REPORT

SITE C CLIMATE & AIR QUALITY MONITORING

FORT ST. JOHN, BC

2016 ANNUAL REPORT – REV. 1

RWDI #1601625

June 14, 2017

SUBMITTED TO

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VERSION HISTORY

Index	Date	Pages	Authors
1	March 21, 2017	All	Eric Christensen, M.Sc. Iain Hawthorne, Ph.D. (Candidate), M.Sc. Nicholas Grant, M.Sc. Zoran Nesic, M.A.Sc Andrew Black, BSA, M.Sc., Ph.D. Andres Soux, M.Sc. David Chadder, Hon. B.Sc., QEP
2	June 14, 2017	Updated Tables 4.2 and 4.4, and Figures 4.5 to 4.7 with additional text in Sections 2.1, 4.1 and 4.4 and minor text edits elsewhere	Eric Christensen, M.Sc. David Chadder, Hon. B.Sc., QEP Michelle Seguin, Ph.D.

1 INTRODUCTION

BC Hydro's Site C Clean Energy Project (the Project) in British Columbia's Peace region aims to create a new hydroelectric dam on the Peace River in the vicinity of the city of Fort St. John. Approval of the Project by the Canadian Environmental Assessment Agency was contingent on BC Hydro satisfying a number of conditions (CEAA, 2014). Section 12 of the Federal Decision Statement (FDS) is concerned with the health of aboriginal peoples as it relates to air quality. This section mandates proper management, monitoring and reporting of air quality to minimize the potential effects on aboriginal health. Section 12.6 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."

Further to the above-described conditions, a modelling study of the effects of the new dam and associated reservoir would have on the local and regional climate (termed "microclimate") was conducted as part of the Environmental Assessment. 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. A technical data report (TDR) (RWDI AIR Inc. 2012) containing a section discussing the area's microclimate was released in December 2012. Therein, results from the network's first year of observations, from January 16, 2011 to January 15, 2012, were discussed. Four subsequent annual monitoring reports describing the state of the climate and air quality for the years of observations, coinciding with the 2012 through 2015 calendar years were released since then (RWDI AIR Inc. 2015a, 2015b, 2015c, 2016). The network has remained in operation and has continued to collect valuable climate and air quality data in the Peace region.

This document serves to describe the state of the climate and air quality for the sixth year of observations coinciding with the 2016 calendar year. This current report allows for comparisons to the previous data collected by the network and to 30-year climate normals from the Environment Canada station at Fort St John Airport (EC, 2012). Climate parameters such as temperature, precipitation, wind speed and direction, soil temperature and soil volumetric water content as well as air quality parameters such as concentrations of particulate matter (PM), nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and carbon monoxide (CO) are presented.

A summary of the the FDS conditions and the provincial Environmental Assessment Certificate (EAC) conditions and their status in relation to complying with the Air Quality Management Plan is presented in Appendix A.

1.1 Managing Air Quality

In an effort to avoid or minimize exceedances of air quality objectives (FDS, Section 12.1) BC Hydro developed a Construction Environmental Management Plan (CEMP), (BC Hydro 2016). The development of the CEMP satisfies Section 12.2 of the FDS. Section 4.1 of the CEMP details the management practices that will be implemented to minimize emissions of criteria air contaminants. Contractors are required to produce site-specific Environmental Protection Plans (EPPs) that explain how the Contractor will meet the CEMP requirements. Site preparation activities and construction activities are underway involving elements of the majority of activities listed in Section 4.1 of the CEMP. To date, BC Hydro has reviewed and approved over 83 EPPs, many of which include measures to minimize emissions as per Section 4.1 of the CEMP where applicable.

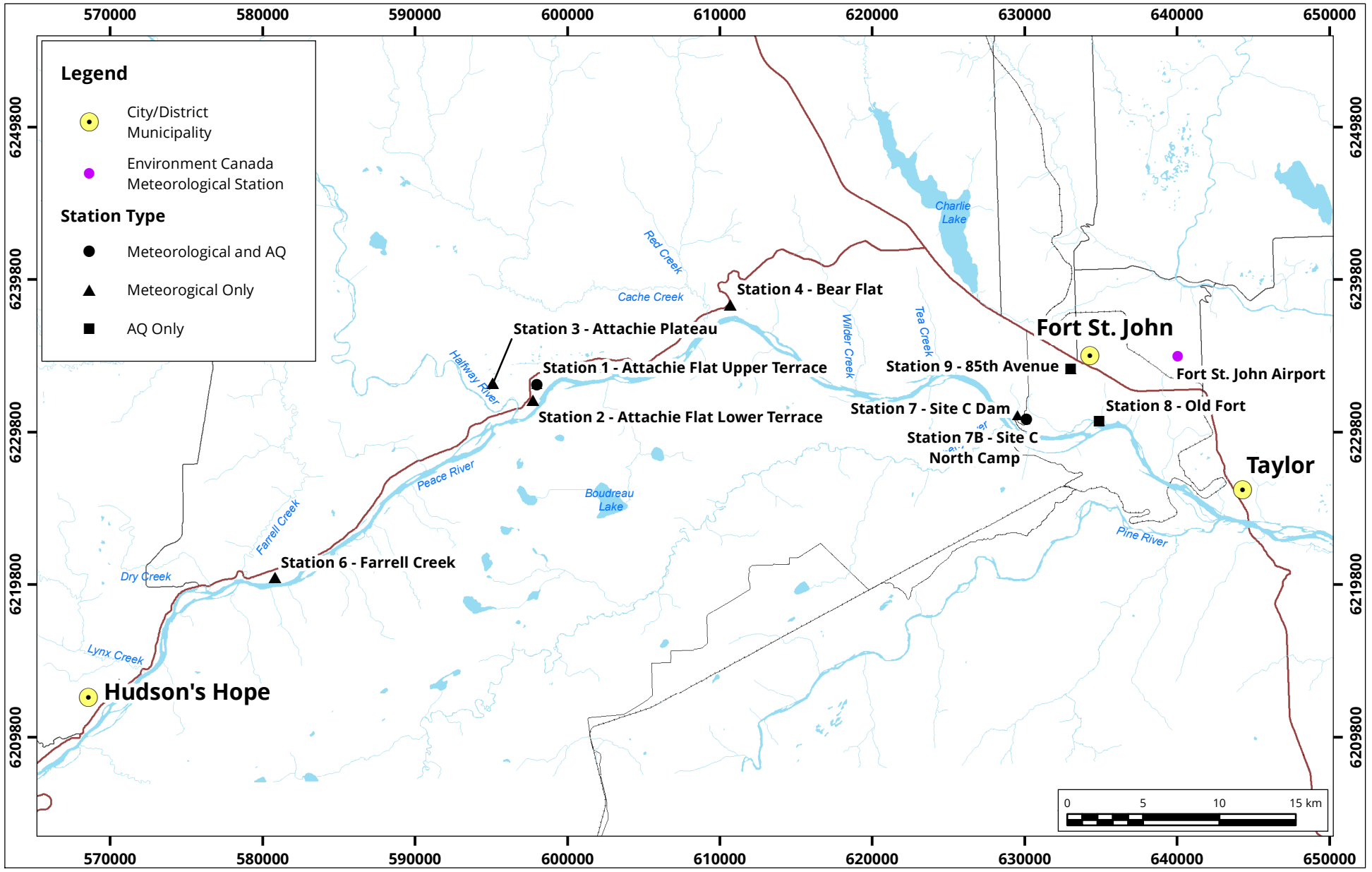
These measures include:

- Application of dust suppressant (water) with authorization under the Water Act on non-paved roads and select other areas such as laydown areas;
- Dust suppression systems on drilling equipment; and
- Vehicle inspection and maintenance programs.

BC Hydro has also developed a Smoke Management Plan (BC Hydro 2015) which satisfies Section 12.3.2 of the FDS conditions.

2 MONITORING NETWORK

Figure 2-1 shows the location of the network stations in relation to local communities and the Peace River. Table 2-1 and Table 2-2 show locations and parameters measured at these stations. Note that Station 7 was decommissioned on April 13, 2016. Instruments and hardware from Station 7 were installed at the new Station 7B alongside air quality equipment on July 7, 2016.



BC Hydro - Site C Meteorological and Air Quality Stations

True North

Drawn by: DJH	Figure: 2-1
Approx. Scale:	1:350,000
Date Revised:	Feb 14, 2017

Map Projection: NAD 1983 UTM Zone 10N

Project #: 1601625

Map Document: C:\Users\djh\Desktop\GIS Temp\1601625\1601625 - Confidential BC Hydro Climate_Monitoring Locations_Figure_2-1 Jan2017.mxd

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

Station	UTM NAD 83 (m)	Latitude, Longitude (decimal degrees)	Elevation (m)
Station 1 - Attachie Flat Upper Terrace	597983 E, 6232938 N	56.23N, -121.41W	479
Station 2 – Attachie Flat Lower Terrace	597721 E, 6231898 N	56.22N, -121.42W	441
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 7 – Site C Dam(1)	629517 E, 6230875 N	56.20N, -120.91W	607
Station 7B – Site C North Camp(2)	630127 E, 6230625 N	56.20 N, -120.90W	581
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
Fort St. John Airport (Environment Canada)	640053 E, 6234872 N	56.24N, -120.74W	695

Notes: (1): Measurements at Station 7 discontinued as of April 13, 2016
(2): Measurements at Station 7B began on July 7, 2016

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

Station	Air Temp. and RH	Wind Speed and Direction	Precipitation	Barometric Pressure	All Radiation Components	Solar Radiation	Turbulent Fluxes	Visibility	Soil Temperature	Soil Moisture	Soil heat Flux	PM_{10} and $PM_{2.5}$	CO, SO_2, NO_2
Station 1 – Attachie Flat Upper Terrace	X	X	X	X	X		X	X	X	X	X	X	
Station 2 – Attachie Flat Lower Terrace	X	X	X	X	X		X		X	X	X		
Station 3 – Attachie Plateau	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							
Station 7 – Site C Dam(1)	X	X	X	X		X							
Station 7B – Site C North Camp(2)	X	X	X	X		X						X	X
Station 8 – Old Fort												X	
Station 9 – 85th Avenue		X										X	
Fort St. John Airport (Environment Canada)	X	X	X	X									

Notes: (1): Station 7 decommissioned on April 13, 2016
(2): Station 7B installed on July 7, 2016

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

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

- Stations with AC power (Station 1, Station 7B, Station 8 and Station 9) had download intervals of one hour; whereas, solar powered stations (Station 2, Station 3, Station 6, Station 7) had their data collected three times per day interval to preserve battery power at the stations; and,
- Station 4 was connected to AC power but also used a satellite modem connection. Downloads from Station 4 were conducted on a daily basis to reduce connection charges.

The first stage of quality assurance applied to the data was included in the datalogger programs of Station 7B and Station 8 wherein all instrumental diagnostics available from the air quality equipment were continually read in and checked by the datalogger for signs of an instrumental malfunction. Upon detection of a problem, the datalogger can issue commands to the air quality instrument in an attempt to rectify the problem and notifies RWDI personnel of the problem so they can follow-up on it.

Human assisted automated quality control was carried out on the data three times per week. This involved running a Mathworks Matlab script which identifies and alerts the operator of missing or duplicate timestamps, data out of range and other anomalous readings (e.g. large spikes in particulate matter). The script then plots the data over the past month and the past 14 days to allow for a visual inspection so the operator can detect anomalous trends or data outliers. This frequency of QA was maintained to allow rapid detection and repair of any instrumental malfunctions.

A third QA/QC operation was conducted on a monthly basis to remove or flag any anomalous data points.

A final QA/QC step was conducted at the end of the monitoring year to look at calibrations and audit results for each particulate matter and gas analyser. In addition to internal RWDI audits, there were two BC MOE audits conducted in 2016. Where one of the two BC MOE audit visits in 2016 indicated an unsatisfactory result relative to the audit criteria, readings leading up to and after the audit were analysed in more detail. Based on this review, some readings were invalidated and/or flagged. Some of the audit criteria for the particulate monitors that were evaluated included mass foil calibration results, nephelometer zero and leak tests. For the gas analyser readings, multi-point calibrations and daily span checks were reviewed relative to the BC MOE acceptance criteria.

3 METEOROLOGY RESULTS

Table 3-1 provides a summary of some of the parameters discussed in this report as well as 30-year climate normals from Fort St. John Airport for the period from 1981 to 2010 (Environment Canada, 2016). Climate normals were calculated from 30 year records of meteorological observations of wind speeds, temperature, precipitation and other related weather conditions at the location of interest. They were provided by Environment Canada and updated on a 10-year basis. The period from 1981-2010 is the most recent period for which Environment Canada climate normals are available.

Table 3-1: Summary of measured climate parameters during 2016 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	3.9	29.6	-30.7	442	2.1
Station 2	3.7	30.0	-31.1	456	1.9
Station 3	4.0	27.2	-30.9	480	2.4
Station 4	4.1	29.6	-30.9	503	1.4
Station 6	4.4	29.2	-29.4	581	1.4
Station 9	-	-	-	-	2.6
Fort St. John Airport	3.4	28.2	-30.0	547	3.9
30 year Climate Normals (1981 – 2010)	2.3	21.7(1)	-16.9(2)	445	3.8

Notes: Station 7 is not included as it was decommissioned as of April 13, 2016
Station 7B is not included as it was installed on July 7, 2016
— indicates no data collected
(1) 30-year average of annual maximum hourly temperature
(2) 30-year average of annual minimum hourly temperature

3.1 Air Temperature and Relative Humidity

Figure 3-1 shows a time series plot of the mean daily temperature at all Site C network stations as well as the Fort St. John Airport for 2016. As was noted in the previous monitoring reports (RWDI AIR Inc. 2015a, 2015b, 2015c, 2016), much greater day to day variability is observed in the winter months (January to March, and November and December) than in the summer months (April to October). This is also observed in the 30-year averaged data from Fort St. John Airport and is attributed to the passage of warm and cold weather fronts in the winter, bringing with them large swings in temperature. In the summer, the cold arctic air masses that dominate in winter are much farther north and there is less frontal activity in the region, resulting in less extreme temperature fluctuations.

The inter-station variation among ambient temperature extremes was generally very small compared to the observed diurnal variations. When averaged over the entire year, the largest difference between all stations was 1.0°C (Table 3-1). Temperature differences of 1 to 2°C were found to be reasonable given that there is a maximum horizontal separation of 60 km between Fort St. John Airport and the most distant station in the network (Station 6 – Farrell Creek) and a maximum change in station elevations of 254 m (from 441 m at Station 2 to 695 m at Fort St. John Airport).

Annual average temperatures for 2016 at all Site C network stations were greater than those reported at Fort St. John Airport. Fort St. John Airport recorded an annual average temperature that was 1.1°C greater than the 30-year climate normal for that station.

The monthly average temperatures tabulated in Appendix B (Table B-1) show that all Site C network stations recorded warmer temperatures than Fort St. John Airport from March through to October. There were no months during which all Site C network stations recorded colder temperatures than the Fort St. John Airport. Fort St. John Airport recorded below normal temperatures in September, October and December. Warmer than normal temperatures were recorded at Fort St. John Airport from January to August and in November.

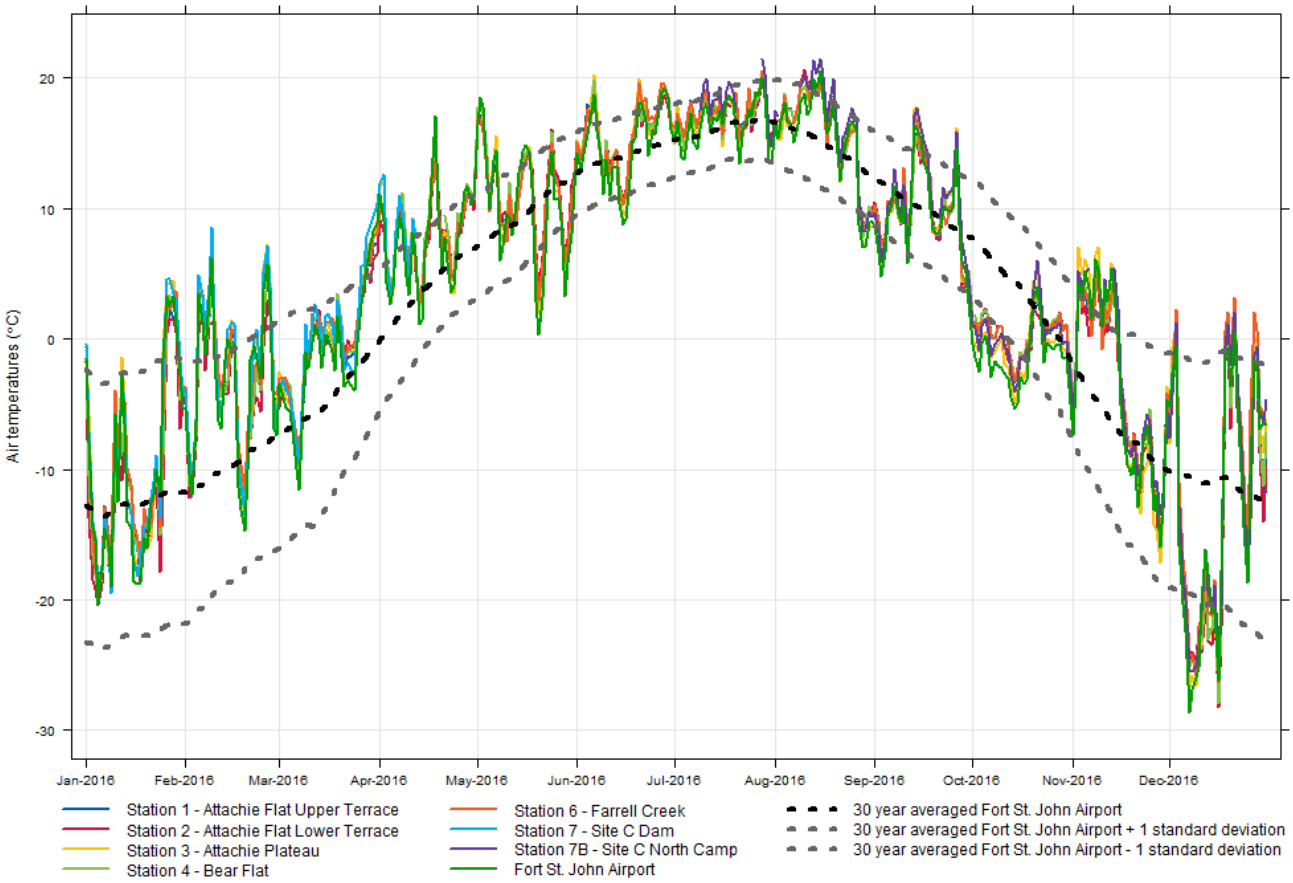


Figure 3-1: Daily average temperatures at all Site C network stations for the year 2016 and comparison with the mean ± 1 standard deviation of 30-year climate normal (based on 21 day centered rolling average) (in °C).

Figure 3-2 shows a time-series of relative humidity (RH) recorded daily at 15:00 Local Standard Time (LST) at each of the stations. This single hour of the day was used instead of a daily average due to the normally large fluctuation in RH over the course of a day and to allow comparisons with climate normals. Relative humidity at Station 2 and Station 3 most frequently had the highest monthly averaged values over all of the stations (four months each). The greatest RH values were found at Station 2 during the colder months of January, October, November and December; whereas, RH at Station 3 most frequently had the highest monthly average values over all of the stations during the warmer months of April, May, June and August. Station 6 was the station at which the monthly average RH was most frequently the lowest (six months).

When compared to Fort St. John Airport (Appendix B, Table A-2), the annual average RH at all Site C stations were lower. Monthly average RH values over all of the stations were lower than Fort St. John Airport from May to December. Fort St. John Airport recorded lower than normal RH values for February, April and September.

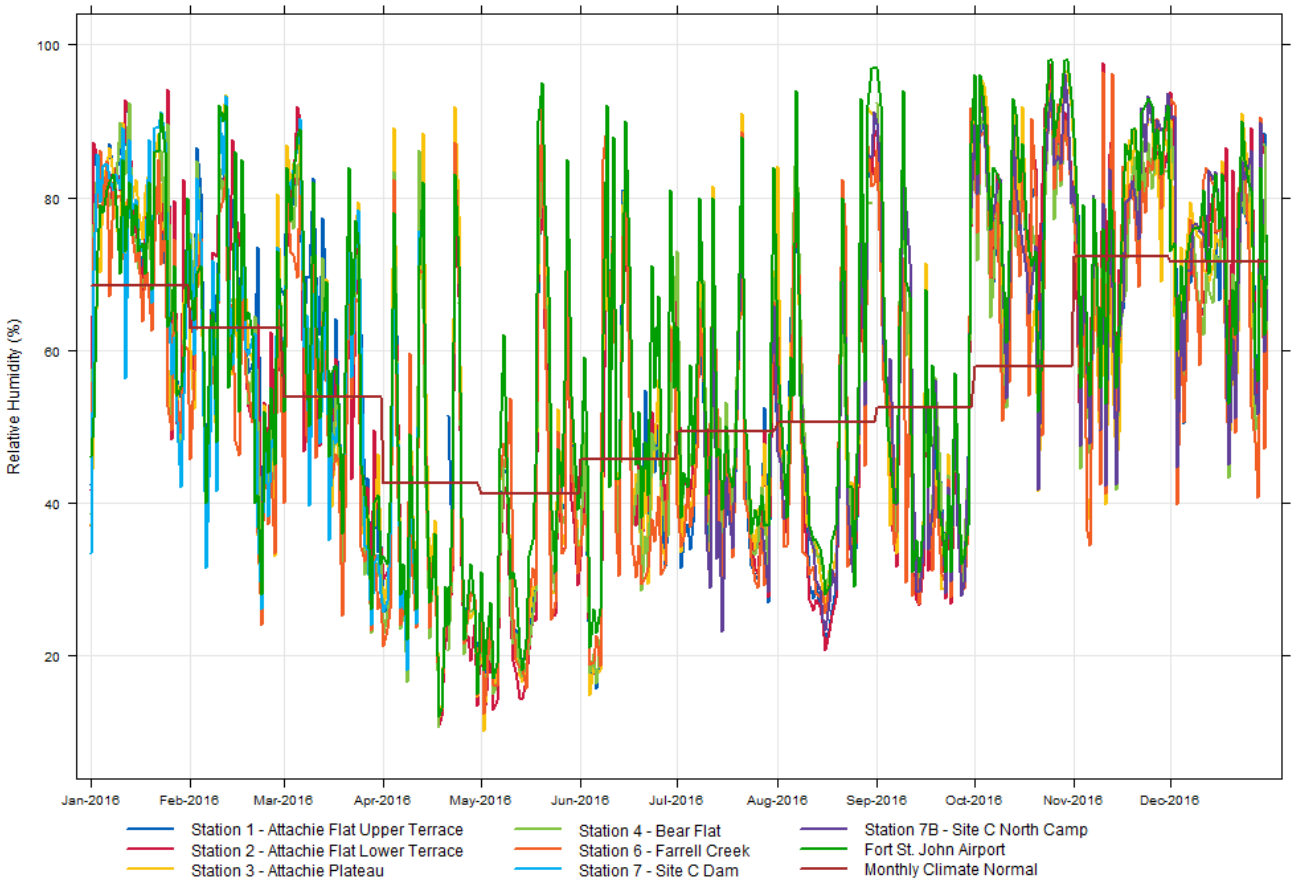


Figure 3-2: Relative Humidity at all Site C network stations measured daily at 15:00 LST for the year 2016 (in percent)

3.2 Wind Characteristics

Wind speed and direction were also measured at all stations except Station 8. Figure 3-3 shows wind roses for all stations with a complete year of data including Fort St. John Airport for 2016. Mean annual wind speed for 2016 ranged from 1.4 m/s (Station 4 and Station 6) and 2.6 m/s (Station 9) at the Site C network stations. Fort St. John Airport recorded a mean annual wind speed of 3.9 m/s which was slightly greater than the 30-year climate normal of 3.8 m/s (Table 3-1).

The differences between stations in wind speed and wind direction 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 station and 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 location with a large fetch in all directions. There was a wide difference of calm wind speeds as well ranging from 0.6 % to 25.8% of the 12 month period.

Station 7 and 7B are not included in Figure 3-3 because there was not a full year of measurements at either location.

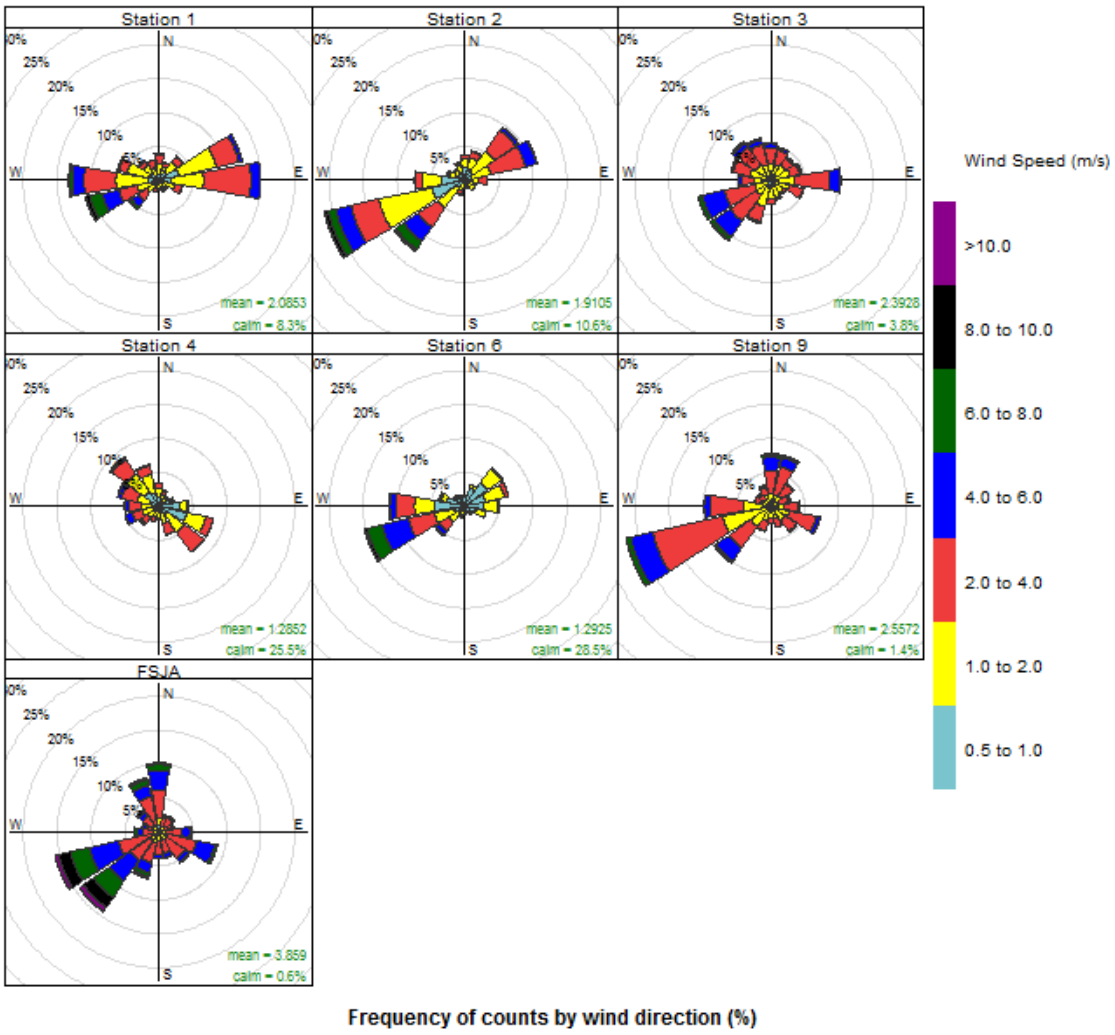


Figure 3-3: Wind roses for all Site C stations with 12 month records for 2016

3.3 Precipitation

Figure 3-4 shows the total monthly precipitation over the course of 2016 for each of the Site C network stations as well as for Fort St. John Airport. Values from this plot are also presented in Appendix B (Table A-3).

Of the Site C network stations, Station 6 recorded the greatest amount of precipitation (581 mm). All of the Site C network stations with the exception of Station 6 recorded lower annual cumulative precipitation than the Fort St. John Airport. This is also true for monthly totals for the months of January, February, March, May, October and November. For all other months, the monthly totals recorded at Fort St. John Airport were less than those measured at least one Site C network station.

Annual cumulative precipitation recorded at Fort St. John Airport (547 mm) was 102 mm greater than the 30-year climate normal (445 mm). Monthly cumulative precipitation at Fort St. John Airport exceeded the 30-year climate normal for the months of March, May, June, August, October and November.

Precipitation during the growing season (May to September) and how it relates to the energy balance at Stations 1, 2 and 4 is further discussed in Appendix D.

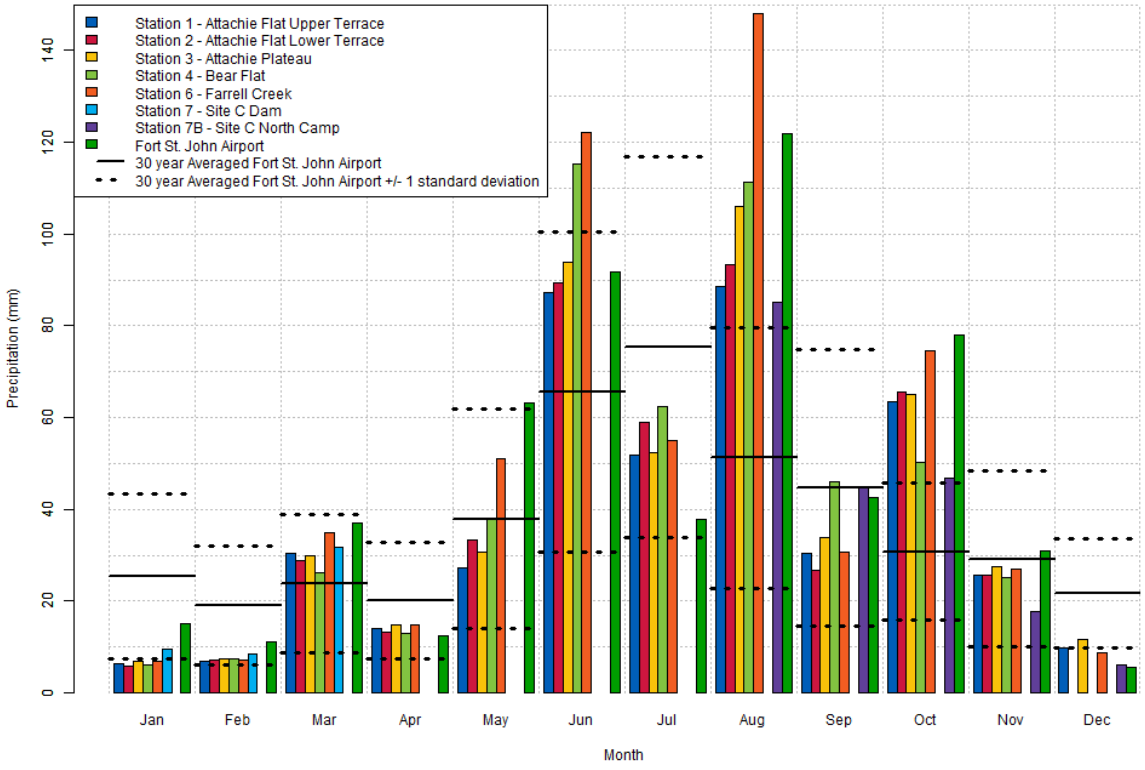


Figure 3-4: Monthly precipitation at all of the Site C network stations for 2016 and comparison with the mean ± 1 standard deviation of 30-year climate normal

3.4 Soil Moisture and Temperature

Figure 3-5 and Figure 3-6 provide the daily averaged soil temperature and soil moisture respectively for Stations 1, 2 and 4. Overall, there is very little difference in soil temperature between the stations except for a period between April and September during which temperatures at Station 4 were noticeably lower than at the other two stations.

The soil temperature at all three stations was observed to approach 0 °C during distinct warm periods in January through March prior to exceeding 0 °C at the end of March and beginning of April. The soil temperature at Station 2 was the earliest of the three stations to increase above 0 °C in the spring, and Station 1 was the latest to decrease below 0 °C in the fall. The soil temperature at Stations 1, 2 and 4 rose above 0 °C on March 30, March 29 and April 1 respectively. Station 1 reached the highest daily average temperature of 19.7 °C on August 10, 2016. The soil temperature at Stations 1, 2 and 4 decreased below 0 °C on December 6, November 26 and November 27, respectively.

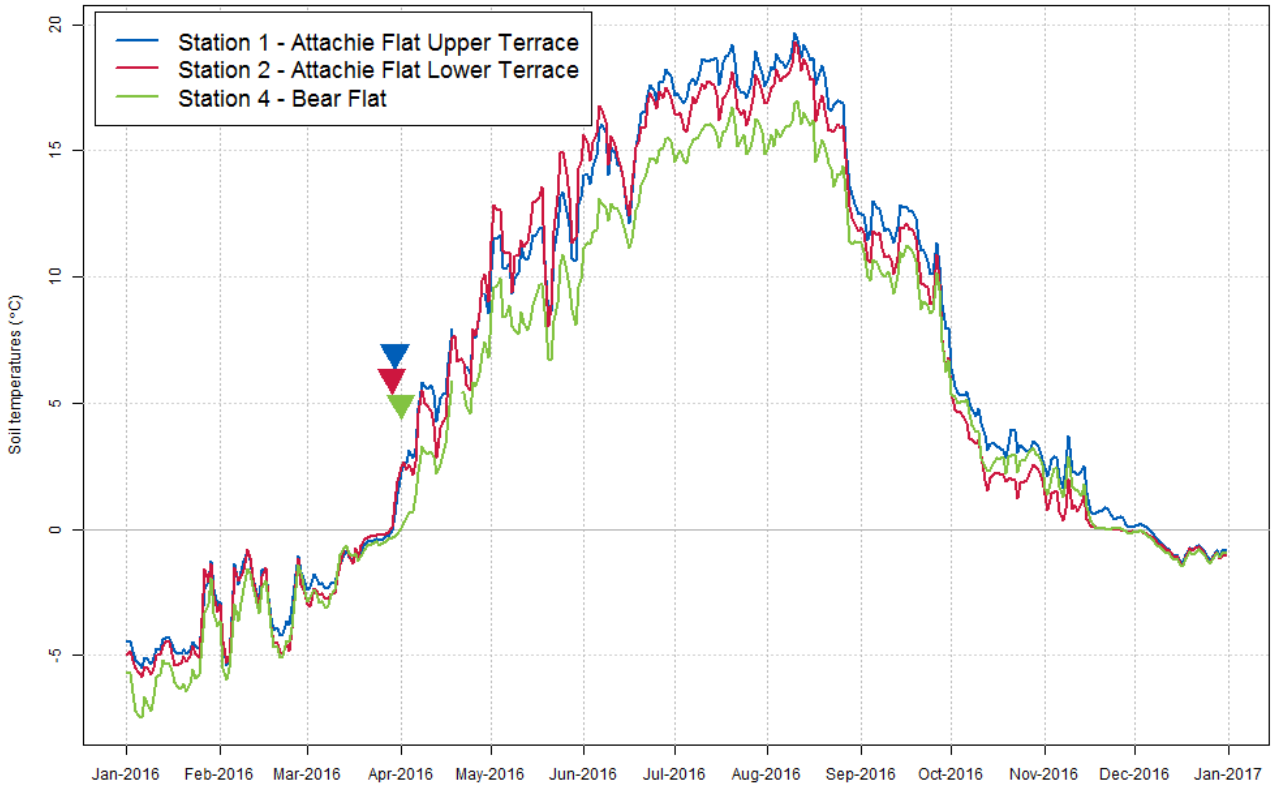


Figure 3-5: 24-hour average soil temperatures for Stations 1, 2 and 4 in 2016 (in ^{0}C). The blue, red and green triangles indicate the time stamps when daily averaged soil temperature approached or exceeded 0°C.

Soil moisture follows a similar response pattern between all three stations wherein liquid precipitation (rain) events were clearly reflected as sudden increases in moisture followed by a gradual decline. An increase of soil moisture is also recorded when soil temperature increases beyond or very near to 0°C when the soil becomes permeable to surface water produced by the snowmelt. Differences between stations are attributable to different soil types (Table 3-2) and agricultural land management practices (Figure D10) between locations.

Further discussion concerning soil temperatures and how this relates to the energy balance is presented in Appendix D.

Table 3-2: Soil types at the Site C Eddy Covariance stations.

	Station 1 – Attachie Flat Upper Terrace	Station 2 – Attachie Flat Lower Terrace	Station 4 – Bear Flat
Soil type	TY3-4 (Taylor) Regosolic Black with Eutric Brunisol	BF1 (Bear Flat)-Cumulic Regosol	AH (Attachie) Regosolic Dark Grey, regosolic Black Chernozemic

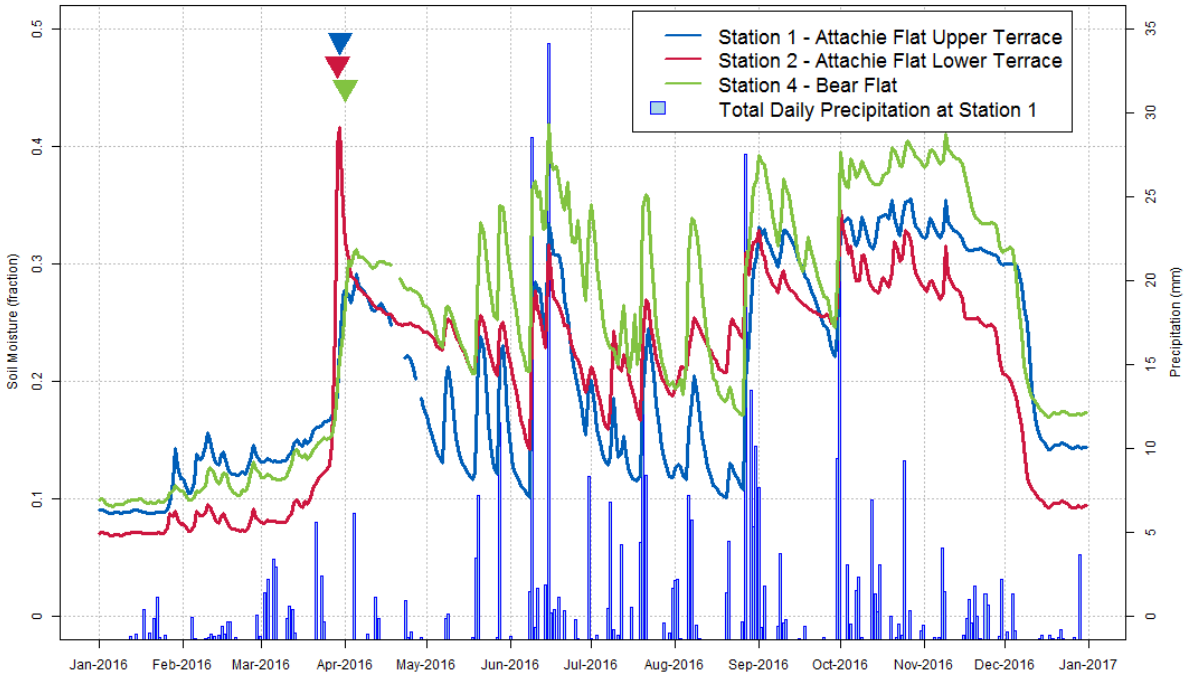


Figure 3-6: 24-hour average soil moisture readings for Stations 1, 2 and 4 in 2016 (expressed as a fraction). The blue, red and green triangles indicate the time stamps when daily averaged soil temperature approached or exceeded 0°C.

3.5 Energy and Carbon Balance

The full eddy covariance (EC) report can be found in Appendix D and a summary is provided below.

3.5.1 Data Recovery

EC system uptime prior to manual data screening for quality assurance/quality control (QA/QC) in 2016 was 95% at Station 1, an improvement from 2015 when system uptime at Station 1 fell to 80% as a result of high frequency data loss on one of the compact flash cards. At Station 2, system uptime was the lowest recorded at 28%. This drop was in part due to battery failures beginning in early January and proceeding through to late June when a total battery replacement was performed; and from sonic anemometer path obstruction. Card error and sonic anemometer path obstruction resulted in the system uptime at Site 4 dropping to 86.7%.

3.5.2 Results

Growing season (May-Sept) conditions at all three EC stations were amongst the wettest in the data record. Compared to other years growing season rainfall in 2016 was more evenly distributed throughout the growing season, with a noticeably large rainfall event occurring in August, which is typically a dry month. Growing season rainfall was 235, 249 and 309 mm for Station 1, Station 2 and Station 4, respectively.

Annual evapotranspiration (ET) at Stations 1 (324 mm) and 4 (371 mm) were lower than the reported results for 2015 (340 mm and 414 mm, respectively) but higher than years 2012 and 2014, which were both drier. Careful theoretical modelling using the Priestly-Taylor method could potentially be used to provide a broad estimate of ET for Station 2. Evidence from the other sites would suggest that ET at Station 2 would fall somewhere in the mid-range of all other years (234 - 345 mm). Winter soil temperatures were uniformly cooler at all three of the EC stations. Air temperatures increased quickly in spring, melting the likely increased snow cover through April, and hence, reduced ET values in that month compared to 2015. Cumulative ET was less in 2016 compared to 2015, likely due to lower down welling photosynthetically active radiation (Q) associated with more consistent cloud cover (and well distributed rainfall) throughout the growing season. A pronounced decrease in ET was observed at Station 1 during hay harvesting, which resulted in the annual cumulative ET being less at this location than at Station 4.

During 2016, Station 1 with its cultivated crop was a small Carbon (C) sink (156 g C m-2 yr-1¬), while Station 4 with its ungrazed pasture was a small source of C (-62 g C m-2 yr-1). Higher rates of photosynthesis in the early part of the growing season, prior to harvesting, were enough to exceed consistently small respiration before and after harvest. The small source strength at Station 4 was due to higher Gross Ecosystem Photosynthesis (GEP) values during May, June and July being insufficient to overcome the sustained ecosystem Respiration (R) throughout the year. The limited availability of data for Station 2 during 2016 resulted in an inability to adequately model C balances. The fact that Station 2 was ungrazed pasture and was a sink for C during all other wet years would suggest that it would have been a sink of less than 220 g C m^{-2} and more than 15 g C m^{-2} for 2016. Caution should

be exercised when interpreting the C-balance traces for the year 2016 at Stations 1 and 4 due to the uncertainty produced from gap-filling the Infra-red Gas Analyser (IRGA) calibration period. More information regarding the precise timing and nature of agricultural practices (e.g., ploughing, sowing, irrigation, etc.) during the period that the IRGA was absent would improve gap-filling in such cases. Arrangements have been made to avoid future data loss during essential maintenance by removing the IRGA in late December for calibration when freezing temperatures minimize all fluxes.

4 AIR QUALITY RESULTS

Section 12.3.4 of the FDS conditions for the approval of the Project requires BC Hydro to develop a plan that includes procedures to monitor air quality effects at locations used by Aboriginal groups. To this end, BC Hydro has developed an Air Quality Monitoring Program (BC Hydro, 2016). As part of the monitoring program, BC Hydro has installed a network of air quality stations in areas that may be affected by Project construction activities.

BC Hydro currently operates four air quality monitoring stations in the Peace River area close to Fort St John, BC. Three of these four stations have continuous Thermo Scientific SHARP 5030 (Station 1 – Upper Attachie Flat and Station 8 – Old Fort) and Thermo Scientific SHARP 5030i (Station 9 – 85th Ave) monitors that measure particulate matter with diameters less than 10 µm (PM_{10}) and 2.5 µm ($PM_{2.5}$). (Station 7B – Site C North Camp was installed on July 7, 2016 and provides continuous measurements of PM_{10} and $PM_{2.5}$ (using Thermo Scientific SHARP 5030 monitors), NO_x (using a Thermo Scientific 42i analyzer), SO_2 (using a Thermo Scientific 43i analyzer) and CO (using a Thermo Scientific 48i analyzer). Figure 2-1 and Table 2-1 provide the locations of all current air quality stations. Once construction begins in the area around Hudson's Hope (anticipated in 2019), an air quality station will be installed there also.

4.1 Particulate Matter

Table 4-1 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 annual AAQOs. An excursion is defined as when the 24-hour average of $PM_{2.5}$ is greater than the 24 hour AAQO without the 98^{th} percentile of daily $PM_{2.5}$ exceeding the AAQO. An exceedance refers to PM_{10} values above the 24-hour AAQO. The lower percentage complete for 24-hour averages than for hourly data stems from a requirement that, to consider a 24-hour average valid, it must contain at least 75% (18 hours) of valid data (BC MOE 2009).

Table 4-2 provides percentiles of note for concentrations of particulate matter at each of the air quality stations. PM_{10} and $PM_{2.5}$ at Station 1, Station 8 and Station 9 as well as $PM_{2.5}$ at Station 7B were below the AAQO for 99% of valid days or more in 2016. PM_{10} concentrations at Station 7B were below the AAQO for 85% of valid days in 2016.

Measurements of PM_{10} at Station 1 had a data completeness of less than 75% (typical of BC MOE permit requirements). Low data completeness was attributed to a failed mass foil check (i.e., the mass foil factor between the old and new factor must be less than 5%) during the MOE audit on August 8, 2016. The foil check failed again during an internal check on November 2, 2016. This invalidated data from July 12 to November 2nd. Foil checks had originally been scheduled on a quarterly basis, which is more often than the Thermo Scientific SHARP 5030 manual recommended annual mass calibration. To avoid future periods of downtime due to this calibration,, the length of time has been reduced between the internal mass foil checks along with other tests that are important to comply with the audit criteria

Readings of $PM_{2.5}$ at Station 9 had a data completeness of less than 75%. Low data completeness was attributed to a failure of the sample pump and pressure control board from January 1 to January 26, a failure of the measurement interface board from April 18 to May 13 and a leak in the system from July 23 to November 17. The long delays in repairing the instrument were caused by the unavailability of pressure control boards from the manufacturer, by the long ship times to send the instrument to the supplier in Surrey, BC for a replacement of the measurement interface board and by a delay in diagnosing a problem that turned out to be caused by a leak. To avoid long delays in acquiring failed parts in the future, a set of replacement parts that typically fail will be kept on hand. Concurrently, a new protocol has been put in place that requires the immediate removal of an instrument if a repair is not successful during a maintenance visit. The instrument in question is to be sent in for repair and a replacement unit is to be procured and installed in its place.

Readings of $PM_{2.5}$ and PM_{10} at Station 7B both had a data completeness of less than 75% for the year due to the station having been installed on July 7, 2016 and no data having been collected prior to that date. Furthermore, a water leak in the enclosure caused additional failures of the $PM_{2.5}$ unit from July 21 to August 11 and from August 29 to September 13. An air leak in the $PM_{2.5}$ unit led to further loss of data from November 1 to November 17. As noted above for Station 9, to avoid long delays in acquiring failed parts in the future, a set of replacement parts that typically fail will be kept on hand. Concurrently, a new protocol has been put in place that requires the immediate removal of an instrument if a repair is not successful during a maintenance visit. The instrument in question is to be sent in for repair and a replacement unit is to be procured and installed in its place.

One excursion above the 25 $\mu g/m^3$ AAQO for $PM_{2.5}$ and the 50 $\mu g/m^3$ AAQO PM_{10} for a 24-hour averaging period were observed at Station 1 in 2016. One excursion above the AAQO for $PM_{2.5}$ and 22 exceedances of the AAQO for PM_{10} for the 24-hour averaging period were observed at Station 7B. At Station 8, one excursion above the 24-hour $PM_{2.5}$ AAQO and no exceedances above the 24-hour PM_{10} AAQO were observed. No excursions above the 24-hour $PM_{2.5}$ AAQO and two exceedances for the 24-hour PM_{10} AAQO were observed at Station 9.

None of the stations recorded any exceedances of the 98th percentile of $PM_{2.5}$ over the provincial AAQO of 25 $\mu g/m^3$. The annual average $PM_{2.5}$ B.C. provincial AAQO of 8 $\mu g/m^3$ was not exceeded at any of the four stations in 2016. It should be noted, however, that Station 7B and Station 9 had insufficient data completeness for a valid annual average and these values are included for illustrative purposes only.

Table 4-1: Summary of measured PM results for 2016 (in µg/m^3)

Parameter	Station 1		Station 7B		Station 8		Station 9	
	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}
Percentage of data complete of hourly data	77.3	62.0	65.1[3]	86.7[3]	85.6	89.9	53.9	81.7
Percentage of data complete (24 hour averages)	75.7	61.2	62.5[3]	83.5[3]	80.3	85.5	53.0	80.3
24 hour AQO	25	50	25	50	25	50	25	50
24 hour AQO excursions / exceedances [1]	1	1	1	22	1	0	0	2
98th percentile of 24 hour daily averages	14.3	23.6	17.8	299	19.9	32.3	13.2	29.5
Annual AQO	8	NA[2]	8	NA[2]	8	NA[2]	8	NA[2]
Annual average	4.4	7.2	6.2	38.7	5.8	10.0	3.8	8.7

Notes: Sources: BC MOE 2009
(1) Excursion is used here for $PM_{2.5}$ when the 24-hour average of $PM_{2.5}$ is greater than the 24-hour AAQO without the 98th percentile of daily $PM_{2.5}$ exceeding the AAQO. Exceedance is used here to refer to PM_{10} values above the 24-hour AAQO.
(2) NA is used where the quantity in question is not applicable to the measurement.
(3): Data completeness for Station 7B expressed as a proportion of the time since inception of the station.
Station 7B and Station 9 had insufficient data completeness for a valid annual average and these values are included for illustrative purposes only.

Table 4-2: Percentile values of 24-hour averaged PM concentrations for 2016 (in µg/m^3)

Percentile	Station 1		Station 7B		Station 8		Station 9	
	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}
0%	0.8	0.03	0.6	0.2	0.9	0.4	0.2	0.2
10%	1.9	1.9	2.1	4.1	2.0	3.1	0.9	2.0
25%	2.5	3.3	3.3	7.5	3.5	5.1	1.6	4.4
50%	3.3	5.6	5.3	16.7	4.8	8.0	3.0	6.9
75%	5.0	8.5	7.9	36.2	7.2	12.7	5.1	10.3
90%	7.4	13.2	11.2	**67.4**	9.9	19.3	6.9	16.9
95%	10.9	16.4	12.6	**138**	13.1	25.0	9.7	21.8
97.5%	12.6	22.0	15.9	**281**	17.0	31.9	11.9	27.4
98%	14.3	23.6	17.8	**299**	19.9	32.3	13.2	29.5
99%	17.9	24.4	19.0	**425**	21.4	40.6	15.3	36.8
99.9%	**56.3**	**102**	24.4	**586**	**25.3**	49.1	19.5	**73.3**

Notes: Bolded values are greater than the AAQO

Figure 4-1 through Figure 4-4 show the time series of the 24-hour daily average of both PM_{10} and $PM_{2.5}$ at each of the four AQ stations, respectively. Table 4-3 provides details regarding each of the events that led to excursions or exceedances at the four monitoring stations and directs the reader to the appropriate section of Appendix C where a preliminary examination of each elevated PM event is presented. Note that some of these events persisted over more than one day. Thirteen time periods are listed in Table 6 and these represent the 28 excursions or exceedances listed in Table 5.

No forest fires of note were reported on the days during which excursions were observed (BC FLNRO, 2017). An alerting system was put in place on August 29, 2016 to immediately notify BC Hydro and its contractors about any excursions taking place so they could identify the source and mitigate its effects if it was related to their operations. Main Civil Works Contractor contacts were added to this alerts notification on December 20, 2016. A summary of alerts received can be found in Appendix C.

Table 4-3: Summary of PM excursion / exceedance events recorded at Site C in 2016

Start Date	End Date	Station	Contaminant	Section in Appendix C
2016-01-07	**2016-01-08**	Station 9	PM_{10}	C.1
2016-01-10	**2016-01-10**	Station 8	$PM_{2.5}$	C.2
2016-05-15	**2016-05-15**	Station 1	$PM_{2.5}$ and PM_{10}	C.3
2016-07-15	**2016-07-15**	Station 7B	PM_{10}	C.4
2016-07-19	**2016-07-19**	Station 7B	PM_{10}	C.5
2016-08-13	**2016-08-19**	Station 7B	PM_{10}	C.6
2016-08-26	**2016-08-26**	Station 7B	PM_{10}	C.7
2016-09-04	**2016-09-05**	Station 7B	PM_{10}	C.8
2016-09-21	**2016-09-23**	Station 7B	PM_{10}	C.9
2016-09-21	**2016-09-21**	Station 7B	$PM_{2.5}$	C.10
2016-09-28	**2016-09-28**	Station 7B	PM_{10}	C.11
2016-12-18	**2016-12-22**	Station 7B	PM_{10}	C.12
2016-12-27	**2016-12-29**	Station 7B	PM_{10}	C.13

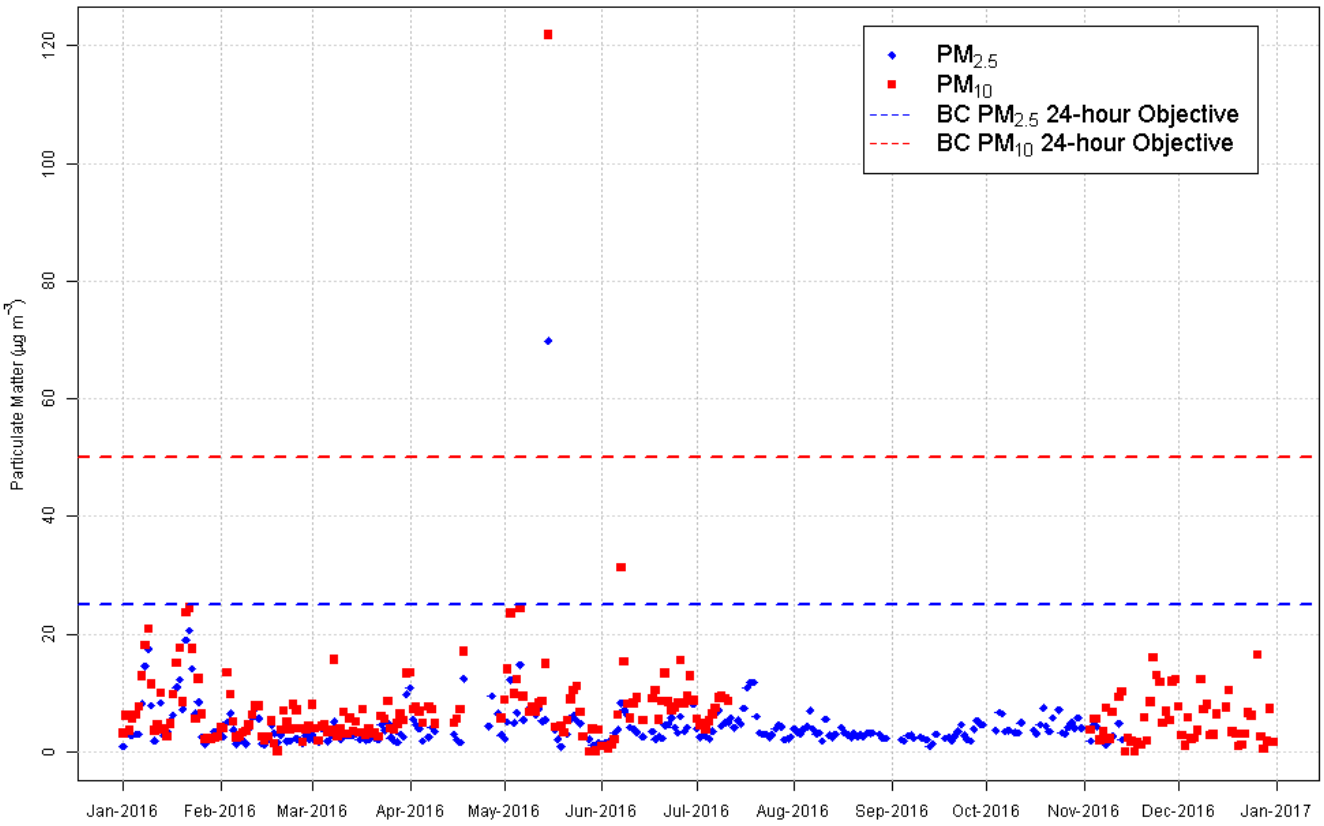


Figure 4-1: Daily average $PM_{2.5}$ and PM_{10} measurements from Station 1 – Attachie Flat Upper Terrace for 2016 (in µg/m^3).

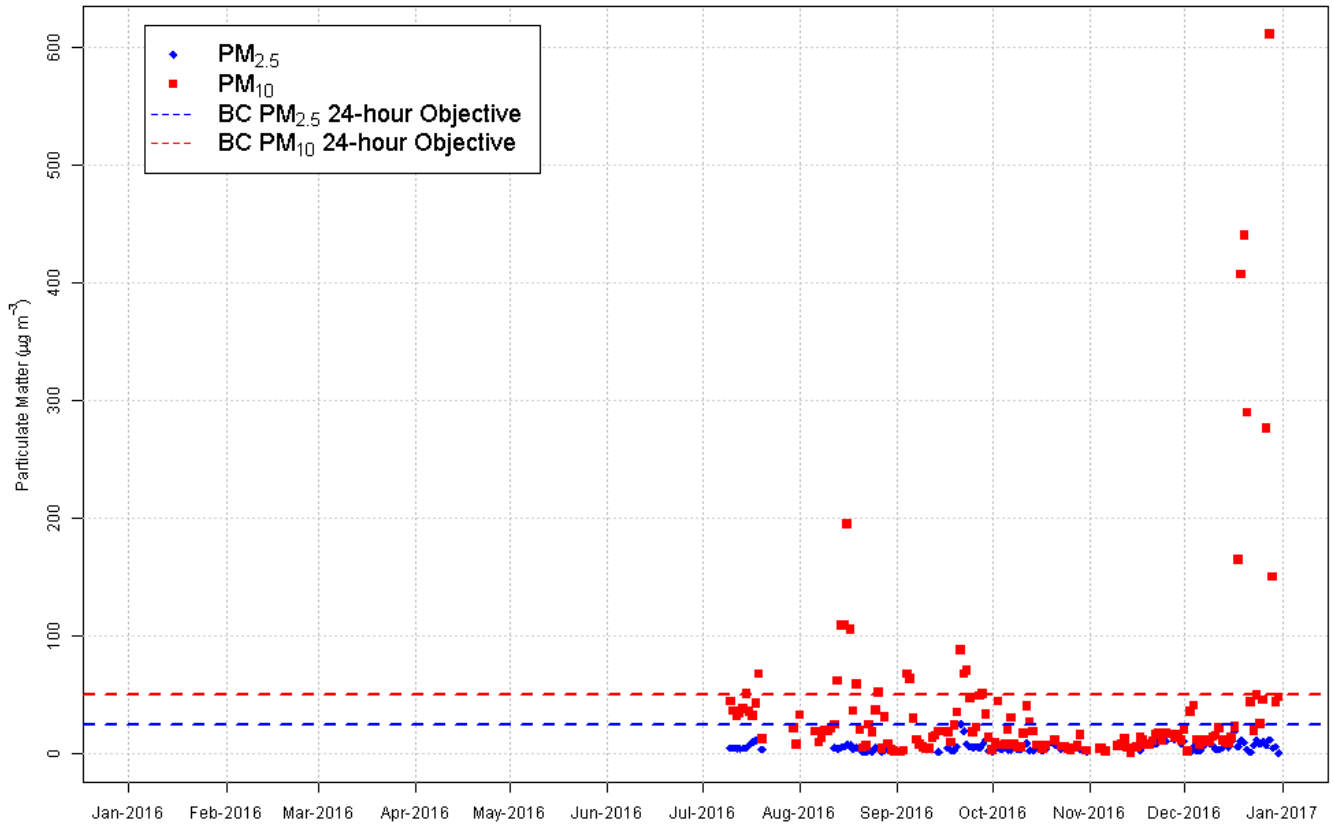


Figure 4-2: Daily average $PM_{2.5}$ and PM_{10} measurements from Station 7B – Site C North Camp for 2016 (in µg/m^3).

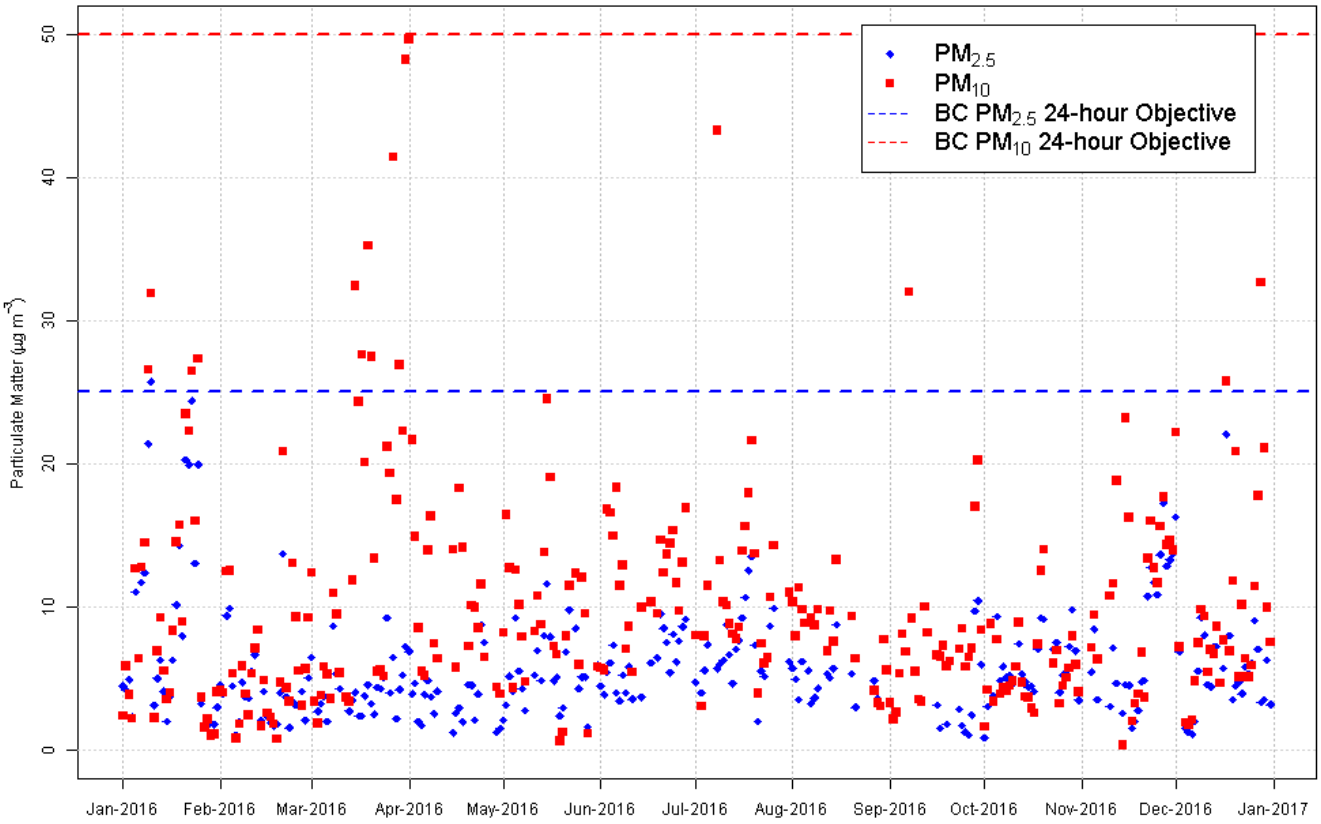


Figure 4-3: Daily average $PM_{2.5}$ and PM_{10} measurements from Station 8 – Old Fort for 2016 (in $\mu g/m^3$).

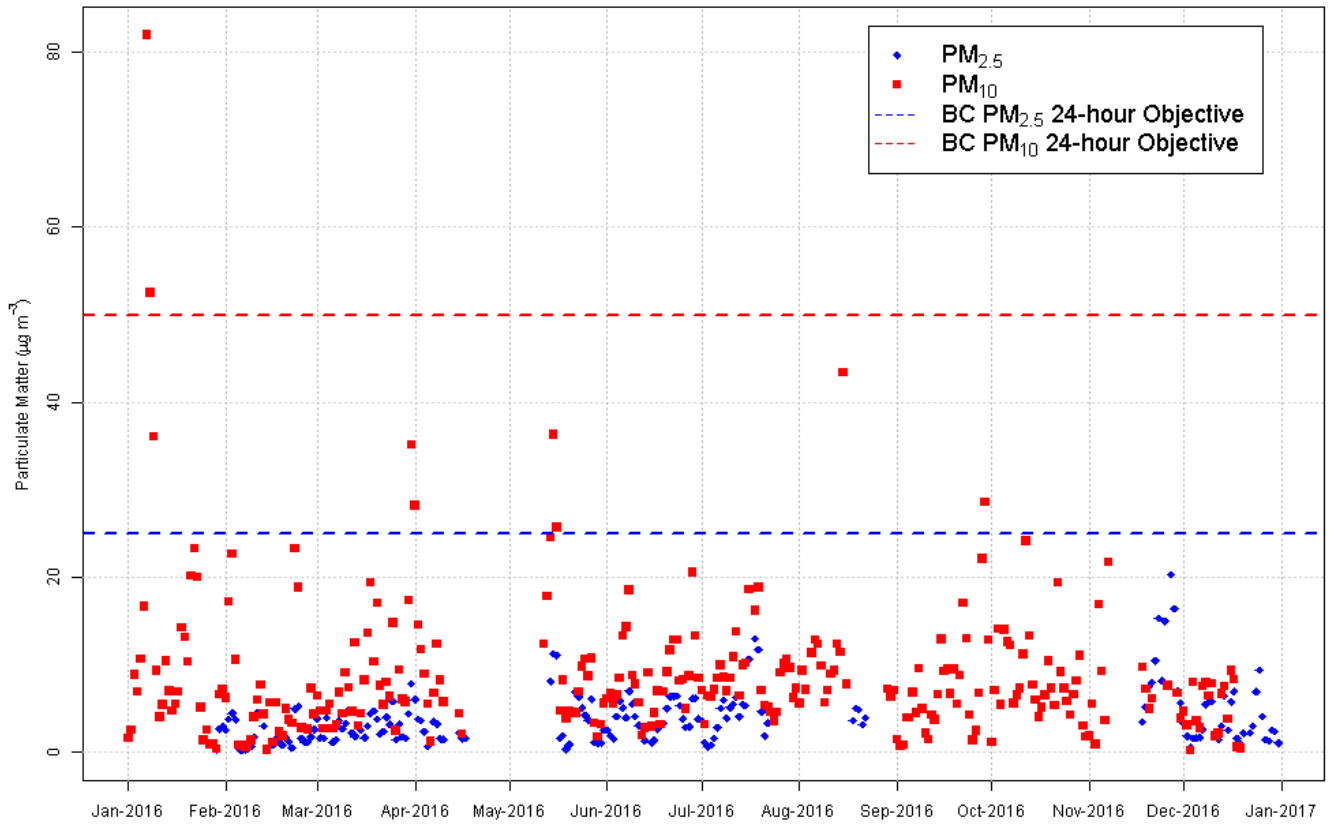


Figure 4-4: Daily average $PM_{2.5}$ and PM_{10} measurements from Station 9 - 85th Avenue for 2016 (in µg/m^3).

4.2 Gaseous Criteria Air Contaminants

Table 4-4 gives an overview of the completeness of the datasets for gaseous criteria air contaminants (CO, NO_2 and SO_2) measured at Station 7B as well as the number of excursions and/or exceedances above the provincial objectives and a comparison of the annual averages with the provincial annual objectives. The term excursion is used here for NO_2 and SO_2 and when the daily 1-hour maximum is greater than the respective AAQO but without satisfying the 98th or 97th percentile conditions, respectively, for achievement. The low percentage complete for the entire year of hourly measurements stems mostly from the instrument inception starting on July 7, 2016 (CO monitor on October 7), with no observations at Station 7B prior to that date. Since instrument inception, the percentage complete has been greater than 85% for SO_2 and CO. Percentage complete of NO_2 observations was 67.4%, which can be attributed to problems of analyser measurement instability, which required that the instrument be sent to the supplier for repair.

For CO, a value is considered to be an exceedance once it is greater than the BC 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 maximum values in the year is greater than the AAQOs, respectively. If this condition has not been met, values above the respective AAQOs do not constitute exceedances and are classified as excursions.

Table 4-4: Summary of gaseous criteria air contaminant results for 2016 (in µg/m^3)

Parameter	NO_2	SO_2	CO	CO (8-hour rolling average)
Percentage of data (24h) complete considering entire year(3)	32.2	40.7	22.9	22.1
Percentage of data (24h) complete since instrument inception(4)	67.4	85.1	97.9	94.4
1-hour AAQO	188	196	14,300	NA(1)
8-hour AAQO	NA(1)	NA(1)	NA(1)	5,500
AAQO Exceedances / Excursions(2)	0	0	0	0
Annual AAQO	60	13	NA(1)	NA(1)
Annual Average	10.7	0.6	122	124
97th percentile of daily 1-hour maximum	NA(1)	9.4	NA(1)	NA(1)
98th percentile of daily 1-hour maximum	69.0	NA(1)	NA(1)	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 and when the daily 1-hour maximum is greater than their respective AAQO but without satisfying the 98th or 97th percentile condition for achievement.
(3): The low percentage complete for the entire year of hourly measurements stems mostly from the station inception on July 7, 2016
(4): NO_2 and SO_2 instruments were installed and operational as of July 10, 2016 and the CO monitor was operational as of October 7, 2016.

No excursions of the 1-hour NO_2 or SO_2 AAQOs were observed since the inception of the station in July 2016. There were also no observed exceedances of the 1-hour or 8-hour PCOs for CO in 2016. Although the annual average NO_2 and SO_2 concentrations were below their respective AAQOs, the available period of observations was insufficient to provide a direct comparison with the objectives.

Figure 4-5 through Figure 4-7 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. The maximum NO_2 concentration of 85.3 µg/m^3 was reached on December 7, the maximum SO_2 concentration of 51.7 µg/m^3 was recorded on December 16 and the CO concentrations reached their one-hour and 8-hour rolling average maxima of 1420 µg/m^3 and 462 µg/m^3 on November 3 and 15, respectively.

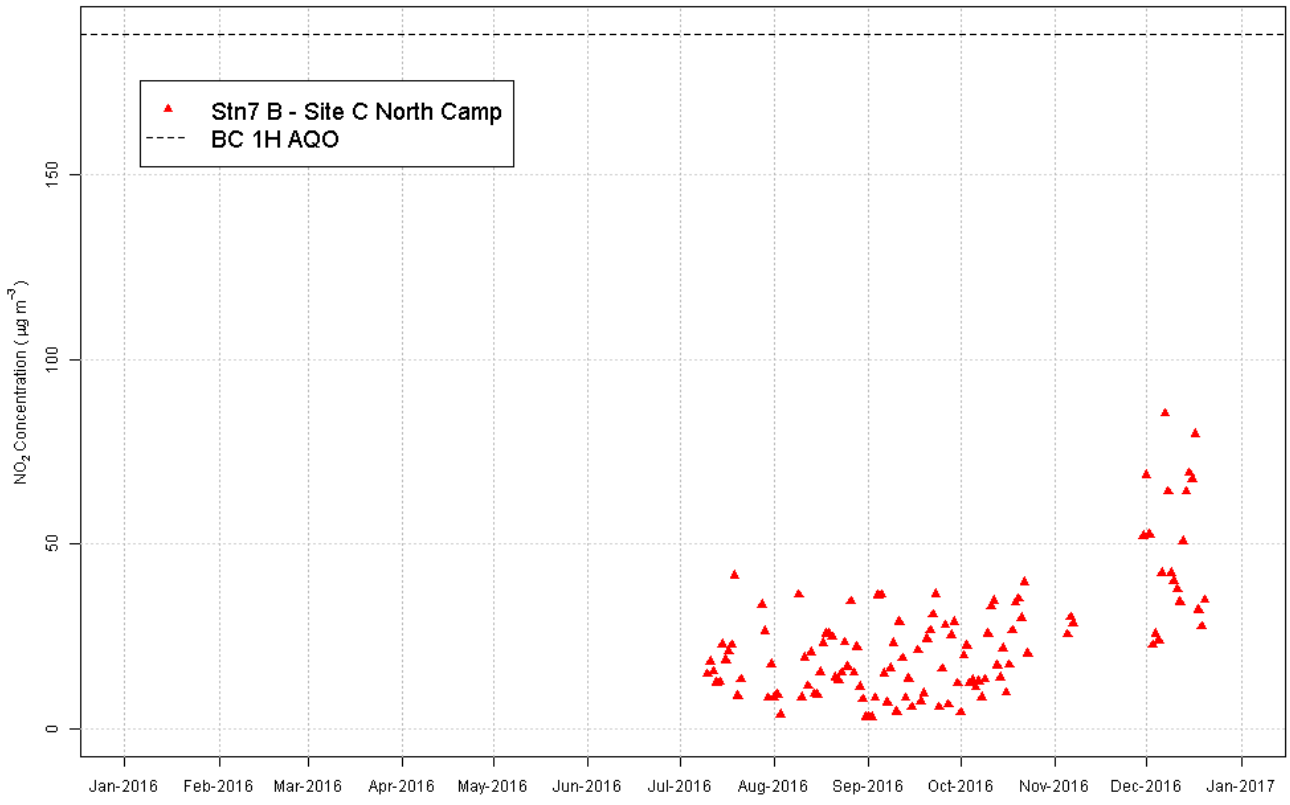


Figure 4-5: Daily 1-hour maximum NO_2 concentrations from Station 7B for 2016 (in µg/m^3).

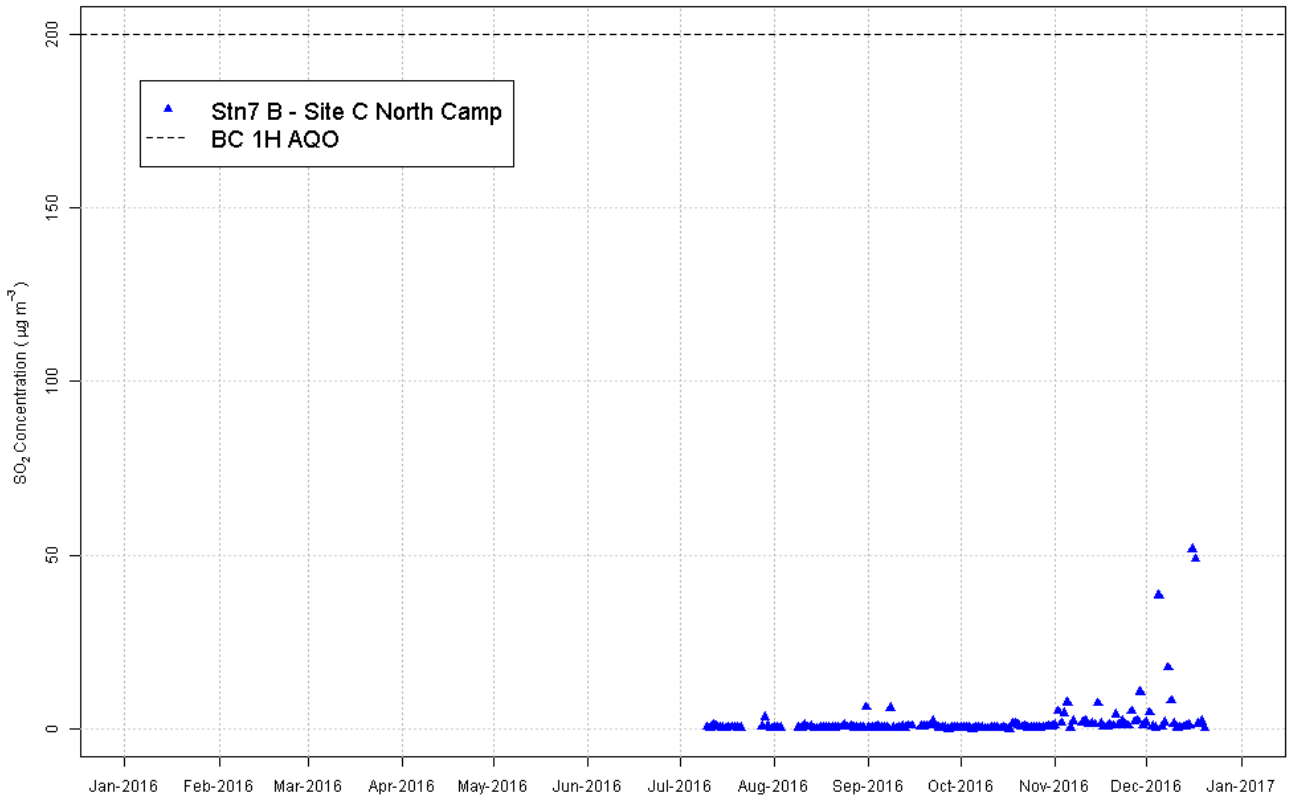


Figure 4-6: Daily 1-hour maximum SO_2 concentrations from Station 7B for 2016 (in $\mu g/m^3$).

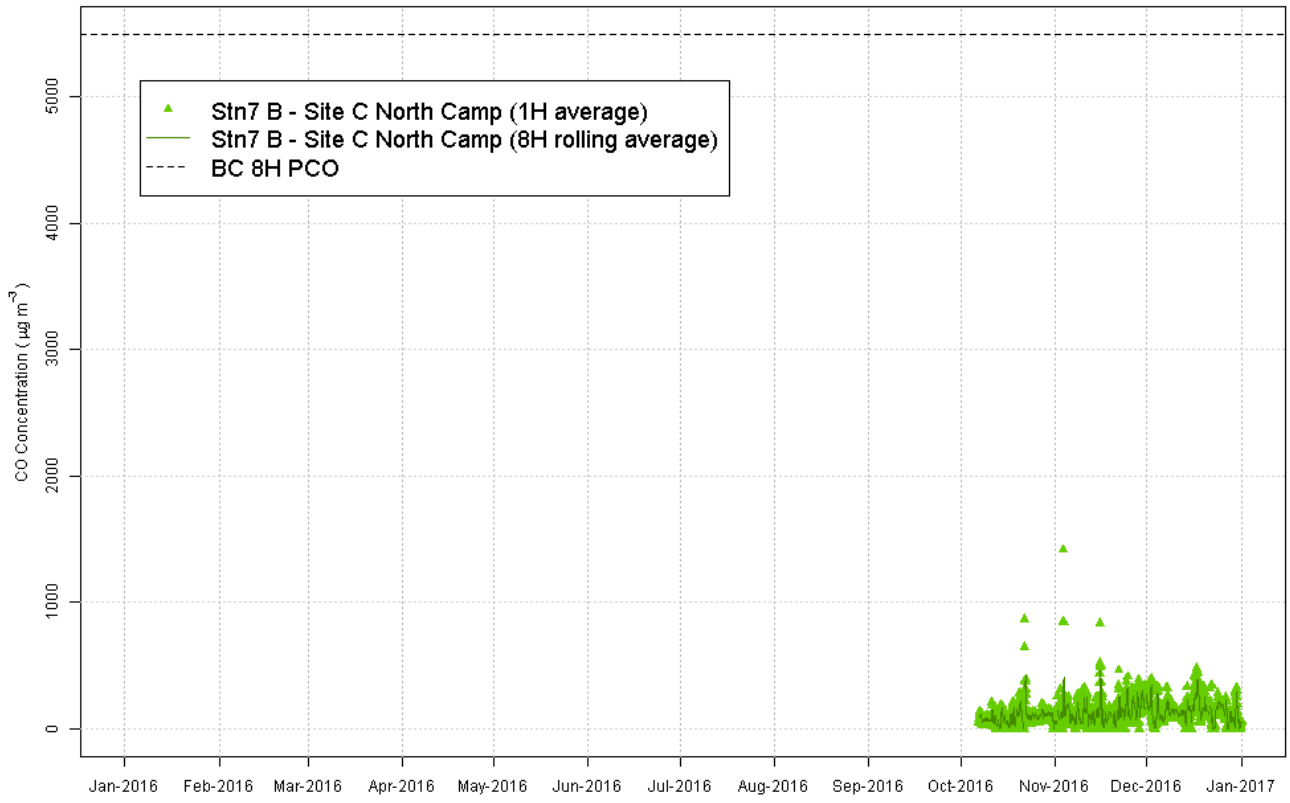


Figure 4-7: 1-hour and 8-hour rolling average CO concentrations from Station 7B (in µg/m^3).

4.3 Air Quality Reporting

Section 12.3.3 of the FDS conditions requires that BC Hydro produce a plan that includes procedures to enable the appropriate authorities to alert sensitive receptor groups and Reservoir Area Aboriginal Groups in the cases of exceedance of air quality standards and to address those exceedances. Following Section 5.0 of BC Hydro's Air Quality Monitoring Program, that forms part of the CEMP (BC Hydro 2016), BC Hydro has developed a Memorandum of Understanding (MOU) with the BC MOE to allow access to all air quality readings monitored by BC Hydro. According to the MOU, the BC MOE 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. Quality assured data are provided annually to the BC MOE. Final validated data must be delivered four to eight weeks prior to the subsequent Provincial Clean Air Day as indicated in the MOU. Based on these measurements and other monitoring in the region the BC MOE and Northern Health are able to issue air quality advisories.

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

4.3.1 Monitoring Station Audits

The MOE conducted audits in April and August 2016 at Stations 1, 7B, 8 and 9. Specific ambient air quality monitors that were audited included $PM_{2.5}$ and PM_{10} at Stations 1, 8 and 9 in April and August. One audit was conducted at Station 7B in August only for NO_2, SO_2, $PM_{2.5}$ and PM_{10}. In general terms, audit findings led to improvements in maintenance procedures such as training of personnel, on-site documentation and response times for repairs.

5 CONCLUSIONS

In fulfillment of the conditions outlined by the environmental assessment, this document reports on the climate and air quality as observed by the Site C monitoring network and the Environment Canada weather station at Fort St. John Airport during the calendar year 2016. Very small differences in ambient air temperature or in relative humidity were observed between the stations. This was attributed to the short distances and small elevation differences between stations; however, wind speed and wind direction were found to vary between stations, due to small-scale surface features having a larger impact on the local air flow patterns.

Site C network stations recorded a warmer annual average temperature, less precipitation and lower wind speeds than the Fort St. John Airport. The Fort St. John Airport annual average temperature was warmer than the 30-year climate normals and it observed greater precipitation and greater wind speeds.

Differences in soil temperature between the stations were most pronounced from April to September. During this period, Station 4 consistently recorded the lowest temperatures. During the remaining months, soil temperatures are similar between the three stations. Soil temperatures and their relationship to soil properties are discussed in greater detail in Appendix D.

One excursion above the 25 µg/m^3 AAQO for $PM_{2.5}$ and one exceedance of the 50 µg/m^3 AAQO for PM_{10} for a 24-hour averaging period were observed at Station 1 in 2016. One excursion above the AAQO for $PM_{2.5}$ and 22 exceedances of the AAQO for PM_{10} for a 24-hour averaging period were observed at Station 7B. At Station 8, one excursion above the 24-hour AAQO for $PM_{2.5}$ and no exceedances above the 24-hour AAQO for PM_{10} were observed. No excursions above the 24-hour AAQO for $PM_{2.5}$ and two exceedances for the 24-hour AAQO for PM_{10} were observed at Station 9.

Very few forest fires of note were reported in 2016 and none were active when the stations in the network equipped with air quality equipment were reporting excursions / exceedances. Many of the 24-hour PM_{10} exceedances observed at Station 7B have been attributed to dam construction activities. An alerting system is in place to immediately notify BC Hydro and its contractors about any elevated concentrations or excursions taking place so they can quickly identify the activities onsite that may be responsible for the emissions and implement mitigation to reduce those emissions.

No excursions above the 1-hour NO_2 or SO_2 AAQOs and no exceedances of the 1-hour and 8-hour PCOs for CO were observed. The available period of observations is insufficient to provide a direct comparison with the NO_2 and SO_2 annual AAQOs.

6 REFERENCES

Amiro, B. D., Barr, A. G., Black, T. A., Iwashitad, H., Kljun, N., McCaughey, J. H., et al. (2006). Carbon, energy and water fluxes at mature and disturbed forest sites, Saskatchewan, Canada. Agriculture and Forest Meteorology, 136, 237-251.

Baldocchi, D. D. (2003). Assessing the eddy covariance technique for evaluating carbon dioxide exchange rates of ecosystems: past present and future. Global Change Biology, 9, 479-492.

Barr, A. G., Black, T. A., Hogg, E. H., Kljun, N., Morgenstern, K., & Nesic, Z. (2004). Interannual variability in the leaf area index of a boreal aspen-hazelnut forest in relation to net ecosystem production. Agricultural and Forest Meteorology, 126, 237–255.

Barr, A. G., Black, T. A., Hogg, E. H., Kljun, N., Morgenstern, K., & Nesic, Z. (2004). Interannual variability in the leaf area index of a boreal aspen-hazelnut forest in relation to net ecosystem production. Agricultural and Forest Meteorology, 126, 237-255.

BC Hydro (2015). Smoke Management Plan. 23 pp.

BC Hydro (2016). Construction Environmental Management Plan. 72 pp.

BC Ministry of Environment. (2016, January 18). British Columbia Ambient Air Quality Objectives.

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

Brown, M., Black, T. A., Nesic, Z., Foord, V. N., Spittlehouse, D. L., Fredeen, A. L., et al. (2010). Impact of mountain pine beetle on the net ecosystem production of lodgepole pine stands in British Columbia. Agricultural and Forest Meteorology, 150, 254-264.

Canadian Environmental Assessment Agency (2014). Decision Statement Issued under Section 54 of the Canadian Environmental Assessment Act, 2012.

Environment 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

Grant, N. J., Black, A., & Nesic, Z. (2012). Eddy-Covariance Measurements of Energy, Water and Carbon Fluxes at Upper Attachie (Station 1), Lower Attachie (Station 2) and Bear Flat (Station 4): 2011 Summary. Report submitted to RWDI AIR Inc.

Grant, N. J., Black, A., & Nesic, Z. (2013). Eddy-Covariance Measurements of Energy, Water and Carbon Fluxes at Upper Attachie (Station 1), Lower Attachie (Station 2) and Bear Flat (Station 4): 2012 Summary. Report submitted to RWDI AIR Inc.

Grant, N. J., Black, A., & Nesic, Z. (2014). Eddy-Covariance Measurements of Energy, Water and Carbon Fluxes at Upper Attachie (Station 1), Lower Attachie (Station 2) and Bear Flat (Station 4): 2013 Summary. Report submitted to RWDI AIR Inc.

Grant, N. J., Black, A., & Nesic, Z. (2015). Eddy-Covariance Measurements of Energy, Water and Carbon Fluxes at Upper Attachie (Station 1), Lower Attachie (Station 2) and Bear Flat (Station 4): 2014 Summary. Report submitted to RWDI Air, Inc.

Grant, N. J., Black, A., & Nesic, Z. (2016). Eddy-Covariance Measurements of Energy, Water and Carbon Fluxes at Upper Attachie (Station 1), Lower Attachie (Station 2) and Bear Flat (Station 4): 2015 Summary. Report submitted to RWDI Air, Inc.

Krishnan, P., Black, T. A., Grant, N. J., Barr, A. G., Hogg, E. H., Jassal, R. S., et al. (2006). Impact of changing soil moisture distribution on net ecosystem productivity of a boreal aspen forest during and following drought. Agricultural and Forest Meteorology, 139, 208-233.

Morgenstern, K., Black, T. A., Humphreys, E. R., Griffis, T. J., Drewitt, G. B., Cai, T., et al. (2004). Sensitivity and uncertainty of the carbon balance of a pacific northwest Douglas-fir forest during an el Niño/La Niña cycle. Agricultural and Forest Meteorology, 123, 201-219.

RWDI Air Inc. (2012). Site C Clean Energy Project Volume 2 Appendix K Technical Data Report: Microclimate. Prepared for BC Hydro Power and Authority. Vancouver, BC.

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.

Wilson, K. (2002). Energy balance closure at FLUXNET sites. Agricultural and Forest Meteorology, 113, 223-243.

APPENDIX A – 2016 COMPLIANCE SUMMARY

APPENDIX A: 2016 COMPLIANCE SUMMARY

Table A- 1: Summary of AQMP Conditions and Year 2016 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 Aboriginal 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 extended an open invitation to interested Aboriginal groups to verify and accurately site land use information. Ground truthing activities are ongoing. To date, the following ground truthing activities related to current use for traditional purposes (i.e., harvesting medicinal/food plants) have taken place: • Along the transmission line right-of-way with Saulteau	To date, ground truthing has identified areas of Aboriginal use along the transmission line right-of-way, Cache Creek / Bear Flats, and Halfway River / Attachie Flats. Confidential ground truthing reports that summarize the ground truthing activities identify times when these areas may be used. Setback distances and ignition criteria described in the Smoke Management Plan (sections 4.4 and 5.0, respectively) would apply in these areas. Aboriginal groups 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).

Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
			First Nations registered trapline holders and McLeod Lake Indian Band • In the Cache Creek area with McLeod Lake Indian Band, Doig River First Nation, and Halfway River First Nation. • In the dam-site area with McLeod Lake Indian Band and Doig River First Nation • Halfway River First Nation in the vicinity of the Halfway River.	
	• 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	No open burning occurred in 2016.
	• 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.

Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
	• 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 MOE to make all air quality measurements available in near real-time. All operational air quality stations are accessed hourly by the BC MOE.
	The EAC Holder must monitor air quality associated with shoreline protection works at Hudson's Hope during the construction period and for the first two years of operations.	Construction Environmental Management Plan Appendix B Section 4.0	Future requirement	Shoreline protection works at Hudson's Hope are planned to commence in 2019 – 2021, and air quality monitoring plans will be implemented during construction and for the first 2 years of reservoir 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 Aboriginal 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.

Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
	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 Aboriginal 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 Aboriginal Groups on June 5, 2015. The CEMP continues to be updated as required, with the most recent version, Revision 4, dated July 26, 2016, was accessible to regulators, government agencies, Aboriginal Groups and the public via the Site C Clean Energy Project website at: https://www.sitecproject.com/document-library/environmental-management.
	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	2016 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, compliant 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 Aboriginal 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 Aboriginal 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
FDS Condition 12.3	The plan shall include:			

Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
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 Aboriginal 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 MOE to make all air quality data available in near real-time. All operational air quality stations are accessed hourly by the BC MOE.
FDS Condition 12.3.4	• procedures to monitor air quality effects at locations used by Aboriginal 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.

Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
FDS Condition 12.4	The Proponent shall submit to the Agency and Reservoir Area Aboriginal 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 Aboriginal 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	Second Annual Report to CEAA included in this document.	Air Quality Management Plan 2015. 1st Annual Report to CEAA submitted July 2016. Second Annual Report included in this document.
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 Aboriginal groups and the Métis Nation British Columbia.	Air Quality Management Plan 2015	Second Annual Report to CEAA included in this document.	Air Quality Management Plan 2015. 1st Annual Report to CEAA submitted July 2016. Second Annual Report included in this document.

APPENDIX B- DATA TABLES

APPENDIX B: DATA TABLES

Table B- 1: Monthly average temperatures at all Site C network stations for the year 2016

Month	Station 1	Station 2	Station 3	Station 4	Station 6	Station 7	Station 7B	FSJ Airport	Climate Normals
Jan	-10.5	-11.4	-9.6	-10.4	-9.3	-9.5	-	-10.2	-12.8
Feb	-3.3	-3.9	-2.4	-3.2	-2.2	-2.2	-	-3.4	-9.6
Mar	-0.5	-0.5	-0.4	0.02	0.08	0.3	-	-1.2	-4.6
Apr	7.9	7.8	8.0	8.4	7.8	-	-	7.4	3.9
May	11.2	11.3	10.8	11.2	10.9	-	-	10.3	9.8
Jun	15.4	15.5	15.6	15.6	15.8	-	-	14.8	14.1
Jul	17.2	16.9	17.0	17.1	17.5	-	-	16.5	16.2
Aug	16.2	16.0	15.4	15.9	15.9	-	16.5	15.4	14.9
Sep	10.0	10.0	10.1	10.0	10.2	-	10.8	9.6	10.1
Oct	0.3	0.3	-0.6	0.6	0.4	-	0.07	-1.4	3.6
Nov	-3.6	-3.9	-3.5	-3.3	-3.5	-	-3.2	-3.7	-6.6
Dec	-12.8	-13.2	-12.5	-12.9	-11.2	-	-12.1	-12.9	-11.4
Annual average	3.9	3.7	4.0	4.1	4.4	-	-	3.4	2.3

Notes: Measurements were discontinued at Station 7 as of April 13, 2016
Measurements began at Station 7B on July 7, 2016
Annual averages were not calculated for either of these two stations because of the incomplete datasets at each station
A "-" indicates a period for which the data was not sufficiently complete to calculate a valid monthly or annual average.

Table B- 2: Monthly average relative humidity measured at15:00 LST at all Site C network stations for the year 2016.

Month	Station 1	Station 2	Station 3	Station 4	Station 6	Station 7	Station 7B	FSJ Airport	Climate Normals
Jan	76.3	76.4	72.2	73.9	70.1	74.1	-	73.5	68.5
Feb	65.3	63.8	58.9	61.3	54.9	61.3	-	62.0	62.9
Mar	61.0	55.7	56.4	56.3	50.9	56.7	-	59.5	53.8
Apr	38.3	36.9	39.5	34.8	35.9	-	-	38.6	42.6
May	37.0	32.8	37.2	35.8	36.2	-	-	42.7	41.1
Jun	45.7	46.0	46.0	45.5	43.7	-	-	52.7	45.7
Jul	44.5	48.2	47.7	48.6	44.6	-	-	51.6	49.3
Aug	45.8	46.6	52.0	49.5	49.1	-	46.8	52.9	50.6
Sep	48.2	45.8	48.0	49.3	45.5	-	49.7	51.6	52.4
Oct	79.4	81.4	80.2	76.3	77.0	-	78.9	83.5	57.9
Nov	73.7	75.1	71.0	72.4	72.4	-	74.6	77.9	72.3
Dec	70.8	71.9	68.4	69.5	68.2	-	71.7	73.0	71.5
Annual average	57.4	56.7	56.5	56.3	54.1	-	-	60.0	55.7

Notes: Measurements were discontinued at Station 7 as of April 13, 2016
Measurements began at Station 7B on July 7, 2016
Annual averages were not calculated for either of these two stations because of the incomplete datasets at each station
A "-" indicates a period for which the data was not sufficiently complete to calculate a valid monthly or annual average.

Table B- 3: Monthly precipitation totals at all Site C stations for the year 2016.

Month	Station 1	Station 2	Station 3	Station 4	Station 6	Station 7	Station 7B	FSJ Airport	Climate Normals
Jan	6.4	6.0	6.8	6.0	6.9	9.5	-	15.0	25.4
Feb	7.0	7.1	7.3	7.3	7.0	8.4	-	11.0	19.0
Mar	30.4	28.8	29.8	26.3	34.8	31.7	-	37.1	23.7
Apr	14.1	13.3	14.9	12.9	14.9	-	-	12.5	20.0
May	27.3	33.3	30.6	37.8	50.9	-	-	63.3	37.9
Jun	87.1	89.4	93.9	115	122	-	-	91.8	65.6
Jul	51.7	59.0	52.4	62.5	55.0	-	-	37.8	75.2
Aug	88.5	93.4	106	111	148	-	85.1	122	51.2
Sep	30.5	26.7	33.8	46.0	30.6	-	44.8	42.5	44.7
Oct	63.4	65.6	65.1	50.2	74.5	-	46.9	77.9	30.8
Nov	25.7	25.6	27.6	25.2	27.0	-	17.6	31.0	29.2
Dec	9.8	-	11.5	-	8.8	-	6.2	5.5	22.0
Total[(1)]	442	456	480	503	581	-	-	547	445

Notes: Measurements were discontinued at Station 7 as of April 13, 2016
Measurements began at Station 7B on July 7, 2016
Annual totals were not calculated for either of these two stations because of the incomplete datasets at each station
A "-" indicates a period for which the data was not sufficiently complete to calculate a valid monthly or annual total.

APPENDIX C – AIR QUALITY ALERT RESPONSE

APPENDIX C: AIR QUALITY ALERT RESPONSE

A summary of alerts in 2016 can be found in Table C-1, followed by a preliminary examination of each elevated PM event in sections C.1 through C.13. Note that not all alerts were representative of an elevated PM event, as noted in Table C-1 (i.e., some alerts were a result of instrumental error).

Table C-1: 2016 Alerts

Event number (serial)	Date / Time Alert issued	Alert text	IN / OUT	90% / 100%	Contaminant	Station Name	Instrumental Error (Y/N)	Reason for Instrumental Error	Did a measured Exceedance occur?	Dominant wind direction during event	BC Hydro (BCH) or Contractor Response	Notes
1	8/31/2016 23:05	IN Alert 'PM2.5 Alert': PM2.5 (30.2 µg/m3) at Peace Valley Attachie Flat Upper Terrace for 2016-08-31 16:00 PST. Description: Peace Valley Attachie Flat Upper Terrace: 'PM2.5 Alert' 2016-08-31 16:00 PST ! IN Alert PM2.5 (30.2 µg/m3) conditions have triggered the 'PM2.5 Alert' alert. An OUT alert will be sent when conditions return to normal.	in	100%	PM2.5	Station 1	Y	PM2.5 was experiencing large positive offset following power surge as evidenced by PM2.5 >> PM10 during the period	N/A	N/A	N/A	N/A
	8/31/2016 23:05	IN Alert 'PM2.5 > 90% Alert': PM2.5 (30.2 µg/m3) at Peace Valley Attachie Flat Upper Terrace for 2016-08-31 16:00 PST.	in	90%								
	9/2/2016 22:05	OUT Alert 'PM2.5 Alert': PM2.5 conditions at Peace Valley Attachie Flat Upper Terrace are normal. Description: Peace Valley Attachie Flat Upper Terrace: 'PM2.5 Alert' 2016-09-02 22:00 PST OUT Alert PM2.5 conditions for the 'PM2.5 Alert' alert at Peace Valley Attachie Flat Upper Terrace have returned to normal.	out	100%								
	9/3/2016 0:05	OUT Alert 'PM2.5 > 90% Alert': PM2.5 conditions at Peace Valley Attachie Flat Upper Terrace are normal. Description: Peace Valley Attachie Flat Upper Terrace: 'PM2.5 > 90% Alert' 2016-09-03 00:00 PST OUT Alert PM2.5 conditions for the 'PM2.5 > 90% Alert' alert at Peace Valley Attachie Flat Upper Terrace have returned to normal.	out	90%								
2	9/4/2016 15:05	IN Alert 'PM10 > 90% Alert': PM10 (45.2 µg/m3) at North Camp for 2016-09-04 15:00 PST. Description: North Camp: 'PM10 > 90% Alert' 2016-09-04 15:00 PST ! IN Alert PM10 (45.2 µg/m3) conditions have triggered the 'PM10 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal.	in	90%	PM10	Station 7B	N	N/A	Y	E	BCH completed a visual inspection around the station to confirm activity at the time and attempt to identify the source.	Wind blowing from camp area. Dry and dusty conditions on site with high traffic volumes kicking up dust. Excavation and hauling occuring from the southeast to the northwest. Contractors were advised to increase application rate of dust suppression. Workers exposed to dusty conditions were encouraged to wear supplied silica filtering half masks.
	9/4/2016 18:05	IN Alert 'PM10 Alert': PM10 (52.1 µg/m3) at North Camp for 2016-09-04 18:00 PST. Description: North Camp: 'PM10 Alert' 2016-09-04 18:00 PST ! IN Alert PM10 (52.1 µg/m3) conditions have triggered the 'PM10 Alert' alert. An OUT alert will be sent when conditions return to normal.	in	100%									
	9/5/2016 7:05	OUT Alert 'PM10 Alert': PM10 conditions at North Camp are normal. Description: North Camp: 'PM10 Alert' 2016-09-05 07:00 PST OUT Alert PM10 conditions for the 'PM10 Alert' alert at North Camp have returned to normal.	out	100%								
	9/5/2016 11:05	IN Alert 'PM10 Alert': PM10 (54.8 µg/m3) at North Camp for 2016-09-05 11:00 PST. Description: North Camp: 'PM10 Alert' 2016-09-05 11:00 PST ! IN Alert PM10 (54.8 µg/m3) conditions have triggered the 'PM10 Alert' alert. An OUT alert will be sent when conditions return to normal.	in	100%									
	9/6/2016 17:05	OUT Alert 'PM10 Alert': PM10 conditions at North Camp are normal. Description: North Camp: 'PM10 Alert' 2016-09-06 17:00 PST OUT Alert PM10 conditions for the 'PM10 Alert' alert at North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than the BC 24-hour air quality objective of 50 ug/m3.	out	100%								
	9/6/2016 19:05	OUT Alert 'PM10 > 90% Alert': PM10 conditions at North Camp are normal. Description: North Camp: 'PM10 > 90% Alert' 2016-09-06 19:00 PST OUT Alert PM10 conditions for the 'PM10 > 90% Alert' alert at North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	out	90%								
3	9/14/2016 16:10	IN Alert 'PM2.5 > 90% Alert': PM2.5 (23.9 µg/m3) at Fort St. John Old Fort for 2016-09-14 16:00 PST. Description: Fort St. John Old Fort: 'PM2.5 > 90% Alert' 2016-09-14 16:00 PST ! IN Alert PM2.5 (23.9 µg/m3) conditions have triggered the 'PM2.5 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM2.5 concentrations has exceeded and remains greater than 22.5 ug/m3 (90% of the BC 24-hour air quality objective of 25 ug/m3).	in	90%	PM2.5	Station 8	Y	PM2.5 >> PM10	N/A	N/A	N/A	N/A
	9/14/2016 17:05	IN Alert 'PM2.5 Alert': PM2.5 (25.6 µg/m3) at Fort St. John Old Fort for 2016-09-14 17:00 PST. Description: Fort St. John Old Fort: 'PM2.5 Alert' 2016-09-14 17:00 PST ! IN Alert PM2.5 (25.6 µg/m3) conditions have triggered the 'PM2.5 Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM2.5 concentrations has exceeded and remains greater than the BC 24-hour air quality objective of 25 ug/m3.	in	100%								
	9/15/2016 7:05	OUT Alert 'PM2.5 Alert': PM2.5 conditions at Fort St. John Old Fort are normal. Description: Fort St. John Old Fort: 'PM2.5 Alert' 2016-09-15 07:00 PST OUT Alert PM2.5 conditions for the 'PM2.5 Alert' alert at Fort St. John Old Fort have returned to normal. The 24-hour rolling average of PM2.5 concentrations has decreased to values less than the BC 24-hour air quality objective of 25 ug/m3.	out	100%								
	9/15/2016 10:05	OUT Alert 'PM2.5 > 90% Alert': PM2.5 conditions at Fort St. John Old Fort are normal. Description: Fort St. John Old Fort: 'PM2.5 > 90% Alert' 2016-09-15 10:00 PST OUT Alert PM2.5 conditions for the 'PM2.5 > 90% Alert' alert at Fort St. John Old Fort have returned to normal. The 24-hour rolling average of PM2.5 concentrations has decreased to values less than 22.5 ug/m3 (90% of the BC 24-hour air quality objective of 25 ug/m3).	out	90%								
4	9/17/2016 6:05	IN Alert 'SO2 Alert': SO2 (1064.8 µg/m3) at North Camp for 2016-09-17 06:00 PST.	in	100%	SO2	Station 7B	Y	The instrument was undergoing calibration at this time. Eric Christensen was on site	N/A	N/A	N/A	N/A
	9/17/2016 6:05	IN Alert 'SO2 > 90% Alert': SO2 (1064.8 µg/m3) at North Camp for 2016-09-17 06:00 PST. Description: North Camp: 'SO2 > 90% Alert' 2016-09-17 06:00 PST ! IN Alert SO2 (1064.8 µg/m3) conditions have triggered the 'SO2 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. The 1-hour average SO2 concentrations have exceeded and remain greater than 180 ug/m3 (90% of the BC 1-hour air quality objective of 200 ug/m3).	in	90%								
	9/17/2016 8:05	OUT Alert 'SO2 Alert': SO2 conditions at North Camp are normal. Description: North Camp: 'SO2 Alert' 2016-09-17 08:00 PST OUT Alert SO2 conditions for the 'SO2 Alert' alert at North Camp have returned to normal. The 1-hour average SO2 concentrations have decreased to values less than the BC 1-hour air quality objective of 200 ug/m3.	out	100%								
	9/17/2016 8:05	OUT Alert 'SO2 > 90% Alert': SO2 conditions at North Camp are normal. Description: North Camp: 'SO2 > 90% Alert' 2016-09-17 08:00 PST OUT Alert SO2 conditions for the 'SO2 > 90% Alert' alert at North Camp have returned to normal. The 1-hour average SO2 concentrations have decreased to values less than 180 ug/m3 (90% of the BC 1-hour air quality objective of 200 ug/m3).	out	90%								

Event number (serial)	Date / Time Alert issued	Alert text	IN / OUT	90% / 100%	Contaminant	Station Name	Instrumental Error (Y/N)	Reason for Instrumental Error	Did a measured Exceedance occur?	Dominant wind direction during event	BC Hydro (BCH) or Contractor Response	Notes
5	9/21/2016 6:10	IN Alert 'PM10 Alert': PM10 (55.8 µg/m3) at North Camp for 2016-09-21 06:00 PST. Description: North Camp: 'PM10 Alert' 2016-09-21 06:00 PST ! IN Alert PM10 (55.8 µg/m3) conditions have triggered the 'PM10 Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM10 concentrations has exceeded and remains greater than the BC 24-hour air quality objective of 50 ug/m3.	in	100%	PM10	Station 7B	N	N/A	Y	WSW, E	BCH completed a visual inspection around the station to confirm activity at the time and attempt to identify the source. Dense fog was noted in the early morning and at night.	Wind blowing from camp area. Dry and dusty conditions around site and active soil hauling roughly 20 m from the station. Active crushing operation across the river was generating a dust plume.Contractors were advised to increase application rate of dust suppression. Workers exposed to dusty conditions were encouraged to wear supplied silica filtering half masks.
	9/21/2016 6:10	IN Alert 'PM10 > 90% Alert': PM10 (55.8 µg/m3) at North Camp for 2016-09-21 06:00 PST. Description: North Camp: 'PM10 > 90% Alert' 2016-09-21 06:00 PST ! IN Alert PM10 (55.8 µg/m3) conditions have triggered the 'PM10 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM10 concentrations has exceeded and remains greater than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	in	90%								
	9/21/2016 8:10	OUT Alert 'PM10 Alert': PM10 conditions at North Camp are normal. Description: North Camp: 'PM10 Alert' 2016-09-21 08:00 PST OUT Alert PM10 conditions for the 'PM10 Alert' alert at North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than the BC 24-hour air quality objective of 50 ug/m3.	out	100%								
	9/21/2016 10:10	IN Alert 'PM10 Alert': PM10 (50.2 µg/m3) at North Camp for 2016-09-21 10:00 PST. Description: North Camp: 'PM10 Alert' 2016-09-21 10:00 PST ! IN Alert PM10 (50.2 µg/m3) conditions have triggered the 'PM10 Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM10 concentrations has exceeded and remains greater than the BC 24-hour air quality objective of 50 ug/m3.	in	100%								
	9/24/2016 9:05	OUT Alert 'PM10 Alert': PM10 conditions at North Camp are normal. Description: North Camp: 'PM10 Alert' 2016-09-24 09:00 PST OUT Alert PM10 conditions for the 'PM10 Alert' alert at North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than the BC 24-hour air quality objective of 50 ug/m3.	out	100%								
	9/25/2016 8:05	IN Alert 'PM10 Alert': PM10 (50.1 µg/m3) at North Camp for 2016-09-25 08:00 PST. Description: North Camp: 'PM10 Alert' 2016-09-25 08:00 PST ! IN Alert PM10 (50.1 µg/m3) conditions have triggered the 'PM10 Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM10 concentrations has exceeded and remains greater than the BC 24-hour air quality objective of 50 ug/m3.	in	100%								
	9/25/2016 10:05	OUT Alert 'PM10 Alert': PM10 conditions at North Camp are normal. Description: North Camp: 'PM10 Alert' 2016-09-25 10:00 PST OUT Alert PM10 conditions for the 'PM10 Alert' alert at North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than the BC 24-hour air quality objective of 50 ug/m3.	out	100%								
	9/25/2016 12:05	OUT Alert 'PM10 > 90% Alert': PM10 conditions at North Camp are normal. Description: North Camp: 'PM10 > 90% Alert' 2016-09-25 12:00 PST OUT Alert PM10 conditions for the 'PM10 > 90% Alert' alert at North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	out	90%								
6	9/21/2016 17:10	IN Alert 'PM2.5 > 90% Alert': PM2.5 (23.7 µg/m3) at North Camp for 2016-09-21 17:00 PST. Description: North Camp: 'PM2.5 > 90% Alert' 2016-09-21 17:00 PST ! IN Alert PM2.5 (23.7 µg/m3) conditions have triggered the 'PM2.5 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM2.5 concentrations has exceeded and remains greater than 22.5 ug/m3 (90% of the BC 24-hour air quality objective of 25 ug/m3).	in	90%	PM2.5	Station 7B	N	N/A	Y	E, ENE	BCH completed a visual inspection around the station to confirm activity at the time and attempt to identify the source. Dense fog was noted in the early morning and at night.	Wind blowing from camp area. Dry and dusty conditions around site and active soil hauling roughly 20 m from the station. Active crushing operation across the river was generating a dust plume.Contractors were advised to increase application rate of dust suppression. Workers exposed to dusty conditions were encouraged to wear supplied silica filtering half masks.
	9/21/2016 18:10	IN Alert 'PM2.5 Alert': PM2.5 (25.2 µg/m3) at North Camp for 2016-09-21 18:00 PST. Description: North Camp: 'PM2.5 Alert' 2016-09-21 18:00 PST ! IN Alert PM2.5 (25.2 µg/m3) conditions have triggered the 'PM2.5 Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM2.5 concentrations has exceeded and remains greater than the BC 24-hour air quality objective of 25 ug/m3.	in	100%								
	9/21/2016 19:10	OUT Alert 'PM2.5 Alert': PM2.5 conditions at North Camp are normal. Description: North Camp: 'PM2.5 Alert' 2016-09-21 19:00 PST OUT Alert PM2.5 conditions for the 'PM2.5 Alert' alert at North Camp have returned to normal. The 24-hour rolling average of PM2.5 concentrations has decreased to values less than the BC 24-hour air quality objective of 25 ug/m3.	out	100%								
	9/22/2016 0:10	IN Alert 'PM2.5 Alert': PM2.5 (25.2 µg/m3) at North Camp for 2016-09-22 00:00 PST. Description: North Camp: 'PM2.5 Alert' 2016-09-22 00:00 PST ! IN Alert PM2.5 (25.2 µg/m3) conditions have triggered the 'PM2.5 Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM2.5 concentrations has exceeded and remains greater than the BC 24-hour air quality objective of 25 ug/m3.	in	100%								
	9/22/2016 17:05	OUT Alert 'PM2.5 Alert': PM2.5 conditions at North Camp are normal. Description: North Camp: 'PM2.5 Alert' 2016-09-22 17:00 PST OUT Alert PM2.5 conditions for the 'PM2.5 Alert' alert at North Camp have returned to normal. The 24-hour rolling average of PM2.5 concentrations has decreased to values less than the BC 24-hour air quality objective of 25 ug/m3.	out	100%								
	9/22/2016 19:05	OUT Alert 'PM2.5 > 90% Alert': PM2.5 conditions at North Camp are normal. Description: North Camp: 'PM2.5 > 90% Alert' 2016-09-22 19:00 PST OUT Alert PM2.5 conditions for the 'PM2.5 > 90% Alert' alert at North Camp have returned to normal. The 24-hour rolling average of PM2.5 concentrations has decreased to values less than 22.5 ug/m3 (90% of the BC 24-hour air quality objective of 25 ug/m3).	out	90%								

Event number (serial)	Date / Time Alert issued	Alert text	IN / OUT	90% / 100%	Contaminant	Station Name	Instrumental Error (Y/N)	Reason for Instrumental Error	Did a measured Exceedance occur?	Dominant wind direction during event	BC Hydro (BCH) or Contractor Response	Notes
7	9/27/2016 20:05	IN Alert 'PM10 > 90% Alert': PM10 (45 µg/m3) at North Camp for 2016-09-27 20:00 PST. Description: North Camp: 'PM10 > 90% Alert' 2016-09-27 20:00 PST ! IN Alert PM10 (45 µg/m3) conditions have triggered the 'PM10 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM10 concentrations has exceeded and remains greater than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	in	90%	PM10	Station 7B	N	N/A	Y	W	BCH completed a visual inspection around the station to confirm activity at the time and attempt to identify the source. Discussions had with RWDI in an attempt to identify potential sources and explain the timing of the alert.	Wind blowing from haul road and excavation. Hauling and excavating material near the station, as well as active crushing on the south bank. Air quality condensed due to normal change to nightly cold weather. Contractors were reminded of their dust supression commitments. Discussions had with RWDI in an attempt to better respond to alerts and identify sources.
	9/28/2016 1:05	IN Alert 'PM10 Alert': PM10 (50.3 µg/m3) at North Camp for 2016-09-28 01:00 PST. Description: North Camp: 'PM10 Alert' 2016-09-28 01:00 PST ! IN Alert PM10 (50.3 µg/m3) conditions have triggered the 'PM10 Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM10 concentrations has exceeded and remains greater than the BC 24-hour air quality objective of 50 ug/m3.	in	100%								
	9/28/2016 14:05	OUT Alert 'PM10 Alert': PM10 conditions at North Camp are normal. Description: North Camp: 'PM10 Alert' 2016-09-28 14:00 PST OUT Alert PM10 conditions for the 'PM10 Alert' alert at North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than the BC 24-hour air quality objective of 50 ug/m3.	out	100%								
	9/28/2016 15:05	OUT Alert 'PM10 > 90% Alert': PM10 conditions at North Camp are normal. Description: North Camp: 'PM10 > 90% Alert' 2016-09-28 15:00 PST OUT Alert PM10 conditions for the 'PM10 > 90% Alert' alert at North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	out	90%								
8	9/29/2016 0:05	IN Alert 'PM10 > 90% Alert': PM10 (45.2 µg/m3) at North Camp for 2016-09-29 00:00 PST. Description: North Camp: 'PM10 > 90% Alert' 2016-09-29 00:00 PST ! IN Alert PM10 (45.2 µg/m3) conditions have triggered the 'PM10 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM10 concentrations has exceeded and remains greater than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	in	90%	PM10	Station 7B	N	N/A	N	NW	BCH completed a visual inspection around the station to confirm activity at the time and attempt to identify the source.	Wind coming from active onsite excavation and hauling, as well as non project related work occuring at the north peace landfill. Excavation and hauling from the northwest around to the southeast. Traffic moving around site and kicking up dust. Air quality condensed due to normal change to nightly cold weather. Contractors were reminded of their dust supression commitments. Discussions with PRHP safety department to assist in alert response and source identification.
	9/29/2016 9:05	OUT Alert 'PM10 > 90% Alert': PM10 conditions at North Camp are normal. Description: North Camp: 'PM10 > 90% Alert' 2016-09-29 09:00 PST OUT Alert PM10 conditions for the 'PM10 > 90% Alert' alert at North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	out	90%								
9	9/29/2016 15:05	IN Alert 'PM10 > 90% Alert': PM10 (45.1 µg/m3) at Stn 7B: North Camp for 2016-09-29 15:00 PST. Description: Stn 7B: North Camp : 'PM10 > 90% Alert' 2016-09-29 15:00 PST ! IN Alert PM10 (45.1 µg/m3) conditions have triggered the 'PM10 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM10 concentrations has exceeded and remains greater than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	in	90%	PM10	Station 7B	N	N/A	N	N, NNE	BCH completed a visual inspection around the station to confirm activity at the time and attempt to identify the source.	Wind coming from PRHP office and laydown area. High traffic volumes kicking up dust on roads. PRHP Office and laydown had active construction on site. Active crushing across the river. Contractors were reminded of their dust supression commitments. Discussions with PRHP safety department to assist in alert response and source identification.
	9/29/2016 20:05	OUT Alert 'PM10 > 90% Alert': PM10 conditions at Stn 7B: North Camp are normal. Description: Stn 7B: North Camp : 'PM10 > 90% Alert' 2016-09-29 20:00 PST OUT Alert PM10 conditions for the 'PM10 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	out	90%								
10	10/1/2016 11:05	IN Alert 'PM2.5 Alert': PM2.5 (29.5 µg/m3) at Stn 1: Peace Valley Attachie Flat Upper Terrace for 2016-10-01 11:00 PST. Description: Stn 1: Peace Valley Attachie Flat Upper Terrace : 'PM2.5 Alert' 2016-10-01 11:00 PST ! IN Alert PM2.5 (29.5 µg/m3) conditions have triggered the 'PM2.5 Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM2.5 concentrations has exceeded and remains greater than the BC 24-hour air quality objective of 25 ug/m3.	in	100%	PM2.5	Station 1	Y	PM2.5 was experiencing large positive offset following as evidenced by PM2.5 >> PM10 during the period	N/A	N/A	N/A	N/A
	10/1/2016 11:05	IN Alert 'PM2.5 > 90% Alert': PM2.5 (29.5 µg/m3) at Stn 1: Peace Valley Attachie Flat Upper Terrace for 2016-10-01 11:00 PST.	in	90%								
	10/2/2016 23:12	OUT Alert 'PM2.5 Alert': PM2.5 conditions at Stn 1: Peace Valley Attachie Flat Upper Terrace are normal. Description: Stn 1: Peace Valley Attachie Flat Upper Terrace : 'PM2.5 Alert' 2016-10-02 23:00 PST OUT Alert PM2.5 conditions for the 'PM2.5 Alert' alert at Stn 1: Peace Valley Attachie Flat Upper Terrace have returned to normal. The 24-hour rolling average of PM2.5 concentrations has decreased to values less than the BC 24-hour air quality objective of 25 ug/m3.	out	100%								
	10/3/2016 1:10	OUT Alert 'PM2.5 > 90% Alert': PM2.5 conditions at Stn 1: Peace Valley Attachie Flat Upper Terrace are normal. Description: Stn 1: Peace Valley Attachie Flat Upper Terrace : 'PM2.5 > 90% Alert' 2016-10-03 01:00 PST OUT Alert PM2.5 conditions for the 'PM2.5 > 90% Alert' alert at Stn 1: Peace Valley Attachie Flat Upper Terrace have returned to normal. The 24-hour rolling average of PM2.5 concentrations has decreased to values less than 22.5 ug/m3 (90% of the BC 24-hour air quality objective of 25 ug/m3).	out	90%								
11	10/23/2016 13:10	IN Alert 'PM2.5 Alert': PM2.5 (35.8 µg/m3) at Stn 1: Peace Valley Attachie Flat Upper Terrace for 2016-10-23 13:00 PST. Description: Stn 1: Peace Valley Attachie Flat Upper Terrace : 'PM2.5 Alert' 2016-10-23 13:00 PST ! IN Alert PM2.5 (35.8 µg/m3) conditions have triggered the 'PM2.5 Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM2.5 concentrations has exceeded and remains greater than the BC 24-hour air quality objective of 25 ug/m3.	in	100%	PM2.5	Station 1	Y	PM2.5 was experiencing large positive offset following as evidenced by PM2.5 >> PM10 during the period	N/A	N/A	N/A	N/A
	10/23/2016 13:10	IN Alert 'PM2.5 > 90% Alert': PM2.5 (35.8 µg/m3) at Stn 1: Peace Valley Attachie Flat Upper Terrace for 2016-10-23 13:00 PST. Description: Stn 1: Peace Valley Attachie Flat Upper Terrace : 'PM2.5 > 90% Alert' 2016-10-23 13:00 PST ! IN Alert PM2.5 (35.8 µg/m3) conditions have triggered the 'PM2.5 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM2.5 concentrations has exceeded and remains greater than 22.5 ug/m3 (90% of the BC 24-hour air quality objective of 25 ug/m3).	in	90%								
	10/24/2016 5:05	OUT Alert 'PM2.5 Alert': PM2.5 conditions at Stn 1: Peace Valley Attachie Flat Upper Terrace are normal. Description: Stn 1: Peace Valley Attachie Flat Upper Terrace : 'PM2.5 Alert' 2016-10-24 05:00 PST OUT Alert PM2.5 conditions for the 'PM2.5 Alert' alert at Stn 1: Peace Valley Attachie Flat Upper Terrace have returned to normal. The 24-hour rolling average of PM2.5 concentrations has decreased to values less than the BC 24-hour air quality objective of 25 ug/m3.	out	100%								
	10/24/2016 8:10	OUT Alert 'PM2.5 > 90% Alert': PM2.5 conditions at Stn 1: Peace Valley Attachie Flat Upper Terrace are normal. Description: Stn 1: Peace Valley Attachie Flat Upper Terrace : 'PM2.5 > 90% Alert' 2016-10-24 08:00 PST OUT Alert PM2.5 conditions for the 'PM2.5 > 90% Alert' alert at Stn 1: Peace Valley Attachie Flat Upper Terrace have returned to normal. The 24-hour rolling average of PM2.5 concentrations has decreased to values less than 22.5 ug/m3 (90% of the BC 24-hour air quality objective of 25 ug/m3).	out	90%								

Event number (serial)	Date / Time Alert issued	Alert text	IN / OUT	90% / 100%	Contaminant	Station Name	Instrumental Error (Y/N)	Reason for Instrumental Error	Did a measured Exceedance occur?	Dominant wind direction during event	BC Hydro (BCH) or Contractor Response	Notes
12	11/1/2016 23:05	IN Alert 'PM2.5 Alert': PM2.5 (44.9 µg/m3) at Stn 1: Peace Valley Attachie Flat Upper Terrace for 2016-11-01 01:00 PST. Description: Stn 1: Peace Valley Attachie Flat Upper Terrace : 'PM2.5 Alert' 2016-11-01 01:00 PST ! IN Alert PM2.5 (44.9 µg/m3) conditions have triggered the 'PM2.5 Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM2.5 concentrations has exceeded and remains greater than the BC 24-hour air quality objective of 25 ug/m3.	in	100%	PM2.5	Station 1	Y	PM2.5 was experiencing large positive offset following as evidenced by PM2.5 >> PM10 during the period	N/A	N/A	N/A	N/A
	11/1/2016 23:05	IN Alert 'PM2.5 > 90% Alert': PM2.5 (44.9 µg/m3) at Stn 1: Peace Valley Attachie Flat Upper Terrace for 2016-11-01 01:00 PST. Description: Stn 1: Peace Valley Attachie Flat Upper Terrace : 'PM2.5 > 90% Alert' 2016-11-01 01:00 PST ! IN Alert PM2.5 (44.9 µg/m3) conditions have triggered the 'PM2.5 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM2.5 concentrations has exceeded and remains greater than 22.5 ug/m3 (90% of the BC 24-hour air quality objective of 25 ug/m3).	in	90%								
	11/2/2016 21:05	OUT Alert 'PM2.5 Alert': PM2.5 conditions at Stn 1: Peace Valley Attachie Flat Upper Terrace are normal. Description: Stn 1: Peace Valley Attachie Flat Upper Terrace : 'PM2.5 Alert' 2016-11-02 21:00 PST OUT Alert PM2.5 conditions for the 'PM2.5 Alert' alert at Stn 1: Peace Valley Attachie Flat Upper Terrace have returned to normal. The 24-hour rolling average of PM2.5 concentrations has decreased to values less than the BC 24-hour air quality objective of 25 ug/m3.	out	100%								
	11/2/2016 23:03	OUT Alert 'PM2.5 > 90% Alert': PM2.5 conditions at Stn 1: Peace Valley Attachie Flat Upper Terrace are normal. Description: Stn 1: Peace Valley Attachie Flat Upper Terrace : 'PM2.5 > 90% Alert' 2016-11-02 23:00 PST OUT Alert PM2.5 conditions for the 'PM2.5 > 90% Alert' alert at Stn 1: Peace Valley Attachie Flat Upper Terrace have returned to normal. The 24-hour rolling average of PM2.5 concentrations has decreased to values less than 22.5 ug/m3 (90% of the BC 24-hour air quality objective of 25 ug/m3).	out	90%								
13	11/10/2016 2:00	IN Alert SO2 (289.4 µg/m3) conditions have triggered the 'SO2 Alert' alert. An OUT alert will be sent when conditions return to normal.	in	100%	SO2	Station 7B	Y	Alerts were caused by a software error during nightly span test	N/A	N/A	N/A	N/A
	11/10/2016 3:00	OUT Alert SO2 conditions for the 'SO2 Alert' alert at Stn 7B: North Camp have returned to normal.	out	100%								
14	11/11/2016 2:00	IN Alert SO2 (294.2 µg/m3) conditions have triggered the 'SO2 Alert' alert. An OUT alert will be sent when conditions return to normal.	in	100%	SO2	Station 7B	Y	Alerts were caused by a software error during nightly span test	N/A	N/A	N/A	N/A
	11/11/2016 3:00	OUT Alert SO2 conditions for the 'SO2 Alert' alert at Stn 7B: North Camp have returned to normal.	out	100%								
15	11/12/2016 2:00	IN Alert SO2 (296.3 µg/m3) conditions have triggered the 'SO2 Alert' alert. An OUT alert will be sent when conditions return to normal.	in	100%	SO2	Station 7B	Y	Alerts were caused by a software error during nightly span test	N/A	N/A	N/A	N/A
	11/12/2016 3:00	OUT Alert SO2 conditions for the 'SO2 Alert' alert at Stn 7B: North Camp have returned to normal.	out	100%								
16	11/13/2016 2:00	IN Alert SO2 (299.1 µg/m3) conditions have triggered the 'SO2 Alert' alert. An OUT alert will be sent when conditions return to normal.	in	100%	SO2	Station 7B	Y	Alerts were caused by a software error during nightly span test	N/A	N/A	N/A	N/A
	11/13/2016 3:00	OUT Alert SO2 conditions for the 'SO2 Alert' alert at Stn 7B: North Camp have returned to normal.	out	100%								
17	11/14/2016 2:00	IN Alert SO2 (308.6 µg/m3) conditions have triggered the 'SO2 Alert' alert. An OUT alert will be sent when conditions return to normal.	in	100%	SO2	Station 7B	Y	Alerts were caused by a software error during nightly span test	N/A	N/A	N/A	N/A
	11/14/2016 3:00	OUT Alert SO2 conditions for the 'SO2 Alert' alert at Stn 7B: North Camp have returned to normal.	out	100%								
18	11/15/2016 20:00	IN Alert PM10 (95.4 µg/m3) conditions have triggered the 'PM10 Alert' alert. An OUT alert will be sent when conditions return to normal.	in	100%	PM10	Station 7B	Y	Adjacent monitors were being calibrated and worked on at this time by David Horrocks	N/A	N/A	N/A	N/A
	11/15/2016 20:00	IN Alert PM10 (95.4 µg/m3) conditions have triggered the 'PM10 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal.	in	90%								
	11/15/2016 22:00	OUT Alert PM10 conditions for the 'PM10 Alert' alert at Stn 7B: North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than the BC 24-hour air quality objective of 50 ug/m3.	out	100%								
	11/15/2016 23:00	OUT Alert PM10 conditions for the 'PM10 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	out	90%								
19	11/17/2016 2:00	IN Alert SO2 (287.6 µg/m3) conditions have triggered the 'SO2 Alert' alert. An OUT alert will be sent when conditions return to normal.	in	100%	SO2	Station 7B	Y	Alerts were caused by a software error during nightly span test	N/A	N/A	N/A	N/A
	11/17/2016 3:00	OUT Alert SO2 conditions for the 'SO2 Alert' alert at Stn 7B: North Camp have returned to normal.	out	100%								
20	11/18/2016 2:00	IN Alert SO2 (283.7 µg/m3) conditions have triggered the 'SO2 Alert' alert. An OUT alert will be sent when conditions return to normal.	in	100%	SO2	Station 7B	Y	Alerts were caused by a software error during nightly span test	N/A	N/A	N/A	N/A
	11/18/2016 3:00	OUT Alert SO2 conditions for the 'SO2 Alert' alert at Stn 7B: North Camp have returned to normal.	out	100%								
21	11/19/2016 2:00	IN Alert SO2 (286.6 µg/m3) conditions have triggered the 'SO2 Alert' alert. An OUT alert will be sent when conditions return to normal.	in	100%	SO2	Station 7B	Y	Alerts were caused by a software error during nightly span test	N/A	N/A	N/A	N/A
	11/19/2016 3:00	OUT Alert SO2 conditions for the 'SO2 Alert' alert at Stn 7B: North Camp have returned to normal.	out	100%								
22	11/20/2016 2:00	IN Alert SO2 (291.3 µg/m3) conditions have triggered the 'SO2 Alert' alert. An OUT alert will be sent when conditions return to normal.	in	100%	SO2	Station 7B	Y	Alerts were caused by a software error during nightly span test	N/A	N/A	N/A	N/A
	11/20/2016 3:00	OUT Alert SO2 conditions for the 'SO2 Alert' alert at Stn 7B: North Camp have returned to normal.	out	100%								
23	11/21/2016 2:00	IN Alert SO2 (293.6 µg/m3) conditions have triggered the 'SO2 Alert' alert. An OUT alert will be sent when conditions return to normal.	in	100%	SO2	Station 7B	Y	Alerts were caused by a software error during nightly span test	N/A	N/A	N/A	N/A
	11/21/2016 3:00	OUT Alert SO2 conditions for the 'SO2 Alert' alert at Stn 7B: North Camp have returned to normal.	out	100%								
24	11/22/2016 2:00	IN Alert SO2 (290.5 µg/m3) conditions have triggered the 'SO2 Alert' alert. An OUT alert will be sent when conditions return to normal.	in	100%	SO2	Station 7B	Y	Alerts were caused by a software error during nightly span test	N/A	N/A	N/A	N/A
	11/22/2016 3:00	OUT Alert SO2 conditions for the 'SO2 Alert' alert at Stn 7B: North Camp have returned to normal.	out	100%								
25	11/23/2016 2:00	IN Alert SO2 (295.2 µg/m3) conditions have triggered the 'SO2 Alert' alert. An OUT alert will be sent when conditions return to normal.	in	100%	SO2	Station 7B	Y	Alerts were caused by a software error during nightly span test	N/A	N/A	N/A	N/A
	11/23/2016 3:00	OUT Alert SO2 conditions for the 'SO2 Alert' alert at Stn 7B: North Camp have returned to normal. The 1-hour average SO2 concentrations have decreased to values less than the BC 1-hour air quality objective of 200 ug/m3.	out	100%								

Event number (serial)	Date / Time Alert issued	Alert text	IN / OUT	90% / 100%	Contaminant	Station Name	Instrumental Error (Y/N)	Reason for Instrumental Error	Did a measured Exceedance occur?	Dominant wind direction during event	BC Hydro (BCH) or Contractor Response	Notes
26	11/23/2016 14:03	OUT Alert 'SO2 Alert': SO2 conditions at Stn 7B: North Camp are normal. OUT Alert SO2 conditions for the 'SO2 Alert' alert at Stn 7B: North Camp have returned to normal. The 1-hour average SO2 concentrations have decreased to values less than the BC 1-hour air quality objective of 200 ug/m3.	out	100%	SO2	Station 7B	Y	Alerts were caused by a software error during nightly span test	N/A	N/A	N/A	N/A
	11/23/2016 14:03	OUT Alert 'SO2 > 90% Alert': SO2 conditions at Stn 7B: North Camp are normal. Description: Stn 7B: North Camp : 'SO2 > 90% Alert' Current Status: OUT 2016-11-10 02:00 PST ! IN Alert SO2 (289.4 µg/m3) conditions have triggered the 'SO2 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. 2016-11-10 03:00 PST OUT Alert SO2 conditions for the 'SO2 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. 2016-11-11 02:00 PST ! IN Alert SO2 (294.2 µg/m3) conditions have triggered the 'SO2 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. 2016-11-11 03:00 PST OUT Alert SO2 conditions for the 'SO2 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. 2016-11-12 02:00 PST ! IN Alert SO2 (296.3 µg/m3) conditions have triggered the 'SO2 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. 2016-11-12 03:00 PST OUT Alert SO2 conditions for the 'SO2 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. 2016-11-13 02:00 PST ! IN Alert SO2 (299.1 µg/m3) conditions have triggered the 'SO2 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. 2016-11-13 03:00 PST OUT Alert SO2 conditions for the 'SO2 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. 2016-11-14 02:00 PST ! IN Alert SO2 (308.6 µg/m3) conditions have triggered the 'SO2 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. 2016-11-14 03:00 PST OUT Alert SO2 conditions for the 'SO2 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. 2016-11-17 02:00 PST ! IN Alert SO2 (287.6 µg/m3) conditions have triggered the 'SO2 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. 2016-11-17 03:00 PST OUT Alert SO2 conditions for the 'SO2 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. 2016-11-18 02:00 PST ! IN Alert SO2 (283.7 µg/m3) conditions have triggered the 'SO2 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. 2016-11-18 03:00 PST OUT Alert SO2 conditions for the 'SO2 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. 2016-11-19 02:00 PST ! IN Alert SO2 (286.6 µg/m3) conditions have triggered the 'SO2 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. 2016-11-19 03:00 PST OUT Alert SO2 conditions for the 'SO2 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. 2016-11-20 02:00 PST ! IN Alert SO2 (291.3 µg/m3) conditions have triggered the 'SO2 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. 2016-11-20 03:00 PST OUT Alert SO2 conditions for the 'SO2 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. 2016-11-21 02:00 PST ! IN Alert SO2 (293.6 µg/m3) conditions have triggered the 'SO2 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. 2016-11-21 03:00 PST OUT Alert SO2 conditions for the 'SO2 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. 2016-11-22 02:00 PST ! IN Alert SO2 (290.5 µg/m3) conditions have triggered the 'SO2 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. 2016-11-22 03:00 PST OUT Alert SO2 conditions for the 'SO2 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. 2016-11-23 02:00 PST ! IN Alert SO2 (295.2 µg/m3) conditions have triggered the 'SO2 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. 2016-11-23 03:00 PST OUT Alert SO2 conditions for the 'SO2 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. The 1-hour average SO2 concentrations have decreased to values less than 180 ug/m3 (90% of the BC 1-hour air quality objective of 200 ug/m3).	out	90%								
27	11/24/2016 2:10	IN Alert 'SO2 Alert': SO2 (293.4 µg/m3) at Stn 7B: North Camp for 2016-11-24 02:00 PST. Description: Stn 7B: North Camp : 'SO2 Alert' 2016-11-24 02:00 PST ! IN Alert SO2 (293.4 µg/m3) conditions have triggered the 'SO2 Alert' alert. An OUT alert will be sent when conditions return to normal. The 1-hour average SO2 concentrations have exceeded and remain greater than the BC 1-hour air quality objective of 200 ug/m3.	in	100%	SO2	Station 7B	Y	Alerts were caused by a software error during nightly span test	N/A	N/A	N/A	N/A
	11/24/2016 2:10	IN Alert 'SO2 > 90% Alert': SO2 (293.4 µg/m3) at Stn 7B: North Camp for 2016-11-24 02:00 PST. Description: Stn 7B: North Camp : 'SO2 > 90% Alert' 2016-11-24 02:00 PST ! IN Alert SO2 (293.4 µg/m3) conditions have triggered the 'SO2 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. The 1-hour average SO2 concentrations have exceeded and remain greater than 180 ug/m3 (90% of the BC 1-hour air quality objective of 200 ug/m3).	in	90%								
	11/24/2016 3:10	OUT Alert 'SO2 Alert': SO2 conditions at Stn 7B: North Camp are normal. Description: Stn 7B: North Camp : 'SO2 Alert' 2016-11-24 03:00 PST OUT Alert SO2 conditions for the 'SO2 Alert' alert at Stn 7B: North Camp have returned to normal. The 1-hour average SO2 concentrations have decreased to values less than the BC 1-hour air quality objective of 200 ug/m3.	out	100%								
	11/24/2016 3:10	OUT Alert 'SO2 > 90% Alert': SO2 conditions at Stn 7B: North Camp are normal. Description: Stn 7B: North Camp : 'SO2 > 90% Alert' 2016-11-24 03:00 PST OUT Alert SO2 conditions for the 'SO2 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. The 1-hour average SO2 concentrations have decreased to values less than 180 ug/m3 (90% of the BC 1-hour air quality objective of 200 ug/m3).	out	90%								
28	11/28/2016 7:10	IN Alert 'PM2.5 Alert': PM2.5 (25.3 µg/m3) at Stn 9: Fort St. John 85th Ave for 2016-11-28 07:00 PST. Description: Stn 9: Fort St. John 85th Ave : 'PM2.5 Alert' 2016-11-28 07:00 PST ! IN Alert PM2.5 (25.3 µg/m3) conditions have triggered the 'PM2.5 Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM2.5 concentrations has exceeded and remains greater than the BC 24-hour air quality objective of 25 ug/m3.	in	100%	PM2.5	Station 9	Y	This occurred following a period of erratic beta derived concentrations and during the work performed to fix it. Measurements are unstable	N/A	N/A	N/A	N/A
	11/28/2016 12:10	OUT Alert 'PM2.5 Alert': PM2.5 conditions at Stn 9: Fort St. John 85th Ave are normal. Description: Stn 9: Fort St. John 85th Ave : 'PM2.5 Alert' 2016-11-28 12:00 PST OUT Alert PM2.5 conditions for the 'PM2.5 Alert' alert at Stn 9: Fort St. John 85th Ave have returned to normal. The 24-hour rolling average of PM2.5 concentrations has decreased to values less than the BC 24-hour air quality objective of 25 ug/m3.	out	100%								
	11/28/2016 15:10	OUT Alert 'PM2.5 > 90% Alert': PM2.5 conditions at Stn 9: Fort St. John 85th Ave are normal. Description: Stn 9: Fort St. John 85th Ave : 'PM2.5 > 90% Alert' 2016-11-28 15:00 PST OUT Alert PM2.5 conditions for the 'PM2.5 > 90% Alert' alert at Stn 9: Fort St. John 85th Ave have returned to normal. The 24-hour rolling average of PM2.5 concentrations has decreased to values less than 22.5 ug/m3 (90% of the BC 24-hour air quality objective of 25 ug/m3).	out	90%								
	11/28/2016 16:03	IN Alert 'PM2.5 > 90% Alert': PM2.5 (22.7 µg/m3) at Stn 9: Fort St. John 85th Ave for 2016-11-28 03:00 PST. Description: Stn 9: Fort St. John 85th Ave : 'PM2.5 > 90% Alert' 2016-11-28 03:00 PST ! IN Alert PM2.5 (22.7 µg/m3) conditions have triggered the 'PM2.5 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM2.5 concentrations has exceeded and remains greater than 22.5 ug/m3 (90% of the BC 24-hour air quality objective of 25 ug/m3).	in	90%								

Event number (serial)	Date / Time Alert issued	Alert text	IN / OUT	90% / 100%	Contaminant	Station Name	Instrumental Error (Y/N)	Reason for Instrumental Error	Did a measured Exceedance occur?	Dominant wind direction during event	BC Hydro (BCH) or Contractor Response	Notes
29	12/4/2016 6:10	IN Alert 'PM10 > 90% Alert': PM10 (47.1 µg/m3) at Stn 7B: North Camp for 2016-12-04 06:00 PST.	in	90%	PM10	Station 7B	N	N/A	N	N/A	N/A	N/A
	12/4/2016 8:10	IN Alert 'PM10 Alert': PM10 (53 µg/m3) at Stn 7B: North Camp for 2016-12-04 08:00 PST. Description: Stn 7B: North Camp : 'PM10 Alert' 2016-12-04 08:00 PST ! IN Alert PM10 (53 µg/m3) conditions have triggered the 'PM10 Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM10 concentrations has exceeded and remains greater than the BC 24-hour air quality objective of 50 ug/m3.	in	100%	PM10	Station 7B						
	12/4/2016 16:10	OUT Alert 'PM10 Alert': PM10 conditions at Stn 7B: North Camp are normal. Description: Stn 7B: North Camp : 'PM10 Alert' 2016-12-04 16:00 PST OUT Alert PM10 conditions for the 'PM10 Alert' alert at Stn 7B: North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than the BC 24-hour air quality objective of 50 ug/m3.	out	100%	PM10	Station 7B						
	12/4/2016 18:10	OUT Alert 'PM10 > 90% Alert': PM10 conditions at Stn 7B: North Camp are normal. Description: Stn 7B: North Camp : 'PM10 > 90% Alert' 2016-12-04 18:00 PST OUT Alert PM10 conditions for the 'PM10 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	out	90%	PM10	Station 7B						
30	12/14/2016 12:10	IN Alert 'PM2.5 > 90% Alert': PM2.5 (27.4 µg/m3) at Stn 1: Peace Valley Attachie Flat Upper Terrace for 2016-12-14 12:00 PST. Description: Stn 1: Peace Valley Attachie Flat Upper Terrace : 'PM2.5 > 90% Alert' 2016-12-14 12:00 PST ! IN Alert PM2.5 (27.4 µg/m3) conditions have triggered the 'PM2.5 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM2.5 concentrations has exceeded and remains greater than 22.5 ug/m3 (90% of the BC 24-hour air quality objective of 25 ug/m3).	in	90%	PM2.5	Station 1	N	N/A	N	W	N/A	N/A
	12/14/2016 12:10	IN Alert 'PM2.5 Alert': PM2.5 (27.4 µg/m3) at Stn 1: Peace Valley Attachie Flat Upper Terrace for 2016-12-14 12:00 PST. Description: Stn 1: Peace Valley Attachie Flat Upper Terrace : 'PM2.5 Alert' 2016-12-14 12:00 PST ! IN Alert PM2.5 (27.4 µg/m3) conditions have triggered the 'PM2.5 Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM2.5 concentrations has exceeded and remains greater than the BC 24-hour air quality objective of 25 ug/m3.	in	100%	PM2.5	Station 1	N	N/A				
	12/14/2016 13:10	OUT Alert 'PM2.5 Alert': PM2.5 conditions at Stn 1: Peace Valley Attachie Flat Upper Terrace are normal. Description: Stn 1: Peace Valley Attachie Flat Upper Terrace : 'PM2.5 Alert' 2016-12-14 13:00 PST OUT Alert PM2.5 conditions for the 'PM2.5 Alert' alert at Stn 1: Peace Valley Attachie Flat Upper Terrace have returned to normal. The 24-hour rolling average of PM2.5 concentrations has decreased to values less than the BC 24-hour air quality objective of 25 ug/m3.	out	100%	PM2.5	Station 1	N	N/A				
	12/14/2016 14:10	IN Alert 'PM2.5 Alert': PM2.5 (35.4 µg/m3) at Stn 1: Peace Valley Attachie Flat Upper Terrace for 2016-12-14 14:00 PST. Description: Stn 1: Peace Valley Attachie Flat Upper Terrace : 'PM2.5 Alert' 2016-12-14 14:00 PST ! IN Alert PM2.5 (35.4 µg/m3) conditions have triggered the 'PM2.5 Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM2.5 concentrations has exceeded and remains greater than the BC 24-hour air quality objective of 25 ug/m3.	in	100%	PM2.5	Station 1	N	N/A				
	12/15/2016 3:10	OUT Alert 'PM2.5 Alert': PM2.5 conditions at Stn 1: Peace Valley Attachie Flat Upper Terrace are normal. Description: Stn 1: Peace Valley Attachie Flat Upper Terrace : 'PM2.5 Alert' 2016-12-15 03:00 PST OUT Alert PM2.5 conditions for the 'PM2.5 Alert' alert at Stn 1: Peace Valley Attachie Flat Upper Terrace have returned to normal. The 24-hour rolling average of PM2.5 concentrations has decreased to values less than the BC 24-hour air quality objective of 25 ug/m3.	out	100%	PM2.5	Station 1	N	N/A				
	12/15/2016 4:10	OUT Alert 'PM2.5 > 90% Alert': PM2.5 conditions at Stn 1: Peace Valley Attachie Flat Upper Terrace are normal. Description: Stn 1: Peace Valley Attachie Flat Upper Terrace : 'PM2.5 > 90% Alert' 2016-12-15 04:00 PST OUT Alert PM2.5 conditions for the 'PM2.5 > 90% Alert' alert at Stn 1: Peace Valley Attachie Flat Upper Terrace have returned to normal. The 24-hour rolling average of PM2.5 concentrations has decreased to values less than 22.5 ug/m3 (90% of the BC 24-hour air quality objective of 25 ug/m3).	out	90%	PM2.5	Station 1	N	N/A				
31	12/18/2016 6:10	IN Alert 'PM10 > 90% Alert': PM10 (45.5 µg/m3) at Stn 7B: North Camp for 2016-12-18 06:00 PST. Description: Stn 7B: North Camp : 'PM10 > 90% Alert' 2016-12-18 06:00 PST ! IN Alert PM10 (45.5 µg/m3) conditions have triggered the 'PM10 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM10 concentrations has exceeded and remains greater than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	in	90%	PM10	Station 7B	N	N/A	Y	WSW	BCH issued field advice memo to MCW Contractor	N/A
	12/18/2016 8:10	IN Alert 'PM10 Alert': PM10 (55 µg/m3) at Stn 7B: North Camp for 2016-12-18 08:00 PST. Description: Stn 7B: North Camp : 'PM10 Alert' 2016-12-18 08:00 PST ! IN Alert PM10 (55 µg/m3) conditions have triggered the 'PM10 Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM10 concentrations has exceeded and remains greater than the BC 24-hour air quality objective of 50 ug/m3.	in	100%	PM10	Station 7B	N	N/A				
	12/22/2016 14:10	OUT Alert 'PM10 Alert': PM10 conditions at Stn 7B: North Camp are normal. Description: Stn 7B: North Camp : 'PM10 Alert' 2016-12-22 15:00 PST OUT Alert PM10 conditions for the 'PM10 Alert' alert at Stn 7B: North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than the BC 24-hour air quality objective of 50 ug/m3.	out	100%	PM10	Station 7B	N	N/A				
	12/22/2016 14:10	OUT Alert 'PM10 > 90% Alert': PM10 conditions at Stn 7B: North Camp are normal. Description: Stn 7B: North Camp : 'PM10 > 90% Alert' 2016-12-22 15:00 PST OUT Alert PM10 conditions for the 'PM10 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	out	90%	Pm10	Station 7B	N	N/A				

Event number (serial)	Date / Time Alert issued	Alert text	IN / OUT	90% / 100%	Contaminant	Station Name	Instrumental Error (Y/N)	Reason for Instrumental Error	Did a measured Exceedance occur?	Dominant wind direction during event	BC Hydro (BCH) or Contractor Response	Notes
32	12/24/2016 21:10	IN Alert 'PM10 > 90% Alert': PM10 (46.5 µg/m3) at Stn 7B: North Camp for 2016-12-24 21:00 PST. Description: Stn 7B: North Camp : 'PM10 > 90% Alert' 2016-12-24 21:00 PST ! IN Alert PM10 (46.5 µg/m3) conditions have triggered the 'PM10 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM10 concentrations has exceeded and remains greater than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	in	90%	PM10	Station 7B	N	N/A	Y	E	BCH issued field advice memo to MCW Contractor	N/A
	12/25/2016 0:10	IN Alert 'PM10 Alert': PM10 (50 µg/m3) at Stn 7B: North Camp for 2016-12-25 00:00 PST. Description: Stn 7B: North Camp : 'PM10 Alert' 2016-12-25 00:00 PST ! IN Alert PM10 (50 µg/m3) conditions have triggered the 'PM10 Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM10 concentrations has exceeded and remains greater than the BC 24-hour air quality objective of 50 ug/m3.	in	100%	PM10	Station 7B	N	N/A				
	12/25/2016 15:10	OUT Alert 'PM10 Alert': PM10 conditions at Stn 7B: North Camp are normal. Description: Stn 7B: North Camp : 'PM10 Alert' 2016-12-25 15:00 PST OUT Alert PM10 conditions for the 'PM10 Alert' alert at Stn 7B: North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than the BC 24-hour air quality objective of 50 ug/m3.	out	100%	PM10	Station 7B	N	N/A				
	12/25/2016 16:10	OUT Alert 'PM10 > 90% Alert': PM10 conditions at Stn 7B: North Camp are normal. Description: Stn 7B: North Camp : 'PM10 > 90% Alert' 2016-12-25 16:00 PST OUT Alert PM10 conditions for the 'PM10 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	out	90%	PM10	Station 7B	N	N/A				
33	12/26/2016 23:10	IN Alert 'PM10 > 90% Alert': PM10 (45.2 µg/m3) at Stn 7B: North Camp for 2016-12-26 23:00 PST. Description: Stn 7B: North Camp : 'PM10 > 90% Alert' 2016-12-26 23:00 PST ! IN Alert PM10 (45.2 µg/m3) conditions have triggered the 'PM10 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM10 concentrations has exceeded and remains greater than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	in	90%	PM10	Station 7B	N	N/A	Y	WSW	BCH issued field advice memo to MCW Contractor	N/A
	12/27/2016 4:10	OUT Alert 'PM10 > 90% Alert': PM10 conditions at Stn 7B: North Camp are normal. Description: Stn 7B: North Camp : 'PM10 > 90% Alert' 2016-12-27 04:00 PST OUT Alert PM10 conditions for the 'PM10 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	out	90%	PM10	Station 7B	N	N/A				
	12/27/2016 6:10	IN Alert 'PM10 > 90% Alert': PM10 (47.1 µg/m3) at Stn 7B: North Camp for 2016-12-27 06:00 PST. Description: Stn 7B: North Camp : 'PM10 > 90% Alert' 2016-12-27 06:00 PST ! IN Alert PM10 (47.1 µg/m3) conditions have triggered the 'PM10 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM10 concentrations has exceeded and remains greater than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	in	90%	PM10	Station 7B	N	N/A				
	12/27/2016 7:10	IN Alert 'PM10 Alert': PM10 (51.2 µg/m3) at Stn 7B: North Camp for 2016-12-27 07:00 PST. Description: Stn 7B: North Camp : 'PM10 Alert' 2016-12-27 07:00 PST ! IN Alert PM10 (51.2 µg/m3) conditions have triggered the 'PM10 Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM10 concentrations has exceeded and remains greater than the BC 24-hour air quality objective of 50 ug/m3.	in	100%	PM10	Station 7B	N	N/A				
	12/30/2016 14:10	OUT Alert 'PM10 Alert': PM10 conditions at Stn 7B: North Camp are normal. Description: Stn 7B: North Camp : 'PM10 Alert' 2016-12-30 14:00 PST OUT Alert PM10 conditions for the 'PM10 Alert' alert at Stn 7B: North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than the BC 24-hour air quality objective of 50 ug/m3.	out	100%	PM10	Station 7B	N	N/A				
	12/30/2016 14:10	OUT Alert 'PM10 > 90% Alert': PM10 conditions at Stn 7B: North Camp are normal. Description: Stn 7B: North Camp : 'PM10 > 90% Alert' 2016-12-30 14:00 PST OUT Alert PM10 conditions for the 'PM10 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	out	90%	PM10	Station 7B	N	N/A				
34	12/31/2016 4:10	IN Alert 'PM10 > 90% Alert': PM10 (47.7 µg/m3) at Stn 7B: North Camp for 2016-12-31 04:00 PST. Description: Stn 7B: North Camp : 'PM10 > 90% Alert' 2016-12-31 04:00 PST ! IN Alert PM10 (47.7 µg/m3) conditions have triggered the 'PM10 > 90% Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM10 concentrations has exceeded and remains greater than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	in	90%	PM10	Station 7B	N	N/A	N	N, W, NW	N/A	N/A
	12/31/2016 5:10	IN Alert 'PM10 Alert': PM10 (50.6 µg/m3) at Stn 7B: North Camp for 2016-12-31 05:00 PST. Description: Stn 7B: North Camp : 'PM10 Alert' 2016-12-31 05:00 PST ! IN Alert PM10 (50.6 µg/m3) conditions have triggered the 'PM10 Alert' alert. An OUT alert will be sent when conditions return to normal. The 24-hour rolling average of PM10 concentrations has exceeded and remains greater than the BC 24-hour air quality objective of 50 ug/m3.	in	100%	PM10	Station 7B	N	N/A				
	12/31/2016 23:10	OUT Alert 'PM10 Alert': PM10 conditions at Stn 7B: North Camp are normal. Description: Stn 7B: North Camp : 'PM10 Alert' 2016-12-31 23:00 PST OUT Alert PM10 conditions for the 'PM10 Alert' alert at Stn 7B: North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than the BC 24-hour air quality objective of 50 ug/m3.	out	100%	PM10	Station 7B	N	N/A				
	1/1/2017 2:10	OUT Alert 'PM10 > 90% Alert': PM10 conditions at Stn 7B: North Camp are normal. Description: Stn 7B: North Camp : 'PM10 > 90% Alert' 2017-01-01 02:00 PST OUT Alert PM10 conditions for the 'PM10 > 90% Alert' alert at Stn 7B: North Camp have returned to normal. The 24-hour rolling average of PM10 concentrations has decreased to values less than 45 ug/m3 (90% of the BC 24-hour air quality objective of 50 ug/m3).	out	90%	PM10	Station 7B	N	N/A				

C.1 Station 9 PM_{10} event from 2016-01-07 to 2016-01-08

The 2-day elevated PM_{10} event and time history are plotted as Figure C- 1: PM10 time series plot for the period, January 7 to 9, 2016. Blue line indicates the 24-hour BC Ambient Air Quality Objective of 50 µg/m3;. The figure shows that this event was characterized by a relatively constant PM_{10} concentration below the 24-hour objective of 50 µg/m^3 followed by a sharp increase in concentration at approximately 06:00 on January 7. Concentrations showed numerous fluctuations over the entire alert period with a maximum hourly PM_{10} concentration of 327 µg/m^3 at 11:00 on January 7.

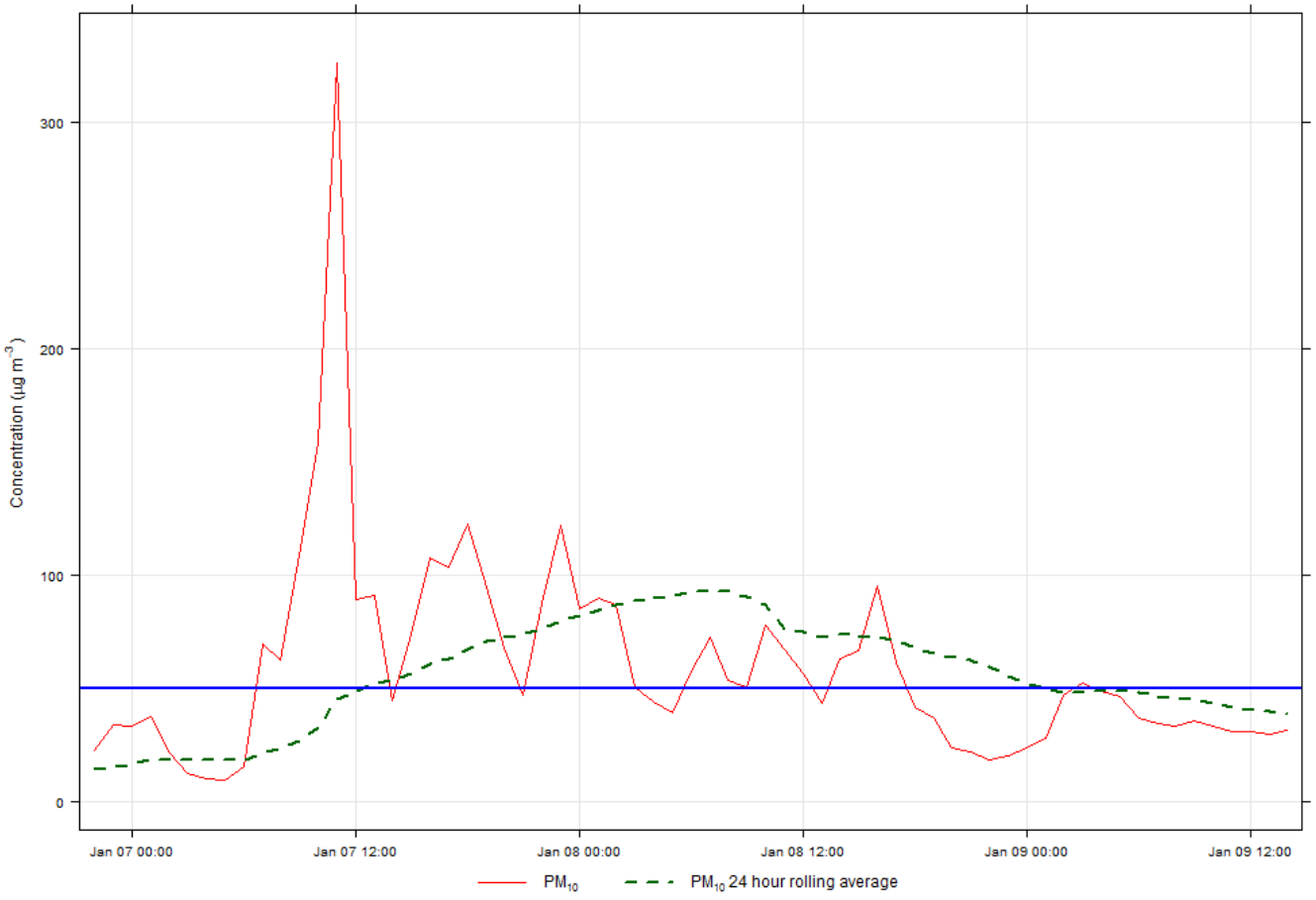


Figure C- 1: PM_{10} time series plot for the period, January 7 to 9, 2016. Blue line indicates the 24-hour BC Ambient Air Quality Objective of 50 µg/m3;

The winds during the time of the event were predominantly from the east-southeast and southeast ranging from 0.5 to 4 m/s (Figure C-2: Wind rose during alert event period, January 7 to 8, 2016.). Calms were observed about 10.2 % of the time. The greatest PM_{10} concentrations were associated with winds from the east-southeast, southeast and south-southeast at wind speeds between 0 and 1 m/s (Figure C-3: Polar frequency plot for PM_{10} during alert event period, January 7 to 8, 2016..

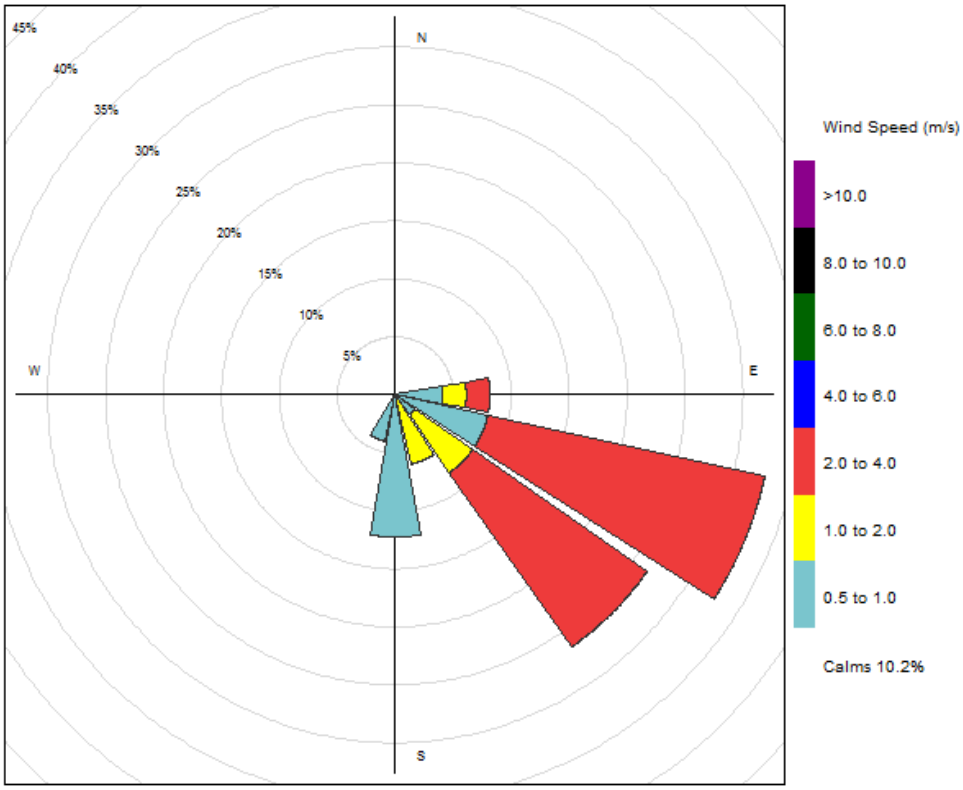


Figure C-2: Wind rose during alert event period, January 7 to 8, 2016.

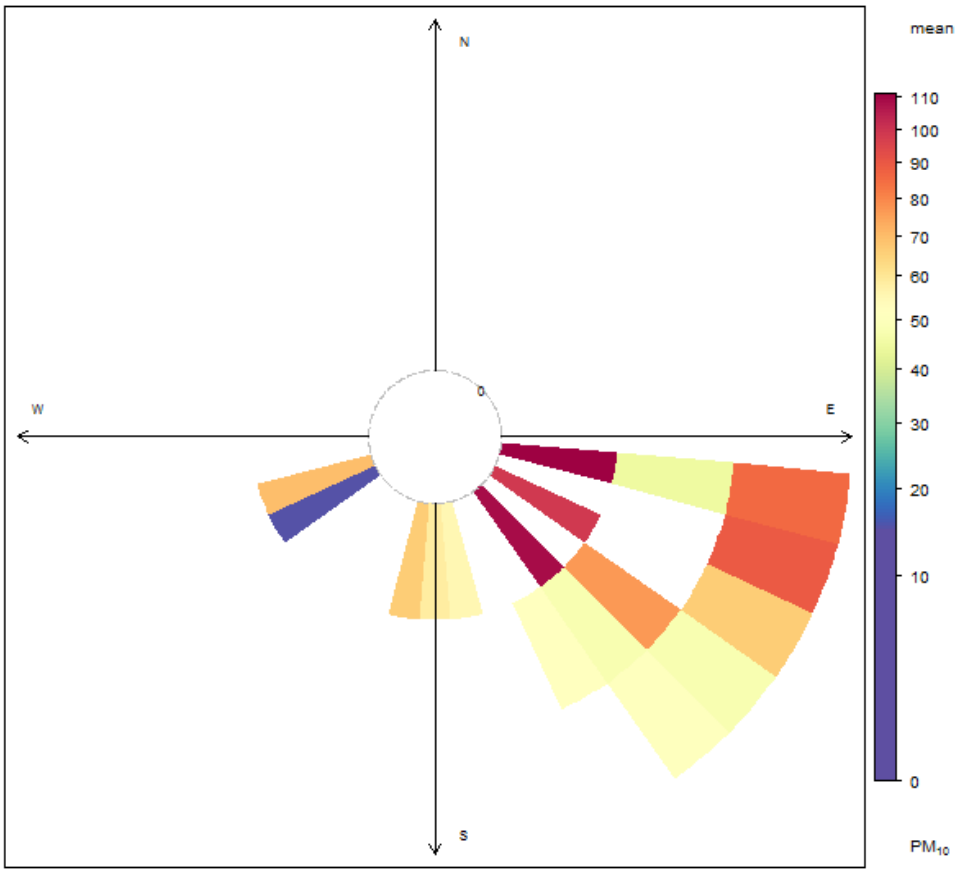


Figure C-3: Polar frequency plot for PM_{10} during alert event period, January 7 to 8, 2016.

C.2 Station 8 $PM_{2.5}$ event on 2016-01-10

The 1-day elevated $PM_{2.5}$ event and time history are plotted as Figure C-4: $PM_{2.5}$ Time series plot for the period, January 9 to 11, 2016. Blue line indicates the 24-hour BC Ambient Air Quality Objective of 25 µg/m^3. The figure shows that this event was characterized by a gradual increase in $PM_{2.5}$ concentrations throughout the day to a maximum value of 68.2 µg/m^3 at 16:00 on January 10 followed by a rapid decline.

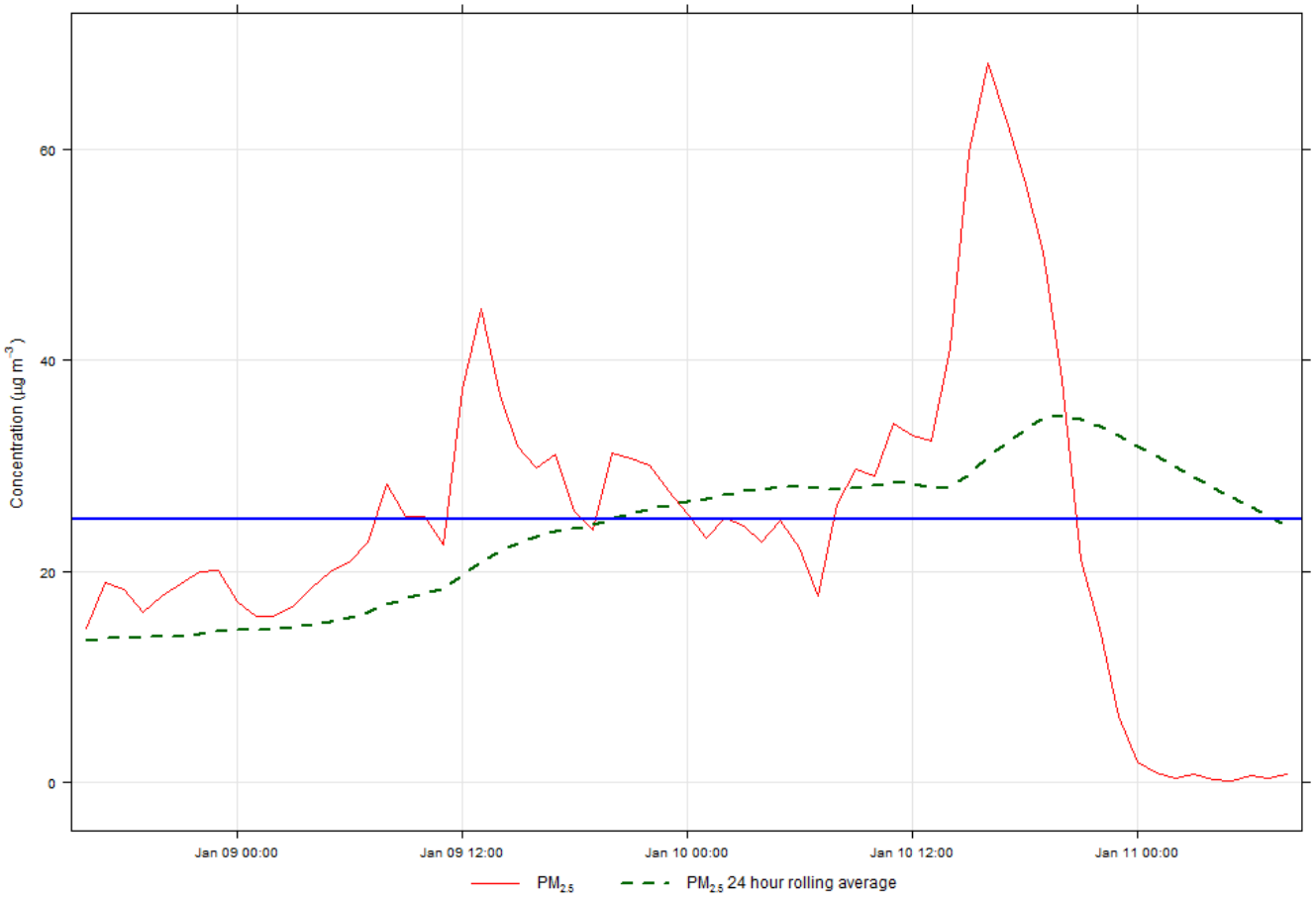


Figure C-4: $PM_{2.5}$ Time series plot for the period, January 9 to 11, 2016. Blue line indicates the 24-hour BC Ambient Air Quality Objective of 25 µg/m^3

The winds during the time of the event were predominantly from the west-southwest and west ranging from 1 to 4 m/s (Figure C-5: Wind rose during alert event period, January 10, 2016.). Calms were observed about 24.5% of the time. The greatest $PM_{2.5}$ concentrations were associated with winds from the northwest and northeast at wind speeds between 1 and 2 m/s (Figure C-6).

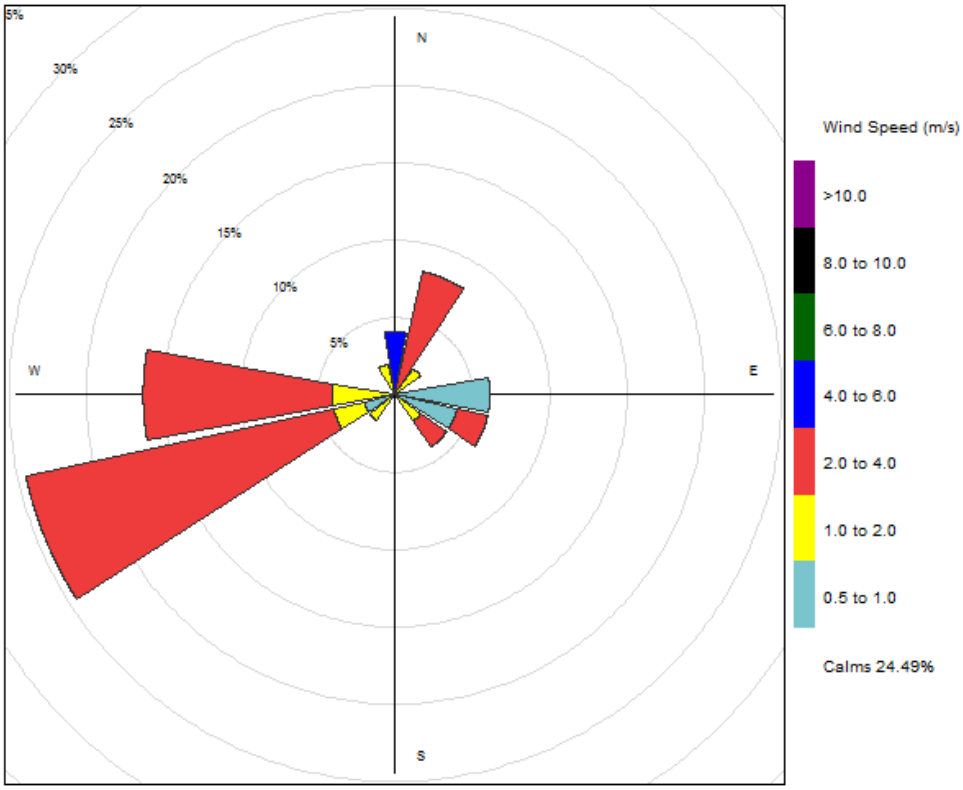


Figure C-5: Wind rose during alert event period, January 10, 2016.

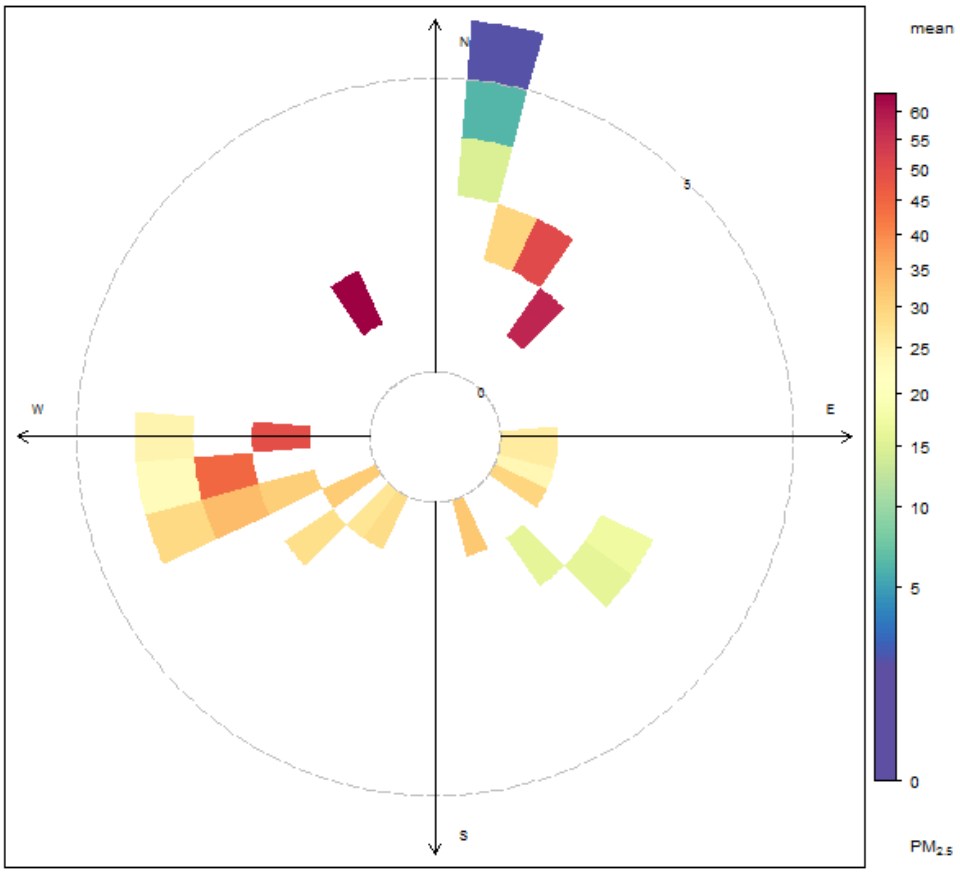


Figure C-6: Polar frequency plot for $PM_{2.5}$ during alert event period, January 10, 2016.

C.3 Station 1 PM_{10} and $PM_{2.5}$ event on 2016-05-15

This 1-day elevated $PM_{2.5}$ and PM_{10} event and time history are plotted as Figure C-7. The figure shows that this event was characterized by relatively constant PM_{10} and $PM_{2.5}$ concentrations below the 24-hour objectives of 50 25 µg/m^3 respectively followed by a sudden spike in PM_{10} and $PM_{2.5}$ of short duration. The respective maximum PM_{10} and $PM_{2.5}$ concentrations of 813.0 and 455.3 µg/m^3 were observed simultaneously at 09:00 on May 15.

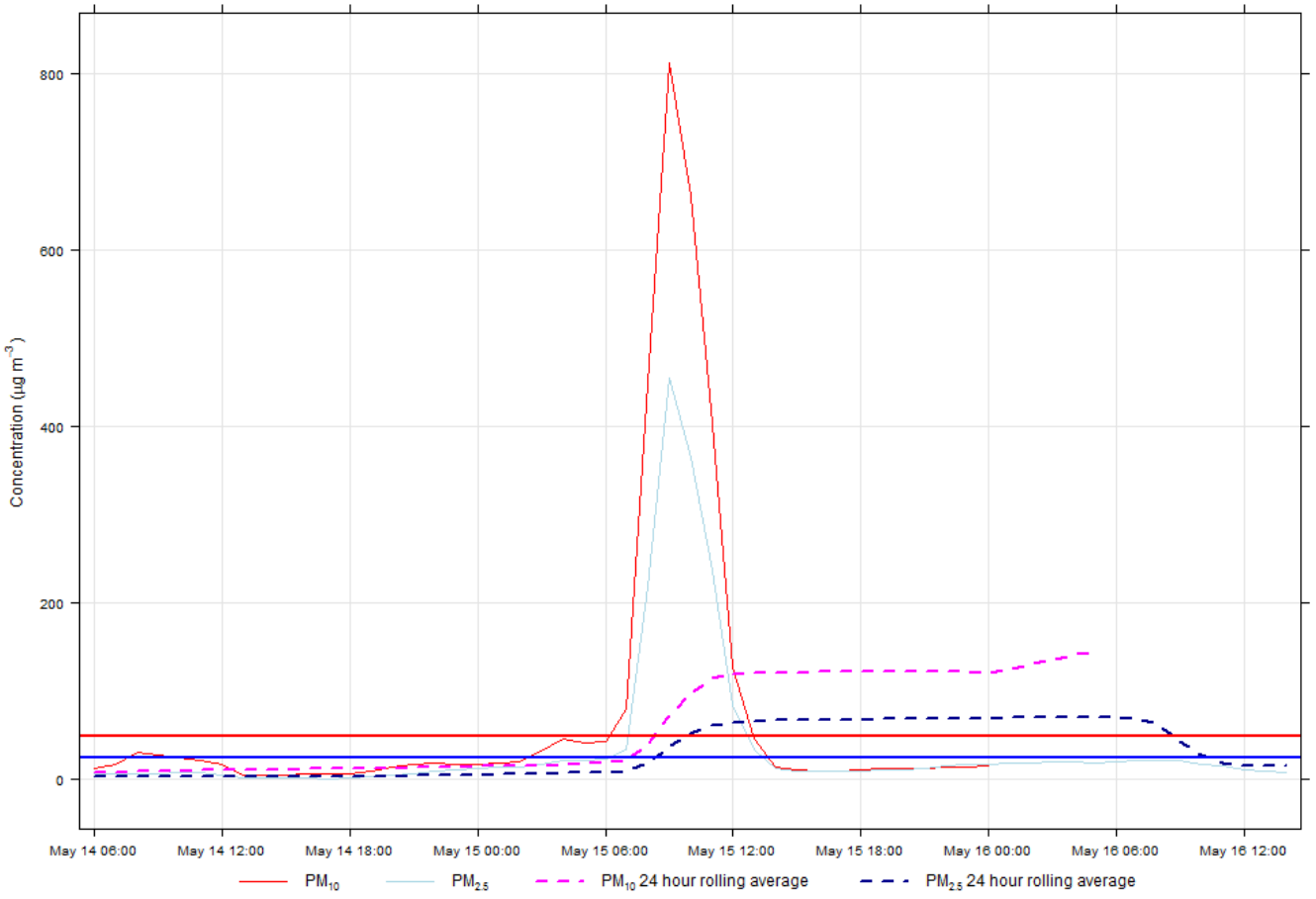


Figure C-7: $PM_{2.5}$ and PM_{10} time series plot for the period, May 14 to 16, 2016. Blue and red horizontal lines indicate the 24-hour BC Ambient Air Quality Objectives of 25 and 50 µg/m^3, respectively.

The winds during the time of the event were predominantly from the south-southwest and west-southwest ranging from 0.5 to 2 m/s (Figure C-8). No calm wind speeds were observed during this event. The greatest PM_{10} and $PM_{2.5}$ concentrations were associated with winds from the west-southwest and south-southwest at wind speeds ranging from 0 to 2 m/s Figure C-9).

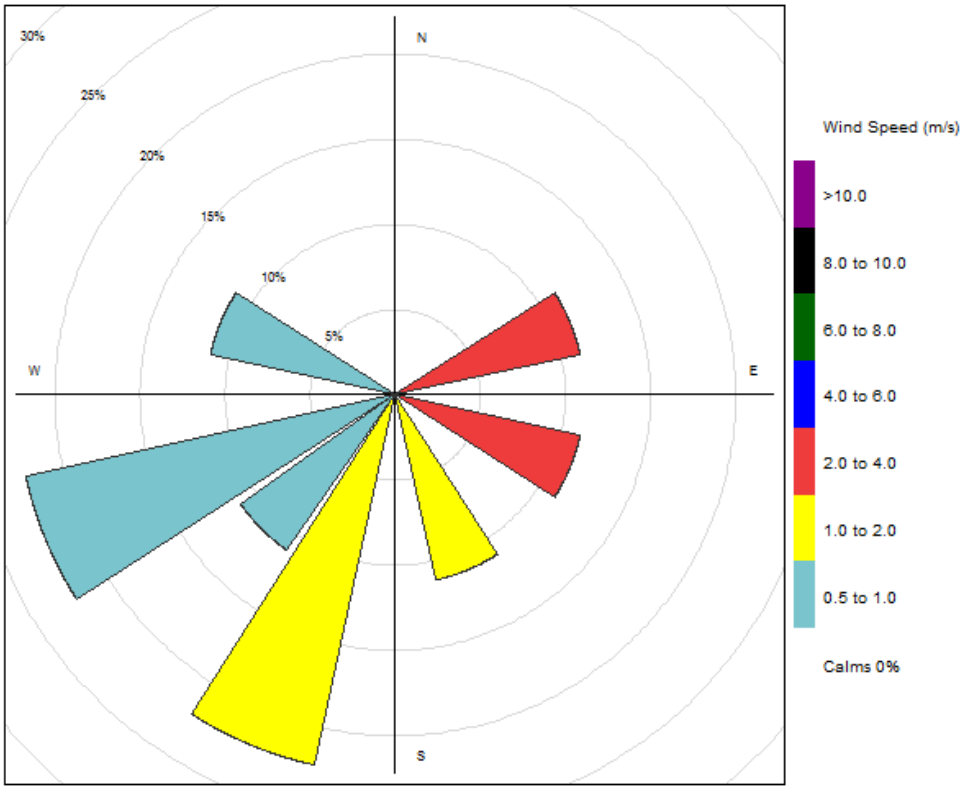


Figure C-8: Wind rose during alert event period, May 15, 2016.

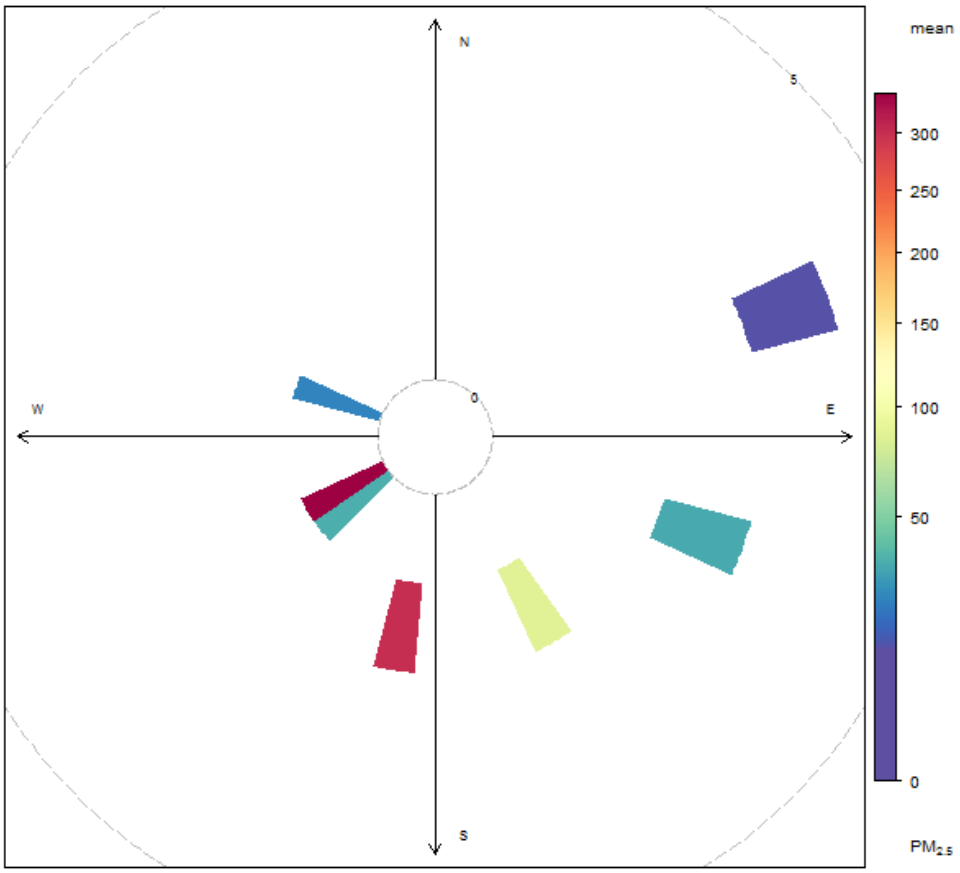


Figure C-9: Polar frequency plot for $PM_{2.5}$ during alert event period, May 15, 2016. Due to the short duration of the event and the similarity of the peak PM_{10} and $PM_{2.5}$ concentrations, only a polar frequency plot for $PM_{2.5}$ is shown.

C.4 Station 7B PM_{10} event on 2016-07-15

This 1-day elevated PM_{10} event and time history are plotted as Figure C-10 The figure shows that this event was characterized by some minor fluctuations in PM_{10} concentration below the 24-hour objective of 50 µg/m^3 followed by a sharp increase in concentration at approximately 10:00 on July 15. Concentrations showed numerous fluctuations over the entire alert period with a maximum hourly PM_{10} concentration of 124.8 µg/m^3 at 15:00 on July 15.

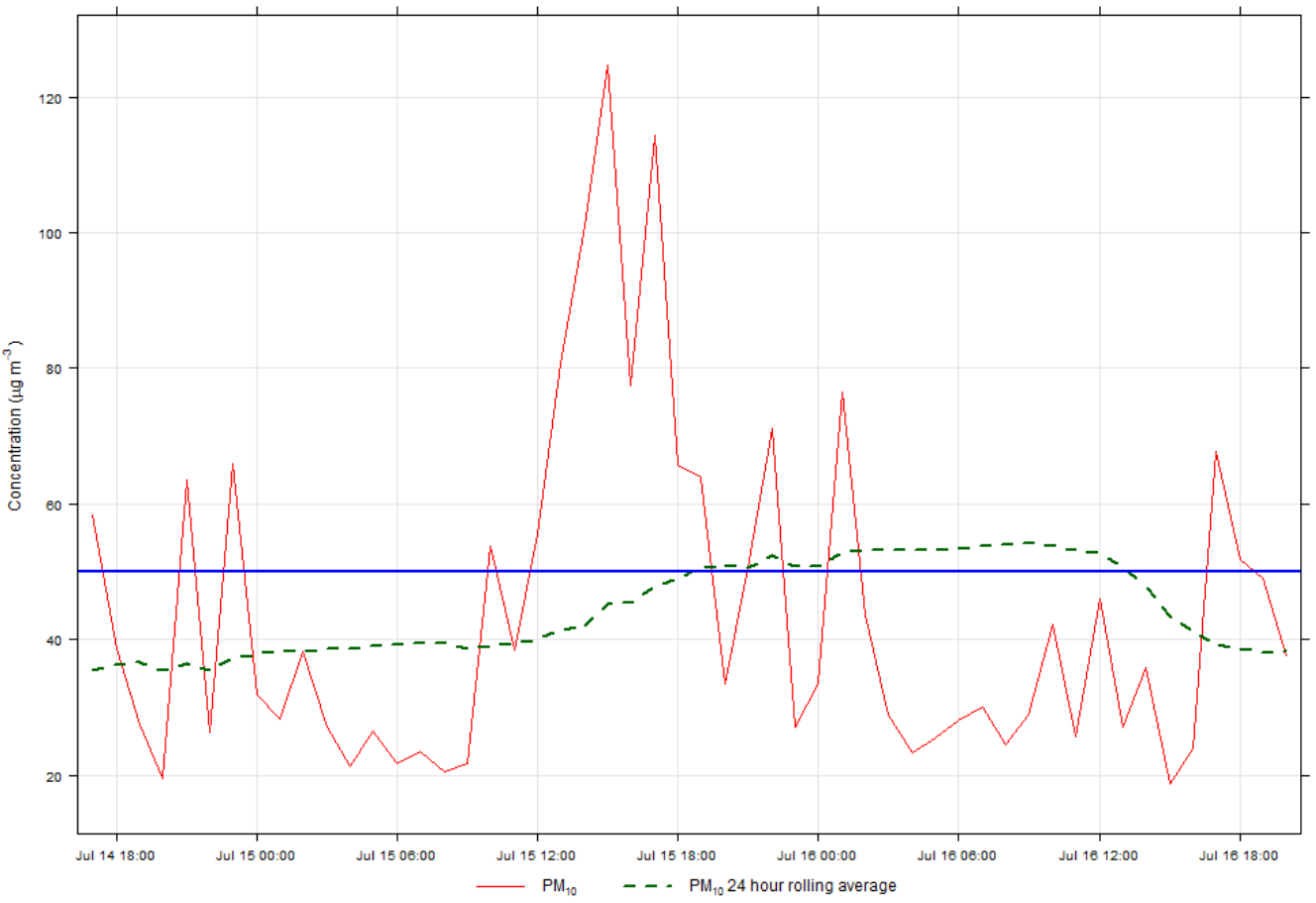


Figure C-10: PM_{10} time series plot for the period, July 14 to16, 2016. . Blue line indicates the 24-hour BC Ambient Air Quality Objective of 50 µg/m^3.

The winds during the time of the event were predominantly from the southwest ranging from 1 to 4 m/s (Figure C-11). Calm wind speeds were observed for 5% of the alert event period. The greatest PM_{10} concentrations were associated with winds from the southwest at wind speeds ranging from 2 to 3 m/s (Figure C-12).

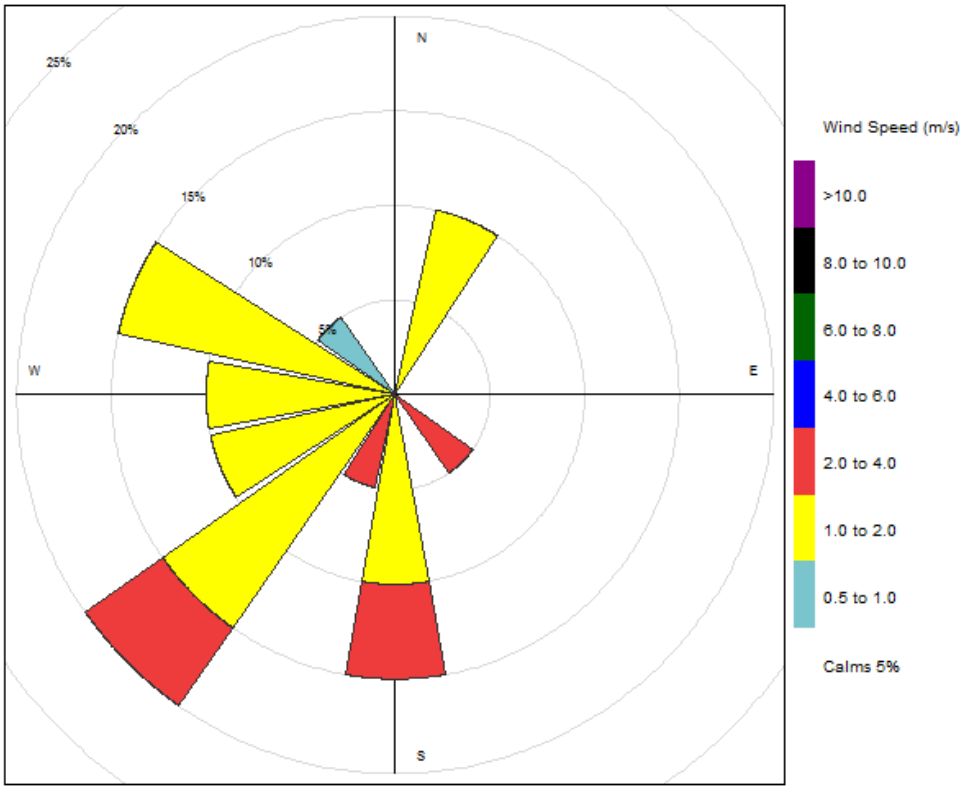


Figure C-11: Wind rose during alert event period, July 15, 2016.

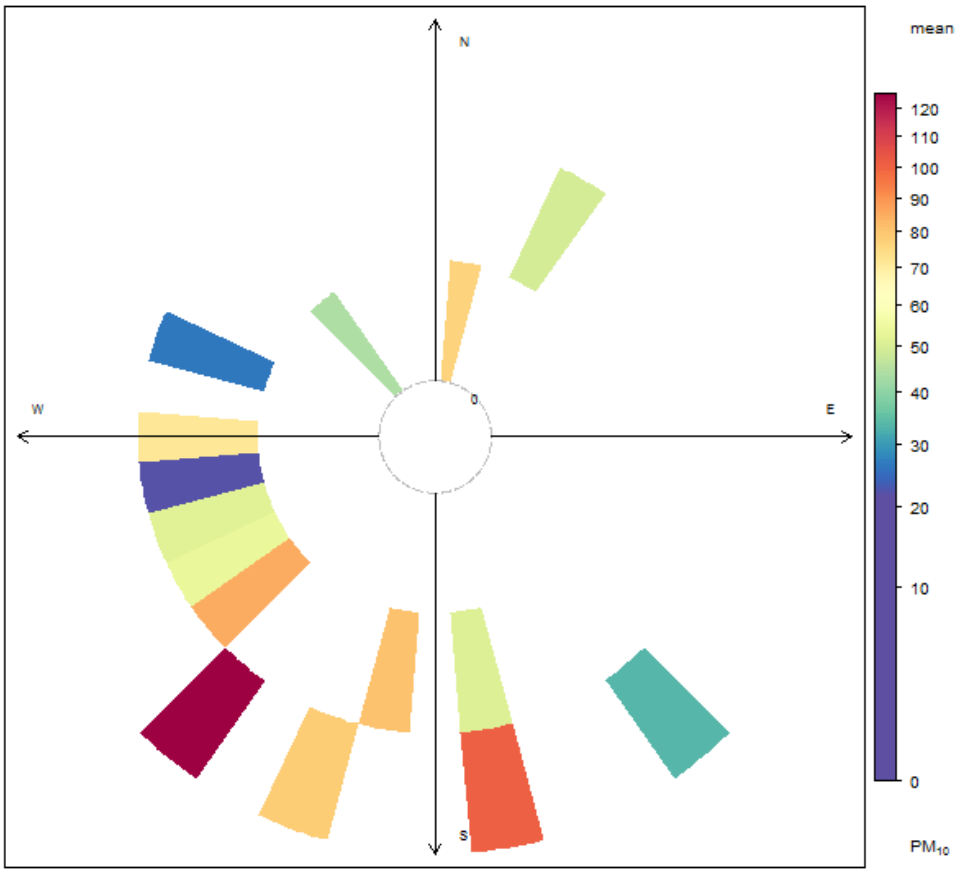


Figure C-12: Polar frequency plot for PM_{10} during alert event period, July 15, 2016.

C.5 Station 7B PM_{10} event on 2016-07-19

This 1-day elevated PM_{10} event and time history are plotted as Figure C-13. The figure shows that this event was characterized by relatively constant PM_{10} concentration just below the 24-hour objective of 50 µg/m^3 followed by an increase in concentration at approximately 06:00 on July 19. Concentrations showed numerous fluctuations over the entire alert period with a maximum hourly PM_{10} concentration of 382.7 µg/m^3 at 19:00 on July 19 followed by a rapid decline.

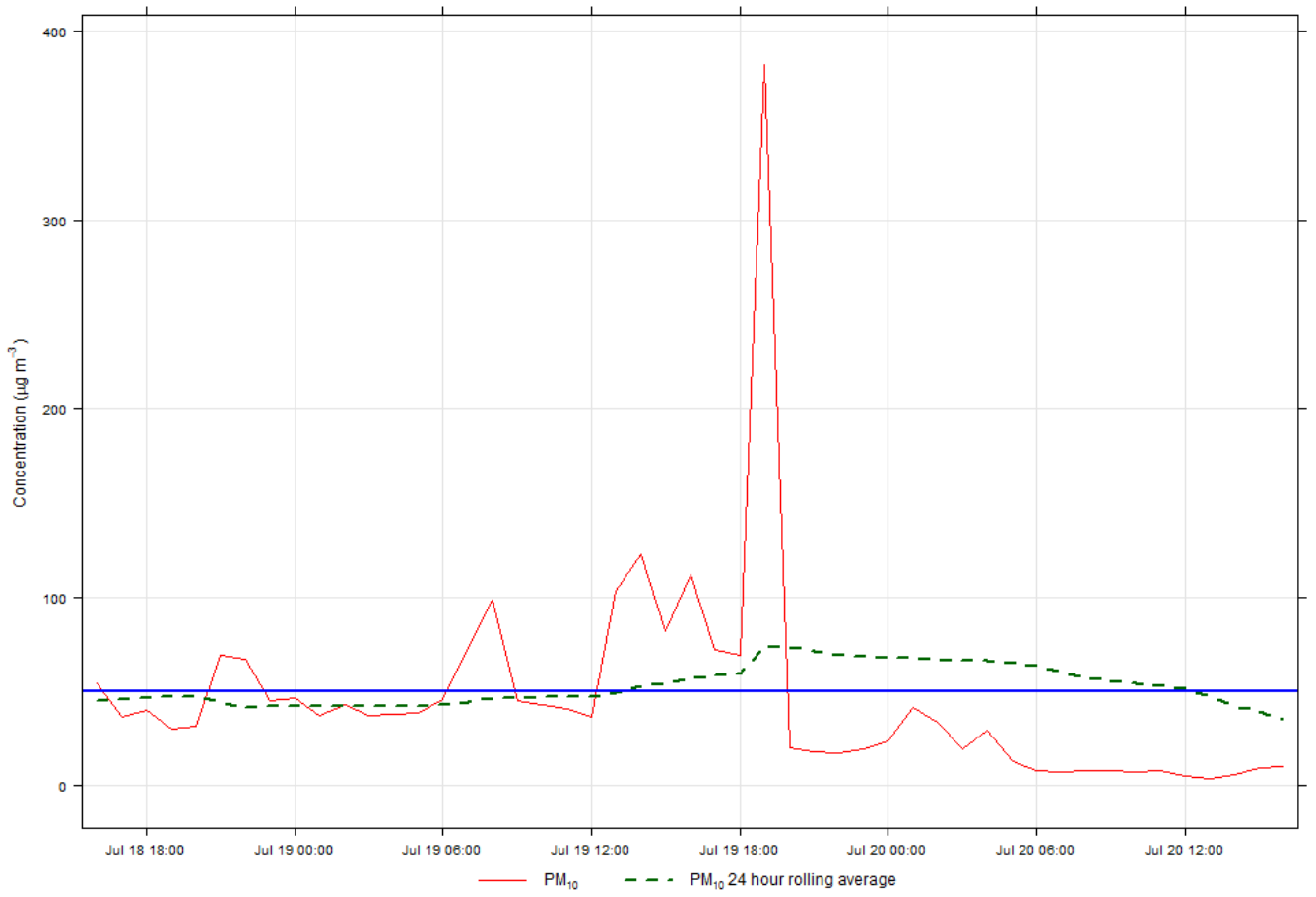


Figure C-13: PM_{10} time series plot for the period, July 18 to 20, 2016. . Blue line indicates the 24-hour BC Ambient Air Quality Objective of 50 µg/m^3

The winds during the time of the event were predominantly from the west-northwest ranging from 2 to 8 m/s (Figure C-14). No calm wind speeds were observed during this period. The greatest PM_{10} concentrations were associated with winds from the west-northwest at wind speeds between 7 and 8 m/s (Figure C-15).

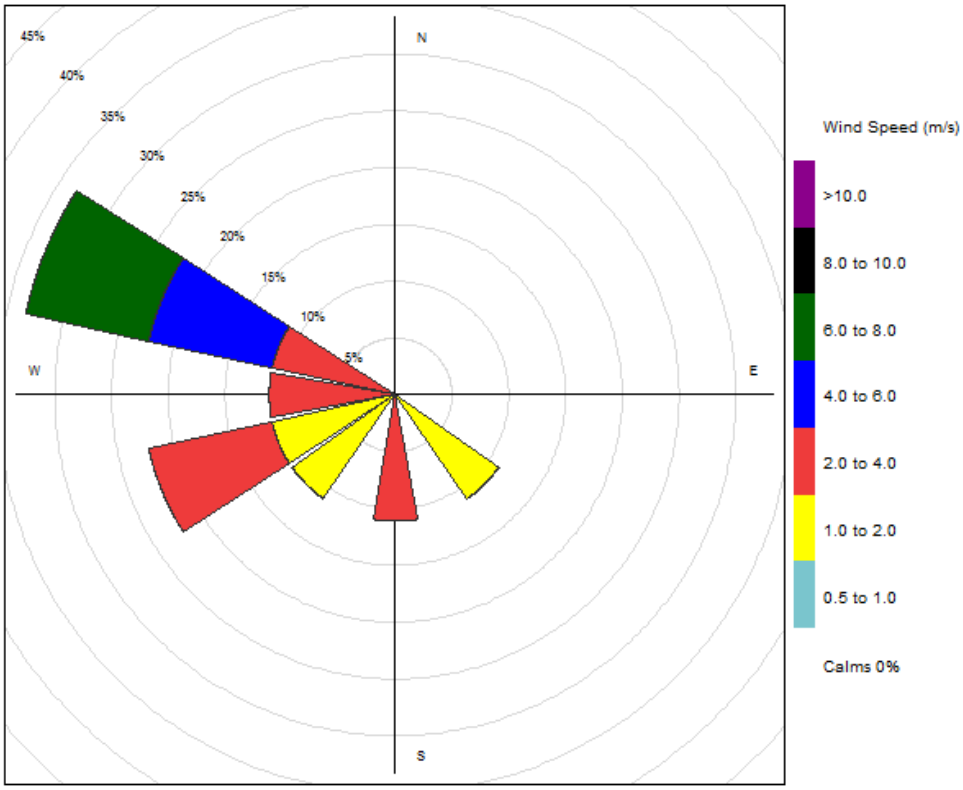


Figure C-14: Wind rose during alert event period, July 19, 2016.

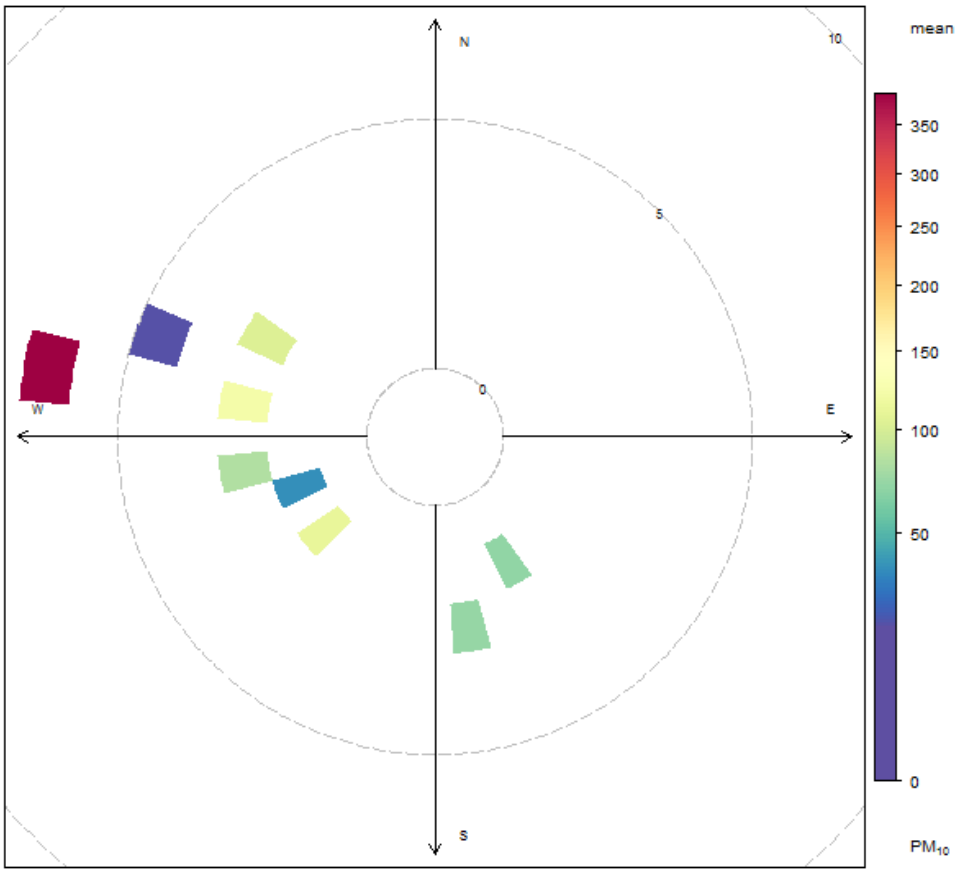


Figure C-15: Polar frequency plot for PM_{10} during alert event period, July 19, 2016.

C.6 Station 7B PM_{10} event from 2016-08-13 to 2016-08-19

The 3-day elevated PM_{10} event and time history are plotted as Figure C-16. The figure shows that this event was characterized by relatively constant PM_{10} concentration below the 24-hour objective of 50 µg/m^3 followed by a series of large and sudden increases and decreases in PM_{10} concentration that resulted in an increase of the 24-hour rolling average and thus, an exceedance. Concentrations showed numerous fluctuations over the entire alert period with a maximum hourly PM_{10} concentration of 725.5 µg/m^3 at 17:00 on August 16 followed by a gradual decline with many fluctuations.

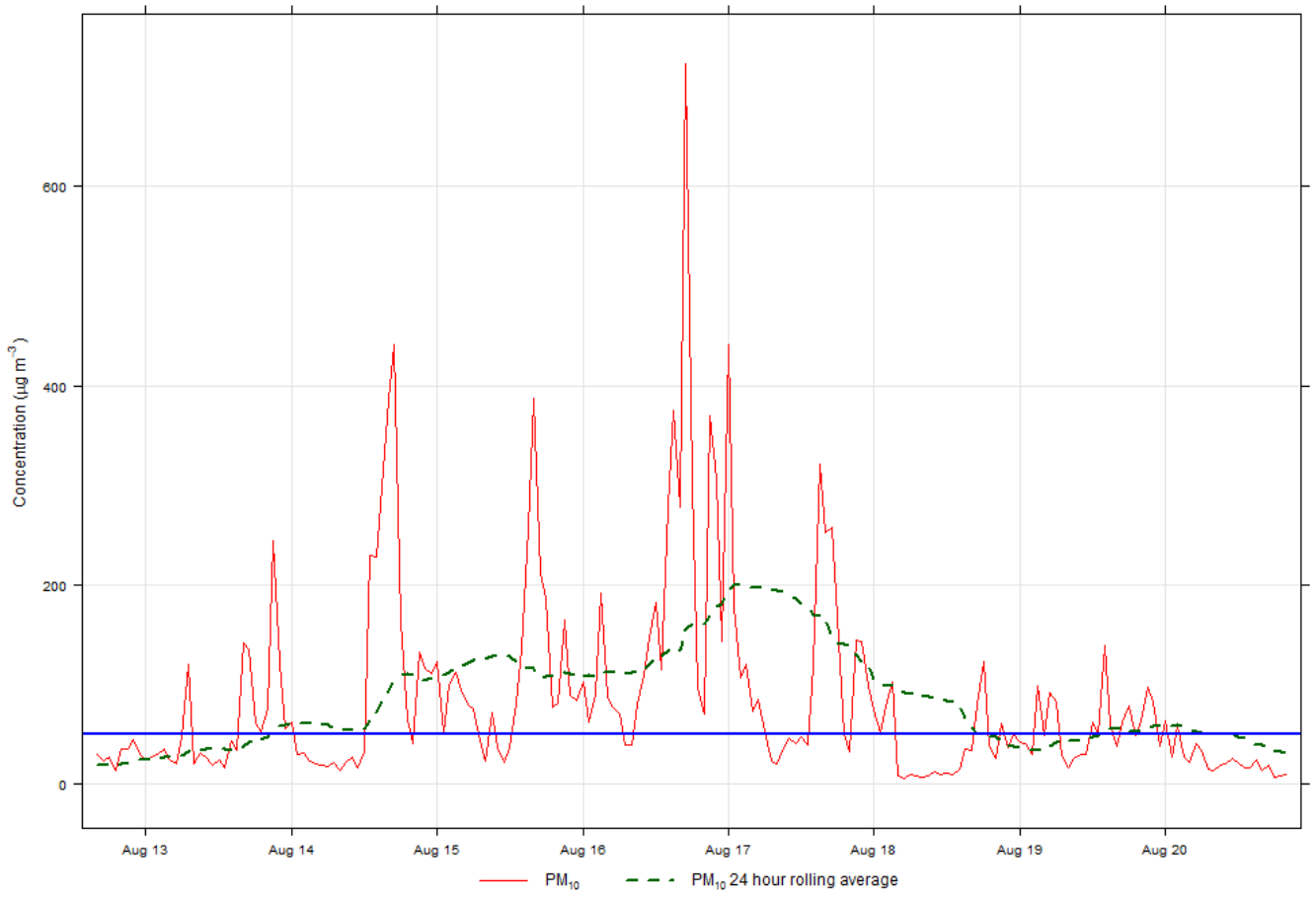


Figure C-16: PM_{10} time series plot for the period, August 13 to 20, 2016. Blue line indicates the 24-hour BC Ambient Air Quality Objective of 50 µg/m^3

The winds during the time of the event were predominantly from the west ranging from 1 to 6 m/s (Figure C-17). Calm wind speeds were recorded 1.3% of the time. The greatest PM_{10} concentrations were associated with winds from the west, west-northwest and west-southwest at wind speeds between 4 and 6 m/s (Figure C-18).

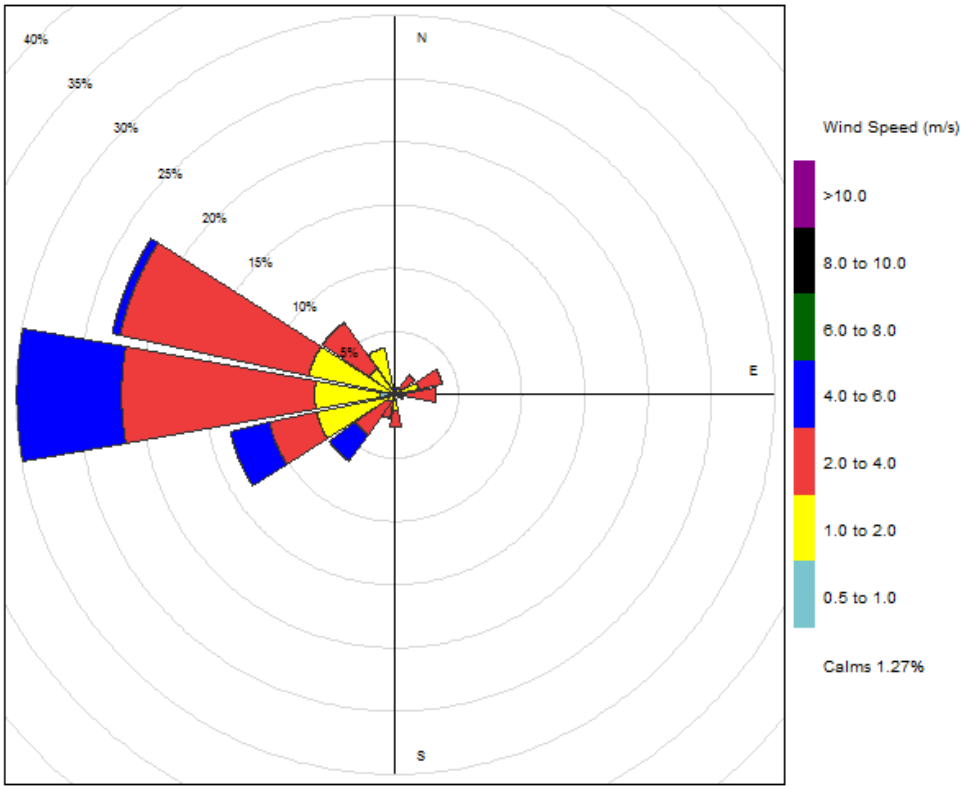


Figure C-17: Wind rose during alert event period, August 13 to 19, 2016.

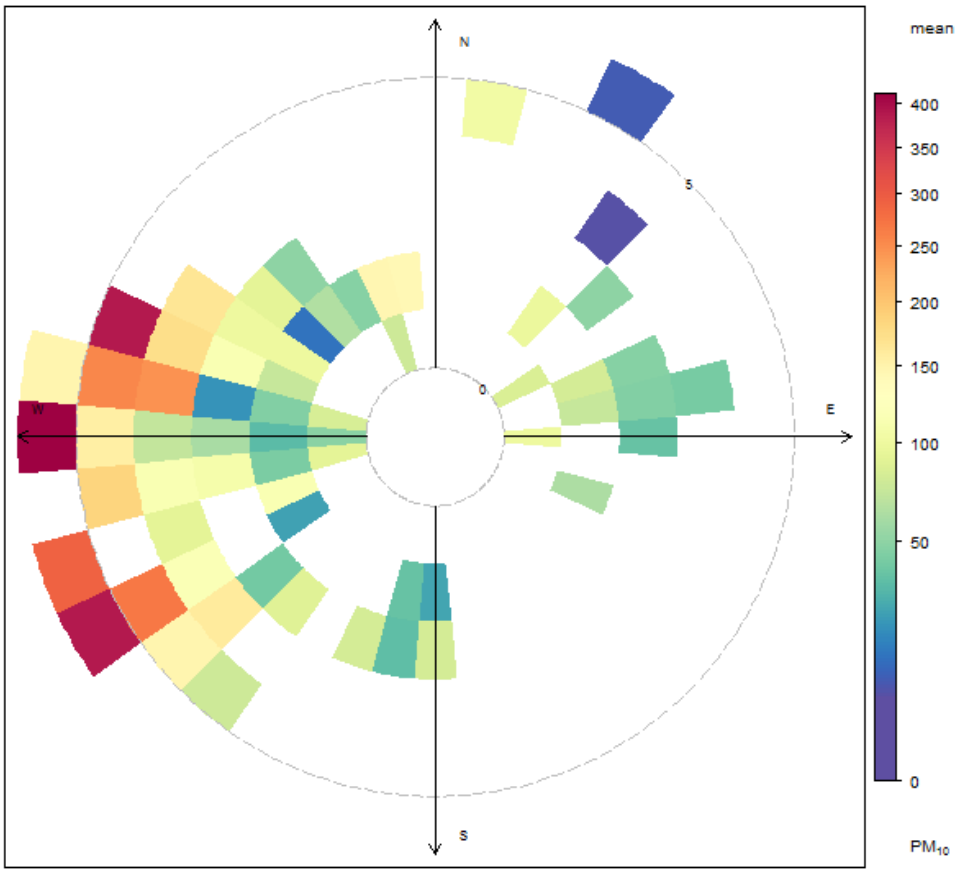


Figure C-18: Polar frequency plot for PM_{10} during alert event period, August 13 to 19, 2016.

C.7 Station 7B PM_{10} event on 2016-08-26

The 1-day elevated PM_{10} event and time history are plotted as Figure C-19. The figure shows that this event was characterized by relatively constant PM_{10} concentration well below the 24-hour objective of 50 µg/m^3 followed by an increases in PM_{10} concentration that began at approximately 16:00 on August 25. Concentrations showed numerous fluctuations over the entire alert period with a maximum hourly PM_{10} concentration of 273.6 µg/m^3 at 07:00 on August 26 followed by a rapid decline.

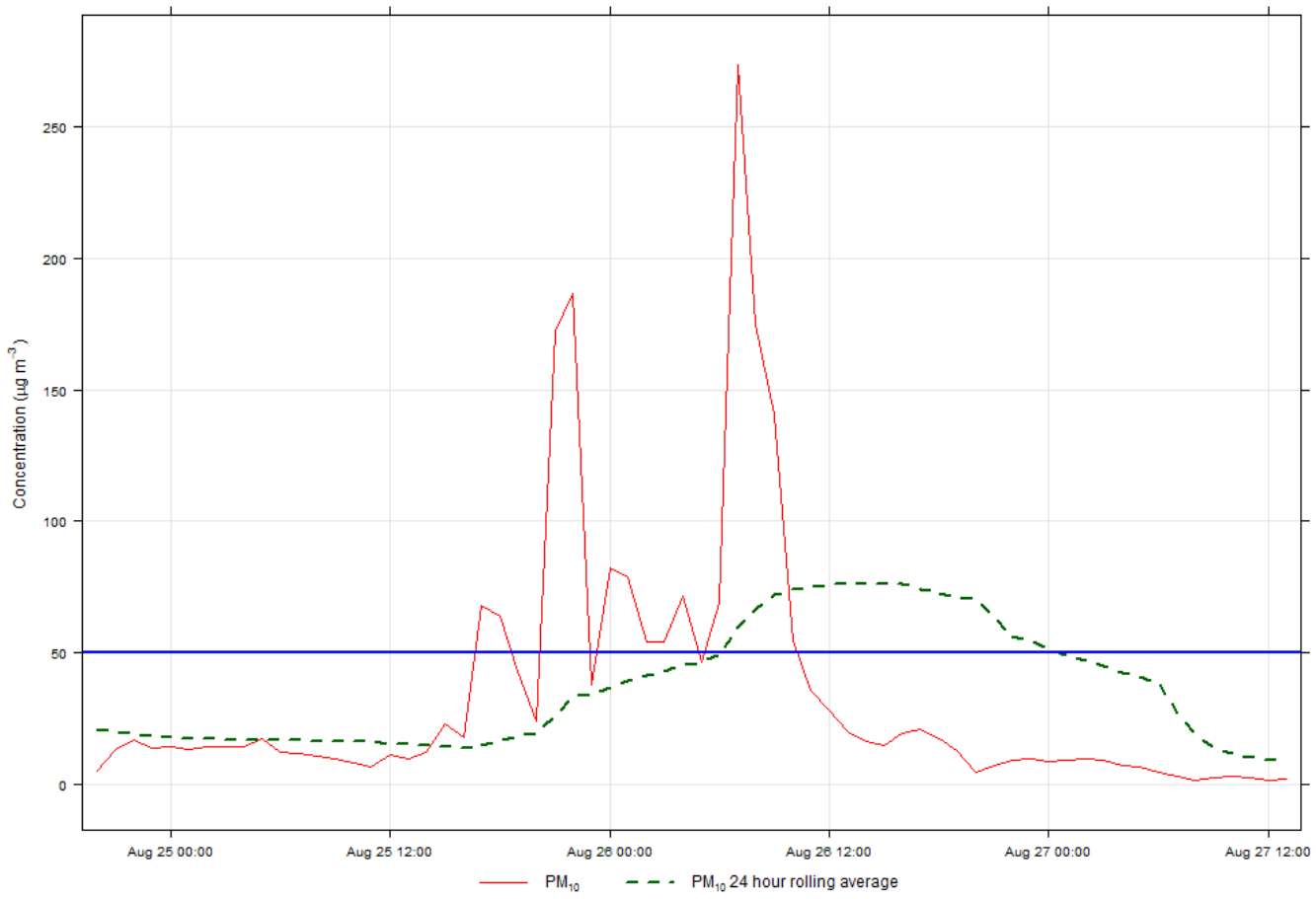


Figure C-19: PM_{10} time series plot for the period, August 25 to 27, 2016. Blue line indicates the 24-hour BC Ambient Air Quality Objective of 50 µg/m^3.

The winds during the time of the event were predominantly from the east-northeast and west ranging from 0.5 to 6 m/s (Figure C-20. Calm wind speeds accounted for 2.9% of the time period. The greatest PM_{10} concentrations were associated with winds from the east-northeast and west-northwest at wind speeds between 0 and 1 m/s (Figure C-21).

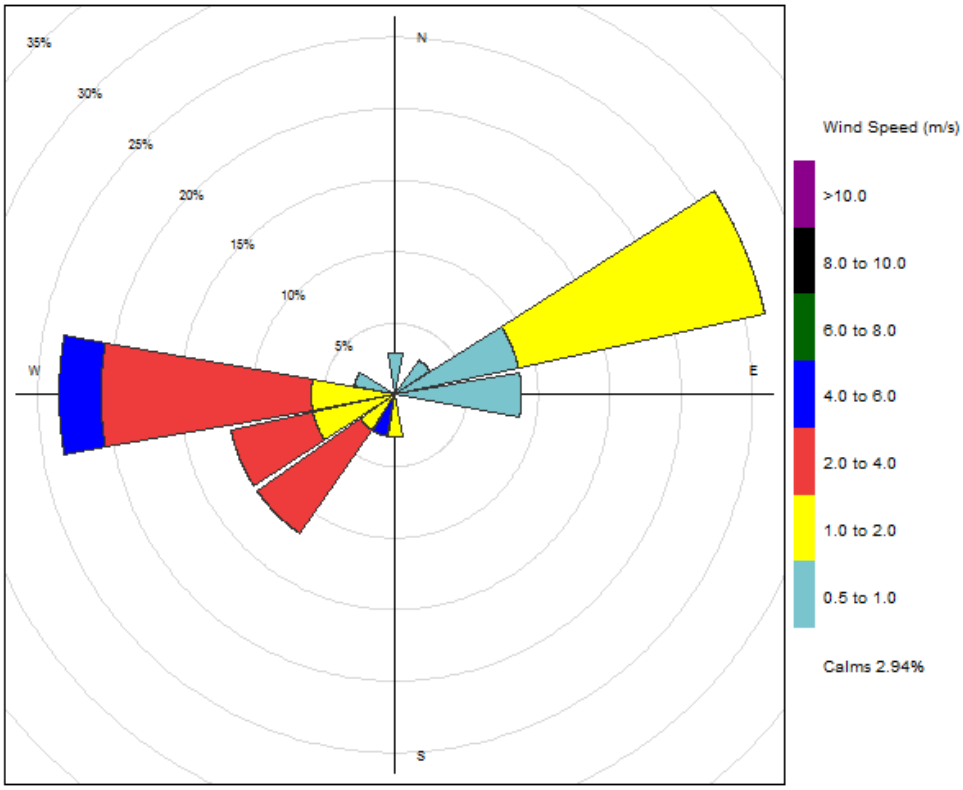


Figure C-20: Wind rose during alert event period, August 26, 2016.

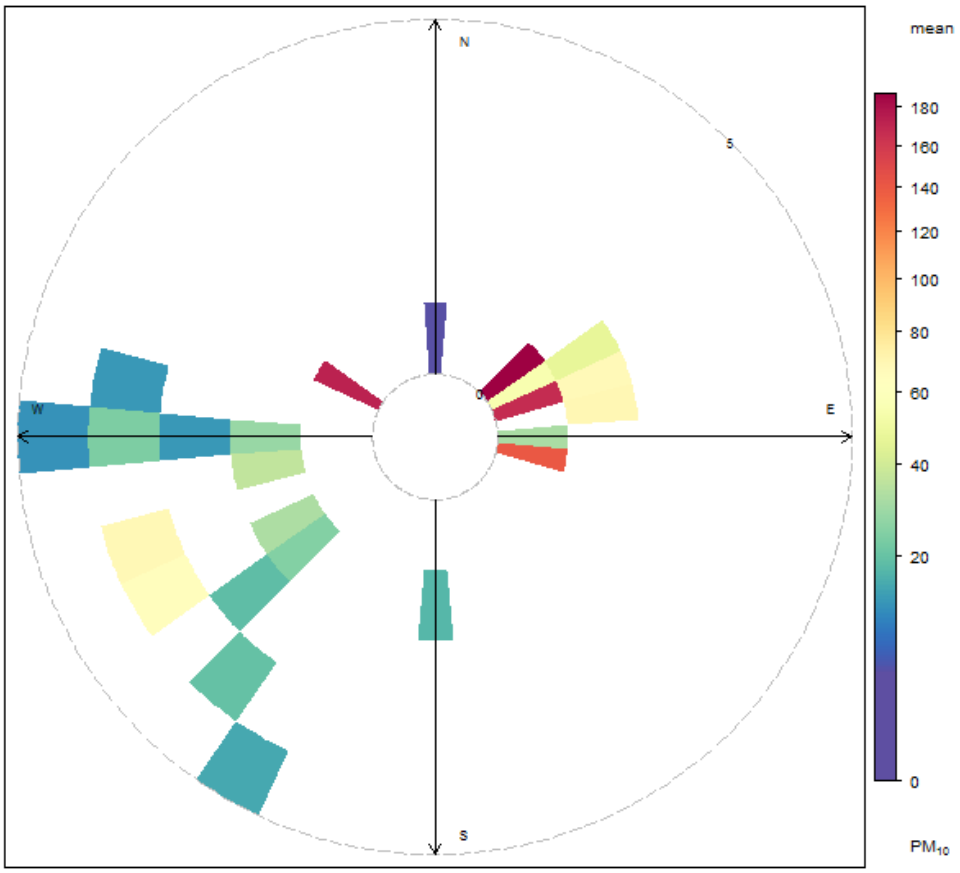


Figure C-21: Polar frequency plot for PM_{10} during alert event period, August26, 2016.

C.8 Station 7B PM_{10} event from 2016-09-04 to 2016-09-05

The 2-day elevated PM_{10} event and time history are plotted as Figure C-22. The figure shows that this event was characterized by very low PM_{10} concentrations, well below the 24-hour objective of 50 µg/m^3, followed by a sudden increase in PM_{10} concentration that began at approximately 02:00 on September 4. Concentrations showed numerous fluctuations over the entire alert period with a maximum hourly PM_{10} concentration of 209.9 µg/m^3 at 20:00 on September 5 followed by a rapid decline.

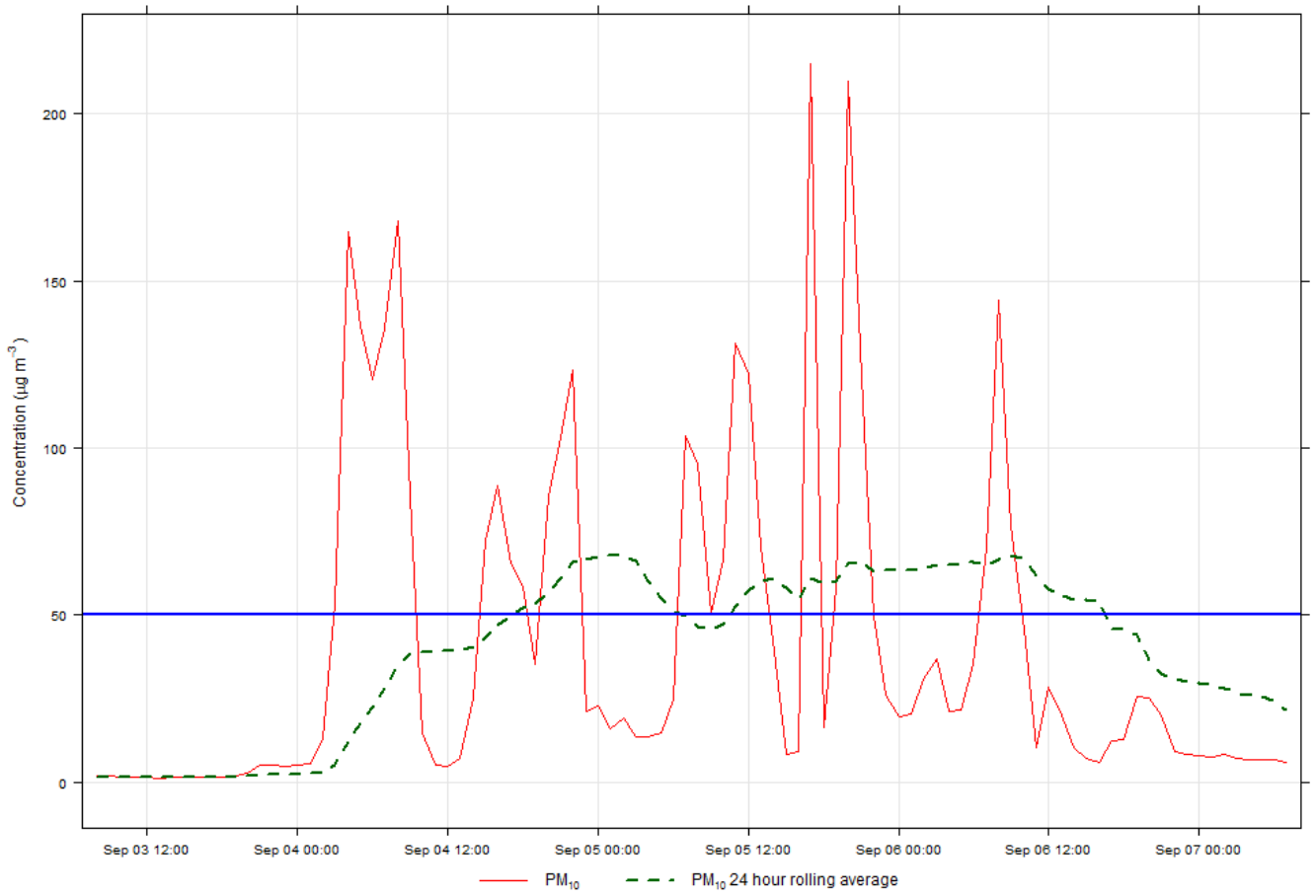


Figure C-22: PM_{10} time series plot for the period, September 3 to 7, 2016. Blue line indicates the 24-hour BC Ambient Air Quality Objective of 50 µg/m^3.

The winds during the time of the event were predominantly from the east from 1 to 4 m/s (Figure C-23). Calm wind speeds were recorded for 12.5% of the time. The greatest PM_{10} concentrations were associated with winds from the southeast at wind speeds between 1 and 2 m/s (Figure C-24).

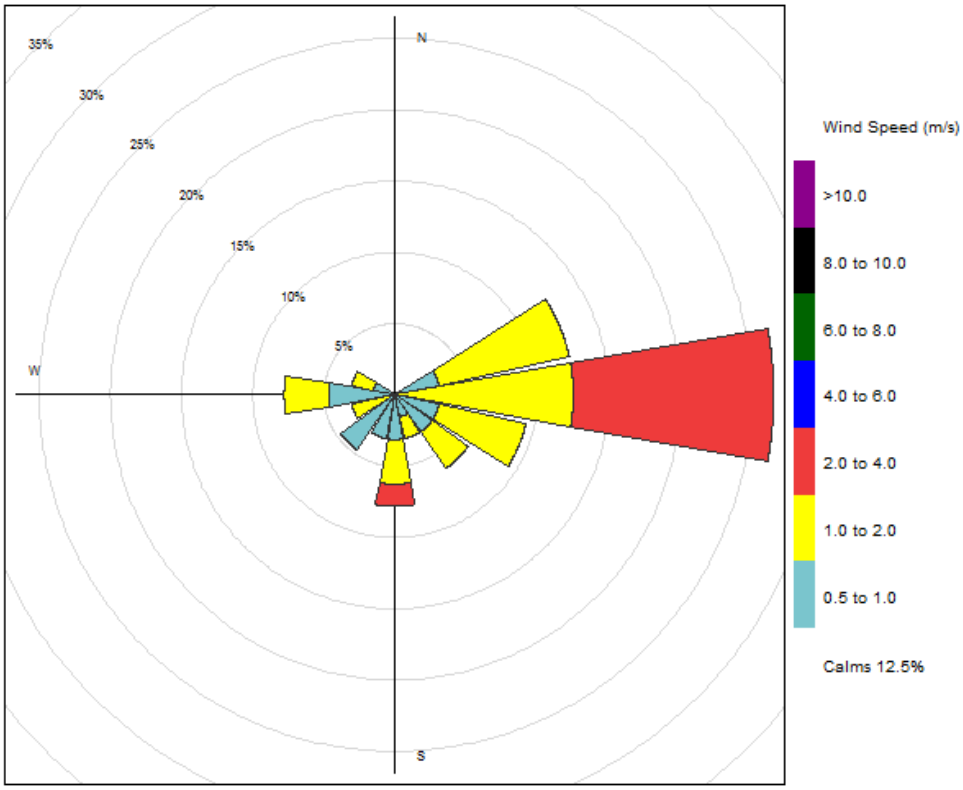


Figure C-23: Wind rose during alert event period, September 4 to 5, 2016.

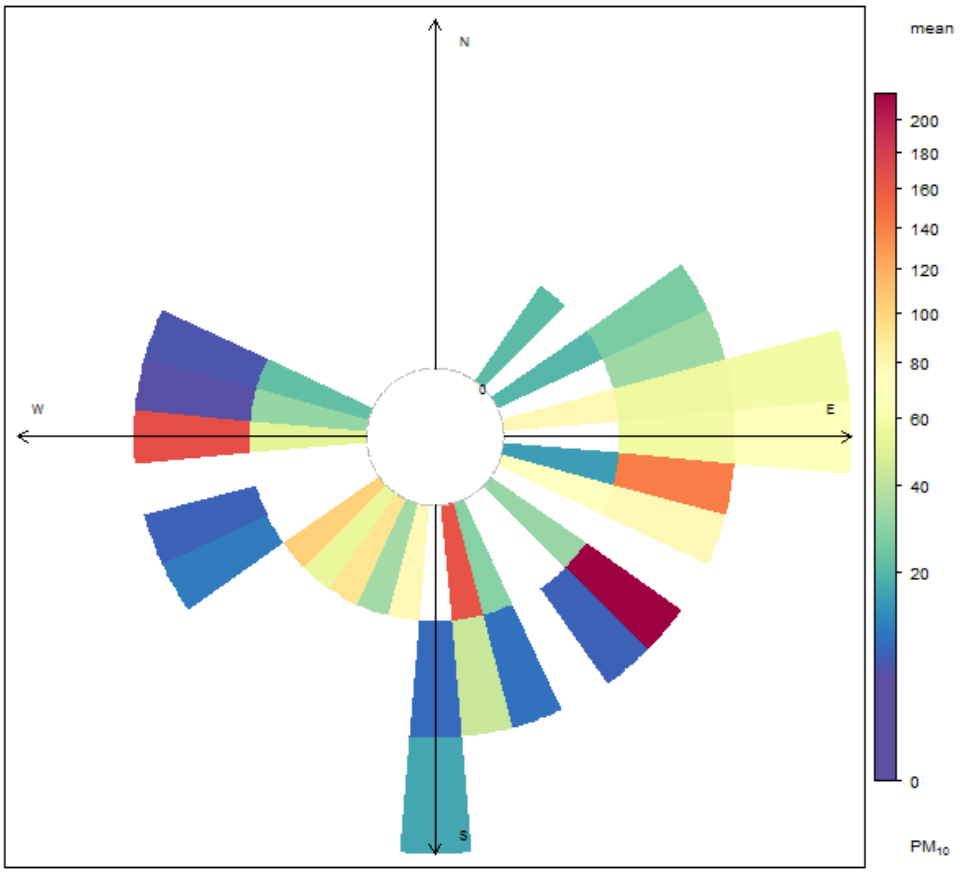


Figure C-24: Polar frequency plot for PM_{10} during alert event period, September 4 to 5, 2016.

C.9 Station 7B PM_{10} event from 2016-09-21 to 2016-09-23

The 3-day elevated PM_{10} event and time history are plotted as Figure C-25. The figure shows that this event was characterized by relatively constant PM_{10} concentration just below the 24-hour objective of 50 µg/m^3 followed by a sudden large spike in PM_{10} concentration to 477.8 µg/m^3 that occurred at 06:00 on September 21. Concentrations then showed numerous fluctuations over the following days followed by a gradual decline.

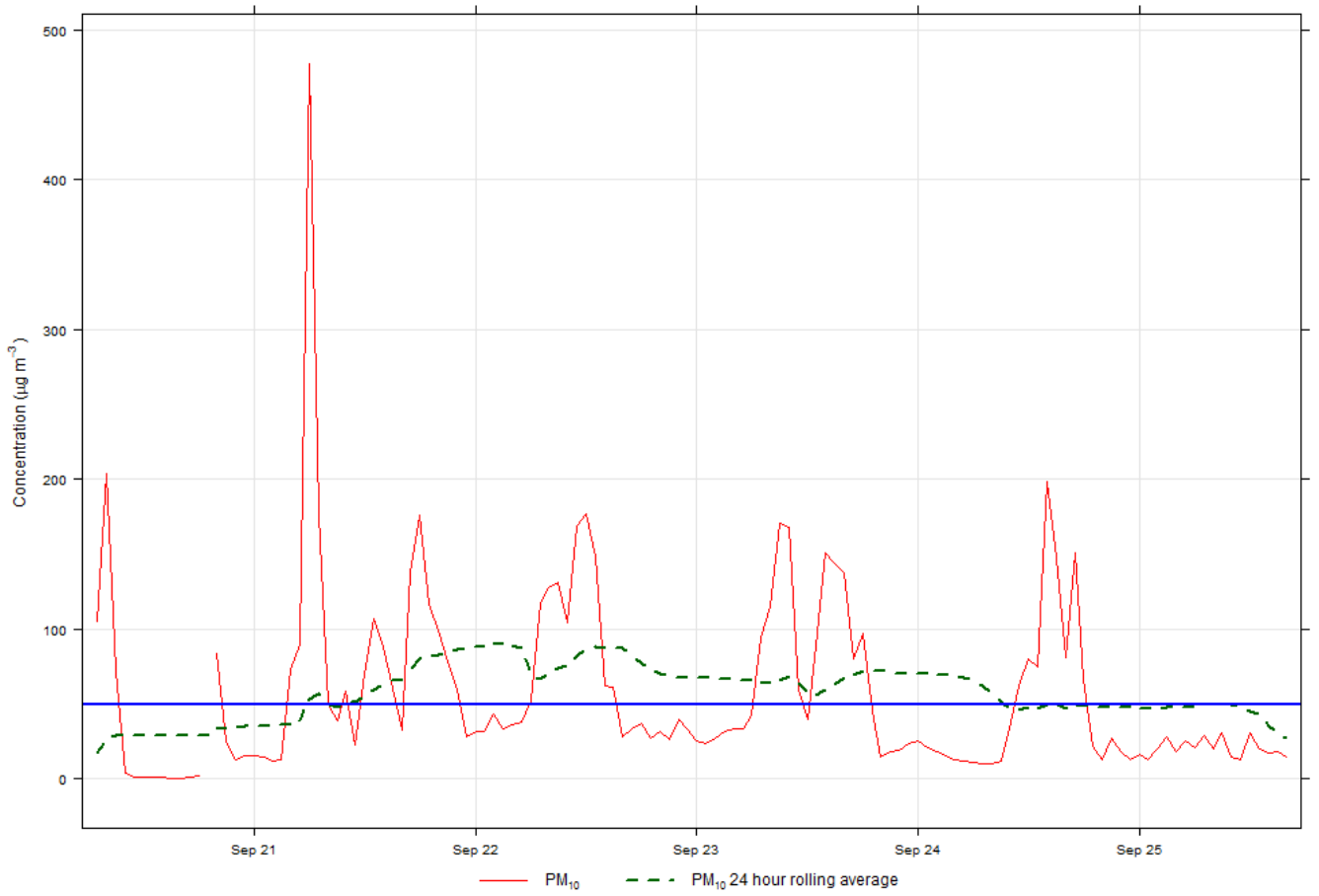


Figure C-25: PM_{10} time series plot for the period, September 21 to 25, 2016. Blue line indicates the 24-hour BC Ambient Air Quality Objective of 50 µg/m^3.

The winds during the time of the event were predominantly from the east and west-northwest ranging from 1 to 10 m/s Figure C-26). Calm wind speeds were recorded 3.3% of the time. The greatest PM_{10} concentrations were associated with winds from the northwest at wind speeds between 0 and 1 m/s (Figure C-27).

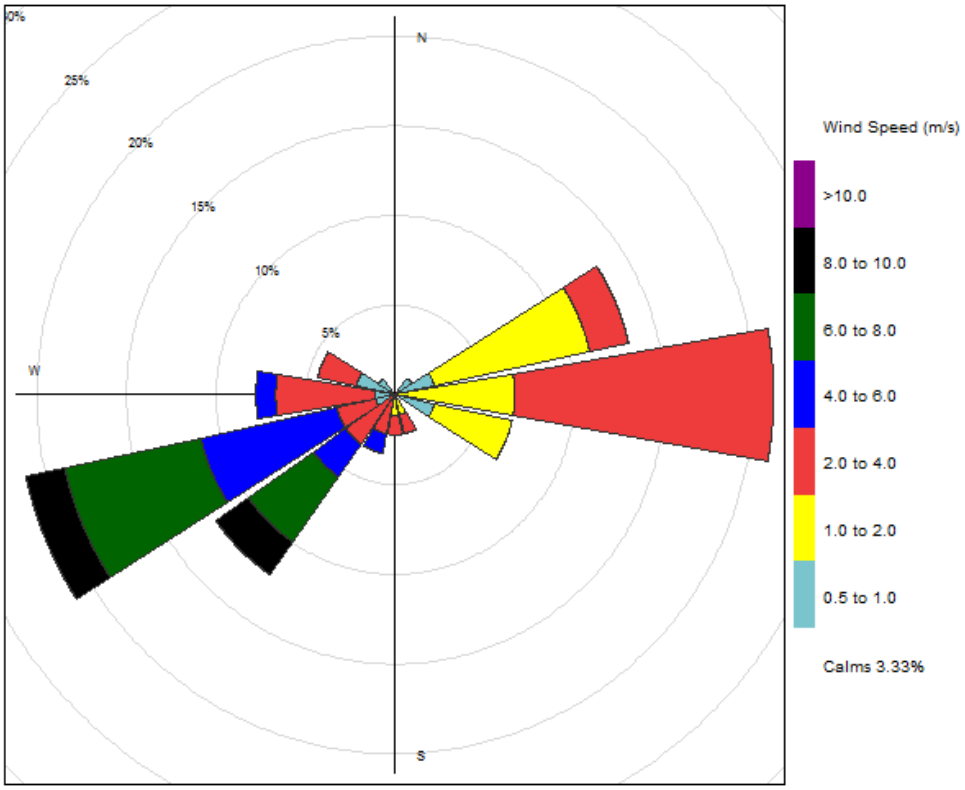


Figure C-26: Wind rose during alert event period, September 21 to 23, 2016.

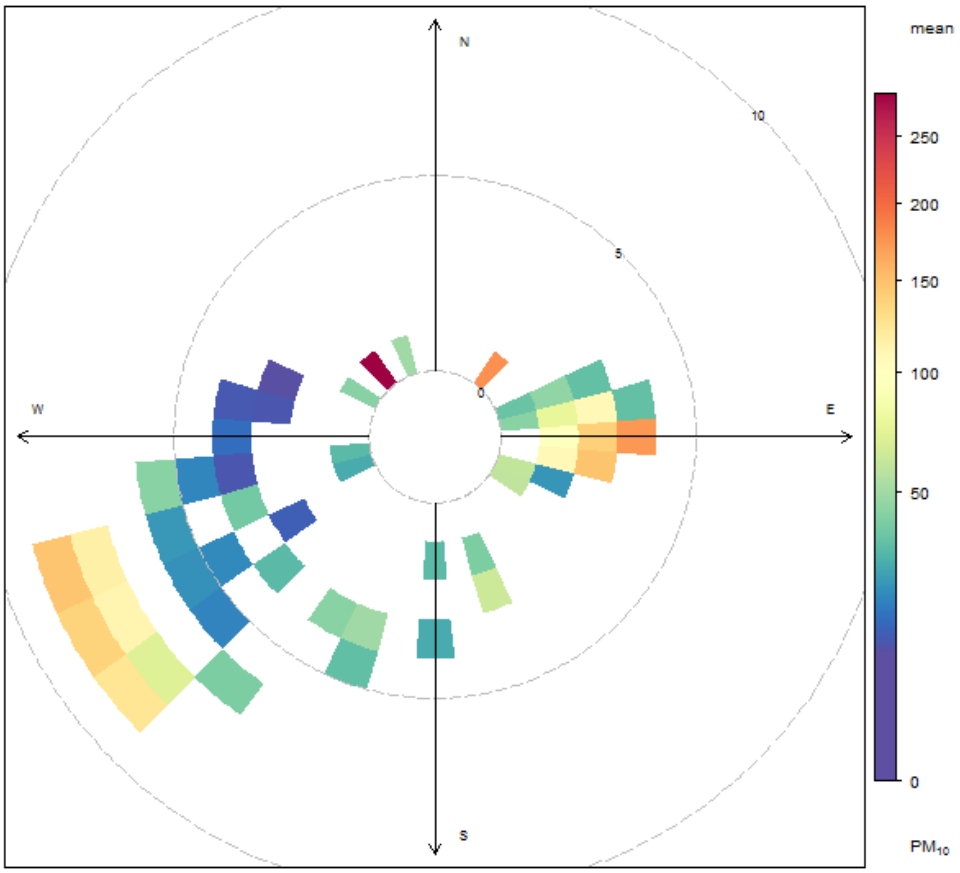


Figure C-27: Polar frequency plot for PM_{10} during alert event period, September 21 to 23, 2016.

C.10 Station 7B $PM_{2.5}$ event on 2016-09-21

The 1-day elevated $PM_{2.5}$ event and time histories are plotted as Figure C-28. The figure shows that this event was characterized by large fluctuations in hourly $PM_{2.5}$ concentrations. Greater amplitude and frequency in these fluctuations beginning at approximately 11:00 on September 21 caused the 24 hour rolling average concentration to exceed the AAQO of 25 µg/m^3 followed by an overall decline and settling in $PM_{2.5}$ concentrations.

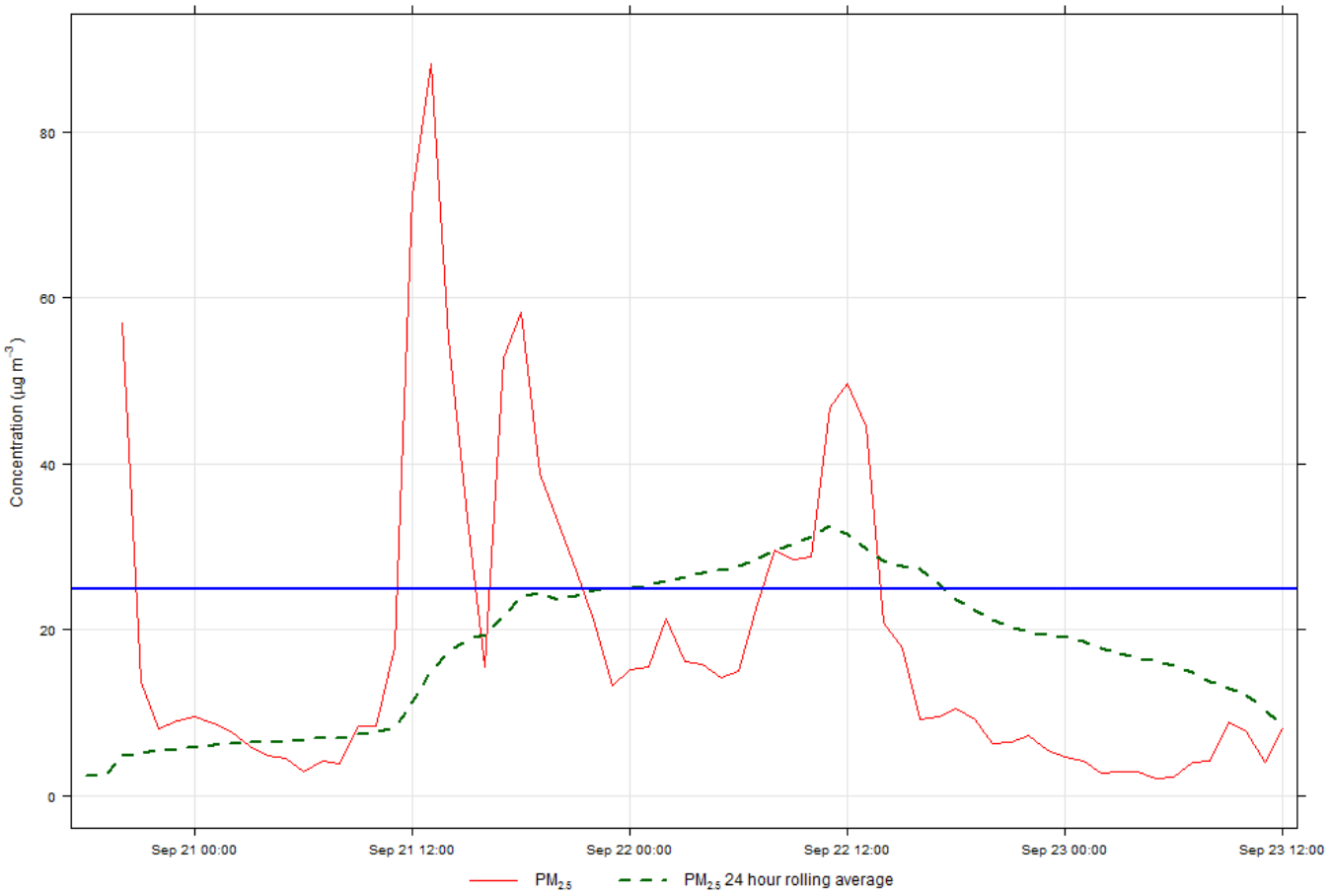


Figure C-28: $PM_{2.5}$ time series plot for the period, September 21 to 23, 2016. Blue line indicates the 24-hour BC Ambient Air Quality Objective of 25 µg/m^3.

The winds during the time of the event were predominantly from the east ranging from 1 to 4 m/s (Figure C-29). Calm wind speeds were observed 4.6% of the time. The greatest $PM_{2.5}$ concentrations were associated with winds from the east-southeast at wind speeds between 1 and 2 m/s (Figure C-30).

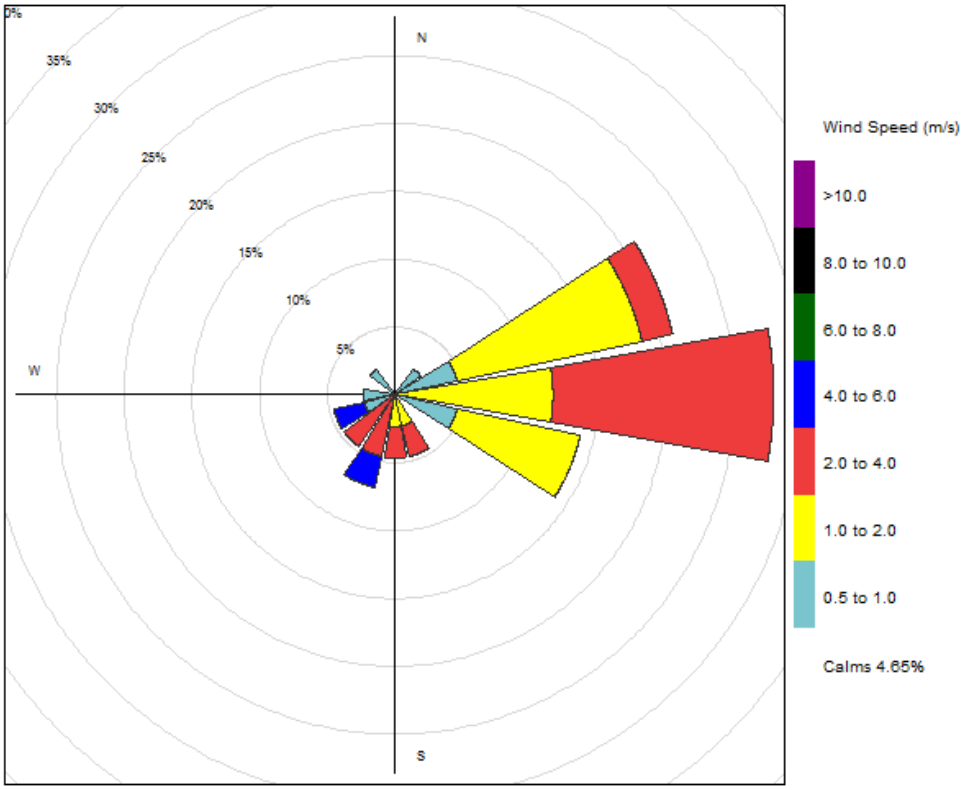


Figure C-29: Wind rose during alert event period, September 21, 2016.

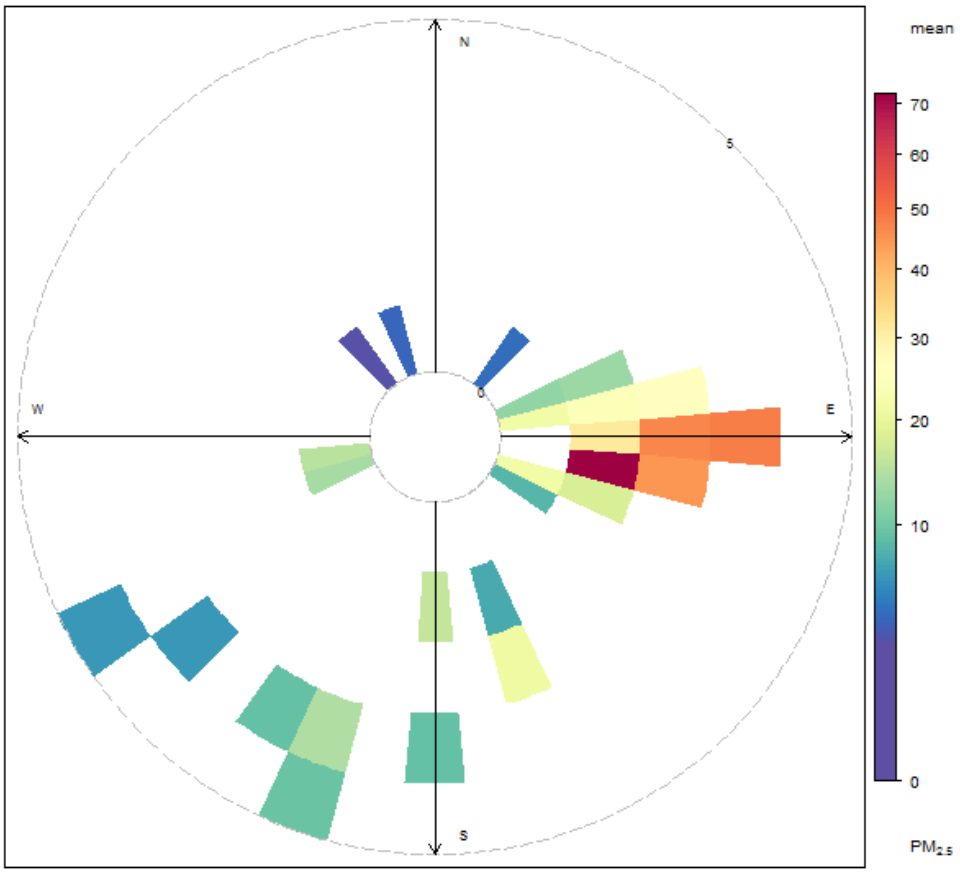


Figure C-30: Polar frequency plot for $PM_{2.5}$ during alert event period, September 21, 2016.

C.11 Stn7B PM_{10} event on 2016-09-28

The 1-day elevated PM_{10} event and time history are plotted as Figure. The figure shows that this event was characterized by variable one-hour PM_{10} mostly below the 24-hour objective of 50 µg/m^3 followed by a sudden increase in PM_{10} concentration 150.1 µg/m^3 at 20:00 on September 28. Afterwards, PM_{10} concentrations are seen to decrease with another momentary spike of PM_{10} concentrations that is not large enough to increase the 24 hour rolling average above 50 µg/m^3 once more.

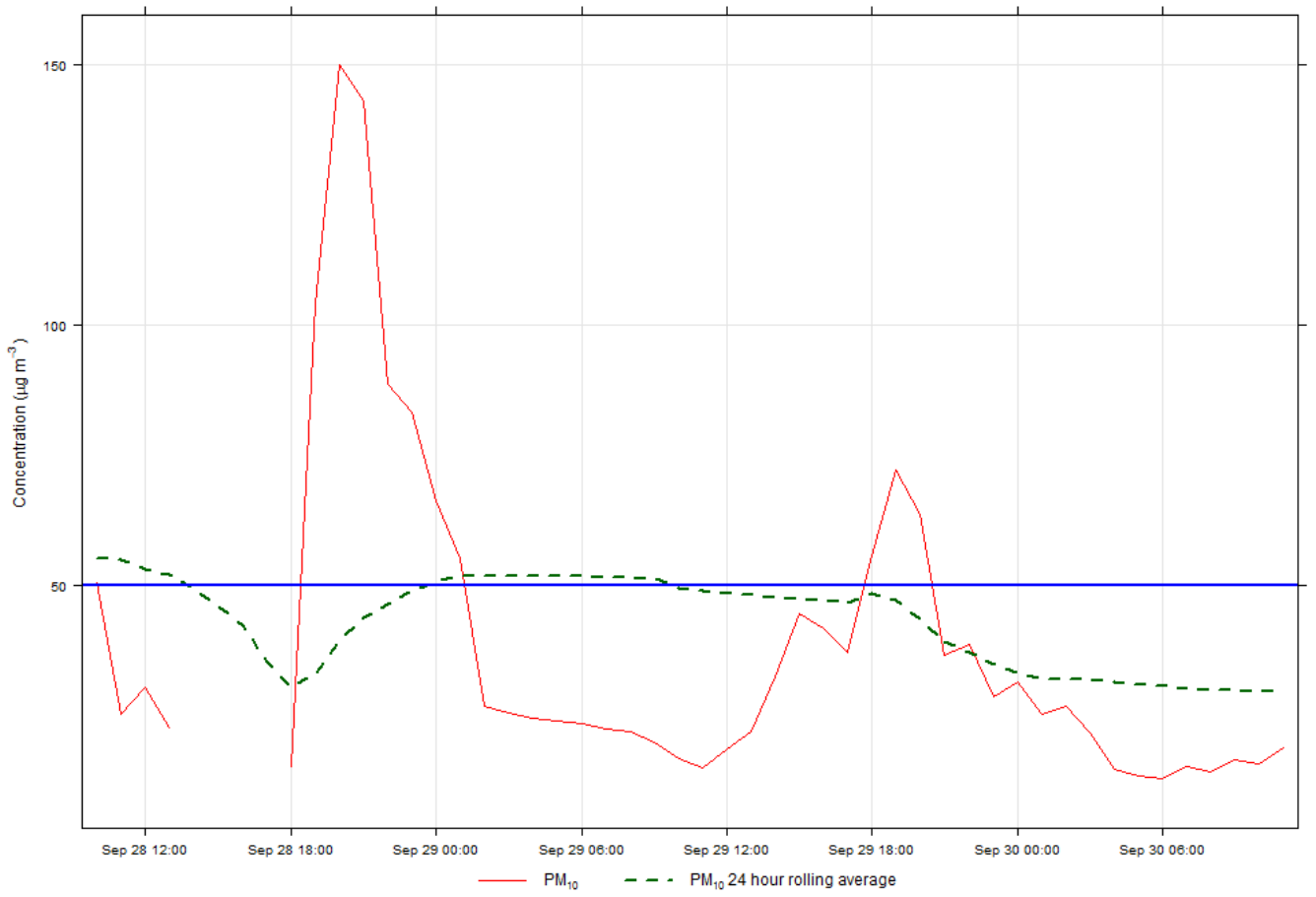


Figure C-31: PM_{10} time series plot for the period, September 28 to 30, 2016. Blue line indicates the 24-hour BC Ambient Air Quality Objective of 50 µg/m^3.

The winds during the time of the event were predominantly from the northwest and north-northeast ranging from 0.5 to 4 m/s (Figure C-32). Calm wind speeds were recorded 5.9% of the time. The greatest $PM_{2.5}$ concentrations were associated with winds from the east-northeast at wind speeds between 1 and 2 m/s (Figure C-33).

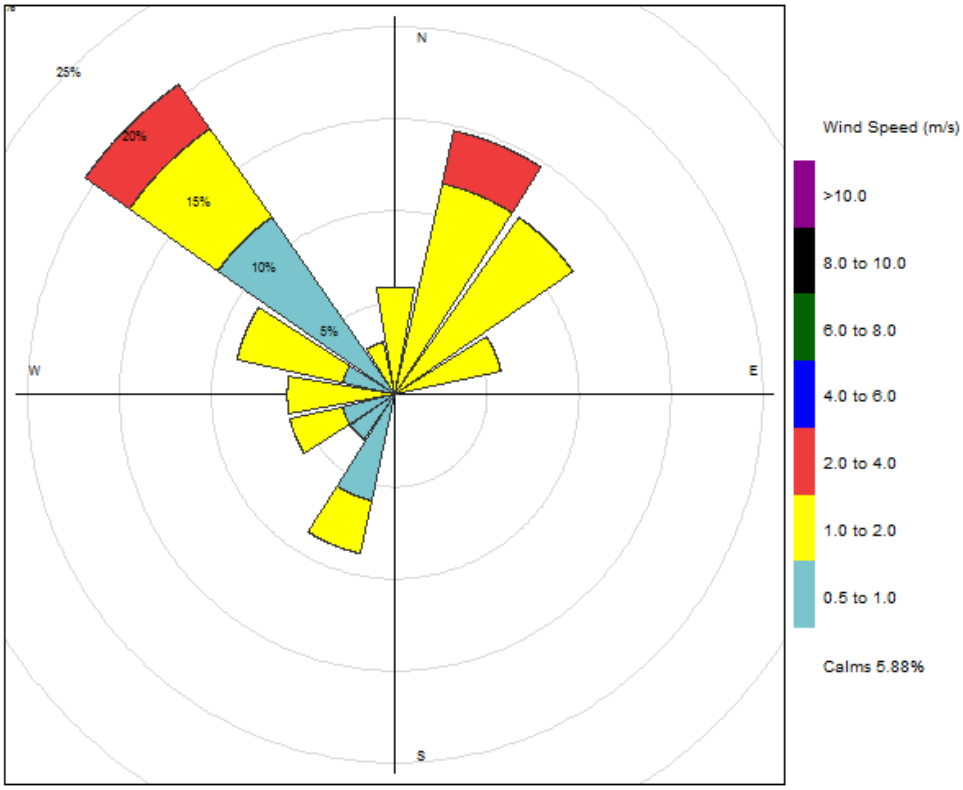


Figure C-32: Wind rose during alert event period, September 28, 2016.

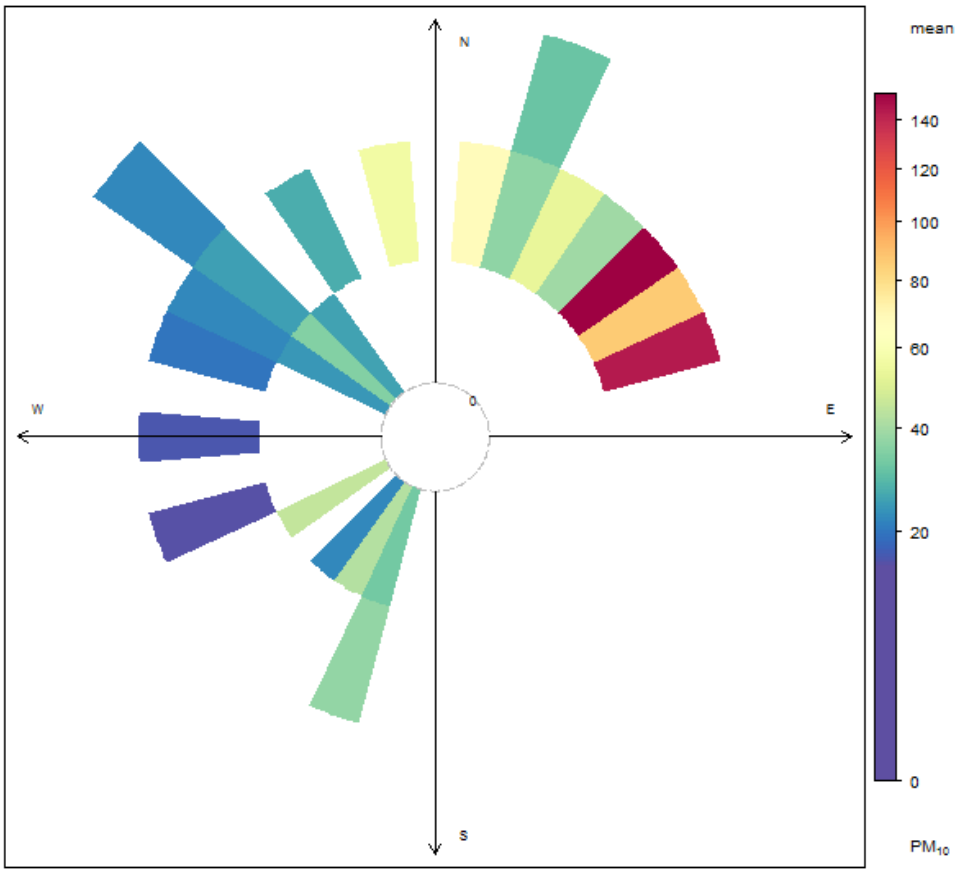


Figure C-33: Polar frequency plot for PM_{10} during alert event period, September 28, 2016.

C.12 Station7B PM_{10} event from 2016-12-18 to 2016-12-22

To assist with our understanding of this five day event beginning on December 18, 2016 when an alert was issued for elevated PM_{10} concentrations at Site C, RWDI created some plots of the PM_{10} measurements in addition to the wind conditions. The 5-day elevated PM_{10} event and time histories are plotted below in Figure C- 34. The figure shows that the event was characterized by a sharp increase in PM_{10} concentration at approximately 0300h on December 18. Concentrations remained high but variable for the majority of the 5-day event with a maximum hourly concentration reaching 1174 µg/m^3 at 2300h on December 19.

The winds during the time of the alert were from the west-southwest and west and between 4.0 and 10.0 m/s (Figure C- 35) with the highest concentrations associated with winds from the southwest at wind speeds between 7.0 and 9.0 m/s (Figure C- 36). No calm wind speeds were recorded over the five day period.

As there were no other alerts at other air quality monitoring stations in the region, it is likely that this event was caused by local emission sources at or near the dam site construction area.

This five day event resulted in four exceedances above the 24-hour BC Ambient Air Quality Objective for PM_{10} of 50 µg/m^3, over the period, December 18-21.

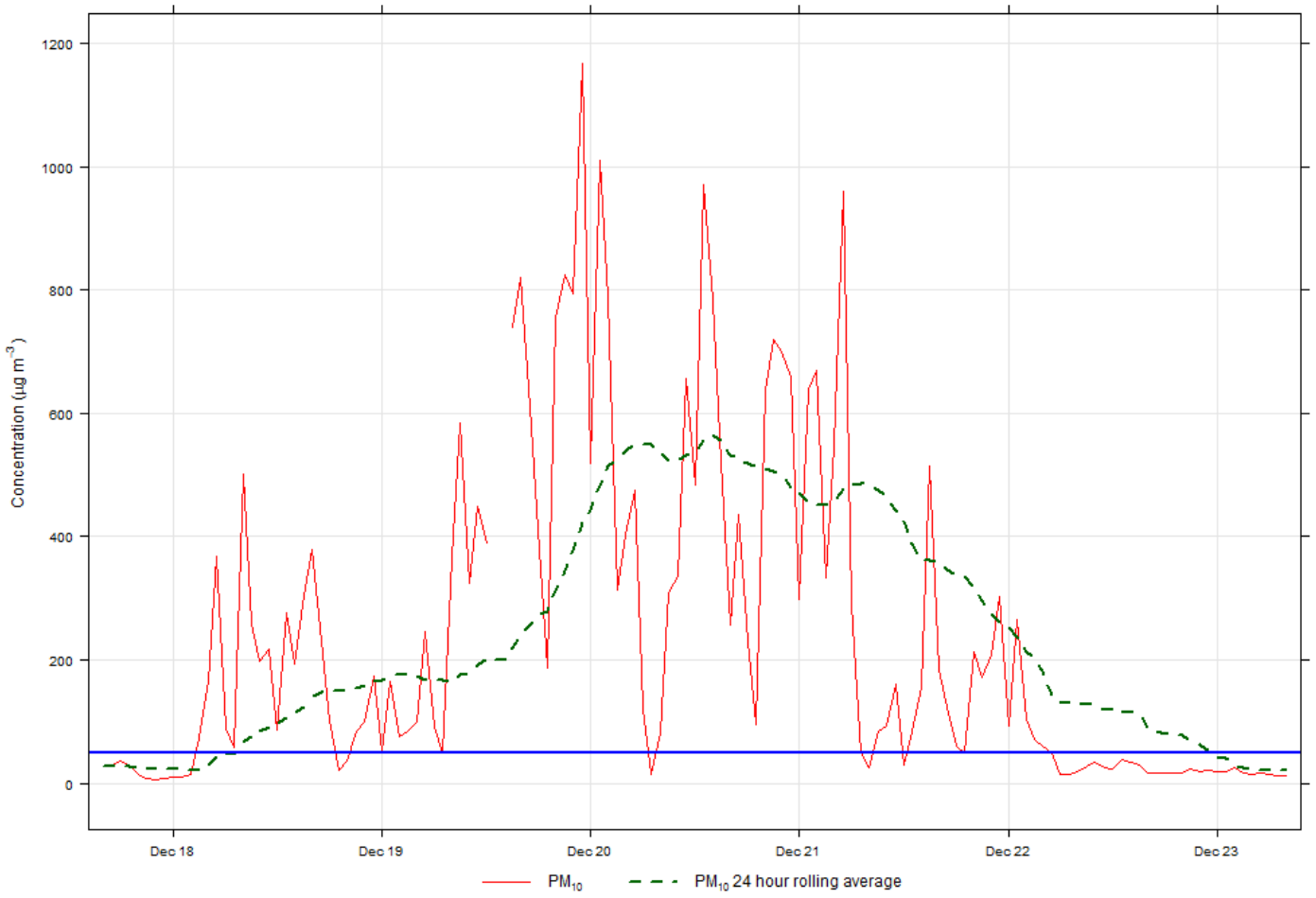


Figure C- 34: PM_{10} time series plot for the period, December 18 to 23, 2016. Blue line indicates the 24-hour BC Ambient Air Quality Objective of 50 µg/m^3

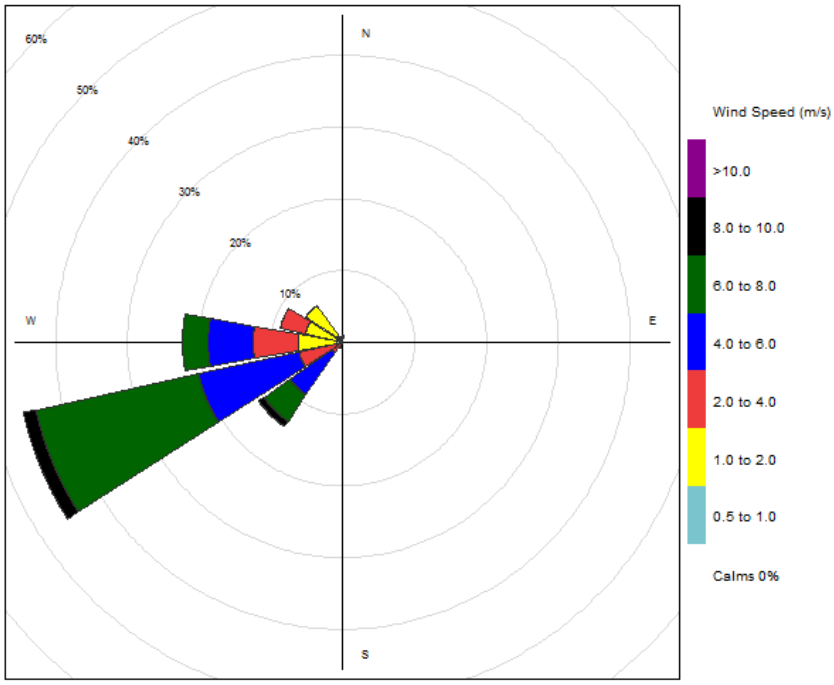


Figure C- 35: Wind rose during alert event period, December 18 to 23, 2016.

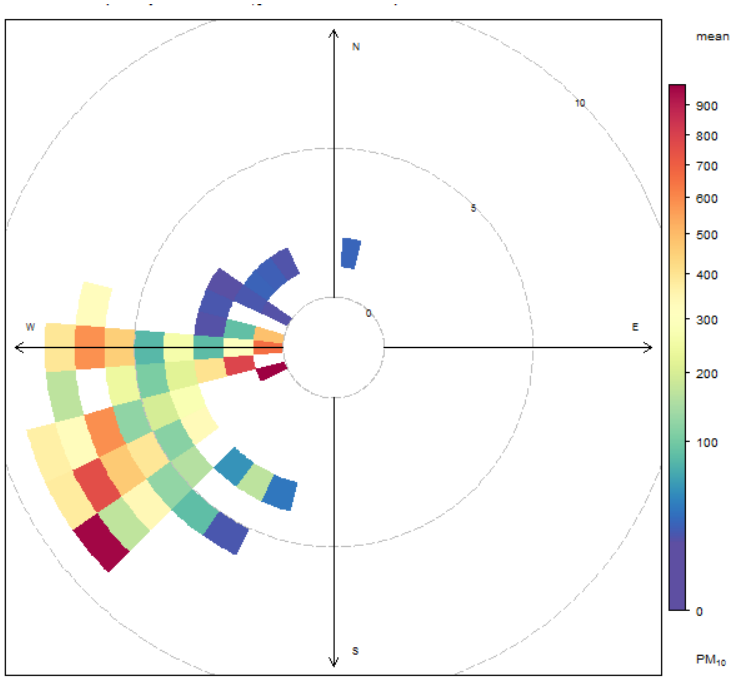


Figure C- 36: Polar frequency plot for PM_{10} during alert event period, December 18 to 23, 2016.

C.13 Station 7B PM_{10} event from 2016-12-27 to 2016-12-29

To assist with our understanding of this event which began on December 26, 2016 when an alert was issued for elevated PM_{10} concentrations at Site C, RWDI created some plots of the PM_{10} measurements in addition to the wind conditions. The 5-day elevated PM_{10} event and time history are plotted below as Figure C- 37. The figure shows that this event was characterized by a relatively constant PM_{10} concentration slightly below the 24-hour objective of 50 µg/m^3 followed by a sharp increase in concentration at approximately 0500h on December 28. Concentrations showed numerous peaks over the entire alert period with a maximum concentration of 1424 µg/m^3 at 2000h on December 28. The hourly concentrations dropped below the 24-hour objective at 1500h on December 29 with the running 24-hour average dropping below the objective at 1400h on December 30.

The winds during the time of this alert were predominantly from the west-southwest and west-northwest ranging from 2.0 to 10.0 m/s (Figure C- 38) with the highest PM_{10} concentrations associated with winds from the west-southwest at wind speeds between 7.0 and 8.0 m/s (Figure C- 39).

As there were no other alerts at other air quality monitoring stations in the region, it is likely that this event was caused by local emission sources at or near the dam site construction area.

This event did result in three exceedances above the 24-hour BC Ambient Air Quality Objective for PM_{10} of 50 µg/m^3 from December 28 to 30.

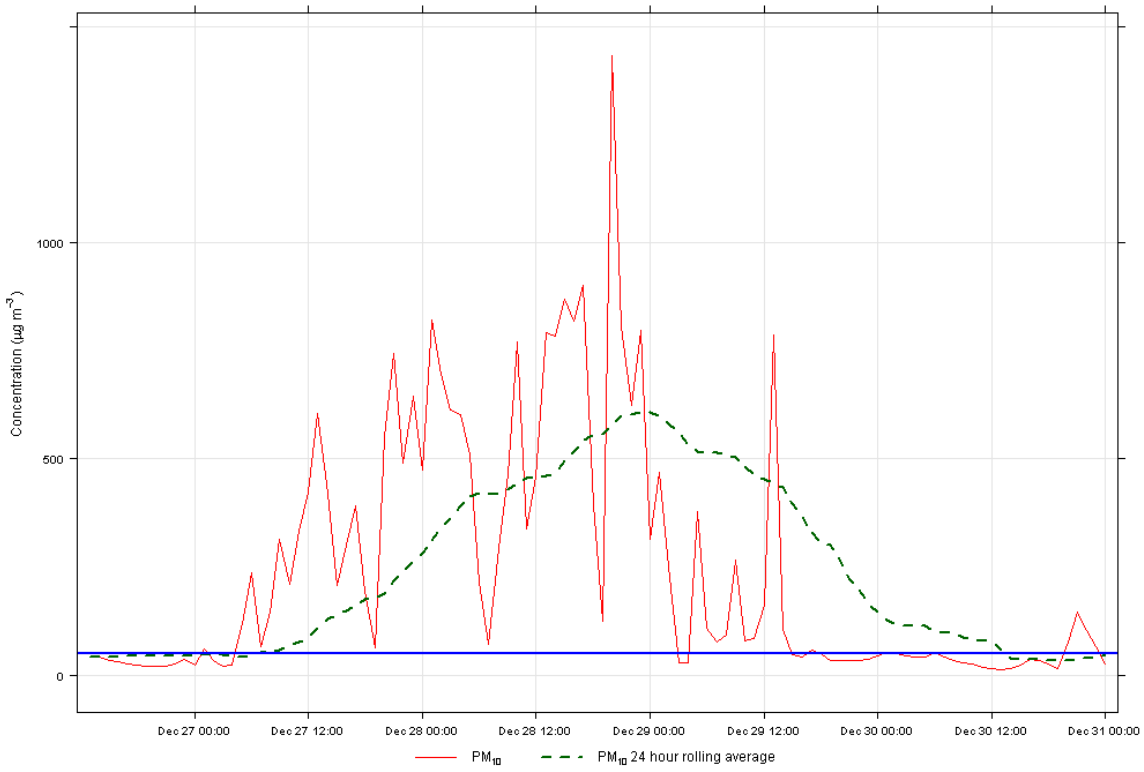


Figure C- 37: PM_{10} time series plot for the period, December 27 to 31, 2016. Blue line indicates the 24-hour BC Ambient Air Quality Objective of 50 µg/m^3.

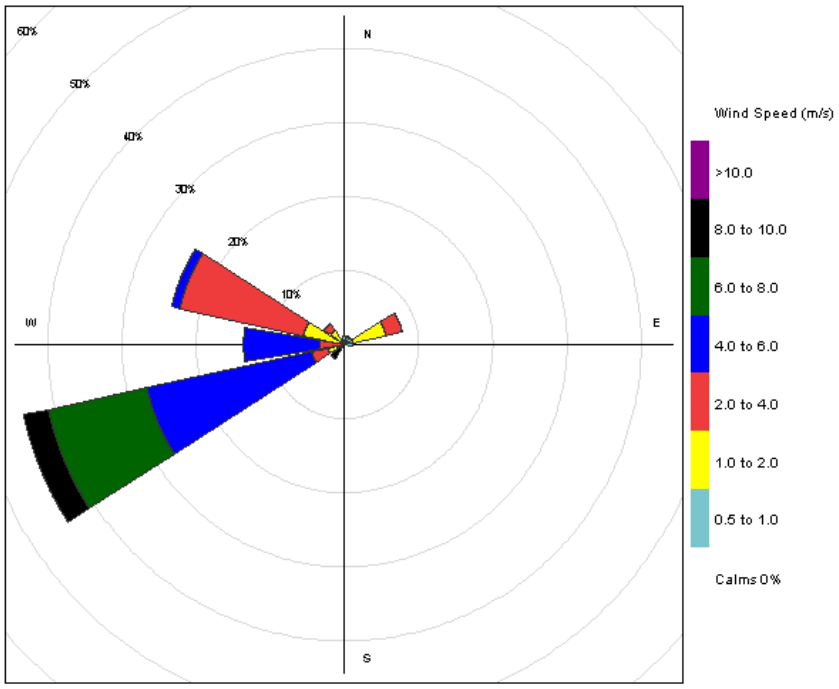


Figure C- 38: Wind rose during alert event period, December 26 to 30, 2016.

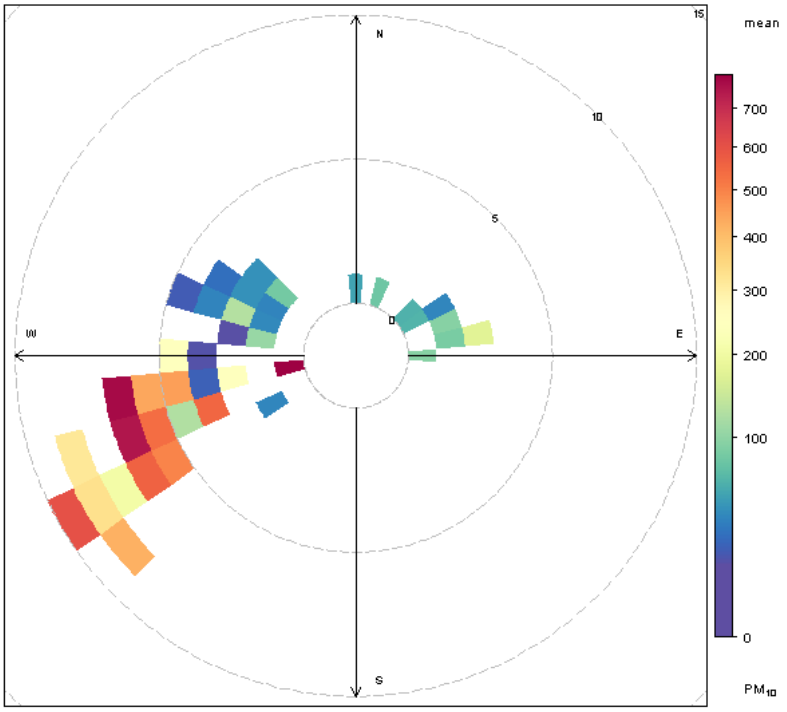


Figure C- 39: Polar frequency plot for PM_{10} during alert event period, December 26 to 30, 2016.

APPENDIX D – EDDY COVARIANCE REPORT

APPENDIX D: EDDY COVARIANCE REPORT

D1 Introduction

As part of the collection of baseline environmental data for the Site C project area, eddy covariance (EC) systems were installed at three meteorological stations: Station 1 (Upper Attachie), Station 2 (Lower Attachie) and Station 4 (Bear Flat). This report summarizes the results of the EC component of the baseline environmental measurement program for 2016.

The EC technique has become the standard method for measuring sensible heat flux (H), latent heat flux (λE) and CO_2 flux (F_c) over footprints of ≤ 1 km^2 (Baldocchi, 2003). Knowledge of the partitioning of available energy ($R_n - G$, or net radiation minus soil heat flux) between sensible and latent heat fluxes is critical for understanding the interaction of the measured ecosystem with the overall water cycle, atmospheric boundary layer development, weather, and climate (Wilson et al. 2002). Measurements of F_c yield the net ecosystem productivity (NEP)—the difference between gross ecosystem photosynthesis (GEP) and ecosystem respiration (R). NEP is a direct measure of whether an ecosystem is a source (NEP < 0), or a sink (NEP > 0) of atmospheric C over time and is a useful indicator of ecosystem health because it integrates the individual responses of GEP and R to weather and environmental variables. In addition, in managed forest or agricultural settings, NEP measurements can serve as a useful indicator of overall ecosystem response to a particular management practice (e.g. selective harvesting, no-tillage farming).

EC systems were installed at Station 2 and Station 4 on December 2, 2010. An additional EC system was installed at Station 1 on January 13, 2011. Since the installation at each of these stations, continuous 10 Hz measurements of the three components of the wind vector and air temperature have been made using a 3-dimensional ultrasonic anemometer (model CSAT3, Campbell Scientific Inc. (CSI), Logan, Utah), while 20 Hz turbulent fluctuations of CO_2 and H_2O have been measured using an open-path infrared gas analyzer (IRGA) (model LI-7500A, LI-COR, Inc., Lincoln, Nebraska). Signals were measured with a data logger (CSI, model CR1000) with a synchronous-device-for-measurement (SDM) connection. High frequency (HF) data were stored on a compact flash card that was replaced every 2-3 weeks. Half-hourly covariances and other statistics were calculated on the data logger (to provide near-real time diagnostics), and as well from the raw HF data using in-house MATLAB processing code. H, λE and F_c fluxes were calculated as the half-hourly covariances of the sonic air temperature, H_2O or CO_2 mixing ratio with the vertical wind velocity (w), respectively. Further details of the flux calculations can be found in Brown et al. (2010). Briefly, sensible heat (H), latent heat (λE) and CO_2 (F_C) fluxes were calculated as the half-hourly covariances of the sonic air temperature, H_2O and CO_2 mixing ratios with the vertical wind velocity (w), respectively (Webb et al. 1980).

For example, in the case of H_2O, λE is calculated using:

$$\lambda E = \lambda \rho_a \overline{w' s_v'} \qquad (1)$$

where ρ_a is the dry air density, w is the vertical wind velocity, s_v is the H_2O mixing ratio, λ is the latent heat of vaporization, and the primes indicate fluctuations from the half-hourly mean value

and the overbar indicates the time average. The calculation is therefore a 30-minute block average with no detrending applied.

D2 EC SYSTEM PERFORMANCE

D2.1 System Uptime/Data Loss

Protocols for data recovery, extraction, and re-processing high frequency EC data, and cleaning (i.e., removal of unreliable data and gap-filling) of the resulting half-hourly CO2 (Fc), sensible heat (H) and latent heat (λE) fluxes were unchanged from 2011-2016.

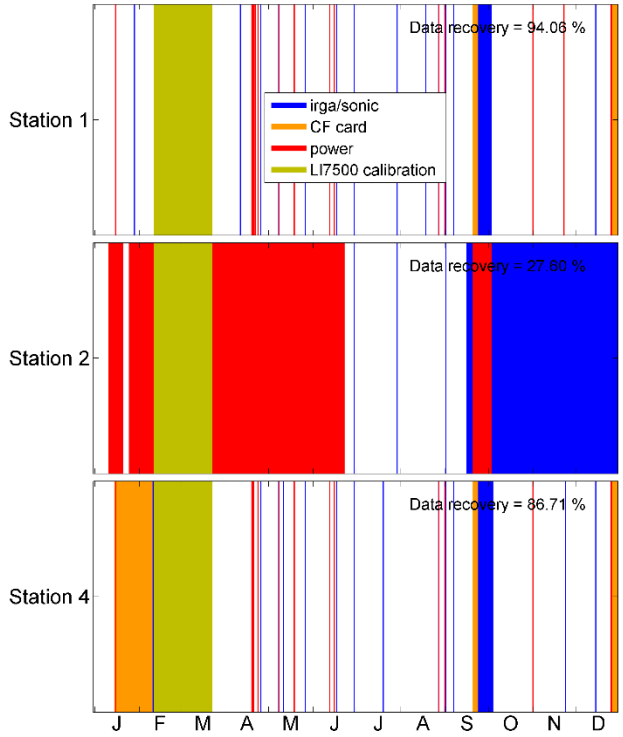


Figure D1. EC system performance for Stations 1, 2, 4 in 2016 indicating sources (IRGA/sonic anemometer failure, CF card malfunction, power (low battery voltage), IRGA calibration) of data loss prior to manual QA/QC of the data. Vertical bars indicate flux data loss. Annual data recovery percentage indicated in each panel.

EC system uptime prior to manual data screening for quality assurance/quality control (QA/QC) in 2016 was 95% at Station 1, an improvement from 2015 when system uptime at Station 1 fell to 80% as a result of high frequency data loss on one of the CF cards. At station 2, system uptime was the lowest recorded at 28%. This drop was in part due to battery failures beginning in early January and proceeding through to late June when a total battery replacement was preformed; and from

IRGA failure, and sonic anemometer path obstruction in latter part of the year. Card error and sonic anemometer path obstruction resulted in the system uptime at Site 4 dropping to 86.7%.

D2.2 QA/QC issues

D2.2.1 Gap-Filling

Gap-filling of the carbon balance components (NEP, GEP, and R) at all three stations was made more challenging for the 2016 calendar year by the relatively late removal of the IRGA units at all three EC stations for their annual calibration. The delay, which resulted from unavoidable scheduling conflicts, resulted in the loss of flux measurements at the start of the growing season. In all but 2015 and 2016, the IRGA units had been returned to operation just prior to spring thaw and the onset of biologically-linked carbon and water fluxes from the agricultural soils. In future efforts will be made to remove IRGA before the end of year for reinstallation prior to spring thaw. Only measured data is presented for site 2 due to the extensive data periods missing due to battery and IRGA failure, and sonic anemometer path obstruction.

In a natural forest or grassland ecosystem, filling data gaps in the λE and F_c fluxes this time interval would typically be accomplished using protocols slightly modified from those used in the Fluxnet Canada Research Network and the Canadian Carbon Program (Barr et al. 2004, Brown et al., 2010). This approach is best suited to natural ecosystems where the response of the local vegetation is largely the result of the integration of the phenological response of the individual species of plants and trees and environmental variables such as light, air temperature and soil temperature and moisture.

In the agricultural settings in which the Site C EC stations are situated, the biological response is affected by human factors, as the farmer is the one controlling the sowing and planting; hence the timing of the photosynthetic response cannot be captured in a model without more detailed knowledge of the actions of each individual farmer following spring thaw. While gap-filling the carbon balance flux components was accomplished using the same FCRN approach as in prior years, interpretation of changes to these fluxes during the gap-filled period should be done with some caution (discussed further below, see Section 3.5).

In contrast to the C-balance flux components, gap-filling of λE was accomplished using the same energy balance closure model approach (Amiro et al., 2006) of previous years and introduced no additional uncertainty as H continued to be measured throughout the IRGA calibration period.

D2.2.2 Uncertainty Analysis

Uncertainties associated with calculating annual totals of *ET*, NEP, GEP, and R from the half-hour EC fluxes were determined using techniques detailed extensively elsewhere (Brown et al. 2010, Krishnan et al. 2006, Morgenstern et al 2004). Random error was assessed using propagation of errors following Morgenstern et al. (2004), in which up to a 20% error is randomly assigned to each half-hourly measured flux (NEP or λE). The uncertainty due to the gap filling algorithms was estimated using Monte Carlo simulation following the procedure of Krishnan et al. (2006). Briefly, gaps were created in annual NEP or λE ranging from a half-hour to 10 days in length and a

uniformly distributed random number generator was applied to day and night-time data separately so as to approximate the typical diurnal distribution of data gaps in the annual dataset for each site.

For each iteration, the standard FCRN gap filling approach as modified by Brown et al. (2010) discussed above was used to fill the gaps generated. This procedure was then repeated 1000 times, and the simulated annual values of NEP, R, GEP or *ET* were then sorted to determine the 95% confidence intervals. For the Site C EC stations, the combined random and systemic error introduced from the gap filling procedure amounted to ~10 mm for the annual *ET* and ~30 g C for the annual NEP. It should be noted that the IRGAs are removed for calibration at a time of year (February-March) when energy, water and carbon fluxes are very close to zero—hence they are relatively easy to model. The shift of the calibration period into the growing season necessarily increases the uncertainty involved in gap-filling from the values reported above as the daytime EC fluxes are higher and change more rapidly due to shifts in weather and agricultural practices.

Finally, as is standard Fluxnet protocol, the annual totals for *ET* and NEP reported below have not been corrected for energy balance closure. As noted in previous annual reports (Grant et al. 2012, 2013, 2014, 2016) the energy balance closure continues to be ~0.75 for each of Stations 1 and 4. Hence, the EC fluxes could be up to 25% underestimated.

D3 Results

D3.1 Climate Measurements

RWDI Air continued to manage the climate instrumentation and data collection of at all three EC stations. Growing season (May-Sept) conditions at all three EC stations were wetter than conditions in 2015. However, 2016 growing season rainfall though lower was comparable to 2011 and 2013 which were also wet years. Growing season rainfall was 235, 249 and 309 mm for Station 1, Station 2 and Station 4, respectively (Fig. 2). The Fort St. John Airport has a 30-year May Sept norm of 287 mm (1970-2000).

The most notable difference in the environmental conditions among the EC stations was greater precipitation and lower soil temperatures measured at Station 4 during the growing season (Figure D2). Incoming photosynthetically active radiation (*Q*) was particularly low at all locations, generally throughout spring and specifically during April. The lower soil temperatures measured at Station 4 are possibly due to moister soil conditions, requiring more energy to heat up. Unlike other years Station 2 did not have noticeably higher soil temperatures compared to other stations.

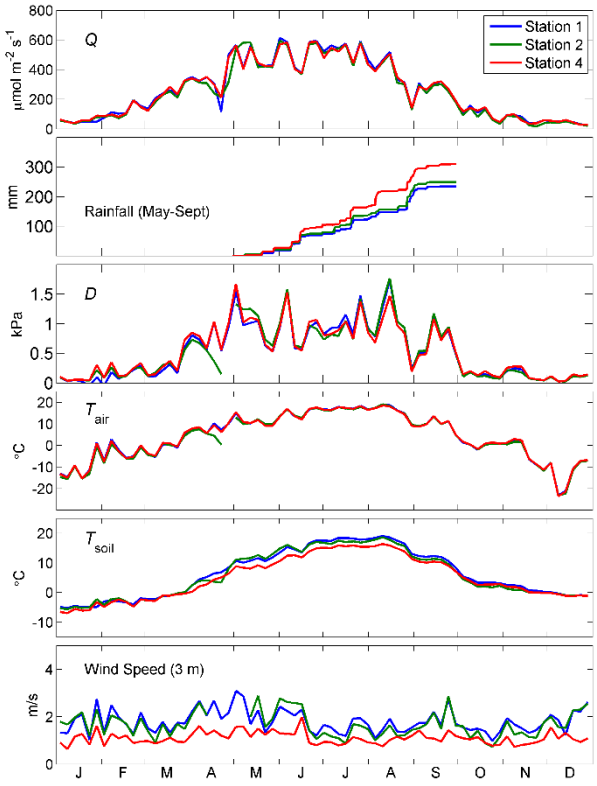


Figure D2. Five-day-averaged climate variables for Stations 1, 2 and 4 for 2016: (a) daytime average downwelling photosynthetically active radiation (*Q*), (b) growing season cumulative rainfall, (c) daytime average vapour pressure deficit (*D*), (d) 24-h average air temperature (T_{air}), (e) 24-h average soil temperature (T_{soil}), and (f) 24-h sonic anemometer cup wind speed (3 m height).

When the conditions from 2011-2016 are plotted by station (Fig. 3), the most notable differences are related to the timing of growing season rainfall and whether a particular year received below or average to above-average rainfall. Years with average to above-average rainfall (2011, 2013) show lower vapour pressure deficit (*D*) during July-August compared to the three drier years (2012, 2014, 2015). However, in 2016 rainfall was more evenly distributed across the growing season, with less falling during spring, compared to other wet years resulting in high *D* during this time (Figure D3). There was less rainfall until later in the growing season during August when a significant rainfall event is more noticeable at Stations 1 and 2, reducing *D* at that time. Winter T_{soil} at all stations was coldest in 2011, 2012 and 2016, suggesting less snowcover was present to insulate the soil column. Air temperatures rose quickly in 2016 matching the rapid rise in T_{soil} through spring seen in 2015, which would have resulted in rapid melting of snowcover.

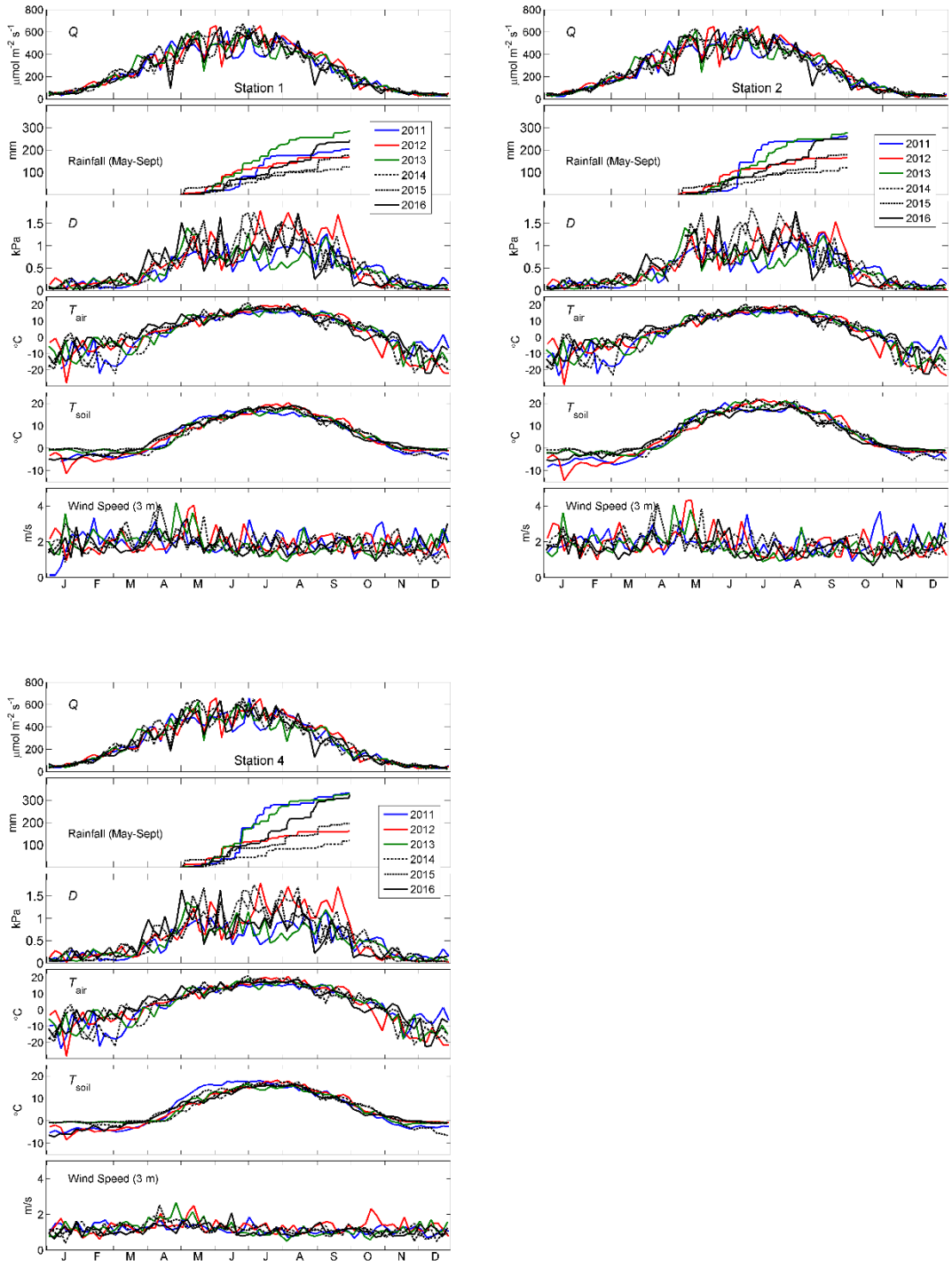


Figure D3. Five-day-averaged climate variables for Stations 1, 2 and 4 for 2011-2015: (a) daytime average downwelling photosynthetically active radiation (Q), (b) growing season cumulative rainfall, (c) daytime average vapour pressure deficit (D), (d) 24-h average air temperature (T_{air}), (e) 24-h average soil temperature (T_{soil}), and (f) 24-h sonic anemometer cup wind speed (3-m height).

D3.2 Energy Balance Measurements

From the available data in 2016 the seasonal pattern of variation in each component of the energy balance was similar to 2013 (Figures D4 and D5). The latent heat fluxes (*λE)* fluxes were noticeably lower in April-May 2016 than 2015 at Station 1 and 4 when *Q* was low and the likely deeper snow pack would have taken longer to melt and expose bare soil to incoming solar radiation and warming. However, the aforementioned rapid rise in the T_{air} during April-May 2016 normalized this relationship between Station 1 and 4 closer to 2015 levels in June. In June through September the *λE* fluxes changed from being larger at Station 1 to being larger at Station 4 possibly due to more water being available and harvesting of the crop cover at Station 1. Furthermore, during July it can be seen that the sensible heat flux (*H*) at Station 1 takes over Station 4 when the farmer harvested the hay crop. Soil heat flux ($G+S_t$) at all Stations was similar.

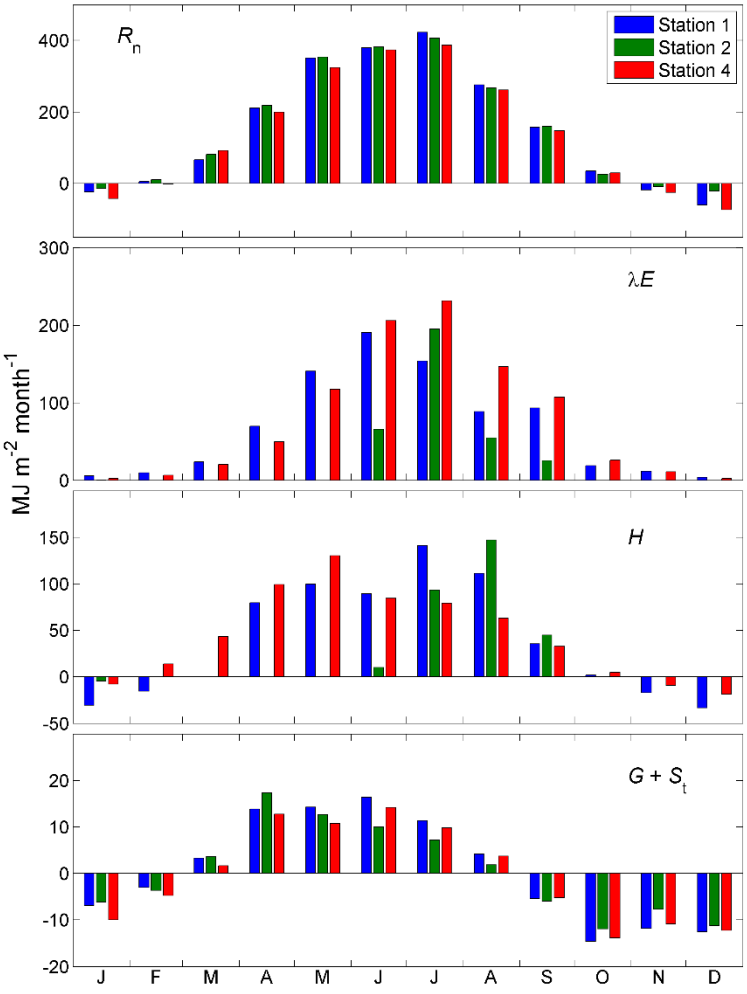


Figure D4. 2016 Annual energy balance for Stations 1, 2 and 4, with monthly total energy flux by term (a) R_n, (b) *λE*, (c) *H*, and (d) $G + S_t$. Note: Station 2 data not available during spring and fall due to extensive data loss at those times.

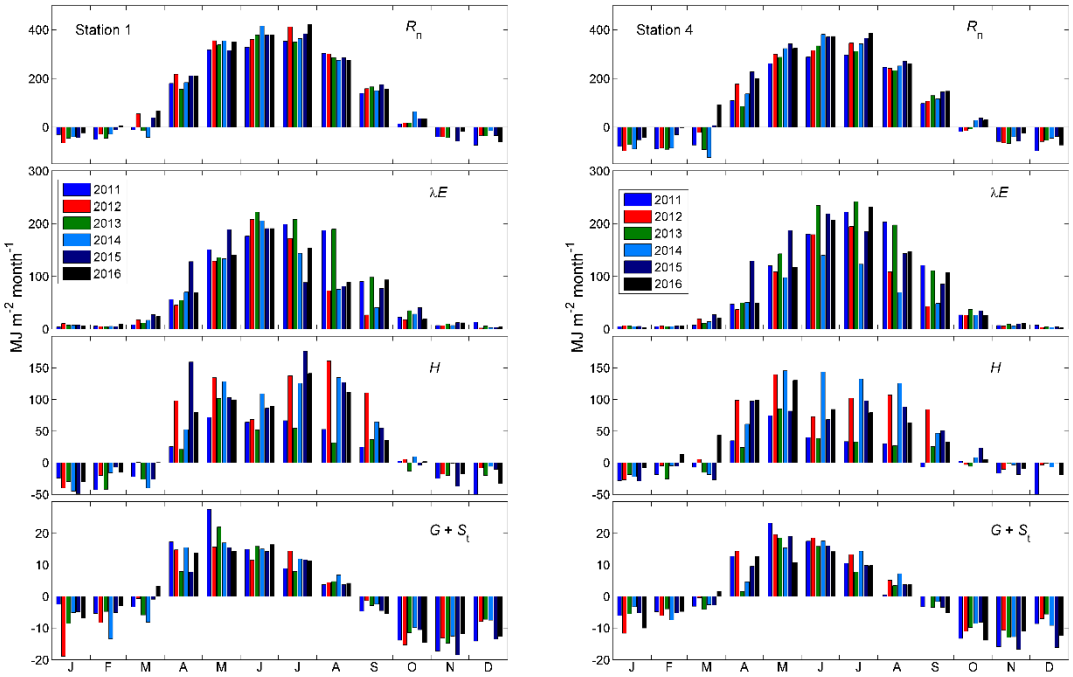


Figure D5. Annual energy balance for Stations 1 and 4, 2011-2016 with monthly total energy flux by term (a) R_n, (b) λE, (c) H, and (d) $G + S_t$. Note: Station 2 not available due to extensive data loss throughout the year.

D3.3 Evapotranspiration

Annual *ET* was greater at Station 4 (371 mm) than Station 1 (324 mm) (Figure D6). This was possibly due to more precipitation providing more water to be available for *ET* from the consistently plant-covered soils at Station 4. Monthly *ET* values were similar to λE fluxes at the stations with station 4 maintaining high *ET* later in the growing season which could be attributed to the late rainfall in that year and maintained plant cover, whereas at Station 1 hay harvest would have reduce *ET* relative to Station 4, as is seen in Figure D6. Annual *ET* at the EC Stations 1 and 4 were in the mid-range being less than wet years 2011 and 2013 and more than during dry years 2012 and 2014 but less than 2015 which was drier than 2016 (Figure D7). Both years (2015 and 2016) at these Stations (1 and 4) had the same land cover types (Figure D10) and similar air temperatures. The reduction in *ET* could be due to lower values of *Q* during the growing season reducing λE fluxes and *ET*. It is reasonable to assume that the patterns observed at Stations 1 and Stations 4 would also be the case for Station 2, where extensive data gaps made empirical modelling inappropriate. This would suggest that values of *ET* at Station 2 would be mid-range between the minimum measured *ET* (234 mm) in 2014 and maximum measured *ET* (345 mm) in 2015 at that station. With careful consideration of crop cover and use of the theoretical equation provided in the Priestley-Taylor model it may be possible to provide a direct estimate of *ET* outside of the normal protocols used.

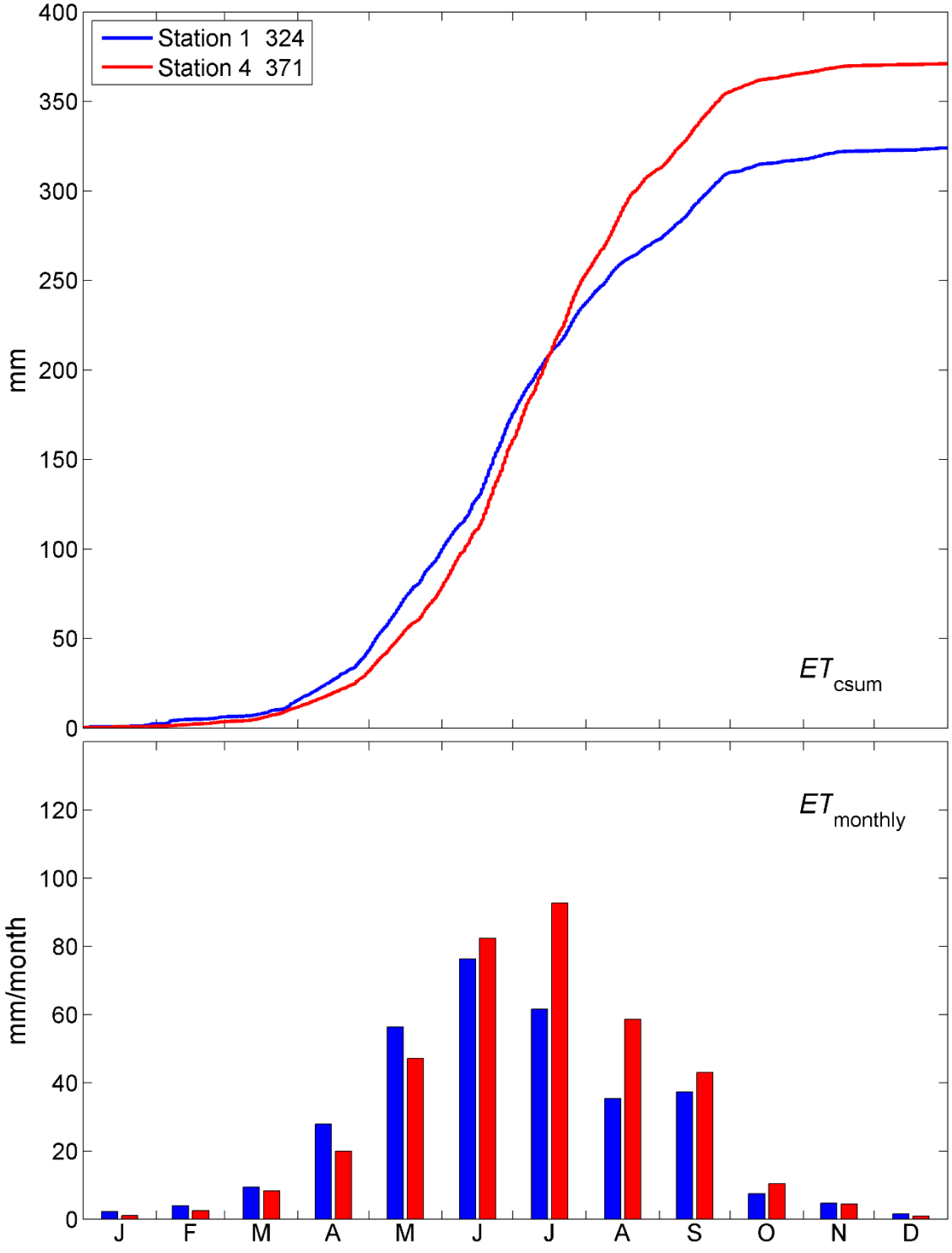


Figure D6. Cumulative (ET_{csum}) and monthly ($ET_{monthly}$) evapotranspiration at Station 1 and Station 4 for 2016. Annual ET totals in mm are shown in the legend.

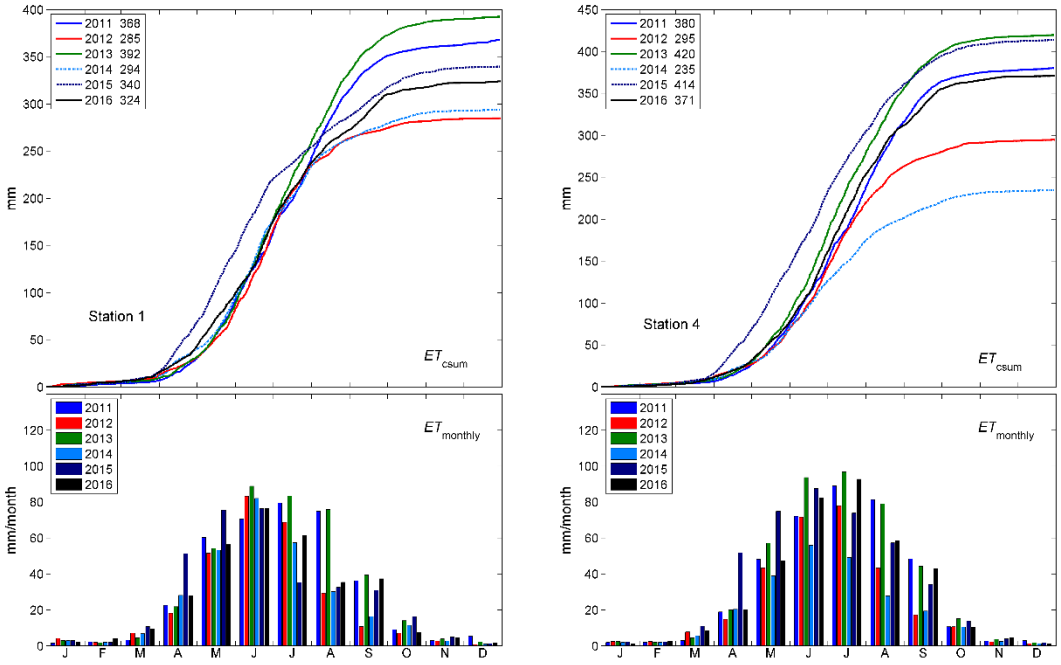


Figure D7. Annual cumulative ET (upper panels) monthly ET (lower panels) for Stations 1 and 4, 2011-2016.

D3.4 C Balance

During 2016, Station 1 with its cultivated crop was a small C sink (156 g C m^{-2} yr^{-1}), while Station 4 with its ungrazed pasture was small source of C (-62 g C m^{-2} yr^{-1}) (Figure D8). The small sink strength at Station 1 was due to higher rates of photosynthesis (GEP) in May and June prior to harvest being sufficient to exceed sustained lower rates of ecosystem respiration (R) throughout the year. The small source strength at Station 4 was due to higher GEP values during May, June and July being insufficient to overcome the sustained R throughout the year. Lower values of *Q* during August when a large rainfall event occurred likely reduced the photosynthetic capacity of the pasture grass.

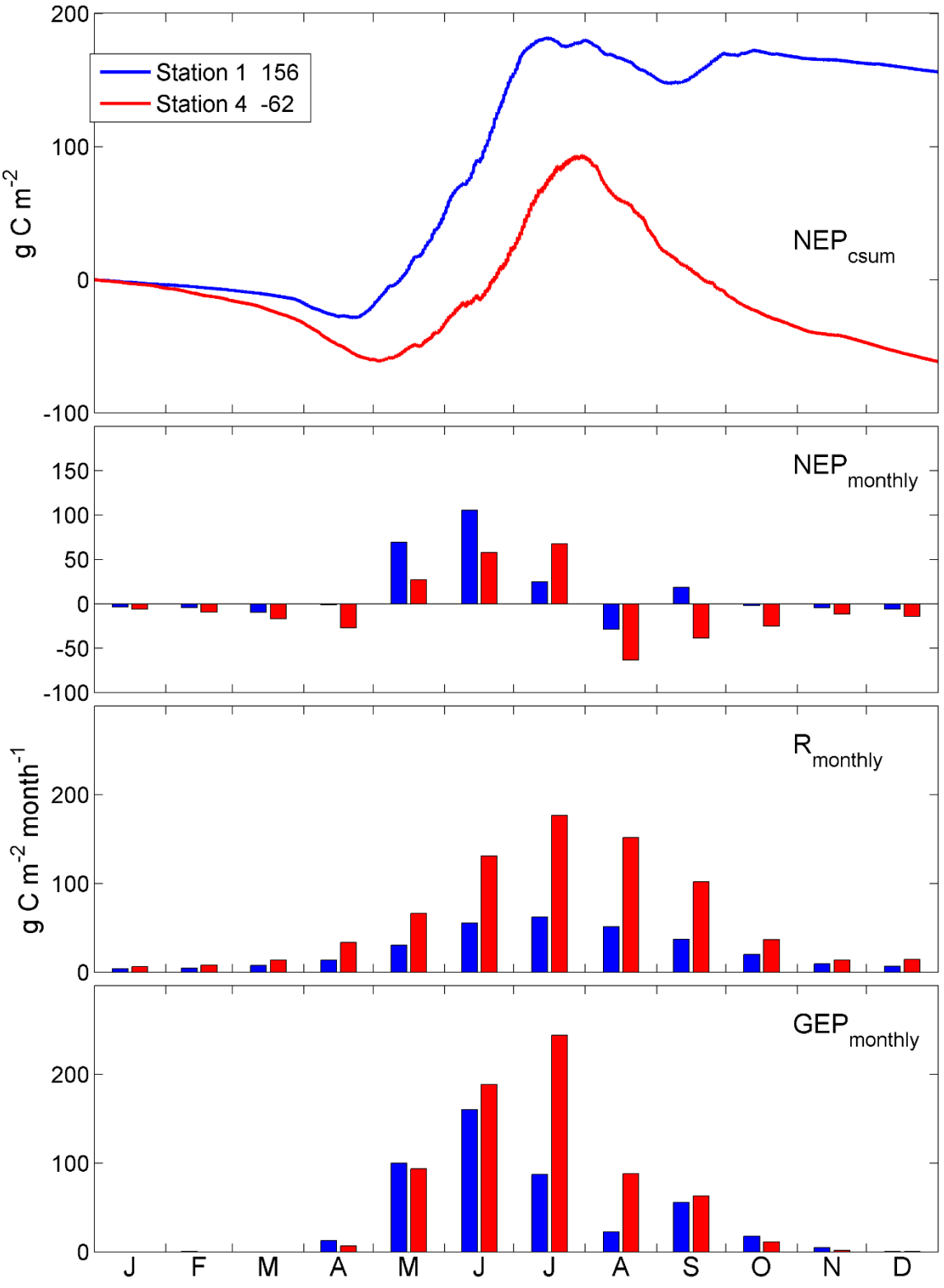


Figure D8. C balance components for 2016 at Station 1 and Station 4. (a) Annual cumulative NEP, (b) monthly NEP, (c) monthly R and (d) monthly GEP.

When the components of the C balance are examined by station for 2011-2016 (Fig. 9), clear patterns of inter- and intra-annual variability in GEP and R emerge between normal-to-wet years and dry years. Stations 1 and 4 are C sinks (NEP > 0) during normal-to-wet years and become near C-neutral (Station 1) or C-sources (Station 4) during dry years. In each case, the pattern is reinforced by similar patterns of agricultural practice between wet and dry years (e.g. cattle grazing or undisturbed pasture, schedules of crop planting and harvesting, respectively). The year 2016 is however slightly different with relatively low values of GEP early and later in the growing season for both sites leading to reduced values of NEP for both Stations. This could be related to cooler winter temperatures delaying the growing season and similarly to *ET* lower levels of *Q* during the spring at time with increased cloud cover associated with well distributed precipitation throught the growing season and in particular the large rainfall event in August.

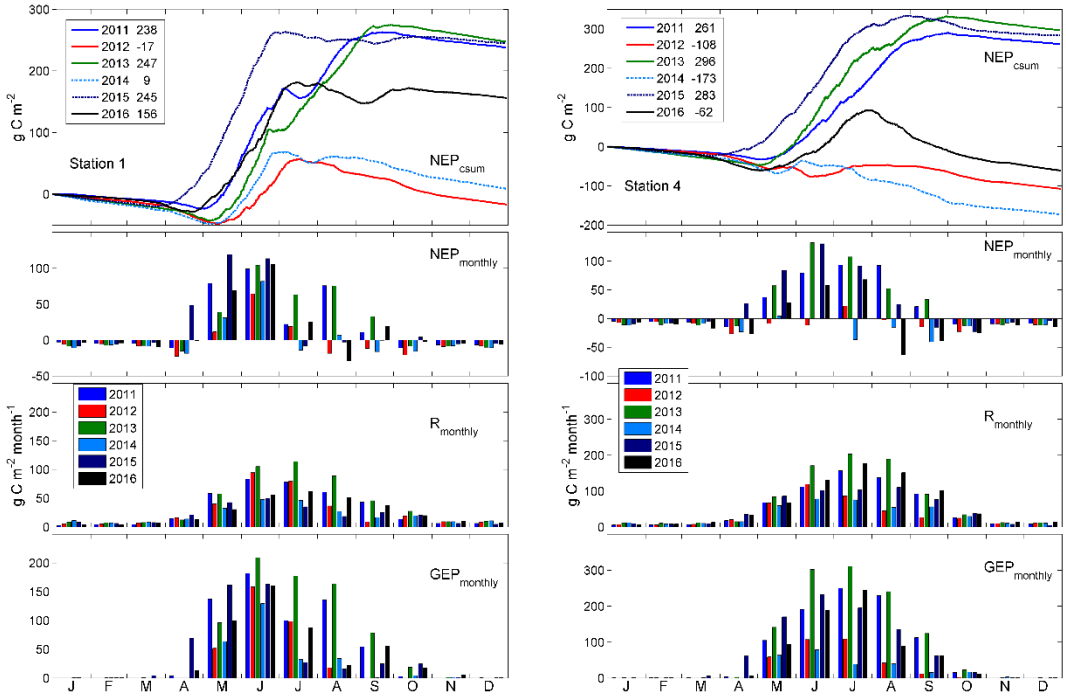


Figure D9. C balance components for 2011-2015 for Stations 1, 2 and 4. (a) Annual cumulative NEP, (b) monthly NEP, (c) monthly R and (d) monthly GEP.

In previous reports, it has been pointed out that Station 2 is unique amongst the EC stations because the C balance between wet and dry years is so robust—the station has been an annual C sink in wet and dry years (Grant et al. 2012, 2013, 2014, 2015). The limited availability of data for Station 2 during 2016 resulted in an inability to adequately model C balances. The fact that it was ungrazed pasture and was a sink for C during all other wet years would suggest that it would have been a sink of less than 220 and more than 15 g C m-2 for 2016. For other stations caution should be exercised when interpreting the C-balance traces for the 2016 year due to the aforementioned uncertainty produced from gap-filling the IRGA calibration period, which affects the partitioning of NEP (which is essentially measured by the IRGA) and the C components GEP and R which are derived from empirical models fit to filtered subsets of the NEP data (see Barr et al. 2004 for details). As explained previously, this approach works best in a natural ecosystem setting and would need to be informed with much more information regarding the precise timing and nature of agricultural practices (ploughing, sowing, irrigation, etc.) during the period the IRGA was not making measurements to yield the most accurate results. A relatively low-expense addition to the EC sites that would aid in this task is the use of a digital camera mounted to each EC tower and programmed to record an image every half-hour or less. Much detail can be gleaned from such images regarding the precise timing and nature of agricultural management practices, which can then be subsequently incorporated in the empirical models of GEP and R just described. Changes to the timing of IRGA calibration and monthly site pictures have been made available to help in this process moving forward.

D3.5 EC Flux Measurement Summary 2011-2016

Figure D10 summarizes the EC results from 2011-2016; the data used in the figure is presented in the Appendix (Table A1) in tabular form. The top panel indicates the agricultural land management status for each station for each year, and the panels below summarize respectively: growing season rainfall, mean growing season air temperature, annual ET, mean growing season Bowen ratio ($\beta = H/\lambda E$), and finally annual NEP, R and GEP. Similarly to 2015, Station 4 remained ungrazed pasture and Station 1 was planted with crops, while station 2 changed from cultivated crops to ungrazed pasture in 2016 (Figure D10).

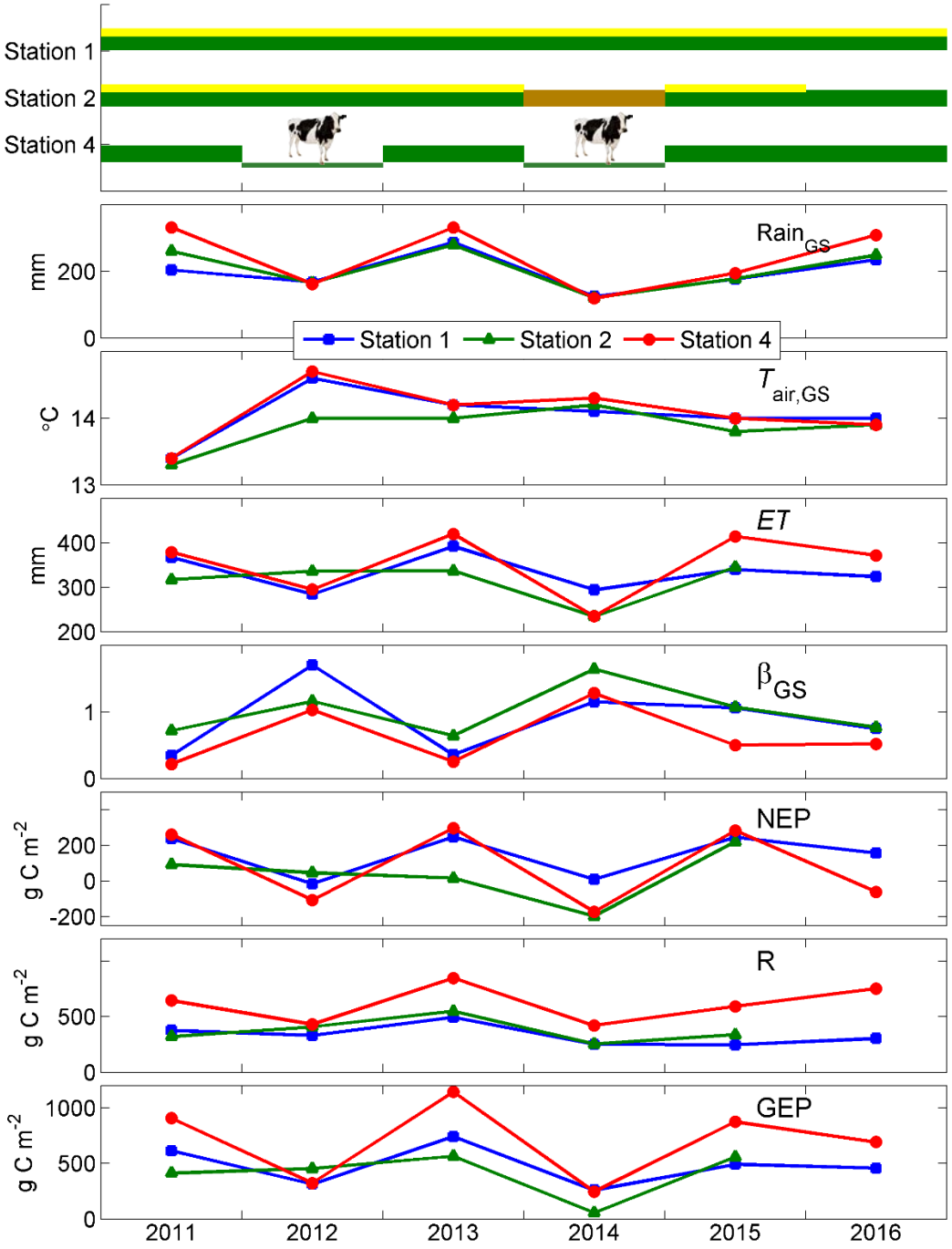


Figure D10. Summary of eddy covariance results 2011-2016. The top panel indicates the agricultural land management status for each station for each year (green and yellow bars=cultivated with crops, green bars=ungrazed pasture; thin green bar and cattle icon=grazed pasture; brown bar=bare soil) and the panels below summarize, respectively: growing season rainfall, mean growing season air temperature, annual ET, mean growing season Bowen ratio (β = H/λE), and annual NEP, R and GEP.

The pattern of interannual differences in these variables between wet and dry years at Stations 1 and 4 are very similar, with sensible heat transfer dominating dry years ($\beta \geq 1$) and latent heat transfer dominating normal to wet years ($\beta < 1$). As discussed above, Station 2 shows far less interannual variability in all EC fluxes except in 2014 when the land surrounding the flux tower was left bare during the growing season.

D4 Summary

1. Growing season (May-Sept) conditions at all three EC stations were amongst the wettest in the data record and all exceeded rainfall amounts in 2015. Growing season rainfall was 235, 249 and 309 mm for Station 1, Station 2 and Station 4, respectively.

2. Annual evapotranspiration (*ET*) at the three EC stations during 2016 was less than measured during 2015 and more than dry years 2012 and 2014. At Stations 1 (324 mm) and Station 4 (371 mm) *ET* was higher than during dry year 2014 (294 and 235 mm, respectively). It is likely that ET at Station 2 would be mid-range between the minimum measured *ET* (234 mm) in 2014 and maximum measured *ET* (345 mm) in 2015 at that station. Decreased *ET* at all stations in 2016 relative to drier year 2015 was likely due to increased cloud cover during 2016 reducing downwelling photosynthetically active radiation associated with more evenly distributed rainfall throughout the growing season.

3. During 2016 the Station 1 land cover was a cultivated crop harvested in July and was a small C sink (156 g C m^{-2} y^{-1}). Higher rates of photosynthesis in the early part of the growing season, prior to harvesting, were enough to exceed consistently small respiration before and after harvest. Station 4 land cover was ungrazed pasture and was small source of C (-62 g C m^{-2} y^{-1}). The small source strength at Station 4 was due to higher GEP values during May, June and July being insufficient to overcome the sustained R throughout the year. The limited availability of data for Station 2 during 2016 resulted in an inability to adequately model C balances. The fact that it was ungrazed pasture and was a sink for C during all other wet years would suggest that it would have been a sink of less than 220 and more than 15 g C m^{-2} for 2016.

D5 REFERENCES

Amiro B.D., Barr A.G., Black T.A., Iwashitad H., Kljun N., McCaughey J.H., MorgensternK., Murayama S., Nesic Z., Orchansky A.L., Saigusa N. 2006. Carbon, energy and water fluxes at mature and disturbed forest sites, Saskatchewan, Canada. Agricultural and Forest Meteorology. 136, 237–251.

Baldocchi, D.D., 2003. Assessing the eddy covariance technique for evaluating carbon dioxide exchange rates of ecosystems: past, present and future. Global Change Biology. 9, 479–492.

Barr, A.G., Black, T.A., Hogg, E.H., Kljun, N., Morgenstern, K., Nesic, Z., 2004. Interannual variability in the leaf area index of a boreal aspen-hazelnut forest in relation to net ecosystem production. Agricultural and Forest Meteorology. 126, 237–255.

Brown M., Black T.A., Nesic Z., Foord V.N., Spittlehouse D.L., Fredeen A.L., Grant N.J., Burton P.J., Trofymow J.A., 2010. Impact of mountain pine beetle on the net ecosystem production of lodgepole pine stands in British Columbia. Agricultural and Forest Meteorology. 150, 254-264.

Grant, N.J., Black, A., Nesic, Z. 2012. Eddy-Covariance Measurements of Energy, Water and Carbon Fluxes at Upper Attachie (Station 1), Lower Attachie (Station 2) and Bear Flat (Station 4): 2011 Summary. Report submitted to RWDI Air, Inc.

Grant, N.J., Black, A., Nesic, Z. 2013. Eddy-Covariance Measurements of Energy, Water and Carbon Fluxes at Upper Attachie (Station 1), Lower Attachie (Station 2) and Bear Flat (Station 4): 2012 Summary. Report submitted to RWDI Air, Inc.

Grant, N.J., Black, A., Nesic, Z. 2014. Eddy-Covariance Measurements of Energy, Water and Carbon Fluxes at Upper Attachie (Station 1), Lower Attachie (Station 2) and Bear Flat (Station 4): 2013 Summary. Report submitted to RWDI Air, Inc.

Grant, N.J., Black, A., Nesic, Z. 2015. Eddy-Covariance Measurements of Energy, Water and Carbon Fluxes at Upper Attachie (Station 1), Lower Attachie (Station 2) and Bear Flat (Station 4): 2013 Summary. Report submitted to RWDI Air, Inc.

Krishnan, P., Black, T.A., Grant, N.J., Barr, A.G., Hogg, E.H., Jassal, R.S., Morgenstern, K., 2006. Impact of changing soil moisture distribution on net ecosystem productivity of a boreal aspen forest during and following drought. Agricultural and Forest Meteorology 139, 208–223.

Morgenstern, K., Black, T.A., Humphreys, E.R., Griffis, T.J., Drewitt, G.B., Cai, T., Nesic, Z., Spittlehouse, D.L., Livingston, N.J., 2004. Sensitivity and uncertainty of the carbon balance of a pacific northwest Douglas-fir forest during an el Niño/La Niña cycle. Agricultural and Forest Meteorology 123, 201–219.

Wilson K, et al., 2002. Energy balance closure at FLUXNET sites. Agricultural and Forest Meteorology.113:223-243.

APPENDIX A

A1. Climate and EC Data at Stations 1, 2, 4 for 2011-2016.

	Station 1						Station 2						Station 4					
	2011	*2012*	*2013*	*2014*	*2015*	*2016*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
[b]Rainfall (mm)	204	168	287	125	176	235	261	165	279	121	178	249	332	162	331	119	195	309
[b]T_{air} (°C)	13.4	14.6	14.2	14.1	14.0	14	13.3	14.0	14.0	14.2	13.8	13.9	13.4	14.7	14.2	14.3	14.0	13.9
[c]ET (mm)	367	284	392	294	340	324	317	336	337	234	345	NaN	379	295	420	235	414	371
[b]β	0.347	1.70	0.356	1.15	1.06	0.747	0.718	1.16	0.640	1.64	1.07	0.768	0.218	1.03	0.253	1.28	0.5	0.520
[c]NEP (g C m^{-2})	238	-17	247	9	245	156	91	46	15	-198	220	NaN	261	-108	296	-173	283	-62
[c]R (g C m^{-2})	376	330	494	250	246	302	321	408	549	253	338	NaN	645	430	846	419	591	752
[c]GEP (g C m^{-2})	614	313	741	259	491	547	412	454	564	55	558	NaN	906	322	1142	246	874	691

[b] denotes growing season total (Rainfall) or mean (T_{air}, β)
[c] denotes annual totals

A2. Site Photos

15th Jan 2016

15th Mar 2016

12th Apr 2016

11th May 2016

3rd June 2016

1st Sep 2016

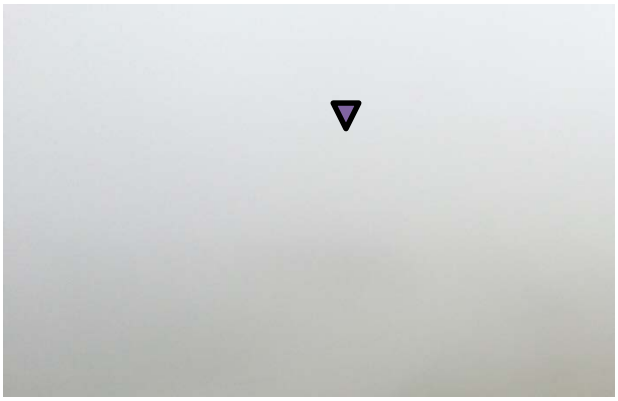


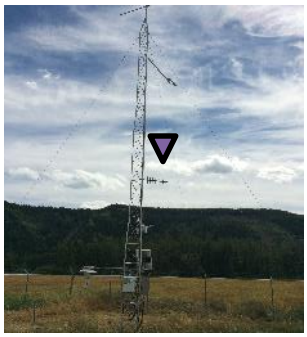
Figure 11. Station 1 site photos from January to September, 2016. The inverted green and black triangles indicate the location of the EC system in all photos.

15th Mar 2016

26th Apr 2016

26th May 2016

29th Jul 2016



1st Sep 2016

Figure 12. Station 2 site photos from May to December, 2016. The inverted green and black triangle indicates the location of the EC system in all photos.

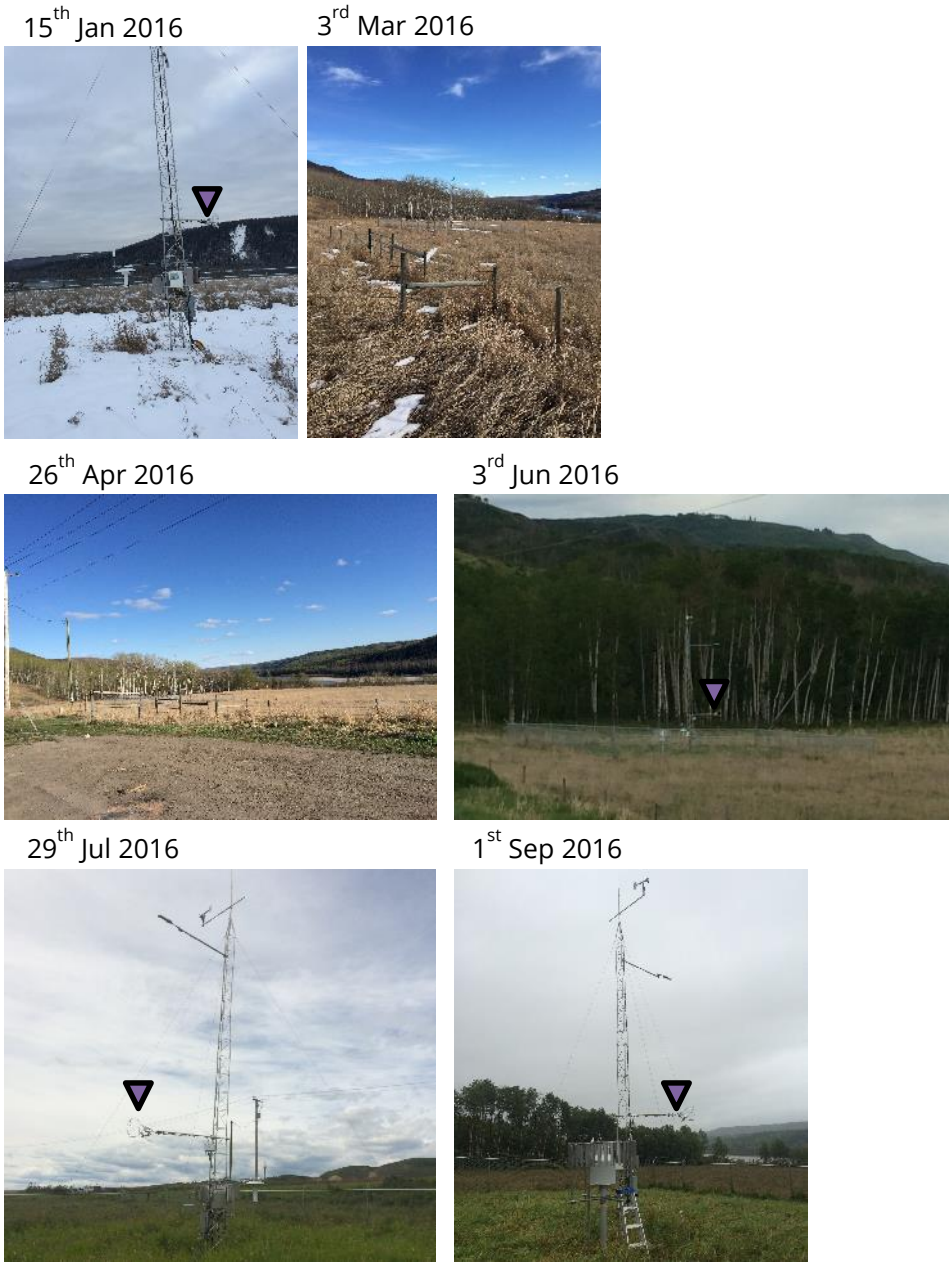
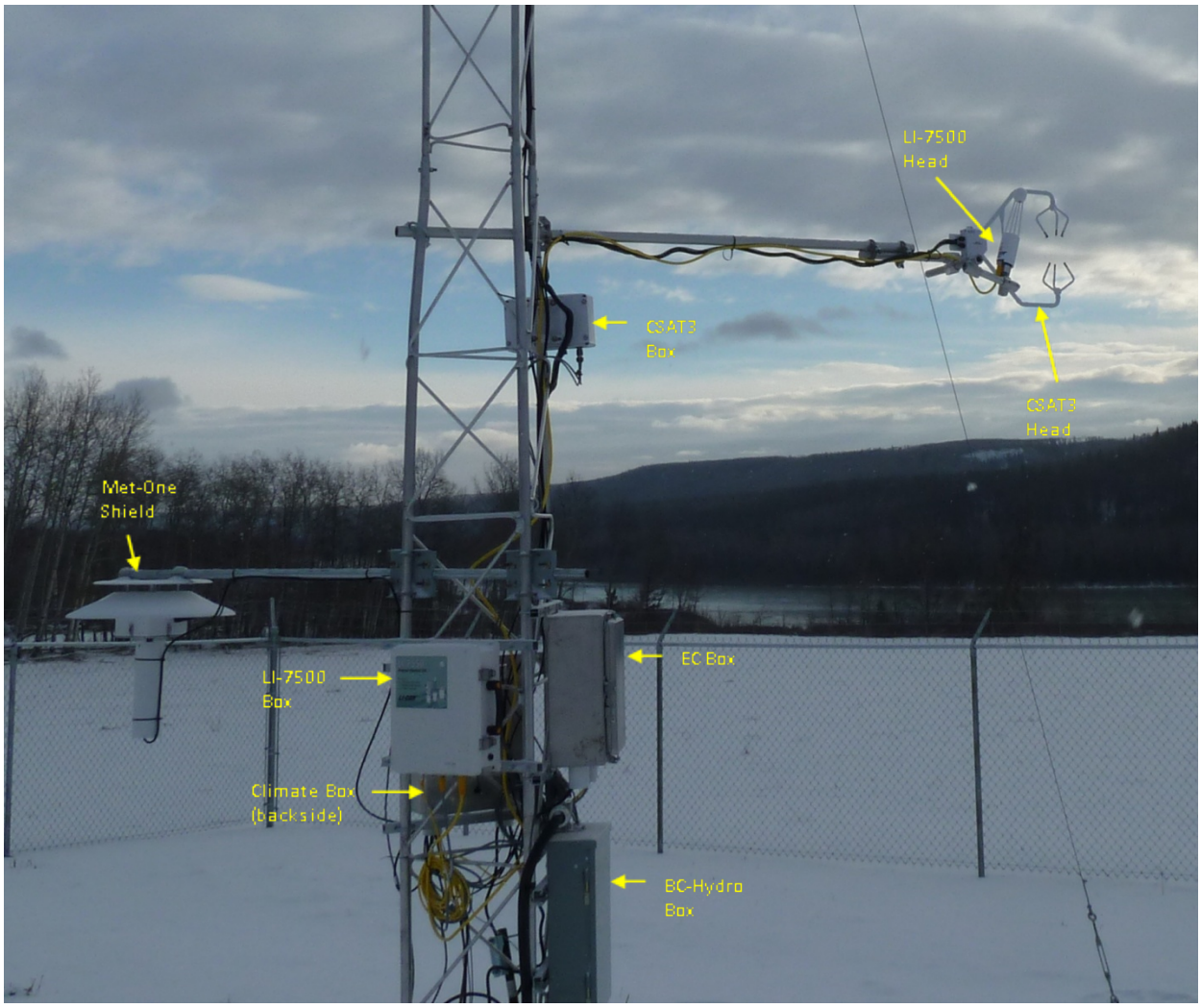


Figure 13. Station 4 site photos from January-November, 2016. The inverted green and black triangle indicates the location of the EC system in all photos.

A3. Hardware Components of the Climate and Eddy Covariance Systems at Station 4.



A4. List of Symbols and Acronyms

Symbol / Acronym	Units	Definition
C		carbon
CO_2		carbon dioxide
DVD		digital video disc storage media (4.5 GB)
EC		eddy covariance
FCRN		Fluxnet Canada Research Network
IRGA		infrared gas analyzer
NEP	µmol m^{-2} s^{-1} or g C m^{-2} time $^{-1}$	net ecosystem production
NEP_{csum}	g C m^{-2}	cumulative net ecosystem production
$NEP_{monthly}$	g C m^{-2} $month^{-1}$	monthly total NEP
PAR	µmol m^{-2} s^{-1}	photosynthetically active radiation flux
D	kPa	vapour pressure deficit
ET	mm $time^{-1}$	evapotranspiration
ET_{csum}	mm	cumulative evapotranspiration
G	W m^{-2}	soil surface heat flux
GEP	µmol m^{-2} s^{-1} or g C m^{-2} time $^{-1}$	gross ecosystem photosynthesis
$GEP_{monthly}$	g C m^{-2} $month^{-1}$	Monthly total GEP
H	W m^{-2}	sensible heat flux
Q	µmol m^{-2} s^{-1}	downwelling photosynthetically active radiation (calculated as = 2 R_s in W m^{-2})
QA/QC		quality control/quality assurance
R_n	W m^{-2}	net radiation flux
R_a	W m^{-2}	available energy flux (= R_n –*G* – S_t)
R	µmol m^{-2} s^{-1} or g C m^{-2} time $^{-1}$	ecosystem respiration
$R_{monthly}$	g C m^{-2} $month^{-1}$	Monthly total R
R_s	W m^{-2}	downwelling shortwave radiation
S_t	W m^{-2} (per unit ground area)	sum of the rate of change in energy storage in the air between the EC sensors and the ground surface,
T_{air}	°C	air temperature
T_{soil}	°C	soil temperature at the 4-cm depth
u_*	m s^{-1}	friction velocity
λE	W m^{-2}	latent heat flux
β		Bowen Ratio (= *H*/*λE*)