



FINAL

Report for a Short Term Predictive Ambient Air Quality Monitoring Program performed at the Aldershot Centre Quarry – October 2017

1775 King Rd., Burlington, ON
L7P 5A4

Submitted to:

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November 24, 2017

Pinchin File: 120235



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EXECUTIVE SUMMARY

Meridian Brick Canada Ltd. (Meridian) operates extraction activities at their centre quarry located at 1775 King Rd., Burlington, ON.

As part of the company's internal due diligence, Meridian performed this voluntary, short-term ambient monitoring program for respirable silica and speciated particulate matter (PM); specifically respirable (PM₁₀) and inhalable (PM_{2.5}) at their centre quarry, to estimate potential downwind impact. The analytes of interest were determined through discussions with Glenn Ferguson of Intrinsic Corp. on August 14-15, 2017. The monitoring program was conducted on four (4) separate days between October 3, 2017 and October 20, 2017. Warm, dry days were targeted.

Based on local meteorological (MET) data available on-line through the Hamilton Air Monitoring Network (HAMN), a wind rose encompassing the period from October 1, 2016 to November 15, 2016 was used to initially site the stations. A three meter (3m) tripod mounted MET station was situated in the same location as STN1 providing a location that was relative level, offered open terrain, and was away from any obstructions such as buildings or trees. Wind speed and direction were monitored using a RM Young Model 05103 VK Wind Speed Wind Direction Monitor equipped with a Campbell Scientific CR800 Data Logger with battery back-up, continually charged using solar panels.

For monitoring PM₁₀ and PM_{2.5}, United States Environmental Protection Agency (US EPA) Federal Reference Method (FRM) designated air samplers were used. The automatic samplers used were BGI, by Mesa Labs, PQ200 Air Samplers. The samplers were operated off solar panels with battery back-up.

There was no promulgated ambient monitoring method found for respirable silica. As such, sampling for respirable silica was performed over a twenty four hour (24 hr) period using a cyclone and pre-weighed PVC filter following National Institute for Occupational Safety and Health (NIOSH) Method 0600 – Particulates not Otherwise Regulated, Respirable. Silica (as cristobalite, quartz and tridymite) was analyzed following NIOSH Method 7500 – Silica, Crystalline, by XRD (filter redeposition).

Results, observations and conclusions regarding the data set for this short term ambient program are summarized as follows:

- Measured concentrations of PM₁₀ were below the applicable Ontario AAQC, twenty-four (24) hour criteria as provided in Table 4.2.1, Table 4.2.2 and Table 4.2.3 of this report;
- Measured concentrations of PM_{2.5} were below the applicable Ontario AAQC, twenty-four (24) hour criteria as provided in Table 4.2.1, Table 4.2.2 and Table 4.2.3 of this report;
- Measured concentrations of silica were all below the analytical reporting limit (<RL) with the exception of quartz for the last round of sampling at Station STN2.



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- Measured concentrations of silica were all below the applicable Ontario AAQC, twenty-four (24) hour criteria as provided in Table 4.2.1, Table 4.2.2 and Table 4.2.3 of this report;
- Operations at the quarry during the sampling were considered normal with no abnormal or upset conditions encountered;



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1.0 INTRODUCTION

Meridian Brick Canada Ltd. (Meridian) operates extraction activities at their centre quarry located at 1775 King Rd., Burlington, ON.

1.1 Summary of Ambient Air Monitoring Program

As part of the company's internal due diligence, Meridian performed this voluntary, short-term ambient monitoring program for respirable silica and speciated particulate matter (PM); respirable (PM₁₀) and inhalable (PM_{2.5}) at their centre quarry, to estimate potential downwind impact. The analytes of interest were determined through discussions with Glenn Ferguson of Intrinsic Corp. on August 14-15, 2017. The short-term ambient program was conducted on four (4) separate days between October 3, 2017 and October 20, 2017. Warm dry days were targeted.

1.2 Location of Monitoring Stations

Based on local meteorological (MET) data available on-line through the Hamilton Air Monitoring Network (HAMN), a wind rose encompassing the period from October 1, 2016 to November 15, 2016 was used to initially site the stations. A three meter (3m) tripod mounted MET station was situated in the same location as STN1 providing a location that was relative level, offered open terrain, and was away from any obstructions such as buildings or trees. Wind speed and direction were monitored using a RM Young Model 05103 VK Wind Speed Wind Direction Monitor equipped with a Campbell Scientific CR800 Data Logger with battery back-up, continually charged using solar panels.

The sampling stations and MET station were located on the property to prevent vandalism/tampering or theft of the equipment.

The site is shown in Figure 1.2.1 on the following page. Station locations are provided in Figure 1.2.2. Figure 1.2.3 shows the typical stations set-up (Station STN1), including the MET station.

Figure 1.2.1. Site Location

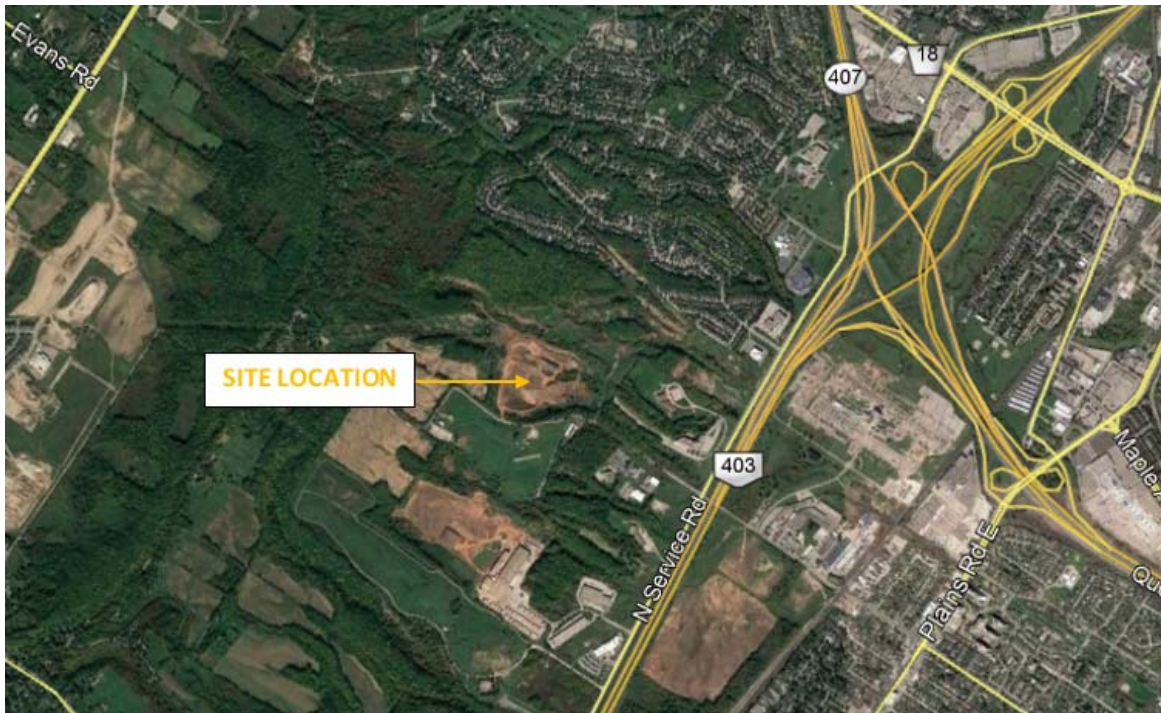


Figure 1.2.2. Ambient Air Quality Monitoring Station Locations



Figure 1.2.3. Ambient Air Quality Monitoring Station STN1 and MET Tower



2.0 PARAMETERS MEASURED

2.1 Meteorological Data

The three meter (3m) tripod mounted MET station measured wind speed and direction.

2.2 Ambient Air Quality Analytes to be Monitored

The analytes monitored during the short term ambient monitoring program were PM₁₀, PM_{2.5} and respirable silica (as cristobalite, quartz and tridymite).

2.3 Ontario AAQC Criteria

The applicable Ontario Ambient Air Quality Criteria (AAQCs) that the monitoring results were compared to are summarized in Table 2.3 on the following page.



Table 2.3. Summary of Ontario AAQCs

Analyte	CASRN	Ontario Ambient Air Quality Criteria (AAQC) ($\mu\text{g}/\text{m}^3$)	Averaging Time	Limiting Effect
Particulate matter (fine fraction) - $\text{PM}_{2.5}$	N/A	30	24 Hour	See Note 1
Particulate matter - PM_{10}	N/A	50	24 Hour	See Note 2
Silica - respirable (<10 μm diameter), cristobalite	14464-46-1	5	24 Hour	Health
Silica - respirable (<10 μm diameter), quartz	14808-60-7	5	24 Hour	Health
Silica - respirable (<10 μm diameter), tridymite	15468-32-3	5	24 Hour	Health

Note 1 This value is not an AAQC per se but is included, together with the following guide, for decision making.

The value of 30 $\mu\text{g}/\text{m}^3$ (24 hr) is the Canada-wide Standard (CWS) for $\text{PM}_{2.5}$, developed jointly by the Federal government and the Provinces, including Ontario, as a step towards the long-term goal of minimizing the risk that fine particles impose on human health and the environment.

Achievement of the $\text{PM}_{2.5}$ CWS (by the year 2010) in various airsheds is to be based on the 24 hour 98th percentile ambient measurement annually, averaged over three consecutive years.

Note 2 This value of 50 $\mu\text{g}/\text{m}^3$ (24 hr) is an interim AAQC and is provided here as a guide for decision making (with no conversion to other averaging times).

3.0 SAMPLING METHODOLOGY SUMMARY

3.1 Sampling Procedure

Due to the short duration of the study, the sampling periods were targeted to capture dry ambient conditions expected to yield maximum fugitive dust emissions from the active quarry site. As such, the scheduling did not allow consistency with the Federal National Air Pollutants Surveillance (NAPS) 2017 schedule to which long term ambient air programs currently being performed in Canada adhere to. The NAPS program was developed to provide accurate and long-term air quality data of a uniform standard across Canada.

For monitoring PM_{10} and $\text{PM}_{2.5}$, US EPA FRM designated air samplers were used. The equipment used were BGI, by Mesa Labs, PQ200 Air Samplers. The samplers were operated off solar panels and battery back-up.

The specific reference methods are provided as follows:

- PM_{10} RFPS-1298-125
- $\text{PM}_{2.5}$ RFPS-0498-116

Sampling was performed automatically over a twenty-four (24) hour period. The samplers were set to run from midnight to midnight as stated in s.2.4.2 Non –continuous Data, “Operations Manual for Air Quality



Monitoring in Ontario”, Ministry of the Environment and Climate Change, Operations Division, Technical Support Section, March 2008 (Operations Manual).

Sampling involved drawing a known volume of air at a fixed sampling rate (nominally 16.7 litres per minute (Lpm)) through a tared forty seven millimetre (47 mm) filter cassette. Pre-test preparation of the filter cassettes was performed by Maxxam Analytics.

There was no promulgated ambient monitoring method found for respirable silica. As such, sampling for respirable silica was performed over a twenty four hour (24 hr) period using a cyclone and pre-weighed PVC filter following National Institute for Occupational Safety and Health (NIOSH) Method 0600 – Particulates not Otherwise Regulated, Respirable.

A sample pump pre-calibrated to a flow rate of nominally 2.5 Lpm and connected to a filter cassette and 10 micron aluminum cyclone was used for the sampling. The cassette and cyclone assembly were securely mounted within a special holder which was connected to a sampling post at a height of nominally 1.8 metres above grade (approximate breathing zone).

Prior to and again at the end of sampling, the pump flow rate was calibrated. The pre-test and post-test calibration results were averaged to determine the sample rate during the test. The sampling rate was then multiplied by the sampling time to determine the total volume sampled for each test.

During each trip to site, the operator filled out a data sheet/activity log to verify proper operation of the monitoring equipment and data acquisition systems. Information on the sheets included the station ID, filter ID, examination of external station conditions, station characteristics (to ensure siting criteria continue to be met), as well as relevant sample data.

3.2 Analytical Procedure

Maxxam Analytics prepared the tared PQ200 filter cassettes for PM sampling as well as the tared poly vinyl chloride (PVC) filter cassettes for silica sampling and analysis.

PM₁₀ and PM_{2.5} filters were analyzed gravimetrically. Analysis of the silica samples (as cristobalite, quartz and tridymite) was performed following NIOSH Method 7500 – Silica, Crystalline, by XRD (filter redeposition).

3.3 Ambient Program Issues

With the exception of the 4th run at STN2, there were no field test changes or problems encountered during the program that affected data validity or quality. For each sampling run, Pinchin personnel checked the stations to ensure equipment was operational.



On the evening of October 19, 2017 during set-up for the 4th run, it was noticed that the door on the PM₁₀ monitor was open. During sample recovery on the morning of October 21, 2017, it was noted that the filter assembly for the PM₁₀ monitor was in the open position. Further, it was noted that the PM_{2.5} monitor had not appeared to operate for the sampling period. As such, the PM samples collected at STN2 for the 4th run were considered suspect.

Issues associated with the program are summarized below.

Table 3.3. Program Issues

Period	Station ID / Monitor	Issue	Remedial Action
Oct. 19 - Oct. 20, 2017	STN2 / PM ₁₀	Monitor door found open upon arriving to set up for 4 th run.	Checked equipment for vandalism - no issues observed. Checked inlet pipe for tampering/damage - no issues observed. Checked power and operation - no issues observed. Set up for 4 th run.
		Filter holder assembly found in open position when returning to collect samples.	Checked equipment for vandalism - no issues observed. Checked inlet pipe for tampering/damage - no issues observed. Checked power and operation - no issues observed. Set up for 4 th run.
Oct. 19 - Oct. 20, 2017	STN2 / PM _{2.5}	Monitor appears to not have run. Start and stop dates still showing dates for 3 rd run (Oct. 17-18, 2017).	Checked power - no issues observed. Monitor may not have been turned off during set-up for 4 th run.

4.0 SUMMARY AND DISCUSSION OF RESULTS

4.1 Summary of Process/Production Operating Data

Currently, quarrying operations are taking place in the centre cell of the quarry. During the study which targeted dry periods, excavation operations in the centre cell were indicative of those operations expected during quarrying in the east cell with the some exceptions described in this section.

The following information was garnered from Meridian™ Brick, “Aldershot Quarry Report”, Issue 1, Spring 2017, and used with permission by Meridian Brick LLC.

An existing earth berm in the east cell currently provides a thirty nine (39) metre excavation setback to the open space behind the residential properties along Westhaven Drive. It should be noted that this is substantially wider than the regulated excavation setback. Meridian’s phasing strategy will include a fully treed interim buffer zone to be in place for at least fifteen (15) years of ninety (90) to one hundred and fifty (150) metres. The current City of Burlington’s open space zone adds another fifteen (15) to one hundred and forty five (145) metres, resulting in a combined interim buffer width from the residential rear property lines varying between one hundred and thirty one (131) metres at the south end to one hundred and sixty five (165) metres at the north limit.

For the first fifteen (15) years the fully treed buffer will remain in the northern corner of the east cell. As operations progress, the trees will be removed as required and replanted, eventually restoring the site to a fully forested landscape.



Excavation in the final portion of the east cell is not expected to take place for at least fifteen (15) to twenty (20) years.

4.2 Summary of Ambient Monitoring Data

A summary of the monitoring data for each twenty-four hour (24 hr) sampling run is provided in Table 4.2.1 below for STN1, Table 4.2.2 for STN2 and Table 4.2.3 for STN3.

It should be noted that for all but one quartz sample at STN2 on the Oct 17, 2017 run, there were no silica analyses above the analytical reporting limit (RL). The RL is the smallest concentration (or amount) of analyte that can be reported by a laboratory. As stated in section 2.2 Method Detection Limits of the Operations Manual, where results show less than the reportable limit (<RL), using half the RL is allowable common practice.

Table 4.2.1 Summary of Program Results – STN1

Start Date of 24 hr Run	Monitoring Results				
	Station STN1				
	PM ₁₀ µg/m ³	PM _{2.5} µg/m ³	Cristobalite µg/m ³	Silica* Quartz µg/m ³	Tridymite µg/m ³
October 3, 2017	40.0	9.4	<0.7	<0.7	<1.4
October 6, 2017	16.6	7.1	<0.7	<0.7	<1.4
October 17, 2017	13.6	4.9	<0.7	<0.7	<1.4
October 20, 2017	25.8	6.1	<0.7	<0.7	<1.4
Data Summary					
Average Concentration	24.0	6.9	<0.7	<0.7	<1.4
Minimum Concentration	13.6	4.9	<0.7	<0.7	<1.4
Maximum Concentration	40.0	9.4	<0.7	<0.7	<1.4
No. of Valid Samples	4	4	4	4	4
Reportable Limit	1.2	1.2	1.4	1.4	2.8
Half Reportable Limit	0.6	0.6	0.7	0.7	1.4
Percent Valid Data (%)	100	100	100	100	100
Comparison to Ontario Ambient Air Quality Criteria (AAQC)					
Particulate Matter - PM ₁₀	50	-	-	-	-
Particulate Matter - PM _{2.5}	-	30	-	-	-
Silica - Respirable Cristobalite	-	-	5	-	-
Silica - Respirable Quartz	-	-	-	5	-
Silica - Respirable Tridymite	-	-	-	-	5
No. of Samples Higher than AAQC	0	0	0	0	0

* As stated in section 2.2 Method Detection Limits of the Operations Manual, where results show less than the reportable limit (<RL), using half the RL is allowable common practice.



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Table 4.2.2 Summary of Program Results – STN2

Start Date of 24 hr Run	Monitoring Results				
	Station STN2				
	PM ₁₀ µg/m ³	PM _{2.5} µg/m ³	Cristobalite µg/m ³	Silica* Quartz µg/m ³	Tridymite µg/m ³
October 3, 2017	30.1	6.8	<0.7	<0.7	<1.4
October 6, 2017	17.1	7.7	<0.7	<0.7	<1.4
October 17, 2017	13.4	4.7	<0.7	2.5	<1.4
October 20, 2017	8.1 **	2.1 **	<0.7	<0.7	<1.4
Data Summary					
Average Concentration	17.2	5.3	<0.7	1.2	<1.4
Minimum Concentration	8.1	2.1	<0.7	<0.7	<1.4
Maximum Concentration	30.1	7.7	<0.7	2.5	<1.4
No. of Valid Samples	3	3	4	4	4
Reportable Limit	1.2	1.2	1.4	1.4	2.8
Half Reportable Limit	0.6	0.6	0.7	0.7	1.4
Percent Valid Data (%)	75	75	100	100	100
Comparison to Ontario Ambient Air Quality Criteria (AAQC)					
Particulate Matter - PM ₁₀	50	-	-	-	-
Particulate Matter - PM _{2.5}	-	30	-	-	-
Silica - Respirable Cristobalite	-	-	5	-	-
Silica - Respirable Quartz	-	-	-	5	-
Silica - Respirable Tridymite	-	-	-	-	5
No. of Samples Higher than AAQC	0	0	0	0	0

* As stated in section 2.2 Method Detection Limits of the Operations Manual, where results show less than the reportable limit (<RL), using half the RL is allowable common practice.

** Results considered suspect due to issues encountered with the station monitors.

Table 4.2.3 Summary of Program Results – STN3

Start Date of 24 hr Run	Monitoring Results				
	Station STN3				
	PM ₁₀ µg/m ³	PM _{2.5} µg/m ³	Cristobalite µg/m ³	Silica* Quartz µg/m ³	Tridymite µg/m ³
October 3, 2017	18.9	7.8	<0.7	<0.7	<1.4
October 6, 2017	14.6	7.8	<0.7	<0.7	<1.4
October 17, 2017	14.4	5.5	<0.7	<0.7	<1.4
October 20, 2017	17.4	6.0	<0.7	<0.7	<1.4
Data Summary					
Average Concentration	16.3	6.8	<0.7	<0.7	<1.4
Minimum Concentration	14.4	5.5	<0.7	<0.7	<1.4
Maximum Concentration	18.9	7.8	<0.7	<0.7	<1.4
No. of Valid Samples	4	4	4	4	4
Reportable Limit	1.2	1.2	1.4	1.4	2.8
Half Reportable Limit	0.6	0.6	0.7	0.7	1.4
Percent Valid Data (%)	100	100	100	100	100
Comparison to Ontario Ambient Air Quality Criteria (AAQC)					
Particulate Matter - PM ₁₀	50	-	-	-	-
Particulate Matter - PM _{2.5}	-	30	-	-	-
Silica - Respirable Cristobalite	-	-	5	-	-
Silica - Respirable Quartz	-	-	-	5	-
Silica - Respirable Tridymite	-	-	-	-	5
No. of Samples Higher than AAQC	0	0	0	0	0

* As stated in section 2.2 Method Detection Limits of the Operations Manual, where results show less than the reportable limit (<RL), using half the RL is allowable common practice.



4.3 Validity of Data

As stated in s.2.4.2 Non-continuous Data of the Operations Manual, a daily sample would be considered to be valid if the sampling period was within $\pm 10\%$ of the required twenty four (24) hours (21.6 to 26.4 hours). All sample times met this criterion.

Data recovery rates for the non-continuous sampling runs are summarized below.

Table 4.3. Data Validation Summary

Parameter	Station	No. of Runs Performed	No. of Valid Data Results	Percent Valid Data %
PM ₁₀	STN1	4	4	100
	STN2	4	3	75
	STN3	4	4	100
PM _{2.5}	STN1	4	4	100
	STN2	4	3	75
	STN3	4	4	100
Respirable Silica	STN1	4	4	100
	STN2	4	4	100
	STN3	4	4	100

Note: Results of the 4th run at STN2 were considered suspect due to issues with the station monitors.

4.4 Summary of Wind Speed Data

A summary of the one hour wind speed data from October 3 through October 20, 2017, including each individual twenty-four (24) hour run, is provided in the following table. The data shows the minimum, maximum, average and standard deviation based on one (1) hour data for the program period as well as the average wind speeds for each individual run based on the five (5) minute MET data.

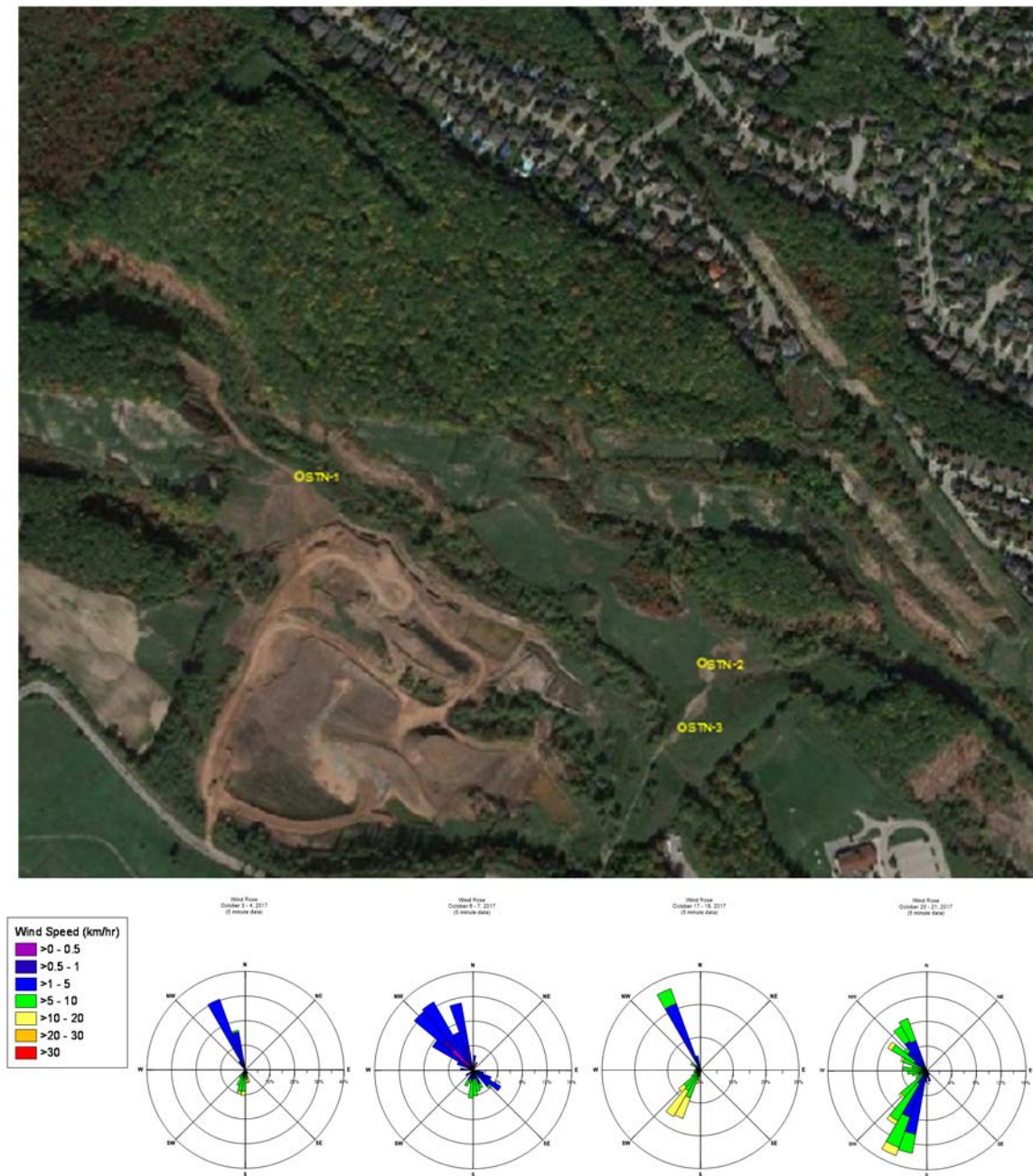
Table 4.4. Summary of Wind Speed Data from October 3 through October 20, 2017

Parameter		Units	Station MET1
Wind Speed (1 hr.)	Minimum	km/hr	0.29
	Maximum	km/hr	14.2
	Average	km/hr	4.50
	Standard Deviation	km/hr	2.72
Wind Speed (5 min.)	Average (October 3-4, 2017)	km/hr	5.33
	Average (October 6-7, 2017)	km/hr	2.29
	Average (October 17-18, 2017)	km/hr	6.43
	Average (October 20-21, 2017)	km/hr	5.45

Note: Wind speed measured at 3 metres.

The site layout and individual wind roses for each sample run based on five (5) minute MET data and the entire sampling program from October 3 through October 20, 2017 (based on one (1) hour MET data) are provided in Figure 4.4 below. As shown, winds for the sampling periods were variable.

Figure 4.4 Wind Roses for Short-term Monitoring Program





4.5 Discussion of Results

Based on a review of the individual five (5) minute wind direction readings, it appears that STN1 was likely the predominant down-wind station during the daytime periods, summarized as follows:

- October 3-4 run Winds from a southerly (south to south-west) direction between 9:00 AM and 6:00 PM
- October 6-7 run Winds from a southerly (south to south-west) direction between 1:00 PM and 4:30 PM
- October 17-18 run Winds from a southerly (south to south-west) direction between 8:00 AM and 9:00 AM
- October 20-21 run Winds from a southerly (south to south-west) direction between 8:20 AM and 6:10 PM

Through the evening and early morning hours for each twenty-four (24) hour sampling period, the winds in the quarry were predominantly from the north-north-west.

The results indicate that at all stations the contaminant concentrations measured for the short term ambient program were below their corresponding 24 hr AAQC limits.

The following link provides historical and current PM_{2.5} concentrations for the City of Burlington. The MOECC station monitors ozone, PM_{2.5} and nitrogen dioxide (NO₂) concentrations on an hourly basis. The five (5) metre station is located at Northshore Boulevard East and Lakeshore Rd.

http://www.airqualityontario.com/history/pollutant.php?stationid=44008&pol_code=124&start_day=0&start_month=0&start_year=0&chart=0

The following table summarizes the data collected at the quarry versus historic fine particulate matter (PM_{2.5}) concentrations for the City of Burlington on the sampling dates. As shown, the fine particulate matter (PM_{2.5}) concentrations measured during the short-term ambient program do not differ greatly from those concentrations measured for the City of Burlington.

Table 4.5. Comparison of Program Results (PM_{2.5}) versus MOECC City of Burlington Data

Date/Time	Averages over 24 hour Period			
	PM _{2.5} Results of Monitoring Program			City of Burlington µg/m ³
	STN1 µg/m ³	STN2 µg/m ³	STN3 µg/m ³	
Oct 3 - 4, 2017; 00:00 to 00:00	9.4	6.8	7.8	9
Oct 6 - 7, 2017; 00:00 to 00:00	7.1	7.7	7.8	9
Oct 17 - 18, 2017; 00:00 to 00:00	4.9	4.7	5.5	5
Oct 20 - 21, 2017; 00:00 to 00:00	6.1	2.1*	6.0	5

* result considered suspect due to issues encountered with station monitor.



5.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

6.0 REFERENCES

1. "Ontario's Ambient Air Quality Criteria", Standards Development Branch, Ontario Ministry of the Environment, April 2012, PIBs # 6570e01.
2. "List of Designated Reference and Equivalent Methods", United States Environmental Protection Agency, December 17, 2016.
3. "National Air Pollution Surveillance Network Quality Assurance and Quality Control Guidelines", Environment Canada Report No. AAQD 2004-1 (Originally published in December 1995 as PMD 95-8).
4. "Operations Manual for Air Quality Monitoring in Ontario", Ministry of the Environment and Climate Change, Operations Division, Technical Support Section, March 2008.
5. Meridian™ Brick, "Aldershot Quarry Report", Issue 1, Spring 2017.
6. National Institute for Occupational Safety and Health (NIOSH) "Method 0600 – Particulates not Otherwise Regulated, Respirable".
7. National Institute for Occupational Safety and Health (NIOSH) "Method 7500 – Silica, Crystalline, by XRD (filter redeposition)".