March 9, 2015

APPENDIX 5.7-D

Air Quality and Meteorology Baseline Report

Submitted to:
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REPORT

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Distribution:

1 Electronic Copy - BURNCO Rock Products
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Golder Associates

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1.0 INTRODUCTION

BURNCO Rock Products Ltd. (BURNCO) is planning the development of a sand and gravel pit in Howe Sound, British Columbia (BC) (the Project) to provide high quality construction aggregate for use in the BC lower mainland. Golder Associates Ltd. (Golder) has been retained by BURNCO to prepare an Environmental Assessment Certificate Application/Environmental Impact Statement for the Project (EAC Application/EIS).

This report supplements Chapter 5.7 of the EAC Application/EIS. This report presents the existing conditions in the study area for the atmospheric environment components, specifically air quality and meteorological conditions. To appropriately assess the impact on air quality from the Project it is necessary to characterize the existing atmospheric environment in the Project area (i.e., the current air quality and meteorological conditions). This report presents the results of the air quality and meteorology baseline study.

1.1 Objectives

The objective of this baseline report is to establish existing air quality and meteorological conditions for the Project area to allow the subsequent assessment of potential impacts.

The existing air quality has been described by focussing on selected compounds that are of greatest relevance for the Project, either because they will be emitted from the Project, or could result from Project emissions. These compounds include:

- total suspended particulates (TSP);
- suspended particles with a nominal aerodynamic diameter of 10 micrometres (µm) or less (PM_{10});
- suspended particles with a nominal aerodynamic diameter of 2.5 µm or less ($PM_{2.5}$);
- nitrogen dioxide (NO_2); and
- sulphur dioxide (SO_2).

Other compounds, in addition to those listed above, will be of interest to other disciplines (human health). Therefore background concentrations will be established for these compounds, more specifically dustfall and metal species.

The existing air quality has been described using available regional air quality data, and a small dataset gathered from an onsite monitoring program. To contextualize the data background concentrations have been compared to relevant BC and Canadian ambient air quality criteria.

1.2 Study Area

The Project will be located on a flat, glaciological fan-delta deposit comprising sand and gravel on the western shore of Howe Sound's Thornborough Channel, north of Gambier Island and approximately 22 km west-southwest of Squamish and 35 km northwest of Vancouver.

The Local Study Area (LSA) for assessment of air quality is a 20 by 20 km area centered on the Project. The LSA will also extend along the barge route corridor, 1 km on either side of the corridor to the edge of the regional study area (RSA). This is currently anticipated to be the area within which air quality effects can be predicted or measured with reasonable certainty. The RSA corresponds to the wider area that will be used for the dispersion modelling domain, approximately 80 by 80 km centered on the Project.

2.0 METHODS

2.1 Air Quality

In order to assess the effect of the Project, and compare to the existing conditions, the regional air quality must first be characterized. British Columbia Ministry of Environment (BC MoE), *Guidelines for Air Quality Dispersion Modelling in British Columbia* (BC Modelling Guidelines) (2008) states that a background concentration needs to be determined and added to the model predicted concentrations from the Project. The characterization of the background air quality (TSP, PM_{10}, $PM_{2.5}$, NO_2 and SO_2) was based on data from available existing air quality monitoring data collected at three air quality stations.

Air quality monitoring data for dustfall (particulate deposition) and metals were collected during an onsite monitoring campaign carried out in November 2013.

2.1.1 Ambient Air Quality Criteria

The air compounds of greatest concern with regards to gravel extraction operations are typically particulate matter, NO_2, and SO_2. From an air assessment perspective particulate matter is generally defined into three size fractions as follows:

- particulates of all size classes are referred to as total suspended particulate (TSP);
- particulates with a diameter of 10 microns (µm) or less are referred to as PM_{10}; and
- particulates with a diameter of 2.5 µm or less are referred to as $PM_{2.5}$.

Exposure to respirable (PM_{10}) and fine particulate matter ($PM_{2.5}$) aggravates a number of respiratory illnesses. Smaller particles are generally thought to be of greater concern to human health than larger particles.

The BC and the Federal government have established ambient air quality criteria that were developed by environmental and health authorities for environmental protection. Federal and provincial air quality objectives and standards for criteria air contaminants are shown in Table 1 (BC MoE 2014a). The Government of BC rolled out interim air quality objectives in October 2014 (BC MoE 2014a). The interim provincial air quality objectives include daily maximum 1-hour NO_2 and 1-hour SO_2, based on the 98^{th} and 99^{th} percentile (respectively) over one year.

Table 1: Ambient Air Quality Criteria

Contaminant	Averaging Period	Unit	Criteria					
			Federal			British Columbia		
			Maximum Desirable	Maximum Acceptable	Maximum Tolerable	Level A	Level B	Level C
TSP	24-hour	µg/m^3	--	120	400	120	200	260
	Annual	µg/m^3	60	70	--	60	70	75
PM_{10}	24-hour	µg/m^3	--			50		
$PM_{2.5}$	24-hour	µg/m^3	28[1]			25[2]		
	Annual	µg/m^3	--			8		
NO_2	1-hour	ppb	--			100[3,4]		
	Annual	ppb	--			32[3]		
SO_2	1-hour	ppb	--			75[3,5]		

Note 1: Compliance based on annual 98th percentile value, averaged over three consecutive years.
Note 2: Compliance based on annual 98th percentile value.
Note 3: Interim Provincial Air Quality Objectives (October 2014).
Note 4: Compliance based on annual 98th percentile of daily 1-hour maximum, over one year.
Note 5: Compliance based on annual 99th percentile of daily 1-hour maximum, over one year.
*"**--**" signifies that no air quality criteria is available.*
***µg/m^3** – micrograms per cubic metre.*

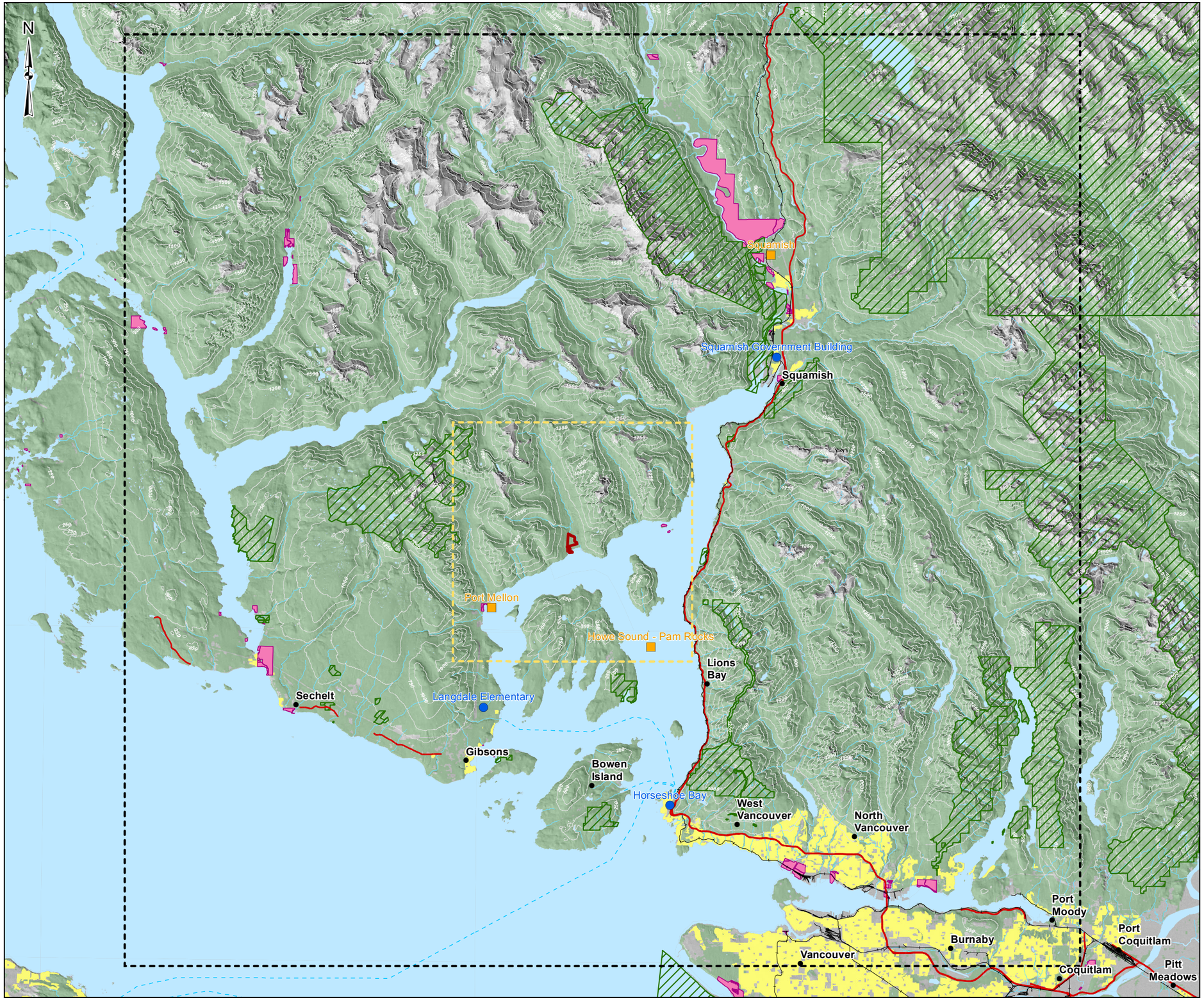
Both national and provincial programs categorize ambient air quality into three categories. Nationally, these are divided into "*maximum desirable*", "*maximum acceptable*" and "*maximum tolerable*"; with "*maximum desirable*" being the most stringent category. In BC, a similar categorization is used, with designations of Level A, B and C that roughly correspond to the national levels; with Level A being the most stringent.

2.1.2 Existing Air Quality Monitoring

There are three air quality monitoring stations in operation within proximity of the Project, these stations are:

- **Langdale Elementary**, operated by Howe Sound Pulp and Paper and located approximately 16 km to southwest;
- **Horseshoe Bay**, operated by Metro Vancouver and located approximately 23 km to southeast; and
- **Squamish**, operated by BC MoE & National Air Pollution Surveillance (NAPS) and located approximately 23 km to northeast.

All three stations' data is reported to the BC MoE and available through the data archive website (BC MoE 2014b). Air quality station locations are shown on Figure 1.



LEGEND

- Air Quality Station
- Meteorological Station
- Project Area
- Local Study Area
- Regional Study Area
- Park / Protected Area
- Vegetation
- Residential Area
- Indian Reserve
- Waterbody
- Watercourse
- Highway
- Railway
- Ferry
- Contour (250m)

REFERENCE

Air Quality and Meteorological Stations obtained from the British Columbia Ministry of Environment. Elevation and indian reserves from Geobase. Base data from CanVec. DEM from British Columbia Imagery WMS.
Projection: UTM Zone 10 Datum: NAD 83

SCALE

10 0 10
SCALE 1:320,000 KILOMETRES

PROJECT
BURNCO ROCK PRODUCTS LTD.
BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C.

TITLE
AIR QUALITY AND METEOROLOGY STATION LOCATIONS

Golder Associates

PROJECT NO. 11-1422-0046			PHASE No. 4700	
DESIGN	TB	02 Mar. 2015	SCALE AS SHOWN	REV. 0
GIS	DL	03 Mar. 2015		
CHECK	JR	03 Mar. 2015		
REVIEW	SC	03 Mar. 2015		

FIGURE 1

Path: X:\Project Data\BC\McNab\Figures\MXD\Air Quality\BURNCO_AIR_Figure_01_Air_Quality_and_Meteorology_Station_Locations.mxd

2.1.2.1 Station Description

Air quality data were reported on an hourly basis for the three stations. Table 2 summarizes the station information used to establish the baseline concentrations for the region.

Table 2: Air Quality Station Summary Table

Monitoring Station	UTM		Parameter	Frequency of Monitoring Data
	Easting (m)	Northing (m)		
Langdale	465,303	5,476,447	$PM_{2.5}$	Hourly
			PM_{10}	Hourly
			NO_2	Hourly
			SO_2	Hourly
Horseshoe Bay	479,918	5,468,469	$PM_{2.5}$	Hourly
Squamish	488,867	5,505,988	$PM_{2.5}$	Hourly
			PM_{10}	Hourly
			NO_2	Hourly
			SO_2	Hourly

As Table 2 indicates, the three stations do not monitor TSP. The Squamish station is also a NAPS station and NAPS stopped publishing daily TSP records in 2002. Therefore a literature review on the relationship between TSP and PM_{10} was undertaken. The United States Environmental Protection Agency (US EPA) publication *Procedures for Estimating Probability of Nonattainment of a PM_{10} NAAQS Using Total Suspended Particulate or PM_{10} Data* (US EPA 1986) was used to establish background TSP values.

2.1.2.2 Data Processing

For Langdale Elementary PM_{10}, NO_2 and SO_2 data were available between January 2010 and December 2013 and data for $PM_{2.5}$ were available between December 2011 and December 2013.

For Squamish station PM_{10} data were only available between January 2010 and January 2011, while $PM_{2.5}$ data were available between February 2011 and December 2013. Data for NO_2 and SO_2 were available between January 2010 and December 2013.

For Horseshoe Bay $PM_{2.5}$ data were available between January 2011 and December 2013.

As observed, air quality data were available from different stations over different temporal periods. To determine which data were used in establishing background levels, recommendations within the BC Modelling Guidelines (BC MoE 2008) were considered, including:

- use the most recent monitoring data from the last year with 75% data availability from each quarter;
- set the background level not lower than the 98th percentile;
- select background levels for the same averaging period to correspond to the model predictions; and
- in the case where there is more than one representative monitoring site, apply the same approach for each sites and taking the arithmetic average to set the background concentration.

To establish background air quality concentrations, data were downloaded from the BC Air Archive Website (BC MoE 2014b). The initial background analysis of particulate matter undertaken by Golder was completed prior to the BC MoE release of the 2013 calendar year data on the BC Air Archive Website. As well, within the draft detailed model plan submitted to the BC MoE on August 8, 2014, Golder recommended averaging the data from Langdale Elementary, Horseshoe Bay and Squamish in establishing background concentrations within the Local Study Area (LSA). In conversation with the BC MoE on November 19, 2014 it was suggested that that the data from Langdale should be used to establish background concentrations in the local study area; as well the BC MoE suggested the use of the most recent calendar year's data. A conservative approach was taken in the selection of representative background concentrations considering all of the methods discussed in this paragraph; this is consistent with the recommendations in the detailed model plan, which was accepted by the BC MoE (Golder 2015). Therefore, the analysis performed prior to the release of the 2013 calendar year data plus the 2013 results for all three stations are presented in this report.

The aforementioned recommendations were considered when establishing existing air quality concentrations for particulate matter prior to the release of 2013 data. Table 3 provides a summary of data completeness for the three stations for the years that were considered to establish the particulate matter background concentrations, as well as 2013 for NO_2 and SO_2. As mentioned in section 2.1.1, the new interim provincial air quality objectives for NO_2 and SO_2, concentrations are based on the daily 1-hour maximum concentration at the 98th percentile and 99th percentile respectively. The BC MOE published *Guidance on Application of Provincial Interim Air Quality Objectives for NO_2 and SO_2* (BC MoE 2014c) which outlines the recommended methods to be used in establishing background concentrations for NO_2 and SO_2 consistent with the interim air quality objectives.

Table 3: Air Quality Percent Data Complete

Year	Parameter	Langdale				Squamish				Horseshoe Bay			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
2013	$PM_{2.5}$	99%	100%	100%	99%	99%	90%	89%	100%	100%	100%	98%	100%
2012	$PM_{2.5}$	100%	100%	64%	100%	92%	100%	97%	93%	100%	100%	100%	88%
2013	PM_{10}	100%	100%	100%	100%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	PM_{10}	97%	96%	99%	100%	98%	100%	100%	100%	N/A	N/A	N/A	N/A
2013	NO_2	91%	92%	90%	90%	89%	88%	75%	95%	N/A	N/A	N/A	N/A
2013	SO_2	95%	90%	96%	96%	98%	38%	95%	100%	N/A	N/A	N/A	N/A

TSP

TSP measurement record was not available from Langdale Elementary, Squamish, or Horseshoe Bay station. Therefore, in discussion with BC MoE, it was agreed that Golder would undertake a literature review to establish a relationship between PM_{10} and TSP (Golder 2013). As shown in Table 1, TSP criteria for the 24-hour and the annual averaging periods. Therefore, the average concentrations of PM_{10} for the corresponding periods from the Langdale Elementary and Squamish stations were used to calculate the 24 hour average and annual TSP background concentrations along with a TSP: PM_{10} ratio provided in US EPA (1986).

PM_{10}

For the case of PM_{10}, Horseshoe Bay does not record PM_{10} data. With regards to data completeness, 2010 was the last calendar year where PM_{10} was monitored at both Langdale Elementary and Squamish. Therefore, the average value of the 98th percentile from Langdale and Squamish stations were considered prior to the release of 2013 data to be used to determine the background PM_{10} concentration. From Table 3 it is observed that in 2013, Langdale Elementary data meets the guideline for data completeness, but that PM_{10} is not measured at Squamish.

$PM_{2.5}$

From Table 3 it is observed that for 2013 all three stations met the guideline for data completeness (75% data completeness in each quarter) for $PM_{2.5}$.

From Table 3, it can be seen that Langdale Elementary data did not meet the guideline for data completeness of 75% for the third quarter in 2012. However, 2012 Langdale Elementary record was considered to be used prior to the release of 2013 data for the following reasons:

- using Langdale Elementary data was recommended by the BC MoE (Golder 2013); and
- the 98th percentile $PM_{2.5}$ concentration was the highest value from the three stations in 2012, hence omitting Langdale Elementary would potentially result in underestimating the representative local background $PM_{2.5}$ concentration.

NO_2

From Table 3 it is observed that for 2013 both Langdale Elementary and Squamish data met the guideline for data completeness. As described in BC MoE (2014c), the 98th percentile value of all daily-maximum 1-hour measurements are to be used in establishing the background 1-hour NO_2 concentration.

SO_2

From Table 3 it is observed that for 2013 Squamish data did not meet the guideline for data completeness. The data measured at Langdale Elementary did meet the data completeness guideline. Similarly to 1-hour NO_2 background concentration, the method detailed in BC MoE (2014c), the 99th percentile value of all daily-maximum 1-hour measurements are to be used in establishing the background 1-hour SO_2 concentration.

2.1.3 On Site Air Quality Monitoring

The on-site monitoring was completed to support the technical assessment for other disciplines; specifically to provide the water quality and health disciplines with baseline metal concentration and deposition rates. Monitoring was undertaken for TSP, PM_{10}, ambient metals concentrations and particulate deposition.

The TSP and PM_{10} concentrations were sampled over two 24-hour monitoring periods on November 6 and November 8. This limited dataset was therefore not used to determine existing air quality concentrations for these parameters.

2.1.3.1 On Site Monitoring Description

Monitoring data for TSP and PM_{10} were collected within the Project area using a Mini-Vol portable air sampler. The Mini-Vol is a battery operated active air sampling device. Air is pulled through the device using a pump and passed through a sampling filter. During the on-site sampling the Mini-Vol air intake was positioned approximately 1.5 m off the ground. Monitoring was undertaken for two 24-hour periods in November 2013 at a single location near to seasonal residences located less than 0.5 km from the Project boundary (UTM coordinates 472,302 m easting, 5,490,318 m northing). The sample filters were analyzed by ALS laboratories for the particulate loading of TSP, PM_{10}, and metal composition Meteorological data (wind speed, relative humidity, temperature, and pressure) were measured at the monitoring location during the sampling period using a Nielsen Kellerman, Kestrel 4500 pocket weather meter.

Dustfall (particulate deposition) monitoring was undertaken for a one month period from November 6 to December 6, 2013. The sample was analyzed for total particulates, fixed and volatile fractions. The particulate deposition container was placed in a wind shield, which would limit the lateral entrainment of particulates and the inlet was positioned approximately 1.8 m off the ground. When the particulate deposition container was retrieved, after the sampling period, the sample fluid was frozen and also contained two bugs and a petal. The dustfall container was analyzed by ALS laboratories for total particulates and metal species.

The particulate deposition monitoring station was co-located with the Mini-Vol portable air sampler.

2.1.3.2 Data Processing

TSP concentrations were calculated from the particulate loading on the sampling filter and the volume of air that passed through the filter during the monitoring period. The particulate loading on the filter was determined through laboratory analysis and based on the filter's weight prior to monitoring and after monitoring. The volume of air that passed through the filter was calculated based on the flow rate indicated by the Mini-Vol at the start and end of the monitoring period, and average meteorological conditions during the monitoring period. Temperature and barometric pressure data from the portable meteorological station were used to correct the volumetric flow rate of Mini-Vol.

The TSP sample filters were analyzed for a suite of metals, for use in determining existing metals concentrations for the health discipline. The lab analysis results showed that the blank sample and the monitored sample had similar metal concentrations; this suggests that there were no distinctive difference between the blank sample and the monitored sample. The lab analysis on 31 metals showed that 26 metals yielded the same or lower average concentration than the blank. Antimony, Copper, Lithium, Uranium and Vanadium's average values were 0.7% to 10% higher than the blank values. Therefore, it was assumed that the metal concentrations would be based on the laboratory metal detection limits.

The particulate deposition rates were determined from laboratory analysis of the contents of the dustfall container. Analysis was undertaken for total dustfall and a suite of metals. Deposition data was not used within the air quality assessment; rather the data was used to complete the assessment for other disciplines.

2.2 Meteorology

Meteorology parameters are currently measured at two Environment Canada stations within the RSA. Port Mellon is located approximately 8 km south-southwest of the Project site (465,015 m easting, 5,485,006 m northing) and Pam Rocks is located approximately 11 km south east of the Project site (478,351 m easting, 5,481,739 m northing). These stations measure daily precipitation and hourly temperature, relative humidity, atmospheric pressure, and wind speed and direction. Pam Rocks has been operating since 1994, while Port Mellon has been operating since 2006. However, Pam Rocks station was not used as a part of the meteorological baseline study for the following reasons. Firstly Port Mellon is closer to the Project site than Pam Rocks. Secondly the Port Mellon station is located at the mouth of a valley, and the station is located adjacent to a land water interface; this physical setting is similar to the Project location. Therefore, Port Mellon station was chosen to be the representative meteorological station. Data was downloaded from Environment Canada's historic data website (Environment Canada 2014).

3.0 EXISTING ENVIRONMENTAL CONDITIONS

The following section describes the existing atmospheric conditions in the context of regional air quality, represented by TSP, PM_{10}, $PM_{2.5}$, NO_2 and SO_2.

3.1 Air Quality

Concentrations measured for PM_{10} from 2010 and 2013 and $PM_{2.5}$, NO_2, and SO_2 from 2012 and 2013 are summarized in the following sections.

3.1.1 Analysis

The continuous PM_{10} and $PM_{2.5}$ monitoring data are presented by month as simplified box-and-whisker plots. The NO_2 and SO_2 monitoring data are presented by hour in the same format. The box on the figures represents the bounds of the middle (50^{th} percentile) of the data points, with the top of the box representing the 75^{th} percentile concentration and the bottom of the box representing the 25^{th} percentile concentration. The blue diamond represents the average concentration. On the figure, the 'whiskers' extend up to the maximum, and down to the minimum concentration.

3.1.2 Langdale Elementary

The Langdale Elementary station is located approximately 16 km south-southwest of the Project. As shown in Table 2, the monitored air quality parameters include PM_{10}, $PM_{2.5}$, NO_2 and SO_2.

3.1.2.1 PM_{10}

Figure 2 indicates that PM_{10} concentrations were well below the BC air quality criteria of 50 µg/m^3 for 2010. Concentrations are observed to go through gradual change throughout the year. The monthly median value based on 24-hour averaging period ranged from 5.2 to 11.3 µg/m^3. The daily concentrations peak in late summer and early fall (July, August, September and October).

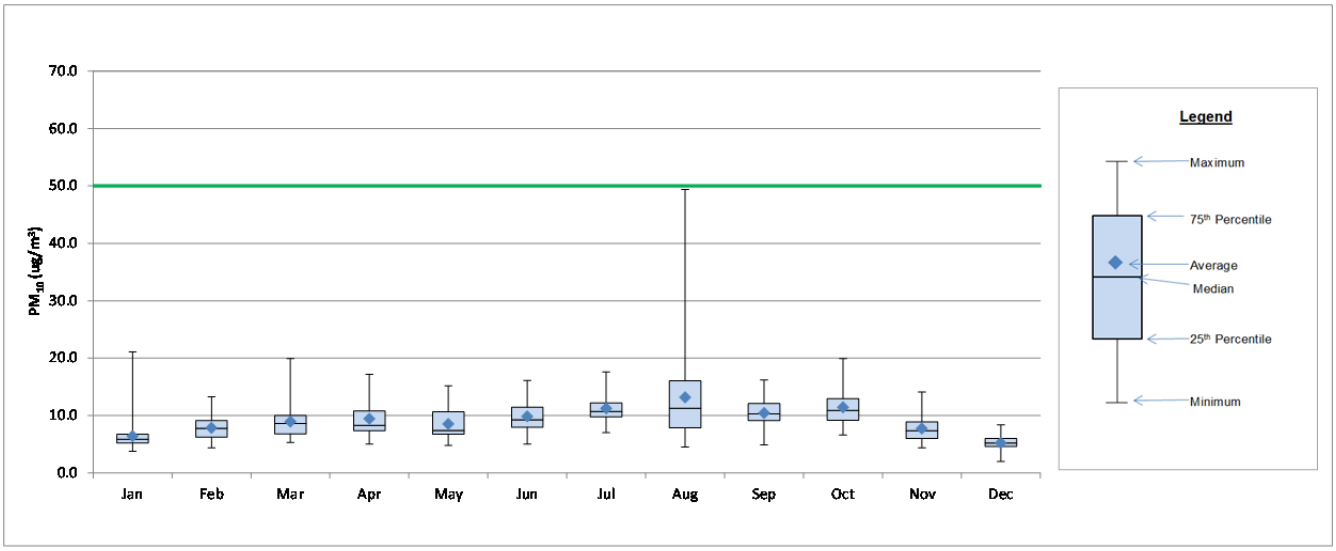


Figure 2: Langdale Elementary PM_{10} Concentrations for 2010

Figure 3 indicates that PM_{10} concentrations were well below the BC air quality criteria of 50 µg/m^3 for 2013. Concentrations are observed to follow similar trends as in 2010. The monthly median value based on 24-hour averaging period ranged from 5.4 to 15.5 µg/m^3.

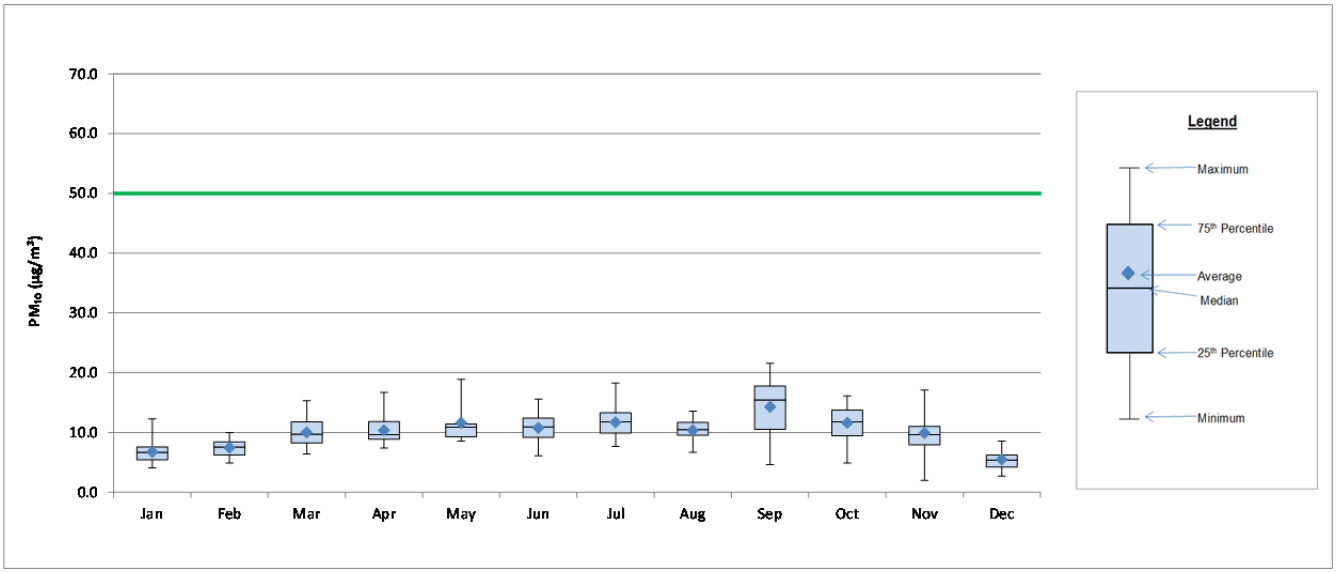


Figure 3: Langdale Elementary PM_{10} Concentrations for 2013

Table 4 indicates that the PM_{10} concentrations do not exceed the air quality criteria and that the concentrations were greater than half of the criteria only 0.3% of the time in 2010 and not at all in 2013. Table 5 shows that the 98th percentile value of the PM_{10} 24-hour data recorded at Langdale Elementary for 2010 was 19.9 µg/m^3 and for 2013 was 18.8 µg/m^3, whereas the BC 24-hour air quality criteria is 50 µg/m^3.

Table 4: Langdale Elementary PM_{10} Frequency Analysis for 2010 and 2013

Parameter	2010	2013
Total Valid Data (Days)	357	365
Number of Days >25 µg/m^3	1	0
Frequency of Days >25 µg/m^3	0.3%	0.0%
Number of Days >50 µg/m^3	0	0
Frequency of Days >50 µg/m^3	0.0%	0.0%

Note: BC's 24-hour air quality criteria for PM_{10} is 50 µg/m^3.

Table 5: Langdale Elementary PM_{10} Background Concentrations in 2010 and 2013

Averaging Period	Criteria (µg/m^3)	Background Concentration[3] (µg/m^3)	
		2010	2013
1-hour	—[1]	25.0	25.0
24-hour	50[2]	19.9	18.8
Annual	—[1]	9.2	10.0

Note 1: No criteria, data used for the health risk assessment only.
Note 2: BC's 24-hour air quality criteria.
Note 3: Short term background concentrations are based on the 98th percentile value.

3.1.2.2 $PM_{2.5}$

Figure 4 indicates that the daily concentrations of $PM_{2.5}$ in 2012 did not exceed BC's air quality criteria. Average concentrations are observed to peak in July and September. Note that this station had missing data during the month of August in 2012, and only six days of data were available. This station generally reported higher concentrations than the Squamish and Horseshoe Bay stations. The monthly median concentrations based on 24-hour averaging periods ranged from 3.2 to 9.0 µg/m^3.

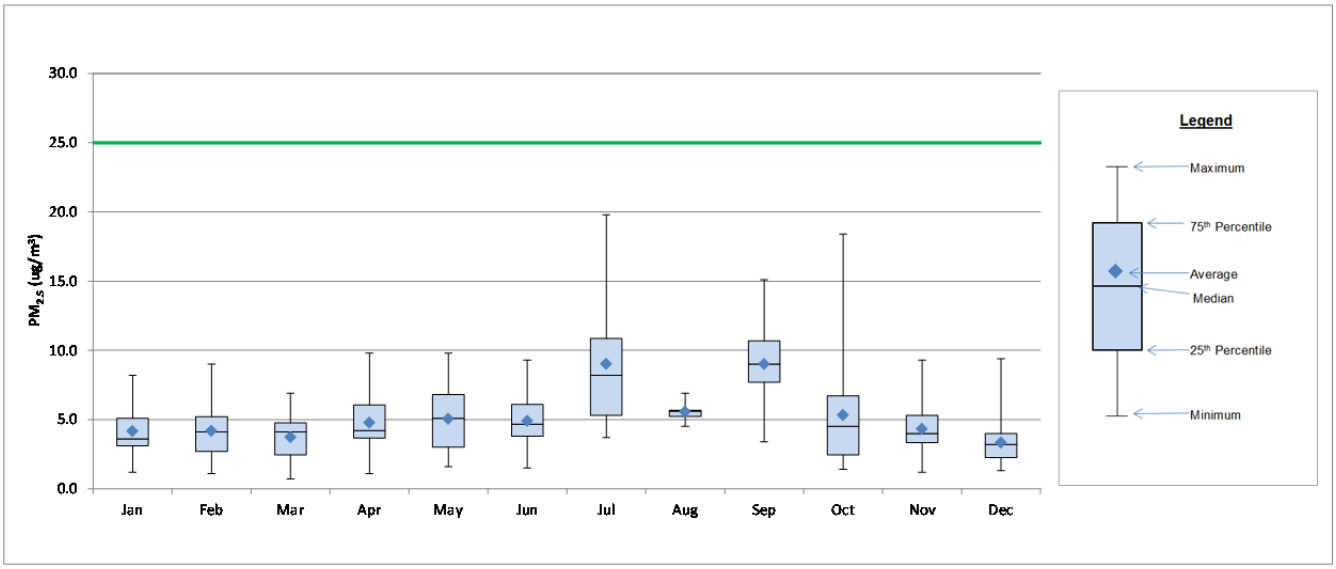


Figure 4: Langdale Elementary $PM_{2.5}$ Concentrations for 2012

Figure 5 indicates that the daily concentrations of $PM_{2.5}$ in 2013 did not exceed BC's air quality criteria. Similar trends to 2012 data were seen. The monthly median concentrations based on 24-hour averaging periods ranged from 2.9 to 9.6 µg/m^3.

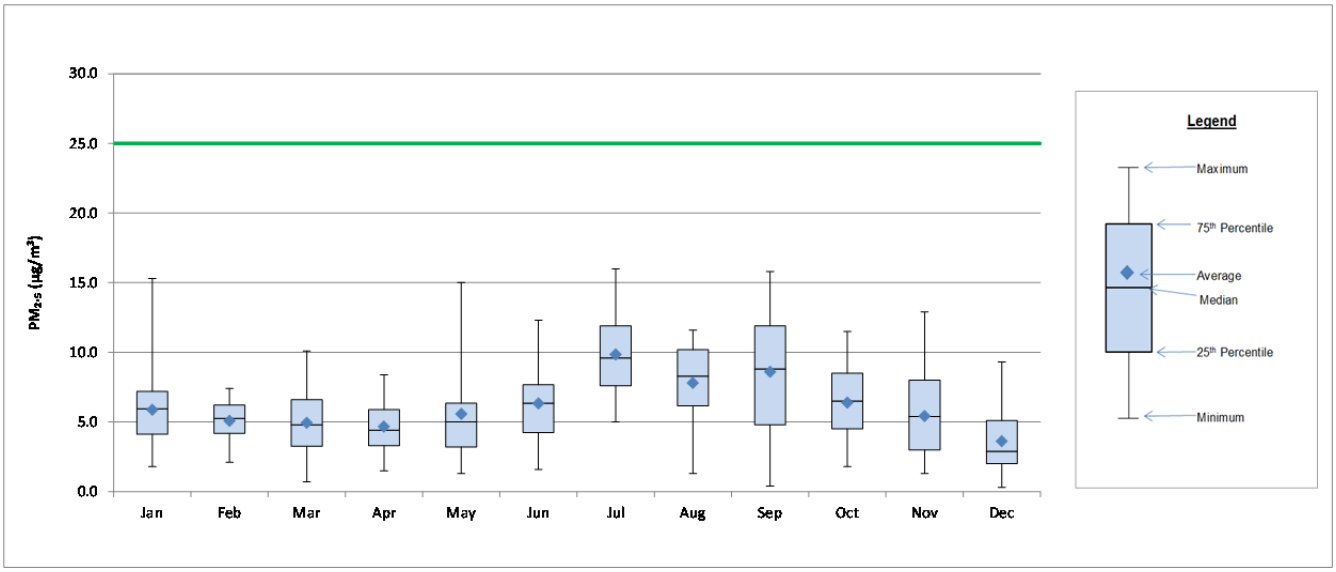


Figure 5: Langdale Elementary $PM_{2.5}$ Concentrations for 2013

Table 6 indicates that the $PM_{2.5}$ concentrations do not exceed the air quality criteria and that the concentrations are greater than half of the criteria 2.4% of the time (8 days of the year) in 2012 and 4.7% of the time (17 days of the year) in 2013. As shown in Table 7, the 98th percentile 24-hour concentration was 13.6 µg/m^3 in 2012 and 14.3 µg/m^3 in 2013, whereas the BC 24-hour criteria is 25 µg/m^3. The annual concentration was 5.2 µg/m^3 in 2012 and 6.2 µg/m^3 in 2013, whereas the BC annual criteria is 8 µg/m^3.

Table 6: Langdale Elementary $PM_{2.5}$ Frequency Analysis for 2012 and 2013

Parameter	2012	2013
Total Valid Data (Days)	333	363
Number of Days >12.5 µg/m^3	8	17
Frequency of Days >12.5 µg/m^3	2.4%	4.7%
Number of Days >25 µg/m^3	0	0
Frequency of Days >25 µg/m^3	0.0%	0.0%

Note: BC's 24-hour air quality criteria for $PM_{2.5}$ is 25 µg/m^3.

Table 7: Langdale Elementary $PM_{2.5}$ Background Concentrations in 2012 and 2013

Averaging Period	Criteria (µg/m^3)	Background Concentration^3 (µg/m^3)	
		2012	2013
1-hour	—[1]	17.6	20.4
24-hour	25[2]	13.6	14.3
Annual	8[2]	5.2	6.2

Note 1: No criteria, data used for the health risk assessment only.
Note 2: BC's air quality criteria.
Note 3: Short term concentrations are based on the 98th percentile value. Annual concentrations are based on the 100th percentile.

3.1.2.3 NO_2

Figure 6 presents the distribution of hourly NO_2 measurements from the Langdale Elementary station. The figure indicates that the hourly concentrations of NO_2 in 2013 did not exceed BC's 1-hour air quality criteria. Average concentrations are observed to increase slightly during the daytime and decrease at night. The median concentrations based on 1-hour averaging periods ranged from 3.3 to 5.8 ppb.

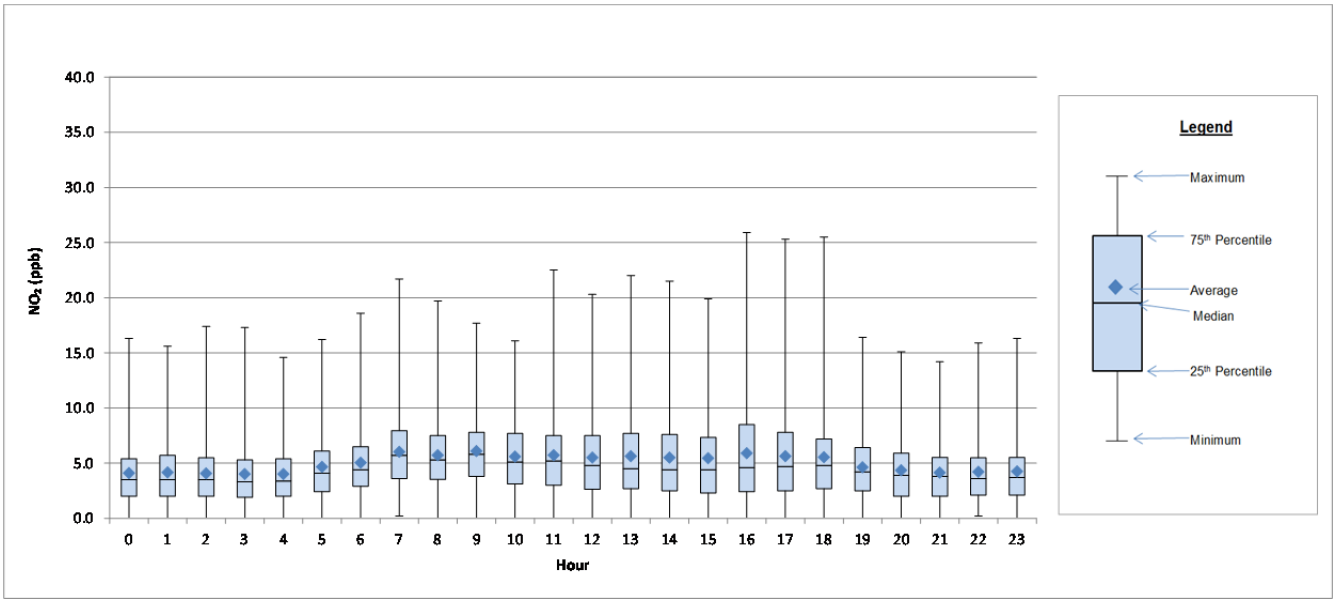


Figure 6: Langdale Elementary NO_2 Concentrations for 2013

As mentioned in 2.1.2.2, daily maximum 1-hour was used to establish the background concentration Table 8 presents the total valid data for the number of hours, and total valid days with daily maximum 1-hour data within 2013. Note that Guidance on Application of Provincial Interim Air Quality Objectives for NO_2 and SO_2 (BC MoE 2014c) states that daily 1-hour maximum concentration is considered as a valid data point, only if there are 18 or more measurements in a day. Table 8 also presents frequency of exceedance against the air quality objective based on hourly measurement. Table 8 indicates that hourly and annual NO_2 concentrations were well below the air quality criteria in 2013. Table 9 indicates that based on daily maximum 1-hour measurements, the 1-hour NO_2 value for Langdale Elementary was 22 ppb, whereas the 1-hour BC ambient air quality criteria is 100 ppb. The annual NO_2 value was 5.0 ppb, whereas the annual criteria is 32 ppb.

Table 8: Langdale Elementary NO_2 Frequency Analysis for 2013

Parameter	2013
Total Valid Data (Hours)	7969
Total Valid Days (days with daily maximum 1-hour)	359
Number of Hours > 50 ppb	0
Frequency of Hours > 50 ppb	0.0%
Number of Hours > 100 ppb	0
Frequency of Hours > 100 ppb	0.0%

Note: BC's 1-hour air quality criteria for NO_2 is 100 ppb.

Table 9: Langdale Elementary NO_2 Background Concentrations in 2013

Averaging Period	Criteria (ppb)	Background Concentration[3] (ppb)
1-hour	100[1]	22
24-hour	—[2]	9.8
Annual	32[1]	5.0

Note 1: BC's Interim criteria based on daily 1-hour maximum value.
Note 2: No criteria, data used for the health risk assessment only.
Note 3: Concentrations are calculated based on the Guidance on Application of Provincial Interim Air Quality Objectives for NO_2 and SO_2 (BC MoE 2014c).

3.1.2.4 SO_2

Figure 7 presents the distribution of SO_2 hourly measurement from Langdale station. The figure indicates that the hourly concentrations of SO_2 in 2013 did not exceed BC's 1-hour air quality criteria. Average concentrations are observed to increase slightly during the daytime and decrease at night. The median concentrations based on 1-hour averaging periods ranged from 0.5 to 1.1 ppb.

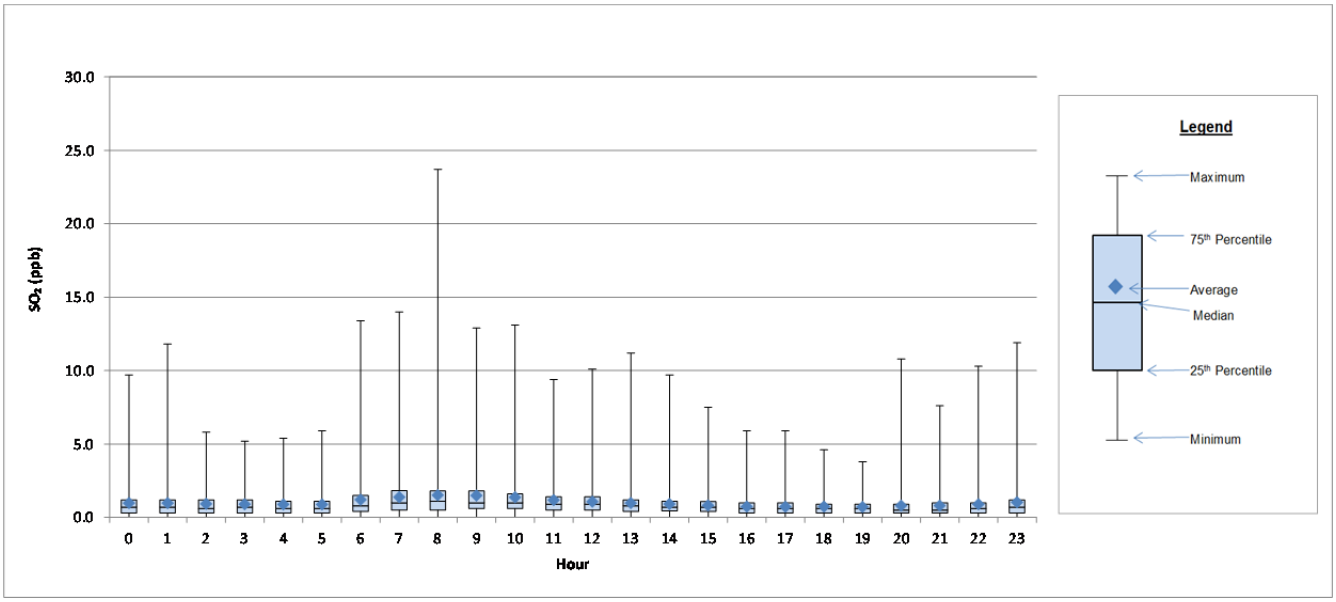


Figure 7: Langdale Elementary SO_2 Concentrations for 2013

Table 10 presents the total valid data for the number of hours, and total valid days with daily maximum 1-hour data within 2013. Table 10 also presents frequency of exceedance against the air quality objective based on hourly measurement. Table 10 indicates that hourly SO_2 concentrations based on daily maximum 1-hour measurements were well below the air quality criteria in 2013. Table 11 indicates that based on daily maximum 1-hour measurements, the 1-hour SO_2 background concentration for Langdale Elementary was 13 ppb, whereas the 1-hour BC ambient air quality criteria is 75 ppb.

Table 10: Langdale Elementary SO_2 Frequency Analysis for 2013

Parameter	2013
Total Valid Data (Hours)	8259
Total Valid Data (days with daily maximum 1-hour)	359
Number of Hours > 37.5 ppb	0
Frequency of Hours > 37.5 ppb	0.0%
Number of Hours > 75 ppb	0
Frequency of Hours > 75 ppb	0.0%

Note: BC's 1-hour air quality criteria for SO_2 is 75 ppb.

Table 11: Langdale Elementary SO_2 Background Concentrations in 2013

Averaging Period	Criteria (ppb)	Background Concentration[3] (ppb)
1-hour	75[1]	13
24-hour	—[2]	2.4
Annual	—[2]	1.0

Note 1: BC's Interim criteria based on daily 1-hour maximum value.
Note 2: No criteria, data used for the health risk assessment only.
Note 3: Concentrations are calculated based on the Guidance on Application of Provincial Interim Air Quality Objectives for NO_2 and SO_2 (BC MoE 2014c).

3.1.3 Squamish

The Squamish air quality station is located approximately 23 km northeast from the Project site. As shown in Table 2, the monitored air quality parameters include PM_{10}, $PM_{2.5}$, NO_2 and SO_2.

3.1.3.1 PM_{10}

Figure 8 shows that in August and November, the measured PM_{10} concentrations exceeded the BC air quality criteria. The monthly median concentration based on 24-hour averaging period ranged from 5.6 to 19.0 µg/m^3. However, the figure trend shows that the PM_{10} concentrations are generally higher during the summer season (June, July and August).

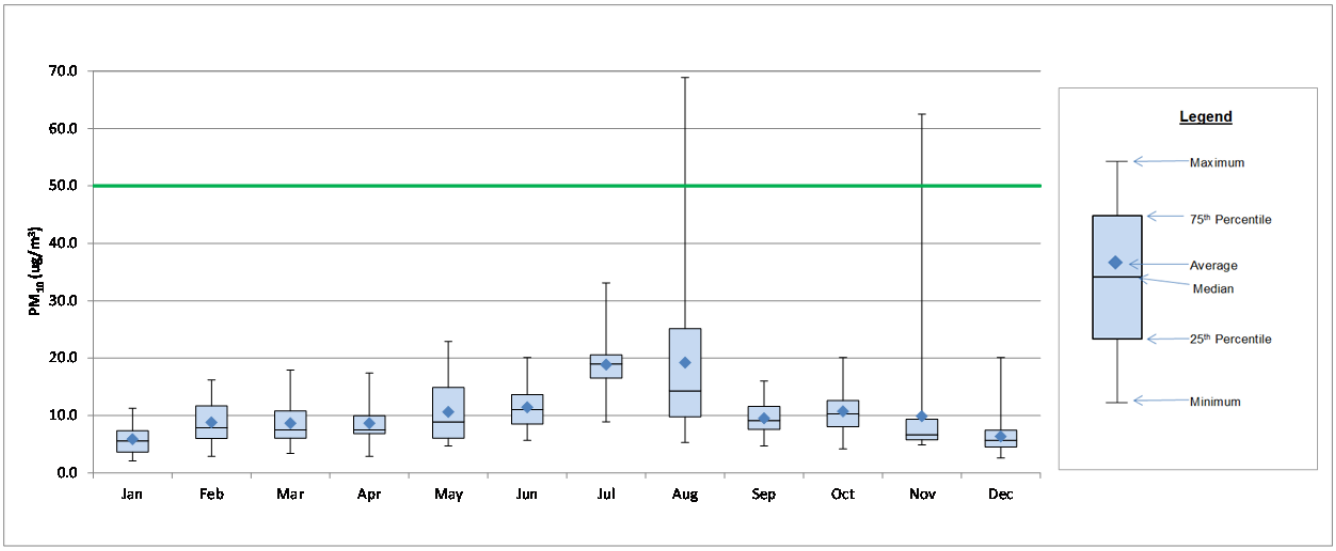


Figure 8: Squamish PM_{10} Concentrations for 2010

Table 12 indicates that Squamish experienced days where the PM_{10} concentration exceeded the 24-hour average air quality criteria 0.6% of the time. The PM_{10} concentration was greater than half of the criteria 3.0% of the time. This shows that Squamish tends to observe higher PM_{10} concentrations compared to Langdale Elementary station. As shown in Table 13, the 98th percentile value of the 24-hour data recorded at Squamish station for 2010 was 32.5 µg/m^3, whereas the BC Ambient Air Quality Criteria is 50 µg/m^3.

Table 12: Squamish PM_{10} Frequency Analysis for 2010

Parameter	2010
Total Valid Data (Days)	363
Number of Days >25 µg/m^3	11
Frequency of Days >25 µg/m^3	3.0%
Number of Days >50 µg/m^3	2
Frequency of Days >50 µg/m^3	0.6%

Note: BC's 24-hour air quality criteria for PM_{10} is 50 µg/m^3.

Table 13: Squamish PM_{10} Background Concentrations in 2010

Averaging Period	Criteria[1] (µg/m^3)	Background Concentration[3] (µg/m^3)
		2010
1-hour	—[1]	37.4
24-hour	50[2]	32.5
Annual	—[1]	10.7

Note 1: No criteria, data used for the health risk assessment only.
Note 2: BC's 24-hour air quality criteria.
Note 3: Short term background concentrations are based on the 98th percentile value.

3.1.3.2 $PM_{2.5}$

Figure 9 indicates that the daily $PM_{2.5}$ concentrations did not exceeded the air quality criteria for 2012. The monthly median concentration based on 24-hour averaging period ranged from 2.0 to 6.8 µg/m^3. The graph shows that the concentration increased in the summer time (July, August and September).

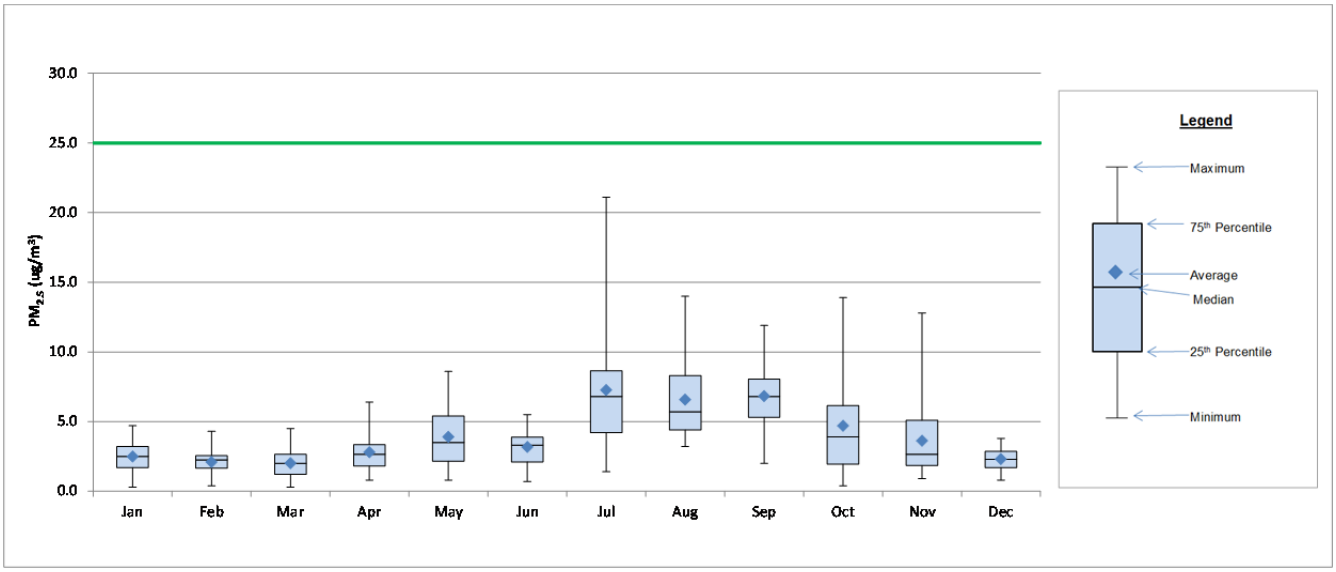


Figure 9: Squamish $PM_{2.5}$ Concentrations for 2012

Figure 10 indicates that the daily $PM_{2.5}$ concentrations did not exceeded the air quality criteria for 2013. The monthly median concentration based on 24-hour averaging period ranged from 1.9 to 10.1 µg/m^3. The graph shows that the concentration increased in the summer time (July, August and September).

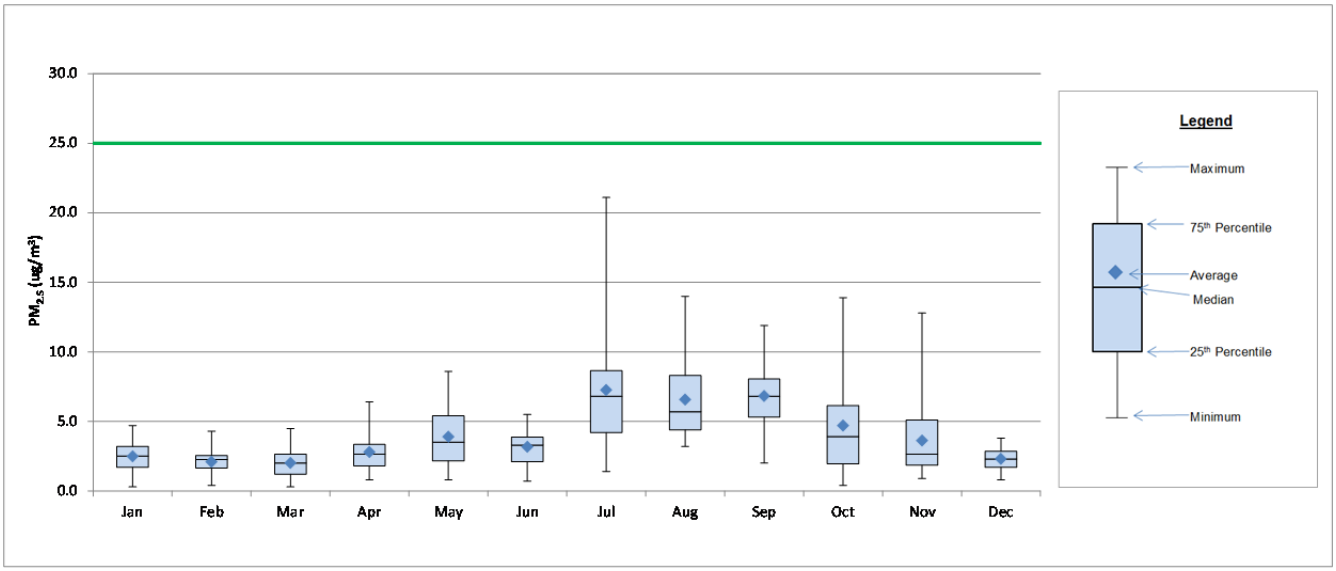


Figure 10: Squamish $PM_{2.5}$ Concentrations for 2013

Table 14 indicates that, for the 24-hour averaging period, $PM_{2.5}$ concentrations at Squamish did not exceed the air quality objective and that the concentrations are greater than half of the criteria 2.3% of the time in 2012 and 5.5% of the time in 2013. As shown in Table 15, the $PM_{2.5}$ 98th percentile value of the 24-hour data for 2012 was 12.8 µg/m^3 and 14.7 µg/m^3 in 2013, whereas the BC 24-hour criteria is 25 µg/m^3. The annual concentration was 4.0 µg/m^3 in 2012 and 6.4 µg/m^3 in 2013, whereas the BC annual criteria is 8 µg/m^3.

Table 14: Squamish $PM_{2.5}$ Frequency Analysis for 2012 and 2013

Parameter	2012	2013
Total Valid Data (Days)	350	345
Number of Days >12.5 µg/m^3	8	19
Frequency of Days >12.5 µg/m^3	2.3%	5.5%
Number of Days >25 µg/m^3	0	0
Frequency of Days >25 µg/m^3	0.0%	0.0%

Note: BC's 24-hour air quality criteria for $PM_{2.5}$ is 25 µg/m^3.

Table 15: Squamish $PM_{2.5}$ Background Concentrations in 2012 and 2013

Averaging Period	Criteria[1] (µg/m^3)	Background Concentration[3] (µg/m^3)	
		2012	2013
1-hour	—[1]	15.4	21.0
24-hour	25[2]	12.8	14.7
Annual	8[2]	4.0	6.4

Note 1: No criteria, data used for the health risk assessment only.
Note 2: BC's air quality criteria.
Note 3: Short term concentrations are based on the 98th percentile value. Annual concentrations are based on the 100th percentile.

3.1.3.3 NO_2

Figure 11 presents the distribution of NO_2 hourly measurements from Squamish station. The figure indicates that the hourly concentrations of NO_2 in 2013 did not exceed BC's 1-hour air quality criteria. Average concentrations are observed to increase slightly during the morning and evening. The median concentrations based on 1-hour averaging periods ranged from 3.4 to 6.3 ppb.

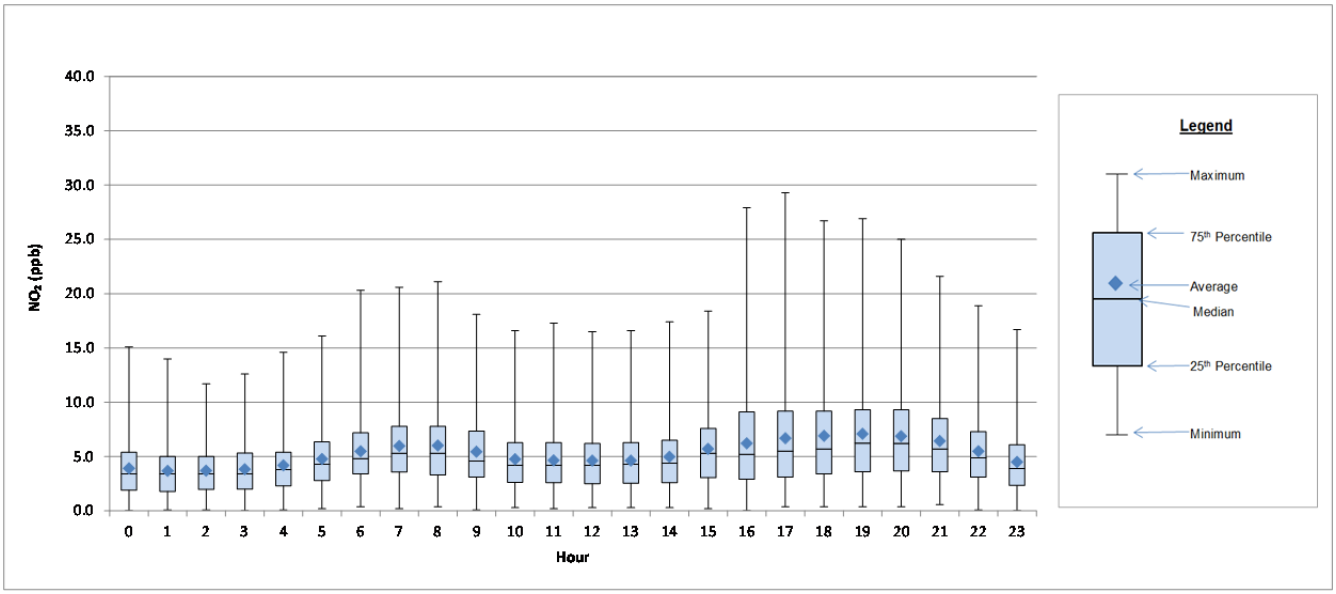


Figure 11: Squamish NO_2 Concentrations for 2013

Table 16 presents the total valid data for the number of hours, and total valid days with daily maximum 1-hour data within 2013. Table 16 also presents frequency of exceedance against the air quality objective based on hourly measurement. It also indicates that hourly and annual NO_2 concentrations were well below the air quality objective in 2013. Table 17 indicates that based on daily maximum 1-hour measurements, the 1-hour NO_2 background concentration for Squamish was 21 ppb, whereas the 1-hour BC ambient air quality criteria is 100 ppb. The annual NO_2 value was 5.3 ppb, whereas the annual objective is 32 ppb.

Table 16: Squamish NO_2 Frequency Analysis for 2013

Parameter	2013
Total Valid Data (Hours)	7610
Total Valid Data (days with daily maximum 1-hour)	302
Number of Hours > 50 ppb	0
Frequency of Hours > 50 ppb	0.0%
Number of Hours > 100 ppb	0
Frequency of Hours > 100 ppb	0.0%

Note: BC's 1-hour air quality criteria for NO_2 is 100 ppb.

Table 17: Squamish NO_2 Background Concentrations in 2013

Averaging Period	Criteria (ppb)	Background Concentration[3] (ppb)
1-hour	100[1]	21
24-hour	—[2]	10.0
Annual	32[1]	5.3

Note 1: BC's Interim criteria based on daily 1-hour maximum value.
Note 2: No criteria, data used for the health risk assessment only.
Note 3: Concentrations are calculated based on the Guidance on Application of Provincial Interim Air Quality Objectives for NO_2 and SO_2 (BC MoE 2014c).

3.1.3.4 SO_2

Figure 12 presents the distribution of SO_2 hourly measurements from Squamish station. The figure indicates that the hourly concentrations of SO_2 in 2013 did not exceed BC's 1-hour air quality criteria. Average concentrations are observed to increase slightly during the daytime and decrease at night. The median concentrations based on 1-hour averaging periods ranged from 0.4 to 0.7 ppb.

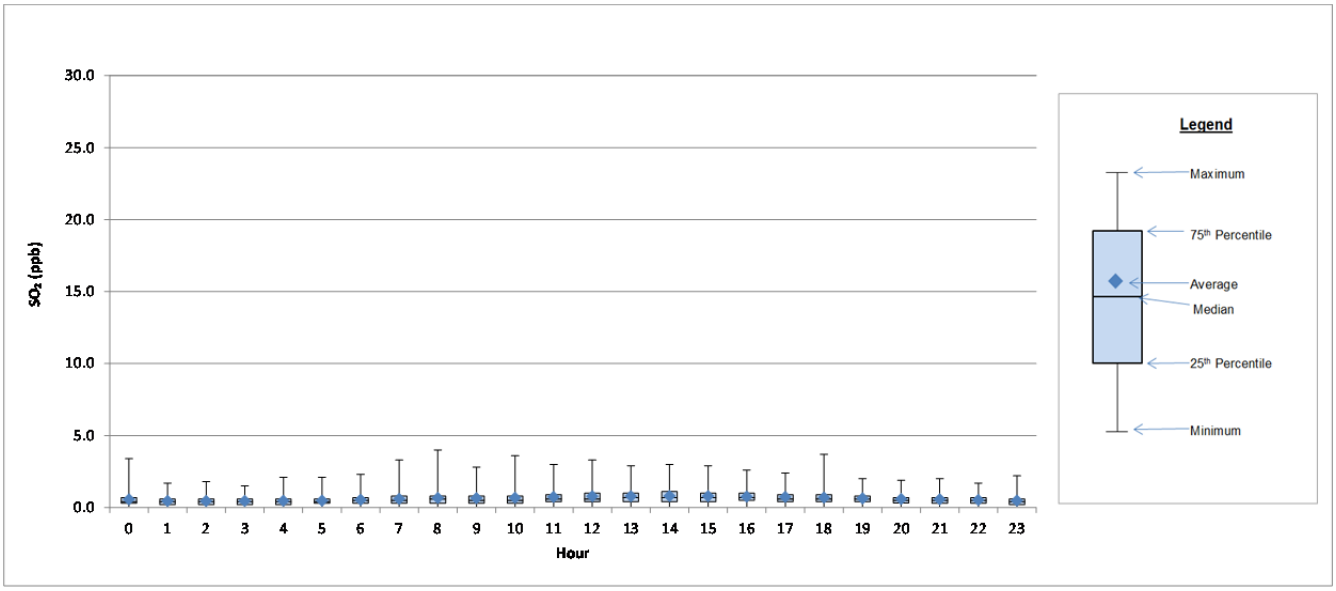


Figure 12: Squamish SO_2 Concentrations for 2013

Table 18 presents the total valid data for the number of hours, and total valid days with daily maximum 1-hour data within 2013. Table 18 also presents frequency of exceedance against the air quality objective based on hourly measurement. It also indicates that hourly and annual SO_2 concentrations were well below the air quality criteria in 2013. Table 19 indicates that based on daily maximum 1-hour measurements, the 1 hour SO_2 background concentration for Squamish was 3 ppb, whereas the 1 hour BC ambient air quality criteria is 75 ppb.

Table 18: Squamish SO_2 Frequency Analysis for 2013

Parameter	2013
Total Valid Data (Hours)	7239
Total Valid Data (days with daily maximum 1-hour)	302
Number of Hours > 37.5 ppb	0
Frequency of Hours > 37.5 ppb	0.0%
Number of Hours > 75 ppb	0
Frequency of Hours > 75 ppb	0.0%

Note: BC's 1-hour air quality criteria for SO_2 is 75 ppb.

Table 19: Squamish SO_2 Background Concentrations in 2013

Averaging Period	Criteria (ppb)	Background Concentration[3] (ppb)
1-hour	75[1]	3
24-hour	—[2]	1.2
Annual	—[2]	0.6

Note 1: BC's Interim criteria based on daily 1-hour maximum value.
Note 2: No criteria, data used for the health risk assessment only.
Note 3: Concentrations are calculated based on the Guidance on Application of Provincial Interim Air Quality Objectives for NO_2 and SO_2 (BC MoE 2014c).

3.1.4 Horseshoe Bay

The Horseshoe Bay station is located approximately 23 km south-southeast from the Project site. Only $PM_{2.5}$ data were available from this station.

3.1.4.1 $PM_{2.5}$

Figure 13 indicates that the daily $PM_{2.5}$ concentrations did not exceeded the air quality criteria for 2012. The graph shows that the average daily concentration increases in the summer time (July, August and September). The monthly median concentration based on 24-hour averaging period ranged from 1.5 to 4.2 µg/m^3.

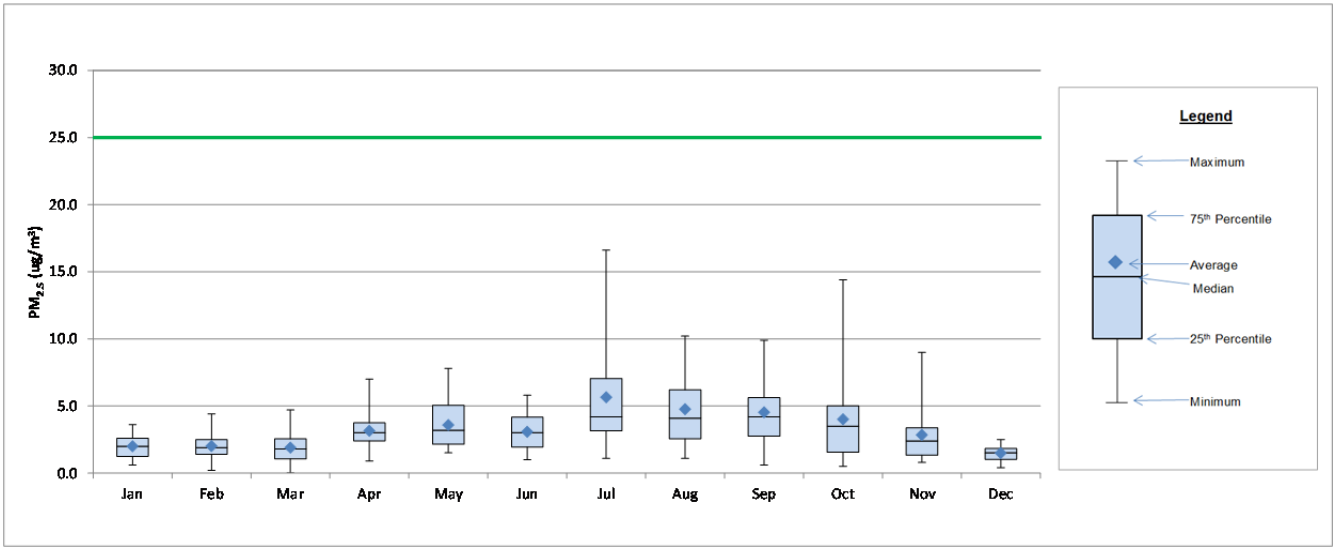


Figure 13: Horseshoe Bay $PM_{2.5}$ Concentrations for 2012

Figure 14 indicates that the daily $PM_{2.5}$ concentrations did not exceeded the air quality criteria for 2013. The graph shows that the average daily concentration remains consistent throughout the year. The monthly median concentration based on 24-hour averaging period ranged from 3.4 to 5.2 µg/m^3.

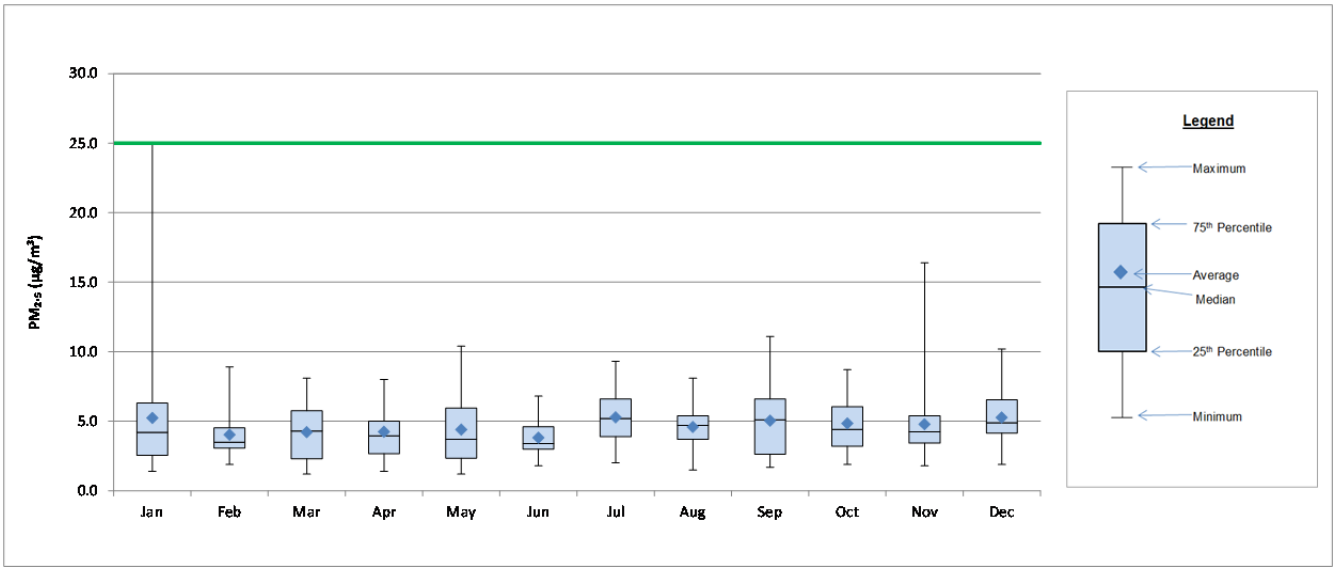


Figure 14: Horseshoe Bay $PM_{2.5}$ Concentrations for 2013

Table 20 indicates that for the 24-hour averaging period, $PM_{2.5}$ did not exceed the air quality criteria while concentrations were greater than half of the criteria 1.1% of the time in 2012 and 0.6% of the time in 2013. As shown in Table 21, the 24-hour $PM_{2.5}$ 98th percentile value for Horseshoe Bay was 10.2 µg/m^3 for 2012 and 10.0 µg/m^3 in 2013, whereas the 1-hour BC criteria is 25 µg/m^3. The annual concentration was 3.3 µg/m^3 in 2012 and 4.6 µg/m^3 in 2013, whereas the annual BC criteria is 8 µg/m^3.

Table 20: Horseshoe Bay $PM_{2.5}$ Frequency Analysis for 2012 and 2013

Parameter	2012	2013
Total Valid Data (Days)	355	363
Number of Days >12.5 µg/m^3	4	2
Frequency of Days >12.5 µg/m^3	1.1%	0.6%
Number of Days >25 µg/m^3	0	0
Frequency of Days >25 µg/m^3	0.0%	0.0%

Note: BC's 24-hour air quality criteria for $PM_{2.5}$ is 25 µg/m^3.

Table 21: Horseshoe Bay $PM_{2.5}$ Background Concentrations in 2012 and 2013

Averaging Period	Criteria (µg/m^3)	Background Concentration[3] (µg/m^3)	
		2012	2013
1-hour	—[1]	11.7	12.1
24-hour	25[2]	10.2	10.0
Annual	8[2]	3.3	4.6

Note 1: No criteria, data used for the health risk assessment only.
Note 2: BC's air quality criteria.
Note 3: Short term concentrations are based on the 98th percentile value. Annual concentrations are based on the 100th percentile.

3.2 On Site Air Quality Monitoring

3.2.1 TSP

The TSP concentrations measured at the Project site are summarized in Table 22.

Table 22: Project 24-hour TSP Concentrations

Date	Concentration (µg/m³)
6 Nov 2013	9.3
8 Nov 2013	23.3

Table 22 indicates that for the two 24-hour samples taken, TSP concentrations were well below the Federal Maximum Acceptable and the BC Level A criteria of 120 µg/m³.

3.2.2 Dustfall (Particulate Deposition)

The dustfall (particulate deposition) rate measured at the Project site are summarised in Table 23.

Table 23: Project Deposition Rate

Particulates	Deposition Rate (mg/dm^2/day)
Fixed Dustfall	<0.10
Volatile Dustfall	0.23
Total Dustfall	0.32

3.2.3 Metals

Table 24 summarizes the metals background concentrations calculated based on the TSP monitored data. The methods used to calculate metal concentrations are described in Section 2.1.3.2.

Table 24: Project Baseline Metal Concentrations from TSP Samples

	1-hour Concentration (µg/m^3)	24-hour Concentration (µg/m^3)	Annual Concentration (µg/m^3)
Aluminum (Al)	0.331	0.278	0.106
Antimony (Sb)	0.005	0.004	0.002
Arsenic (As)	0.017	0.014	0.005
Barium (Ba)	0.017	0.014	0.005
Beryllium (Be)	0.017	0.014	0.005
Bismuth (Bi)	0.050	0.042	0.016
Cadmium (Cd)	0.008	0.007	0.003
Calcium (Ca)	1.656	1.392	0.529
Chromium (Cr)	0.166	0.139	0.053
Cobalt (Co)	0.017	0.014	0.005
Copper (Cu)	0.017	0.014	0.005
Iron (Fe)	0.331	0.278	0.106

	1-hour Concentration ($\mu g/m^3$)	24-hour Concentration ($\mu g/m^3$)	Annual Concentration ($\mu g/m^3$)
Lead (Pb)	0.050	0.042	0.016
Lithium (Li)	0.083	0.070	0.026
Magnesium (Mg)	0.828	0.696	0.264
Manganese (Mn)	0.008	0.007	0.003
Mercury (Hg)	0.002	0.001	0.001
Molybdenum (Mo)	0.050	0.042	0.016
Nickel (Ni)	0.050	0.042	0.016
Phosphorus (P)	3.312	2.785	1.057
Potassium (K)	1.656	1.392	0.529
Selenium (Se)	0.083	0.070	0.026
Silver (Ag)	0.005	0.004	0.002
Sodium (Na)	1.656	1.392	0.529
Strontium (Sr)	0.008	0.007	0.003
Thallium (Tl)	0.008	0.007	0.003
Tin (Sn)	0.050	0.042	0.016
Titanium (Ti)	0.083	0.070	0.026
Uranium (U)	0.001	0.001	0.000
Vanadium (V)	0.083	0.070	0.026
Zinc (Zn)	0.083	0.070	0.026

Table 25 summarizes the metal deposition rates obtained from the particulate deposition sample, using the method outlined in Section 2.1.3.

Table 25: Project Baseline Metal Deposition Rates

Metal	Annual Deposition Rate ($g/m^2/y$)
Aluminum (Al)	0.0045
Antimony (Sb)	0.0001
Arsenic (As)	0.0018
Barium (Ba)	0.0001
Beryllium (Be)	0.0003
Bismuth (Bi)	0.0003
Cadmium (Cd)	0.0000
Calcium (Ca)	0.0292
Chromium (Cr)	0.0003
Cobalt (Co)	0.0001
Copper (Cu)	0.0005
Iron (Fe)	0.0178
Lead (Pb)	0.0001
Lithium (Li)	0.0029
Magnesium (Mg)	0.0584
Manganese (Mn)	0.0004

Metal	Annual Deposition Rate ($g/m^2/y$)
Mercury (Hg)	0.0000
Molybdenum (Mo)	0.0000
Nickel (Ni)	0.0003
Phosphorus (P)	0.1779
Potassium (K)	1.1387
Selenium (Se)	0.0006
Silver (Ag)	0.0000
Sodium (Na)	1.1387
Strontium (Sr)	0.0001
Thallium (Tl)	0.0001
Tin (Sn)	0.0001
Titanium (Ti)	0.0058
Uranium (U)	0.0000
Vanadium (V)	0.0006
Zinc (Zn)	0.0046

3.3 Existing Meteorology

Within the air quality assessment, the air dispersion model will be executed in no-observation mode using one year's worth of mesoscale meteorological data to drive the dispersion model meteorological predictions; which is consistent with BC MoE (2008) guidelines, and the detailed model plan approved by the BC MoE (Golder 2015). Therefore, meteorological station data, within the modelling domain, will be used to validate the dispersion model's meteorological data as well as providing an understanding of the local weather conditions.

Two Environment Canada meteorological observation stations were operational within the RSA, Port Mellon, and Pam Rocks. As discussed in Section 2.2, Port Mellon was selected to be the representative meteorological station for the baseline study. For meteorological data comparison purposes, it was determined that comparing modelled meteorological dataset against Pam Rocks was not suitable. Pam Rocks is located on a small island, approximately 2.4 km south of Anvil Island. The station is surrounded by the ocean in all directions, and since the island is so small, and is 4.9 masl, this small island will not be resolved by the dispersion model's meteorological processor (CALMET), making a comparison between model and observation data not relevant.

With regards to Port Mellon, temperature, relative humidity, atmospheric pressure, and wind speed and direction and precipitation were measured hourly. Five years of meteorological data was summarized based on BC MoE (2008) guidelines: it is expected that the frequency distribution of meteorological conditions would stabilize after five years. And since this report is meant to provide a contextualization of local metrological conditions five years are being presented. Measured hourly data from January 2008 to December 2012 are presented. Data completeness checks indicate that the precipitation data from 2008 to 2012 does not meet the recommended criteria set by the BC Modelling guideline (BC MoE 2008). Therefore, precipitation data were examined from 2007 to 2011 instead.

3.3.1 Data Completeness

A data gap analysis was undertaken for the meteorology parameters presented in this report to identify the completeness of the datasets. Table 26 summarizes the gaps in the Port Mellon hourly meteorology station data from January 2008 to December 2012, and in the precipitation data from January 2007 to December 2011. Note that precipitation data were taken from 2007-2011 as it did not meet the data completeness criteria for the 2008 - 2012 period. Table 26 indicates that all meteorological parameters measured at Port Mellon meet the BC MoE (2008) data completeness recommendation of 90%.

Table 26: Port Mellon Meteorology Gap Analysis

Meteorology Parameter	Percent of Missing Data
Temperature	5.4%
Relative Humidity	8.2%
Wind Speed	4.7%
Wind Direction	4.7%
Precipitation [(a)]	8.2%

(a) Daily measurement data from 2007 – 2011

3.3.2 Temperature

Figure 15 indicates hourly temperatures peak during the summer months (July and August) to approximately 18°C. The maximum and minimum monthly values indicate consistent temperatures from year to year over the five year period.

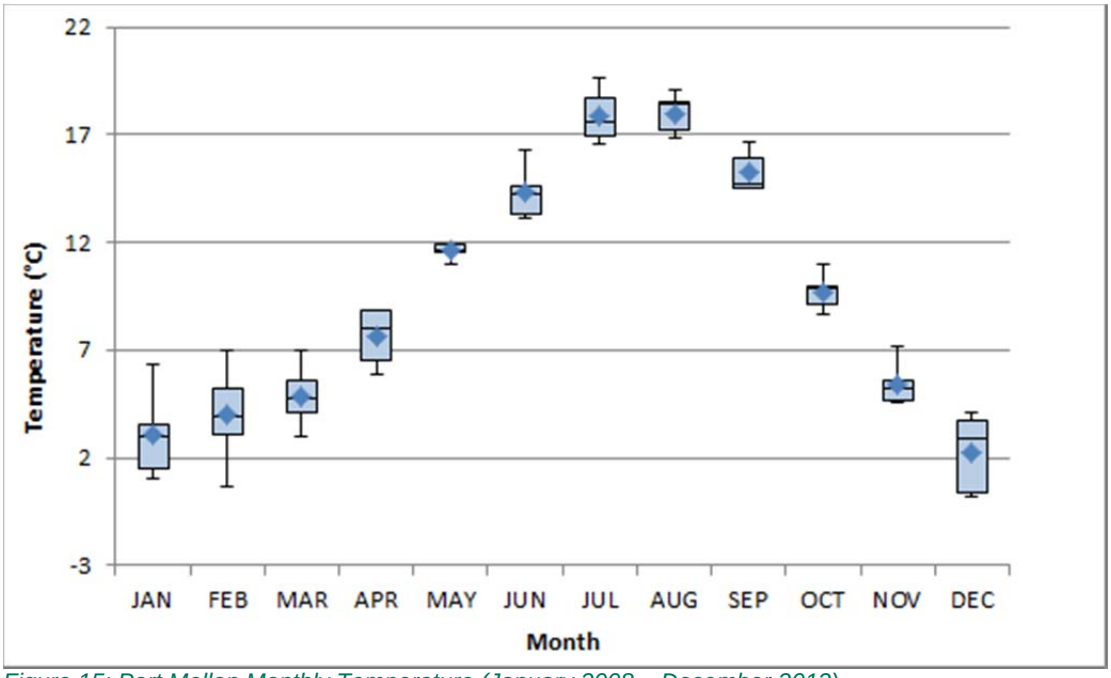


Figure 15: Port Mellon Monthly Temperature (January 2008 – December 2012)

3.3.3 Relative Humidity

Figure 16 shows that the lowest relative humidity readings are generally observed during the spring and summer months (April through August) and peak in November. The minimum and maximum hourly values demonstrate there is some variability from year to year (up to 15%).

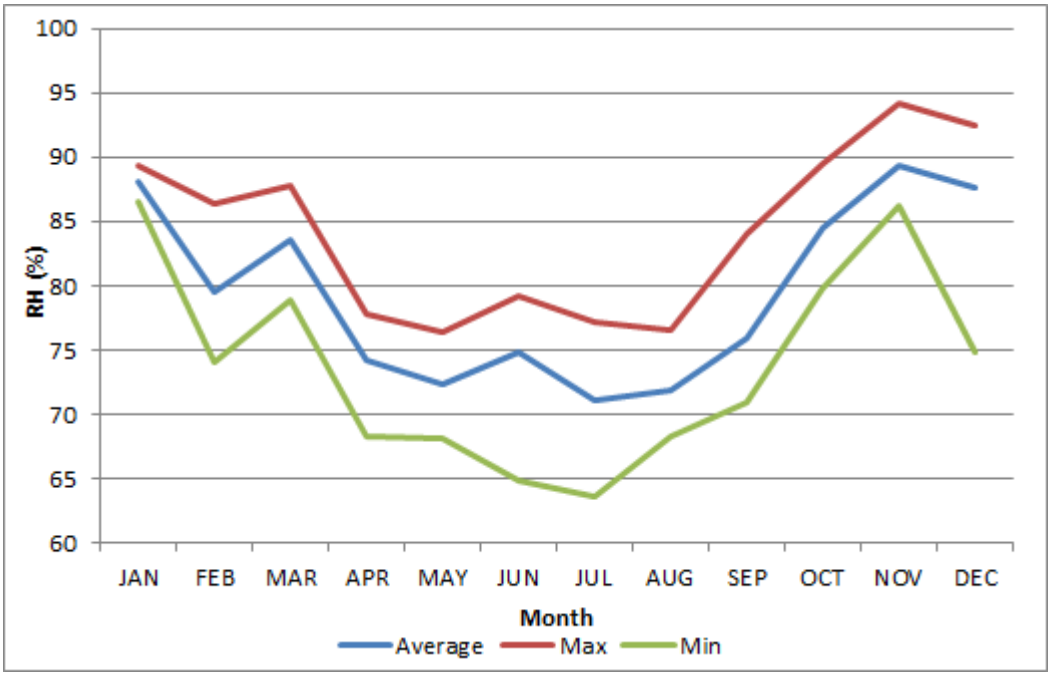


Figure 16: Port Mellon Monthly Relative Humidity (January 2008 – December 2012)

3.3.4 Precipitation

Figure 17 illustrates the precipitation measured at Port Mellon over five years (2007 – 2011). It is observed that precipitation peaks in November and falls to its lowest levels during the summer months (June through August). This trend correlates to the relative humidity trend, where the summer months show the lowest relative humidity values, and peaks in November.

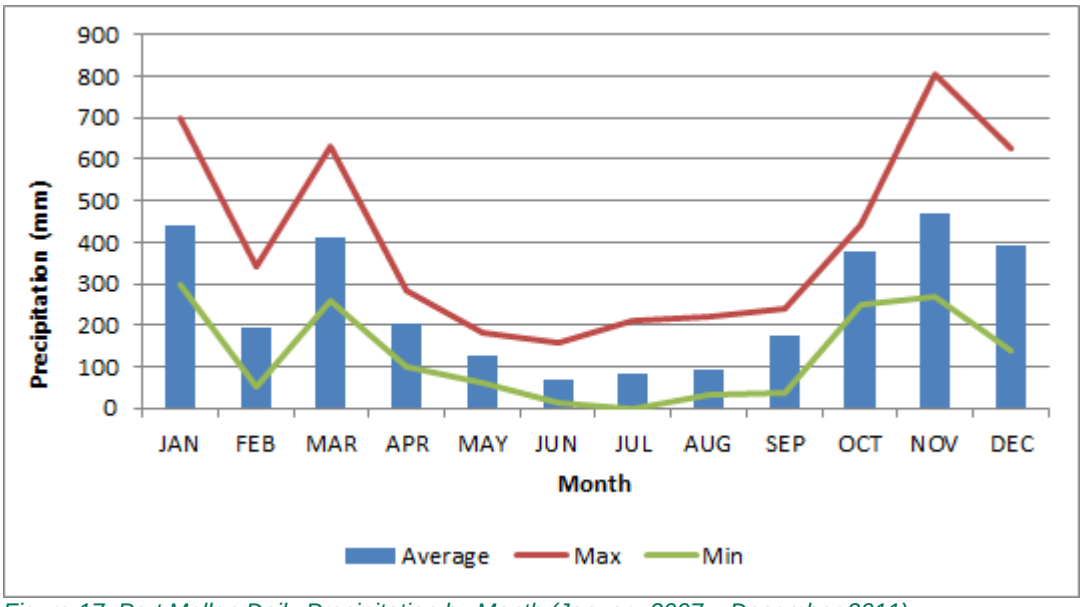
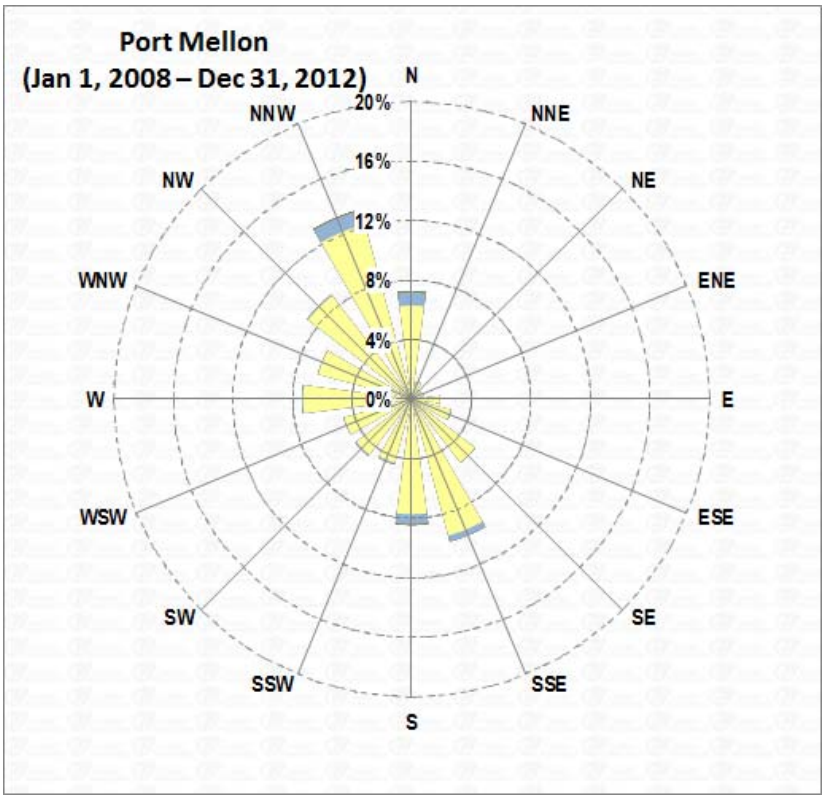


Figure 17: Port Mellon Daily Precipitation by Month (January 2007 – December 2011)

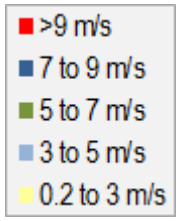
3.3.5 Winds

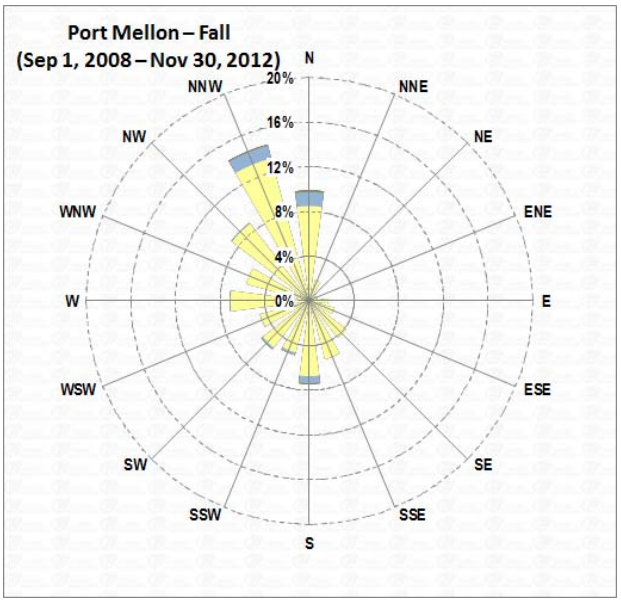
A wind rose depicts the relative frequency of wind direction on a 16-point compass, with north, east, south, and west directions going clockwise, whose value is listed adjacent to each of the compass points. Each ring on the wind rose represents a frequency of 4% of the total. The length of the shaded bars on each wind rose petal represents the frequency of wind recorded from a given direction within a certain speed range.

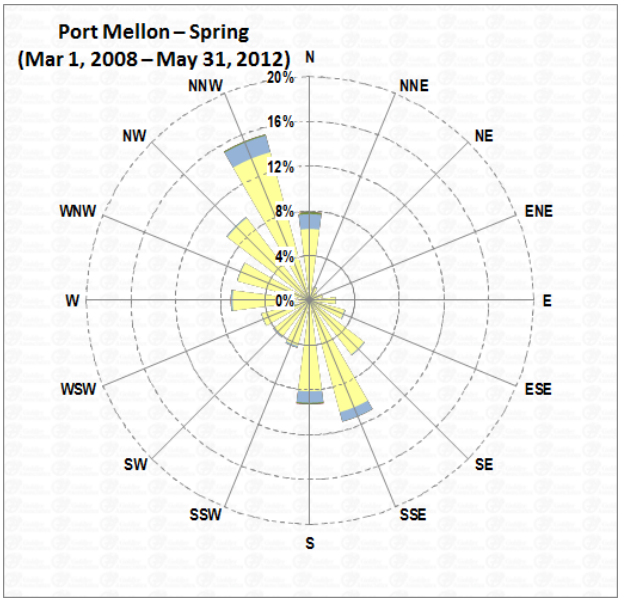
A wind rose plot depicting the relative frequency of mean hourly wind speed and direction over the five year period and seasonal distribution is shown for 2008 - 2012 in Figure 18.



calms (i.e., <0.2 m/s) = 11.5%
model calms (i.e., <1 m/s) = 45.2%







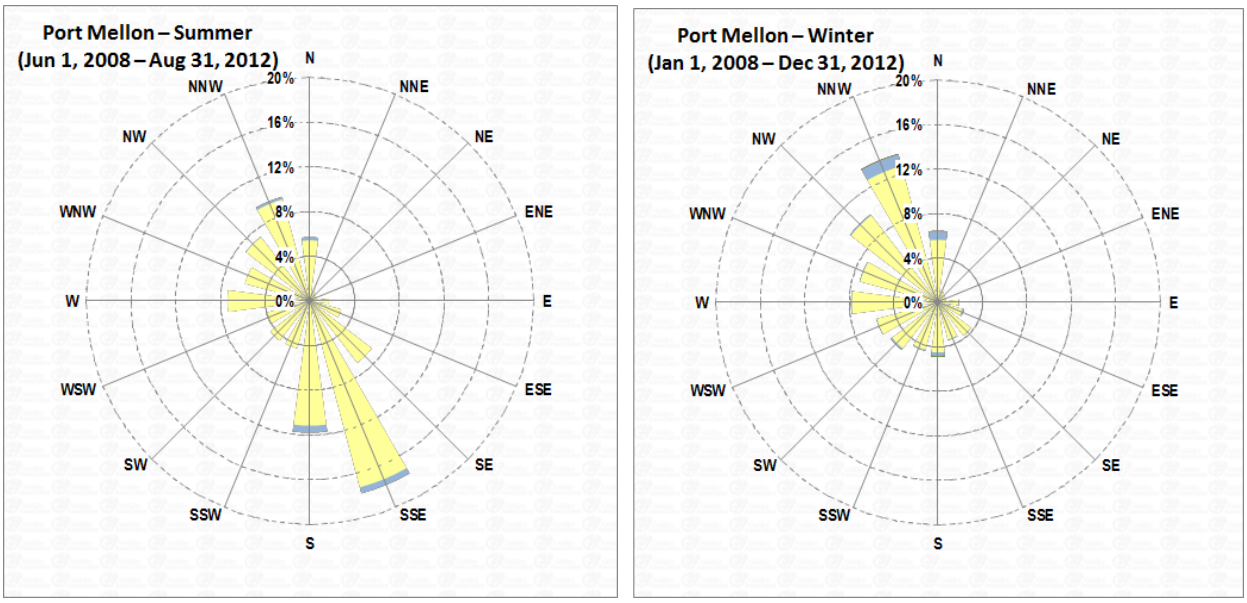


Figure 18: Port Mellon Annual and Seasonal Wind Roses (January 2008 – December 2012)

The wind rose indicates that the predominant wind direction is from the north-northwest, with a predominance of winds below 3 m/s. Figure 18 also indicates a high predominance of winds measured below 1 m/s (45.2%). Within atmospheric modelling programs this would generally be defined as calm periods. Seasonal wind roses are also provided in Figure 18, these wind roses demonstrates a slight seasonal variability in wind patterns. In the spring and summer months (March through August) there is a higher predominance of winds blowing from the south-southeast.

4.0 SUMMARY OF EXISTING CONDITIONS

4.1 Air Quality

Background concentrations for TSP, PM_{10}, $PM_{2.5}$, SO_2 and NO_2 were established using data from three existing air quality monitoring stations. Table 27 provides is a summary of the measured concentrations at all three stations and the final background concentrations that will be added to the air dispersion model's predictions. Background concentrations presented in the table that do not have associated air quality criteria are used for the health risk assessment only and are not considered for the air quality assessment. Background air quality concentrations for use in the assessment are bolded within Table 27.

Total suspended particulate concentrations and dustfall (particulate deposition) were measured on the Project site for two 24-hour periods. TSP concentrations from the two samples were 9.3 and 23.3 µg/m³, both values were less than the 24-hour Federal Maximum Acceptable and the BC Level A limit of 120 µg/m³. Due to the grab sample nature of the TSP measurements they were not used to establish background TSP concentrations for the air quality assessment. Dustfall (particulate deposition) was measured at 0.32 mg/dm^2/day. The TSP and dustfall samples were analysed for metals to support the human health and surface water disciplines. The metal concentrations and deposition rate values calculated based on onsite sampling will be used to support other discipline's assessments.

Table 27: BC Ambient Air Quality Objectives and Regional Baseline Concentrations

Compound	Averaging Period	Unit	Ambient Air Quality Criteria	2010 or 2012 Data				2013 Data				Background Concentration
				Langdale	Squamish	Horseshoe Bay	Average	Langdale	Squamish	Horseshoe Bay	Average	
$PM_{2.5}$	1-hour	µg/m	—[2]	18	15	12	15	**20**	21	12	18	**20**
	24 hour	µg/m	25	14	13	10	12	**14**	15	10	13	**14**
	Annual	µg/m	8	5	4	3	4	**6**	6	5	6	**6**
PM_{10}	1-hour	µg/m	—[2]	25	37	—	**31**	25	—	—	—	**31**
	24 hour	µg/m	50	20	33	—	**26**	19	—	—	—	**26**
	Annual	µg/m	—[2]	9	11	—	**10**	**10**	—	—	—	**10**
TSP[1]	1-hour	µg/[3]	—[2]	—	—	—	**65**	—	—	—	—	**65**
	24 hour	µg/m	120	—	—	—	**55**	39	—	—	—	**55**
	Annual	µg/m	60	—	—	—	**21**	21	—	—	—	**21**
NO_2	1-hour	ppb	100	—	—	—	—	**22**	21	—	21	**22**
	24 hour	ppb	—[2]	—	—	—	—	10	10	—	**10**	**10**
	Annual	ppb	32	—	—	—	—	5	5	—	**5**	**5**
SO_2	1-hour	ppb	75	—	—	—	—	**13**	3	—	8	**13**
	24 hour	ppb	—[2]	—	—	—	—	**2**	1	—	2	**2**
	Annual	ppb	—[2]	—	—	—	—	**1.0**	0.6	—	0.8	**1.0**

Note 1: TSP 24-hour baseline concentration derived from the 98th percentile PM_{10} value of the 24-hour average value for 2010.
Note 2: No criteria. Data used in health risk assessment only.

4.2 Meteorology

Temperature averages measured at Port Mellon shows the highest readings in the summer months of approximately 18°C. The monthly average temperature for year to year shows that there is little temperature variation. The relative humidity and precipitation decrease in the late spring and summer months. The predominant wind direction at Port Mellon is from the north-northwest, with a high level of calms. Port Mellon wind roses show that the majority of wind speeds occur in the wind speed class of 3 to 5 m/s or less, and this region is expected to have relatively calm winds. This is likely due to the valley terrain features surrounding the Port Mellon station.

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