22	26	50	12

In 2019, the primary sources of fugitive dust were associated with unpaved road and airstrip usage and construction and mining activities at A21. Due to construction and mining activities at A21, the distance to mining operations were recalculated in 2019. The revised distances to mining operations are shown in Table 2.1-1.

Major waste rock material transfers in 2019 included the use of haul roads to move waste rock (7,644,984 tonnes) and the transfer of kimberlite ore to the crusher (2,454,964 tonnes). Another source of fugitive dust was truck traffic along the ice road to the Mine. The higher deposition rate near the ice road (at Dust 7 station) during the winter is explained by dustfall associated with the ice road, and by Dust 7's location close to the road and downwind of it. Some dustfall stations that are located close to the ice road (SS2-4 and SS3-8) did not show elevated readings, possibly because they are upwind of the road. To suppress dust generation, roads, parking areas and the plant site were watered during the summer as needed. Between June and September 2019, approximately 656 m^3 of water was applied to the plant site and 19,797 m^3 of water was applied to haul roads. The exact impact of dust suppression could not be determined from the data collected in 2019, however it is likely that road watering reduced the amount of dust generated at the Mine. In 2019, the Underground Mine production continued at A154 and A418, as well as stripping and production at the A21 open pit. Fugitive dust generation is expected to be greatest during snow-free periods where and when there is site activity. It was expected that the highest fugitive dust generation and resulting dustfall occurred in areas closest to the roads, the airstrip, and the mine footprint such as near A21 between May and September. The difference between the summer and winter dustfall rate was generally minor with the summer rate being slightly higher at some stations (e.g., the rate at Dust 3 was 1,024 $mg/dm^2/y$ in the summer and 940 $mg/dm^2/y$ in the winter), while some sites recorded a higher dustfall rate in winter than in summer (e.g., the rate at Dust 2A was 309 $mg/dm^2/y$ in the summer and 399 $mg/dm^2/y$ in the winter).

The predominant winds at the site in 2019 were from the northwest and east, although winds in general can be described as omnidirectional. Therefore, the expectation is that airborne material will be deposited in all directions around the mine, possibly with higher amounts to the southeast and to the west of the mine. The results show that proximity to mine activity is a stronger indicator of dust deposition than wind direction. This is supported by the fact that the stations with the three highest dust deposition rates in 2019 (Dust 3, 10 and 11) are located south or southwest of the mine footprint where, based on the predominant wind directions, deposition is not favoured. Dust 3, which is located only 22 m from the mine, had the highest observed dustfall rate of the dustfall gauges in 2019.

Results from the dustfall gauges, dustfall snow surveys, and the snow water chemistry analyses are presented below.

2.4.1 Dustfall Gauges

For each station, total dustfall collected throughout the year is summarized by zone in Table 2.4-1. The following list describes tables or figures that are included in the *Diavik Diamond Mine: 2019 Dust Deposition Report* (Appendix A; ERM 2020):

- 2019 annual dustfall collected at each station, relative to the Mine;
- historical records of annual dustfall for each station from 2002 to 2019;

- a comparison of dustfall versus distance from the Mine footprint for 2019 and historical 2002 to 2019 datasets; and
- boxplots summarizing the dustfall magnitude distribution from all stations during each year from 2002 to 2019.

Similar to 2018, the greatest estimated dustfall rate measured in 2019 using gauges occurred at the Dust 3 station (22 m from the Mine). In 2019 the measured dustfall rate at the Dust 3 station was 982 $mg/dm^2/y$. The Dust 10 station (683 $mg/dm^2/y$) and the Dust 11 station (667 $mg/dm^2/y$) recorded the second and third highest dustfall rates measured using gauges, respectively. The Dust 10 station is adjacent to the A21 open pit, while the Dust 11 station is located west of the South Country Rock Pile – Waste Rock Storage Area (SCRP-WRSA; Figure 2.1-1). The lowest dustfall rate was recorded at the Dust 9 station (65 $mg/dm^2/y$). Both control stations, Dust C1 (115 $mg/dm^2/y$; 4,646 m to the south) and Dust C2 (82 $mg/dm^2/y$; 3,031 m to the west), recorded higher dustfall rates than Dust 9. This is explained by the distance of Dust 9 from the Project footprint (3,796 m to the east), which places it within the control stations' zone.

The dustfall rates estimated from dustfall gauges in 2019 were comparable to the 2018 rates. Four locations recorded lower deposition rates in 2019 than 2018, while all other locations recorded higher rates in 2019. 2018 rates were generally the highest recorded since 2008. The higher recorded dustfall values in both 2018 and 2019 suggest that dustfall rates in these two years were likely influenced by the surface activity at the mine, particularly at the A21 open pit, which began in December 2017, while the dustfall rates in 2017 were related mainly to the airstrip.

The annualized dustfall rates estimated from gauges at all stations were less than the upper limit of the Alberta Ambient Air Quality Objectives and Guidelines for dustfall (1,922 $mg/dm^2/y$), which is applied to industrial locations. The lower limit of these objectives (645 $mg/dm^2/y$) that is applied to residential and recreational areas was exceeded at the three sites that recorded the highest dustfall rates in 2019 (Dust 3, 10, and 11). The Alberta Ambient Air Quality Objectives and Guidelines recommends that dustfall objectives be used as general performance indicators only with no compliance requirement, thus these objectives are used here for comparison purposes only, particularly as there are currently no standards or objectives for the Northwest Territories.

2.4.2 Dustfall Snow Surveys

Annual dustfall rates estimated from each snow survey station in 2019 are included in the combined dustfall gauge and snow survey results in Table 2.4-1. Historical records of annual dustfall rates for each station, the relationship between annual dustfall rates and distance from the Mine footprint, boxplots summarizing dustfall rates measured in each year, and the data quality assurance and quality control are presented in the annual dust deposition report (Appendix A).

Annualized dustfall rates estimated from the 2019 snow survey data ranged from 12 to 1,114 $mg/dm^2/y$ (Table 2.4-1). The maximum dust deposition rate was recorded at SS1-1 followed by SS5-3 (481 $mg/dm^2/y$). SS1-1 consistently recorded the highest dustfall rates from 2017 to 2019. The station is located due north of the airstrip, which explains the higher levels of dustfall found here. The higher levels of dustfall rates at SS5-3 are associated with the mine activity at A21 open pit (Figure 2.1-1).

Dustfall rates from the snow survey generally decreased with increasing distance from the Mine. Mean dustfall rates estimated using both dustfall gauges and snow surveys within the 0 m to 100 m, 101 m to 250 m, 251 m to 1,000 m, 1,001 m to 2,500 m, control, and control–assessment zones were 506, 282, 265, 114, 73 and 26 $mg/dm^2/y$, respectively (Table 2.4-1). Dustfall rates at stations SS1-1, Dust 3, Dust 11, SS5-3, Dust 7, Dust 8, Dust 12, and Dust C1 were greater than the upper limit of the 95% confidence interval (CI) for their respective zones in 2019. A sample that exceeds the 95% confidence interval (CI) has a probability of occurrence of 5% or less, indicating a particularly high dust deposition. In the 0 m to 100 m zone, the 95% CI was exceeded at the two stations adjacent to the airstrip (SS1-1 and Dust 3), while in the 251 m to 1,000 m zone the 95% CI was exceeded at Dust 11 and SS5-3, which is likely explained by the stations' proximity to the A21 open pit. Three exceedances of the 95% CI occurred in zone 1,001 m to 2,500 m (Dust 7, Dust 8, and Dust 12), while one exceedance occurred in the control zone (Dust C1). The exceedance of the 95% CI at Dust 7 is associated with dust from the ice road, and with Dust 7's location close to the road and downwind of it. Although the dustfall rates at Dust 8, Dust 12 and Dust C1 were relatively low in comparison to other dustfall gauges, they exceeded the 95% CI of their respective zone. This is mainly a result of the very low dustfall rates at all other sites of each zone except Dust 7 within the 1,001 to 2,500 m zone.

Annualized dustfall rates estimated from the snow survey stations in 2019 were generally lower than in 2018, although several stations saw higher rates in 2019 than in 2018. The annualized dustfall rates estimated from snow surveys never exceeded the upper limit (applied to industrial locations) of the Alberta Ambient Air Quality Objectives and Guidelines at any station; only the rates at SS1-1 exceeded the lower limit of these guidelines, which applies to residential and recreational areas.

2.4.3 Snow Water Chemistry

Maximum snow water chemistry results for 2019 are presented in Table 2.4-2. All analytical results for snow water chemistry and data quality assurance and quality control analysis are included in *the Diavik Diamond Mine: 2019 Dust Deposition Report* (Appendix A; ERM 2020).

Table 2.4-2: Snow Water Chemistry Results, Diavik Diamond Mine, 2019

Zone ID (m)	Number of Stations in Zone	2019 Maximum Snow Water Chemistry Results (µg/L)										
		Aluminum	Ammonia	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Nitrite	Phosphorous	Zinc
0 - 100	1	96.3	96.0	0.1	0	0.4	0.1	0.1	2.0	5.6	254.0	0.1
101 - 250	2	134.0	110.0	0.1	0	0.5	0.2	0.1	1.7	11.0	413.0	0.8
251 - 1,000	6	139.5	110.0	0.1	0.01	0.3	0.2	0.1	2.7	7.3	278.5	1.5
1,001 - 2,500	7	52.8	120.0	0.1	0	0.2	0.1	0.1	3.9	5.0	94.3	1.6
Control	3	47.7	56.0	0.1	0.01	0.2	0.3	0.1	3.3	4.0	81.4	1.4
Control-assessment	4	126.0	170.0	0.04	0	1.5	0.3	0.2	5.4	-	11.8	1.7

Dash (-) = not available (snow water chemistry not sampled)

All 2019 sample concentrations were less than their associated reference levels as specified by the "maximum concentration of any grab sample" in Water Licence W2015L2-0001 (Table 2-1.2).

In general, average concentrations of snow water chemistry variables of interest decreased with increasing distance from the Mine. Concentrations of all parameters except ammonia, nitrite, and phosphorous were lower in 2019 than in recent years.

3. NATIONAL POLLUTANT RELEASE INVENTORY

3.1 Program Overview

According to ECCC, air issues such as smog and acid rain result from the presence of, and interactions between a group of pollutants known as Criteria Air Contaminants (CAC) and some related pollutants. CAC, in particular, refer to a group of pollutants that include:

- Sulphur oxides (SO_x);
- Nitrogen oxides (NO_x);
- Particulate matter (PM);
- Volatile organic compounds (VOC);
- Carbon monoxide (CO); and
- Ammonia (NH_3).

CAC are produced from a number of sources, including burning of fossil fuels and it is in part because of these shared sources that CAC are grouped together.

While there is no regulatory requirement or standard for these pollutant releases in the Northwest Territories, the National Pollutant Release Inventory (NPRI) is a legislated, publicly accessible inventory used to track the amount of pollutant releases (to air, water and land), disposals and transfers for recycling. The program is administered by ECCC and is a requirement of the *Canadian Environmental Protection Act* (CEPA 1999) for owners and operators of facilities that meet the NPRI reporting requirements published in the Canada Gazette, Part I (ECCC 2020a). Reporting requirements are normally revised every one or two years, with accompanying revised guidance documents (ECCC 2018). NPRI reports containing emissions of CACs are to be submitted to ECCC before June 1 each year.

NPRI substance emissions were derived by DDMI using emission factor calculations in the ECCC NPRI Toolbox (ECCC 2020b). Operational values such as fuel usage and mobile equipment hours were recorded at the Mine throughout the year and weather conditions from the Mine's on-site weather station were used to calculate NPRI values.

3.2 Results

Table 3.2-1 compares the Mine's 2019 NPRI CAC emission submission results against the 2018 NPRI submission. NPRI reports for previous years (2001 to 2018) are available on the NPRI website (ECCC 2020c). NPRI results for the previous year are typically released by ECCC in April, ten months following submission on June 1 of each year (e.g., 2019 data reported by June 1, 2020 are expected to be released by ECCC in April of 2021).

There was a decrease of 14% in CO and 19% in VOC emissions in 2019 compared to 2018. SO_2 emissions decreased by 9% in 2019 relative to 2018. These emission decreases are due to decreased waste incineration and decreased waste oil burned in 2019. NO_x emissions were relatively consistent between 2018 and 2019.

TPM, PM_{10}, and $PM_{2.5}$ emissions decreased by 19%, 15%, and 13%, respectively in 2019 compared to 2018 due to decreases in road traffic, incineration, and waste oil burned, and due to an increase in the number of days with more than 2 mm of precipitation.

Table 3.2-1: NPRI Results for CAC Emissions, Diavik Diamond Mine, 2018 and 2019

CAC Emissions	2019 Reporting Threshold (tonnes)	2018 (tonnes)	2019 (tonnes)	Reasons for Changes from Previous Year
Carbon Monoxide (CO)	20	833.7	719.0	Decreased waste incineration and waste oil burned in 2019
Sulphur Dioxide (SO_2)	20	5.7[1]	5.2	Decreased waste incineration and waste oil burned in 2019
Oxides of Nitrogen (NO_x expressed as NO_2)	20	2,281	2,320.1	No change
Volatile Organic Compounds (VOC)	10	72.3	58.4	Decreased waste incineration and waste oil burned in 2019
Total Particulate Matter (TPM)	20	1,194.7	964.3	Decreased waste incineration and waste oil burned, decreased road traffic, more days of precipitation greater than 2 mm in 2019
Particulate Matter ≤ 10 µm (PM_{10})	0.5	425.9	364.0	Decreased waste incineration and waste oil burned, decreased road traffic, more days of precipitation greater than 2 mm in 2019
Particulate Matter ≤ 2.5 µm ($PM_{2.5}$)	0.3	87.4	76.1	Decreased waste incineration and waste oil burned, decreased road traffic, more days of precipitation greater than 2 mm in 2019

Notes:

[1] This amount was incorrectly stated in the 2018 Air Quality Monitoring Report as 110.6 tonnes. The correct value is shown here.

4. GREENHOUSE GAS REPORTING

4.1 Program Overview

While there is no territorial regulatory requirement or standard for GHG release in the Northwest Territories, the national Greenhouse Gas Emissions Reporting Program (GHGRP) is Canada's legislated, publicly accessible inventory of facility-reported GHG data and information. The program is administrated by ECCC and is a requirement of the CEPA 1999 for owners or operators of facilities that emit GHGs above a certain threshold. Starting for 2017 reporting, the GHGRP requirement applied to all facilities that emit the equivalent of 10,000 tonnes of carbon dioxide equivalent units (tCO_2e) or more, per year (ECCC 2019a, ECCC 2020d). The previous threshold was 50,000 tCO_2e per year. GHG reports are to be submitted prior to June 1 each year.

GHG emissions were derived by DDMI using emission factor calculations in the Guidance Manual for Estimating Greenhouse Gas Emissions (Environment Canada 2004). Operational values such as fuel usage and mobile equipment hours were recorded at the Mine throughout the year.

Three GHG emissions are calculated for the Mine: CO_2, methane (CH_4) and nitrous oxide (N_2O). To calculate CO_2e, 100-year Global Warming Potentials (GWP) are used to convert CH_4 and N_2O from tonnes to tCO_2e. The CH_4 and N_2O GWP multipliers used were 25 and 298, respectively (ECCC 2019b).

4.2 Results

Table 4.2-1 compares 2018 and 2019 GHG emissions results for the Mine. The 2019 GHG emission reporting information will be filed with ECCC by the updated 2020 submission deadline of July 31. GHG reports for previous years (2001 to 2018) are published by ECCC and available from the open government website (ECCC 2020e).

Table 4.2-1: GHG Equivalents for the Diavik Diamond Mine, 2018 and 2019

Constituent	2018 (t)	2018 (tCO_2e)	2019 (t)	2019 (tCO_2e)
CO_2e	209,436	209,436	192,103	192,103
CH_4	10	260	10	238
N_2O	31	9,313	29	8,541

GHG emissions results for the previous year are typically released by ECCC in April, ten months following submission on June 1 of each year (e.g., 2019 data reported by June 1, 2020 are expected to be released by ECCC in April of 2021).

CO_2e emissions decreased from 2018 to 2019 at the Mine (Table 4.2-1) due to decreased diesel usage for heavy mine equipment, boilers, and furnaces. GHG emissions at the Mine are from stationary equipment fuel combustion and mobile equipment fuel combustion (75% and 25% of GHG emissions, respectively).

In 2019, the Mine's 9.2 megawatt wind farm (consisting of four turbines; Photo 4.2-1) generated 17.5 gigawatt-hours of electricity (9.4% energy penetration) and saved 4.1 million litres of diesel fuel needed for power, thereby reducing the Mine's CO_2e by 11.0 kilotonnes.

Photo 4.2-1: The Diavik 9.2 megawatt wind farm. The wind farm consists of four wind turbines.

5. SUMMARY

In 2019, dustfall was monitored at 14 dustfall gauges and 31 snow survey stations located at varying distances and directions from the mine. Snow water chemistry was measured at 23 of the snow survey stations and compared to EQC set out in the WLWB Water Licence W2015L2-0001.

Annual dustfall estimated from each of the 14 dustfall gauges ranged from 65 to 982 $mg/dm^2/y$ in 2019. The annualized dustfall rates estimated from the 2019 snow survey data ranged from 12 to 1,114 $mg/dm^2/y$. All of the annualized dustfall rates estimated from dustfall gauges and snow surveys were less than 5.27 $mg/dm^2/day$ (1,922 $mg/dm^2/y$), the non-residential Alberta Ambient Air Quality Guideline for dustfall (Alberta Environment and Parks 2019). Observed dustfall rates at the Dust 3, Dust 10, Dust 11, and SS1-1 stations were higher than 1.77 $mg/dm^2/day$ (645 $mg/dm^2/y$), the residential Alberta Ambient Air Quality Guideline for dustfall. This Guideline is used only as a general performance indicator. Dustfall rates in 2019 were generally within the range of historical data collected for the Mine.

Because the dustfall gauges continuously collect dust throughout the year, and the snow surveys are only representative of dustfall accumulated over the snow cover period, the reported annual dustfall results from the dustfall gauges are expected to provide a better estimate of annual dustfall compared to snow survey results for similar geographic areas. However, results obtained from both methods showed similar spatial patterns, with dustfall generally decreasing with distance away from the Mine.

Snow water chemistry analysis of interest included those variables with effluent quality criteria (EQC; i.e., aluminum, ammonia, arsenic, cadmium, chromium, copper, lead, nickel, nitrite, and zinc). All 2019 sample concentrations were less than their associated reference levels as specified by the “maximum concentration of any grab sample” in Water Licence W2015L2-0001.

The Mine reported CAC emissions as part of the annual NPRI submission and emissions were estimated using published emission factors. Compared to 2018, 2019 emissions of CO and VOC decreased by 14% and 19% respectively. SO_2 emissions in 2019 decreased (5.2 tonnes; 9% decrease) relative to 2018 (5.7 tonnes). The decrease in SO_2 emissions was due to decreased waste incineration and decreased waste oil burned in 2019. NO_x emissions were relatively consistent between 2018 and 2019. There was a decrease of 13% to 19% in TPM, PM_{10} and $PM_{2.5}$ emissions in 2019 compared to 2018 due to decreases in road traffic, incineration, and waste oil burned, and due to an increase in the number of days with more than 2 mm of precipitation.

The Mine reported GHG emissions as part of the annual national GHGRP submission, and CO_2e emissions were estimated using published emission factors and 100-year GWP ratios. Starting for 2017 reporting, the GHGRP was changed to require all facilities to report if they emit the equivalent of 10,000 tCO_2e or more per year, compared to the previous 50,000 tCO_2e per year threshold.

Mine GHG emissions of CO_2, CH_4 and N_2O totalled 200,883 tCO_2e in 2019, a 8.3% decrease from 2018 due to decreased diesel usage for heavy mine equipment, boilers, and furnaces. GHG emissions at the Mine in 2019 were from stationary equipment fuel combustion (75%) and mobile equipment fuel combustion (25%). In 2019, the Mine’s 9.2 megawatt wind farm helped to reduce the Mine’s GHG footprint by generating 17.5 gigawatt-hours of electricity which saved 4.1 million litres of diesel fuel and thereby prevented the direct release of 10,991 tCO_2e.

6. REFERENCES

Definitions of the acronyms and abbreviations used in this reference list can be found in the Glossary and Abbreviations section.

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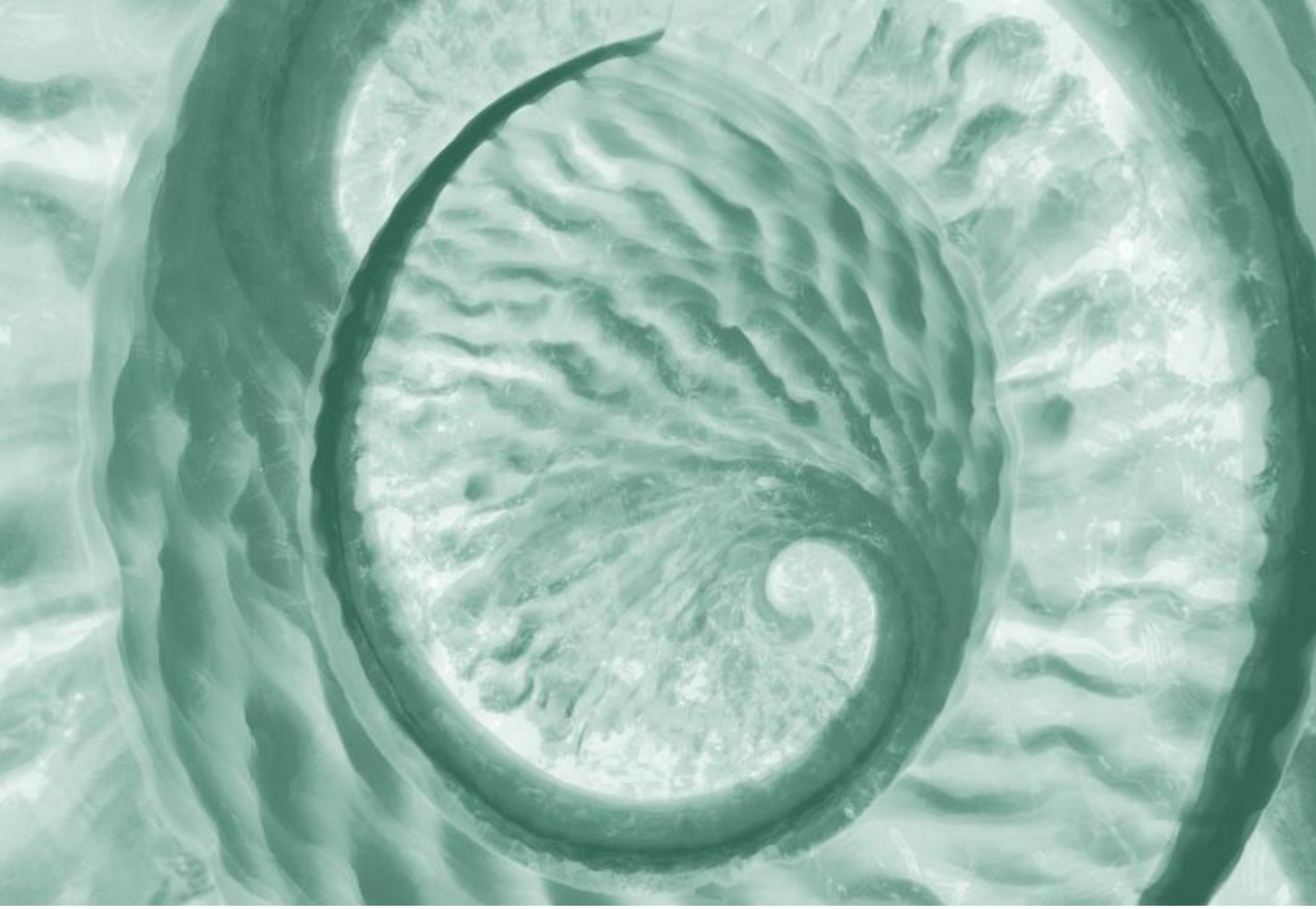
APPENDIX A DIAVIK DIAMOND MINE: 2019 DUST DEPOSITION REPORT (DATED MARCH 2020)



Diavik Diamond Mine

2019 Dust Deposition Report

March 2020

Project No.: 0207514-0021

The business of sustainability

March 2020

Diavik Diamond Mine

2019 Dust Deposition Report

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EXECUTIVE SUMMARY

Potential air and water quality concerns associated with airborne fugitive dust, which may result from Diavik Diamond Mine (the "Project") mining activities, were identified in the Diavik Diamond Mine Environmental Assessment (DDMI 1998). In accordance with the Environmental Assessment and requirements associated with the Aquatic Effects Monitoring Program (AEMP), a dust monitoring program was initiated in 2001. The program was designed to achieve the following objectives:

- determine dust deposition (dustfall) rates at various distances from the mine project footprint; and
- determine the chemical characteristics of dustfall that may be deposited onto, and subsequently into, Lac de Gras as a result of mining activities, in support of the AEMP.

In 2019, dustfall monitoring included three components, with sampling conducted at varying distances around the mine from 13 to 30,711 metres (m) away from infrastructure:

1. Dustfall gauges (12 monitoring and 2 control locations);
2. Dustfall from snow surveys (24 monitoring, 3 control locations and 4 control-assessment locations); and
3. Snow water chemistry from snow surveys (16 monitoring, 3 control locations and 4 control-assessment locations).

Overall, as expected, dustfall rates decreased with distance from the Project. The proximity to mine activity was the strongest indicator of dustfall deposition. In 2019, the annual dustfall estimated from each of the 14 dustfall gauges ranged from 65 to 982 mg/dm^2/y. Dust 3 (22 m from the Project) had the highest recorded dustfall followed by Dust 10 (42 m from the Project). Although it is expected that fugitive dust generation is higher during snow-free periods because of exposed road surfaces, the difference between summer and winter rates was minor in most cases with some sites recording a slightly higher summer rate (e.g., Dust 3 rate was 1,024 mg/dm^2/y in the summer and 940 mg/dm^2/y in the winter), and other sites a slightly higher winter rate (e.g. Dust 2 rate was 309 mg/dm^2/y in the summer and 399 mg/dm^2/y in the winter).

The annualized dustfall rates estimated from the 2019 snow survey data ranged from 12 to 1,114 mg/dm^2/y. Although there are no dustfall standards for the Northwest Territories, dustfall rates at all stations in 2019 were lower than the non-residential objective of 5.26 mg/dm^2/d (1,920 mg/dm^2/y) documented in the Alberta Ambient air Quality Objectives and Guidelines (Alberta Environment and Parks 2019), and only four sites (Dust 3, Dust 10, Dust 11 and SS1-1) exceeded the residential limit of these objectives. These objectives are used as general performance indicators only.

Snow water chemistry analytes of interest included those variables with effluent quality criteria (EQC; i.e., aluminum, ammonia, arsenic, cadmium, chromium, copper, lead, nickel, nitrite, and zinc) or a load limit (i.e., phosphorus) specified in the Type "A" Water Licence (W2015L2-0001, formerly W2007L2-0003). All 2019 sample concentrations were less than the EQC "maximum concentration of any grab sample" described in Water Licence W2015L2-0001. Concentrations in 2019 were generally lower than recent years for all parameters except ammonia, nitrite, and phosphorus.
Typically, concentrations decreased with distance from the Project. The highest concentrations for all variables were less than their corresponding EQC.

ACKNOWLEDGEMENTS

This report was prepared for Diavik Diamond Mines (2012) Inc. (DDMI) by ERM Consultants Canada Ltd. (ERM). Fieldwork and on site sample analyses were completed by DDMI, and other sample analyses were completed by Maxxam Analytics. Data analyses and reporting were completed by Talaat Bakri (M.Sc.) and reviewed by Andres Soux (M.Sc.). The project was managed by Carol Adly (M.Sc., R.P.Bio.), and Marc Wen (M.Sc., R.P.Bio.) was the Partner in Charge.

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ACRONYMS AND ABBREVIATIONS

AEMP	Aquatic effects monitoring program
BC	British Columbia
BC MOE	British Columbia Ministry of Environment
CI	Confidence interval
DDMI	Diavik Diamond Mines (2012) Inc.
DL	Detection limit
Dustfall	Dust deposition
EQC	Effluent quality criteria
ERM	ERM Consultants Canada Ltd.
Fugitive Dust	Atmospheric dust arises from mechanical disturbance of granular material exposed to the air and is not discharged to the atmosphere in a confined flow stream.
IQR	The interquartile range of the box plot. In box plots, the middle 50% of data occurs within the limits of the interquartile range.
Q1	The lower quartile of the box plot. In box plots, 25% of data lie below than this value.
Q3	The upper quartile of the box plot. In box plots, 25% of data lie above than this value.
QA/QC	Quality assurance and quality control
the Project	Diavik Diamond Mine
RPD	Relative percent difference
SCRP	South Country Rock Pile
SOP	Standard operating procedure
WLWB	Wek'èezhìi Land and Water Board
WRSA	Waste Rock Storage Area: an elevated surface constructed from dumping waste rock.

1. INTRODUCTION

Potential air and water quality concerns associated with airborne fugitive dust, which may result from Diavik Diamond Mine (the Project) mining activities, were identified in the Diavik Diamond Mine Environmental Assessment (DDMI 1998). In accordance with the Environmental Assessment and requirement associated with the Aquatic Effects Monitoring Program (AEMP), a dust monitoring program was initiated in 2001. The program was designed to achieve the following objectives:

- determine dust deposition (dustfall) rates at various distances from the mine project footprint; and
- determine the chemical characteristics of dustfall that may be deposited onto, and subsequently into, Lac de Gras as a result of mining activities, in support of the AEMP.

Since 2001, the dustfall monitoring program has gone through various changes, including an increase in the number of sampling locations, the relocation of some sampling stations, and improvements to the dustfall sampling methodology. A description of annual changes is provided in Appendix A. This report includes a comparison between the 2019 observations of dustfall to all site-specific data collected between 2002 and 2019. Appendix A of the Dust Deposition Report summarizes the amendments and additions to the dustfall monitoring program since 2001. Historical dustfall monitoring results have been presented each year in the Diavik Diamond Mine Dust Deposition reports from 2001 to 2018 (DDMI 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019). The historical data presented are not considered to represent baseline conditions because construction of the mine began in 2001.

2. METHODOLOGY

The 2019 dustfall monitoring program incorporated three monitoring components:

1. Dustfall gauges (12 monitoring and two control locations);
2. Dustfall from snow surveys (24 monitoring, three control and four control-assessment locations); and
3. Snow water chemistry from snow surveys (16 monitoring, three control and four control-assessment locations).

Sampling was completed at varying distances around the mine along five transects, including three control locations. In addition, four more sites located further from the Project footprint were added to the 2019 monitoring program to assess the adequacy of the current control locations (hereafter called control-assessment locations; Table 2-1, Figure 2-1).

2.1 Dustfall Gauges

Dustfall gauges were placed at 14 stations (including two control stations) around the Project at distances ranging from approximately 13 m to 4,646 m from mining operations (Table 2-1; Figure 2-1). The 12 stations (plus two control stations) collected dustfall year-round, with samples collected approximately every three months. The average total sampling period for the 12 year-round locations was 361 days.

Dustfall gauges consisted of a hollow brass cylinder (52 cm length, 12.5 cm inner diameter) housed in a Nipher snow gauge (Photo 2.1-1). The cylinder collected dustfall, while the Nipher snow gauge reduced air turbulence around the gauge to increase dustfall catch efficiency. The cylinder was exchanged with an empty, clean cylinder at the end of each sampling period, and the content of the cylinder that was retrieved was processed in the Diavik Diamond Mines (2012) Inc. (DDMI) environment lab to determine the mass of collected dustfall. This processing involved filtration, drying in a high heat oven, and weighing of samples as specified in the Dust Gauge Collection Standard Operating Procedure (SOP; ENVR-508-0112; Appendix E) and the Quality Assurance/Quality Control SOP (ENVR-303-0112; Appendix G).

Once the mass of collected dustfall at a station was measured, the mean daily dustfall rate over the collection period was calculated as:

$$D = \frac{M}{A*T} \quad \text{[Equation 1]}$$

where:

D = mean daily dustfall rate (mg/dm^2/d) during time period T
M = mass of dustfall collected (mg) during time period T
A = surface area of dustfall gauge collection cylinder orifice (dm^2; approximately 1.227 dm^2)
T = number of days of dustfall collection (d)

The mean daily dustfall rate (mg/dm^2/d) was then multiplied by 365 days to estimate the mean annual dustfall rate (mg/dm^2/y).

The Northwest Territories has no guidelines or objectives for dustfall deposition. The estimated dustfall rates are compared to the Alberta Ambient Air Quality Objectives and Guidelines for dustfall (Alberta Environment and Parks, 2019), which are used only as general performance indicators and are not a regulatory requirement in compliance evaluation. The Alberta Ambient Air Quality Guidelines for dustfall include a guideline for residential and recreation areas (53 mg/dm^2 per 30 days) and a guideline for commercial and industrial areas where higher dustfall rates are expected (158 mg/dm^2 per 30 days). To compare against the Alberta Ambient Air Quality Guidelines, the daily and annual thresholds are calculated based on the 30 days objectives. The daily threshold ranged from 1.77 mg/dm^2/d to 5.27 mg/dm^2/d, while the annual threshold ranged from 646 to 1924 mg/dm^2/y. Snow water chemistry data were compared to effluent quality criteria (EQC) set out in Wek'èezhìi Land and Water Board (WLWB) Water Licence W2015L2-0001 (formerly W2007L2-0003).

Table 2-1: Dustfall and Snow Chemistry Sampling Locations, Diavik Diamond Mine, 2019

Station ID	2019 Sampling Dates	Total Sample Exposure Duration (days)	UTM Coordinates[1]		Approx. Distance from Mining Operations (m)	Surface Description	Snow Water Chemistry Sampled[2]
			Easting (m)	Northing (m)			
Dustfall Gauges							
Dust 1	Dec. 28 (2018; start), Apr. 8, Jun. 26, Sep. 30, Dec. 26	363	533964	7154321	70	Land	n/a
Dust 2A	Jan. 3 (start), Apr. 7, Jun. 25, Sep. 29, Dec. 28	359	535678	7151339	425	Land	n/a
Dust 3	Dec. 28 (2018; start), Apr.3, Jun. 26, Sep. 30, Dec. 26	363	535024	7151872	22	Land	n/a
Dust 4	Dec 28 (2018; start), Apr.6, Jun. 27, Sep. 28, Dec. 26	363	531397	7152127	173	Land	n/a
Dust 5	Jan. 2 (start), Apr. 6, Jun. 25, Sep. 29, Dec. 28	360	535696	7155138	1183	Land	n/a
Dust 6	Dec. 28 (2018; start), Apr. 3, Jun. 26, Sep. 30, Dec. 26	363	537502	7152934	13	Land	n/a
Dust 7	Jan. 3 (start), Apr. 5, Jun. 25, Sep. 29, Dec. 27	358	536819	7150510	1147	Land	n/a
Dust 8	Jan. 2 (start), Apr. 6, Jun. 25, Sep. 29, Dec. 28	360	531401	7154146	1213	Land	n/a
Dust 9	Jan. 4 (start), Apr. 4, Jun. 25, Sep. 29, Dec. 27	357	541204	7152154	3796	Land	n/a
Dust 10	Dec. 28 (2018; start), Apr. 5, Jun. 27, Sep. 30, Dec. 26	363	532908	7148924	46	Land	n/a
Dust 11	Jan. 3 (start), Apr. 5, Jun. 25, Sep. 29, Dec. 28	359	531493	7150156	747	Land	n/a
Dust 12	Jan. 3 (start), Apr. 6, Jun. 25, Sep. 29, Dec. 28	359	529323	7151191	2326	Land	n/a

Station ID	2019 Sampling Dates	Total Sample Exposure Duration (days)	UTM Coordinates[1]		Approx. Distance from Mining Operations (m)	Surface Description	Snow Water Chemistry Sampled[2]
			Easting (m)	Northing (m)			
Dust C1	Jan. 4 (start), Apr. 5, Jun. 25, Sep. 29, Dec. 27	357	534979	7144270	4646	Land	n/a
Dust C2	Jan. 3 (start), Apr. 6, Jun. 26, Sep. 29, Dec. 28	359	528714	7153276	3031	Land	n/a
Snow Surveys							
SS1-1	Apr. 6	215	533912	7154298	30	Land	
SS1-2	Apr. 6	215	533909	7154382	115	Land	
SS1-3[3]	Apr. 6	215	533975	7154514	260	Land	
SS1-4	Apr. 6	155	534489	7155083	899	Ice	✓
SS1-5	Apr. 6	155	535096	7156290	2175	Ice	✓
SS2-1[4]	Apr. 7	156	537550	7153476	145	Ice	✓
SS2-2[5]	Apr. 7	156	537835	7153489	427	Ice	✓
SS2-3	Apr. 4	153	538492	7153940	1194	Ice	✓
SS2-4	Apr. 4	153	539169	7154694	2164	Ice	✓
SS3-4	Apr. 7	156	536585	7151002	585	Ice	✓
SS3-5	Apr. 7	156	537676	7150832	1325	Ice	✓
SS3-6	Apr. 7	156	536308	7151578	35	Ice	✓
SS3-7	Apr. 7	156	536343	7151359	239	Ice	✓
SS3-8	Apr. 7	156	536696	7150809	826	Ice	✓
SS4-1[6]	Apr. 4	213	531497	7152209	61	Land	
SS4-2	Apr. 4	213	531361	7152258	196	Land	
SS4-3	Apr. 4	213	531328	7152476	335	Land	
SS4-4	Apr. 4	153	531147	7153165	1022	Ice	✓
SS4-5	Apr. 4	153	531405	7154124	1214	Ice	✓

Station ID	2019 Sampling Dates	Total Sample Exposure Duration (days)	UTM Coordinates[1]		Approx. Distance from Mining Operations (m)	Surface Description	Snow Water Chemistry Sampled[2]
			Easting (m)	Northing (m)			
SS5-1	Apr. 5	214	533143	7148934	26	Land	
SS5-2	Apr. 5	214	533141	7148899	55	Land	
SS5-3[7]	Apr. 5	154	533155	7148687	259	Ice	✓
SS5-4	Apr. 5	154	533138	7147947	941	Ice	✓
SS5-5	Apr. 5	154	533141	7146959	1894	Ice	✓
Contorl-1[8]	Apr. 5	214	534941	7144103	4802	Land	✓[9]
Control-2	Apr. 6	215	528714	7153307	3042	Land	✓[9]
Control-3	Apr. 5	214	538636	7148753	3550	Land	✓[9]
FFA-4	May 8	187	503724	7154100	27909	Ice	
FFB-4	May 5	184	515668	7150029	16004	Ice	
FF1-2	May 4	183	526547	7159040	7614	Ice	
LDS-2	Apr. 26	175	546443	7161147	11897	Ice	

Notes:
[1] UTM Zone 12W, NAD83.
[2] n/a = not applicable.
[3] Duplicate sample for dustfall snow surveys was collected at station SS1-3 (SS1-3-4 & SS1-3-5).
[4] Blank samples were collected at station SS2-1 (SS2-1-1 & SS2-1-1B).
[5] Duplicate samples for dustfall snow surveys and snow water chemistry were collected at station SS2-2 (SS2-2-4 & SS2-2-5).
[6] Duplicate sample for dustfall snow surveys was collected at station SS4-1 (SS4-1-4 & SS4-1-5).
[7] Duplicate sample for snow water chemistry was collected at station SS5-3 (SS5-3-4 & SS5-3-5).
[8] Duplicate sample for snow water chemistry was collected at Control-1 station (Control-1-4 & Control-1-5).
[9] Snow water chemistry was sampled over ice, adjacent to the on-land control station; see Section 2.3 for further details.

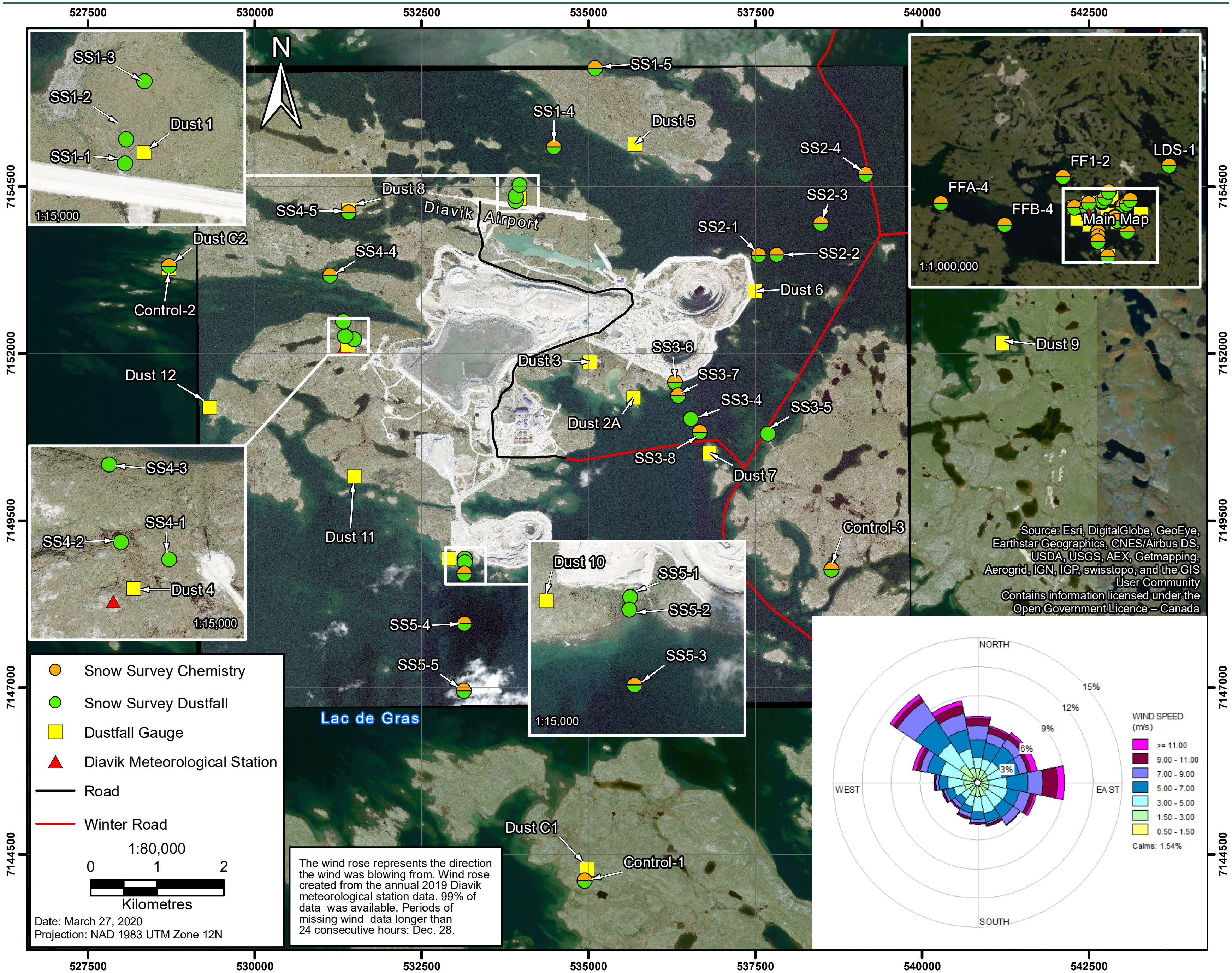


Figure 2-1: Dustfall Gauge and Snow Survey Locations, Diavik Diamond Mine, 2019

Photo 2.1-1: Dustfall gauge during sample collection. The dustfall gauge consisted of a hollow brass cylinder (centre) housed inside a Nipher snow gauge (right).

2.2 Dustfall Snow Surveys

Dustfall snow surveys were performed at 24 monitoring, three control, and four control-assessment stations along five transects around the Project (Table 2-1 and Figure 2-1). Across stations, the distance from mining operations ranged from approximately 26 m to 2,175 m for the monitoring stations, from 3,042 m to 4,802 m for the control stations and from 7,614 m, to 27,909 m for the control-assessment stations. The average total sampling period for the monitoring stations in 2019 was 214 and 155 days for the land and ice stations, respectively (control and control-assessment stations not included). The start dates correspond to the first snowfall for land stations (September 3, 2018), and shortly after freeze up of ice stations (November 2, 2018).

At each snow survey station, a snow corer was used to drill into the snow pack to retrieve a cylindrical snow core (6.1 cm inner diameter; Photo 2.2-1). Cores were extracted at each station and composited in the field to ensure a representative snow sample was obtained for the station. A minimum of three snow cores were collected at each (land and ice) of the snow sampling stations, as outlined in the Snow Core Survey SOP (ENVR-512-0213; Appendix F). Composited samples were bagged and brought to the DDMI environment lab for processing as specified in the Snow Core Survey SOP (ENVR-512-0213; Appendix F) and the Quality Assurance/Quality Control SOP (ENVR-303-0112; Appendix G). Processing of snow cores involved filtration, drying in a high heat oven, and weighing. For quality assurance and control (QA/QC), duplicate samples were collected at stations SS1-3, SS2-2, and SS4-1.

Mean daily dustfall rate ($mg/dm^2/d$) was then calculated over the collection period using Equation 1, with surface area (A) equal to the surface area of the snow corer tube orifice (0.2922 dm^2) multiplied by the number of snow cores used for the composited sample at the station. The mean annual dustfall rate ($mg/dm^2/y$) was estimated by multiplying the mean daily dustfall rate by 365 days.

Dustfall rates were compared to the Alberta Ambient Air Quality Objectives and Guidelines for dustfall (Table 2.2-1), which served as general performance indicators only.

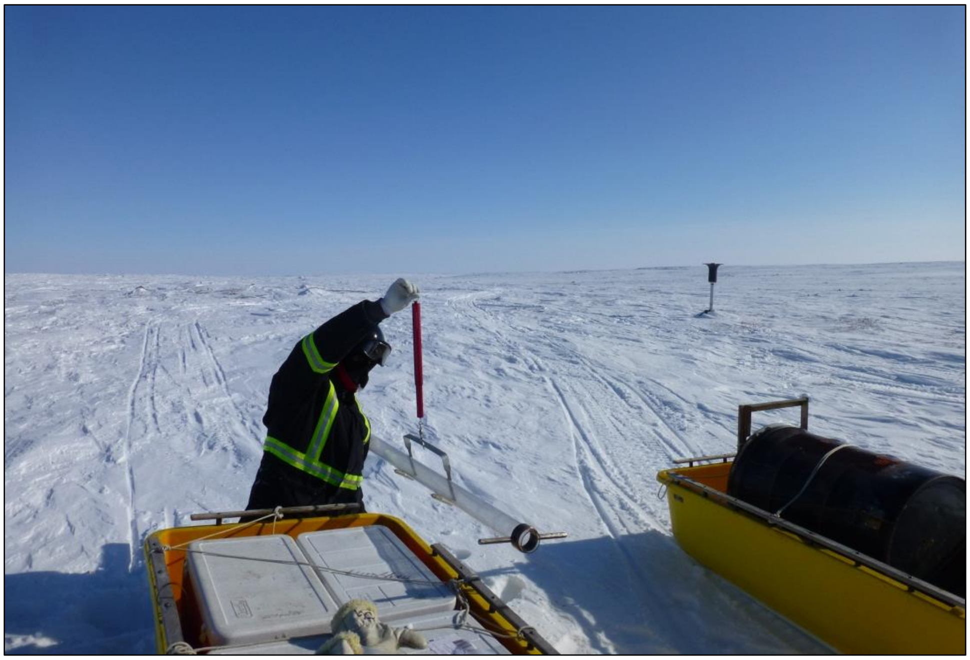


Photo 2.2-1: Snow core sample being weighed, with dustfall gauge in background.

Table 2.2-1: Dustfall and Snow Water Chemistry Reference Values

Parameter	Value	Unit	Comment	Source
Dustfall Rate	53–158	mg/dm^2/ 30 day	Alberta Ambient Air Quality Guidelines for dustfall	(Alberta Environment and Parks, 2019).
Aluminum-Total	3,000	µg/L	Max. grab sample concentration	W2015L2-0001
Ammonia-N	12,000	µg/L	Max. grab sample concentration	W2015L2-0001
Arsenic-Total	100	µg/L	Max. grab sample concentration	W2015L2-0001
Cadmium-Total	3	µg/L	Max. grab sample concentration	W2015L2-0001
Chromium-Total	40	µg/L	Max. grab sample concentration	W2015L2-0001
Copper-Total	40	µg/L	Max. grab sample concentration	W2015L2-0001
Lead-Total	20	µg/L	Max. grab sample concentration	W2015L2-0001
Nickel-Total	100	µg/L	Max. grab sample concentration	W2015L2-0001
Nitrite-N	2,000	µg/L	Max. grab sample concentration	W2015L2-0001
Zinc-Total	20	µg/L	Max. grab sample concentration	W2015L2-0001

2.3 Snow Water Chemistry

Snow water chemistry analysis was performed on snow cores extracted from 23 locations, including 16 dustfall snow survey stations located on ice, three samples taken on ice adjacent to the three control locations, and four control-assessment stations located on ice (Table 2-1 and Figure 2-1). The distance of the snow survey stations from mining operations in 2019 ranged approximately 35 m to 2,175 m, while this distance ranged from 3,042 m to 4,802 m and from 7,614 m to 27,909 m for the control and control-assessment locations, respectively. The average total sampling period in 2019 for the snow survey stations was 155 days (control and control-assessment stations not included). At each station located over water, cores were collected for chemistry analysis immediately after the dustfall snow cores were extracted.

Snow water chemistry cores were extracted using a snow corer in accordance with the dustfall snow survey core extraction. A minimum of three cores at each site were extracted and composited to obtain the necessary 3 L of snow water required for the laboratory chemical analysis as required (see Appendix F). Snow cores were then processed and prepared for shipment to Maxxam where the chemical analysis was performed. For QA/QC purposes, duplicate samples were collected at stations SS2-2, SS5-3 and Control-1 station. An equipment blank sample was collected at station SS2-1. Snow water chemistry sampling methodology is detailed in SOP ENVR-512-0213 (see Appendix F).

EQC, including “maximum average concentration” and “maximum concentration of any grab sample,” are stipulated in DDMI’s Water Licence (W2015L2-0001) for aluminum, ammonia, arsenic, cadmium, chromium, copper, lead, nickel, nitrite, and zinc (Table 2.2-1). Snow water chemistry results for these variables were compared to the “maximum concentration of any grab sample.” These results are also presented as part of DDMI’s AEMP report.

DDMI measures the chemistry of snow samples as this assists with characterizing the chemical content of the particulate material deposited over time. This is measured as the total metals and nutrients concentrations of the melted snow sample and makes direct comparison to maximum grab sample concentrations for EQCs difficult. It is important to note that the dust monitoring program is not designed to assess effects in the context used for most other AEMP water quality components.

DDMI compares the measured total metals levels for dust with EQC only because these criteria provide concentrations that can serve as general performance indicators, in a similar way that dustfall rates are compared with the Alberta Ambient Air Quality Objectives and Guidelines for dustfall (Alberta Environment and Parks, 2019). There is no intention or requirement that snow samples must meet the EQC or Alberta dustfall objectives.

3. RESULTS

Dustfall and snow water chemistry results were grouped into zones based on their relative distance from the mine footprint (Table 3-1). Station groupings into zones were first established at the outset of the program; however, these groupings were re-established in 2013 using satellite imagery of the site.

In 2019, the primary sources of fugitive dust were associated with unpaved road and airstrip usage and construction and mining activities at A21. Due to construction and mining activities at A21, the distance to mining operations were recalculated in 2019. The revised distances to mining operations are shown in Tables 2-1 and 3-1.

Major waste rock material transfers in 2019 included the use of haul roads (7,644,984 tonnes) and the transfer of kimberlite ore to the crusher (2,454,964 tonnes). Another source of fugitive dust was truck traffic along the ice road to the Project. The higher deposition rate near the ice road (at Dust 7 station) during the winter is explained by dustfall associated with the ice road; however, other dustfall stations immediately downwind of the ice road (SS2-4, SS3-5 and SS3-8) did not show elevated readings, indicating that dustfall associated with the ice road is generally insignificant relative to other sources. To suppress dust generation, roads, parking areas and the plant site were watered during the summer as needed. Between June and September 2019, approximately 656 m^3 of water was applied to the plant site and 19,797 m^3 of water was applied to haul roads. The exact impact of dust suppression could not be determined from the data collected in 2019; however, it is likely that road watering reduced the amount of dust generated at the Mine in 2019. In 2019, the Underground Mine production continued at A154 and A418, as well as stripping and production at the A21 open pit. Fugitive dust generation is expected to be greatest during snow-free periods where and when there is site activity. It was expected that the highest fugitive dust generation and resulting dustfall occurred in areas closest to the roads, the airstrip, and mine footprint such as near A21 between May and September. The difference between the summer and winter dustfall rate was generally minor with the summer rate being slightly higher at few sites (e.g. Dust 3 rate was 1,024 mg/dm^2/y in the summer and 940 mg/dm^2/y in the winter), while some sites recorded a higher winter dustfall rate (e.g. Dust 2A rate was 309 mg/dm^2/y in the summer and 399 mg/dm^2/y in the winter).

The predominant wind directions at the site in 2019 were from east and northwest although winds in general can be described as omnidirectional. Therefore, the expectation is that airborne material will be deposited in all directions around the mine with a southeast and west emphasis (Figure 2-1 and 3.1-1). The results show that the proximity to the mine activity is a stronger indicator of dust deposition than wind direction. This is supported by the fact that the three highest dust deposition rates in 2019 (Dust 3, 10 and 11) are located south or southwest of the mine footprint where wind speeds were relatively weak compared to other directions. Dust 3, which is located only 22 m from the mine, had the highest recorded dustfall rate of the dustfall gauges in 2019.

Results from the dustfall gauges, dustfall snow surveys, and the snow water chemistry analyses are presented below.

3.1 Dustfall Gauges

For each station, total dustfall collected throughout the year is summarized in Table 3-1. Annual 2019 dustfall and the station location relative to the Project is presented in Figure 3.1-1, and the historical records of annual dustfall are presented in Figures 3.1-2 and 3.1-3. A comparison of 2019 dustfall versus distance from the mine footprint is presented in Figure 3.1-4. Boxplots summarizing the dustfall magnitude distribution measured in each year are presented in Figure 3.1-5. Detailed information on 2019 measurements and calculations for each station are included in Appendix B.

Table 3-1: Dustfall and Snow Water Chemistry Results, Diavik Diamond Mine, 2019

Zone	Station	Approx. Distance from Mining (m)	Dustfall (mg/dm²/y)	Snow Water Chemistry (µg/L)										
				Aluminum	Ammonia	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Nitrite	Phosphorus	Zinc
0-100 m	Dust 1	70	260	-	-	-	-	-	-	-	-	-	-	-
	Dust 3	22	982	-	-	-	-	-	-	-	-	-	-	-
	Dust 6	13	266	-	-	-	-	-	-	-	-	-	-	-
	Dust 10	46	683	-	-	-	-	-	-	-	-	-	-	-
	SS1-1	30	1,114	-	-	-	-	-	-	-	-	-	-	-
	SS3-6	35	276	96.3	96.00	0.06	0.00	0.39	0.09	0.07	2.02	5.60	254.00	0.05
	SS4-1	61	164	-	-	-	-	-	-	-	-	-	-	-
	SS5-1	26	381	-	-	-	-	-	-	-	-	-	-	-
	SS5-2	55	425	-	-	-	-	-	-	-	-	-	-	-
Mean			**506**	**96.3**	**96.00**	**0.06**	**0.00**	**0.39**	**0.09**	**0.07**	**2.02**	**5.60**	**254.00**	**0.05**
Median			**381**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
Standard Deviation			**342**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
95% Confidence Interval (Mean +/-)			**263**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
Upper Limit of 95% Confidence Interval			**769**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
Lower Limit of 95% Confidence Interval			**242**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Zone	Station	Approx. Distance from Mining (m)	Dustfall (mg/dm²/y)	Snow Water Chemistry (µg/L)										
				Aluminum	Ammonia	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Nitrite	Phosphorus	Zinc
101-250 m	Dust 4	173	392	-	-	-	-	-	-	-	-	-	-	-
	SS1-2	115	371	-	-	-	-	-	-	-	-	-	-	-
	SS2-1	145	34	19.40	72.00	0.05	0.00	0.06	0.03	0.01	1.18	0.50	30.00	0.64
	SS3-7	239	432	134.00	110.00	0.10	0.00	0.47	0.18	0.10	1.68	11.00	413.00	0.83
	SS4-2	196	179	-	-	-	-	-	-	-	-	-	-	-
Mean			**282**	**76.70**	**91.00**	**0.07**	**0.00**	**0.26**	**0.10**	**0.05**	**1.43**	**5.75**	**221.50**	**0.74**
Median			**371**	**76.70**	**91.00**	**0.07**	**0.00**	**0.26**	**0.10**	**0.05**	**1.43**	**5.75**	**221.50**	**0.74**
Standard Deviation			**169**	**81.03**	**26.87**	**0.03**	**0.00**	**0.29**	**0.11**	**0.06**	**0.35**	**7.42**	**270.82**	**0.13**
95% Confidence Interval (Mean +/-)			**210**	**728.07**	**241.42**	**0.30**	**0.00**	**2.61**	**0.97**	**0.54**	**3.18**	**66.71**	**2,433.24**	**1.21**
Upper Limit of 95% Confidence Interval			**492**	**804.77**	**332.42**	**0.38**	**0.00**	**2.88**	**1.07**	**0.60**	**4.61**	**72.46**	**2,654.74**	**1.94**
Lower Limit of 95% Confidence Interval			**71**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Zone	Station	Approx. Distance from Mining (m)	Dustfall (mg/dm^2/y)	Snow Water Chemistry (µg/L)										
				Aluminum	Ammonia	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Nitrite	Phosphorus	Zinc
251-1,000 m	Dust 2A	425	355	-	-	-	-	-	-	-	-	-	-	-
	Dust 11	747	667	-	-	-	-	-	-	-	-	-	-	-
	SS1-3	260	32	-	-	-	-	-	-	-	-	-	-	-
	SS1-4	899	95	53.30	80.00	0.03	0.01	0.13	0.13	0.05	1.12	4.30	95.40	1.48
	SS2-2	427	44	19.80	34.00	0.02	0.00	0.04	0.04	0.01	0.44	1.20	17.00	0.89
	SS3-4	585	248	50.30	68.00	0.04	0.00	0.20	0.12	0.08	2.69	4.20	144.00	0.59
	SS3-8	826	296	78.90	110.00	0.05	0.00	0.30	0.10	0.06	1.47	4.70	211.00	0.41
	SS4-3	335	162	-	-	-	-	-	-	-	-	-	-	-
	SS5-3	259	481	139.50	75.00	0.05	0.00	0.24	0.20	0.12	1.77	7.25	278.50	1.10
	SS5-4	941	101	67.30	43.00	0.04	0.00	0.18	0.16	0.06	1.49	1.20	111.00	1.33
Mean			**265**	**68.18**	**68.33**	**0.04**	**0.00**	**0.18**	**0.12**	**0.06**	**1.50**	**3.81**	**142.82**	**0.97**
Median			**248**	**60.30**	**71.50**	**0.04**	**0.00**	**0.19**	**0.13**	**0.06**	**1.48**	**4.25**	**127.50**	**0.99**
Standard Deviation			**212**	**40.21**	**27.34**	**0.01**	**0.00**	**0.09**	**0.05**	**0.04**	**0.74**	**2.31**	**91.82**	**0.42**
95% Confidence Interval (Mean +/-)			**163**	**42.20**	**28.69**	**0.01**	**0.00**	**0.09**	**0.06**	**0.04**	**0.78**	**2.42**	**96.35**	**0.44**
Upper Limit of 95% Confidence Interval			**428**	**110.38**	**97.02**	**0.05**	**0.00**	**0.27**	**0.18**	**0.10**	**2.27**	**6.23**	**239.17**	**1.40**
Lower Limit of 95% Confidence Interval			**102**	**25.99**	**39.64**	**0.03**	**0.00**	**0.09**	**0.07**	**0.02**	**0.72**	**1.39**	**46.46**	**0.53**

Zone	Station	Approx. Distance from Mining (m)	Dustfall (mg/dm²/y)	Snow Water Chemistry (µg/L)										
				Aluminum	Ammonia	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Nitrite	Phosphorus	Zinc
1,001-2,500 m	Dust 5	1,183	111	-	-	-	-	-	-	-	-	-	-	-
	Dust 7	1,147	298	-	-	-	-	-	-	-	-	-	-	-
	Dust 8	1,213	173	-	-	-	-	-	-	-	-	-	-	-
	Dust 12	2,326	212	-	-	-	-	-	-	-	-	-	-	-
	SS1-5	2,175	84	46.40	72.00	0.03	0.00	0.10	0.13	0.04	1.20	4.40	94.30	1.48
	SS2-3	1,194	41	31.00	77.00	0.02	0.00	0.06	0.09	0.02	0.79	0.50	40.00	1.00
	SS2-4	2,164	41	36.10	71.00	0.05	0.00	0.07	0.10	0.02	1.11	0.50	48.00	0.96
	SS3-5	1,325	50	23.50	65.00	0.03	0.00	0.08	0.03	0.02	3.03	2.80	52.10	0.53
	SS4-4	1,022	121	46.30	120.00	0.05	0.00	0.22	0.08	0.06	3.92	5.00	60.00	0.28
	SS4-5	1,214	137	52.80	87.00	0.03	0.00	0.20	0.08	0.05	3.40	2.40	77.30	0.45
	SS5-5	1,894	40	30.90	33.00	0.04	0.00	0.03	0.08	0.03	1.14	0.50	46.40	1.60
+2,500 m	Dust 9	3,796	84	-	-	-	-	-	-	-	-	-	-	-
Mean			**114**	**38.14**	**75.00**	**0.04**	**0.00**	**0.11**	**0.08**	**0.03**	**2.08**	**2.30**	**59.73**	**0.90**
Median			**98**	**36.10**	**72.00**	**0.03**	**0.00**	**0.08**	**0.08**	**0.03**	**1.20**	**2.40**	**52.10**	**0.96**
Standard Deviation			**80**	**10.58**	**26.02**	**0.01**	**0.00**	**0.07**	**0.03**	**0.02**	**1.31**	**1.90**	**19.44**	**0.51**
95% Confidence Interval (Mean +/-)			**51**	**9.78**	**24.06**	**0.01**	**0.00**	**0.07**	**0.03**	**0.01**	**1.21**	**1.76**	**17.98**	**0.47**
Upper Limit of 95% Confidence Interval			**166**	**47.93**	**99.06**	**0.04**	**0.00**	**0.18**	**0.11**	**0.05**	**3.30**	**4.06**	**77.70**	**1.37**
Lower Limit of 95% Confidence Interval			**63**	**28.36**	**50.94**	**0.03**	**0.00**	**0.04**	**0.06**	**0.02**	**0.87**	**0.54**	**41.75**	**0.43**

Zone	Station	Approx. Distance from Mining (m)	Dustfall ($mg/dm^2/y$)	Snow Water Chemistry (µg/L)										
				Aluminum	Ammonia	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Nitrite	Phosphorus	Zinc
Control	Dust C1	4,646	115	-	-	-	-	-	-	-	-	-	-	-
	Dust C2	3,031	82	-	-	-	-	-	-	-	-	-	-	-
	Control 1	4,802	28	12.90	31.50	0.02	0.00	0.08	0.06	0.02	0.76	0.50	22.70	1.40
	Control 2	3,042	68	24.70	56.00	0.01	0.01	0.08	0.05	0.03	0.75	1.60	28.80	1.16
	Control 3	3,550	73	47.70	13.00	0.11	0.00	0.19	0.26	0.06	3.28	4.00	81.40	0.86
Mean			**73**	**28.43**	**33.50**	**0.05**	**0.00**	**0.12**	**0.12**	**0.03**	**1.60**	**2.03**	**44.30**	**1.14**
Median			**73**	**24.70**	**31.50**	**0.02**	**0.00**	**0.08**	**0.06**	**0.03**	**0.76**	**1.60**	**28.80**	**1.16**
Standard Deviation			**31**	**17.70**	**21.57**	**0.05**	**0.00**	**0.06**	**0.12**	**0.02**	**1.46**	**1.79**	**32.27**	**0.27**
95% Confidence Interval (Mean +/-)			**39**	**43.96**	**53.58**	**0.13**	**0.01**	**0.16**	**0.29**	**0.06**	**3.62**	**4.45**	**80.17**	**0.67**
Upper Limit of 95% Confidence Interval			**112**	**72.40**	**87.08**	**0.18**	**0.01**	**0.28**	**0.42**	**0.09**	**5.22**	**6.48**	**124.47**	**1.80**
Lower Limit of 95% Confidence Interval			**34**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.47**
Control-assessment	FFA-4	27,909	12	20.00	65.00	0.01	0.00	0.14	0.11	0.05	0.36	-	2.00	1.10
	FFB-4	16,004	50	126.00	61.00	0.04	0.00	1.48	0.33	0.17	5.41	-	11.80	1.37
	FF1-2	7,614	24	119.00	170.00	0.02	0.00	0.60	0.20	0.14	1.58	-	6.80	1.69
	LDS-1	11,897	20	16.60	29.00	0.01	0.00	0.07	0.09	0.05	0.20	-	1.00	1.10
Mean			**26**	**70.40**	**81.25**	**0.02**	**0.00**	**0.57**	**0.18**	**0.10**	**1.89**	**-**	**5.40**	**1.32**
Median			**22**	**69.50**	**63.00**	**0.02**	**0.00**	**0.37**	**0.16**	**0.10**	**0.97**	**-**	**4.40**	**1.24**
Standard Deviation			**16**	**60.24**	**61.32**	**0.01**	**0.00**	**0.65**	**0.11**	**0.06**	**2.43**	**-**	**4.96**	**0.28**
95% Confidence Interval (Mean +/-)			**26**	**95.86**	**97.58**	**0.02**	**0.00**	**1.03**	**0.17**	**0.10**	**3.86**	**-**	**7.89**	**0.45**
Upper Limit of 95% Confidence Interval			**52**	**166.26**	**178.83**	**0.04**	**0.00**	**1.60**	**0.35**	**0.21**	**5.75**	**-**	**13.29**	**1.76**
Lower Limit of 95% Confidence Interval			**0.5**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.00**	**0.00**	**-**	**0.00**	**0.87**

Notes:

Dash (-) = not available (snow water chemistry not sampled)

n/a = not applicable

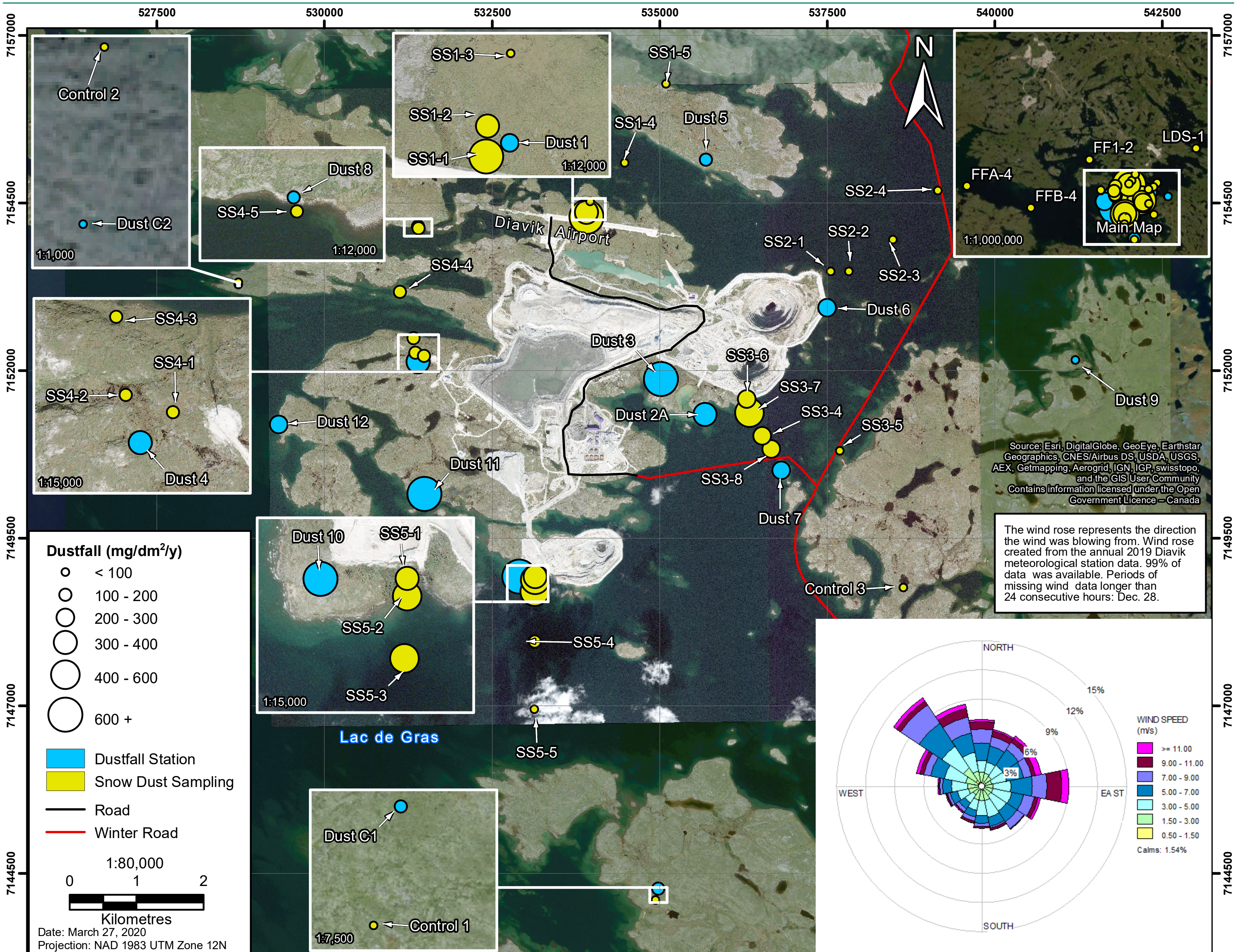
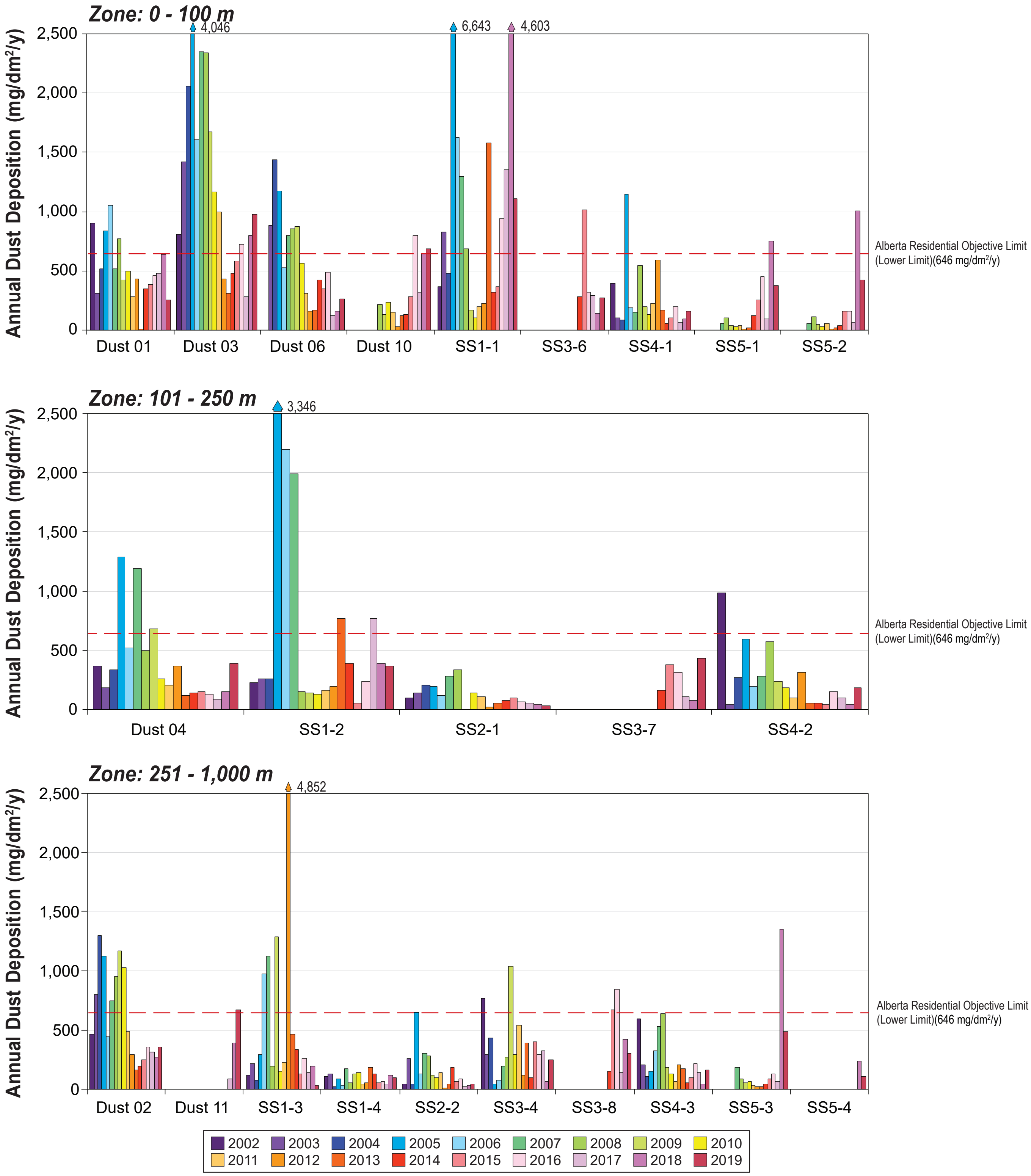
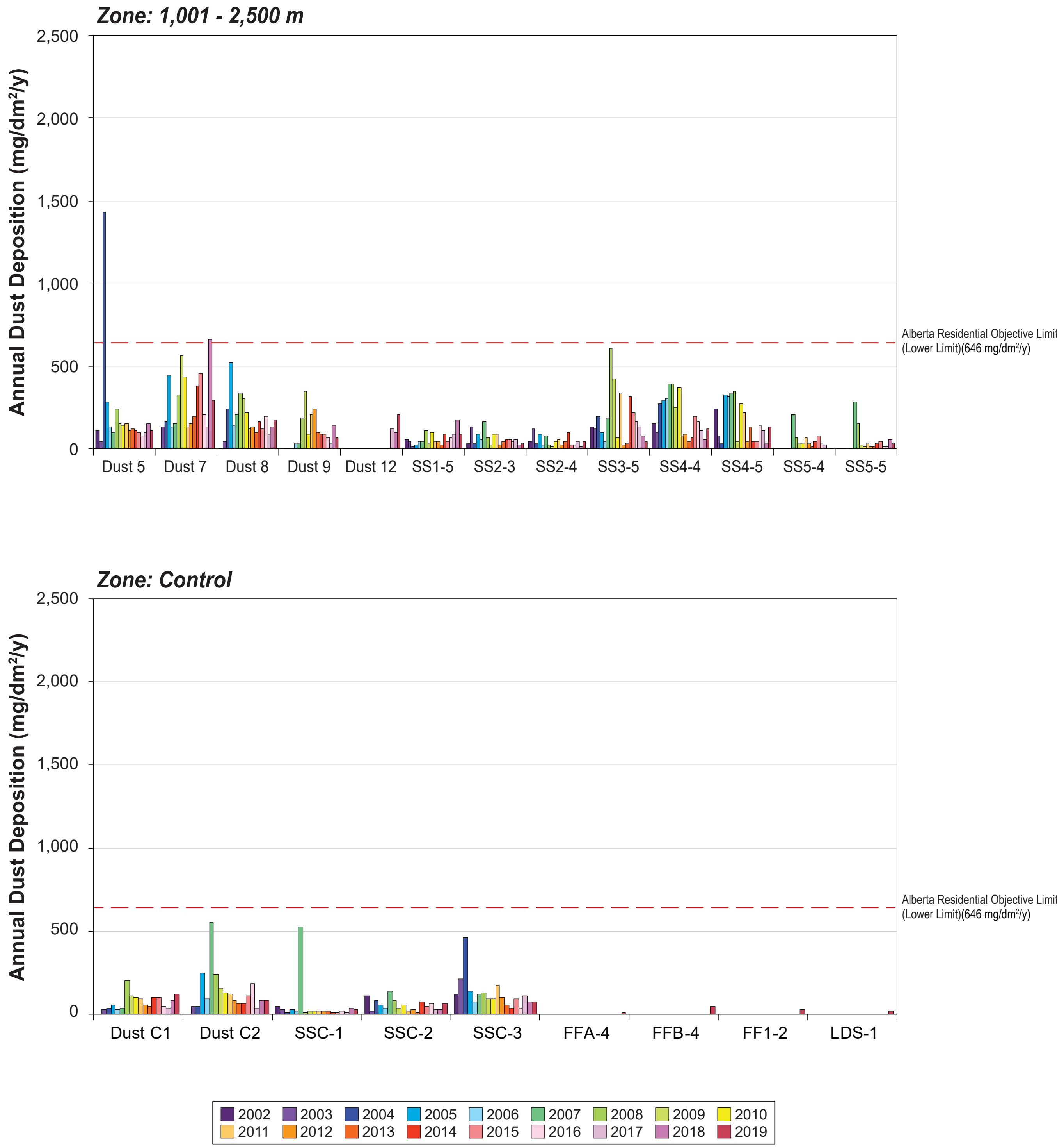


Figure 3.1-1: Dustfall Results, Diavik Diamond Mine, 2019



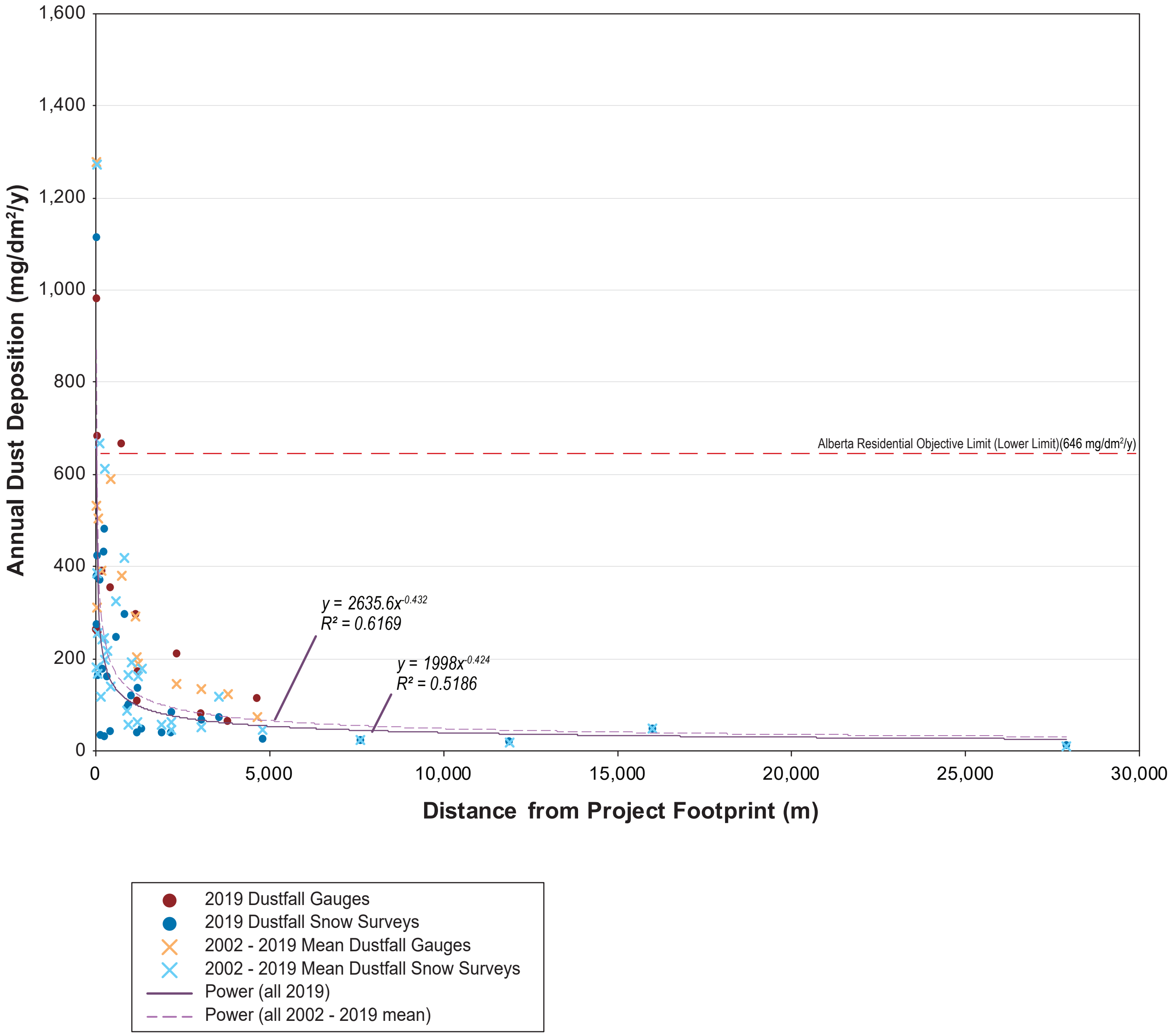
Notes: Annual deposition was calculated using the methodology described in Section 2.
See Table 2-1 for actual 2019 sample exposure times.
Station locations have been grouped into zones based on their distance from the 2019 Project footprint (see Section 3 for further details).
SS5-4 moved to 251-1,000 m zone in 2018

Figure 3.1-2: Calculated Annual Dust Deposition Rates at Dustfall Gauges and Snow Survey Locations up to 1,000 m from the Project Footprint, Diavik Diamond Mine, 2002 to 2019



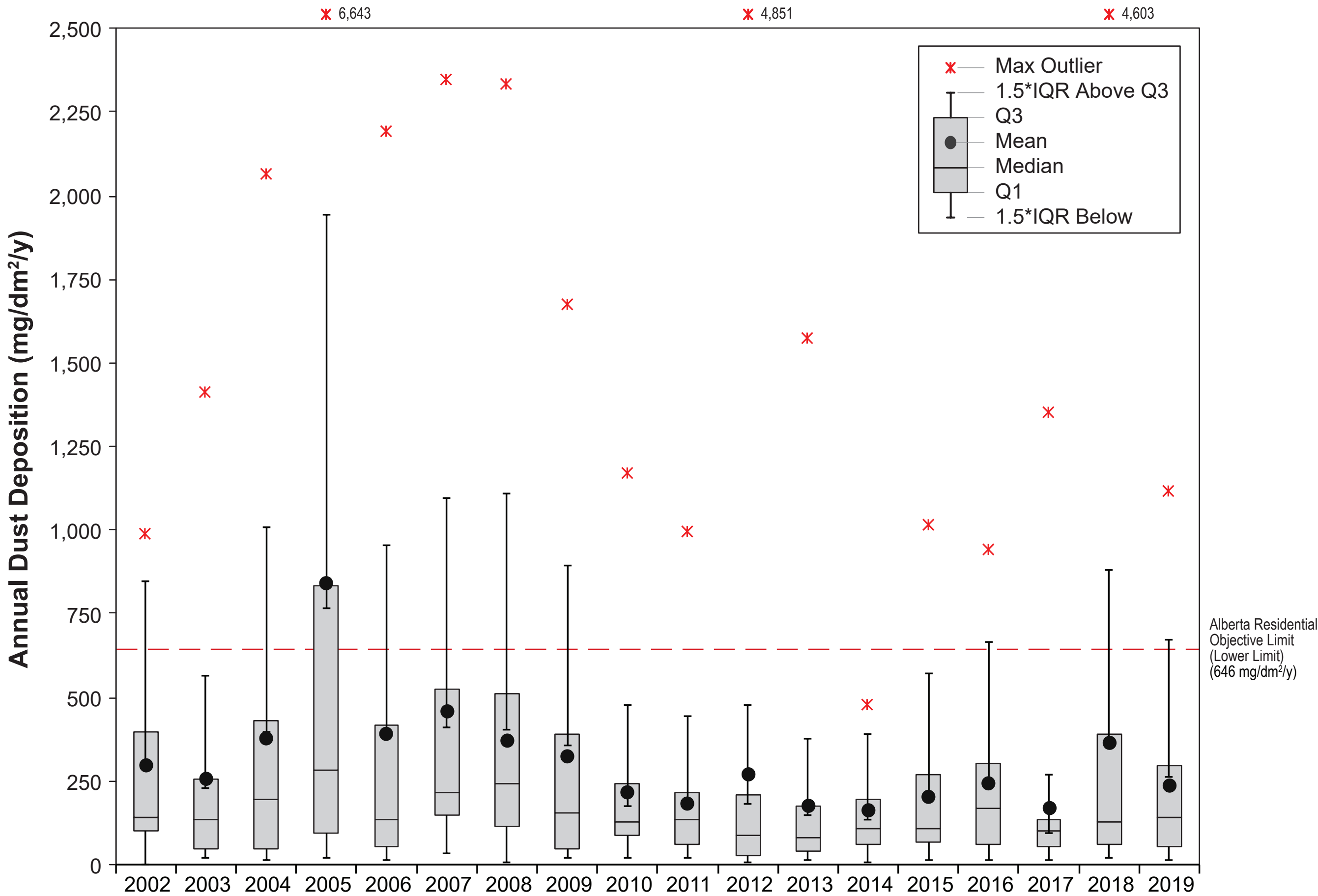
Notes: Annual deposition was calculated using the methodology described in Section 2.
See Table 2-1 for actual 2019 sample exposure times.
Station locations have been grouped into zones based on their distance from the 2019 Project footprint (see Section 3 for further details).
New locations added in 2019 include FFA-4, FFB-4, FF1-2 and LDS-1
SS5-4 moved to 251-1,000 m zone in 2018

Figure 3.1-3: Calculated Annual Dust Deposition Rates at Dustfall Gauges and Snow Survey Locations greater than 1,000 m from the Project Footprint, Diavik Diamond Mine, 2002 to 2019



Notes: Annual deposition was calculated using the methodology described in Section 2.
See Table 2-1 for actual 2019 sample exposure times.

Figure 3.1-4: Dust Deposition Versus Distance from Project Footprint, Diavik Diamond Mine, 2019



Notes: *Annual deposition is calculated using the methodology described in Section 2.*
See Table 2-1 for actual 2019 sample exposure times.
Q1: Lower quartile (25% of data are less than this value) ,
Q3: Upper quartile (25% of data are greater than this value),
IQR = Q3 – Q1 (the interquartile range).

Figure 3.1-5: Dust Deposition Box Plot, Diavik Diamond Mine, 2002 to 2019

Similar to 2018, the greatest estimated dustfall rate in 2019 measured using gauges occurred at Dust 3 (22 m from the Project). The Dust 3 measured dustfall rate in 2019 was 982 mg/dm^2/y. Dust 10 (683 mg/dm^2/y) and Dust 11 (667 mg/dm^2/y) recorded the second and third highest dustfall rates measured using gauges, respectively. Dust 10 site is adjacent to the A21 open pit, while Dust 11 is located west to the South Country Rock Pile – Waste Rock Storage Area (SCRP-WRSA; Figure 2-1). The lowest dustfall rate was recorded at Dust 9 (65 mg/dm^2/y). Both control stations Dust C1 (115 mg/dm^2/y; 4,646 m to the south) and Dust C2 (82 mg/dm^2/y; 3,031 m to the west) recorded higher dustfall rates than Dust 9 (Table 3-1; Figures 3.1-3 and 3.1-4). This is explained by the distance of Dust 9 from the Project footprint (3,796 m to the east), which places it within the control stations zone.

The dustfall rates estimated from dustfall gauges in 2019 were comparable to the 2018 rates. Four locations recorded lower deposition rates in 2019 than 2018, while all other locations recorded higher rates in 2019 (Figures 3.1-2 to 3.1-4). 2018 rates were generally the highest recorded since 2008 (DDMI 2019). The higher recorded dustfall values in both 2018 and 2019 suggest that dustfall rates in these two years were likely influenced by the surface activity at the mine, particularly at the A21 open pit, which began in December 2017, while the dustfall rates in 2017 were related mainly to the airstrip (DDMI 2019; DDMI 2018).

The annualized dustfall rates estimated from gauges at all stations were less than the upper limit of the Alberta Ambient Air Quality Objectives and Guidelines for dustfall (1,922 mg/dm^2/y), which is applied to industrial locations. The lower limit of these objectives (646 mg/dm^2/y) that is applied to residential and recreational areas was exceeded at the three sites that recorded the highest dustfall rates in 2019 (Dust 3, 10 and 11). The Alberta Ambient Air Quality Objectives and Guidelines recommends that dustfall objectives be used as general performance indicators only with no compliance requirement; thus, these objectives are used here for comparison purposes only, particularly as there are currently no standards or objectives for the Northwest Territories.

3.2 Dustfall Snow Surveys

Annual dustfall rates estimated from each snow survey station in 2019 are summarized in Table 3-1. Historical records of annual snow survey dustfall rates for each station are presented in Figures 3.1-2 and 3.1-3. The relationships between annual snow survey dustfall rates and distance from the mine footprint are shown in Figures 3.1-1 and 3.1-4. Boxplots summarizing dustfall rates measured in each year are presented in Figure 3.1-5. 2019 snow survey field datasheets and laboratory results are included in Appendix B. Duplicate samples collected at stations SS1-3, SS2-2 and SS4-1 for QA/QC purposes are discussed in Section 3.4.

Annualized dustfall rates estimated from 2019 snow survey data ranged from 12 to 1,114 mg/dm^2/y (Table 3-1; Figures 3.1-2 and 3.1-3). The maximum dust deposition rate was recorded at SS1-1 followed by SS5-3 (481 mg/dm^2/y). SS1-1 consistently recorded the highest dustfall rates from 2017 to 2019. The station is located due north of the airstrip, which explains the higher levels of dustfall found here. The higher levels of dustfall rates at SS5-3 is associated with the mine activity at A21 open pit (Figure 3.1-1).

In general, snow survey dustfall rates decreased with increasing distance from the Project. Mean dustfall rates estimated using both dustfall gauges and snow surveys within the 0 m to 100 m, 101 m to 250 m, 251 m to 1,000 m, 1,001 m to 2,500 m, control, and control–assessment zones were 506, 282, 265, 114, 73 and 26 mg/dm^2/y, respectively (Table 3-1). Dustfall rates at stations SS1-1, Dust 3, Dust 11, SS5-3, Dust 7, Dust 8, Dust 12 and Dust C1 were greater than the upper limit of the 95% confidence interval (CI) for their respective zones in 2019. A sample that exceeds the 95% confidence interval (CI) has a probability of occurrence of 5% or less, which indicating a particularly high dust deposition. In the 0 m to 100 m zone, the 95% CI was exceeded at the two sites adjacent to the air strip (SS1-1 and Dust 3), while in the 251 m to 1,000 m zone the 95% CI was exceeded at Dust 11 and SS5-3, which is likely explained by the proximity to the A21 open pit. Three exceedances of the 95% CI occurred in zone 1,001 m to 2,500 m (Dust 7, Dust 8 and Dust 12), while once exceedance occurred in the control zone (Dust C1). The exceedance of the 95% CI at Dust 7 is associated with dust from the ice road. Although the dustfall rates at Dust 8, Dust 12 and Dust C1 were relatively low in comparison to other dustfall gauges, they exceeded the 95% CI of their respective zone. This is mainly a result of the very low dustfall rates at all other sites of each zone except Dust 7 within the 1,001 to 2,500 m zone (Figure 3.1-1 and Table 3-1).

Annualized dustfall estimated from snow survey stations in 2019 were generally lower than 2018 dustfall estimates (Figure 3.1-5); although several stations recorded higher rates in 2019 than 2018 (Figures 3.1-2 and 3.1-3). The annualized dustfall rates estimated from snow surveys never exceeded the upper limit (applied to industrial locations) of the Alberta Ambient Air Quality Objectives and Guidelines at any station, while only SS1-1 exceeded the lower limit of these guidelines, which applies to residential and recreational areas.

3.3 Snow Water Chemistry

A summary of the snow water chemistry results for each variable of interest (i.e., variables with EQC and phosphorus) is provided below. The full suite of analytical results for snow water chemistry is included in Appendix D. For QA/QC purposes, duplicate samples were collected at stations SS2-2, SS5-3 and Control-1 station. An equipment blank sample was collected at station SS2-1. Results of QA/QC samples are discussed in Section 3.4.

All 2019 sample concentrations were less than their associated reference levels as specified by the “maximum concentration of any grab sample” in Water Licence W2015L2-0001.

In general, average concentrations of snow water chemistry variables of interest decreased with increasing distance from the Project (Figures 3.3-1 to 3.3-4). Concentrations of all parameters except ammonia, nitrite, and phosphorus were lower in 2019 compared to recent years. It should be noted that the 0 m to 100 m zone contains only one sampling location; therefore, no median was reported in Figures 3.3-1 to 3.3-4.

3.3.1 Aluminum

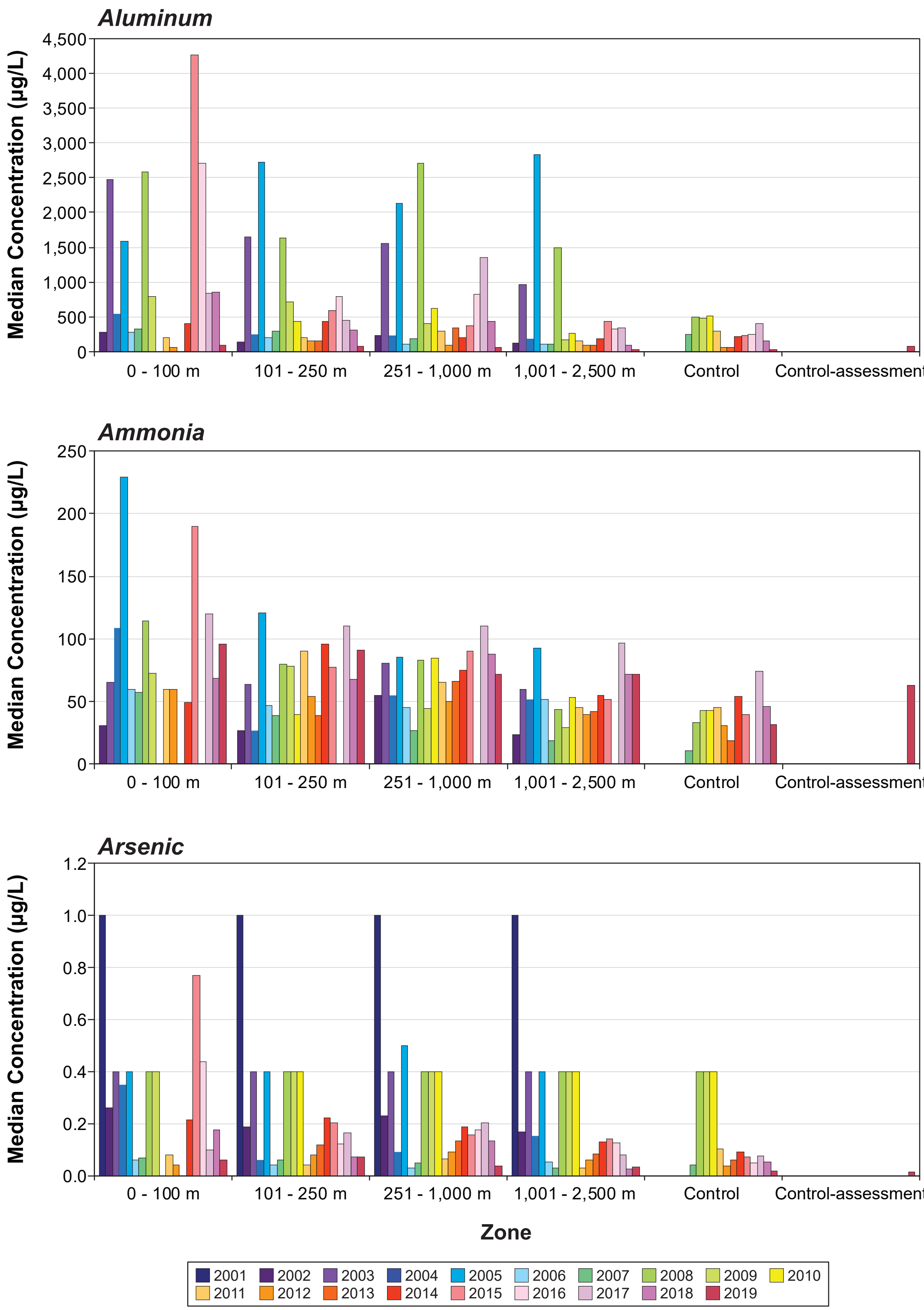
Aluminum concentrations measured in 2019 ranged from 13 µg/L at Control-1 station to 140 µg/L at station SS5-3 in the 251 m to 1,000 m zone (Table 3-1). Aluminum concentrations in 2019 were slightly higher in the 0 m to 100 m zone than other zones, where only one sample is available (Figure 3.3-1). The median concentrations in all other zones were much lower in 2019 compared to historical records (2001 to 2018). All the locations were well below the EQC concentration of 3,000 µg/L specified in the Water Licence (Table 3-1; Figure 3.3-1).

3.3.2 Ammonia

Ammonia concentrations measured in 2019 ranged from 13 µg/L at Control-3 station to 170 µg/L at FF1-2 Control-assessment station (Table 3-1). The second highest concentration of ammonia in 2019 was recorded at station SS4-4 in the 1,001 m to 2,500 m zone. The 2019 median concentrations in all zones were generally similar to historical data. All 2019 and historical ammonia measurements were well below the EQC of 12,000 µg/L specified in the Water Licence for grab sample concentrations.

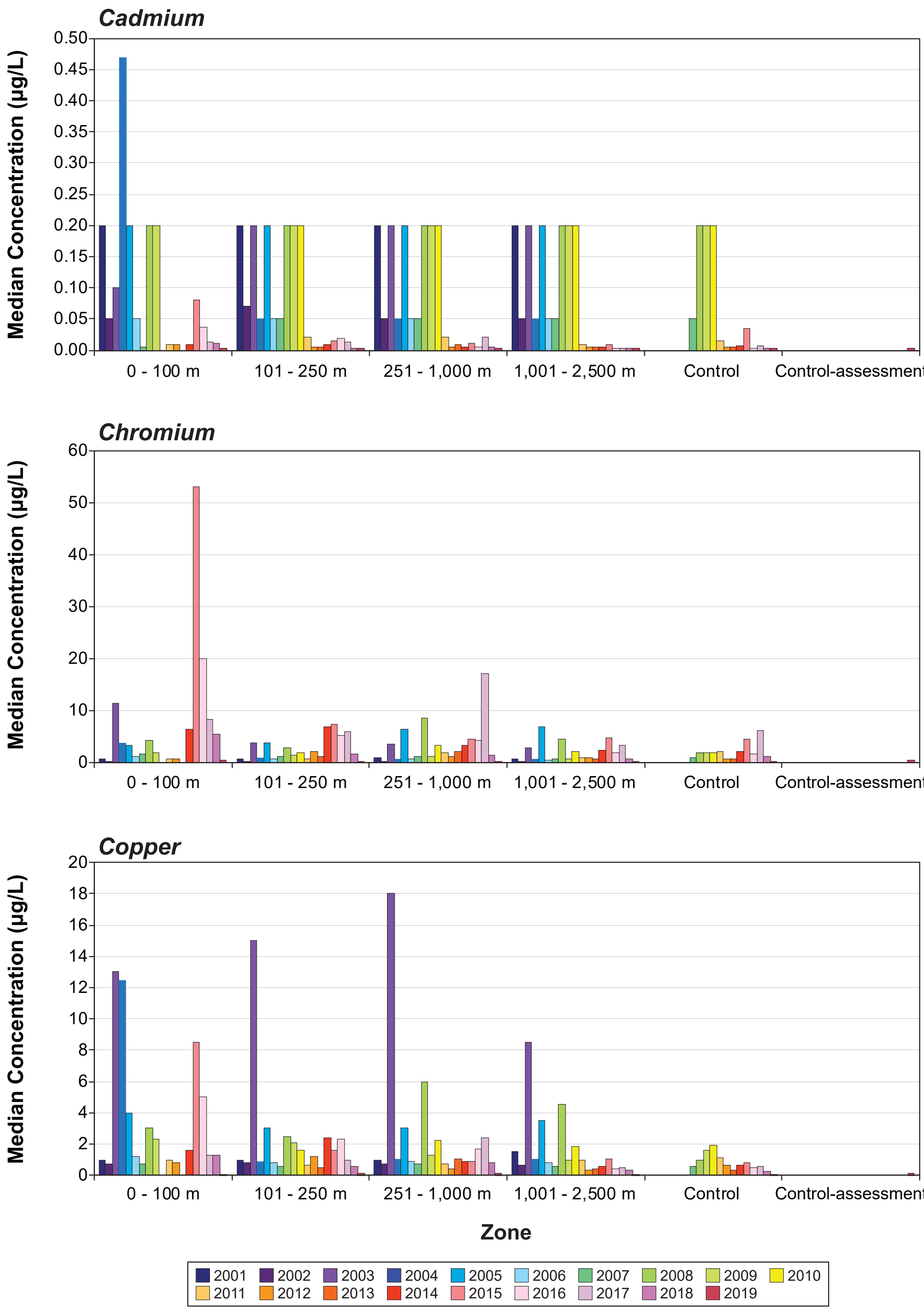
3.3.3 Arsenic

Arsenic concentrations measured in 2019 ranged from 0.01 µg/L at control-assessment stations FFA-4 and LDS-1 to 0.11 µg/L at Control-3 station (Table 3-1). Median 2019 arsenic concentrations generally decreased with increasing distance from the Project (Figure 3.3-1). 2019 median concentrations were generally lower than historical median concentrations in all zones (Figure 3.3-1). All measurements were well below the EQC of 100 µg/L specified in the Water Licence for grab sample concentrations.



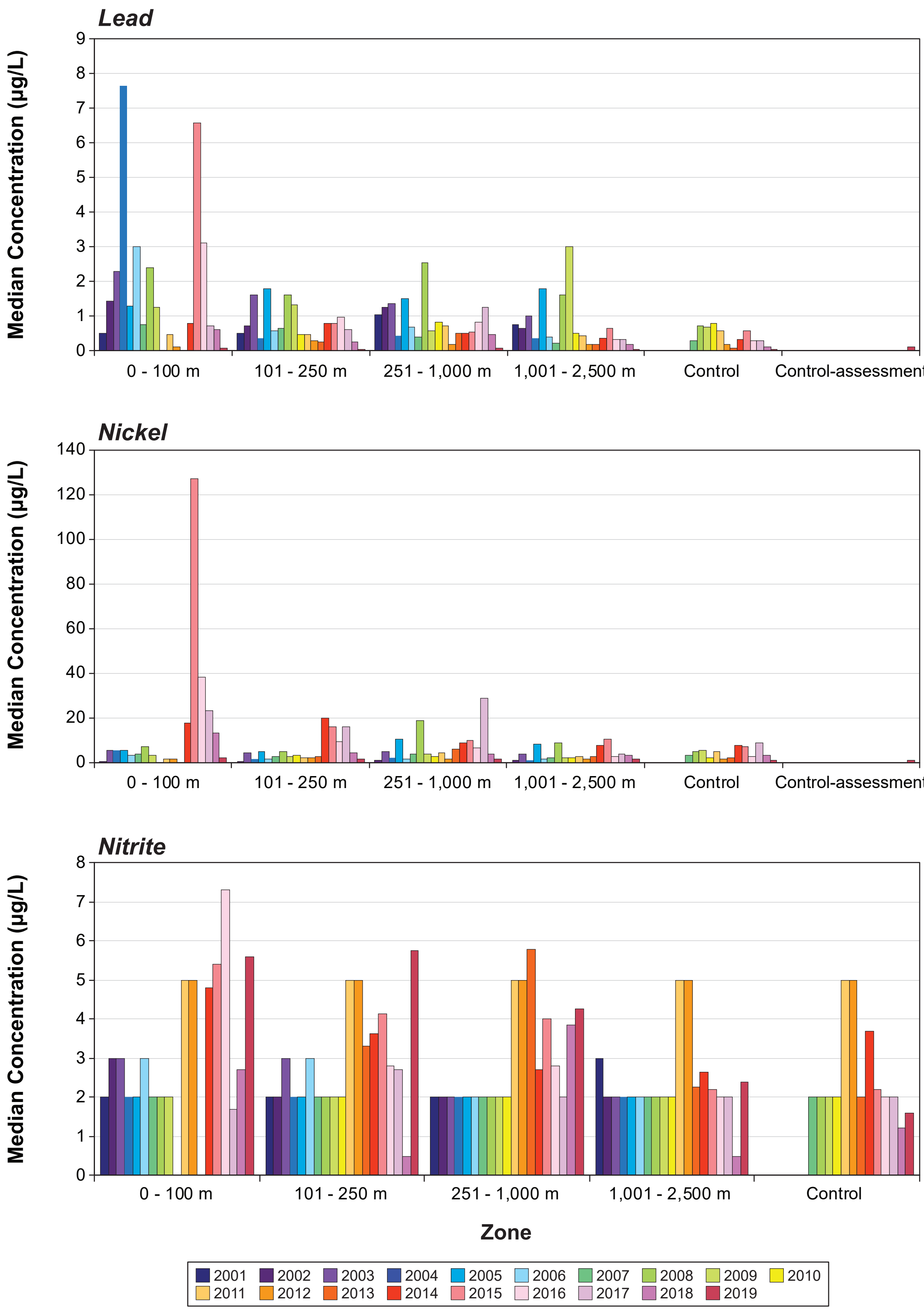
Notes: *The value used for the 0-100 m zone in 2019 represents one sample rather than the median.*
EQC (µg/L) = 3000 for Aluminum, 12000 for Ammonia, and 100 for Arsenic
Control-assessment locations added in 2019

Figure 3.3-1: Snow Water Chemistry Results: Aluminum, Ammonia and Arsenic, 2001 to 2019



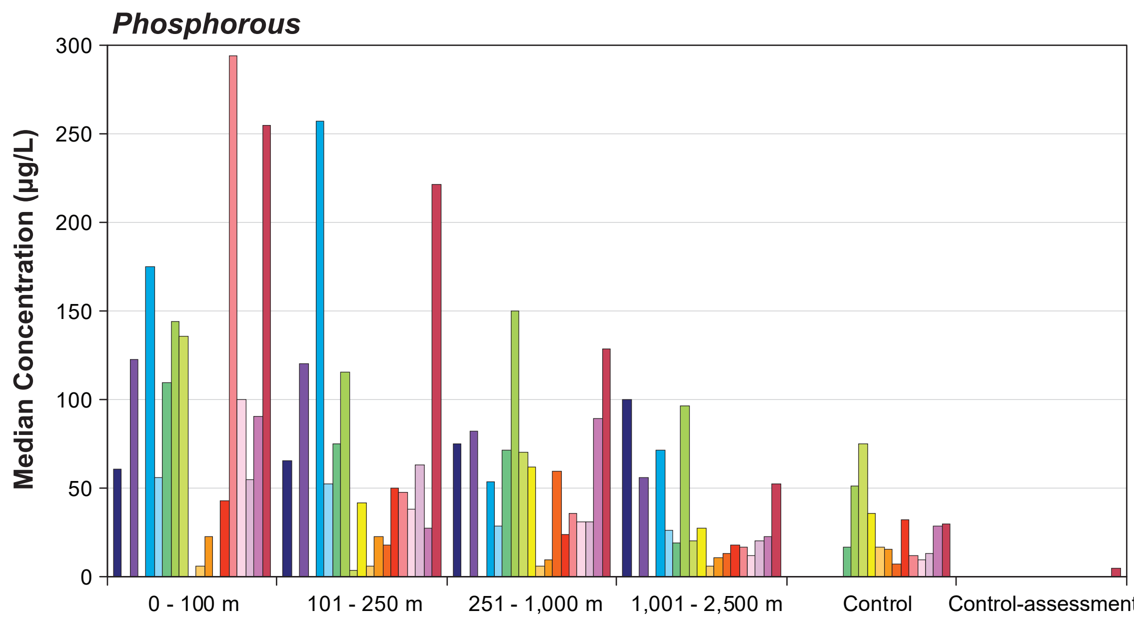
Notes: *The value used for the 0-100 m zone in 2019 represents one sample rather than the median.*
EQC (µg/L) = 3 for Cadmium, 40 for Chromium, and 40 for Copper
Control-assessment locations added in 2019

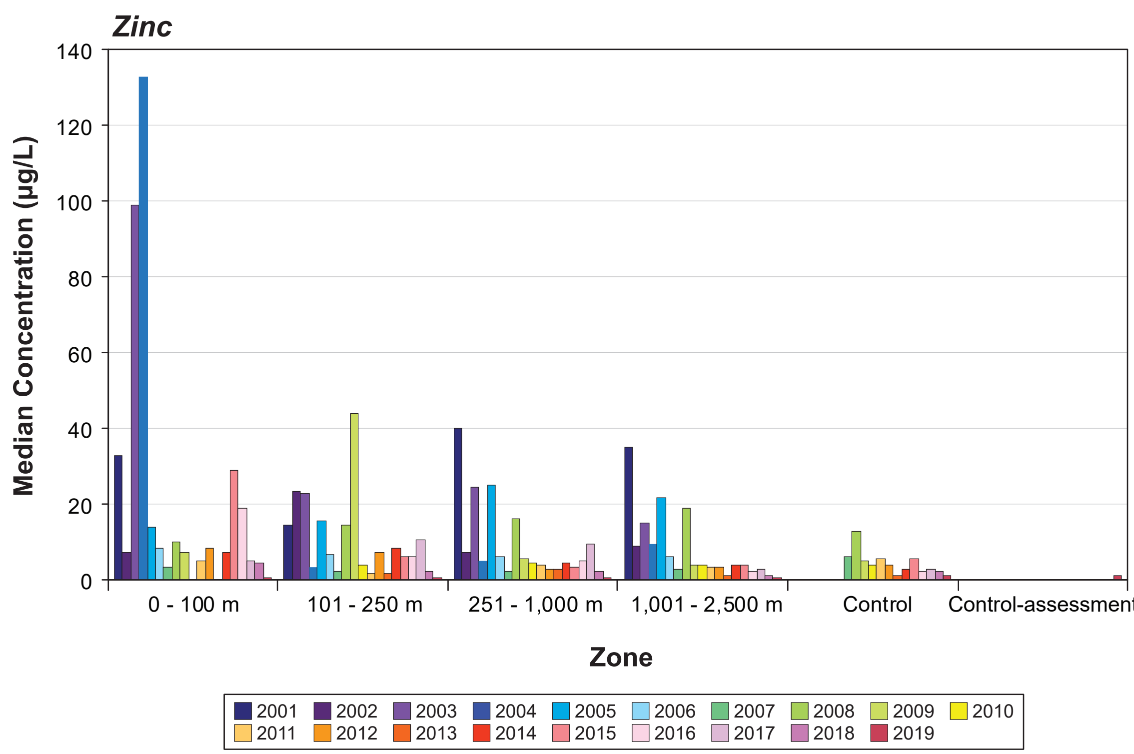
Figure 3.3-2: Snow Water Chemistry Results: Cadmium, Chromium and Copper, 2001 to 2019



Notes: *The value used for the 0-100 m zone in 2019 represents one sample rather than the median.*
EQC (µg/L) = 20 for Lead, 100 for Nickel, and 2000 for Nitrite
Control-assessment locations added in 2019

Figure 3.3-3: Snow Water Chemistry Results: Lead, Nickel and Nitrite, 2001 to 2019





Notes: *The value used for the 0-100 m zone in 2019 represents one sample rather than the median.*
EQC (µg/L) = 20 for Zinc, no EQC specified for Phosphorus
Control-assessment locations added in 2019

Figure 3.3-4: Snow Water Chemistry Results: Phosphorous and Zinc, 2001 to 2019

3.3.4 Cadmium

Cadmium concentrations measured in 2019 ranged from less than the analytical detection limit (< 0.0025 µg/L) at multiple stations in all zones to 0.006 µg/L at the Control-2 station (Table 3-1). Median 2019 cadmium concentrations were near or below analytical detection limits and were similar for all distance ranges (Figure 3.3-2). Medians and overall cadmium concentrations in 2019 were generally less than historical medians and concentrations. (Figure 3.3-2). All measurements were well below than the EQC of 3 µg/L specified in the Water Licence for grab sample concentrations.

3.3.5 Chromium

Chromium concentrations measured in 2019 ranged from less than the analytical detection limit (< 0.05 µg/L) at multiple stations to 1.5 µg/L at the control-assessment station FFB-4 (Table 3-1). The 2019 median concentration in each zone was generally lower than historical concentrations and well below 2018 and 2017 median concentrations (Figure 3.3-2). None of the measurements exceeded the EQC of 40 µg/L specified in the Water Licence for grab sample concentrations.

3.3.6 Copper

Copper concentrations measured in 2019 ranged from below the analytical detection limit (< 0.05 µg/L) at multiple locations to 0.33 µg/L at the control-assessment station FFB-4 (Table 3-1). Median 2019 copper concentrations were the lowest in the record (2001-2019; Figure 3.3-2), with very little variance between zones. All measurements were less than the EQC of 40 µg/L specified in the Water Licence for grab sample concentrations.

3.3.7 Lead

Lead concentrations measured in 2019 ranged from 0.01 µg/L at SS2-1 station in the 101-250 zone and station SS2-2 in the 251-1,000 m zone to 0.2 µg/L at station SS3-8 in the 251-1,000 m zone (Table 3-1). Similar to copper, the 2019 lead median concentrations in all zones were below all historical medians (2001-2018) with very little variance between zones (Figure 3.3-3). All measurements were well below than the EQC of 20 µg/L specified in the Water Licence for grab sample concentrations.

3.3.8 Nickel

Nickel concentrations measured in 2019 ranged from 0.2 µg/L at the control-assessment station LDS-1 to 5.4 µg/L at the Control-assessment station FFB-4 (Table 3-1). Median 2019 nickel concentrations were generally comparable or below historical concentrations (2002-2018) with little variance between the zones. All measurements were well below than the EQC of 100 µg/L specified in the Water Licence for grab sample concentrations.

3.3.9 Nitrite

Nitrite concentrations measured in 2019 ranged from less than the analytical detection limit (<1.0 µg/L) at multiple stations to 11 µg/L at station SS3-7 in the 101-250 m zone (Table 3-1). Median 2019 nitrite concentrations decreased with increasing distance down to below the detection limit (Figure 3.3-3). Nitrite concentrations at the control-assessment sites were not available in 2019. The 2019 median concentrations were higher than 2018 concentrations in all zones but still comparable to historical medians (Figure 3.3-3). All measurements were well below the EQC of 2,000 µg/L specified in the Water Licence for grab sample concentrations.

3.3.10 Phosphorus

Phosphorus concentrations measured in 2019 ranged from below the analytical detection limit (<2.0 µg/L) at the control-assessment station LDS-1 to 413 µg/L at station SS3-7 in the 101-250 m zone (Table 3-1). Median 2019 phosphorus concentrations decreased with increasing distance from the Project (Figure 3.3-4) and were higher than 2016 to 2018 concentrations in all zones (Figure 3.3-4). Although the Water Licence has a load limit for phosphorus, there is no EQC specified for this parameter.

3.3.11 Zinc

Zinc concentrations measured in 2019 ranged from 0.3 µg/L at SS4-4 station in the 1,001-2,500 zone to 1.7 µg/L at the Control-assessment station FF1-2 (Table 3-1). Median 2019 zinc concentrations were generally less than historical records (2001-2018) with little variance between all zones (Figure 3.3-4). All measurements were well below the EQC of 20 µg/L specified in the Water Licence for grab sample concentrations.

3.4 Evaluation of Existing Control Sites

The three lowest dustfall rates in 2019 were recorded at the newly added far-field control-assessment sites FFA-4 (11 $mg/dm^2/y$), LDS-1 (20 $mg/dm^2/y$) and FF1-2 (24 $mg/dm^2/y$). These sites are located furthest away from the mine footprint (7,614 to 27,909 m away from footprint); thus, they likely represent background values. The SS2 transect stations (SS2-1, SS2-2, SS2-3 and SS2-4), in addition to stations SS1-3 and SS5-5, all recorded low dustfall rates. Stations SS1-3, SS5-5 and SS2, as well as the control-assessment sites (except FFB-4), recorded lower dustfall rates than the control sites SSC-2 and SSC-3, indicating that the rates at these two control sites may not be representative of background values, suggesting that dustfall rates at the control sites are potentially affected by the Project. However, the potential effects of the Project on the dustfall in the control zone have marginal impacts on the dustfall monitoring program since dustfall rates at the control zone are significantly lower than rates within zones closer to the Project area (e.g., zones 0 m to 100 m, 101 m to 250 m, 251 m to 1000 m). The highest concentration of several snow water chemistry variables were recorded at the FF1-2 and FFB-4 control-assessment sites (FF1-2 recorded the highest Ammonia and Zinc concentrations, while FFB-4 recorded the highest Chromium, Copper and Nickel concentration). The distant location of both FF1-2 and FFB-4 from the Project footprint indicates that the higher snow chemistry concentrations at these sites are likely not related to the Project activity.

3.5 Quality Assurance and Control

Dustfall gauge, dustfall snow survey and snow water chemistry sampling and analysis were conducted by experienced technicians following SOPs ENVR-508-0112, ENVR-512-0213 and ENVI 303 0112 to ensure proper field sampling and laboratory analysis. As part of SOP ENVR 512 0213, duplicate and blank samples were taken for some snow survey and snow water chemistry sample sites (Table 2-1). The results from these samples are summarized in Tables 3.5-1 and 3.5-2.

The relative percent difference (RPD) of duplicate samples from a site represents the amount of variation between duplicates. According to the Project AEMP, the data quality objective for duplicate water quality samples is a RPD of 40% when concentrations are ≥ 5 times the detection limit (DL; AEMP 2017). RPD values are only calculated when concentrations are ≥ 5 times the DL (BC MOE 2013). The calculated RPD values exceeded 40% at two occasions.

Table 3.5-1: Sample Duplicates

Parameter	Duplicate Analytical Results (DUPW1/DUPW2; mg/dm^2/y; µg/L)					Analytical Detection Limit (µg/L)	Relative Percent Difference [a] (%)				
	SS1-3	SS4-1	SS2-2	Control-1	SS5-3		SS1-3	SS4-1	SS2-2	Control-1	SS5-3
Dustfall	50/39	254/208	26/38	-	-	0.1	25%	20%	37%	-	-
Aluminum	-	-	17.9/21.7	13.1/12.7	128/151	0.2	-	-	19%	3%	16%
Ammonia	-	-	37/31	23/40	72/78	5	-	-	18%	54%	8%
Arsenic	-	-	0.01/0.027	0.027/0.01	0.051/0.054	0.02	-	-	n/a	n/a	n/a
Cadmium	-	-	*0.0025/0.0025*	*0.0025/0.0025*	*0.0025/0.0025*	0.005	-	-	n/a	n/a	n/a
Chromium	-	-	0.053/0.025	0.025/0.128	0.236/0.235	0.05	-	-	n/a	n/a	n/a
Copper	-	-	0.025/0.052	0.054/0.065	0.154/0.245	0.05	-	-	n/a	n/a	n/a
Lead	-	-	0.0074/0.0077	0.0182/0.0166	0.11/0.126	0.005	-	-	n/a	n/a	14%
Nickel	-	-	0.414/0.47	0.685/0.839	1.79/1.74	0.02	-	-	13%	20%	3%
Nitrite	-	-	1.9/0.5	0.5/0.5	7.2/7.3	1	-	-	n/a	n/a	1%
Phosphorus	-	-	18/16	25.4/20	189/368	2	-	-	12%	24%	64%
Zinc	-	-	0.87/0.91	1.18/1.61	0.92/1.27	0.1	-	-	4%	31%	32%

Notes:

n/a = RPD is not applicable since concentration is less than 5 times the detection limit.

"-" = parameter is not measured.

For measurements that were less than the detection limit, the detection limit was used for calculations and are italicized.

[a] Relative difference between duplicates, with respect to their mean: RPD = 100 × |rep1 − rep2| / [(rep1 + rep2)/2].

Table 3.5-2: Analytical Blanks for QA/QC Program

Parameter	SS2-1 Equipment Blank Sample (µg/L)	Percent of Equipment Blank Sample Below SS2-1 Sample	Detection Limit (µg/L)
Aluminum	0.10	99%	0.2
Ammonia	*2.50*	97%	5
Arsenic	*0.01*	79%	0.02
Cadmium	*0.003*	0%	0.005
Chromium	*0.03*	58%	0.05
Copper	*0.03*	0%	0.05
Lead	*0.003*	79%	0.005
Nickel	0.02	98%	0.02
Nitrite	*0.50*	0%	1
Phosphorus	*1.00*	97%	2
Zinc	0.46	29%	0.1

Notes:

For measurements that were less than the detection limit, half the detection limit was used for calculations and are italicized.

The results of the QA/QC duplicates indicate that snow chemistry is spatially variable on the scale of metres within which the duplicates are collected. The data quality objective from the AEMP (i.e., RPD less than 40%) is designed for surface *liquid* water samples. Surface water in a stream or lake will mix more readily than snow, particularly once snow has settled and has been compacted by wind. Site-specific differences between snow core sampling replicates may not be visible to the sampling team, but may result in differences in the chemical composition of the snow. RPD exceeded 40% once at each of Control-1 station and SS5-3 station. The absolute differences between observations were similar in magnitude for both duplicates from both locations. The similarity in the magnitude of the variability is consistent with small-scale spatial variation, rather than data quality issues. The results of the sampling network of 23 sites has been demonstrated to detect and quantify Project effects on snow water chemistry (Section 3.3), and these results are concluded to be reliable despite the small-scale variation identified in the QA/QC program.

Dustfall RPD at SS1-3 was 25%, SS4-1 was 20%, and SS2-2 was 37% which shows that small scale variation for dustfall and snow water chemistry measures was similar. There is no similar data quality objective for RPD related to dustfall, although spatial variability in dustfall rates similar to snow chemistry is expected.

The equipment blank sample was processed at station SS2-1, thus the blank sample concentrations are compared against SS2-1 concentrations. Most of the blank parameters were much less than those from the SS2-1 sample, suggesting the data were of good quality. The cadmium, copper and nitrite samples were at the detection limit, while the cause of the relatively small difference in zinc is unknown.

4. SUMMARY

Median dustfall rates from dustfall gauges measured in 2019 were slightly higher than 2018 results, with most dustfall gauges recording higher rates in 2019, while 2019 rates from snow surveys were comparable to 2018 results. Similar to historical results, dustfall rates in 2019 decreased with distance from the Project. Annual dustfall estimated from each of the 14 dustfall gauges ranged from 65 to 982 mg/dm^2/y. The annualized dustfall rates estimated from the 2019 snow survey data ranged from 12 to 1,114 mg/dm^2/y. Because dustfall gauges continuously collect dust throughout the year, and the snow surveys are only representative of dustfall accumulated over the snow-covered period, the reported annual dustfall results from the dustfall gauges are expected to provide a better estimate of annual dustfall compared to snow survey results for similar geographic areas. However, results obtained from both methods showed similar patterns. Dustfall rates in 2019 were generally within the historical data range collected for the Project. Annualized dustfall rates estimated from each snow survey station in 2019 were less than some historical dustfall estimates.

In 2019, four new locations were added to the snow survey monitoring network to assess the performance of the existing control sites (control-assessment stations). The new sites are located at greater distances from the project footprint (7,614 m to 27,909 m) than the existing monitoring network (13 m to 4,802 m). Overall, as expected, dustfall rates generally decreased with distance from the Project with the lowest dustfall rate recorded at station FFA-4 (a new added site at 27,909 m west of the Project) with the three lowest dustfall rates recorded at the newly added control-assessment sites. Two of the existing control sites recorded higher dustfall rates than the control-assessment sites, and higher than all the SS2 transect stations (SS2-1, SS2-2, SS2-3 and SS2-4) and stations SS1-3 and SS5-5, which suggests that dustfall rates at the control sites are potentially affected by the Project. Thus, the rates at the control sites may not represent background values. However, the potential effects of the Project on the dustfall in the control zone have marginal impacts on the dustfall monitoring program since dustfall rates at the control zone are significantly lower than rates within zones closer to the Project area (e.g., zones 0 m to 100 m, 101 m to 250 m, 251 m to 1,000 m).

Areas that were closer to the Project, roads, and airstrip received more dustfall than other areas. Mean dustfall rates estimated using both dustfall gauges and snow surveys within the 0 m to 100 m, 101 m to 250 m, 251 m to 1,000 m, 1,001 m to 2,500 m and control and control-assessment zones were 506, 282, 265, 114, 73 and 26 mg/dm^2/y, respectively. Although there are no dustfall standards for the Northwest Territories, all the 2019 dustfall rates were well below the non-residential 5.26 mg/dm^2/d (1,920 mg/dm^2/y) Alberta Ambient Air Quality Objective for dustfall (Alberta Environment and Parks 2019). Dust 3, Dust 10, Dust 11 and SS1-1 stations were higher than the residential limit of the Alberta Ambient air Quality Objective for dustfall (1.76 mg/dm^2/d; 646 mg/dm^2/y). This objective is used only as a general performance indicator.

Snow water chemistry analytes of interest included those variables with EQC (i.e., aluminum, ammonia, arsenic, cadmium, chromium, copper, lead, nickel, nitrite, and zinc) or a load limit (i.e., phosphorus) specified in the Type "A" Water Licence (W2015L2-0001, formerly W2007L2 0003). All 2019 sample concentrations were well below their associated reference levels as specified by the "maximum concentration of any grab sample" specified in Water Licence W2015L2 0001. Concentrations in 2019 were generally lower than recent years for all parameters except ammonia, nitrite and phosphorus. Typically, concentrations decreased with distance from the Project. The highest concentrations of six variables of interest were recorded at three of the control-assessment sites (FFB-4, LDS-1 and FF1-2) and one was recorded at Control-2 station. The highest concentrations for all variables were less than their corresponding EQC.

5. REFERENCES

Definitions of the acronyms and abbreviations used in this reference list can be found in the Glossary and Abbreviations section.

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APPENDIX A ANNUAL CHANGES TO DUSTFALL PROGRAM

Appendix A: Annual Changes to Dustfall Program

2001

The 2001 dust monitoring program was based entirely upon snow survey samples collected along four radial transects emanating from the project footprint outward to a distance of approximately 1,000 metres. All sample locations were analyzed for dust deposition, while only those locations on Lac de Gras were analyzed for snow water chemistry.

2002

DDMI amended the dust monitoring program, in response to recommendations made by the Mackenzie Valley Land and Water Board, to include two snow survey control locations. In addition, five dust gauges (passive dust collectors) were deployed, one along each of the snow survey transects and one at a control location, in efforts to enhance the monitoring program.

2003

In response to further recommendations, the dust monitoring program was modified. All four snow survey transects were extended in length to a distance of approximately 2,000 metres from the project footprint. An additional five dust gauges, including a second control, were deployed.

2004

Increased construction activity necessitated further changes to the dust monitoring program. One dust gauge (Dust 02) was removed from its location to accommodate project footprint expansion, and subsequently relocated and redeployed (Dust 2A).

2005

Dust deposition monitoring was carried out with no modifications to either the snow survey or the dust gauge portion of the program.

2006

An additional dust gauge was deployed bringing the total to eleven (including two controls). Testing of Mini-Vol portable air samplers were conducted to determine feasibility of incorporation into the dust monitoring program. Preliminary findings proved the inclusion of the Mini-Vol samplers would be impractical.

2007

The snow survey portion of the program was amended with an additional snow survey transect being incorporated bringing the total number of transects to five. As well, snow water chemistry samples were collected adjacent to the pre-existing control locations as background references.

Two additional dust gauges (temporary) were deployed adjacent to two pre-existing dust gauges. The intent of the temporary gauges was to compare results from the same location when sample collection frequency is altered.

DDMI initiated contact with Environment Canada and Golder Associates with regards to remodeling dust deposition with the intent of revising predictions made in the 1998 environmental effects report.

In light of dust deposition monitoring results from previous years, several control measures were adopted to reduce dust generation on site, including the utilization of EK-35 (suppressant) on the airport apron, taxiway and helipad, and fitting a second 830E haul truck with tank for haul road watering.

2008

All of the dust gauges were modified to accommodate the replacement of the polyacrylic dust gauge inserts with brass Nipher gauge inserts, to minimize loss associated with damage during the collection and handling of the dust gauges.

An additional dust gauge was added to the program bringing the total to twelve permanently deployed (including two control), and two temporary (reference) dust gauges.

Three snow survey sample points were not sampled as they had become overtaken by construction activity and expansion of the project footprint.

Additional preparations for dust deposition modelling were completed including data collection, identification of point source inputs, selection of a modelling program and inputs (with regulator input) and discussion of cumulative effects.

2009

The two temporary dust gauges deployed in 2007 were decommissioned. All twelve permanent gauges were collected quarterly. An error in collection/deployment resulted in “No Data” being collected for Dust 03 between July 11 and September.

Snow survey sampling was conducted in April. An error in collection/analysis resulted in the Dust Deposition sample for SS2-1 being compromised; as such “No Dust Deposition Data” was available for this location.

2010

All twelve permanent dust gauges were collected quarterly during 2010. Overall, there was a reduction of observed dustfall deposition from 2009 to 2010, with the exception of Dust 1 and Dust 10.

Snow survey sampling was conducted throughout the month of April. An error in collection/ processing resulted in two missing stations for the water quality analysis. SS2-1 field results were collected; however, the sample was compromised during processing in the lab. An error also resulted with the collection of SS5-2; data collection for water quality analysis was missed in the field. No data for these two stations resulted in Zone 1 having no data for the various water chemistry results and SS5-2 was not represented in Zone 3 data for 2010.

2011

All twelve permanent dust gauges were collected quarterly during 2011. During collection and repair to Station Dust 5 in September, the sample was compromised and therefore not processed, which resulted in data loss.

Snow survey sampling was conducted throughout the month of April. Due to an internal error shipping samples, water quality samples for stations SS1-4, SS1-5, SS2-1, SS2-2, SS2-3, SS2-4, and SSC-3 arrived at the Maxxam laboratory past the recommended holding time.

2012

All twelve permanent dust gauges were collected quarterly during 2012. During collection in June, repairs were conducted on Station Dust 9 as it was found on its side, the sample was compromised, which resulted in data loss. Overall in 2012, 8 of the 12 dust gauges reported lower deposition rates compared to 2011.

Snow survey sampling was conducted on April 30, and on May 4 and 5.

2013

All twelve permanent dust gauges were collected quarterly during 2013. Station Dust 5 was dismantled upon arrival in September and the sample was compromised, which resulted in data loss for that quarter.

Snow survey sampling was conducted at 24 locations from April 26 to 28.

2014

All twelve permanent dust gauges were collected quarterly during 2014.

Snow survey sampling was conducted at 24 locations from April 7 to May 12. Three additional sites, SS3-6, SS3-7, SS3-8, were installed.

2015

No changes were made to the dustfall program in 2015.

All twelve permanent dust gauges were collected quarterly during 2015.

Snow survey sampling was conducted at 24 locations from March 31 to April 10.

2016

Due to construction activities at A21, the distance to mining operations decreased for dustfall stations Dust 10, SS5-1, SS5-2, SS5-3, SS5-4, SS5-5, Dust C1, and Control 1. The new distances to mining operations are shown in Table 2-1. Dust 10 station was 670 m from mining operations and now is 46 metres from mining operations.

All twelve permanent dust gauges were collected quarterly during 2016.

Snow survey sampling was conducted at 27 locations from March 3 to April 7.

2017

All twelve permanent dust gauges were collected quarterly during 2017.

During collection of Stations Dust 3 Dust 4, Dust 8 and Dust 10 in July were compromised and an indeterminate amount of sample was lost.

Two new permanent dust gauges (Dust 11 and Dust 12) were deployed on 2017-Oct-05.

Dust 11 and 12 are 0.805 km and 2.58 km respectively from mining operations.

Snow survey sampling was conducted at 27 locations from April 1 to April 10.

2018

No changes to the dustfall program were made in 2018. All fourteen permanent dust gauges were collected quarterly during 2018.

2019

New four stations are added to the snow survey monitoring network to help assessing the efficiency of the existing control stations. The stations added include FF!-2, FFA-1, FFB-4 and LDS-1. All fourteen permanent dust gauges were collected quarterly during 2019.

Snow survey sampling was conducted at 31 locations from April 4 to May 8.

APPENDIX B DUSTFALL GAUGE ANALYTICAL RESULTS

Appendix B: Dustfall Gauge Analytical Results

Sample Date	Dust Gauge ID	Filter #	Weight of Filter (mg)	Filter + Residue (mg)	Cumulative Weight of Residue (mg)	Dust Deposition (mg/dm^2)	Days Deployed	Dust Deposition ($mg/dm^2/d$)	Dust Deposition ($mg/dm^2/y$)
28-Dec-18	**Initial deployment date**								
8-Apr-19	Dust 1	1	122.3	166.6					
		2	126	169.4	87.7		101	0.7	
26-Jun-19		1	122.3	149.3					
		2	124.8	157.8					
		3	125.9	140.5	74.6		79	0.8	
30-Sep-19		1	114.2	119.4					
		2	114.2	137.1					
		3	114.2	161.1	75.0		96	0.6	
26-Dec-19		1	118.2	198			87	0.7	
					TOTALS	**258.5**	**363**	**0.7**	**260.0**
3-Jan-19	**Initial deployment date**								
7-Apr-19	Dust 2	1	125.4	212.8					
		2	125.6	196.7	158.5		94	1.4	
25-Jun-19		1	126.8	160.4					
		2	124.9	176.8					
		3	125.6	129.5	89.4		79	0.9	
29-Sep-19		1	114.9	174.9					
		2	116.1	148.6	92.5		96	0.8	
28-Dec-19		1	118.9	207.2	88.3		90	0.8	
					TOTALS	**349.5**	**359**	**1.0**	**355.4**
28-Dec-18	**Initial deployment date**								
3-Apr-19	Dust 3	1	27961.2	28070.7					
		2	37520	37646					
		3	38610.2	38740	365.3		96	3.1	
26-Jun-19		1	121.8	174.8					
		2	125.3	463.2					
		3	123.8	147	414.1		84	4.0	
30-Sep-19		1	116.3	321.8	205.5		96	1.7	
26-Dec-19		1	114.9	327.7	212.8		87	2.0	
					TOTALS	**976.5**	**363**	**2.7**	**981.8**
28-Dec-18	**Initial deployment date**								
6-Apr-19	Dust 4	1	125.7	155.2					
		2	124.7	144.4	49.2		99	0.4	
27-Jun-19		1	122.2	293.5					
		2	121.6	193.3					
		3	121.6	230	351.4		82	3.5	
28-Sep-19		1	113.3	131.2					
		2	114.4	117.7					
		3	114	139.4					
		4	114.5	120.4	52.5		93	0.5	
26-Dec-19		1	117.6	142.2	24.6		89	0.2	
					TOTALS	**389.5**	**363**	**1.1**	**391.6**

Appendix B: Dustfall Gauge Analytical Results

Sample Date	Dust Gauge ID	Filter #	Weight of Filter (mg)	Filter + Residue (mg)	Cumulative Weight of Residue (mg)	Dust Deposition (mg/dm^2)	Days Deployed	Dust Deposition (mg/dm^2/d)	Dust Deposition (mg/dm^2/y)
2-Jan-19	**Initial deployment date**								
6-Apr-19	Dust 5	1	122.1	135.4					
		2	123.8	140.5	30		94	0.3	
25-Jun-19		1	122.4	129.9					
		2	117.4	131.5					
		3	116.5	117.1	22.2		80	0.2	
29-Sep-19		1	121.1	168.5	47.4		96	0.4	
28-Dec-19		1	117.8	152.5	34.7		90	0.3	
					TOTALS	**109.5**	**360**	**0.3**	**111.0**
28-Dec-18	**Initial deployment date**								
3-Apr-19	Dust 6	1	39421	39439.2					
		2	38954.8	38974.7					
		3	27114.7	27140.6	64		96	0.5	
26-Jun-19		1	125.1	181.5					
		2	125.4	175.7					
		3	122.1	130.9	115.5		84	1.1	
30-Sep-19		1	116.8	144.5					
		2	118.4	130.8					
		3	121	196.4	115.5		96	1.0	
26-Dec-19		1	117	146	29		87	0.3	
					TOTALS	**264.2**	**363**	**0.7**	**265.6**
3-Jan-19	**Initial deployment date**								
5-Apr-19	Dust 7	1	39067	39127.8					
		2	33186.1	33263.6	138.3		92	1.2	
25-Jun-19		1	122.2	140.5					
		2	124.5	174	67.8		81	0.7	
29-Sep-19		1	113.6	144.8					
		2	114.9	126.9	43.2		96	0.4	
27-Dec-19		1	118.3	227.7	109.4		89	1.0	
					TOTALS	**292.4**	**358**	**0.8**	**298.2**
2-Jan-19	**Initial deployment date**								
6-Apr-19	**Dust 8**	1	122.9	137.2					
		2	122.6	130.4	22.1		94	0.2	
25-Jun-19		1	126.3	167.9					
		2	121.8	148.2					
		3	125	125.2	68.2		80	0.7	
29-Sep-19		1	114.6	136.4					
		2	115.2	120.3					
		3	113.7	123.4					
		4	113.7	119	41.9		96	0.4	
28-Dec-19		1	118.2	195.7	77.5		90	0.7	
					TOTALS	**171.0**	**360**	**0.5**	**173.3**

Appendix B: Dustfall Gauge Analytical Results

Sample Date	Dust Gauge ID	Filter #	Weight of Filter (mg)	Filter + Residue (mg)	Cumulative Weight of Residue (mg)	Dust Deposition (mg/dm^2)	Days Deployed	Dust Deposition ($mg/dm^2/d$)	Dust Deposition ($mg/dm^2/y$)
4-Jan-19	**Initial deployment date**								
4-Apr-19	Dust 9	1	38548.1	38566.4	18.3		90	0.2	
25-Jun-19		1	124.8	126.9					
		2	125.7	132.5					
		3	122.5	134.3					
		4	123.4	124.6	21.9		82	0.2	
29-Sep-19		1	113.8	123.8					
		2	113.6	124.2					
		3	115	126.4	32		96	0.3	
27-Dec-19		1	119	124.9	5.9		89	0.1	
					TOTALS	**63.7**	**357**	**0.4**	**65.1**
28-Dec-18	**Initial deployment date**								
5-Apr-19	Dust 10	1	124.3	171.5					
		2	122.2	206.8					
		3	122.1	173.2	182.9		98	1.5	
27-Jun-19		1	123.7	263.7					
		2	123	284					
		3	122.3	249.4	428.1		83	4.2	
30-Sep-19		1	117	175.8					
		2	121.7	175	112.1		95	1.0	
26-Dec-19		1	117.4	227.6	110.2		87	1.0	
					TOTALS	**679.4**	**363**	**1.9**	**683.1**
3-Jan-19	**Initial deployment date**								
5-Apr-19	Dust 11	1	31347.5	31402.6					
		2	29108.4	29160.1					
		3	39842.5	39903.9					
		4	30990.5	31047.6					
		5	40224.8	40224.8	225.3		92	2.0	
25-Jun-19		1	115.3	270.1					
		2	121.4	274.5					
		3	115.3	172.6					
		4	125.2	181.8					
		5	122.9	196.1					
		6	117	122.8	500.8		81	5.0	
29-Sep-19		1	114.8	153.1					
		2	115.4	125.9	48.8		96	0.4	
28-Dec-19		1	118.30	148.40	30.1		90	0.3	
					TOTALS	**656.3**	**359**	**1.9**	**667.3**

Appendix B: Dustfall Gauge Analytical Results

Sample Date	Dust Gauge ID	Filter #	Weight of Filter (mg)	Filter + Residue (mg)	Cumulative Weight of Residue (mg)	Dust Deposition (mg/dm^2)	Days Deployed	Dust Deposition (mg/dm^2/d)	Dust Deposition (mg/dm^2/y)
3-Jan-19	**Initial deployment date**								
6-Apr-19	Dust 12	1	125.4	142.6					
		2	124.5	139.9	32.6		93	0.3	
25-Jun-19		1	123.5	124.9					
		2	122.3	136.6					
		3	122.7	157.3					
		4	125	171.5					
		5	124.9	164.1					
		6	117.9	164.3	182.4		80	1.9	
29-Sep-19		1	114.8	124.8					
		2	114.6	124.9					
		3	114.4	114.8					
		4	113.7	119	26		96	0.2	
28-Dec-19		1	116.20	131.10	14.9		90	0.1	
					TOTALS	**208.6**	**359**	**0.6**	**212.1**
4-Jan-19	**Initial deployment date**								
5-Apr-19	**Dust C1**	1	26485	26505.8					
		2	35602.6	35644	62.2		91	0.6	
25-Jun-19		1	124.9	132.6					
		2	126	140.1	21.8		81	0.2	
29-Sep-19		1	114.9	144.2	29.3		96	0.2	
27-Dec-19		1	118.30	143.30	25		89	0.2	
					TOTALS	**112.8**	**357**	**0.3**	**115.3**
3-Jan-19	**Initial deployment date**								
6-Apr-19	Dust C2	1	125.4	141.6					
		2	122.4	132.5	26.3		93	0.2	
26-Jun-19		1	126.2	132					
		2	126.2	159.6					
		3	115.4	116	39.8		81	0.4	
29-Sep-19		1	115.5	134.5	19		95	0.2	
28-Dec-19		1	118.3	132.1	13.8		90	0.1	
					TOTALS	**80.6**	**359**	**0.2**	**82.0**