REPORT

SITE C CLIMATE & AIR QUALITY MONITORING

FORT ST. JOHN, BC

2022 ANNUAL REPORT
RWDI #2002352
March 22, 2023

SUBMITTED TO

Dan Gorton, B.Sc., PMP
Senior Environmental Coordinator
Physical Environment
Site C Clean Energy Project
Dan.Gorton@bchydro.com

BC Hydro
333 Dunsmuir St, 6th floor
Vancouver, BC V6B 5R3

SUBMITTED BY

Laura Dailyde, P.Eng., PMP
Senior Project Manager / Associate
Laura.Dailyde@rwdi.com

David Chadder, Hon. B.Sc., QEP
Senior Technical Director
David.Chadder@rwdi.com

RWDI
Suite 280 – 1385 West 8th Avenue,
Vancouver, Canada, V6H 3V9
T: 604.730.5688
F: 519.823.1316

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

VERSION HISTORY

Index	Date	Pages	Authors
1	21-Mar-2023	All	Emmanuel Anglo, Ph. D. David Chadder, Hon. B.Sc., QEP Laura Dailyde, P.Eng., PMP Iain Hawthorne, Ph.D.
2	22-Mar-2023	21 (Table 3-5 edit)	Laura Dailyde, P.Eng., PMP

LIST OF ACRONYMS

AAQO	Ambient Air Quality Objective
ACMT	Active Compliance Management Tool
BC	British Columbia
CCME	Canadian Council of Ministers of the Environment
CEMP	Construction Environmental Management Plan
CO	Carbon Monoxide
EAC	Environmental Assessment Certificate
ECCC	Environment and Climate Change Canada
ENV	BC Ministry of the Environment and Climate Change Strategy
EPP	Environmental Protection Plan
FDS	Federal Decision Statement
MOU	Memorandum of Understanding
NO_2	Nitrogen Dioxide
PCIC	Pacific Climate Impacts Consortium
PCO	Pollution Control Objective
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter consisting of particles 2.5 µm in equivalent diameter or smaller
PM_{10}	Particulate Matter consisting of particles 10 µm in equivalent diameter or smaller
QA	Quality Assurance
QEP	Qualified Environmental Professional
SO_2	Sulphur Dioxide

1 INTRODUCTION

BC Hydro's Site C Clean Energy Project (the Project) in British Columbia's Peace region will create a new hydroelectric dam and generating station on the Peace River in the vicinity of the City of Fort St. John. To characterize the microclimate and to provide a baseline against which to compare future changes brought on as a result of the Project, BC Hydro installed a network of climate and air quality monitoring stations in the Peace River Valley. This network has been active since 2011, through the preparation and submission of the Project's Environmental Impact Statement, and throughout Project construction to date, which began in mid-2015. We acknowledge this work is being conducted on the traditional territory of Treaty 8 First Nations of Dunne Zaa, Cree and Tse'khene cultural descent.

Approval of the Project in 2014 by the Joint Review Panel comprised of the Canadian Environmental Assessment Agency and the British Columbia Environmental Assessment Office was contingent upon BC Hydro satisfying a number of conditions (CEAA, 2014; EAO, 2014).

Condition 12 of the Federal Decision Statement (FDS) is concerned with the health of Indigenous peoples as it relates to air quality. This Condition mandates proper management, monitoring and reporting of air quality to minimize the potential effects on Indigenous health. Condition 12.6 of the FDS requires BC Hydro to "implement the [management] plan and provide to the Agency an analysis and summary of the implementation of the plan, as well as any amendments made to the plan in response to the results, on an annual basis during construction and the first year of operation."

Condition 57 of the provincial Environmental Assessment Certificate (EAC) dictates the management plans (Air Quality Management Plan, Smoke Management Plan) that were developed for the Project to minimize air emissions, monitor the ambient air quality and provide these readings to the BC Ministry of the Environment and Climate Change Strategy (ENV) to notify sensitive populations (in collaboration with Northern Health) if air quality conditions warrant. In addition, EAC Condition 31 requires that microclimate monitoring is also conducted to support an understanding of how the Project might affect agricultural activities. An example includes changes to ambient humidity levels that could affect crop drying as well as other climatic factors to estimate moisture deficits.

Throughout 2022, there were five ambient air quality and nine meteorological monitoring stations in operation in support of the Project. The air quality stations provided continuous ambient measurements that were used to monitor effects of the Project on Indigenous and public health, and to inform construction activities, while the meteorological stations provided continuous measurements for several meteorological parameters (discussed further in Section 2). Data from Station 8 (Old Fort), Station 9 (85th Avenue) and Station 12 (Hudson's Hope) were used to inform air quality advisories issued publicly by ENV.

A summary of the the applicable FDS Conditions and the provincial EAC Conditions and their status of the Project with respect to complying with the Air Quality Management Plan and Smoke Management Plan for the calendar year are presented in Appendix A. A summary of the meteorological data collected by the program is included herein but reporting to satisfy EAC Condition 31 will be done under separate cover.

This document serves to describe the state of the climate and air quality for the eleventh year of observations and the seventh year of project construction, coinciding with the 2022 calendar year. Ten previous annual monitoring reports describing the state of the climate and air quality for the years of observations, coinciding with the 2012 through 2021 calendar years have been released (RWDI AIR Inc. 2015a, 2015b, 2015c, 2016, 2017, 2018, 2019, 2020, 2021, 2022). The initial monitoring established baseline conditions that were in effect until the summer of 2015 when construction activities began. The network has remained in operation and has continued to collect valuable climate and air quality data in the Peace region. Air quality parameters such as concentrations of particulate matter (PM), specifically $PM_{2.5}$ and PM_{10}, nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and carbon monoxide (CO) are presented in this report. Also included in this report is a review of the annual climate conditions, roadway dust suppression activities and open burn pile summary.

1.1 Managing Air Quality

BC Hydro developed a Construction Environmental Management Plan (CEMP), (Rev. 11, BC Hydro 2022), which includes a component of an Air Quality Management Plan (Section 4.1) and a description of the Air Quality Monitoring Program (Appendix B, Rev 3, 2022) to avoid or minimize exceedances of the BC Ambient Air Quality Objectives (ENV, 2021) (FDS, Section 12.1). Section 4.1 of the CEMP details the management practices that will be implemented to minimize emissions of air contaminants. Contractors are required to produce site-specific Environmental Protection Plans (EPPs) that explain how the Contractor will meet the CEMP requirements. As of December 2020, construction activities, particularly the Main Civil Works, Generating Station and Spillways Civil Works, clearing for the future Site C reservoir, realignment of several segments of Highway 29, and construction of shoreline protection measures in Hudson's Hope were well underway involving elements of the majority of activities listed in Section 4.1 of the CEMP.

BC Hydro conducts environmental audits during construction to verify implementation of EPPs, including implementation of appropriate mitigation measures in response to air quality alerts. BC Hydro implemented the Active Compliance Management Tool (ACMT) in 2017, which is a database to house environmental inspection data.

BC Hydro has also developed a Smoke Management Plan (Rev. 5, BC Hydro 2021), which is another component of the CEMP (Appendix A), and which satisfies Section 12.3.2 of the FDS conditions and Condition 57 of the provincial EAC.

Open burning of piles of vegetation cleared in the footprint of the future Site C reservoir occurred in 2022. All ignition events were based on custom venting forecasts which were used to inform brush burning events. Further details are discussed in Section 3.2.

2 MONITORING NETWORK

Condition 12.3.4 of the FDS approval of the Project requires BC Hydro to develop a plan that includes procedures to monitor air quality effects at locations used by Indigenous groups. To this end, BC Hydro developed an Air Quality Monitoring Program (BC Hydro, 2022). As part of the monitoring program, BC Hydro has installed and continuously operates a network of ambient air quality stations in areas that may be affected by Project construction activities.

BC Hydro currently operates five ambient air quality monitoring stations in the Peace River area. Three of these stations are located in the vicinity of the Project construction including:

- Station 1 – Attachie Flat Upper Terrace;
- Station 8 – Old Fort; and
- Station 12 – Hudson's Hope.

Two of these five stations are located directly within Project construction work areas including:

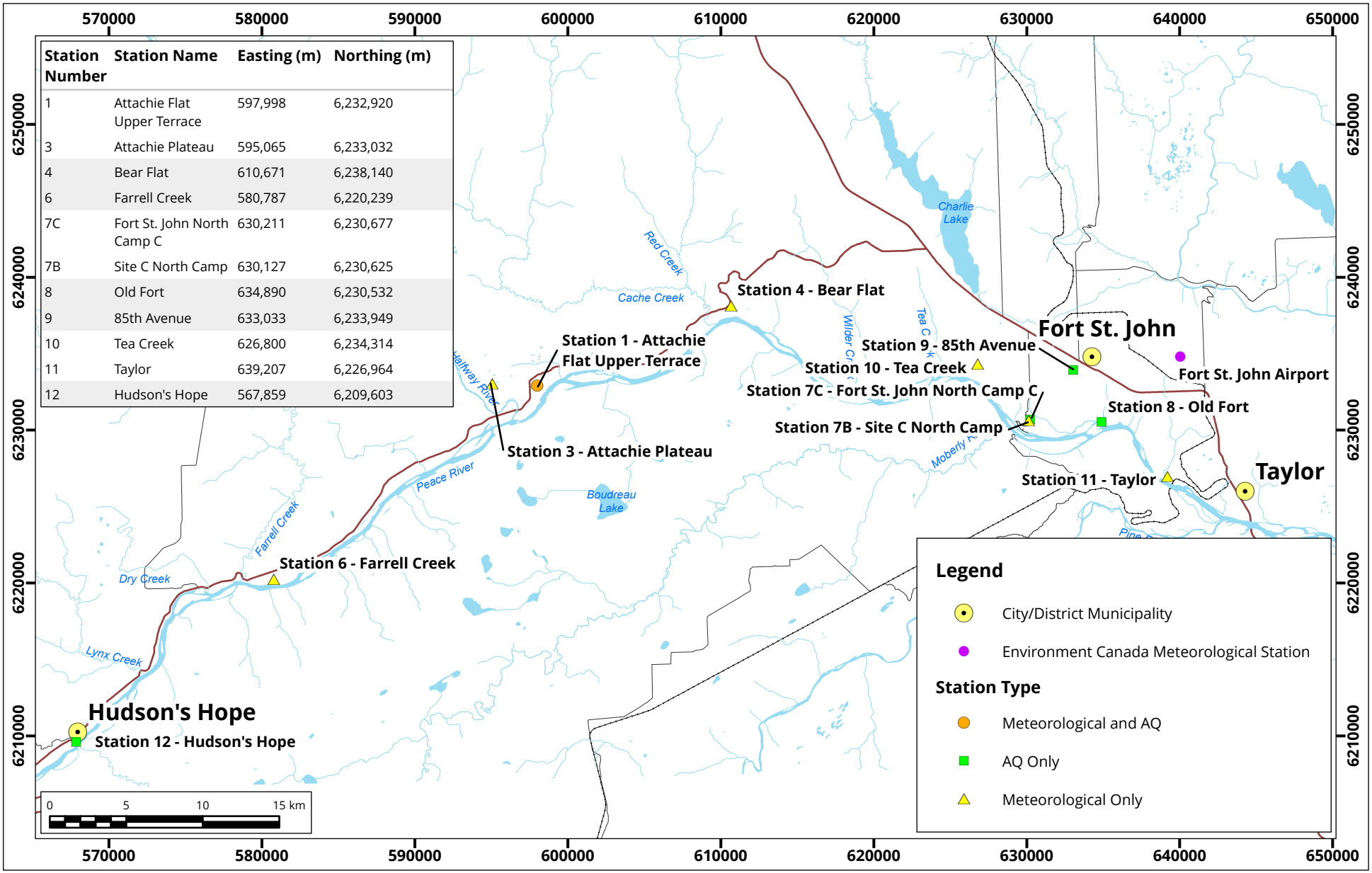
- Station 7C – Fort St. John North Camp C; and
- Station 9 – 85th Avenue.

Stations 1 (Attachie Flat Upper Terrace), 8 (Old Fort) and 7C (Fort St. John North Camp C) have continuous Thermo Scientific SHARP 5030 monitors, and Station 9 (85th Avenue) and 12 (Hudson's Hope) have Thermo Scientific SHARP 5030i monitors. These monitors measured particulate matter with diameters less than 10 µm (PM_{10}) and diameters less than 2.5 µm ($PM_{2.5}$). Station 7C (Fort St. John North Camp C) measures NO_X (using a Thermo Scientific 42i analyzer) and SO_2 (using a Thermo Scientific 43i analyzer). Station 12 (Hudson's Hope) measures NO_X (using a Thermo Scientific 42iQ analyzer) and SO_2 (using a Thermo Scientific 43iQ analyzer). Station 7C (Fort St. John North Camp C) additionally measures CO (using a Thermo Scientific 48i analyzer).

In addition to air quality parameters, the Site C monitoring Network also measures a number of meteorological parameters.

Figure 2-1 shows the location of the network stations in relation to local communities and the Peace River, as well as the meteorological station run by Environment and Climate Change Canada (ECCC) located at Fort St. John Airport.

Table 2-1 and Table 2-2 show the coordinates and elevations for the station locations, and parameters measured at these stations, respectively.



Station Number	Station Name	Easting (m)	Northing (m)
1	Attachie Flat Upper Terrace	597,998	6,232,920
3	Attachie Plateau	595,065	6,233,032
4	Bear Flat	610,671	6,238,140
6	Farrell Creek	580,787	6,220,239
7C	Fort St. John North Camp C	630,211	6,230,677
7B	Site C North Camp	630,127	6,230,625
8	Old Fort	634,890	6,230,532
9	85th Avenue	633,033	6,233,949
10	Tea Creek	626,800	6,234,314
11	Taylor	639,207	6,226,964
12	Hudson's Hope	567,859	6,209,603

BC Hydro - Site C Meteorological and Air Quality Stations

True North

Drawn by: DJH | Figure: 2-1

Approx. Scale: 1:350,000

Date Revised: Dec 3, 2020

Project #: 2002352

Map Projection: NAD 1983 UTM Zone 10N

Map Document: C:\GIS Temp - Copy\1601625\Misc AQ Deliverables\1601625_BC_Hydro_Misc_AQ_Deliverables.aprx

Table 2-1: BC Hydro Site C network station locations and elevations.

Station Name	UTM NAD 83 (m)	Latitude, Longitude (decimal degrees)	Elevation (m)
Station 1 - Attachie Flat Upper Terrace	597999 E, 6232919 N	56.23N, -121.42W	479
Station 3 – Attachie Plateau	595065 E, 6233032 N	56.23N, -121.46W	645
Station 4 – Bear Flat	610669 E,6238135 N	56.27N, -121.21W	474
Station 6 – Farrell Creek	580779 E, 6220238 N	56.12N, -121.70W	471
Station 7B/C – Site C North Camp/Fort St. John North Camp C(1)	630206 E, 6230688 N	56.20 N, -120.90W	584
Station 8 – Old Fort	634890 E, 6230532 N	56.20N, -120.82W	423
Station 9 – 85th Avenue	633033 E, 6233949 N	56.23N, -120.85W	686
Station 10 – Tea Creek	626798 E, 6234314 N	56.24 N, -120.95W	653
Station 11 – Taylor	639206 E, 6226964 N	56.17N, -120.76W	411
Station 12 – Hudson's Hope	567932 E, 6209604 N	56.03N, -121.91W	494
Fort St. John Airport (ECCC)	640053 E, 6234872 N	56.24N, -120.74W	695

Note: (1) Meteorology parameters are measured at a tower that is located approximately 100 m to the northeast of the trailer where the air quality analyzers are located. The meteorology instrument tower is considered Station 7B, the air quality trailer is considered Station 7C. Coordinates provided are for the air quality analyzer location (7C).

Table 2-2: BC Hydro Site C network stations and the Fort St. John Airport ECCC station with parameters measured.

Station	Air Temperature and Relative Humidity	Wind Speed and Direction	Precipitation	Barometric Pressure	All Radiation Components	Solar Radiation	Net radiation	Turbulent Fluxes	Visibility	Soil Temperature	Soil Moisture	Soil heat Flux	PM_{10} and $PM_{2.5}$	SO_2, NO_2	CO
Station 1 – Attachie Flat Upper Terrace	X	X	X	X	X			X	X	X	X	X	X		
Station 3 – Attachie Plateau	X	X	X	X		X	X			X	X	X			
Station 4 – Bear Flat	X	X	X	X	X			X		X	X	X			
Station 6 – Farrell Creek	X	X	X	X		X	X			X	X	X			
Station 7B/C – Site C North Camp/Fort St. John North Camp C	X	X	X	X		X	X			X	X	X	X	X	X
Station 8 – Old Fort													X		
Station 9 – 85th Avenue		X											X		
Station 10 – Tea Creek	X	X	X	X	X		X			X	X	X			
Station 11 – Taylor	X	X	X	X		X	X			X	X	X			
Station 12 – Hudson's Hope	X	X											X	X	
Fort St. John Airport (ECCC)	X	X	X	X	X										

2.1 Equipment Maintenance

Scheduled monthly calibration and maintenance checks were performed on all Thermo Scientific gas analyzers and Sharp PM units. Gas instruments (Models 42i, 43i, 48i, 42iQ, 43iQ) run daily span and zero checks that are used to guide the need for unscheduled maintenance. This process exceeds the recommendations in the BC Field Sampling Manual (EGovernment of BC, 2020).

2.2 Data Collection and Quality Assurance / Quality Control (QA/QC)

Measurements from the Site C network stations were remotely downloaded to RWDI servers using Campbell Scientific's LoggerNet software over cellular modem connections at the following intervals:

- The following stations with AC power had download intervals of one hour:
  - Station 1 (Attachie Flat Upper Terrace)
  - Station 4 (Bear Flat)
  - Station 7C (Fort St. John North Camp C)
  - Station 8 (Old Fort)
  - Station 9 (85thAvenue)
  - Station 12 (Hudson's Hope)

- The following solar powered stations had their data collected hourly when battery power was >12.7 V:
  - Station 3 (Attachie Plateau)
  - Station 6 (Farrell Creek)

- The following solar powered stations had their data collected only at specific times during daylight hours to preserve battery charge:
  - Station 7B (Site C North Camp)
  - Station 10 (Tea Creek)
  - Station 11 (Taylor)

The first stage of data quality assurance (QA) applied to the readings involved diagnostic monitoring in the data logger by continually reading in and checking all instrumental diagnostics available from the air quality equipment for signs of an instrumental malfunction. If a problem is detected, the data logger can issue commands to the air quality instrument to rectify the problem and notify RWDI personnel so the issue can be addressed. This first level of data QA was included in the data logger programs at Station 1 (Attachie Flat Upper Terrace), Station 7C (Fort St. John North Camp C, air quality), Station 8 (Old Fort), Station 9 (85th Avenue), and Station 12 (Hudson's Hope). In 2021 all climate stations were upgraded to include diagnostic monitoring as well.

Secondly, manually assisted and automated quality control was carried out on the raw data weekly. This involved plotting the readings over the past month and the previous 10 to 30 days to allow for a visual inspection of the time history so the operator can detect anomalous trends or data outliers. This frequency of QA was maintained to allow rapid detection and repair of any instrument malfunctions or drift.

As part of the RWDI data validation process, a third QA/QC operation was conducted monthly to invalidate any data from an instrument known to be malfunctioning based on the results of routine monthly visits for maintenance, calibrations and checks. Results from both checks performed by RWDI personnel as well as equipment performance audits performed by the ENV were used to increase confidence in the validity of the data.

3 METEOROLOGY AND AIR QUALITY RESULTS

An overview of results for meteorology and air quality parameters associated with the 2022 field monitoring are presented in the following subsections.

3.1 Meteorology

Table 3-1 provides a summary of some of the climate parameters discussed in this report as well as 30-year climate normals from Fort St. John Airport for the period, 1981 to 2010 (ECCC, 2016). Climate normals were calculated from 30-year records of meteorological observations of wind speed, temperature, precipitation and other related weather conditions at the location of interest. Climate normals are updated by ECCC on a 10-year basis and the most recent reporting period available is from 1981 to 2010. The 30-year climate normals for the maximum and minimum temperatures differ from what are reported in the published normals, because ECCC takes the daily maximum/daily minimum and averages that occur over the month for all years. These numbers are averaged over the 30-year annual maxima/minima in the period so they are more extreme and more comparable to the maximum and minimum temperatures at any one site for this year. The year 2022 was warm and dry. The maximum mean temperature difference of 2.2°C and maximum precipitation difference of 97 mm when compared to the 30-year normal shows this. The maximum temperature measured in July at Station 6 (34°C) was 3.8°C greater than any in the 30-year normal record.

Table 3-1: Summary of measured climate parameters during 2022 and comparison with climate normals.

Data Record	Mean Temp (°C)	Max Temp (°C)	Min Temp (°C)	Total Precipitation (mm)	Mean Wind Speed (m/s)
Station 1 – Attachie Flat Upper Terrace	2.9	33.4	-40.4	350	2.5
Station 3 – Attachie Plateau	3.1	32.6	-42.6	367	2.9
Station 4 – Bear Flat	2.9	32.7	-39.8	352	2.1
Station 6 – Farrell Creek	4.2	34.0	-39.3	358	1.7
Station 7B – Site C North Camp	4.0	32.7	-38.7	357	2.8
Station 9 – 85th Avenue	-	-	-	-	3.7
Station 10 – Tea Creek	4.5	30.4	-39.5	348	2.6
Station 11 – Taylor	4.3	33.1	-37.2	372	1.5
Station 12 – Hudson's Hope	4.6	33.7	-37.8	-	1.2
Fort St. John Airport	2.6	30.2	-40.0	-	4.6
30-year climate normals (1981 – 2010)	2.3	30.2	-36.6	445	3.8
Max difference from normals	2.2	3.8	6	97	2.3

Note: - indicates insufficient or no data collected

3.1.1 Wind Characteristics

Wind speed and wind direction were measured at all stations except Station 8 (Old Fort). Figure 3-1 shows wind roses for all stations with a complete year of records including Fort St. John Airport for 2022. Mean annual wind speed for 2022 ranged from 1.2 m/s (Station 12 – Hudson's Hope) to 3.7 m/s (Station 9 – 85th Avenue) at the Site C network stations. Fort St. John Airport recorded a mean annual wind speed of 4.6 m/s which was 13% greater than the 30-year climate normal of 3.8 m/s (Table 3-1) and the same as measured in 2020.

The differences in wind speed and wind direction between stations that are apparent in the wind roses are attributed to small scale surface features such as proximity of trees and local topography to the network stations and their location within the meandering Peace River Valley. The higher wind speed at Fort St. John Airport is likely due to this station being on the plateau above the Peace River Valley and its very open surroundings with a large fetch in all directions. There was a wide difference of the proportion of calms as well: ranging from 0.7 % to 26.5 % of the 12-month period. Higher calm measurements were noted at lower elevation stations beside the Peace River in more enclosed areas of the valley, with site values similar to previous years.

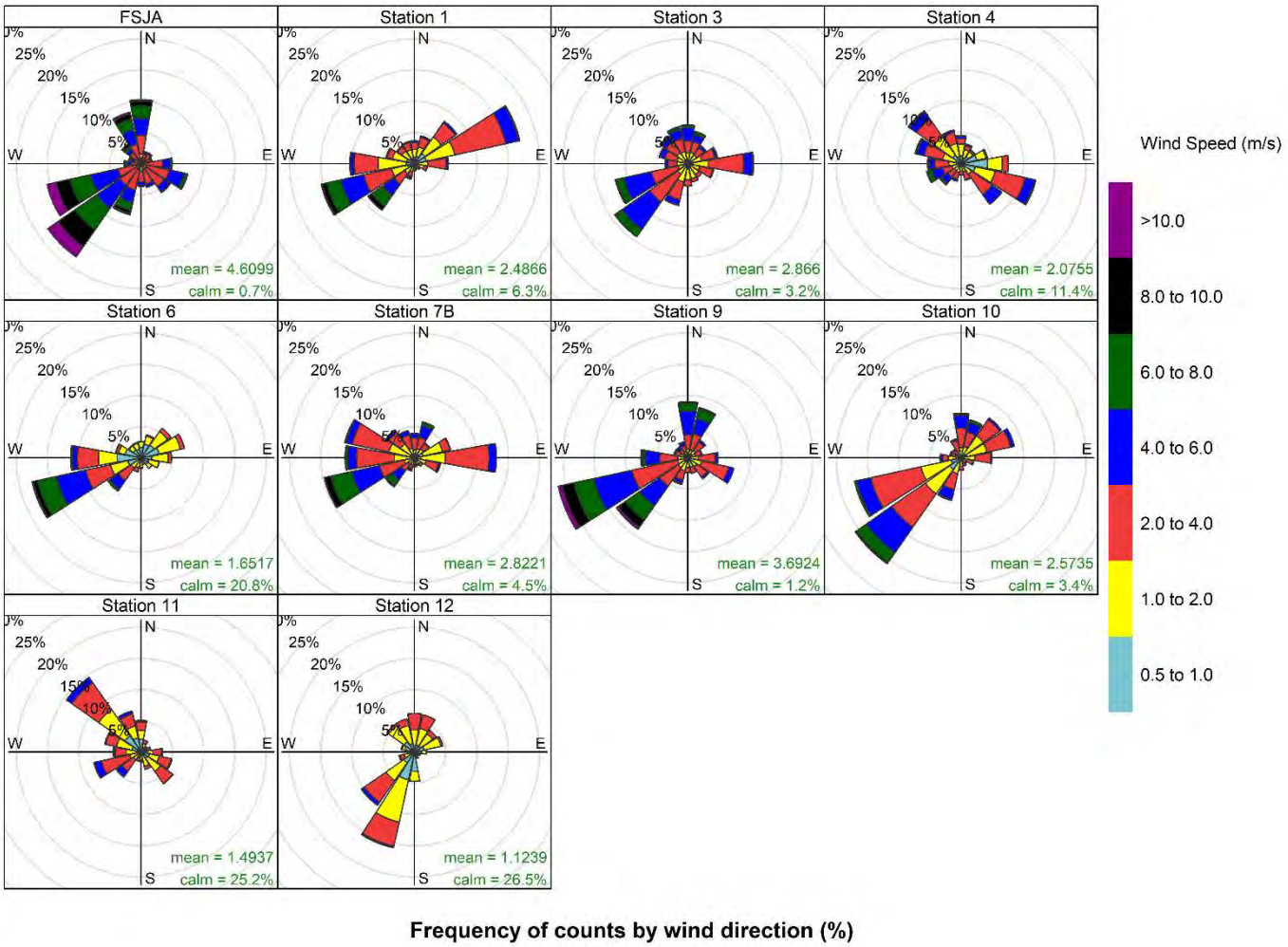


Figure 3-1: Wind roses for all Site C stations with 12-month records and Fort St. John Airport for 2022.

3.2 Particulate Matter

Table 3-2 gives an overview of the completeness of the datasets for PM_{10} and $PM_{2.5}$ at each station as well as the number of excursions and/or exceedances above the provincial 24-hour Ambient Air Quality Objectives (AAQOs) and a comparison of the annual averages with the provincial AAQOs. Excursions and exceedances are defined as follows:

Excursions occur when the concentration for a contaminant at a certain averaging period exceeds the AAQO. Per ENV, a 24-hour average is averaged from midnight to midnight.

Exceedances are defined by the AAQO and may require certain conditions to be met before an excursion is called an exceedance. For example, an exceedance for $PM_{2.5}$ requires that the annual 98th percentile of the 24-hour average > AAQO. PM_{10} has no such conditions (i.e., calculated annual percentiles) so any 24-hour excursions for PM_{10} are always exceedances.

The lower percentage data completeness for 24-hour averages than for hourly data stems from a requirement that, to consider a 24-hour average to be valid, it must contain at least 75% (18 hours) of valid hourly data (CCME 2019). This ensures that 24-hour averages are not biased toward one single time of the day. Unless specified otherwise, the 24-hour average refers to the daily block average from the 01:00 hour to the 00:00 hour-ending time stamp of the following day.

Per the Memorandum of Understanding (MOU) with ENV, there is a data polling requirement of 90%. This means that 90% of the time the province should be able to successfully obtain data from BC Hydro's sites and display air quality readings on the Ministry's air quality public portal within an hour of when the observation is collected at the site. In 2022, the 90% data polling criteria was met.

All PM monitors had a data completeness of greater than 75% (typical of ENV permit requirements). Many of the excursions and exceedances in 2022 were related to smoke from forest fires or community specific events such as road dust. Under these conditions, ENV issued Smoky Skies Bulletins and Air Quality Advisories, respectively. Specific dates for these events in 2022 are provided later in this section.

Table 3-2: Summary of measured PM results for 2022 (in µg/m³).

Parameter	Station 1 Attachie Flat Upper Terrace		Station 7C Fort St. John North Camp C		Station 8 Old Fort		Station 9 85th Avenue		Station 12 Hudson's Hope	
	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}
Percentage data complete of hourly data	97.4	97.3	96.3	98.0	99.2	99.3	97.5	97.9	98.7	98.8
Percentage data complete (24-hour averages)	98.9	98.4	95.3	97.3	99.7	100	97.0	97.8	99.2	99.5
24-hour AAQO	25	50	25	50	25	50	25	50	25	50
24-hour AAQO excursions ($PM_{2.5}$) / exceedances (PM_{10})	13	11	10	39	12	2	12	28	21	17
98th percentile of 24-hour daily averages	**41.7**	**54.2**	**27.3**	**82.2**	**26.7**	37.5	**29.0**	**79.7**	**60.2**	**77.2**
Annual AAQO	8	NA(2)	8	NA(2)	8	NA(2)	8	NA(2)	8	NA(2)
Annual average	6.6	12.5	6.1	23.8	5.5	11.0	6.4	20.7	8.2	14.0

Notes: **Bolded** PM values indicates measured concentrations that exceeded their respective AAQO
(1) NA is used where the quantity in question is not applicable to the measurement.

In 2022, Station 1 (Attachie Flat Upper Terrace) had 13 exceedances for $PM_{2.5}$ above the 25 µg/m³ AAQO for a 24-hour averaging period and 11 exceedances of the AAQO for PM_{10}. Ten exceedances of the AAQO for $PM_{2.5}$ and 39 exceedances of the AAQO for PM_{10} over 24-hour averaging periods were observed at Station 7C (Fort St. John North Camp C). At Station 8 (Old Fort), 12 exceedances of the 24-hour AAQO for $PM_{2.5}$ and two exceedances of the AAQO for PM_{10} were observed. There were 12 exceedances of the 24-hour AAQO for $PM_{2.5}$ observed at Station 9 (85th

Avenue) and 28 exceedances above the AAQO for PM_{10}. Lastly, there were 21 exceedances above the 24-hour AAQO for $PM_{2.5}$ observed at Station 12 (Hudson's Hope) and 17 exceedances above the AAQO for PM_{10}.

Table 3-3 provides percentile levels of note for PM concentrations at each of the air quality stations. Measured PM_{10} levels at Stations 1 (Attachie Flat Upper Terrace), 8 (Old Fort) and 12 (Hudson's Hope) were all below their applicable AAQO for 95% valid days or more in 2022. At Station 9 (85th Avenue) measured PM_{10} levels were below their applicable AAQO for less than 95% and at Station 7C (Fort St. John North Camp C) for less than 90% of the valid days. Measured $PM_{2.5}$ levels at Stations 1 (Attachie Flat Upper Terrace), 7C (Fort St. John North Camp C), 8 (Old Fort) and 9 (85th Avenue) were below their applicable AAQO for more than 95% valid days in 2022. At Station 12 (Hudson's Hope), measured $PM_{2.5}$ levels were below their applicable AAQO for less than 90% valid days.

Table 3-3: Percentile values of 24-hour averaged PM concentrations for 2022 (in µg/m³).

Percentile	Station 1 Attachie Flat Upper Terrace		Station 7C Fort St. John North Camp C		Station 8 Old Fort		Station 9 85th Avenue		Station 12 Hudson's Hope	
	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}
0	0.008	0.02	0.01	1.2	0.004	0.1	0.1	0.1	0.2	0.3
0.1	1.1	3.1	1.5	5.0	1.0	3.8	1.7	3.9	1.1	3.6
0.25	2.6	5.2	2.8	8.2	1.9	6.0	2.7	8.6	2.3	5.7
0.5	4.3	8.6	4.5	17.2	3.6	8.9	4.6	15.8	4.4	9.2
0.75	7.4	14.6	7.3	33.4	6.9	13.8	8.0	25.8	7.7	14.2
0.9	12.6	26.5	10.7	52.7	11.1	18.7	11.7	43.1	12.6	25.5
0.95	20.3	40.4	15.7	63.6	14.8	24.9	18.0	57.2	26.7	47.6
0.975	37.2	52.6	26.0	81.0	26.0	36.2	27.9	77.6	52.9	75.3
0.98	41.7	54.2	27.3	82.2	26.7	37.5	29.0	79.7	60.2	77.2
0.99	47.9	68.2	29.4	91.3	28.9	43.9	32.3	88.1	69.6	84.9
0.999	61.9	89.4	44.4	131	42.1	58.6	51.5	130	180	189

Note: Red cells denote values greater than the AAQO

Figure 3-2 through Figure 3-6 show the time series of the 24-hour averages of both PM_{10} and $PM_{2.5}$ concentrations at each of the five stations, respectively.

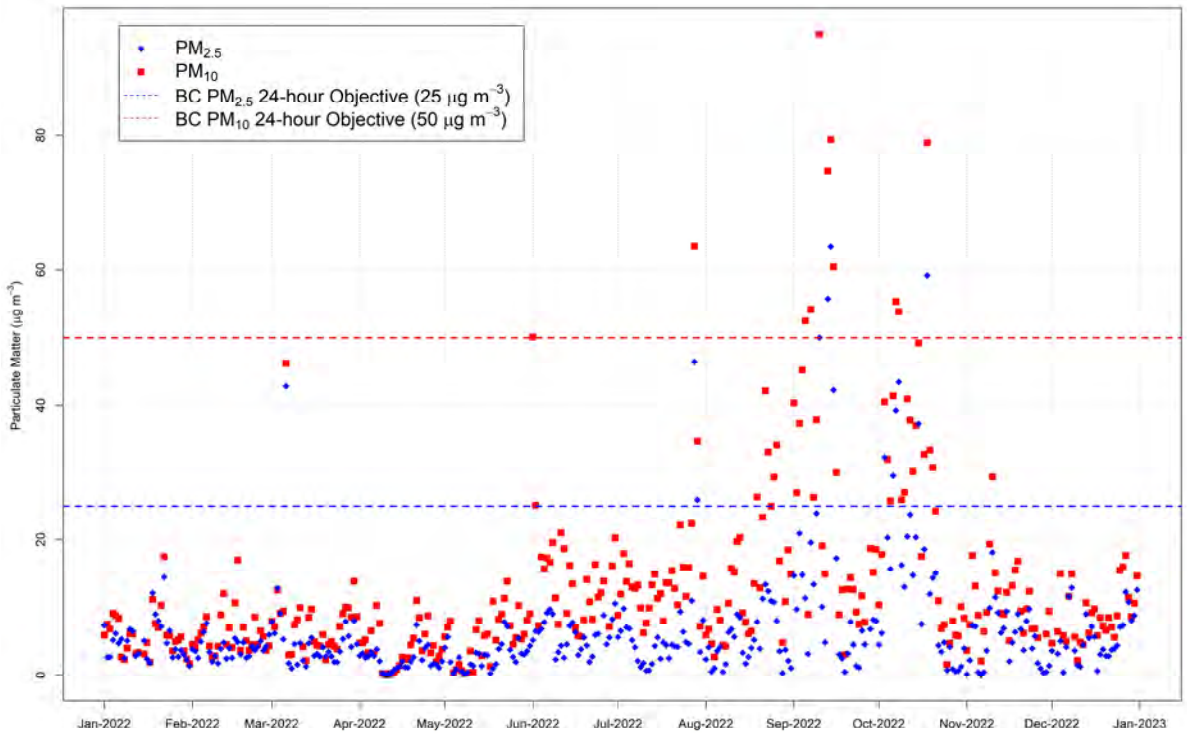


Figure 3-2: Daily average $PM_{2.5}$ and PM_{10} measurements from Station 1 – Attachie Flat Upper Terrace for 2022 (in µg/m³).

Note: The target AAQO's are plotted as broken lines. The annual daily 98th percentile $PM_{2.5}$ concentration of 19.4 µg/m³ was less than the AAQO (25 µg/m³) so all $PM_{2.5}$ events were considered to be excursions.

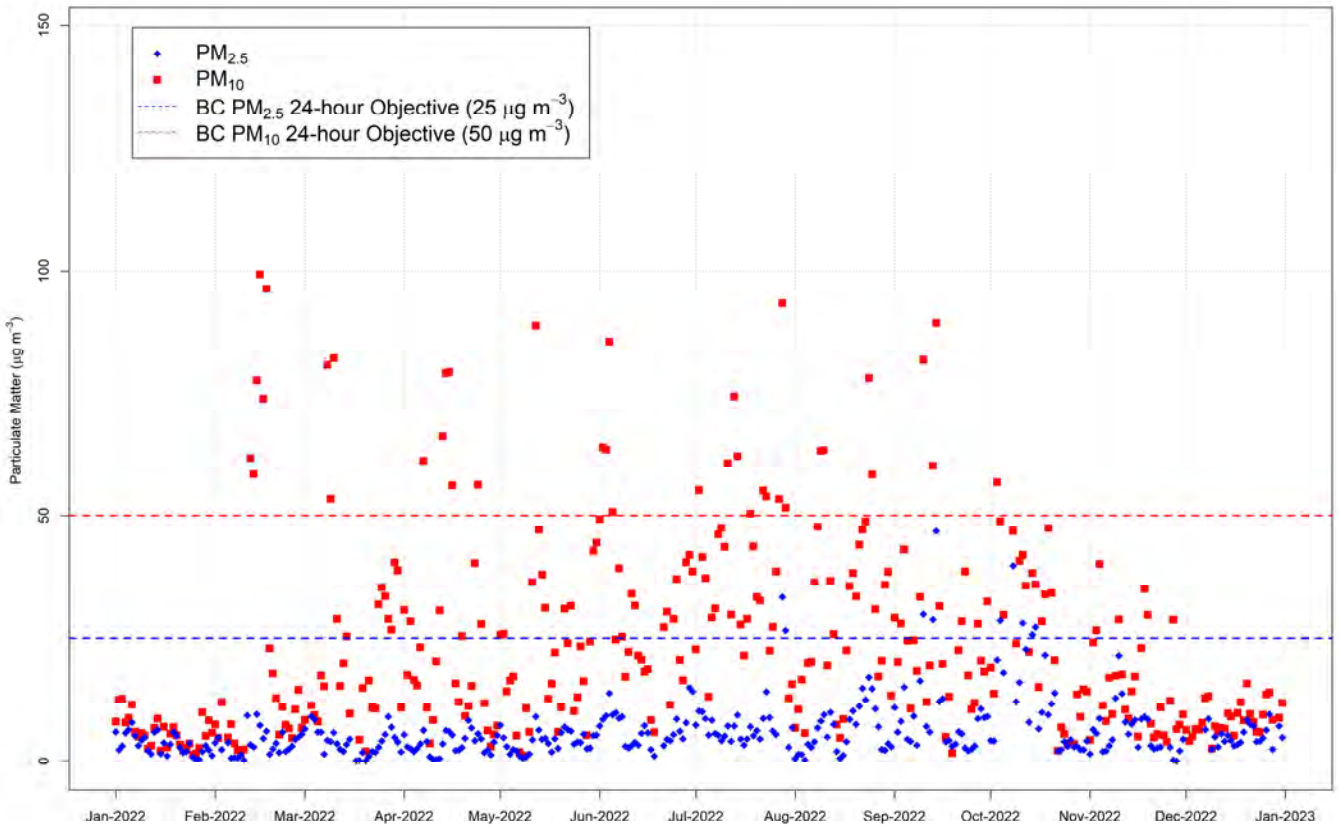


Figure 3-3: Daily average $PM_{2.5}$ and PM_{10} measurements from Station 7C – Fort St. John North Camp C for 2022 (in µg/m³).

Note: The target AAQO's are plotted as broken lines. The annual daily 98th percentile $PM_{2.5}$ concentration of 22.8 µg/m³ was less than the AAQO (25 µg/m³) so all $PM_{2.5}$ events were excursions.

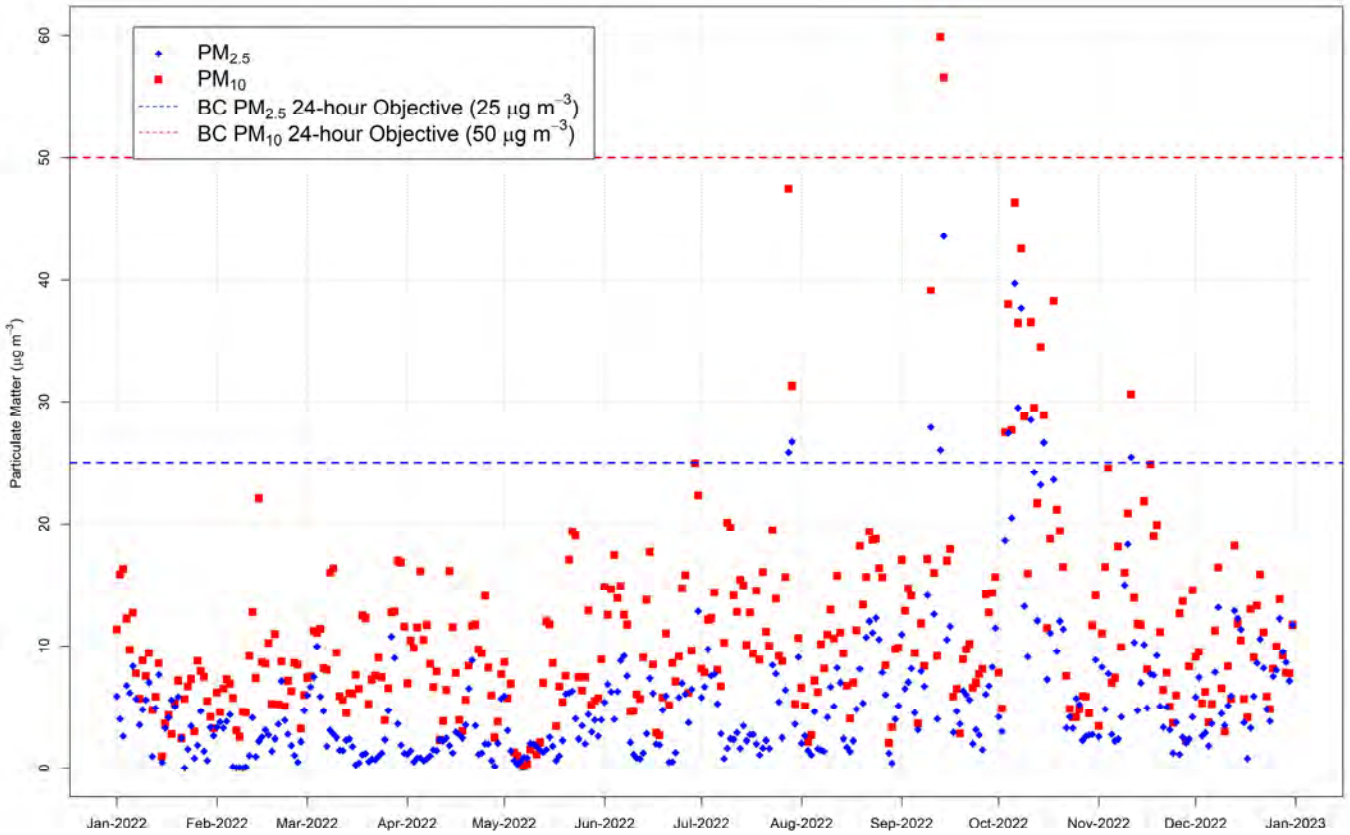


Figure 3-4: Daily average $PM_{2.5}$ and PM_{10} measurements from Station 8 – Old Fort for 2022 (in µg/m³).

Note: The target **AAQO's** are plotted as broken lines. The annual daily 98th percentile $PM_{2.5}$ concentration of 20.1 µg/m³ was less than the AAQO (25 µg/m³) so all $PM_{2.5}$ events were excursions.

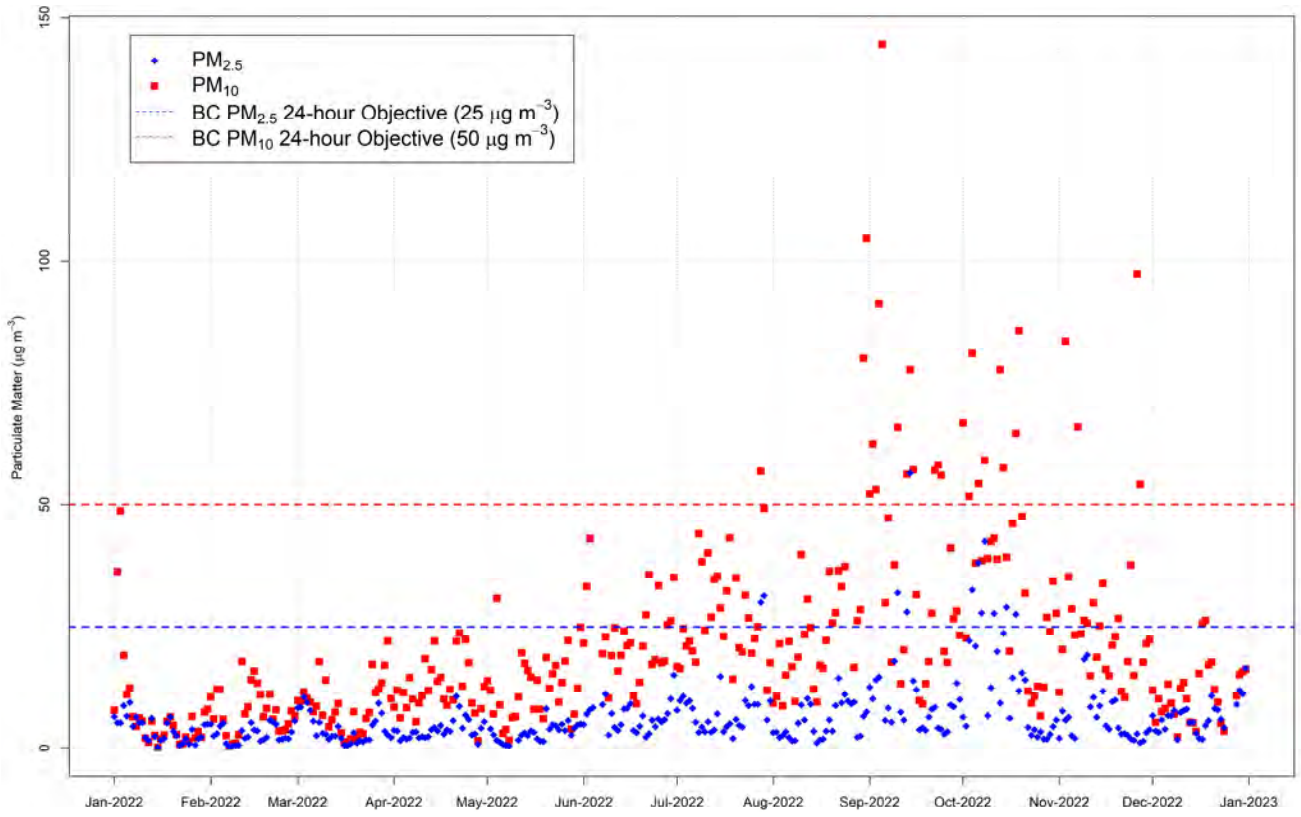


Figure 3-5: Daily average $PM_{2.5}$ and PM_{10} measurements from Station 9 - 85th Avenue for 2022 (in µg/m³).

Note: The target AAQO's **are** plotted as broken lines. The annual daily 98th percentile $PM_{2.5}$ concentration of 24 µg/m³ was less than the AAQO (25 µg/m³) so all $PM_{2.5}$ events were excursions.

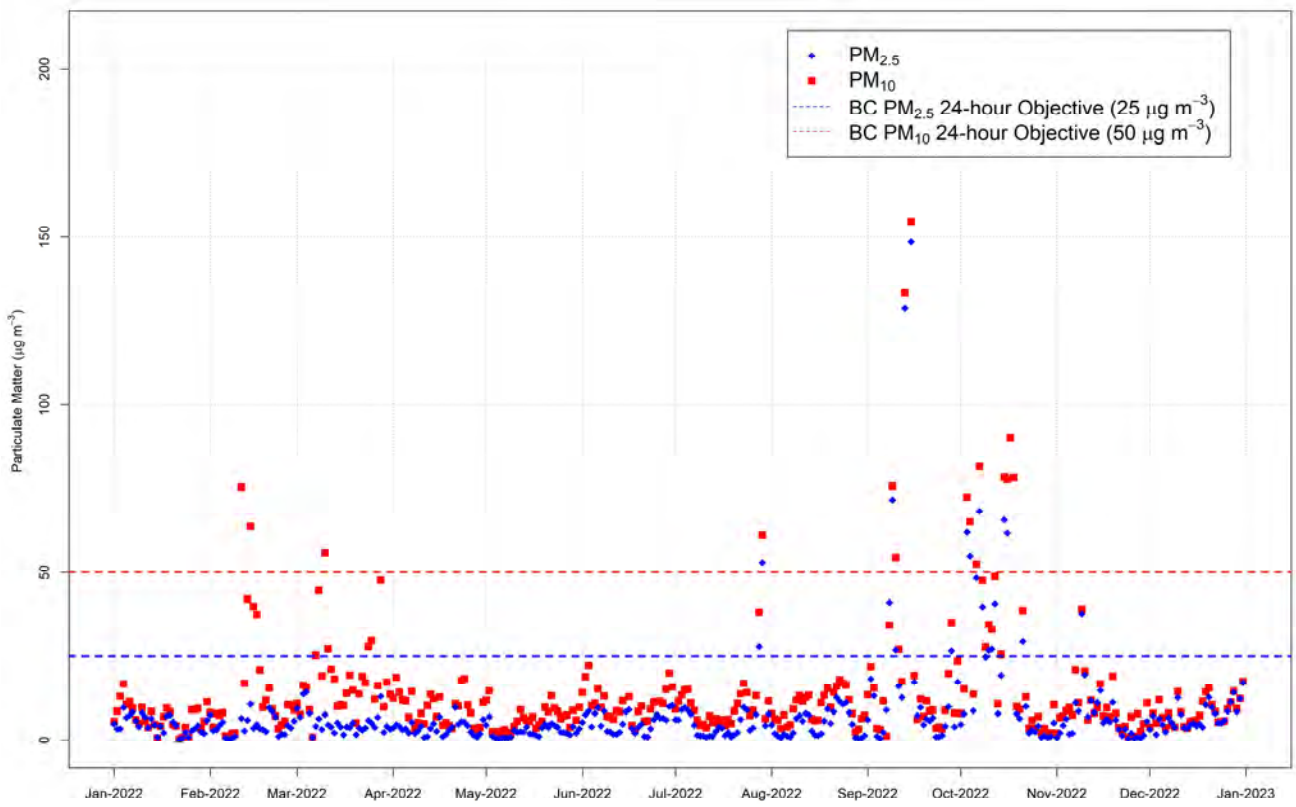


Figure 3-6: Daily average $PM_{2.5}$ and PM_{10} measurements from Station 12 – Hudson's Hope for 2022 (in µg/m³).

Note: The target AAQO's are plotted as broken lines. The annual daily 98th percentile $PM_{2.5}$ concentration of 25.5 µg/m³ was greater than the **AAQO** (25 µg/m³) so all $PM_{2.5}$ events were exceedances.

An email alerting system operated for the duration of 2022 to immediately notify BC Hydro staff and its contractors about any excursions of the AAQOs taking place so they could work to identify the emission source and mitigate its associated effects if it was found to be related to their operations. As of December 31, 2022, the distribution list for the alerting system included over 120 individuals representing over 20 firms, including BC Hydro and contractor environment, health and safety, and construction management personnel, and the Project's Independent Environmental Monitor (EDI Environmental Dynamics Inc.). The alerting system sends notifications of events when measured concentrations near or above AAQO's are being recorded by the analyzers.

Table 3-4 lists the alert events for 2022 at the five monitoring stations. Note that some of these events persisted over more than one day and had multiple daily excursions and exceedances within the time period (i.e., start and end dates).

Table 3-4: Summary of PM alert events at Site C in 2022.

Start Date	End Date	Station	Contaminant	Excursion /Exceedance [1]	Total Excursions or Exceedances During Event
2022-01-03	2022-01-04	Stn 9: 85th Avenue	PM_{10}	No	n/a
2022-02-11	202-02-18	Stn 7C: Fort St. John North Camp C	PM_{10}	Yes	7
2022-02-11	2022-02-12	Stn 12: Hudson's Hope	PM_{10}	Yes	1
2022-02-14	2022-02-15	Stn 12: Hudson's Hope	PM_{10}	Yes	1
2022-03-06	2022-03-07	Stn 1: Attachie Flat Upper Terrace	$PM_{2.5}$	Yes	1
2022-03-07	2022-03-07	Stn 1: Attachie Flat Upper Terrace	PM_{10}	No	n/a
2022-03-08	2022-03-10	Stn 7C: Fort St. John North Camp C	PM_{10}	Yes	3
2022-03-08	2022-03-11	Stn 12: Hudson's Hope	PM_{10}	Yes	1
2022-03-25	2022-03-29	Stn 7C: Fort St. John North Camp C	PM_{10}	No	n/a
2022-03-29	2022-03-30	Stn 12: Hudson's Hope	PM_{10}	No	n/a
2022-04-07	2022-04-08	Stn 7C: Fort St. John North Camp C	PM_{10}	Yes	1
2022-04-13	2022-04-17	Stn 7C: Fort St. John North Camp C	PM_{10}	Yes	4
2022-04-24	2022-04-25	Stn 7C: Fort St. John North Camp C	PM_{10}	Yes	1
2022-05-12	2022-05-15	Stn 7C: Fort St. John North Camp C	PM_{10}	Yes	1
2022-06-01	2022-06-07	Stn 7C: Fort St. John North Camp C	PM_{10}	Yes	4
2022-06-01	2022-06-02	Stn 1: Attachie Flat Upper Terrace	PM_{10}	Yes	1
2022-06-29	2022-06-30	Stn 7C: Fort St. John North Camp C	PM_{10}	No	n/a
2022-07-02	2022-07-03	Stn 7C: Fort St. John North Camp C	PM_{10}	Yes	1
2022-07-08	2022-07-15	Stn 7C: Fort St. John North Camp C	PM_{10}	Yes	3
2022-07-09	2022-07-09	Stn 9: 85th Avenue	PM_{10}	No	n/a
2022-07-18	2022-07-24	Stn 7C: Fort St. John North Camp C	PM_{10}	Yes	3
2022-07-18	2022-07-18	Stn 9: 85th Avenue	PM_{10}	No	n/a
2022-07-27	2022-07-30	Stn 7C: Fort St. John North Camp C	PM_{10}	Yes	3
2022-07-28	2022-07-30	Stn 12: Hudson's Hope	$PM_{2.5}$	Yes	2
2022-07-28	2022-07-30	Stn 9: 85th Avenue	PM_{10}	Yes	1

Start Date	End Date	Station	Contaminant	Excursion /Exceedance [1]	Total Excursions or Exceedances During Event
2022-07-28	2022-07-30	Stn 9: 85th Avenue	$PM_{2.5}$	Yes	2
2022-07-28	2022-07-30	Stn 1: Attachie Flat Upper Terrace	$PM_{2.5}$	Yes	2
2022-07-28	2022-07-30	Stn 1: Attachie Flat Upper Terrace	PM_{10}	Yes	1
2022-07-28	2022-07-30	Stn 8: Old Fort	$PM_{2.5}$	Yes	2
2022-07-29	2022-07-29	Stn 8: Old Fort	PM_{10}	No	n/a
2022-07-29	2022-07-30	Stn 12: Hudson's Hope	PM_{10}	Yes	1
2022-07-30	2022-07-30	Stn 7C: Fort St. John North Camp C	$PM_{2.5}$	Yes	2
2022-08-08	2022-08-11	Stn 7C: Fort St. John North Camp C	PM_{10}	Yes	2
2022-08-21	2022-08-26	Stn 7C: Fort St. John North Camp C	PM_{10}	Yes	2
2022-08-30	2022-08-30	Stn 7C: Fort St. John North Camp C	PM_{10}	No	n/a
2022-08-30	2022-09-07	Stn 9: 85th Avenue	PM_{10}	Yes	7
2022-09-02	2022-09-08	Stn 1: Attachie Flat Upper Terrace	PM_{10}	Yes	2
2022-09-04	2022-09-04	Stn 1: Attachie Flat Upper Terrace	$PM_{2.5}$	No	n/a
2022-09-04	2022-09-04	Stn 7C: Fort St. John North Camp C	PM_{10}	No	n/a
2022-09-08	2022-09-16	Stn 12: Hudson's Hope	$PM_{2.5}$	Yes	6
2022-09-09	2022-09-16	Stn 12: Hudson's Hope	PM_{10}	Yes	5
2022-09-09	2022-09-16	Stn 1: Attachie Flat Upper Terrace	$PM_{2.5}$	Yes	4
2022-09-10	2022-09-16	Stn 1: Attachie Flat Upper Terrace	PM_{10}	Yes	4
2022-09-10	2022-09-11	Stn 9: 85th Avenue	PM_{10}	Yes	1
2022-09-10	2022-09-15	Stn 9: 85th Avenue	$PM_{2.5}$	Yes	3
2022-09-10	2022-09-11	Stn 7C: Fort St. John North Camp C	$PM_{2.5}$	Yes	1
2022-09-10	2022-09-10	Stn 7C: Fort St. John North Camp C	PM_{10}	Yes	1
2022-09-10	2022-09-11	Stn 8: Old Fort	$PM_{2.5}$	Yes	1
2022-09-13	2022-09-16	Stn 9: 85th Avenue	PM_{10}	Yes	3
2022-09-13	2022-09-15	Stn 7C: Fort St. John North Camp C	$PM_{2.5}$	Yes	2
2022-09-13	2022-09-15	Stn 8: Old Fort	$PM_{2.5}$	Yes	2

Start Date	End Date	Station	Contaminant	Excursion /Exceedance [1]	Total Excursions or Exceedances During Event
2022-09-13	2022-09-15	Stn 7C: Fort St. John North Camp C	PM_{10}	Yes	2
2022-09-13	2022-09-15	Stn 8: Old Fort	PM_{10}	Yes	2
2022-09-20	2022-09-21	Stn 7C: Fort St. John North Camp C	PM_{10}	No	n/a
2022-09-22	2022-09-28	Stn 9: 85th Avenue	PM_{10}	Yes	3
2022-09-28	2022-09-29	Stn 12: Hudson's Hope	$PM_{2.5}$	Yes	1
2022-10-01	2022-10-21	Stn 9: 85th Avenue	PM_{10}	Yes	9
2022-10-03	2022-10-19	Stn 1: Attachie Flat Upper Terrace	$PM_{2.5}$	Yes	6
2022-10-03	2022-10-19	Stn 12: Hudson's Hope	PM_{10}	Yes	8
2022-10-03	2022-10-22	Stn 12: Hudson's Hope	$PM_{2.5}$	Yes	11
2022-10-03	2022-10-20	Stn 7C: Fort St. John North Camp C	PM_{10}	Yes	1
2022-10-03	2022-10-16	Stn 7C: Fort St. John North Camp C	$PM_{2.5}$	Yes	5
2022-10-04	2022-10-19	Stn 1: Attachie Flat Upper Terrace	PM_{10}	Yes	3
2022-10-04	2022-10-09	Stn 8: Old Fort	PM_{10}	No	n/a
2022-10-04	2022-10-22	Stn 8: Old Fort	$PM_{2.5}$	Yes	6
2022-10-04	2022-10-19	Stn 9: 85th Avenue	$PM_{2.5}$	Yes	7
2022-11-03	2022-11-08	Stn 9: 85th Avenue	PM_{10}	Yes	2
2022-11-09	2022-11-10	Stn 12: Hudson's Hope	$PM_{2.5}$	Yes	1
2022-11-11	2022-11-11	Stn 7C: Fort St. John North Camp C	$PM_{2.5}$	No	n/a
2022-11-11	2022-11-12	Stn 8: Old Fort	$PM_{2.5}$	Yes	1
2022-11-19	2022-11-19	Stn 7C: Fort St. John North Camp C	PM_{10}	No	n/a
2022-11-26	2022-11-28	Stn 9: 85th Avenue	PM_{10}	Yes	2
2022-12-02	2022-12-02	Stn 7C: Fort St. John North Camp C	$PM_{2.5}$	No	n/a

Notes:

Regional Air Quality Advisory in place

Smokey Skies Bulletin released by ENV

(1) 'No' indicates a measurement of 90% of the AAQO was recorded, but levels did not exceed the AAQO.

There was one exceedance of $PM_{2.5}$ measured during BC Hydro Site C wood pile burning events in 2022. The 24-hour rolling average of $PM_{2.5}$ concentration exceeded the BC 24-hour air quality objective of 25 µg/m^3 for less than one day, from 19:00 MST on 06-Mar-2022 to 17:00 MST 07-Mar-2022. The $PM_{2.5}$ and PM_{10} excursions/exceedances recorded between August 30th and November 1st coincided with the time period of the Battleship Mountain fire which reached 31,755 hectares in size and came within 8 km of Hudson's Hope. During this time period, 44 of the 97 PM_{10} exceedances were recorded and 55 of the 68 $PM_{2.5}$ exceedances were recorded. Prior to that local fire the Smokey Skies bulletins during July were the result of seven fires burning in the north, to the east of Watson Lake in the Yukon (6 fires) and BC (1 fire). Time periods when ENV issued Smokey Skies bulletins due to forest fires, this was the major factor in elevated $PM_{2.5}$ which often contributed >75% of the PM_{10} and resulted in PM_{10} exceedances. These advisories provide important regional context for the air quality exceedances recorded by stations in the Site C monitoring network. Events recorded at only one station such as at the main Project dam construction site, Station 7C (Fort St. John North Camp C) are more likely to originate from a local PM emission source(s) from the Project, while one regional emission source like a wildfire could potentially be detected at many stations at the same time.

Open burning of piles of vegetation cleared in the footprint of the future Site C reservoir occurred in 2022 and are summarized in Table 3-5.

Table 3-5: 2022 Open Burn Pile Summary

Location	2022 Burn Piles
Peace Islands	103
Halfway River Drainage	143
South Bank Halfway River to Farrell Creek	22
North Bank Farrell Creek to Peace Canyon	729
TOTAL	**997**

All ignition events were based on custom venting forecasts which were used to inform brush burning events. A Qualified Environmental Professional (QEP) sent out advance notification for every ignition event to the stakeholder list included as Appendix A in the Smoke Management Plan (Rev. 5, BC Hydro 2021). Notices were also included in publications (e.g., notifications to First Nations, biweekly construction bulletins, etc.) distributed by the BC Hydro public relations team.

3.3 Gaseous Criteria Air Contaminants

Table 3-6 gives an overview of the completeness of the datasets for gaseous criteria air contaminants (CO, NO_2 and SO_2) measured at Station 7C (Fort St. John North Camp C) and Station 12 (Hudson's Hope), as well as the number of any excursions and/or exceedances above the provincial AAQOs (ENV 2021) and a comparison of the annual averages with the provincial AAQOs.

For CO, a value is an exceedance once it is greater than the provincial Pollution Control Objectives (PCOs); whereas, for NO_2 and SO_2, there is only an exceedance if the 98th and 97th percentile of daily 1-hour maxima in the year is greater than their AAQOs, respectively. If this condition has not been met, values above the respective AAQOs do not constitute exceedances and are classified only as excursions.

The SO_2 and NO_2 analyzers (43i and 42i) had a data completeness of greater than 95%. The 48i measuring CO at Station 7C (Fort St. John North Camp C) had a data completeness of over 80%, having been removed for repair and recalibration from 2022-06-20 through 2022-07-30.

Table 3-6: Summary of gaseous criteria air contaminant results for 2022 at Station 7C (Fort St. John North Camp C) and Station 12 (Hudson's Hope) (in µg/m^3).

	Station 7C Fort St. John North Camp C				Station 12 Hudson's Hope	
	NO_2	SO_2	CO	CO (8-H Rolling average)	NO_2	SO_2
Percent data complete (in %)	99.7	96.2	84.5	83.2	97.8	96.7
1 hour AAQO or PCO	113	183	14,300	NA(1)	113	183
8 hour AAQO or PCO	NA(1)	NA(1)	NA(1)	5,500	NA(1)	NA(1)
AAQO Exceedances / Excursions(2)	0	0	0	0	0	0
Annual AAQO	32	13	NA(1)	NA(1)	32	13
Annual Average	7.2	0.6	148	149	4.0	0.2
97th percentile of Daily 1 Hour Maximum	NA(1)	8.7	NA(1)	NA(1)	NA(1)	1.5
98th percentile of Daily 1 Hour Maximum	49.0	NA(1)	NA(1)	NA(1)	32.8	NA(1)

Notes: (1) NA is used where the quantity in question is not applicable to the measurement.
(2) The term excursion is used here for NO_2 and SO_2 when the daily 1-hour maximum is greater than their respective AAQO but without satisfying the 98th or 97th percentile condition for achievement, respectively.

No excursions of the 1-hour SO_2 and 1-hour NO_2 AAQOs were observed in 2022 at either Station 7C (Fort St. John North Camp C) or Station 12 (Hudson's Hope). There were also no observed exceedances of the 1-hour and 8-hour

rolling average Pollution Control Objectives (PCO) for CO in 2022 at Station 7C (Fort St. John North Camp C). The annual average NO_2 and SO_2 concentrations were well below their respective annual AAQOs.

Figure 3-7 through Figure 3-9 show the daily 1-hour maximum concentrations of NO_2 and SO_2, as well as the 1-hour and 8-hour rolling average CO concentrations, respectively at Station 7C (Fort St. John North Camp C). Figure 3-10 and Figure 3-11 show the daily 1-hour maximum concentrations of NO_2 and SO_2, at Station 12 (Hudson's Hope), respectively.

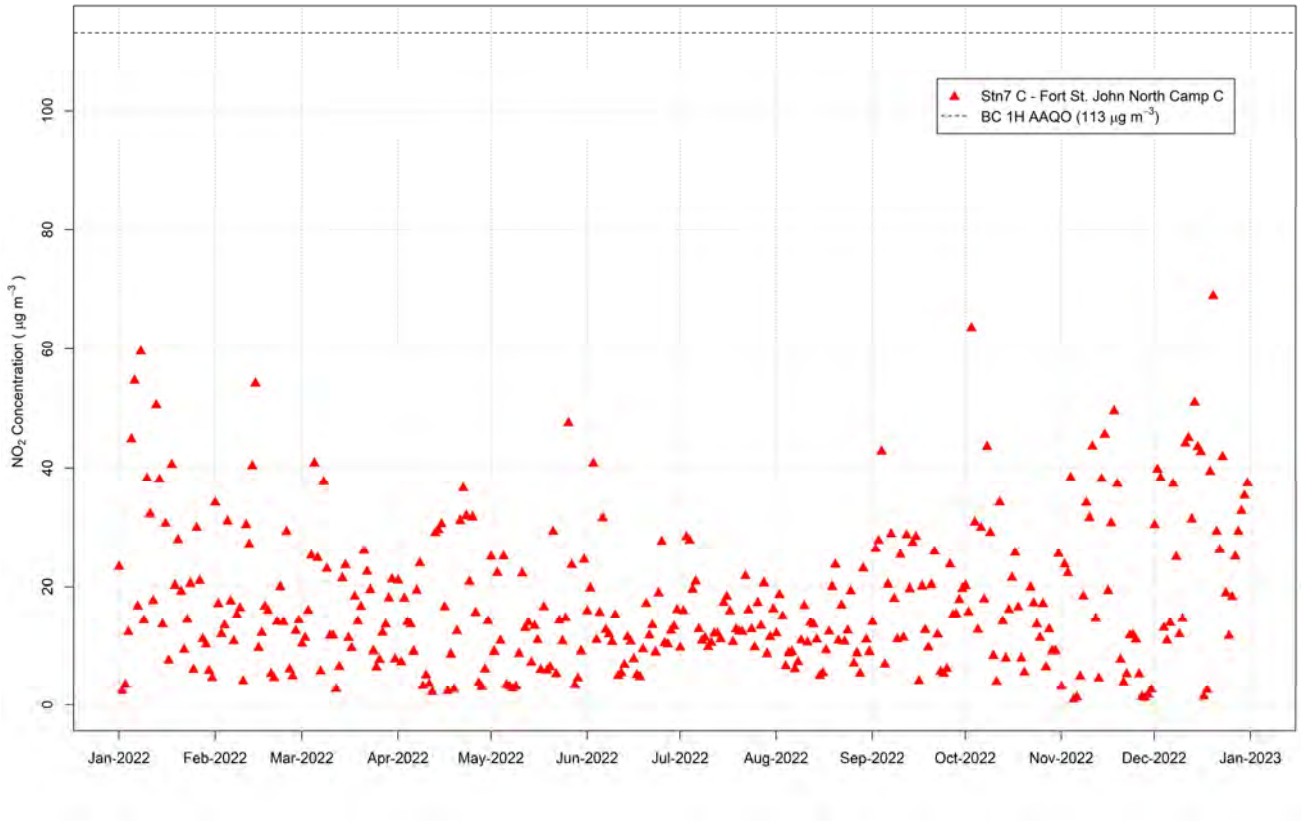


Figure 3-7: Daily 1-hour maximum NO_2 concentrations from Station 7C - Fort St. John North Camp C for 2022 (in µg/m³).

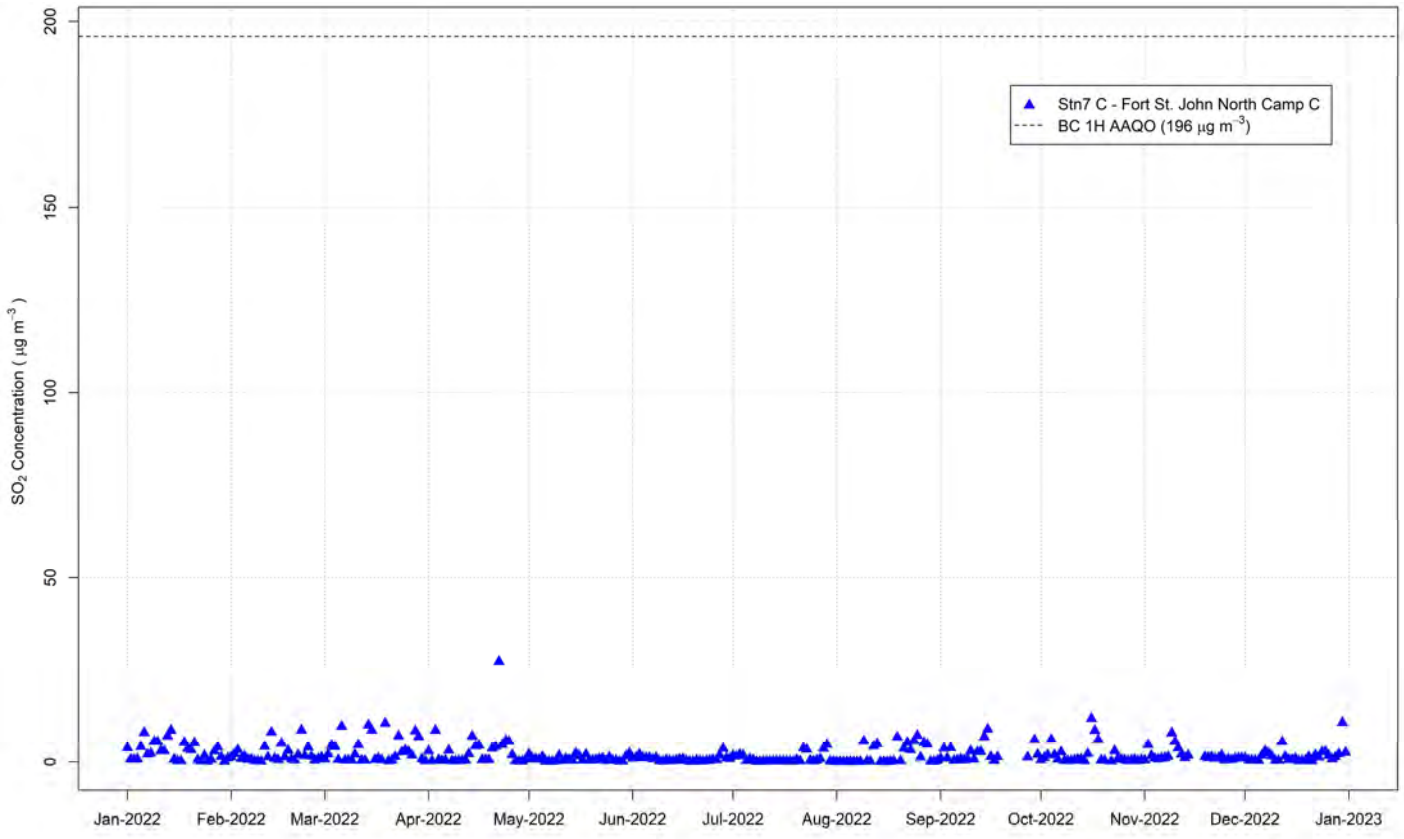


Figure 3-8: Daily 1-hour maximum SO_2 concentrations from Station 7C - Fort St. John North Camp C for 2022 (in µg/m³).

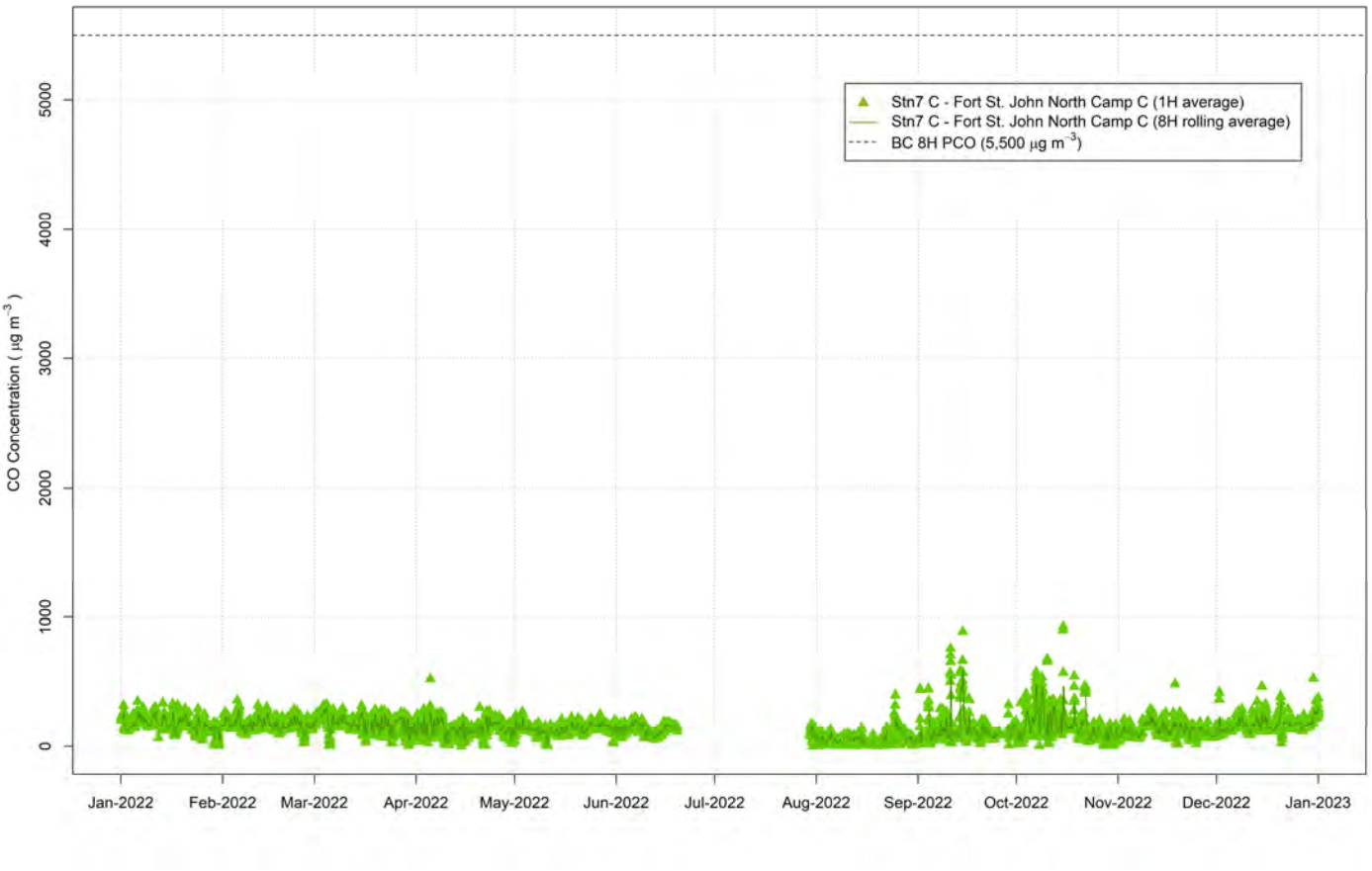


Figure 3-9: Measured 1-hour (green) and 8-hour rolling average (black line) CO concentrations from Station 7C - Fort St. John North Camp C for 2022 (in µg/m³).

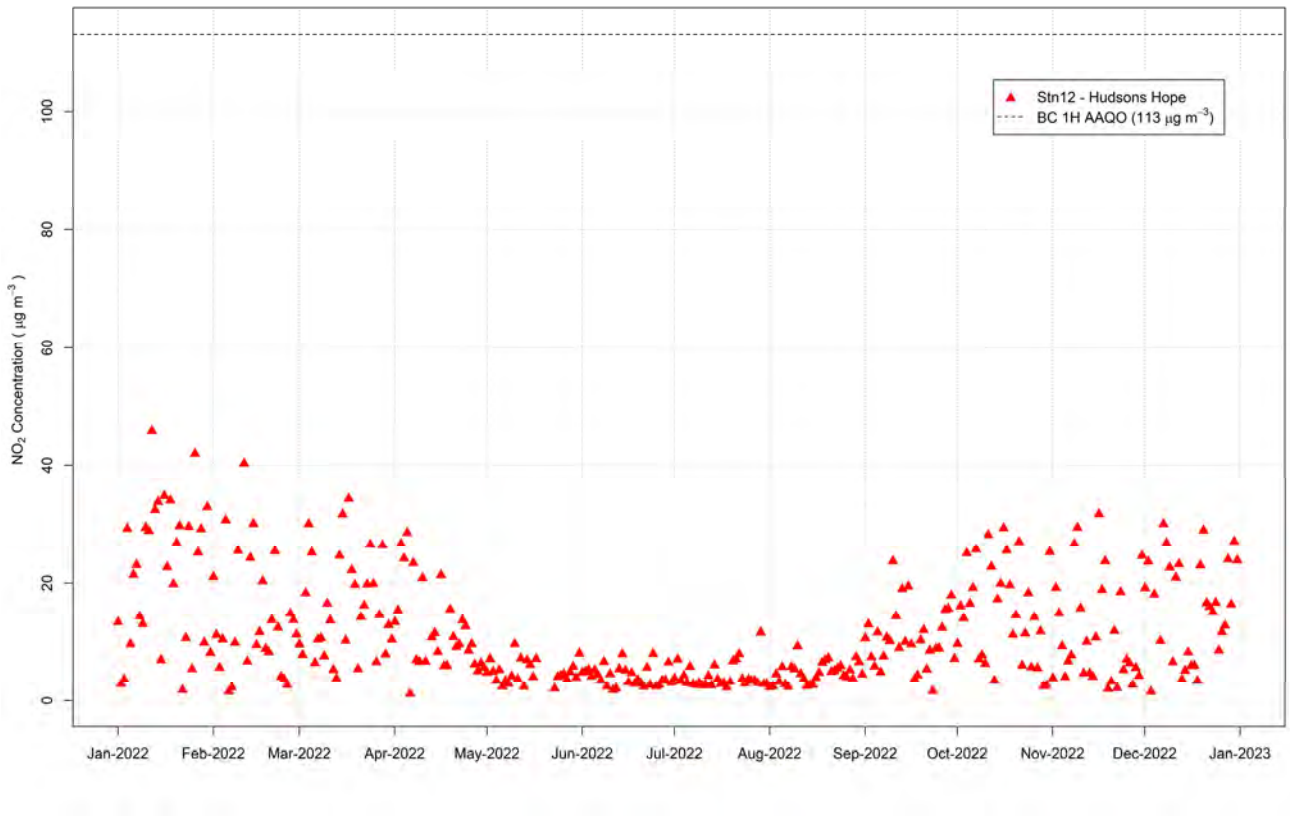


Figure 3-10: Daily 1-hour maximum NO_2 concentrations from Station 12 - Hudson's Hope for 2022 (in µg/m³).

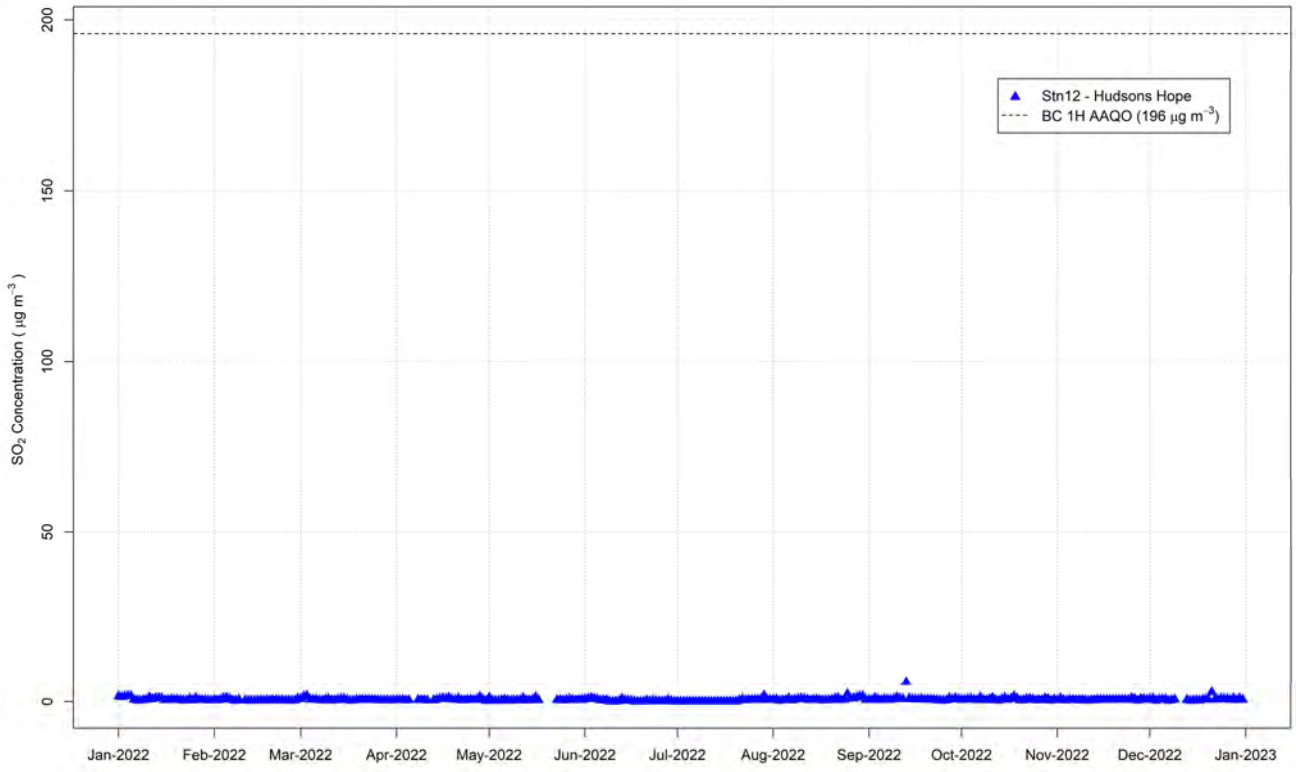


Figure 3-11: Daily 1-hour maximum SO_2 concentrations from Station 12 - Hudson's Hope for 2022 (in µg/m³).

3.4 Air Quality Reporting

Condition 12.3.3 of the FDS requires that BC Hydro produce a plan that includes procedures to enable the appropriate authorities to alert sensitive receptor groups and Reservoir Area Indigenous Groups in case of any measured exceedances of the AAQO's and to address those exceedances. Following Section 5.0 of BC Hydro's Air Quality Monitoring Program (included as Appendix A of the CEMP; BC Hydro 2022), BC Hydro has developed a MOU with ENV to allow access to all air quality readings monitored by BC Hydro. The MOU includes an agreement for BC Hydro to share collected data, with the understanding that ENV will regularly audit the monitoring stations (see Section 3.4.1).

According to the MOU, ENV will be responsible for reporting the information publicly on the Ministry's near real-time air quality data portal[1]. This data portal is currently active and available to all interested parties to view current and historical air quality data from BC Hydro's air quality monitoring stations. Based on these measurements and other monitoring in the region, ENV and Northern Health are able to issue air quality advisories as they deem appropriate. In addition, quality assured data are provided annually to ENV prior to the subsequent Provincial Clean Air Day, in accordance with the MOU. Throughout 2022, also in accordance with the MOU, measurements from the Site C monitoring network were shared regularly (monthly) with the Pacific Climate Impacts Consortium (PCIC).[2] PCIC is a regional climate service centre at the University of Victoria that provides practical information on the physical impacts of climate variability and change in the Pacific and Yukon Region of Canada.

The BC Hydro ambient network has been operated at a high standard that is consistent with provincial and national technical standards per guidance documents (CCME 2019; Province of BC 2020). The real-time readings are being shared with external users to inform decision-making for health alerts and climate issues and with internal Project contractors, and BC Hydro managers and decision makers to minimise emissions and comply with the AAQO's. External audits are discussed in the following section and have indicated that the data quality is high and meets expectations. BC Hydro concludes that the ambient monitoring program is a success and is very useful to all parties seeking reliable, timely and accessible information that has been verified to the highest applicable technical standards.

3.4.1 Monitoring Station Audits

During 2022 ENV conducted equipment performance audit on the $PM_{2.5}$ monitor at Station 7C (Fort St. John North Camp C) on March 30th in accordance with the MOU and this monitor failed due to being over 5% out on the foil check. After assessment it was shown that the foil check equipment was erroneously calibrated and recertified by the manufacturer. Two brand-new foil check kits were purchased to resolve this issue. Going forward RWDI will purchase new foils when required, instead of having them recertified.

ENV also conducted equipment performance audits on the five ambient air quality monitoring stations on May 18-20th and October 26-28th in accordance with the MOU. The results of these audits are presented in Table 3-7. RWDI's annual pass rate at the end of 2022 was 96.4%.

[1] https://envistaweb.env.gov.bc.ca/ Data is available by searching in the reporting tool under purpose = BC HYDRO

[2] https://www.pacificclimate.org/

Table 3-7: Summary of ENV performance audit results for 2022.

Station	Parameter	Audit Date		
		Mar 30th 2022	May 18-20th 2022	Oct 26-28th 2022
Station 1 (Attachie Flat Upper Terrace)	$PM_{2.5}$	No Audit	Pass	Pass
	PM_{10}	No Audit	Pass	Pass
Station 7C (Fort St. John North Camp C)	$PM_{2.5}$	Fail	Pass	Pass
	PM_{10}	No Audit	Pass	Pass
	NOx	No Audit	Pass	Pass
	SO_2	No Audit	Pass	Pass
Station 8 (Old Fort)	$PM_{2.5}$	No Audit	Pass	Pass
	PM_{10}	No Audit	Pass	Pass
Station 9 (85th Avenue)	$PM_{2.5}$	No Audit	Pass	Pass
	PM_{10}	No Audit	Pass	Pass
Station 12 (Hudson's Hope)	$PM_{2.5}$	No Audit	Pass	Pass
	PM_{10}	No Audit	Pass	Pass
	NO_X	No Audit	Pass	Pass
	SO_2	No Audit	Pass	Pass

4 CONCLUSIONS

Data quality was high in 2022 and for PM measurements, the complete amount of valid data exceeded 96% for the 1-hour readings and exceeded 95% for the 24-hour averages. The complete amount of valid data exceeded 96% for the 1-hour readings for all gases except CO at Station 7C (Fort St. John North Camp C), which was at 84% due to extended down time resulting from removal and repair.

The majority of the measured ambient concentrations for PM and gases in 2022 were below their respective AAQO. Year 2022 included a hot and dry summer that featured several wildfires that can be related to the elevated PM readings as discussed in detail below. No exceedances of the 1-hour or annual AAQO's for sulphur dioxide (SO_2) and nitrogen dioxide (NO_2), or 1-hour and 8-hour Pollution Control Objectives (PCO's) 's for carbon monoxide (CO) were observed in 2022 at the two stations where these parameters are being measured, specifically, Station 7C (Fort St. John North Camp C) and Station 12 (Hudson's Hope).

For particulate matter, elevated levels of $PM_{2.5}$ and PM_{10} were not uncommon with more alerts in in 2022 compared to any other year. This was due to dry conditions and the very extensive forest fire season, ending with the Battleship Mountain fire, which was spotted on August 30th, reaching 31,755 hectares in size and coming within 8 km of Hudson's Hope and was still burning in November. During that time period, elevated $PM_{2.5}$ concentrations contributed significantly to the PM_{10} signal. Relative to the BC AAQO, there were ninety-seven exceedances of the 24-hour target of 50 µg/m^3. The majority of the 24-hour PM_{10} exceedances outside of the fire season were observed at Station 7C (Fort St. John North Camp C). After careful consideration of weather conditions, these can likely be attributed to fugitive dust mobilized by vehicles and strong winds. An alerting system is in place to immediately notify BC Hydro and its contractors about excursions of the AAQOs taking place so they can work to identify the activities onsite that may be responsible for the emissions and implement mitigation measures or change activities to reduce those emissions.

For $PM_{2.5}$ measurements in 2022, there were 68 exceedances recorded where elevated levels occurred, and alerts were issued. Of the 68 $PM_{2.5}$ exceedances measured, 55 were related to the Battleship Mountain Fire and all stations across the BC Hydro network detected these and others were the result of wood-fire stoves and local smoke. There was one exceedance of $PM_{2.5}$ measured during BC Hydro Site C wood pile burning events in 2022. The 24-hour rolling average of PM2.5 concentration exceeded the BC 24-hour air quality objective of 25 µg/m^3 for less than one day, from 19:00 MST on 06-Mar-2022 to 17:00 MST 07-Mar-2022.

During 2022 the BC ENV conducted $PM_{2.5}$ equipment performance audit at Station 7C (Fort St. John North Camp C) and this unit failed because the foil check equipment was erroneously calibrated and recertified by the manufacturer. Two brand-new foil check kits were purchased to resolve this issue. Following that audit, the ENV conducted equipment performance audits on the five ambient air quality monitoring stations on May 18-20th and October 26-28th in accordance with the MOU. The annual audit pass rate for 2022 was 96.4%.

5 REFERENCES

BC Hydro (2022). Air Quality Monitoring Program (Rev. 3). 9 pp. Included as Appendix B of CEMP as noted below.

BC Hydro (2021). Smoke Management Plan (Rev. 5). 52 pp. Included as Appendix A of CEMP as noted below.

BC Hydro (2022). Construction Environmental Management Plan (CEMP). Revision 11. Retrieved 2023-02-28 from: https://www.sitecproject.com/sites/default/files/construction-environmental-management-plan-CEMP-rev-11_0.pdf

B.C. Ministry of Environment & Climate Change Strategy (2021). British Columbia Ambient Air Quality Objectives. November 2021. Retrieved 2022-02-08 from: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/air/reports-pub/prov_air_qual_objectives_fact_sheet.pdf

BC Ministry of Forests, Lands and Natural Resource Operations (2017). Wildfire Management Branch. Wildfire season summary. Retrieved 2017-02-08, from http://www2.gov.bc.ca/gov/content/safety/wildfire-status/wildfire-statistics/wildfire-season-summary

Canadian Council of Ministers of the Environment (2019). Ambient Air Monitoring And Quality Assurance/Quality Control Guidelines, National Air Pollution Surveillance Program. PN1599, ISBN 978-1-77202-056-4 PDF, Downloaded from: https://ccme.ca/en/res/ambientairmonitoringandqa-qcguidelines_ensecure.pdf

Canadian Environmental Assessment Agency (2014). Decision Statement Issued under Section 54 of the Canadian Environmental Assessment Act, 2014.

Environmental Assessment Office (2014). Environmental Assessment Certificate # E14-02 Issued under the ENVIRONMENTAL ASSESSMENT ACT. S.B.C. 2002, c. 43.

Environment and Climate Change Canada. (2016). Canadian Climate Normals or Averages 1981-2010. Retrieved 02 2017, from: http://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnName&txtStationName=fort+st+john&searchMethod=contains&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=1413&dispBack=1

Province of British Columbia. 2020. The British Columbia Field Sampling, Manual Part B Air and Air Emissions Testing. Downloaded from: https://www2.gov.bc.ca/assets/gov/environment/research-monitoring-and-reporting/monitoring/emre/bc_field_sampling_manual_part_b.pdf. pp 206.

RWDI Air Inc. (2015a). Site C Climate and Air Quality Monitoring Annual Report 2012. Prepared for BC Hydro Power and Authority. Vancouver, BC.

RWDI Air Inc. (2015b). Site C Climate and Air Quality Monitoring Annual Report 2013. Prepared for BC Hydro Power and Authority. Vancouver, BC.

RWDI Air Inc. (2015c). Site C Climate and Air Quality Monitoring Annual Report 2014. Prepared for BC Hydro Power and Authority. Vancouver, BC.

RWDI Air Inc. (2016). Site C Climate and Air Quality Monitoring Annual Report 2015. Prepared for BC Hydro Power and Authority. Vancouver, BC.

RWDI Air Inc. (2017). Site C Climate and Air Quality Monitoring Annual Report 2016. Prepared for BC Hydro Power and Authority. Vancouver, BC.

RWDI Air Inc. (2018). Site C Climate and Air Quality Monitoring Annual Report 2017. Prepared for BC Hydro Power and Authority. Vancouver, BC.

RWDI Air Inc. (2019). Site C Climate and Air Quality Monitoring Annual Report 2018. Prepared for BC Hydro Power and Authority. Vancouver, BC.

RWDI Air Inc. (2020). Site C Climate and Air Quality Monitoring Annual Report 2019. Prepared for BC Hydro Power and Authority. Vancouver, BC.

RWDI Air Inc. (2021) Site C Climate and Air Quality Monitoring Annual Report 2020. Prepared for BC Hydro Power and Authority. Vancouver, BC.

RWDI Air Inc. (2022) Site C Climate and Air Quality Monitoring Annual Report 2021. Prepared for BC Hydro Power and Authority. Vancouver, BC.

APPENDIX A

2022 COMPLIANCE SUMMARY

Table A- 1: Summary of AQMP Conditions and Year 2022 Compliance Summary

Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
EAC Condition 57	The EAC Holder must develop an Air Quality Management Plan and Smoke Management Plan	Construction Environmental Management Plan Section 4.1 (Air Quality Management Plan) and Appendices A (Smoke Management Plan and B (Air Quality Monitoring Plan)	Completed February 4, 2016	Construction Environmental Monitoring Plan
	The Air Quality Management Plan and Smoke Management Plan must include at least the following to describe how the EAC Holder:			
	• Identify places of high use by Indigenous Groups for traditional purposes and develop mitigation measures if adverse effects are predicted at those locations.	Ground truthing activities are conducted per the Aboriginal Plant Use Mitigation Plan, Cultural Resources Mitigation Plan, and Heritage Resources Management Plan.	• BC Hydro has initiated ground truthing programs with the purpose of engaging with Indigenous land users, including registered trapline holders, to verify and accurately locate Indigenous land use information, and to identify concerns related to specific features, or sites that may be affected by the Project. BC Hydro has provided funding to Indigenous groups for ground truthing through Consultation and Capacity Funding Agreements. During this reporting period, ground truthing was undertaken by Blueberry River, Doig River, and Halfway River First Nation.	Indigenous Nations have generally reported through traditional use studies, ground-truthing reports and other communications, that certain places/landscapes continue to be highly valued for cultural purposes, including several of the stream confluences on the north shore of the Peace River including but not limited to Cache Creek / Bear Flats, and Halfway River / Attachie Flats, and other areas. Additionally, Indigenous Nations have reported areas of importance along the transmission line right of way. Setback distances and ignition criteria described in the Smoke Management Plan (Sections 4.4 and 5.0, respectively) would apply in these areas. Indigenous Nations will be notified of planned debris burning through the activities and tools described in section 5.0 of the Aboriginal Group Communications Plan (Appendix D of the CEMP). The Project continues to consult with individual Indigenous Nations regarding construction plans and offers opportunities for site visits where ground truthing has not already occurred. Given that the Project is

Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
				nearing completion, and most areas within the PAZ have already been disturbed, no ground truthing occurred in F23. Site-visits did occur in on July 25, 2022. BC Hydro hosted members of the Site C Reclamation Sub-committee to review the operational Area E aggregate mine and progressive reclamation activities including topsoil and coarse woody debris stockpiling. Additional field activities included boat tours of the Peace River prior to reservoir filling with HRFN on August 10, 2022.
	• Measures to manage emissions and dust from all Project activities.	Construction Environmental Management Plan Section 4.1	Completed February 4, 2016, and ongoing	Section 4.1 provides mitigation measures to be completed to manage emissions and dust.
	• Measures to manage Project effects on air quality associated with concrete production at concrete batch plants.	Construction Environmental Management Plan Section 4.1	Completed February 4, 2016, and ongoing	Section 4.1 provides mitigation measures to be taken to manage air quality effects associated with concrete batch plant operations
	• Control Project-related smoke by following the most current BC Ministry of Environment Open Burning Smoke Control Regulation.	Construction Environmental Management Plan Appendix A	Ongoing	Section 4.1 and Appendix A of the CEMP refer to the requirement to control Project-related smoke in accordance with the BC Ministry of Environment and Climate Change's Open Burning Smoke Control Regulation. BC Hydro audits compliance with this requirement by reviewing contractor EPPs and conducting environmental audits during construction to verify implementation of EPPs.
	• Measures to retain vegetative barriers, or install temporary barriers, where practical.	Construction Environmental Management Plan Section 4.1	Ongoing	Section 4.1 identifies this commitment.
	• Procedures to provide MOE with data collected during monitoring so that they can notify sensitive populations if air quality thresholds are exceeded.	Construction Environmental Management Plan Appendix B Section 5.0	Ongoing	BC Hydro has entered into an agreement with the BC Ministry of Environment and Climate Change (ENV) to make all air quality measurements available in near real-time. All operational air quality stations are accessed hourly by the BC ENV.
	The EAC Holder must monitor air quality associated with shoreline protection works at	Construction Environmental Management Plan	Ongoing	Shoreline protection works at Hudson's Hope began in 2020 and were completed in November 2022. An air quality monitoring station was installed

Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
	Hudson's Hope during the construction period and for the first two years of operations.	Appendix B Section 4.0		in October 2020, monitoring will continue during construction and for the first 2 years of Site C operations.
	The EAC Holder must provide these draft Air Quality Management Plan and Smoke Management Plan to MOE, City of Fort St. John, District of Hudson's Hope, Peace River Regional District, District of Taylor, District of Hudson's Hope, District of Chetwynd and Indigenous Groups for review a minimum of 90 days prior to the commencement of construction activities.	Draft Construction Environmental Management Plan Section 4.1 (Air Quality Management Plan) and Appendix A (Smoke Management Plan) and Appendix B (Air Quality Monitoring Program)	Completed	The draft CEMP was submitted for review and comment on October 17, 2014.
	The EAC Holder must file the final Air Quality Management Plan and Smoke Management Plan with EAO, MOE, City of Fort St. John, District of Hudson's Hope, Peace River Regional District, District of Taylor, District of Chetwynd and Indigenous Groups a minimum of 30 days prior to the commencement of construction activities.	Construction Environmental Management Plan Section 4.1 (Air Quality Management Plan) and Appendix A (Smoke Management Plan) and Appendix B (Air Quality Monitoring Program)	Completed	The final (Revision 1) of the CEMP was provided to regulatory agencies, governments and Indigenous Groups on June 5, 2015. The CEMP continues to be updated as required, with the most recent version, Revision 11, dated October 11, 2022, was accessible to regulators, government agencies, Indigenous Groups and the public via the Site C Clean Energy Project website at: https://www.sitecproject.com/sites/default/files/construction-environmental-management-plan-CEMP-rev-11_0.pdf

Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
	The EAC Holder must develop, implement and adhere to the final Air Quality Management Plan and Smoke Management Plan, and any amendments, to the satisfaction of EAO.	Construction Environmental Management Plan Section 4.1 (Air Quality Management Plan) and Appendices A (Smoke Management Plan and B (Air Quality Monitoring Plan)	Ongoing	2022 Air Quality Management Plan Annual Report BC Hydro audits contractor compliance with implementation of relevant requirements of the Air Quality Management Plan through: • reviewing Environmental Protection Plans (EPPs) submitted by the contractors and, • conducting environmental audits during construction to verify that requirements of the Plan are being considered and implemented as required BC Hydro will continue to issue Field Advice Memos to its contractors to address any issues of non-compliance.
EAC Condition 59	The EAC Holder must outline measures including relocation of affected home-owners, as deemed appropriate in consultation with affected home-owners, to address serious levels of noise or changes in air quality during construction of the Project. The measures would be included in the appropriate plans.	Construction Environmental Management Plan Section 4.11 (Noise and Vibration Management) and Appendix B (Air Quality Monitoring Plan)	Consultation with affected homeowners or Northern Health/BC Ministry of Environment to occur if necessary	A noise and air quality complaint response process has been developed and is being implemented. Key steps in the process include proactive noise mitigation, complaint response, monitoring/notification as required, and additional mitigation if warranted.

Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
FDS Condition 12.1	The Proponent shall ensure that Designated Project construction is undertaken in a manner that protects the health of Indigenous peoples, by ensuring that exceedances of federal and provincial ambient air quality objectives are avoided or minimized and by managing the potential effects of smoke and dustfall.		Ongoing	Construction Environmental Management Plan Section 4.1 (Air Quality Management Plan) and Appendices A (Smoke Management Plan and B (Air Quality Monitoring Plan) BC Hydro audits contractor compliance with implementation of relevant requirements of the Air Quality Management Plan through: • reviewing Environmental Protection Plans (EPPs) submitted by the contractors and, • conducting environmental audits during construction to verify that requirements of the Plan are being considered and implemented as required BC Hydro will continue to issue Field Advice Memos to its contractors to address any issues of non-compliance.
FDS Condition 12.2	The Proponent shall develop, in consultation with Reservoir Area Indigenous groups, an air quality management plan to ensure exceedances of those ambient air quality objectives due to Designated Project construction are avoided or minimized at human receptor sites located outside the Project Activity Zone.	Construction Environmental Management Plan Section 4.1 (Air Quality Management Plan) and Appendices A (Smoke Management Plan and B (Air Quality Monitoring Plan)	Completed February 4, 2016	Construction Environmental Management Plan

Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
FDS Condition 12.3	The plan shall include:			
FDS Condition 12.3.1	• measures to avoid or minimize exceedances of federal and provincial ambient air quality objectives for Total Suspended Particulates (TSP), Particulate Matter ($PM_{2.5}$, PM_{10}), Carbon Monoxide (CO), Nitrogen Dioxide (NO_2) and Sulphur Dioxide (SO_2);	Construction Environmental Management Plan Section 4.1	Completed February 4, 2016	Construction Environmental Management Plan
FDS Condition 12.3.2	• measures to minimize or manage the potential effects of smoke and dustfall;	Construction Environmental Management Plan Section 4.1 (Air Quality Management Plan) and Appendices A (Smoke Management Plan)	Completed February 4, 2016	Construction Environmental Management Plan
FDS Condition 12.3.3	• procedures to enable the appropriate authorities to alert sensitive receptor groups and Reservoir Area Indigenous groups in cases of exceedance of air quality standards and to address those exceedances; and	Construction Environmental Management Plan Appendix B Section 5.0	Ongoing	BC Hydro has entered into an agreement with the BC ENV to make all air quality data available in near real-time. All operational air quality stations are accessed hourly by the BC ENV.
FDS Condition 12.3.4	• procedures to monitor air quality effects at locations used by Indigenous groups and to develop mitigation measures if adverse effects are predicted at those locations.	Construction Environmental Management Plan Appendix B	Completed July 8, 2016	Air quality monitors measuring PM_{10} and $PM_{2.5}$ were installed at three locations before construction began. A fourth station at the construction site measuring PM_{10}, $PM_{2.5}$, SO_2, NO_x and CO was installed July 7, 2016, and a fifth station at Hudson's Hope measuring PM_{10}, $PM_{2.5}$, SO_2, and NO_x was installed as of October 1, 2020.

Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
FDS Condition 12.4	The Proponent shall submit to the Agency and Reservoir Area Indigenous groups a draft copy of the plan for review 90 days prior to initiating construction.	Construction Environmental Management Plan Section 4.1 (Air Quality Management Plan) and Appendix A (Smoke Management Plan)	Completed	The draft CEMP was submitted for review and comment on October 17, 2014.
FDS Condition 12.5	The Proponent shall submit to the Agency the final plan a minimum of 30 days prior to initiating construction. When submitting the final plan, the Proponent shall provide to the Agency an analysis that demonstrates how it has appropriately considered the input, views or information received from Reservoir Area Indigenous groups.	Construction Environmental Management Plan Section 4.1 (Air Quality Management Plan) and Appendices A (Smoke Management Plan)	Completed	The final Construction Environmental Management Plan, along with the Consideration Tracking Table was submitted on June 5, 2015.
FDS Condition 12.6	The Proponent shall implement the plan and provide to the Agency an analysis and summary of the implementation of the plan, as well as any amendments made to the plan in response to the results, on an annual basis during construction and the first year of operation.	Air Quality Management Plan 2015	8th Annual Report to CEAA included in this document.	Air Quality Management Plan 2015. • 1st Annual Report to CEAA submitted July 2016. • 2nd Annual Report submitted March 21, 2017 and revised June 14, 2017. • 3rd Annual Report was submitted March 29, 2018 • 4th Annual Report submitted April 1, 2019. • 5th Annual Report submitted March 31, 2020. • 6th Annual Report submitted March 31, 2021. • 7th Annual Report submitted March 31, 2022. • 8th Annual Report included in this document.

Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
FDS Condition 12.7	The Proponent shall provide a copy of the same version of its annual reporting on ambient air quality as provided to the Agency and in the same timeframe to Reservoir Area Indigenous groups and the Métis Nation British Columbia.	Air Quality Management Plan 2015	8th Annual Report to CEAA included in this document.	Air Quality Management Plan 2015. • 1st Annual Report to CEAA submitted July 2016. • 2nd Annual Report submitted March 21, 2017 and revised June 14, 2017. • 3rd Annual Report submitted March 29, 2018 • 4th Annual Report submitted April 1, 2019. • 5th Annual Report submitted March 31, 2020. • 6th Annual Report submitted March 31, 2021. • 7th Annual Report submitted March 31, 2022. • 8th Annual Report included in this document.

APPENDIX B

EXAMPLES OF DUST SUPPRESSION WITH CALCIUM CHLORIDE ROADWAY APPLICATION

Figure 1: Calcium Road Application

As provided by Peace River Hydro Partners in memo dated May 15, 2022

Figure 2: Calcium Road Application

As provided by Peace River Hydro Partners in memo dated July 18, 2022

Figure 3: Calcium Road Application

As provided by Peace River Hydro Partners in memo dated July 18, 2022

Figure 4: Calcium Road Application
As provided by Peace River Hydro Partners in memo dated September 4, 2022

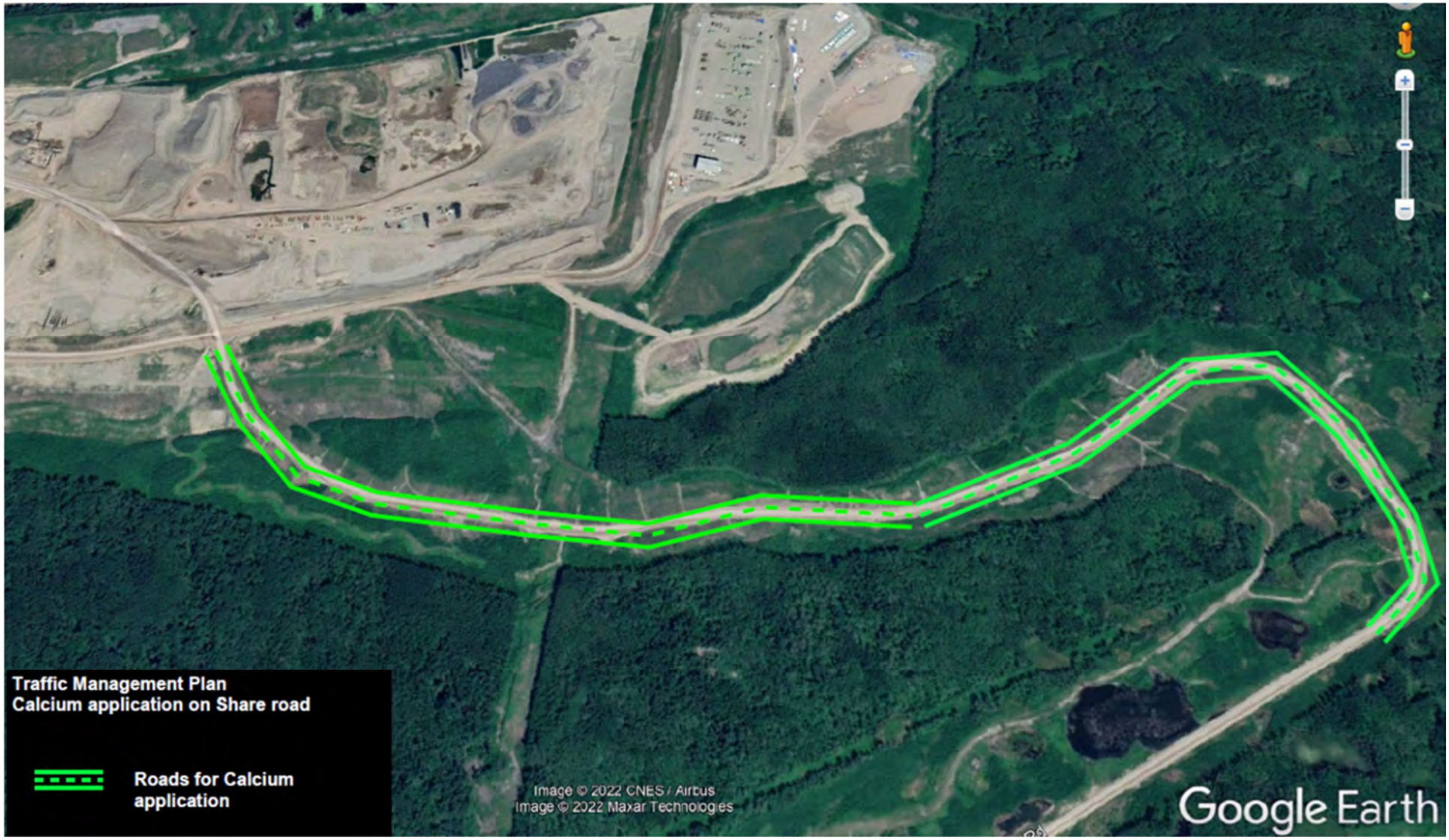


Figure 5: Calcium Road Application

As provided by Peace River Hydro Partners in memo dated September 4, 2022