2015 Annual Ambient Air Quality Monitoring Report for the Durham York Energy Centre

Durham York Energy Centre

Prepared for:
The Regional Municipality of Durham
605 Rossland Rd
Whitby, ON L1N 6A3

Prepared by:
Stantec Consulting Ltd.
300W-675 Cochrane Dr.
Markham, ON L3R 0B8

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Sign-off Sheet

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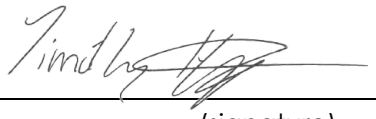
Prepared by 
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Timothy Hung, B.A.Sc.

Reviewed by 
(signature)

Gregory Crooks M.Eng., P.Eng.

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Executive Summary

The Regional Municipalities of Durham and York are constructing and commissioning the Durham York Energy Centre (DYEC) which is an Energy-from-Waste (EFW) Facility intended to provide a long-term, sustainable solution to manage municipal solid waste remaining after diversion from the Regions.

The Ambient Air Quality Monitoring Plan - Durham York Residual Waste Study (Stantec, May 8, 2012), was developed based on the Regional Council's mandate to provide ambient air quality monitoring in the area of the DYEC for a three year period. An ambient air quality monitoring and reporting program was also a requirement laid out in the Provincial Minister's Notice of Approval to Proceed with the Undertaking, detailed in Condition 11 of the Notice of Approval (MOECC, 2010). The air monitoring plan was also developed to satisfy the conditions of the Environmental Compliance Approval and the environmental mitigation and commitments set out in the Environmental Assessment (Jacques Whitford, 2009). The predominantly downwind station is located along Rundle Road, south of Baseline Road. The predominantly upwind station is sited at the Courtice Water Pollution Control Plant (WPCP). Concentrations of the following air contaminants were measured at the two stations:

- Continuously monitored
  - Sulphur Dioxide (SO_2);
  - Nitrogen Oxides (NO_X); and,
  - Particulate Matter smaller than 2.5 microns ($PM_{2.5}$).
- Non-Continuously monitored
  - Metals in Total Suspended Particulate (TSP) matter;
  - Polycyclic Aromatic Hydrocarbons (PAHs); and,
  - Dioxins and Furans.

Operation of the non-continuous monitors was temporarily discontinued on June 28, 2014 as per Section 1.2 of the Ambient Monitoring Plan (Stantec, 2012). The facility commenced commissioning on February 13, 2015 and was being commissioned throughout the rest of 2015. As per the Ambient Monitoring Plan, collection of continuous parameters only during the commissioning was conducted. When the EFW facility is fully operational, monitoring of non-continuous parameters will resume (as specified in the Ambient Monitoring Plan).

Meteorological data is also measured at the two stations. The predominantly downwind Rundle Road station measures horizontal wind speed, wind direction, atmospheric temperature, relative humidity and rainfall. The predominantly upwind Courtice station measures atmospheric temperature, relative humidity, rainfall and barometric pressure. Wind speed and wind direction data at the predominantly upwind location are available from the Courtice Water Pollution Control Plant.

The Ministry of Environment and Climate Change (MOECC) requires that annual reports be issued for the measurements conducted in each calendar year. This annual report provides a summary of the ambient air quality data collected at the two stations for the period January to December 2015.

The 2015 monitoring primarily collected air quality levels during the period when the DYEC was being commissioned. The following observations and conclusions were made from a review of the measured ambient air quality monitoring data:

1. Measured concentrations of NO_2, SO_2 and $PM_{2.5}$ were below the applicable O.Reg. 419/05 criteria or human health risk assessment (HHRA) health-based standards presented in **Table 2-2** of this report for hourly, 24-hour and annual averaging periods.

2. The 98th percentiles of the measured daily average $PM_{2.5}$ levels during the 2015 monitoring period were 27.3 µg/m^3 at the Courtice WPCP station and 28.4 µg/m^3 at the Rundle Road station. As detailed below, these values for the 98th percentile should not be used for comparison against the Canadian Ambient Air Quality Standard.

3. The 24-hour and annual $PM_{2.5}$ Canadian Ambient Air Quality Standards (CAAQS) criteria both require a 3-calendar year average for comparison, with the data considered valid if an annual 98th percentile value is available for at least two of the three calendar years. Using the measured $PM_{2.5}$ data at each station for calendar years 2014 and 2015, average annual 98th percentile daily average and annual average $PM_{2.5}$ levels were calculated and a preliminary comparison to their CAAQS criteria was made. The ambient $PM_{2.5}$ levels were below their respective CAAQS standards at both stations for this preliminary comparison.

4. TSP/ metals, and PAHs were not measured in 2015 as per Section 1.2 of the Ambient Monitoring Plan (Stantec, 2012);

5. Dioxins and furans sampling was resumed on October 21, 2015 (during commissioning of the facility) for the DYEC as requested by the Region of Durham. This additional sampling was not part of the Ambient Monitoring Plan and was conducted at 12-day intervals for the rest of 2015. The maximum toxic equivalent dioxin and furan concentration measured over this period was well below the applicable criteria presented in Table 2-3; and

6. In summary, the measured concentrations of the air contaminants monitored were below their applicable MOECC criteria during the 2015 monitoring period. Further, the measured levels of the monitored contaminants were below their applicable HHRA health-based standards.

Abbreviations

AAQC	Ambient Air Quality Criteria
CAC	Criteria Air Contaminants
D/Fs	Dioxins and Furans
DYEC	Durham York Energy Centre
EFW	Energy from Waste
MOECC	Ontario Ministry of the Environment and Climate Change
SO_2	Sulphur Dioxide
NO_x	Nitrogen Oxides
O_3	Ozone
PAH	Polycyclic aromatic hydrocarbons
Particulate	A particle of a solid or liquid that is suspended in air.
PCB	Polychlorinated biphenyl
PCDD/PCDF	Polychlorinated dibenzo-p-dioxins and dibenzofurans
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter smaller than 2.5 microns
TEQ	Toxic equivalent quotient
TEQs	Toxic Equivalents
TSP	Total Suspended Particulate
WPCP	Water Pollution Control Plant
Elements	
Cd	Cadmium
Hg	Mercury
Pb	Lead
Al	Aluminum
As	Arsenic
Be	Beryllium
Cr	Chromium
Cu	Copper
Mn	Manganese
Ni	Nickel
Ag	Silver
Tl	Thallium

Sn	Tin
V	Vanadium
Zn	Zinc
Miscellaneous	
°C	temperature in degrees Celsius
N/A	not available
%	percent
ppm	part per million
ppb	part per billion
ppt	part per trillion
min	minimum
max	maximum
µg/m^3	microgram per cubic metre

1.0 INTRODUCTION

1.1 BACKGROUND AND OBJECTIVES

The Regional Municipalities of Durham and York are constructing and commissioning the Durham York Energy Centre (DYEC) which is an Energy-from-Waste (EFW) Facility intended to provide a long-term, sustainable solution to manage municipal solid waste remaining after diversion from the Regions. The facility commenced commissioning on February 13, 2015 and was being commissioned throughout the rest of 2015. The site location of the DYEC is shown in **Figure 1-1** below.

A monitoring plan, Ambient Air Quality Monitoring Plan - Durham York Residual Waste Study (Stantec, 2012), was developed based on the Regional Council's mandate to provide ambient air quality monitoring in the area of the DYEC for a three year period.

The purposes of the ambient air quality monitoring program are to:

1. Quantify any measureable ground level concentrations resulting from emissions from the DYEC cumulative to local air quality, including validating the predicted concentrations from the dispersion modelling conducted in the Environmental Assessment (Jacques Whitford, 2009);

2. Monitor concentration levels of EFW-related air contaminants in nearby residential areas; and,

3. Quantify background ambient levels of air contaminants in the area.

Two monitoring stations in the vicinity of the DYEC were set up in April 2013 by Stantec Consulting Ltd. (Stantec) and Stantec's equipment sub-consultant for this project, Valley Environmental Services Inc. (Valley Environmental). Since May 2013, concentrations have been measured at the two stations for the following air contaminants:

- Continuously monitored
  - Sulphur Dioxide (SO_2);
  - Nitrogen Oxides (NO_X); and,
  - Particulate Matter smaller than 2.5 microns ($PM_{2.5}$).
- Non-Continuously monitored
  - Metals in Total Suspended Particulate (TSP) matter;
  - Polycyclic Aromatic Hydrocarbons (PAHs); and,
  - Dioxins and Furans.

Quarterly reports presenting the ambient air quality data collected at these two stations for 2015 were prepared by Stantec and submitted to the Region. This Annual Report summarizes the results of the ambient air monitoring from January to December 2015.

Operation of the non-continuous monitors was temporarily discontinued from June 28, 2014 onwards as per Section 1.2 of the Ambient Monitoring Plan (Stantec, 2012). The facility commenced commissioning on February 13, 2015 and was being commissioned throughout the rest of 2015. As per the Ambient Monitoring Plan, collection of continuous parameters only during the commissioning was conducted. When the EFW facility is fully operational, monitoring of non-continuous parameters will resume (as specified in the Ambient Monitoring Plan).

At the request of the Region of Durham, dioxin/furan (D/F) sampling was resumed for the Durham York Energy Centre (DYEC) on October 21, 2015 (during commissioning of the facility). This additional sampling is outside the scope of the Ambient Monitoring Plan (Stantec, 2012). The sampling was conducted at 12-day intervals corresponding with the Ontario MOECC province-wide ambient sampling schedule between October 21, 2015 and the end of the year. Results of the additional D/F sampling conducted in 2015 are presented in this report.

1.2 LOCATIONS OF AMBIENT AIR QUALITY MONITORING STATIONS

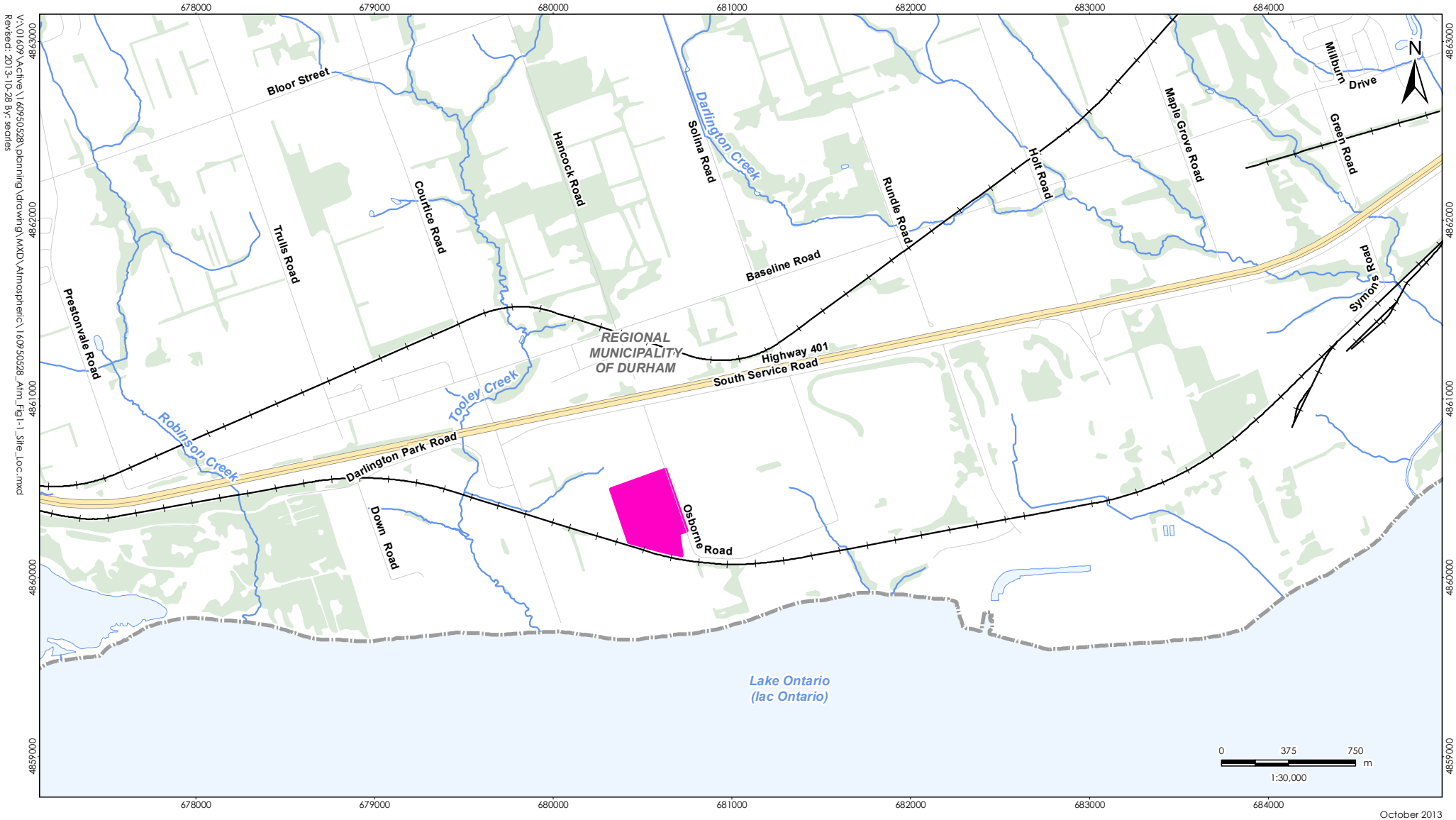
The selection of sites for the monitoring stations was done in consultation with the Ontario Ministry of Environment and Climate Change (MOECC) and Durham/York representatives based on the results of air quality modelling done in support of the environmental assessment for the project, the locations of nearby sensitive receptors, and general MOECC siting criteria. Two monitoring stations (one predominantly downwind and one predominantly upwind) were chosen for the ambient air quality program. The final locations of the monitoring stations were influenced by the availability of electrical power, accessibility of each location, and security. Details of the siting requirements are presented in the Monitoring Plan.

The selected predominantly downwind location is sited northeast of the DYEC in the vicinity of residential receptors downwind of the DYEC in this direction, and falls in the area where maximum annual concentrations are predicted to occur. The downwind station is located along Rundle Road, south of Baseline Road. Its location is shown in **Figure 1-2**. All the air contaminants listed in Section 1.1 and meteorological data are measured at the monitoring station. This station is referred to as the Rundle Road Station.

The predominantly upwind station is sited at the Courtice Water Pollution Control Plant (WPCP), located to the southwest of the DYEC in order to measure background air quality in the predominantly upwind direction. The location is presented in **Figure 1-2**. The air contaminants presented in Section 1.1, as well as meteorological data are measured at this station, with the exception of wind speed and wind direction, which are measured by and available from the Courtice Water Pollution Control Plant.

A third fence line station located at the east property line of the DYEC, which will measure metals and total particulate matter was installed in April 2015. The station was not operated in 2015, as sampling is required only upon commencement of full operation of the DYEC, but the facility remained in the commissioning phase until the end of the year. The fence line station will run for a one-year period upon commencement of full operation of the DYEC.

Photographs of the Rundle Road and Courtice WPCP ambient air quality monitoring stations are shown in **Figures 1-3 and 1-4** respectively.



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October 2013
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Stantec

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

Legend

- Durham York Energy Centre Site
- Railway
- Road
- Highway
- Watercourse
- Waterbody
- Wooded Area

Client/Project

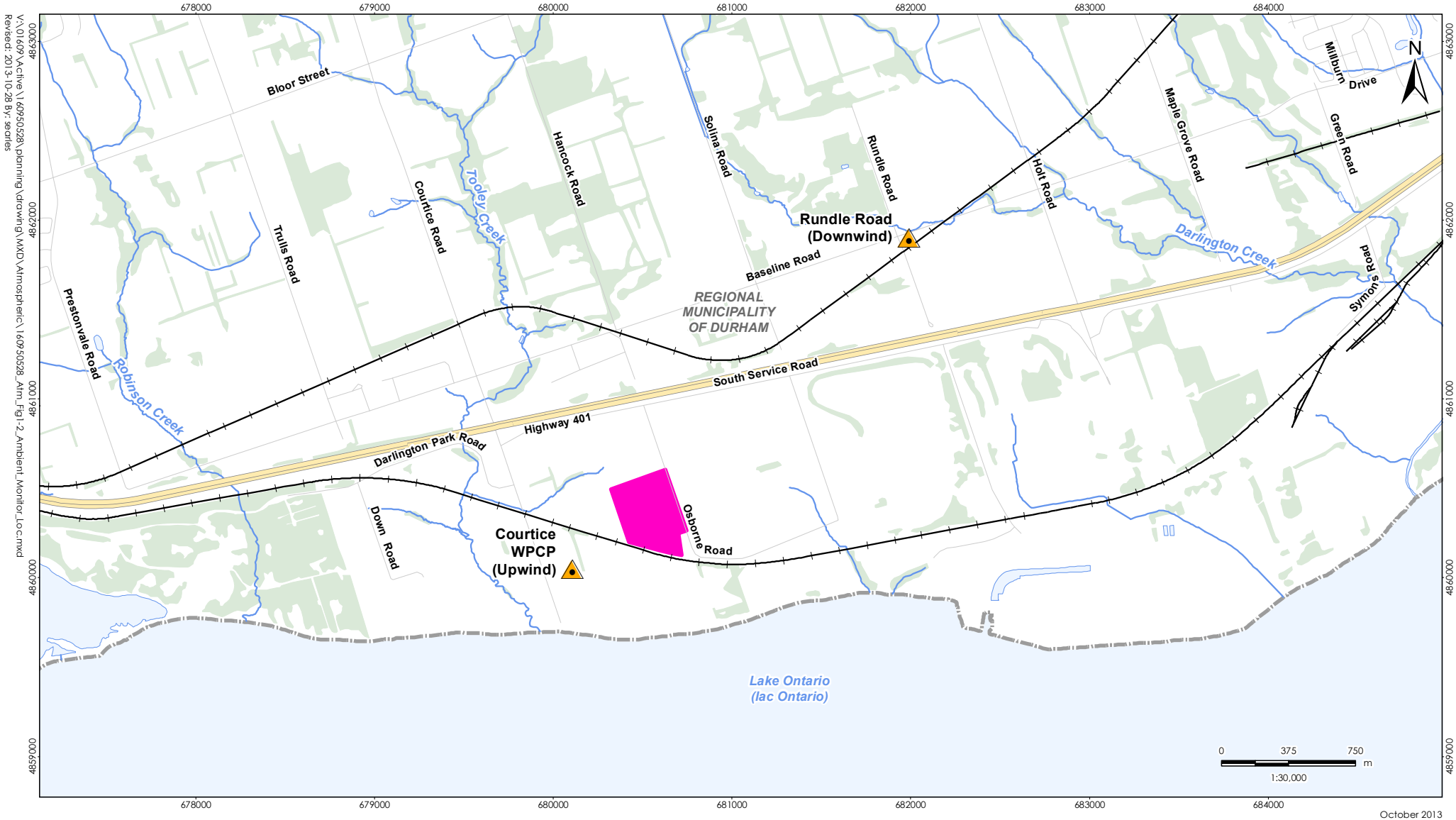
The Region of Durham
Durham York Energy Centre

Figure No.

1-1

Title

Site Location Plan



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October 2013
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Legend

- Station Location
- Durham York Energy Centre Site
- Railway
- Road
- Highway
- Watercourse
- Waterbody
- Wooded Area

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

Client/Project

The Region of Durham
Durham York Energy Centre

Figure No.

1-2

Title

Locations of Ambient Monitoring Stations

Figure 1-3 View of the Rundle Road Ambient Air Quality Monitoring Station

Figure 1-4 View of the Courtice WPCP Ambient Air Quality Monitoring Station

2.0 KEY COMPONENTS ASSESSED

2.1 METEOROLOGY

Meteorological parameters are measured at the Rundle Road and Courtice WPCP monitoring stations, as shown in Table 2-1.

Table 2-1 Summary of Meteorological Parameters Measured at Each Station

Courtice WPCP (Upwind) Ambient Air Quality Monitoring Station	Rundle Road (Downwind) Ambient Air Quality Monitoring Station
Wind Speed and Direction @ 20-m height	Wind Speed and Direction @10-m height
Ambient Temperature @ 2-m	Ambient Temperature @ 2-m
Relative Humidity	Relative Humidity
Rainfall	Rainfall
Barometric Pressure	

2.2 AIR QUALITY CONTAMINANTS OF CONCERN

The ambient air quality monitoring program for the DYEC includes the following contaminants specified in the Ambient Air Quality Monitoring Plan (Stantec 2012):

- Continuously monitored criteria air contaminants (CACs)
  - Sulphur Dioxide (SO_2);
  - Nitrogen Oxides (NO_X); and,
  - Particulate Matter smaller than 2.5 microns ($PM_{2.5}$).
- Non-Continuously monitored
  - Metals in Total Suspended Particulate (TSP) matter;
  - Polycyclic Aromatic Hydrocarbons (PAHs); and,
  - Dioxins and Furans.

The facility commenced commissioning on February 13, 2015 and was being commissioned throughout the rest of 2015. Operation of the non-continuous monitors was temporarily discontinued from June 28, 2014 (after completion of the background air quality data collection period) onwards through the rest of construction and commissioning, as per Section 1.2 of the Ambient Monitoring Plan (Stantec, 2012). When the EFW facility is fully operational, monitoring of non-continuous parameters will resume (as specified in the Ambient Monitoring Plan). As per Section 1.2 of the Ambient Monitoring Plan (Stantec, 2012), monitoring of only the continuous parameters was required during the commissioning period.

At the request of the Region of Durham, dioxin/furan sampling was resumed from October 21, 2015 to January 25, 2016, however this additional sampling was outside the scope of the Ambient Monitoring Plan (Stantec, 2012). The following air contaminants were not measured during 2015:

- Total Suspended Particulate (TSP) matter and metals; and
- Polycyclic Aromatic Hydrocarbons (PAHs).

2.2.1 Nitrogen Oxides (NO_X)

Nitrogen oxides (NO_X) are produced in most combustion processes, and are almost entirely made up of nitric oxide (NO) and nitrogen dioxide (NO_2). Together, they are often referred to as NO_X. NO_2 is an orange to reddish gas that is corrosive with an irritating odour. Most NO_2 in the atmosphere is formed by the oxidation of NO, which is emitted directly by combustion processes, particularly those at high temperature and pressure. NO is a colourless gas. The levels of NO and NO_2, and the ratio of the two gases, together with the presence of hydrocarbons and sunlight, are the most important factors in the formation of ground-level ozone (O_3). Further oxidation and combination with water in the atmosphere forms what is known as "acid rain".

Nitrogen oxides are emitted from a variety of combustion sources including vehicles, industrial heaters and boilers, and residential gas-fired furnaces and hot water boilers. Generally for combustion, 5 to 10% of the initial total emissions of NO_X are NO_2 with the remaining 90-95% being NO. The conversion of the majority of NO occurs after release to the atmosphere. The rate of conversion depends on the oxidizing potential of the atmosphere at the time of release. For example, if the ambient concentration of O_3 is high at the time of release, the conversion might be expected to be higher than if the ambient concentration of O_3 was low at that time.

2.2.2 Sulphur Dioxide (SO_2)

Sulphur dioxide (SO_2) is a colourless gas with a distinctive pungent sulphur odour. It is produced in combustion processes by the oxidation of sulphur in the fuel. The presence of SO_2 can, at high enough concentrations, cause damage to vegetation and health effects to animals through their respiratory system. The SO_2 can also be further oxidized and combines with water to form the sulphuric acid component of "acid rain."

Sulphur dioxide is emitted mainly from industrial sources utilizing coal, coke or oil fired heaters and boilers.

2.2.3 Particulate Matter Smaller than 2.5 Microns ($PM_{2.5}$)

Total suspended particulate matter (TSP) is a measure of the particles in the atmosphere that are too small to settle out quickly, but remain suspended for significant periods of time. Generally, this means particles with an aerodynamic diameter of less than 44 µm. TSP is produced by a variety of emissions sources including wind erosion of agricultural fields and other open areas,

abrasion of vehicle tires on paved and unpaved roads, agricultural activities, and combustion processes (e.g., industrial boilers and heaters, power generation, vehicle emissions).

Although total suspended particulate matter is an excellent measure of the loading of particulate matter in the air, it does not necessarily reflect the health risks of the particulate matter. The larger aerodynamic particles (PM_{10}) are trapped by the upper airways, and do not enter the lungs. Smaller diameter particles ($PM_{2.5}$) can make their way deep into the lungs, and may become lodged there. Over the past few years, greater concern with regard to these fine particles has led to research resulting in new sampling methods and criteria.

2.2.4 Dioxins and Furans

Dioxins and furans refer to a family of toxic substances that all share a similar chemical structure. Dioxins and furans all contain chlorine and can occur in different configurations, called congeners. Most dioxins and furans are not produced intentionally, but are created when other chemicals or products are manufactured. Of all of the dioxins and furans, one cogener 2,3,7,8-tetrachloro-p-dibenzo-dioxin (2,3,7,8 Tetra CDD) is considered the most toxic. International toxicity equivalency factors (I-TEFs) are applied to 17 dioxin and furan isomers to convert them into an equivalent 2,3,7,8 Tetra CDD concentration (I-TEQ) for comparison to ambient air quality criteria.

Concentrations of the following dioxins and furans are measured:

<u>Dioxins and furans:</u>

- 2,3,7,8-Tetra CDD
- 1,2,3,7,8-Penta CDD
- 1,2,3,4,7,8-Hexa CDD
- 1,2,3,6,7,8-Hexa CDD
- 1,2,3,7,8,9-Hexa CDD
- 1,2,3,4,6,7,8-Hepta CDD
- Octa CDD
- Total Tetra CDD
- Total Penta CDD
- Total Hexa CDD
- Total Hepta CDD
- 2,3,7,8-Tetra CDF
- 1,2,3,7,8-Penta CDF
- 2,3,4,7,8-Penta CDF
- 1,2,3,4,7,8-Hexa CDF
- 1,2,3,6,7,8-Hexa CDF
- 2,3,4,6,7,8-Hexa CDF
- 1,2,3,7,8,9-Hexa CDF
- 1,2,3,4,6,7,8-Hepta CDF
- 1,2,3,4,7,8,9-Hepta CDF
- Octa CDF
- Total Tetra CDF
- Total Penta CDF
- Total Hexa CDF
- Total Hepta CDF
- Total toxic equivalency (I-TEQ)

2.3 AIR QUALITY CRITERIA

Two sets of ambient air quality standards were used for comparison to the air quality data as specified in the Ambient Air Monitoring Plan (Stantec, 2012). The first set of standards is the limits as reported in O.Reg.419/05 (Schedules 3 and 6). These are compliance based standards used throughout the province of Ontario. However, not all chemicals have O.Reg.419/05 criteria, and in some instances updated health-based standards were used in the human health risk

assessment (HHRA) that was conducted in support of the Environmental Assessment (July 31, 2009 - December 10, 2009). These health-based values, which were reported in Table 7-2 (Summary of Inhalation TRVs and Inhalation Benchmarks Selected for CACs) and Table 7-3 (Inhalation TRVs and Inhalation Benchmarks for Selected COPCs) of the HHRA (Stantec, 2009) were used as the second set of standards.

The previously applicable 24-hour Canada-Wide Standard (CWS) for $PM_{2.5}$ of 30 µg/m^3 (98th percentile averaged over 3 consecutive years) has been superseded by the new Canadian Ambient Air Quality Standard (CAAQS) of 28 µg/m^3 (98th percentile averaged over 3 consecutive years) as noted in **Table 2-2**. The proposed CAAQS 24-hour objective for 2020 is 27 µg/m^3.

A summary of the relevant ambient air quality criteria is presented in **Tables 2-2 and 2-3**.

Table 2-2 Summary of Air Quality Criteria for CACs

Contaminant	CAS	O. Reg 419/05 – Schedule 3/AAQC			HHRA Health-Based Standards		
		1-Hour (µg/m^3)	24-Hour (µg/m^3)	Annual (µg/m^3)	1-Hour (µg/m^3)	24-Hour (µg/m^3)	Annual (µg/m^3)
Sulphur dioxide	7446095	690	275	-	690	275	29
Nitrogen oxides [A]	10102-44-0	400	200	-	400	200	60
Contaminant	**CAS**	**Canadian Ambient Air Quality Standards (CAAQS)**			**HHRA Health-Based Standards**		
		1-Hour (µg/m^3)	24-Hour (µg/m^3)	Annual (µg/m^3)	1-Hour (µg/m^3)	24-Hour (µg/m^3)	Annual (µg/m^3)
$PM_{2.5}$	N/A	-	28 [B]	10 [C]	-	30 [D]	-

Notes:

A. The Schedule 3 standards for NO_X are based on health effects of NO_2, as NO_2 has adverse health effects at much lower concentrations than NO. Therefore the standard was compared to NO_2 in this report. However, as per the current April 2012 version of O. Reg. 419 Summary of Standards and Guidelines, the standard was also compared to the monitored NO_X.

B. Canadian Ambient Air Quality Standard for Respirable Particulate Matter, effective by 2015. The Respirable Particulate Matter Objective is referenced to the 98th percentile over 3 consecutive years.

C. Annual Canadian Ambient Air Quality Standard for Respirable Particulate Matter, effective by 2015. The Respirable Particulate Matter Objective is referenced to the 3-year average of the annual average concentrations.

D. HHRA Health-Based Standard for $PM_{2.5}$ was selected referencing CCME (2006).

Table 2-3 Summary of Air Quality Criteria for D/Fs

Contaminant	CAS	O. Reg 419/05 – Schedule 3/AAQC			HHRA Health-Based Standards			
		1-Hour (ng/m^3)	24-Hour (ng/m^3)	Other time Period (ng/m^3)	1-Hour (ng/m^3)	24-Hour (ng/m^3)	Annual (ng/m^3)	Toxic Equivalency Factor Annual $(ng/m^3)^{-1}$
Dioxins and Furans Total Toxic Equivalency [A]	NA	-	0.1 (pg TEQ/m^3) [B] 1 (pg TEQ/m^3) [C]	-	-	-	-	-

Notes:

A. Application of the air standard for dioxins, furans, and dioxin-like PCBs requires the calculation of the total toxicity equivalent (TEQ) concentration contributed by all dioxin-like compounds in the mixture. TEQ is calculated using the methodology as per the O. Reg.419 Summary of Standards and Guidelines, and the corresponding WHO_{2005} toxic equivalency factors (TEFs).
B. Ontario Ambient Air Quality Criteria
C. O. Reg. 419 Schedule 6 Upper Risk Thresholds
D. Carcinogenic Annual Average. Units in $(ng/m^3)^{-1}$.

3.0 INSTRUMENTATION AND OPERATIONS SUMMARY

3.1 INSTRUMENTATION

The measurement program at the monitoring sites includes both continuous and non-continuous monitors to sample air contaminant concentrations.

Monitoring for respirable particulate matter ($PM_{2.5}$), nitrogen oxides (NO_X) and sulphur dioxide (SO_2) are conducted on a continuous basis. A summary of the continuous monitors and a brief description of their principle of operation are provided in **Table 3-1** below.

Table 3-1 Summary of Continuous Ambient Air Quality Monitors

Contaminant	Monitor	Principle of Operation	Range	Time Interval
$PM_{2.5}$	Thermo Sharp 5030 Synchronized Hybrid Ambient Real-time Particulate Monitor	Light Scattering Photometry / Beta Attenuation - Consists of a carbon14 source, detector and light scattering Nephelometer in a rack-mountable enclosure. The Thermo Sharp utilizes a continuous (non-step wise) hybrid mass measurement and a combination of beta attenuation and light scattering technology. The unit's filter tape is automatically advanced based upon a user defined frequency or particulate loading.	0-10 mg/m^3	1 minute
NO, NO_2, NO_X	API Model 200E Chemiluminescence Analyzer	Chemiluminescence - Uses a chemiluminescence detection principle and microprocessor technology for ambient continuous emissions monitoring (CEM). Measurements are automatically compensated for temperature and pressure changes.	0 – 1000 ppb	1 second

Table 3-1 Summary of Continuous Ambient Air Quality Monitors

Contaminant	Monitor	Principle of Operation	Range	Time Interval
SO_2	Teledyne Monitor Labs Sulphur Dioxide Analyzer Model T100	Pulsed Florescence - SO_2 levels are measured based on the principle that SO_2 has a strong ultraviolet (UV) absorption at a wavelength between 200 and 240 nanometres (nm). The absorption of photons at these wavelengths results in the emission of fluorescence photons at a higher wavelength. The amount of fluorescence measured is directly proportional to the concentration of SO_2.	0 – 1000 ppb	1 second

Two manually operated, hi-volume air samplers are installed at each of the Courtice WPCP (upwind) and Rundle Road (downwind) monitoring stations to collect metals in total suspended particulates (TSP), polycyclic aromatic hydrocarbons (PAHs) and dioxins and furans. As per Section 1.2 of the Ambient Monitoring Plan (Stantec, 2012), monitoring for metals/TSP, PAHs and dioxins and furans was not conducted in 2015.

However, as mentioned above, Stantec was requested to conduct additional dioxins/furans sampling on a 12-day schedule between October 21, 2015 and January 25, 2016. The methodology and analyses for the dioxins and furans sampling follow those described in the Ambient Air Monitoring Plan (Stantec 2012) as presented in **Table 3-2**, with the exception of the sampling schedule (dioxin/furan sampling is on a 24-day schedule in the Ambient Monitoring Plan). The samples were submitted to Maxxam Analytics Inc., a Canadian Association for Laboratory Accreditation Inc. (CALA) / Standards Council of Canada (SCC) accredited laboratory, for analysis.

Table 3-2 Summary of Non-Continuous Ambient Air Quality Monitors

Contaminant	Sampler	Filter Media	Lab Analysis	Sampling Schedule
Dioxins / Furans	Tisch Environmental TE-1000 mass-flow high volume air sampler	Dual chambered sampling module with a Teflon-coated glass fibre filter and a Poly-Urethane Foam (PUF) cartridge	Gas Chromatography / Mass Spectrometry (GC/MS)	24 hour sample taken every 12 days

Horizontal wind speed, wind direction, atmospheric temperature, relative humidity and rainfall are measured at the predominantly downwind Rundle Road station. The meteorological sensors at the Rundle Road station are mounted on an external 10-m aluminum tower and are logged using a digital data acquisition system (DAS).

The predominantly upwind Courtice station measures atmospheric temperature, relative humidity, rainfall and barometric pressure. Wind speed and wind direction data at the upwind location are available from the Courtice Water Pollution Control Plant.

The meteorological equipment includes the following:

Table 3-3 Summary of Meteorological Equipment

Parameter	Equipment
Wind Speed/Wind Direction	Met One Instruments Inc. Model 034B
Temperature	Campbell Scientific Model HMP60
Relative Humidity	Campbell Scientific Model HMP60
Atmospheric Pressure	Campbell Scientific Model CS106
Rainfall	Texas Electronic TE525M

A Campbell Scientific CRX1000 station data acquisition system is used to collect continuous instrument monitoring data and status codes from the ambient air quality monitors. Continuous station data are maintained in the data loggers, and data is viewed locally using a laptop and the relevant DAS software applications. Remote data transmission is accomplished by the periodic transmission of collected station air quality data via cellular phone.

3.2 MONITORING STATION VISITS AND REGULAR MAINTENANCE ACTIVITIES

Monitoring station visits are conducted on a regular basis. During the station visits, the integrity and proper operation of the sampling and monitoring equipment and of the data acquisition systems, to ensure the collection of valid and complete data were verified, as well as the continued safe and secure environment at the station.

Station visits in 2015 were documented in the site logbook, and visual checks of the equipment were documented during each site visit in an Ambient Pod Checklist. A list of the regular and major preventative maintenance activities performed by Stantec and/or Valley Environmental during the station visits in 2015 is presented in **Table A-1** in **Appendix A**.

Daily diagnostic tests were performed remotely on the continuous monitoring equipment and station parameters to check for anomalous data and assess whether the equipment was functioning normally. Any issues identified were immediately assessed and rectified. If required, Valley Environmental was notified to dispatch a trained technician to address the issue.

3.3 DATA ACQUISITION/ARCHIVING

Data from the continuous monitors at each station are maintained in the data loggers. These data were viewed and collected via the automated data acquisition systems and cell phone modems.

- On a daily basis during weekdays, each data logger was remotely accessed and the current data were reviewed to check the operational status of each monitor and for anomalous data;
- Data was downloaded and backed-up once a week (to a separate file location) to avoid any file overwriting or data loss ;
- The full set of collected data was reviewed including manual verification of values, invalidating false / suspicious / calibration data, etc. The protocols used to invalidate continuous data followed those provided in Table 5 of the MOECC Operations Manual.

Details of the data editing are presented in the quarterly reports.

3.4 INSTRUMENTATION CALIBRATION

Continuous Monitors

The samplers were calibrated when they were installed in the field before their first use. On-going performance checks and external calibrations of the continuous monitors were performed monthly. This meets the recommended calibration schedule listed in the MOECC Operations Manual. The external calibrations for the NO_X and SO_2 monitors involved challenging each monitor with certified calibration gases (each referenced to a primary standard) for zero and span measurements.

Non-Continuous Monitors

The high volume air samplers were calibrated at a minimum monthly (or after any motor maintenance) during the sampling period. The calibration frequency exceeded the MOECC Operations Manual requirement of quarterly calibrations.

A summary of the calibration tasks that are required and have been performed for each sampler are provided in **Table A-2** in **Appendix A**.

3.5 MINISTRY OF THE ENVIRONMENT AND CLIMATE CHANGE MONITOR PERFORMANCE AND SITE AUDIT

Four MOECC audits were conducted in 2015. These were done on March 4, June 30, August 31, and December 14 for the continuous monitors ($PM_{2.5}$, SO_2, and $NO_X/NO_2/NO$) at both the Courtice WPCP and Rundle Road Stations.

All monitors passed the MOECC performance and site audits. The calibrations met all current MOECC criteria. Since the non-continuous air samplers were not in use / not in the scope of the Ambient Air Monitoring Plan (Stantec 2012) in 2015, MOECC audits of these samplers were not conducted.

3.6 INSTRUMENTATION ISSUES

A few instrumentation issues were encountered during 2015. These were generally associated with power outages, UV lamp replacement, Sharp $PM_{2.5}$ monitor sensitivity to high ambient relative humidity levels. There were some minor equipment issues that commonly occur when operating instrumentation continuously for extended periods of time.

A summary of operational issues and the resolution for each measurement parameter during the 2015 monitoring period is presented in **Tables A-3 and A-4** in **Appendix A**.

3.7 DATA RECOVERY RATES

Data recovery rates for each continuous monitor at the two monitoring stations during the 2015 sampling period (January to December 2015) are presented in **Tables 3-4 and 3-5**. The data recovery rates for the measured air contaminants at both stations met or exceeded MOECC requirements for data validity.

Table 3-4 Summary of Data Recovery Rates for the Courtice WPCP Station (Upwind) – 2015 Monitoring Period

Parameter	Valid Measurement Hours	Data Recovery Rate (%)
SO_2	8467	97%
NO_X	8526	97%
$PM_{2.5}$	8126	93%
Temperature	8759	100%
Rainfall	8705	99%
Relative Humidity	8759	100%
Pressure	8759	100%

Table 3-4 Summary of Data Recovery Rates for the Courtice WPCP Station (Upwind) – 2015 Monitoring Period

Parameter	Valid Measurement Hours	Data Recovery Rate (%)
Wind Speed/Direction	8758	100%
TSP/Metals	N/A [A]	N/A [A]
PAHs	N/A [A]	N/A [A]
Dioxins and Furans	4 [B]	67%

Note:

A - Not sampled in 2015.

B - Number of filters/24-hour average samples.

Table 3-5 Summary of Data Recovery Rates for the Rundle Road Station (Downwind) – 2015 Monitoring Period

Parameter	Valid Measurement Hours	Data Recovery Rate (%)
SO_2	8684	99%
NO_X	8678	99%
$PM_{2.5}$	8683	99%
Temperature	8760	100%
Rainfall	8553	98%
Relative Humidity	8760	100%
Pressure	N/A [A]	N/A [A]
Wind Speed/Direction	8760	100%
TSP/Metals	N/A [B]	N/A [B]
PAHs	N/A [B]	N/A [B]
Dioxins and Furans	6 [C]	100%

Note:

A. Not measured at the Rundle Road Station

B. Not sampled in 2015.

C. Number of filters/24-hour average samples.

4.0 SUMMARY OF AMBIENT MEASUREMENTS

The following sections provide summaries of the validated data for each measured parameter.

4.1 METEOROLOGICAL DATA

A summary of the maximum, minimum, arithmetic mean, and standard deviation of the hourly average meteorological parameters measured at the two monitoring stations for January - December 2015 is presented in **Table 4-1**.

Table 4-1 Summary of Hourly Meteorological Measurements – 2015 Monitoring Period

Parameter		Courtice WPCP (Upwind)	Rundle Road (Downwind)	Units
Temperature	Max	29.1	29.4	C
	Min	-25.4	-25.9	C
	Mean	7.7	7.5	C
	Standard Deviation	10.7	11.1	C
Rainfall	Max	19.7	19.5	mm
	Min	0.0	0.0	mm
	Mean	0.07	0.08	mm
	Standard Deviation	0.56	0.60	mm
Relative Humidity	Max	97.6	100.0	%
	Min	18.2	19.8	%
	Mean	71.2	74.5	%
	Standard Deviation	14.7	16.1	%
Pressure [A]	Max	30.5	-	in Hg
	Min	29.0	-	in Hg
	Mean	29.7	-	in Hg
	Standard Deviation	0.2	-	in Hg
Wind Speed [B]	Max	49.5	44.7	km/hr
	Min	0.3	0.0	km/hr
	Mean	11.9	10.9	km/hr
	Standard Deviation	7.3	6.9	km/hr

Notes:

A. Pressure is not measured at the Rundle Road Station.

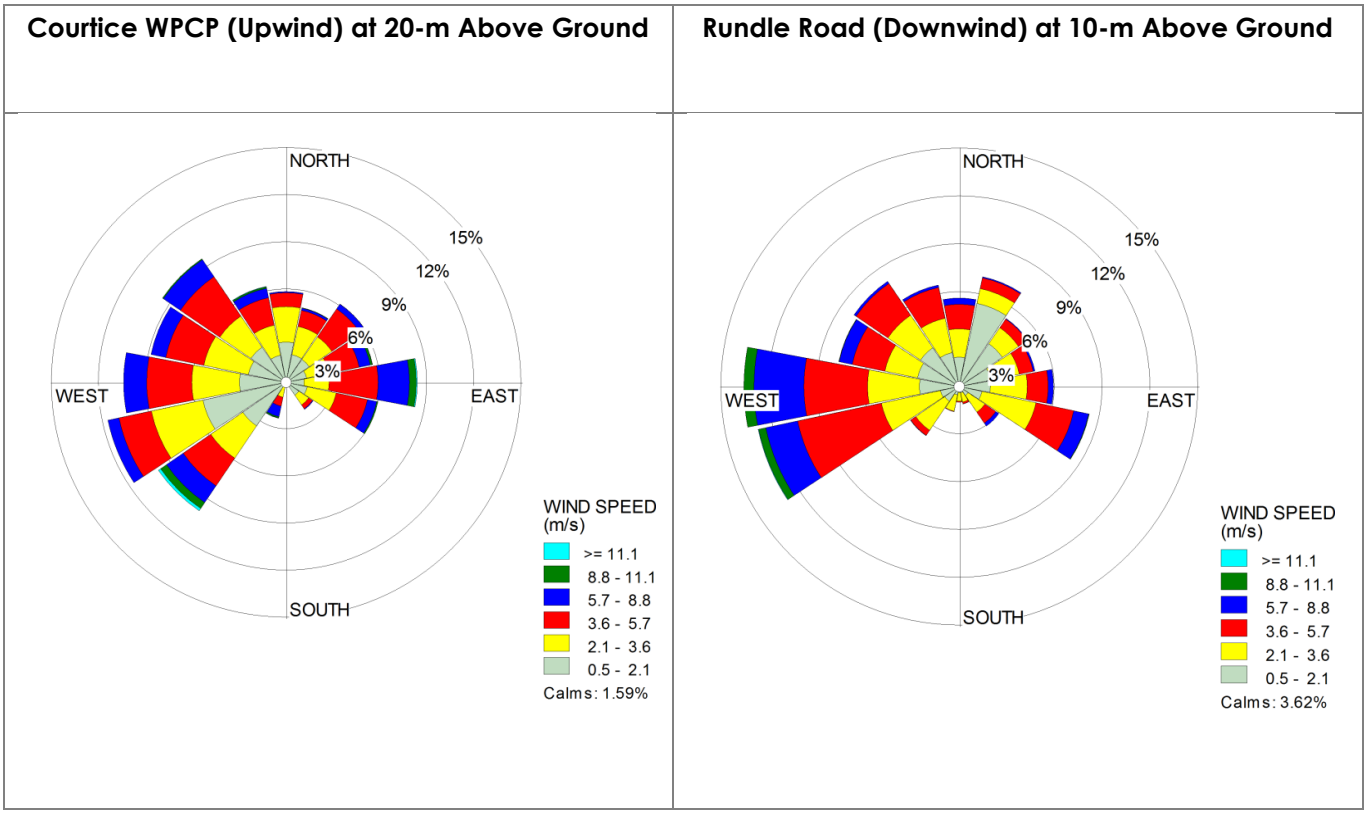
B. Wind speed at the Courtice WPCP Station is measured at 20-m and at the Rundle Road Station at 10-m.

At the Courtice WPCP (Upwind) Station (located near Lake Ontario), wind data were measured and provided by the Courtice Water Pollution Control Plant on a 20-m tower, while at the Rundle Road (Downwind) Station they were measured on a 10-m tower.

Wind roses showing the directionality and speed at each location are presented in **Figure 4-1**. The length of the radial barbs gives the total percent frequency of winds from the indicated direction, while portions of the barbs of different widths indicate the frequency associated with each wind speed category.

Winds over the twelve-month monitoring period in 2015 at the Courtice WPCP Station occurred predominantly from southwesterly to northwesterly directions. Winds blew infrequently from the south. At the Rundle Road Station, the predominant wind directions were winds blowing from west-southwesterly to northwesterly directions. As with the Courtice WPCP Station, the wind contribution from the south was low for the Rundle Road Station.

Figure 4-1 Wind Roses for the 2015 Monitoring Period (Jan-Dec 2015)



4.2 CAC AMBIENT AIR QUALITY MEASUREMENTS

A summary of the maximum, minimum, arithmetic mean, and standard deviation of the CAC pollutant concentrations measured at each station are presented in **Table 4-2**. Also presented in **Table 4-2** is the number of exceedances (if any) of the relevant Ontario ambient air quality criteria (AAQC) or health-based standard for each contaminant.

The measured concentrations of the air contaminants monitored were all below their applicable hourly, 24-hour and annual average criteria during 2015.

The concentration of nitric oxide (NO) has no regulatory criteria as discussed in Section 4.2.2 below. The hourly and 24-hour AAQC values for NO_X are based on health effects of NO_2; therefore the AAQCs were compared to measured NO_2 concentrations in this report (MOECC, 2012a). However, as per the April 2012 version of O.Reg. 419 Summary of Standards and Guidelines (MOECC, 2012b), the Schedule 3 criteria for NO_X were also compared to the monitored NO_X levels.

A comparison of the maximum measured data to their respective air quality criteria is presented graphically in **Figure 4-2**.

Table 4-2 Summary of Ambient CAC Monitoring Data - 2015 Monitoring Period

Pollutant	Averaging Period	AAQC / HHRA Health-Based Standards			Courtice WPCP (Upwind)		Rundle Road (Downwind)	
		µg/m³	ppb		Concentration (µg/m³)	Concentration (ppb)	Concentration (µg/m³)	Concentration (ppb)
SO_2	1	690	250	Maximum	103.8	39.0	79.3	28.3
				Minimum	0.0	0.0	0.0	0.0
				Mean	2.7	1.0	2.0	0.7
				Standard Deviation	5.1	1.8	3.0	1.1
				# of Exceedances	0	0	0	0
	24	275	100	Maximum	23.5	8.8	22.4	8.3
				Minimum	0.0	0.0	0.0	0.0
				Mean	2.7	1.0	2.1	0.7
				Standard Deviation	2.9	1.0	2.4	0.8
				# of Exceedances	0	0	0	0
	Annual	55 / 29 [A]	20 / 11 [A]	Mean (Period)	2.7	1.0	2.0	0.7
				# of Exceedances	0	0	0	0
$PM_{2.5}$	24	28 [B]	N/A	Maximum	59.6	-	64.7	-
				Minimum	0.2	-	0.2	-
				Mean	7.8	-	9.5	-
				98th Percentile [C]	27.3	-	28.4	-
				Standard Deviation	7.4	-	7.3	-
				# of Exceedances	N/A	-	N/A	-
	Annual	10 [D]	N/A	Mean (Period)	7.7	-	9.5	-
				# of Exceedances	N/A	-	N/A	-

Table 4-2 Summary of Ambient CAC Monitoring Data - 2015 Monitoring Period

Pollutant	Averaging Period	AAQC / HHRA Health-Based Standards			Courtice WPCP (Upwind)		Rundle Road (Downwind)	
		µg/m³	ppb		Concentration (µg/m³)	Concentration (ppb)	Concentration (µg/m³)	Concentration (ppb)
NO_2	1	400 [E]	200 [E]	Maximum	135.2	62.3	86.4	42.6
				Minimum	0.0	0.0	0.0	0.0
				Mean	13.8	6.8	13.1	6.6
				Standard Deviation	14.7	7.1	10.8	5.3
				# of Exceedances	0	0	0	0
	24	200 [E]	100 [E]	Maximum	55.2	25.9	45.9	22.6
				Minimum	0.0	0.0	0.0	0.0
				Mean	13.7	6.8	13.1	6.6
				Standard Deviation	9.7	4.6	7.6	3.7
				# of Exceedances	0	0	0	0
	Annual	60	30	Mean	13.8	6.8	13.1	6.6
				# of Exceedances	0	0	0	0
NO [F]	1	NA	NA	Maximum	125.3	88.5	117.7	90.9
				Minimum	0.0	0.0	0.0	0.4
				Mean	3.8	2.9	3.7	2.8
				Standard Deviation	7.6	5.7	4.8	3.7
				# of Exceedances	0	0	0	0
	24	NA	NA	Maximum	28.9	22.3	21.4	15.9
				Minimum	0.0	0.0	0.7	0.7
				Mean	3.8	2.9	3.7	2.8
				Standard Deviation	4.2	3.1	2.1	1.6
				# of Exceedances	0	0	0	0

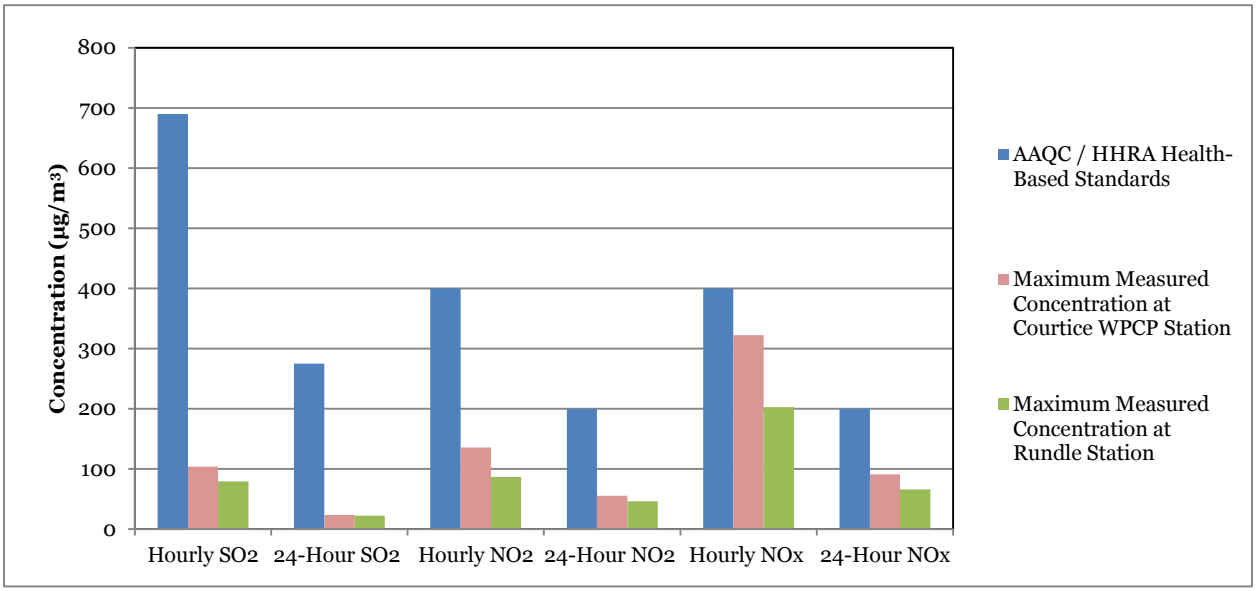
Table 4-2 Summary of Ambient CAC Monitoring Data - 2015 Monitoring Period

Pollutant	Averaging Period	AAQC / HHRA Health-Based Standards			Courtice WPCP (Upwind)		Rundle Road (Downwind)	
		µg/m³	ppb		Concentration (µg/m³)	Concentration (ppb)	Concentration (µg/m³)	Concentration (ppb)
NO_X	1	400 [E]	200 [E]	Maximum	322.2	148.5	202.6	102.0
				Minimum	0.0	0.0	0.0	0.0
				Mean	18.4	9.1	16.3	8.2
				Standard Deviation	23.5	11.4	15.4	7.6
				# of Exceedances	0	0	0	0
	24	200 [E]	100 [E]	Maximum	91.0	42.6	65.9	31.9
				Minimum	0.0	0.0	0.0	0.0
				Mean	18.4	9.1	16.3	8.2
				Standard Deviation	14.6	7.0	9.7	4.8
				# of Exceedances	0	0	0	0
	Annual	60	30	Mean	18.4	9.1	16.3	8.2
				# of Exceedances	0	0	0	0

Notes:

A. Annual AAQC / Annual HHRA.
B. Canadian Ambient Air Quality Standard for Respirable Particulate Matter, effective by 2015. The Respirable Particulate Matter Objective is referenced to the 98th percentile over 3 consecutive years.
C. The 98th percentile of the daily average $PM_{2.5}$ measurements in the period.
D. Annual Canadian Ambient Air Quality Standard for Respirable Particulate Matter, effective by 2015. The Respirable Particulate Matter Objective is referenced to a 3-year average of the annual average concentrations.
E. As per current version (April 2012) of Reg. 419 Summary of Standards and Guidelines, the air standard for NO_X is compared to a monitored NO_X concentration, although the Reg. 419 Schedule 3 standard for NO_X is based on health effects of NO_2.
F. NO has no regulatory criteria.
G. Daily $PM_{2.5}$ concentrations were not compared to the Canadian Ambient Air Quality Standard shown in this table, which requires averaging the 98th percentile concentrations over three consecutive years, as compared to the 12-month period covered by this report.
H. Annual $PM_{2.5}$ concentrations were not compared to the Canadian Ambient Air Quality Standard shown in this table, which requires a 3-year average of the annual average concentrations

Figure 4-2 Comparison of NO_2 / NO_X and SO_2 Ambient Monitoring Data to Applicable Criteria – 2015 Monitoring Period



Additional details on the results for each measured contaminant are presented in the following sections.

4.2.1 Sulphur Dioxide (SO_2)

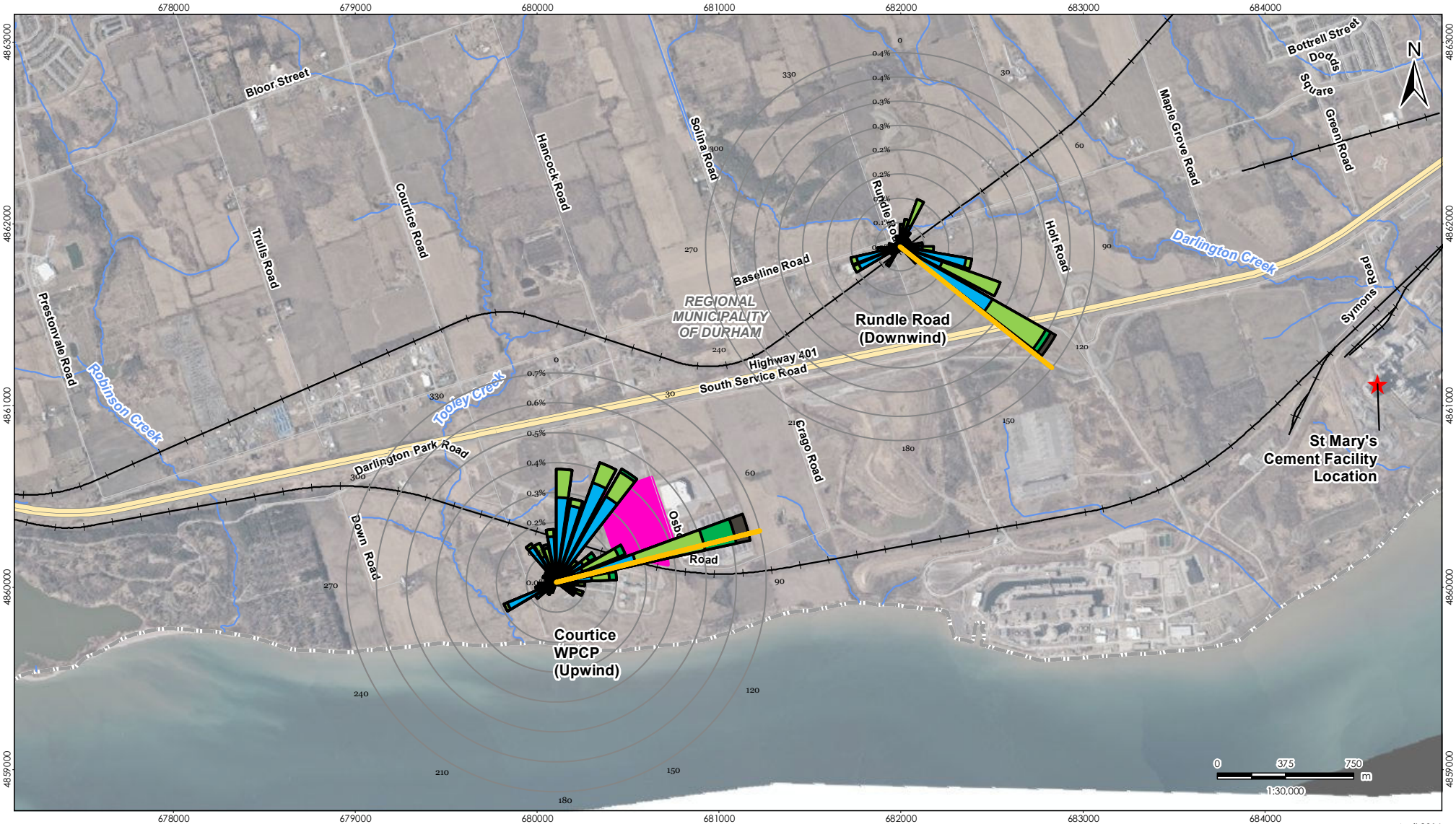
Time history plots of the hourly and 24-hour average SO_2 concentrations over the measurement period are presented in **Appendix B, Figures B1 and B2**. For the hourly and 24-hour average plots, the Ontario AAQCs of 690 µg/m³ and 275 µg/m³ are shown as blue lines on each plot. As shown in these figures, measured ambient SO_2 concentrations at both stations were well below the criteria. The annual Ontario AAQC for SO_2 is 55 µg/m³, and the annual HHRA criterion is 29 µg/m³.

The maximum hourly, 24-hour and annual average concentrations measured at the Courtice WPCP station during the 2015 monitoring period were 103.8, 23.5 and 2.7 µg/m³, respectively, which are 15%, 8.5% and 9.3% of the applicable ambient 1-hour, 24-hour and annual air quality criteria.

The maximum hourly, 24-hour and annual average concentrations measured at the Rundle Road station during 2015 were 79.3, 22.4 and 2 µg/m³, respectively, which are 11.5%, 8.1% and 7.1% of the applicable ambient 1-hour, 24-hour and annual air quality criteria.

Pollution roses of hourly average SO_2 concentrations measured at the Courtice WPCP Station and the Rundle Road Station are presented in **Figure 4-3**. A pollution rose plot presents measured hourly average contaminant concentrations versus measured wind direction (over 10˚ wind sectors). The figure differs slightly from the 2014 annual report figure as concentrations less than 10 µg/m^3, which account for about 95% of the measurements at each station, were removed from the plots to allow the distribution of maximum levels to be more clearly visible in the figure. Plots of the measured hourly average SO_2 concentrations versus wind direction are presented in **Appendix B, Figures B3 and B4**.

For the Courtice WPCP Station, higher measured concentrations occurred from northerly to easterly directions. The maximum measured concentration at this station occurred for east-northeasterly winds – a direction in which the Courtice water pollution control plant, a CN railway, the DYEC and St. Mary's Cement are upwind of the monitoring station. For the Rundle Road station, the measured hourly average concentrations were higher for southeasterly winds relative to other directions. The highest measured concentrations at this station was from the southeast for which St. Mary's Cement, Highway 401 and a CP railway are upwind of the Rundle station.



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Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
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3. Orthoimagery © First Base Solutions, 2013.
4. Courtice WPCP: Concentrations less than 10µg/m3, which account for 95% of the measurements, have been removed from the plot to allow the distribution of maximum levels to be more clearly shown in the figure. Rundle Road: Concentrations less than 10µg/m3, which account for 97% of the measurements, have been removed from the plot to allow the distribution of maximum levels to be more clearly shown in the figure.

Legend

- St Mary's Cement Facility Location
- Durham York Energy Centre Site
- Railway
- Road
- Highway
- Watercourse

Concentration (ug/m³)

- 75 - 105
- 45 - 75
- 20 - 45
- 10 - 20
- 0 - 10
- Direction of Maximum Measured Concentration

Client/Project

The Region of Durham
Durham York Energy Centre

Figure No.

4-3

Title

Pollution Roses of Measured Hourly Average SO_2 Concentrations - 2015 Monitoring Period

4.2.2 Nitrogen Dioxide (NO_2)

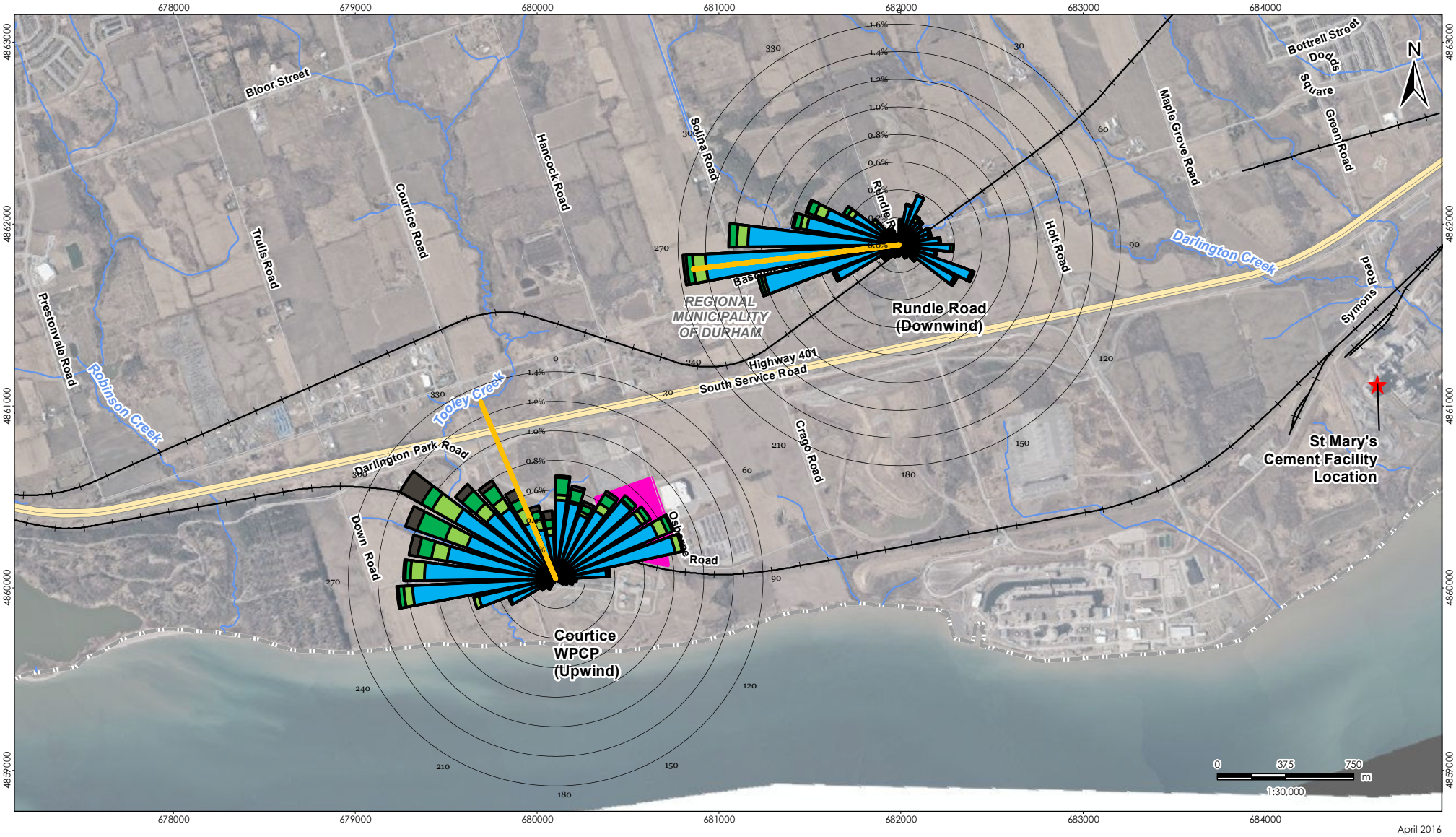
Nitrogen oxides (NO_X) are almost entirely made up of nitric oxide (NO) and nitrogen dioxide (NO_2). Together, they are often referred to as NO_X. Most NO_2 in the atmosphere is formed by the oxidation of NO, which is emitted directly by combustion processes, particularly those at high temperature and pressure. Exposure to both NO and NO_2 can result in adverse health effects to an exposed population. NO_2 is the regulated form of NO_X. Similar to other jurisdictions (e.g., Alberta Environment, World Health Organization),the O. Reg. 419/05 Schedule 3 standards for NO_X are based on health effects of NO_2, as health effects are seen at much lower concentrations of NO_2 than NO. In this report, because NO_2 is the regulated form of NO_X, the AAQC were compared to measured NO_2 concentrations (MOECC, 2012a). However, as per the current April 2012 version of O. Reg. 419 Summary of Standards and Guidelines (MOECC, 2012b), the NO_X Schedule 3 criteria were also compared to the monitored NO_X concentrations (see Section 4.2.3 below).

Time history plots of the hourly and 24-hour average NO_2 concentrations over the measurement period are presented in **Appendix C, Figures C1 and C2**. For hourly and 24-hour averages, the respective Ontario AAQCs of 400 µg/m^3 and 200 µg/m^3 are shown as blue lines on the time history plots. As shown in these figures, measured ambient NO_2 concentrations at both stations were well below the criteria.

The maximum hourly, 24-hour and annual average NO_2 concentrations measured at the Courtice WPCP station during 2015 were 135.2, 55.2 and 13.8 µg/m^3, respectively which are 33.8%, 27.6% and 22.9% of the applicable ambient 1-hour, 24-hour and annual air quality criteria. At the Rundle Road Station, the maximum measured hourly and 24-hour average concentrations were 86.4, 45.9 and 13.1 µg/m^3, which are 21.6%, 23% and 21.9% of the applicable air quality criteria.

Pollution roses of hourly NO_2 concentrations are presented in **Figure 4-4**. Concentrations less than 25 µg/m^3 which account for approximately 85% of measurements were removed from the plots. Plots of measured hourly average NO_2 concentrations versus measured wind direction are presented in **Appendix C, Figures C3 and C4**.

Higher measured hourly concentrations for the Courtice WPCP station occurred most frequently from northwesterly to northerly directions. The maximum measured hourly average NO_2 concentration for the Courtice WPCP Station occurred for a north-northwesterly wind - a direction in which the CN railway, Highway 401 and an agricultural area are upwind of the station. At the Rundle Road Station, higher hourly average NO_2 concentrations were measured for winds blowing from westerly to northwesterly directions. The maximum measured hourly average concentration at the Rundle Road Station was from the west for which commercial businesses along Rundle Road (such as equipment rental companies and truss manufacturers) are upwind of the station.



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Revised: 2016-04-26 By: bcowper

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Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.
3. Orthoimagery © First Base Solutions, 2013.
4. Courtice WPCP: Concentrations less than 25µg/m3, which account for 83% of the measurements, have been removed from the plot to allow the distribution of maximum levels to be more clearly shown in the figure. Rundle Road: Concentrations less than 25µg/m3, which account for 86% of the measurements, have been removed from the plot to allow the distribution of maximum levels to be more clearly shown in the figure.

Legend

- St Mary's Cement Facility Location
- Durham York Energy Centre Site
- Railway
- Road
- Highway
- Watercourse

Concentration (ug/m³)

- 75 - 140
- 60 - 75
- 50 - 60
- 25 - 50
- 0 - 25
- Direction of Maximum Measured Concentration

Client/Project

The Region of Durham
Durham York Energy Centre

Figure No.

4-4

Title

Pollution Roses of Measured Hourly Average NO_2 Concentrations - 2015 Monitoring Period

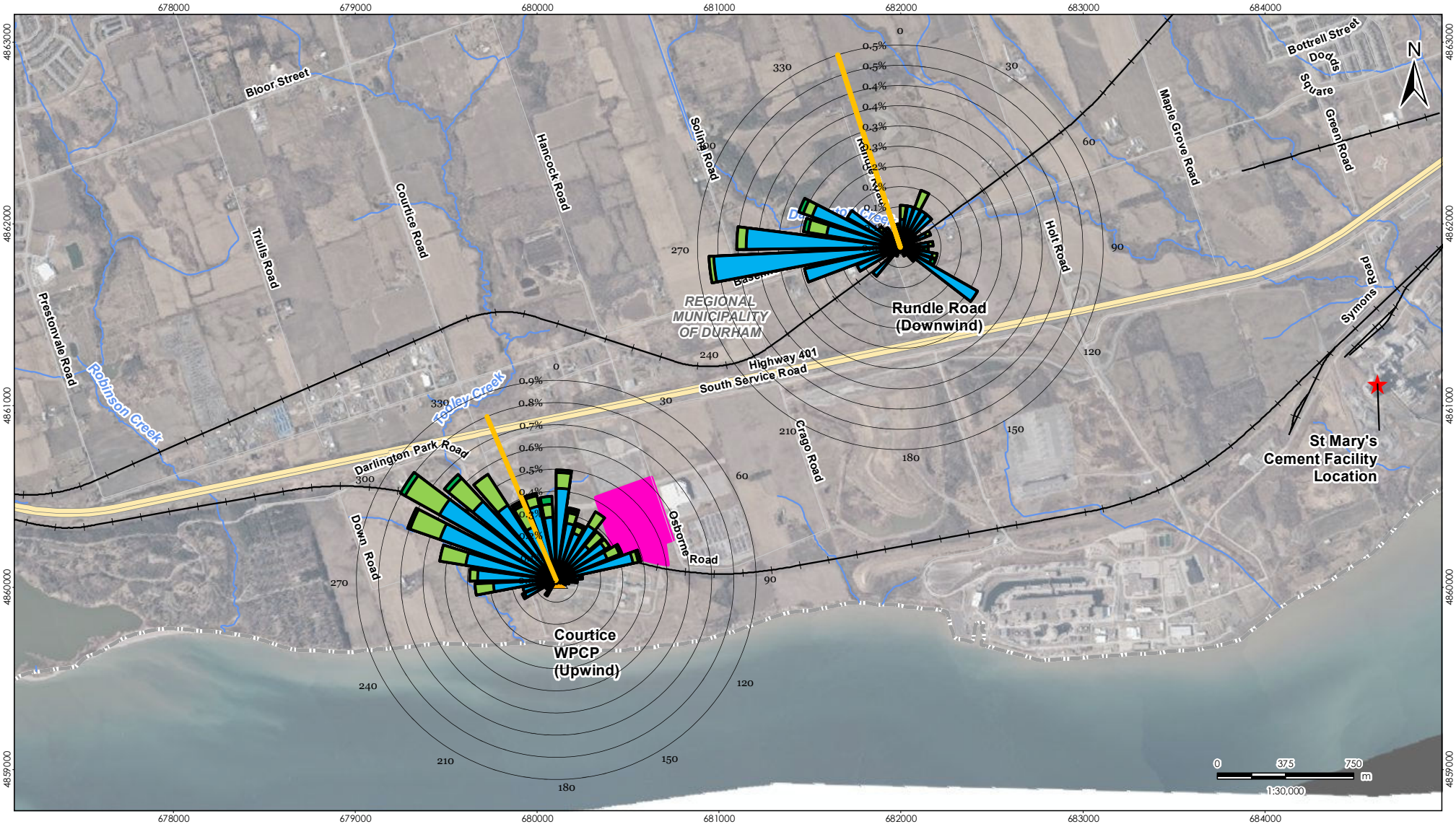
4.2.3 Nitrogen Oxides (NO_X)

Time history plots of hourly and 24-hour average NO_x concentrations over the measurement period are presented in **Appendix D, Figures D1 and D2**. For hourly and 24-hour averages, the Ontario Schedule 3 criteria of 400 µg/m^3 and 200 µg/m^3 are shown as blue lines on the corresponding time history plot. As indicated in the section above, although the criteria were compared to the measured NO_X concentrations in this report, the standards for NO_X are based on health effects of NO_2. As shown in these figures, the maximum measured ambient hourly and 24-hour average NO_X concentrations at the Courtice WPCP station were below the criteria during the monitoring period. The measured concentrations at the Rundle Road station were also well below the criteria.

As presented in **Table 4-2**, the maximum hourly average NO_X concentration measured at the Courtice WPCP station was 322.2 µg/m^3, which is 80.6% of the 1-hour ambient criteria. The 24-hour and annual average NO_X concentrations measured at this station were 91 µg/m^3 and 18.4 µg/m^3, which are 45.5% and 30.6% of the applicable ambient air quality criteria. At the Rundle Road Station, the maximum hourly, 24-hour and annual average concentrations measured in 2015 were 202.6, 65.9 and 16.3 µg/m^3, which are 50.6%, 32.9% and 27.1% of the applicable air quality criteria.

Pollution roses of hourly average NO_X concentrations for the Courtice WPCP Station and the Rundle Road Station are presented in **Figure 4-5**. The wind roses in this figure present measured concentrations above 50 µg/m^3 to allow the higher levels to be more easily visible (concentrations less than 50 µg/m^3 accounted for 90% and 95% of the NOx measurements at the Courtice WPCP and Rundle Road Stations respectively). Plots of wind direction versus measured NO_X concentrations are presented in **Appendix D, Figures D3 and D4**. Higher measured hourly average NO_X concentrations for the Courtice WPCP Station typically occurred for winds blowing from the northwesterly direction. The maximum measured concentration was for a wind blowing from the north-northwest, for which Highway 401 and the CN railway were upwind.

At the Rundle Road Station, higher measured hourly average NO_X concentrations occurred for westerly to west-northwesterly directions. The maximum measured hourly average NO_X concentration occurred for a north-northwesterly wind. In this direction, Rundle Road and some agricultural areas are situated upwind of the monitoring station.



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Revised: 2016-04-26 By: bcowper

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Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.
3. Orthoimagery © First Base Solutions, 2013.
4. Courtice WPCP: Concentrations less than 50µg/m3, which account for 91% of the measurements, have been removed from the plot to allow the distribution of maximum levels to be more clearly shown in the figure. Rundle Road: Concentrations less than 50µg/m3, which account for 95% of the measurements, have been removed from the plot to allow the distribution of maximum levels to be more clearly shown in the figure.

Legend

- St Mary's Cement Facility Location
- Durham York Energy Centre Site
- Railway
- Road
- Highway
- Watercourse

Concentration (ug/m³)

- 200 - 325
- 150 - 200
- 100 - 150
- 50 - 100
- 0 - 50
- Direction of Maximum Measured Concentration

Client/Project

The Region of Durham
Durham York Energy Centre

Figure No.

4-5

Title

Pollution Roses of Measured Hourly Average NO_x Concentrations – 2015 Monitoring Period

4.2.4 Particulate Matter Smaller than 2.5 Microns ($PM_{2.5}$)

Time history plots of the measured 24-hour average $PM_{2.5}$ concentrations over the measurement period are presented in **Appendix E, Figures E1 and E2**.

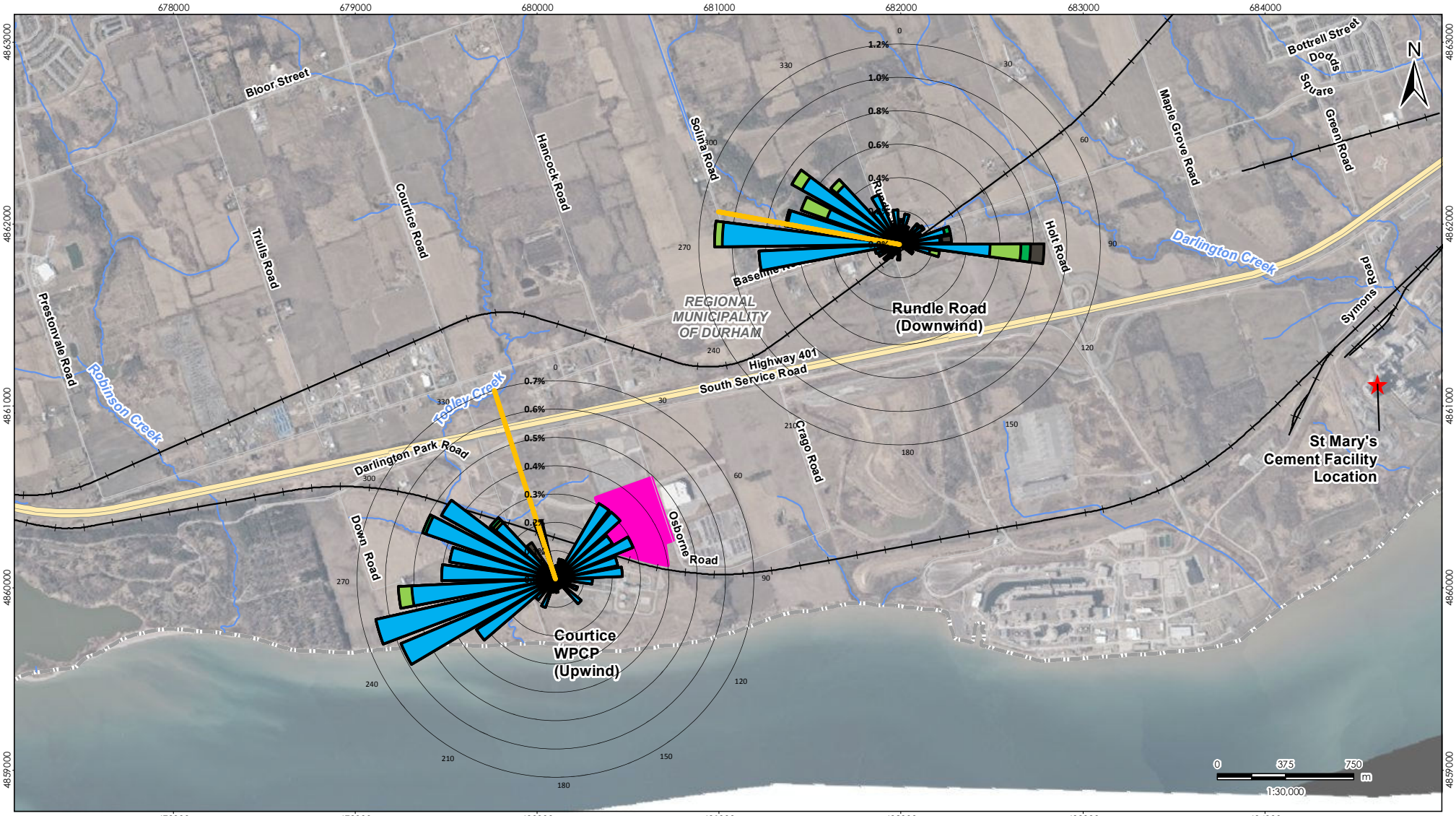
The maximum 24-hour average $PM_{2.5}$ concentration measured at the Courtice WPCP station over the monitoring period was 59.6 µg/m^3. The maximum measured 24-hour average $PM_{2.5}$ concentration at the Rundle Road station was 64.7 µg/m^3. In 2015, the 98th percentiles of the daily average $PM_{2.5}$ concentrations measured over the monitoring period were 27.3 µg/m^3 at the Courtice WPCP Station and 28.4 µg/m^3 at the Rundle Road Station. As detailed below, these values for the 98th percentile should not be used for comparison against the Canadian Ambient Air Quality Standard.

Pollution roses showing measured 24-hour average ambient $PM_{2.5}$ concentrations versus wind direction are shown in **Figure 4-6** for both monitoring stations. Concentrations less than 20 µg/m^3 which accounted for approximately 85% of measurements at the Courtice WPCP and 90% at the Rundle Road Station were not included in this figure to more clearly show the distribution of higher levels. Plots of measured 24-hour average ambient $PM_{2.5}$ concentrations versus measured 24-hour average wind direction are presented in **Appendix E, Figures E-3 and E-4**.

Higher measured $PM_{2.5}$ concentrations at the Courtice WPCP Station occurred for southwesterly to northwesterly and northeasterly winds, with the maximum measured concentration occurring from the north-northwest for which the CN railway and Highway 401 were located upwind of the monitoring station.

At the Rundle Road Station, higher measured 24-hour average $PM_{2.5}$ concentrations occurred for easterly and westerly to northwesterly winds. The maximum measured concentration occurred for a westerly wind – for this wind direction commercial businesses along Rundle Road (such as equipment rental companies and a truss manufacturer) are located upwind of the Rundle Road station.

The 24-hour and annual $PM_{2.5}$ CAAQS criteria both require a 3-calendar year average for comparison, with the data considered valid if an annual 98th percentile value is available for at least two of the required three calendar years. Since **Table 4-2** only covers the year 2015, the presented measurements were not explicitly compared to the CAAQS criteria. With the collection of $PM_{2.5}$ measurements beginning in July 2013 to the end of the period considered in this report (December 2015), there are two calendar years of measured data available to compare against the CAAQS criteria. A preliminary comparison of the calculated 2-year average of the annual 98th percentile of the daily 24-hour average concentrations and the 2-year average of the annual average concentrations to their respective CAAQS criteria using calendar years 2014 and 2015 at both stations is shown in **Table 4-3**. The calculated ambient $PM_{2.5}$ levels were below their respective CAAQS standards for this preliminary comparison.



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Revised: 2016-04-26 By: bcowper

Stantec

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.
3. Orthoimagery © First Base Solutions, 2013.
4. Courtice WPCP: Concentrations less than 20µg/m3, which account for 86% of the measurements, have been removed from the plot to allow the distribution of maximum levels to be more clearly shown in the figure. Rundle Road: Concentrations less than 20µg/m3, which account for 90% of the measurements, have been removed from the plot to allow the distribution of maximum levels to be more clearly shown in the figure.

Legend

- St Mary's Cement Facility Location
- Durham York Energy Centre Site
- Railway
- Road
- Highway
- Watercourse

Concentration

- 55 - 65
- 50 -55
- 40 - 50
- 20 - 40
- 0 - 20
- Direction of Maximum Measured Concentration

Client/Project

The Region of Durham
Durham York Energy Centre

Figure No.

4-6

Title

Pollution Roses of Measured 24-Hour Average $PM_{2.5}$ Concentrations – 2015 Monitoring Period

Table 4-3 Preliminary Comparison of Ambient PM2.5 Levels to the CAAQS Using 2014 and 2015 Measurement Data

Pollutant	Averaging Period	CAAQS Standard (µg/m³)	Courtice WPCP (Upwind)	Rundle Road (Downwind)
			2014 – 2015 [C]	2014 – 2015 [C]
$PM_{2.5}$	24-hour	28 [A]	24.8	24.8
	Annual	10 [B]	8.2	9.0

Notes:

A Canadian Ambient Air Quality Standard for Respirable Particulate Matter. The Respirable Particulate Matter Objective is referenced to the average of the 98th percentile of the daily average over 3 consecutive years.

B Annual Canadian Ambient Air Quality Standard for Respirable Particulate Matter, effective by 2015. The Respirable Particulate Matter Objective is referenced to the 3-year average of the annual average concentrations.

C The CAAQS $PM_{2.5}$ metric considers the data to be valid when a minimum of 2 of the 3 years of data used for comparison are available. The averages shown above are preliminary and based on only 2 years of data.

5.0 AMBIENT AIR QUALITY TRENDS

Ambient air quality measurements from both the Courtice WPCP and Rundle Road monitoring stations from 2014 to 2015 are compared in this section. The ambient monitoring program was initiated in 2013 and ambient air quality data were collected for the period May to December in that year. The MOECC requires that a minimum of 9 months of data out of the 12 months in a year (a minimum 75% data recovery rate) be available for calculation of annual averages. Since the length of the measurement period in 2013 was less than 9-months, the 2013 period averages were not compared to available MOECC annual criteria, nor are they directly comparable to the 2014/ 2015 annual averages. The 2015 monitoring program included continuous sampler measurements for the entire year.

5.1 CRITERIA AIR CONTAMINANT (CAC) COMPARISONS

A summary of the maximum, minimum and arithmetic mean CAC concentrations, along with the number of exceedances of the relevant Ontario ambient air quality criteria (AAQC) or health-based standard for each contaminant (if any occurred) at each station from 2013 to 2015 are presented in Table 1 below. Also presented is the percentage of the applicable criteria for the maximum measured value in each year. The following observations were made from comparing the 2013 to 2015 CAC data:

- All monitored CACs were below their applicable hourly, 24-hour and annual average criteria for all three years.
- The maximum measured hourly and 24-hour average SO_2 concentrations were higher at the Courtice WPCP Station in all 3 years than at the Rundle Road Station, but were all well below their relevant MOECC criteria.
- The 98th percentile daily average $PM_{2.5}$ concentrations were similar in 2013 and 2014 for both monitoring stations (21.1 and 21.7 µg/m^3 at the Rundle Road Station and 21.5 and 22.3 µg/m^3 at Courtice WPCP Station), with higher levels measured at both stations in 2015 (28.4 and 27.3 µg/m^3, respectively). Stantec reviewed $PM_{2.5}$ data for the MOECC Oshawa station, and it also shows an increase in $PM_{2.5}$ levels in 2015 relative to 2013 and 2014.
- Maximum measured hourly, 24-hour and annual average NO_2 concentrations at the Courtice WPCP Station were typically higher or similar in magnitude to those measured at the Rundle Station.
- The maximum measured hourly and 24-hour NO and NO_X concentrations were higher at the Courtice WPCP Station relative to the Rundle Station for all 3 years.

It should be noted that since the monitoring periods in 2013 versus 2014 and 2015 were different (8-months in 2013 versus 12-months in 2014 and 2015), the data from 2013 are not directly comparable to 2014 and 2015 as the 2013 measurements did not encompass a full year including winter months (during which time there is normally a higher percentage of stable meteorological conditions).

Table 5-1 Comparison of Measured Ambient CAC Concentrations (2013 - 2015)

Pollutant	Averaging Period	AAQC / HHRA Standards µg/m³		Courtice WPCP (Upwind)						Rundle Road (Downwind)					
				Measurement (µg/m³)			% of Criteria			Measurement (µg/m³)			% of Criteria		
				2013	2014	2015	2013	2014	2015	2013	2014	2015	2013	2014	2015
SO_2	1	690	Maximum	157.2	120.7	103.8	22.8	17.5	15	65.3	91.6	79.3	9.5	13.3	11.5
			Minimum	0	0	0				0	0	0			
			# of Exceedances	0	0	0				0	0	0			
	24	275	Maximum	36.8	43.7	23.5	13.4	15.9	8.5	10.4	11.2	22.4	3.8	4.1	8.1
			Minimum	0	0	0.0				0	0	0			
			# of Exceedances	0	0	0				0	0	0			
	Annual	55 / 29 [A]	Mean (Period)	4.4	4	2.7	N/A [B]	7.3	9.3	1.2	1.8	2.0	N/A [B]	3.3	7.1
			# of Exceedances	N/A [B]	0	0				N/A [B]	0	0			
$PM_{2.5}$	24	28 [C]	Maximum	27	43.2	59.6				50.6	41.3	64.7			
			Minimum	1.8	0.2	0.2				0.6	0.2	0.2			
			Mean	8.6	8.6	7.8				8.4	8.5	9.5			
			98th Percentile [D]	21.5	22.3	27.3				21.7	21.1	28.4			
			# of Exceedances	N/A [E]	N/A [E]	N/A [E]				N/A [E]	N/A [E]	N/A [E]			
	Annual	10 [F]	Mean (Period)	8.4	8.6	7.7				8.4	8.5	9.5			
			# of Exceedances	N/A [G]	N/A [G]	N/A [G]				N/A [G]	N/A [G]	N/A [G]			

Table 5-1 Comparison of Measured Ambient CAC Concentrations (2013 - 2015)

Pollutant	Averaging Period	AAQC / HHRA Standards µg/m³		Courtice WPCP (Upwind)						Rundle Road (Downwind)					
				Measurement (µg/m³)			% of Criteria			Measurement (µg/m³)			% of Criteria		
				2013	2014	2015	2013	2014	2015	2013	2014	2015	2013	2014	2015
NO_2	1	400 [H]	Maximum	93.8	108.6	135.2	23.5	27.2	33.8	78.3	117.4	86.4	19.6	29.4	21.6
			Minimum	0	0	0				0	0	0			
			# of Exceedances	0	0	0				0	0	0			
	24	200 [H]	Maximum	54.5	68.8	55.2	27.3	34.4	27.6	50.4	60.4	45.9	25.2	30.2	23
			Minimum	0.5	0.1	0				0.4	0	0			
			# of Exceedances	0	0	0				0	0	0			
	Annual	60	Mean	12.6	16.1	13.8	N/A [B]	26.8	22.9	12.8	12.2	13.1	N/A [B]	20.3	21.9
			# of Exceedances	N/A [B]	0	0				N/A [B]	0	0			
NO [I]	1	NA	Maximum	148.1	108.3	125.3				53.5	53.5	117.7			
			Minimum	0	0.2	0				0	0	0			
			# of Exceedances	N/A	N/A	N/A				N/A	N/A	N/A			
	24	NA	Maximum	30.4	30.3	28.9				14.1	15.8	21.4			
			Minimum	0	0.6	0.0				0.6	0	0.7			
			# of Exceedances	N/A	N/A	0				N/A	NA	0			

Table 5-1 Comparison of Measured Ambient CAC Concentrations (2013 - 2015)

Pollutant	Averaging Period	AAQC / HHRA Standards µg/m³		Courtice WPCP (Upwind)						Rundle Road (Downwind)					
				Measurement (µg/m³)			% of Criteria			Measurement (µg/m³)			% of Criteria		
				2013	2014	2015	2013	2014	2015	2013	2014	2015	2013	2014	2015
NO_X	1	400 [H]	Maximum	309	256.7	322.2	77.3	64.2	80.6	138.1	146.2	202.6	34.5	36.6	50.6
			Minimum	0	0	0.0				0	0	0			
			# of Exceedances	0	0	0				0	0	0			
	24	200 [H]	Maximum	100.8	112.5	91	50.4	56.3	45.5	71.2	83.4	65.9	35.6	41.7	32.9
			Minimum	0.3	2.6	0				0.7	0	0			
			# of Exceedances	0	0	0				0	0	0			
	Annual	60	Mean	18.7	21.7	18.4	N/A [B]	36.2	30.6	15.8	15.6	16.3	N/A [B]	26.0	27.1
			# of Exceedances	N/A [B]	0	0				N/A [B]	0	0			

Notes:

A. Annual AAQC / Annual HHRA
B. As the length of the measurement period in 2013 was less than 9-months, the period (i.e. 8-months) averages presented in this report were not compared to available MOECC annual criteria.
C. Canadian Ambient Air Quality Standard for Respirable Particulate Matter. The Respirable Particulate Matter Objective is referenced to the average of the 98th percentile of the daily average over 3 consecutive years.
D. The 98th percentile of the daily average $PM_{2.5}$ measurements in the period.
E. Daily $PM_{2.5}$ concentrations were not compared to the Canadian Ambient Air Quality Standard shown in this table, which requires averaging the 98th percentile concentrations over three consecutive years, as compared to the 8-month period covered in 2013 and the 12-month period covered in 2014 and 2015
F. Annual Canadian Ambient Air Quality Standard for Respirable Particulate Matter, effective by 2015. The Respirable Particulate Matter Objective is referenced to the 3-year average of the annual average concentrations.
G. Annual $PM_{2.5}$ concentrations were not compared to the Canadian Ambient Air Quality Standard shown in this table, which requires the 3-year average of the annual average concentrations compared to the 12-month period considered in this report for 2014 and 2015 and the 8-month period for 2013.
H. As per current (April 2012) Reg 419 Summary of Standards and Guidelines, the air standard for NO_X is compared to a monitored NO_X concentration, although the Reg419 Schedule 3 standard for NO_X is based on health effects of NO_2.
I. NO has no regulatory criteria.

5.2 DIOXIN AND FURAN COMPARISONS

The maximum measured ambient toxic equivalent dioxin and furan concentrations at each station in each year are presented in Table 5-2.

Table 5-2 Comparison of Maximum Measured Dioxin and Furan Concentrations (2013-2015)

Year	Measurement Period in each Year	Courtice WPCP (pg TEQ/m^3)	Rundle Road (pg TEQ/m^3)
2013	April-December	0.036	0.029
2014	January-June	0.038	0.065
2015	October–December	0.017	0.021

The maximum measured toxic equivalent dioxin and furan concentrations at both stations were below the applicable 24-hour criteria of 0.1 pg TEQ/m^3 for all three years.

It should be noted that since the monitoring periods in 2013, 2014 and 2015 were different (as shown in Table 5-2), the data between the three years are not directly comparable. Caution should be exercised in comparing the data as the measurement periods were different and cover different periods of each year (with different meteorological conditions).

6.0 CONCLUSIONS

This report provides a summary of the ambient air quality data collected at the two monitoring stations located predominantly upwind and predominantly downwind in the vicinity of the DYEC for the 2015 monitoring period. The following observations and conclusions were made from a review of the measured ambient air quality monitoring data:

1. Measured concentrations of NO_2, SO_2 and $PM_{2.5}$ were below the applicable O.Reg. 419/05 criteria or human health risk assessment (HHRA) health-based standards presented in **Table 2-2** of this report for hourly, 24-hour and annual averaging periods.

2. The 98th percentiles of the measured daily average $PM_{2.5}$ levels during the 2015 monitoring period were 27.3 µg/m^3 at the Courtice WPCP station and 28.4 µg/m^3 at the Rundle Road station. As detailed below, these values for the 98th percentile should not be used for comparison against the Canadian Ambient Air Quality Standard.

3. The 24-hour and annual $PM_{2.5}$ Canadian Ambient Air Quality Standards (CAAQS) criteria both require a 3-calendar year average for comparison, with the data considered valid if an annual 98th percentile value is available for at least two of the three calendar years. Using the measured $PM_{2.5}$ data at each station for calendar years 2014 and 2015, average annual 98th percentile daily average and annual average $PM_{2.5}$ levels were calculated and a preliminary comparison to their CAAQS criteria was made. The ambient $PM_{2.5}$ levels were below their respective CAAQS standards at both stations for this preliminary comparison

4. TSP/ metals, and PAHs were not measured in 2015 as per Section 1.2 of the Ambient Monitoring Plan (Stantec, 2012);

5. Dioxins and furans sampling was resumed on October 21, 2015 (during commissioning of the facility) for the DYEC as requested by the Region of Durham. This additional sampling was not part of the Ambient Monitoring Plan and was conducted at 12-day intervals for the rest of 2015. The maximum toxic equivalent dioxin and furan concentration measured over this period was well below the applicable criteria presented in Table 2-3; and

6. In summary, the measured concentrations of those air contaminants monitored were below their applicable MOECC criteria during the 2015 monitoring period. Further, the measured levels of the monitored contaminants were below their applicable HHRA health-based standards.

7.0 REFERENCES

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Appendix A EQUIPMENT MAINTENANCE, CALIBRATION SCHEDULE AND SUMMARY OF EQUIPMENT ISSUES

Table A-1 Summary of Preventative Maintenance

Parameter	Equipment Make/Model	Description of Maintenance Activities	Required Schedule (to meet MOE and Ambient Monitoring Plan requirements)	Schedule / Comments	2015 Schedule Dates	
					Courtice	Rundle
SO_2	Teledyne Monitor Labs	Change particulate filter	Monthly	During monthly calibration	See note 1	See note 2
		Replace critical flow orifice and filters	As required	During monthly calibration	See note 1	See note 2
		Exchange chemical – external zero air scrubber	3 months	During monthly calibration	See note 1	See note 2
		Replace perm tube	As required	During annual maintenance	September 23 to September 30	September 30 to October 2
		Replace Pump diaphragm	Annual	During annual maintenance,	September 23 to September 30	September 30 to October 2
		Clean sample chamber, windows and filters	As required	During annual maintenance,	September 23 to September 30	September 30 to October 2
NOx	API Model 200E	Change particulate filter	Monthly	Done during monthly calibration	See note 1	See note 2
		Exchange chemical – external zero air scrubber	3 months	During monthly calibration	See note 1	See note 2
		Replace chemical – external dryer	3 months	During monthly calibration	See note 1	See note 2
		Chemical change – ozone filter	Annually	During annual maintenance,	See note 1	See note 2
		Clean reaction cell window (annually or as necessary)	Annually	During annual maintenance,	September 23 to September 30	September 30 to October 2
		Change particulate DFU filter	Annually	During annual maintenance,	September 23 to September 30	September 30 to October 2
		Replace reaction cell O-rings & sintered filters	Annually or as required	During annual maintenance,	September 23 to September 30	September 30 to October 2
		Rebuild pump head	When RCEL pressures exceeds 10 in Hg	At annual maintenance,	September 23 to September 30	September 30 to October 2
		Replace inline exhaust scrubber	Annually	During annual maintenance,	September 23 to September 30	September 30 to October 2
		Replace inline exhaust scrubber	Annually	During annual maintenance,	September 23 to September 30	September 30 to October 2
		Replace NO2 converter	Every 3 years or if conversion < 96%	Conversion checked every 6 months,	Convertor at 98%	Convertor at 98%
$PM_{2.5}$	Thermo Sharp 5030	Replace filter tape	Upon 10% remaining	As required	Not required	Not required
		Replace SHARP zeroing filters	6 months		February 10 and September 30	February 10 and September 30
		Clean PM2.5 inlet	Monthly	During monthly calibration	See note 1	See note 2
		Clean cyclone	Monthly	During monthly calibration	See note 1	See note 2
		Clean air inlet system	Annually	During annual maintenance,	September 23 to September 30	September 30 to October 2
		Rebuild vacuum pump	12-18 months	During annual maintenance,	September 23 to September 30	September 30 to October 2
		Clean ambient temp/RH shield and assembly	Annually	During annual maintenance,	September 23 to September 30	September 30 to October 2
TSP/metals	TE-5170	Ensure all gaskets sealing properly	Weekly	Check at weekly site visit	Not used in 2015	
		Power cord checks for damage/cracks	Weekly	Check at weekly site visit		
		Inspect screen and remove foreign deposits	Weekly	Check at weekly site visit		
		Inspect holder frame gasket	Every sample	Check at weekly site visit		
		Replace motor brushes	Every 500 hours	Replace as needed		
		Check elapsed time meter	Weekly	Check at weekly site visit		
		Check flow recorder pen/tubing	Weekly	Check at weekly site visit		
		Ensure all gaskets sealing properly	Weekly	Check at weekly site visit		
PAH and D/F	TE-1000	Ensure all gaskets sealing properly	Weekly	Check at weekly site visit	D/F sampling resumed on October 21, 2015 at request of Region of Durham. Equipment checked and calibrated on October 20, 2015 prior to first sampling. Checked at every site visit and calibration day. (see Note 3)	D/F sampling resumed on October 21, 2015 at request of Region of Durham. Equipment checked and calibrated on October 20, 2015 prior to first sampling. Checked at every site visit and calibration day. (see Note 4)
		Power cord checks for damage/cracks	Weekly	Check at weekly site visit		
		Clean any dirt around module and filter holder	Weekly	Check at weekly site visit		
		Inspect dual sampling module gaskets	Every sample	Check at weekly site visit		
		Inspect and replace motor flange gasket and motor cushion	Routinely, minimum annually			
		Replace motor brushes	Every 400 hours	Replaced as needed	Replaced motor brush on December 18.	Replaced motor brush on December 7.
Wind Speed and Direction (Rundle Road Station only)	Met One 034B	Physical inspection of equipment for signs of damage/erratic behavior	Weekly	Check at weekly site visit	N/A	Checked weekly
		Replace wind speed sensor bearings and calibrate	Annually	During annual maintenance		All bearings, potentiometers and factory calibration done March 8 to April 24. During this time a spare new wind head was installed
		Replace wind vane potentiometer and bearings	24-months	To be replaced at 2 years		
		Complete factory overhaul	24-36 months	To be replaced at 2 to 3 years		

Table A-1 Summary of Preventative Maintenance

Parameter	Equipment Make/Model	Description of Maintenance Activities	Required Schedule (to meet MOE and Ambient Monitoring Plan requirements)	Schedule / Comments	2015 Schedule Dates	
Temperature	CS 107 (Rundle)/ HMP 60 (Courtice)	Check radiation shield free from debris	Weekly	Checked at weekly site visit	Weekly	Weekly
Rainfall	TE525M	Inspect funnel and bucket mechanism for debris	Weekly	During weekly site visit	Weekly	Weekly
Relative Humidity	CS HMP60	Change INTERCAP® Sensor	On out of spec calibration	As required	Not required	Not required
		Sensor cleaning	As required	As required	See note 1	See note 2
		Inspect/replace filter if blocked	Monthly	Done during monthly calibration	See note 1	See note 2
Pod / others		Examine the external enclosure station conditions including the inlet probe for damage or blockage. Periodically review the station characteristics for any change or modification to the station	Weekly	Check at weekly site visit	Weekly	Weekly
		Examine the manifold, the transfer lines and the inlet filters for dirt buildup and replace or clean as required. Examine the seals in the sampling system, the scrubbing and drying agents and replace as required	Weekly	Check at weekly site visit	Weekly	Weekly
		Replace zero and span calibration cylinders when pressure is below 1,500 kPa (215 psig)		Check at weekly site visit	SO_2 replaced January 21, 2015, NOx replaced November 18, 2014	SO_2 replaced January 21, 2015, NOx replaced November 18, 2014
		Ensure shelters and gates are locked upon departure	Weekly	Check at weekly site visit	Weekly	Weekly

1. Courtice monthly calibration and maintenance dates in 2015: January 23, February 27, March 26, April 23, May 11, June 29, July 3, July 31, August 20, September 23, October 19, November 18, December 11
2. Rundle monthly calibration and maintenance dates in 2015: January 23, February 27, March 26, April 24, May 11, June 29, July 3, July 31, August 20, September 23, October 19, November 18, December 11
3. Courtice calibration dates for TE-1000: October 20, November 24, December 18.
4. Rundle calibration dates for TE-1000: October 20, November 24, December 7, December 18.

Table A-2 Summary of Equipment Calibration

Parameter	Equipment Make/Model	Description of Maintenance Activities	Required Schedule	Schedule / Comments	2015 Schedule Dates	
					Courtice	Rundle
SO_2	API Model 100E	Verify test functions	Weekly	Checked weekly	Checked weekly	Checked weekly
		Evaluate Zero/Span check	Weekly	Checked daily	Checked weekly	Checked weekly
		Zero/span external check	Monthly	Checked monthly	See note 1	See note 2
		Zero/span calibration	3 months	Calibrated monthly	See note 1	See note 2
		Flow check	6 months	Checked monthly	See note 1	See note 2
		Pneumatic leak check	Annually or after repairs	Done when flow drops or checked annually	Pump replaced under warranty on January 23 Diaphragm replaced December 11 Annual check on September 28	Diaphragm replaced December 11 Annual check on October 1
		Calibrate UV lamp output	Prior to zero/span cal	Done prior to zero/span cal	See note 1	See note 2
		PMT sensor hardware cal	On PMT/preamp changes or slope changes as specified	Done when instrument slope is outside of acceptable range	Checked during annual on September 28 but not adjusted	Checked during annual on October 1 but not adjusted
NOx	API Model 200E	Verify test functions	Weekly	Checked weekly	Checked weekly	Checked weekly
		Evaluate Zero/Span check	Weekly	Checked daily	Checked weekly	Checked weekly
		Zero/span external check	Monthly	Checked monthly	See Note 1, 3	See Note 2, 3
		Zero/span calibration	3 months	Calibrated monthly	See Note 1, 3	See Note 2, 3
		Pneumatic sub-system check	Annually or after repairs	Checked after repairs	See Note 1, 3	See Note 2, 3
		PMT sensor hardware cal	On PMT/preamp changes or slope changes as specified	Done when slope exceeds the acceptable range	See Note 1, 3	See Note 2, 3
$PM_{2.5}$	Thermo Sharp 5030	Ambient temperature	Audit monthly, calibrate annually	Audit monthly.	See note 1, full calibration done September 28, 2015	See note 2, full calibration done October 1, 2015
		Ambient pressure	Audit monthly, calibrate annually	Audit monthly.	See note 1, full calibration done September 28, 2015	See note 2, full calibration done October 1, 2015
		Flow	Audit monthly, calibrate annually	Audit monthly.	See note 1, full calibration done September 28, 2015	See note 2, full calibration done October 1, 2015
		Leak check	Monthly	Leak check is not possible on this make/model.	N/A	N/A
		Analog output	Annually	Done annually	See note 1	See note 2
		Proportional Counter	Audit annually	Done annually	See note 1	See note 2
		Nephelometer zero	Audit quarterly	Done monthly	Checked at monthly calibrations. Adjusted when required.	Checked at monthly calibrations. Adjusted when required.
TSP/metals	TE-5170	Flow calibration	Upon installation, monthly, or after any motor maintenance	Calibrated monthly and after motor maintenance.	Not used in 2015	
PAH and D/F	TE-1000	Flow calibration	Upon installation, monthly, or after any motor maintenance	Calibrated monthly and after motor maintenance.	Not used in 2015	
Wind Speed and Direction	Met One 034B	Wind speed calibration	Annually	Annually	N/A	Full factory calibration done March 28, 2015
		Potentiometer calibration	Annually	Annually	N/A	Full factory calibration done March 28, 2015
Temperature	HMP 60	External calibration	Annually	Annually	March 10, 2015	March 10, 2015
Rainfall	TE525M	Field Calibration. Factory calibration if field calibration not passed.	Annually	Annually	March 10, 2015	March 10, 2015
Relative Humidity	CS HMP60	Calibration (annually)	Annually	Annually	March 10, 2015	March 10, 2015
Atmospheric Pressure	CS106	Re-calibration (2-years)	2-years	To be done at 2 years	March 10, 2015	N/A
Data Acquisition	CS CR1000	Calibration every three years	3- years	To be done at 3 years	Not required in 2015	Not required in 2015

1. Courtice monthly calibration and maintenance dates in 2015: January 23, February 27, March 26, April 23, May 11, June 29, July 3, July 31, August 20, September 23, October 19, November 18, December 11
2. Rundle monthly calibration and maintenance dates in 2015: January 23, February 27, March 26, April 24, May 11, June 29, July 3, July 31, August 20, September 23, October 19, November 18, December 11
3. MOE audit June 29, 2015 suggested the Nox calibration gas bottle was suspect but still passed. New cal gas bottle was checked with MOE equipment and used to calibrate the Nox analyzers on July 3, 2015.

Table A-3 Summary of Instrument Issues at Courtice WPCP Station (Upwind)

Parameter	Issues	Time Frame	Remedial Action
SO_2	Fault indicated, but no error message.	November 16, 2015	Restarted monitor to clear fault.
	Low flow and low lamp output warnings.	November 18, 2015	SO_2 pump diaphragm failed. Replaced diaphragm and cleaned insect debris from lamp chamber. Data between Nov 15th and 18th invalidated as it may potentially have been affected by the pump issue.
NO_X	Sample flow warning, rcell pressure warning	February 24, 2015	Cleared message. No issue with instrument.
	Sample flow warning	Noted on November 3, 2015	Likely from power surge. Cleared monitor - no data issues identified.
	Sample flow, ozone and reaction cell warning	November 16, 2015	Cleared message. No data issues identified.
	Suspected loose connection between monitor and datalogger, affecting NO_2 readings.	December 31, 2015	Connection repaired. Affected NO_2 readings were replaced by deriving NO_2 concentrations from the NOx - NO concentrations.
$PM_{2.5}$	Water leak through hole in roof for inlet sample tube.	July 31 - August 10, 2015 (estimated).	Replaced o-ring seal. Issue did not affect sampler or data collection.
	Unusually elevated measurements recorded at night time and early morning correlating with high RH warning messages.	July 25, 26, August 2–5, August 16-20, August 29 – September 9, 2015	Invalidated data during high RH/high temperature periods that suggested accretion of water on the filter tape.
	Sample pump issue, likely caused by a power surge.	October 29 - November 3, 2015	Reset monitor. The $PM_{2.5}$ data collected during this period was invalidated due to this issue
	High internal relative humidity warning.	November 6 - November 12, 2015	Inlet heater failed and issue with motherboard. Both were replaced under warranty by CDNOVA. The $PM_{2.5}$ data collected during this period was invalidated due to this issue.
Rain gauge	Rain gauge cable to data logger cut by lawn mower.	Noted on June 29, 2015. Based on rainfall data it was likely cut June 28, 2015.	Cable repaired on site but no signal to logger. Rain gauge removed to shop for repairs or replacement.

Table A-3 Summary of Instrument Issues at Courtice WPCP Station (Upwind)

Parameter	Issues	Time Frame	Remedial Action
Data logger	Unable to connect remotely to data logger	February 4 – 5, 2015	Reset logger on the same day. No lost data
	Unable to connect to logger remotely	May 11, 2015	Reset logger on the same day. No lost data
Other	Power outage at the water treatment plan	March 31, 2015 (~ 3.5 hours)	Water treatment plant personnel restored power
	Maintenance work at the Courtice WPCP required power to be turned off.	May 13, 2015 (08:00 – 14:00)	Water treatment plant personnel restored power
TSP/ Metals	N/A [A]		
PAHs/ D/Fs [B]	Timer malfunction	November 2- 6, 2015	Replaced dial. November 2 sample not collected.
	Monitor power failure	December 8, 2015	Reset timer. Hi-vol operated properly for the next sampling day. Collected sample was not sent for lab analysis as it was not a valid 24-hour sample.

Note:

A. Not used this year

B. D/F sampling resumed on October 21, 2015. No PAH sampling.

Table A-4 Summary of Instrument Issues at Rundle Road (Downwind)

Parameter	Issues	Time Frame	Remedial Action
SO_2	UV Lamp warning	Noted on July 2, 2015	Adjusted lamp to within specified operating range. No data issues identified.
	UV lamp warning	October 29 - November 6, 2015	Adjusted lamp to within specified operating range. No data issues identified.
NO_X	Time on monitor was incorrect.	November 19 - November 24, 2015	Adjusted clock. No issue with data.
$PM_{2.5}$	Warning message - Plateau check error during filter change.	Noted on September 2, 2015	Reset system
Rain gauge	Rain gauge full of water due to blockage from debris	Noted on June 18, 2015. Likely blocked from June 10, 2015.	Cleared debris and replaced screen.
Data logger	Unable to connect remotely for data download.	February 4 – 5, 2015	Reset logger
TSP/ Metals	N/A [A]		
PAHs/ D/Fs [B]	N/A		

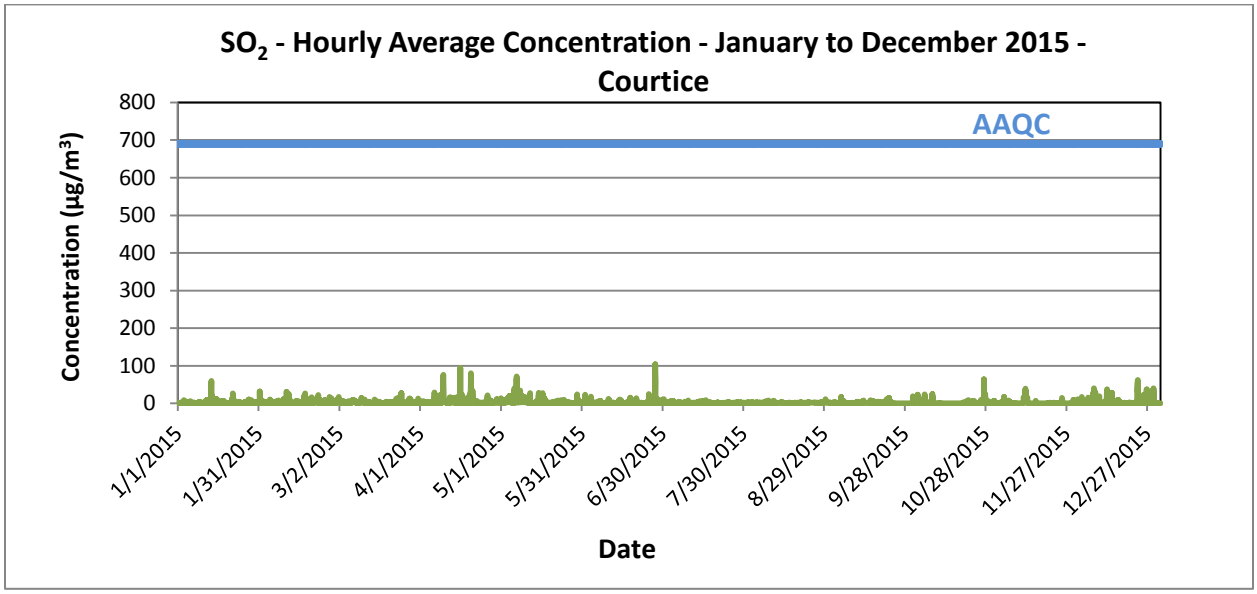
Note:

A. Not used this year

B. D/F sampling resumed on October 21, 2015. No PAH sampling.

Appendix B SO_2 PLOTS

Figure B-1 Time History Plots of Measured Hourly Average and 24-Hour Average SO_2 Concentrations – Courtice WPCP Station



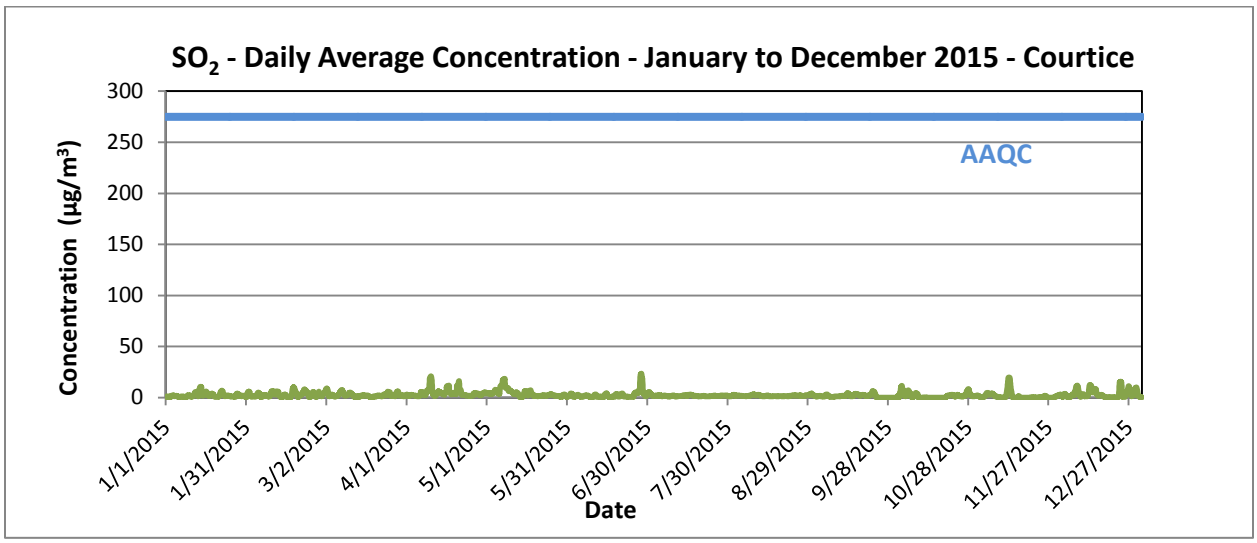
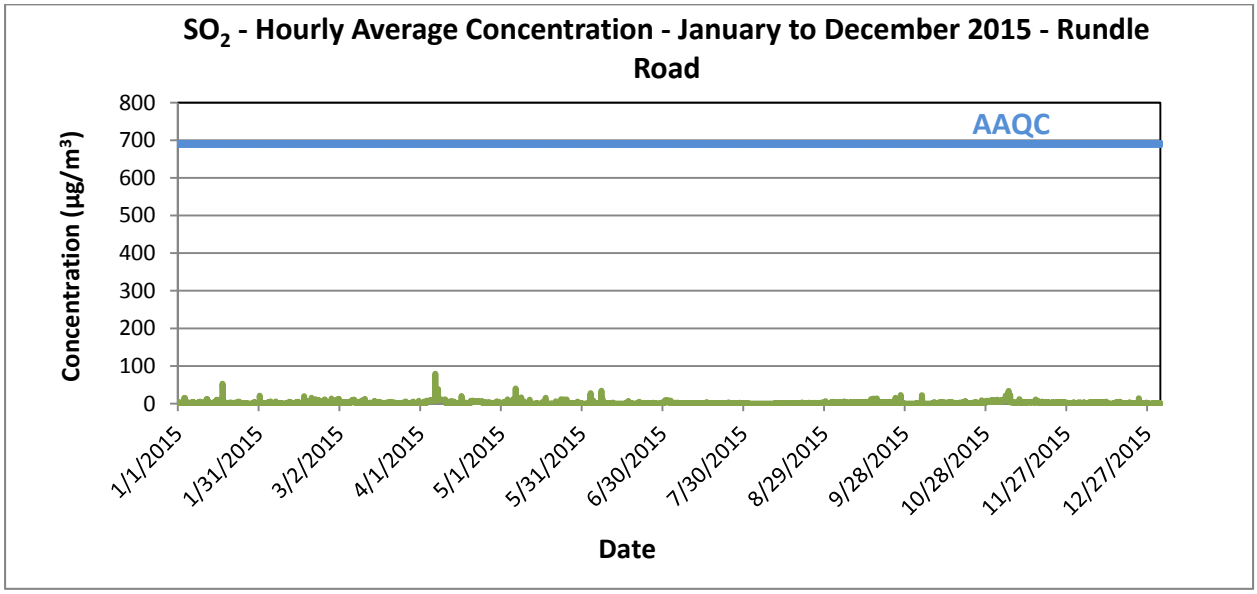


Figure B-2 Time History Plots of Measured Hourly Average and 24-Hour Average SO_2 Concentrations – Rundle Road Station



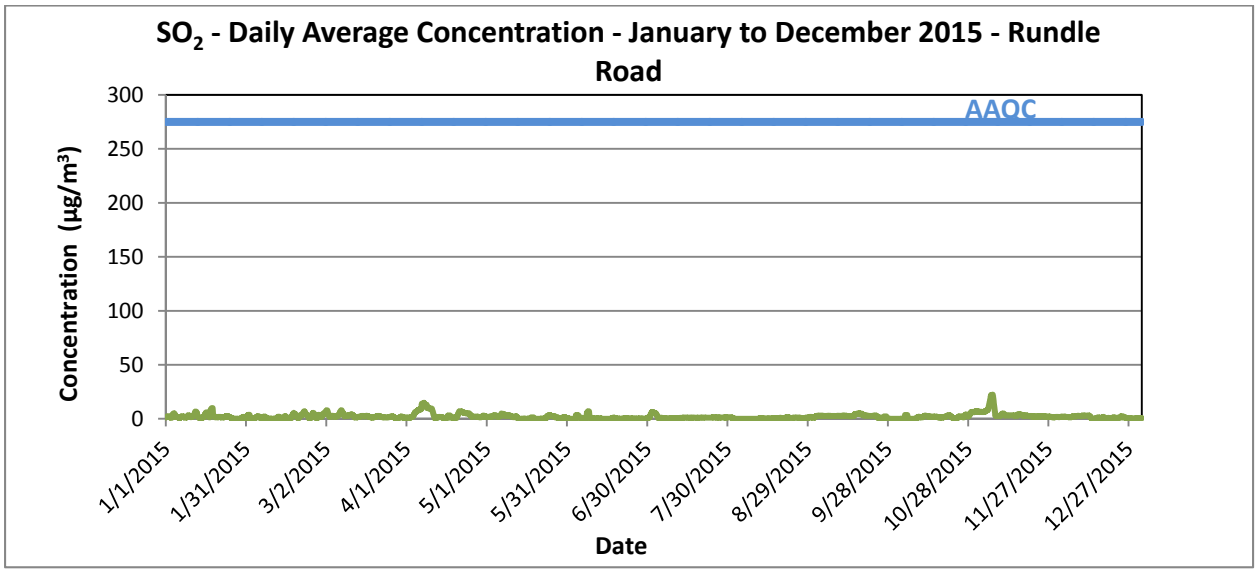


Figure B-3 Measured Hourly Average SO_2 Concentrations vs. Wind Direction – Courtice WPCP Station

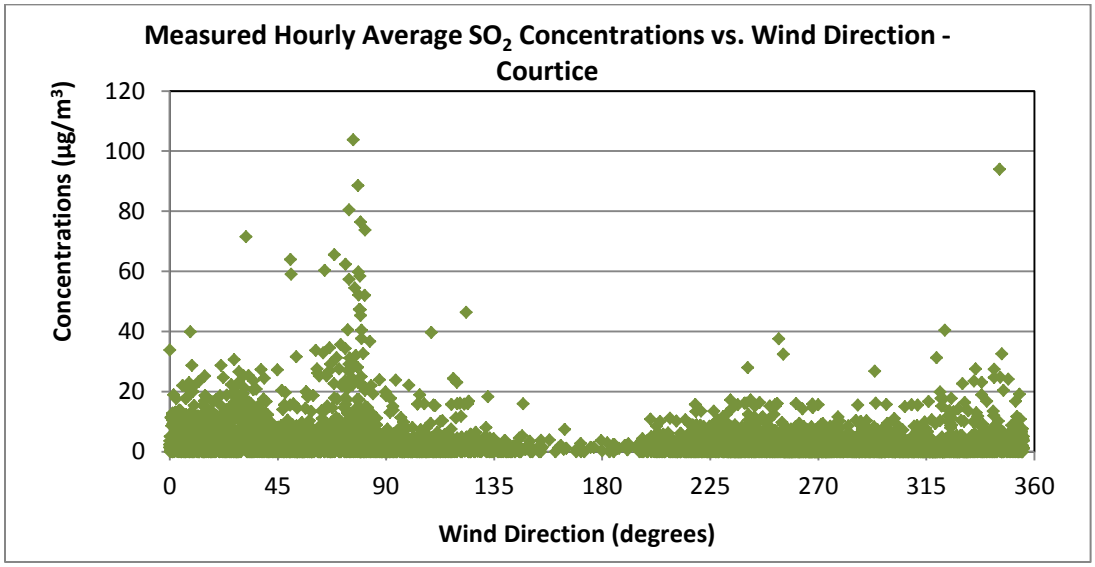
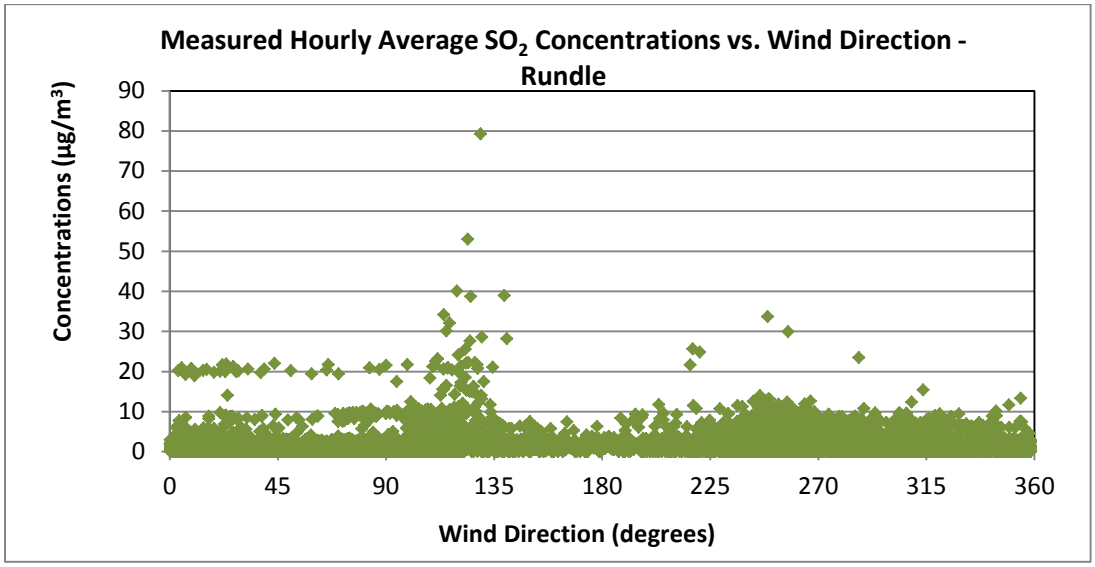
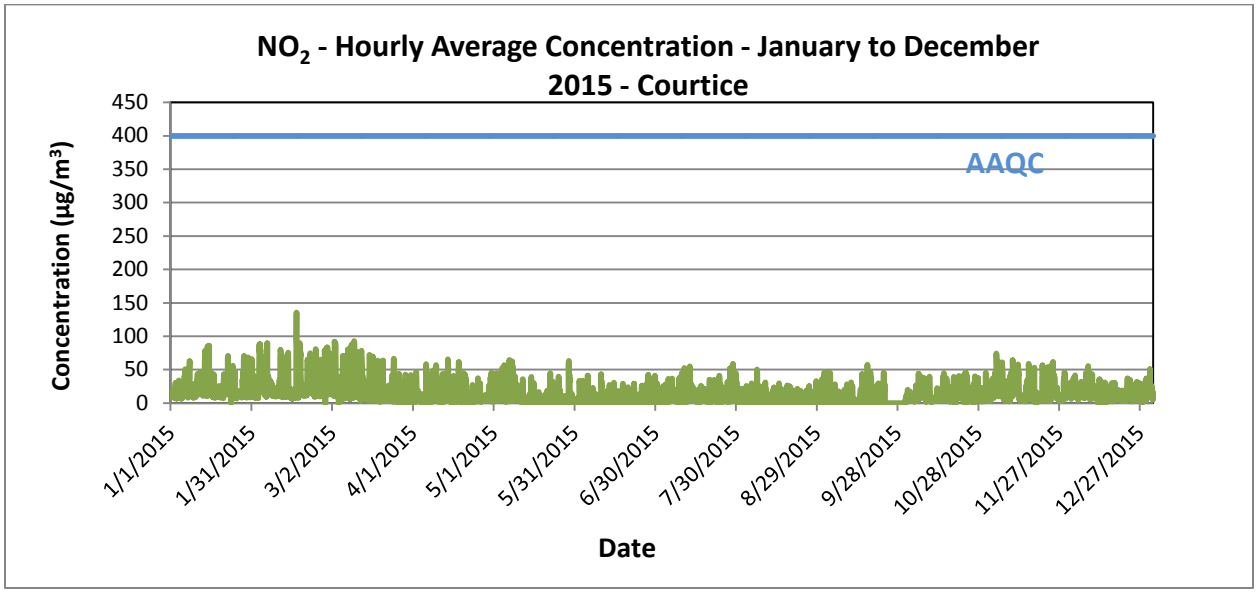


Figure B-4 Measured Hourly Average SO_2 Concentrations vs. Wind Direction - Rundle Road Station



Appendix C NO_2 PLOTS

Figure C-1 Time History Plots of Measured Hourly Average and 24-Hour Average NO_2 Concentrations – Courtice (WPCP) Station



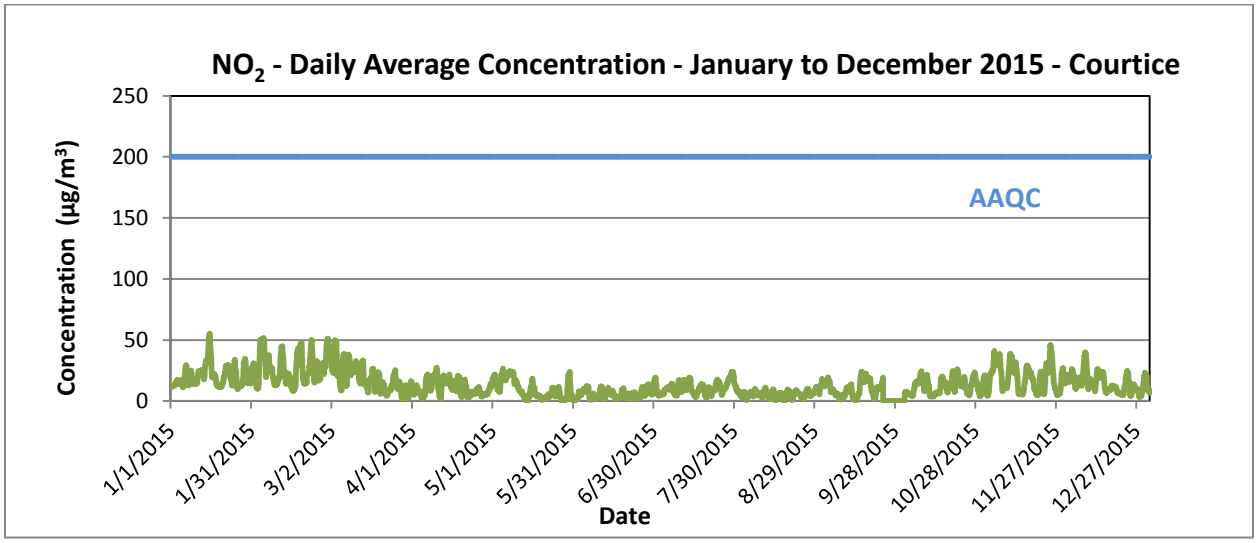
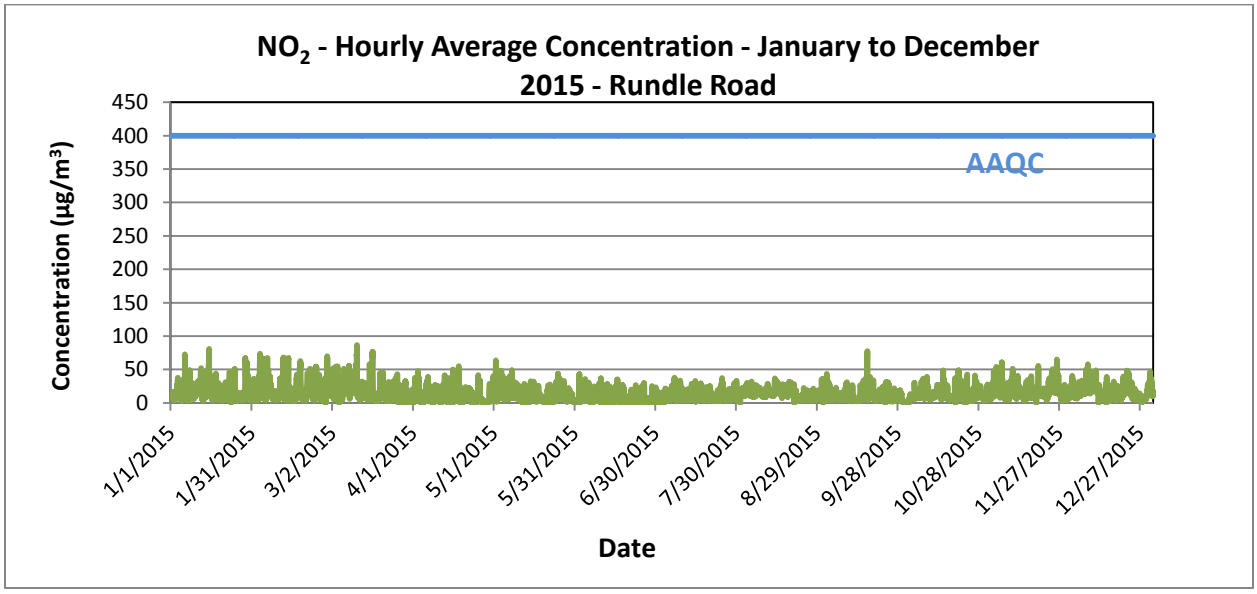


Figure C-2 Time History Plots of Measured Hourly Average and 24-Hour Average NO_2 Concentrations – Rundle Road Station



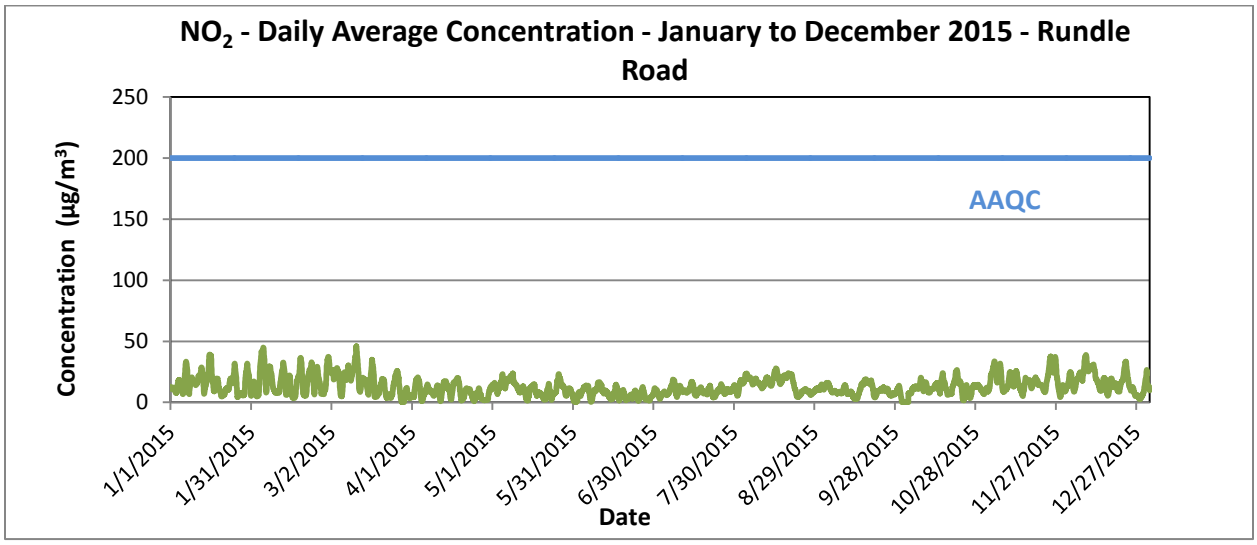


Figure C-3 Measured Hourly Average NO_2 Concentrations vs. Wind Direction – Courtice WPCP Station

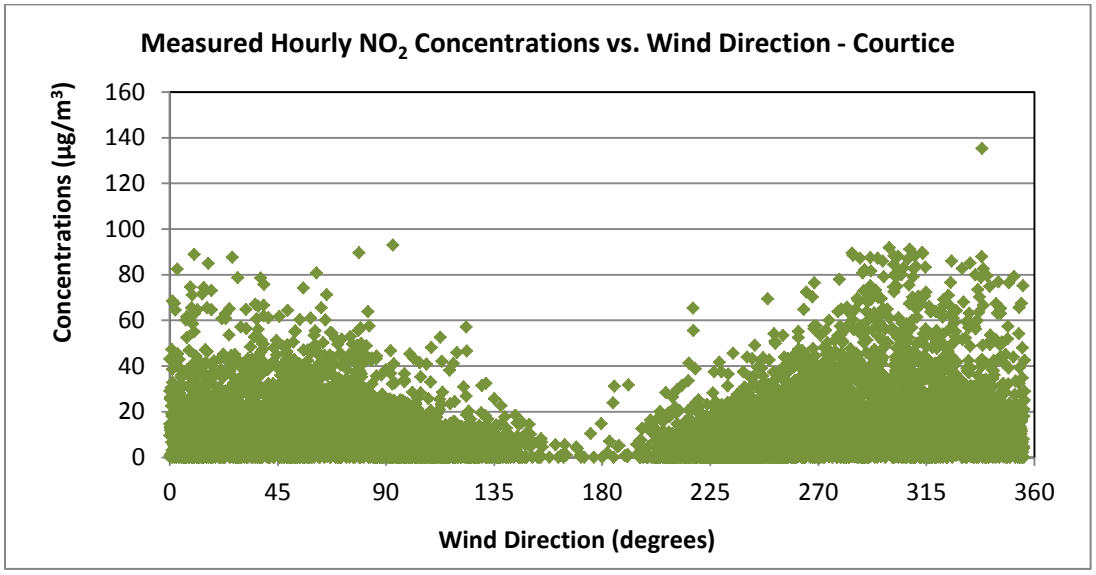
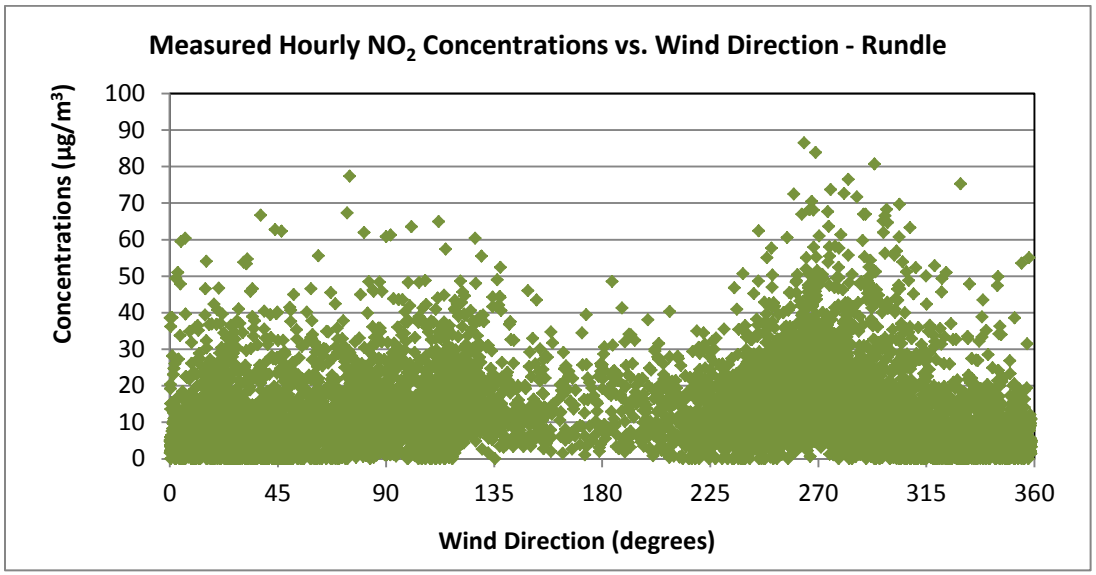
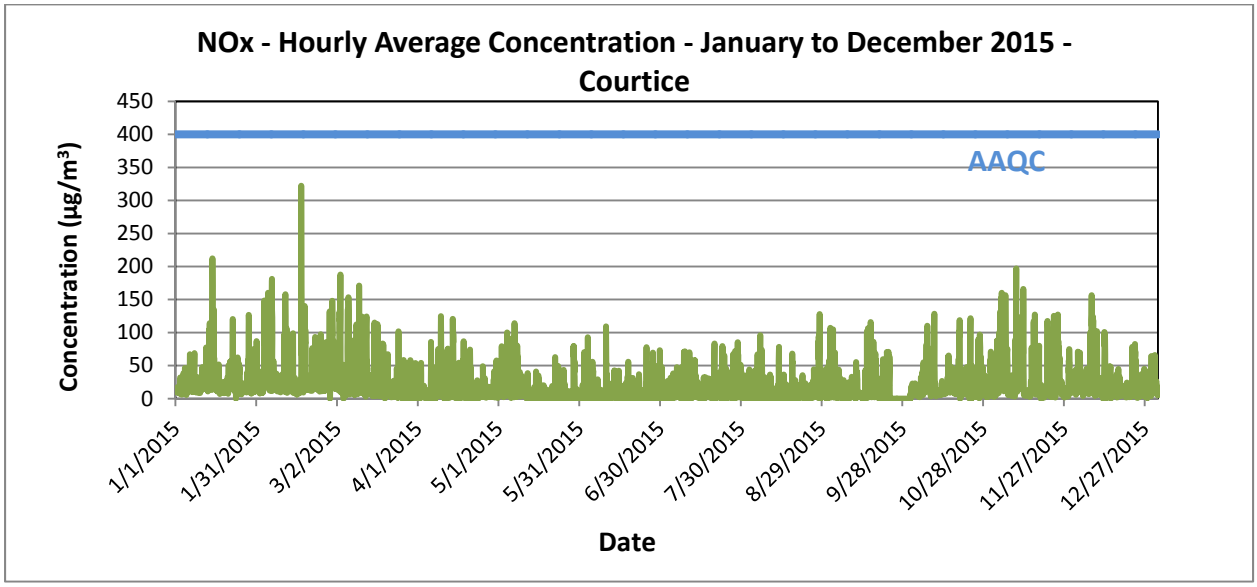


Figure C-4 Measured Hourly Average NO_2 Concentrations vs. Wind Direction - Rundle Road Station



Appendix D NO_X PLOTS

Figure D-1 Time History Plots of Measured Hourly Average and 24-Hour Average NO_x Concentrations– Courtice (WPCP) Station



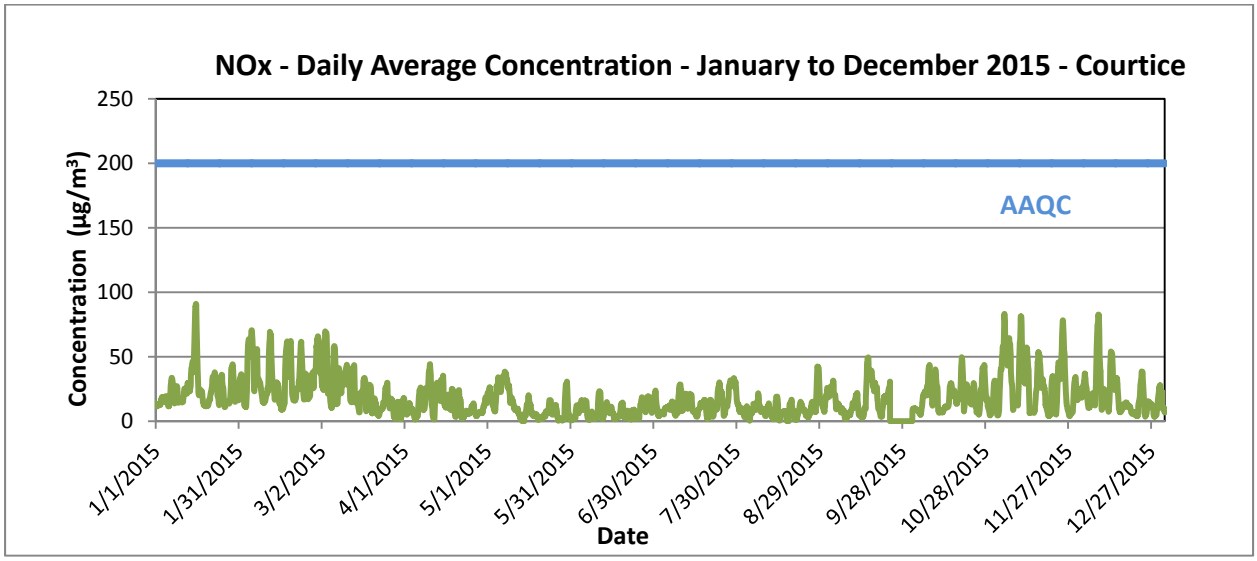
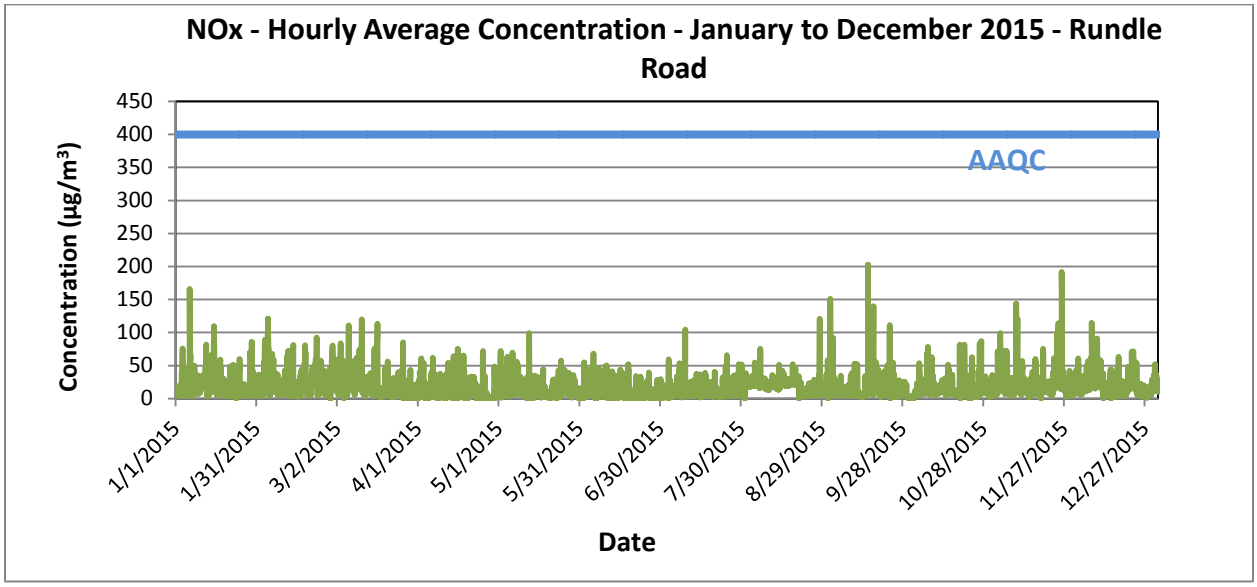


Figure D-2 Time History Plots of Measured Hourly Average and 24-Hour Average NO_x Concentrations – Rundle Road Station



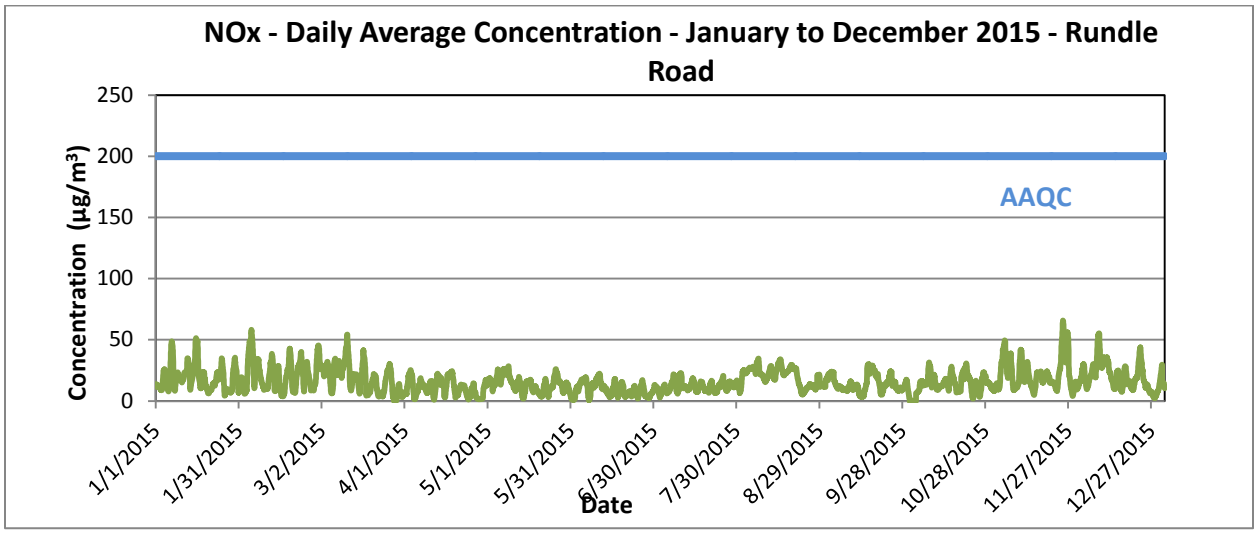


Figure D-3 Measured Hourly NO_X Concentrations vs. Wind Direction – Courtice WPCP Station

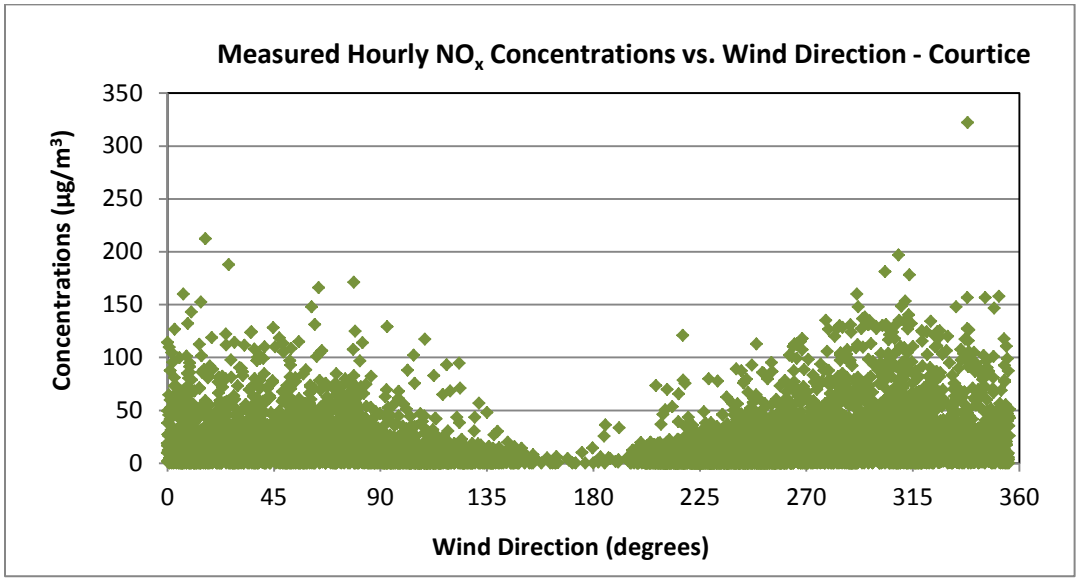
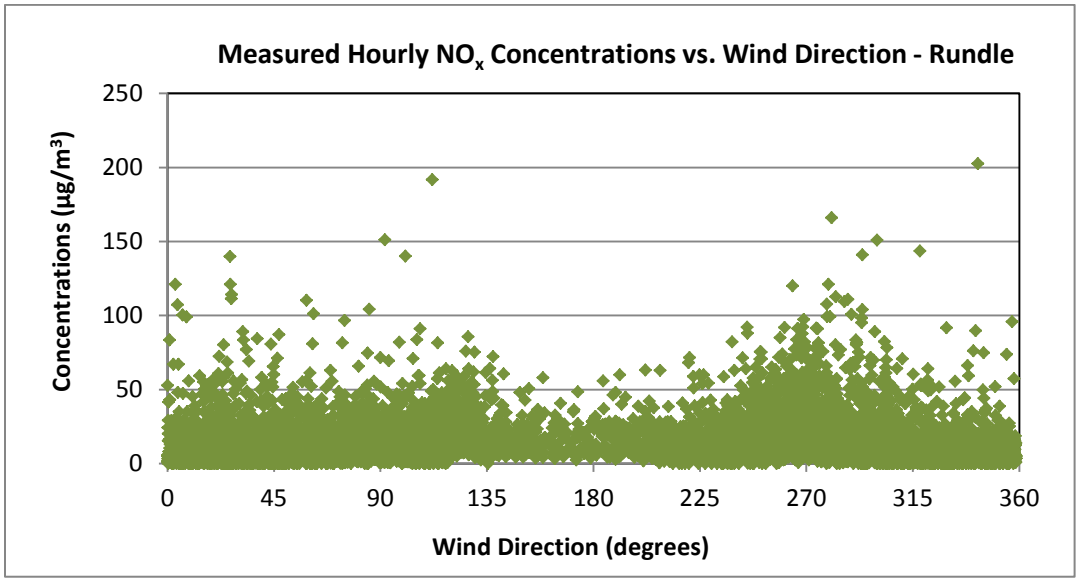


Figure D-4 Measured Hourly NO_X Concentrations vs. Wind Direction - Rundle Road Station



Appendix E $PM_{2.5}$ PLOT

Figure E-1 Time History Plot of Measured 24-Hour Average $PM_{2.5}$ Concentrations– Courtice (WPCP) Station

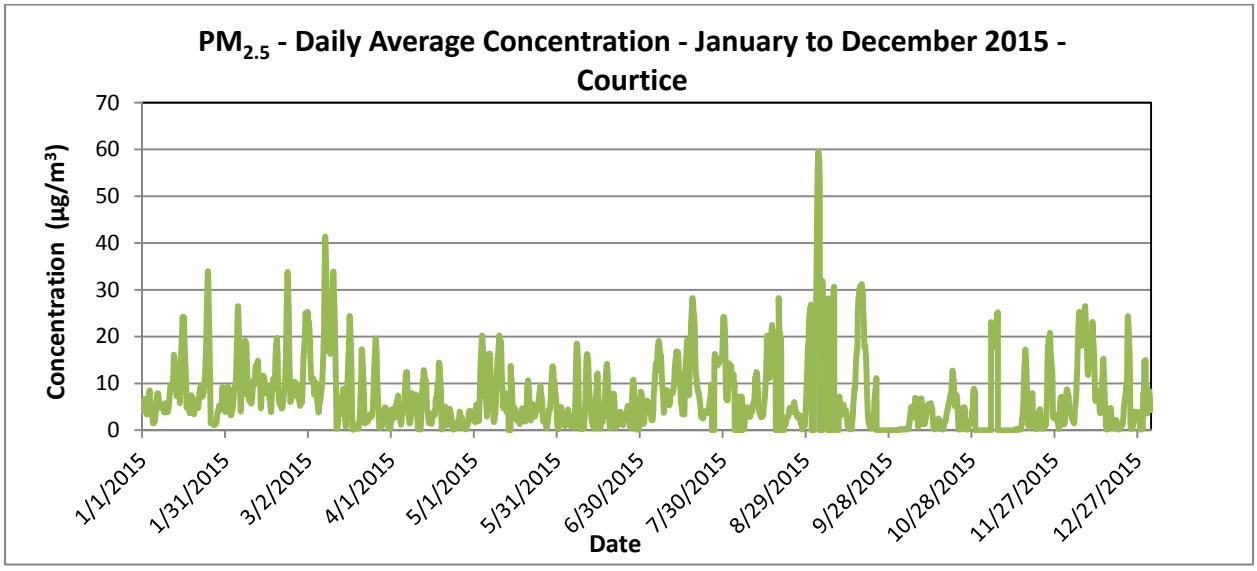


Figure E-2 Time History Plot of Measured 24-Hour Average $PM_{2.5}$ Concentrations – Rundle Road Station

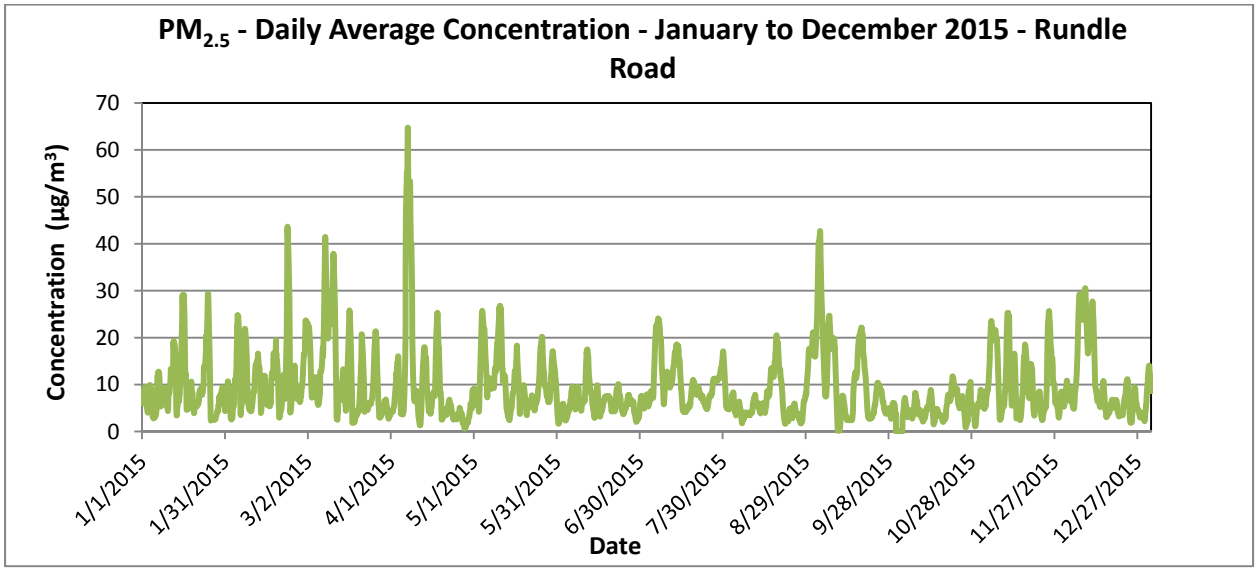


Figure E-3 Measured 24-Hour Average $PM_{2.5}$ Concentrations vs. Measured 24-Hour Vector Averaged Wind Direction Courtice WPCP Station

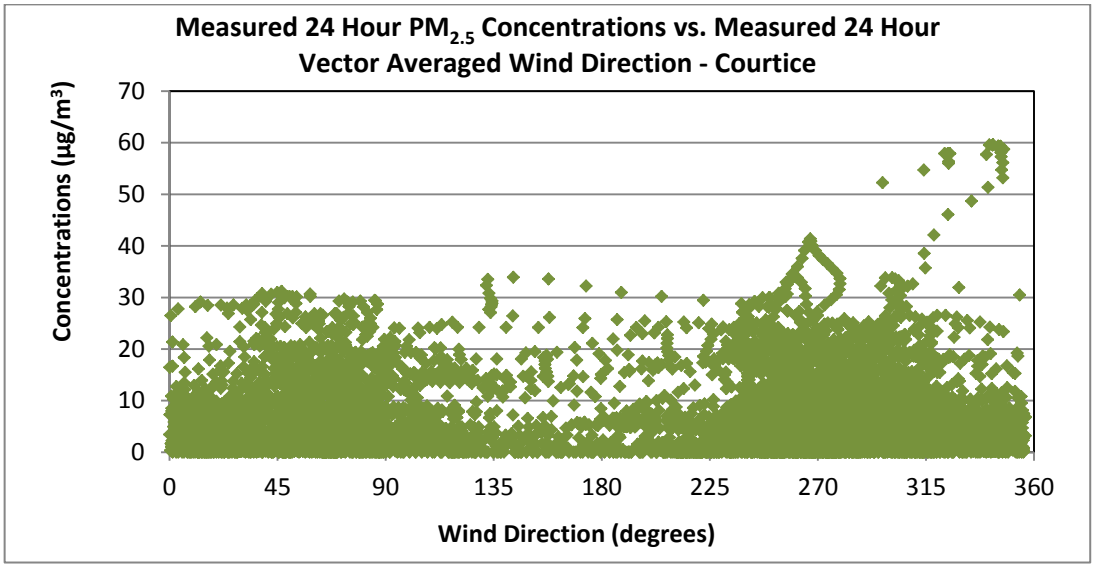
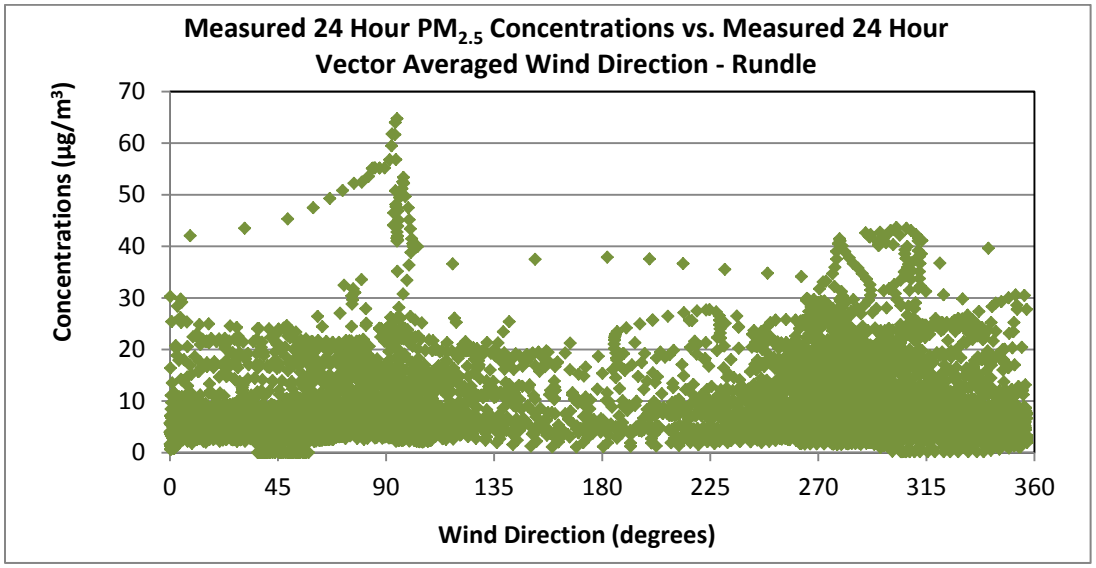


Figure E-4 Measured 24-Hour Average $PM_{2.5}$ Concentrations vs. Measured 24-Hour Vector Averaged Wind Direction – Rundle Road Station



Appendix F DIOXINS AND FURANS DATA SUMMARY

Dioxins and Furans	Courtice WPCP Station	2015								
Location		Courtice			Courtice			Courtice		
Date	dd/mm/yyyy	21/10/2015			02/11/2015			14/11/2015		
Start Time	hh:mm	0:00			0:00			0:00		
Sample Duration	minutes	23			0			23.77		
Technician		TR			TH			TH		
Filter Number		BEB812-01			BFN679-01			BFN874-01		
Maxaam ID					DID NOT RUN (note a)					
Analytical Report #					DID NOT RUN					
Total Volumetric Flow	Am^3/sample	340.62			0.00			370.86		
Analytical Results	Units	Value	EDL	WHO_{2005} TEF	Value	EDL	WHO_{2005} TEF	Value	EDL	WHO_{2005} TEF
2,3,7,8-Tetra CDD *	pg	<3	2.5	1	N/A	N/A	1	<2.1	2.1	1
1,2,3,7,8-Penta CDD	pg	<2	2.3	1	N/A	N/A	1	<2.2	2.2	1
1,2,3,4,7,8-Hexa CDD	pg	<2	2.3	0.1	N/A	N/A	0.1	2.9	2.1	0.1
1,2,3,6,7,8-Hexa CDD	pg	<2	2.4	0.1	N/A	N/A	0.1	6.2	2.2	0.1
1,2,3,7,8,9-Hexa CDD	pg	2	2.1	0.1	N/A	N/A	0.1	12.4	1.9	0.1
1,2,3,4,6,7,8-Hepta CDD	pg	19	2.1	0.01	N/A	N/A	0.01	84.3	2.0	0.01
Octa CDD	pg	61	2.0	0.0003	N/A	N/A	0.0003	313	2.1	0.0003
Total Tetra CDD	pg	<3	2.5		N/A	N/A		<2.4	2.4	
Total Penta CDD	pg	<2	2.3		N/A	N/A		2.8	2.2	
Total Hexa CDD	pg	10	2.3		N/A	N/A		64.4	2.1	
Total Hepta CDD	pg	42	2.1		N/A	N/A		178	2.0	
2,3,7,8-Tetra CDF **	pg	<2	2.1	0.1	N/A	N/A	0.1	2.9	2.4	0.1
1,2,3,7,8-Penta CDF	pg	<2	1.9	0.03	N/A	N/A	0.03	<2.1	2.1	0.03
2,3,4,7,8-Penta CDF	pg	<2	1.9	0.3	N/A	N/A	0.3	<2.2	2.2	0.3
1,2,3,4,7,8-Hexa CDF	pg	<2	1.9	0.1	N/A	N/A	0.1	<2.1	2.1	0.1
1,2,3,6,7,8-Hexa CDF	pg	<2	1.9	0.1	N/A	N/A	0.1	<2.0	2.0	0.1
2,3,4,6,7,8-Hexa CDF	pg	<2	2.1	0.1	N/A	N/A	0.1	<2.1	2.1	0.1
1,2,3,7,8,9-Hexa CDF	pg	<2	2.2	0.1	N/A	N/A	0.1	<2.3	2.3	0.1
1,2,3,4,6,7,8-Hepta CDF	pg	3	1.4	0.01	N/A	N/A	0.01	3.9	1.9	0.01
1,2,3,4,7,8,9-Hepta CDF	pg	<2	1.6	0.01	N/A	N/A	0.01	<2.3	2.3	0.01
Octa CDF	pg	4	1.5	0.0003	N/A	N/A	0.0003	5.6	2.2	0.0003
Total Tetra CDF	pg	<2	2.1		N/A	N/A		2.9	2.4	
Total Penta CDF	pg	<2	1.9		N/A	N/A		<2.1	2.1	
Total Hexa CDF	pg	<2	2.0		N/A	N/A		<2.1	2.1	
Total Hepta CDF	pg	5	1.5		N/A	N/A		7.7	2.1	
Toxic Equivalency	pg									

Calculated Concentrations	Annual			Courtice 1	Courtice 2	Courtice 3
	Units	Maximum	Minimum	10/21/2015	11/2/2015	11/14/2015
2,3,7,8-Tetra CDD *	pg/m^3	0.004	0.003	0.004	-	0.003
1,2,3,7,8-Penta CDD	pg/m^3	0.003	0.003	0.003	-	0.003
1,2,3,4,7,8-Hexa CDD	pg/m^3	0.008	0.002	0.003	-	0.008
1,2,3,6,7,8-Hexa CDD	pg/m^3	0.017	0.003	0.004	-	0.017
1,2,3,7,8,9-Hexa CDD	pg/m^3	0.033	0.003	0.006	-	0.033
1,2,3,4,6,7,8-Hepta CDD	pg/m^3	0.227	0.054	0.056	-	0.227
Octa CDD	pg/m^3	0.844	0.179	0.179	-	0.844
Total Tetra CDD	pg/m^3	0.004	0.003	0.004	-	0.003
Total Penta CDD	pg/m^3	0.008	0.003	0.003	-	0.008
Total Hexa CDD	pg/m^3	0.174	0.029	0.029	-	0.174
Total Hepta CDD	pg/m^3	0.480	0.117	0.123	-	0.480
2,3,7,8-Tetra CDF **	pg/m^3	0.008	0.003	0.003	-	0.008
1,2,3,7,8-Penta CDF	pg/m^3	0.003	0.003	0.003	-	0.003
2,3,4,7,8-Penta CDF	pg/m^3	0.003	0.003	0.003	-	0.003
1,2,3,4,7,8-Hexa CDF	pg/m^3	0.015	0.003	0.003	-	0.003
1,2,3,6,7,8-Hexa CDF	pg/m^3	0.006	0.003	0.003	-	0.003
2,3,4,6,7,8-Hexa CDF	pg/m^3	0.003	0.003	0.003	-	0.003
1,2,3,7,8,9-Hexa CDF	pg/m^3	0.003	0.003	0.003	-	0.003
1,2,3,4,6,7,8-Hepta CDF	pg/m^3	0.031	0.009	0.009	-	0.011
1,2,3,4,7,8,9-Hepta CDF	pg/m^3	0.007	0.002	0.002	-	0.003
Octa CDF	pg/m^3	0.047	0.012	0.012	-	0.015
Total Tetra CDF	pg/m^3	0.020	0.003	0.003	-	0.008
Total Penta CDF	pg/m^3	0.026	0.003	0.003	-	0.003
Total Hexa CDF	pg/m^3	0.034	0.003	0.003	-	0.003
Total Hepta CDF	pg/m^3	0.059	0.015	0.015	-	0.021
Toxic Equivalency	pg/m^3					
TOTAL TOXIC EQUIVALENCY	pg TEQ/m^3	0.017	0.010	0.011	-	0.017
Calculated TEQ Concentrations	**Units**			**Courtice 10/21/2015**	**Courtice 11/2/2015**	**Courtice 11/14/2015**
2,3,7,8-Tetra CDD *	pg TEQ/m^3			0.004	-	0.003
1,2,3,7,8-Penta CDD	pg TEQ/m^3			0.003	-	0.003
1,2,3,4,7,8-Hexa CDD	pg TEQ/m^3			0.0003	-	0.0008
1,2,3,6,7,8-Hexa CDD	pg TEQ/m^3			0.0004	-	0.0017
1,2,3,7,8,9-Hexa CDD	pg TEQ/m^3			0.0006	-	0.0033
1,2,3,4,6,7,8-Hepta CDD	pg TEQ/m^3			0.0006	-	0.0023
Octa CDD	pg TEQ/m^3			0.00005	-	0.00025
Total Tetra CDD	pg TEQ/m^3					
Total Penta CDD	pg TEQ/m^3					
Total Hexa CDD	pg TEQ/m^3					
Total Hepta CDD	pg TEQ/m^3					
2,3,7,8-Tetra CDF **	pg TEQ/m^3			0.0003	-	0.0008
1,2,3,7,8-Penta CDF	pg TEQ/m^3			0.0001	-	0.0001
2,3,4,7,8-Penta CDF	pg TEQ/m^3			0.001	-	0.001
1,2,3,4,7,8-Hexa CDF	pg TEQ/m^3			0.0003	-	0.0003
1,2,3,6,7,8-Hexa CDF	pg TEQ/m^3			0.0003	-	0.0003
2,3,4,6,7,8-Hexa CDF	pg TEQ/m^3			0.0003	-	0.0003
1,2,3,7,8,9-Hexa CDF	pg TEQ/m^3			0.0003	-	0.0003
1,2,3,4,6,7,8-Hepta CDF	pg TEQ/m^3			0.00009	-	0.00011
1,2,3,4,7,8,9-Hepta CDF	pg TEQ/m^3			0.00002	-	0.00003
Octa CDF	pg TEQ/m^3			0.000004	-	0.000005
Total Tetra CDF	pg TEQ/m^3					
Total Penta CDF	pg TEQ/m^3					
Total Hexa CDF	pg TEQ/m^3					
Total Hepta CDF	pg TEQ/m^3					
TOTAL TOXIC EQUIVALENCY	pg TEQ/m^3			0.011	0.000	0.017

Notes:
EDL = Estimated Detection Limit
* CDD = Chloro Dibenzo-p-Dioxin, ** CDF = Chloro Dibenzo-p-Furan
TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient

WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds
a) Sample not collected due to a power outage and timer malfunction.
b) Sample was not analyzed due to monitor power failure.

Dioxins and Furans	Courtice WPCP Station										
						2015					
Location			Courtice			Courtice			Courtice		
Date	dd/mm/yyyy		26/11/2015			08/12/2015			20/12/2015		
Start Time	hh:mm		0:00			0:00			0:00		
Sample Duration	minutes		23.82			7.77			24.46		
Technician			TH/ AW			TH			TH		
Filter Number			BFS952-01			BLF184-01			BNI172-01		
Maxaam ID						DID NOT ANLAYZE (note b)					
Analytical Report #						RUN TIME TOO SHORT					
Total Volumetric Flow	Am^3/sample		353.61			107.44			356.98		
Analytical Results	Units		Value	EDL	WHO_{2005} TEF	Value	EDL	WHO_{2005} TEF	Value	EDL	WHO_{2005} TEF
2,3,7,8-Tetra CDD *	pg		<2.2	2.2	1	N/A	N/A	1	<2.1	2.1	1
1,2,3,7,8-Penta CDD	pg		<2.1	2.1	1	N/A	N/A	1	<2.0	2.0	1
1,2,3,4,7,8-Hexa CDD	pg		<2.0	2.0	0.1	N/A	N/A	0.1	<1.7	1.7	0.1
1,2,3,6,7,8-Hexa CDD	pg		<2.2	2.2	0.1	N/A	N/A	0.1	2.5	1.8	0.1
1,2,3,7,8,9-Hexa CDD	pg		<1.9	1.9	0.1	N/A	N/A	0.1	4.7	1.6	0.1
1,2,3,4,6,7,8-Hepta CDD	pg		19.1	2.1	0.01	N/A	N/A	0.01	26.9	2.2	0.01
Octa CDD	pg		65.9	2.0	0.0003	N/A	N/A	0.0003	76.3	2.4	0.0003
Total Tetra CDD	pg		<2.2	2.2		N/A	N/A		<2.1	2.1	
Total Penta CDD	pg		<2.1	2.1		N/A	N/A		<2.0	2.0	
Total Hexa CDD	pg		11.7	2.0		N/A	N/A		20.4	1.7	
Total Hepta CDD	pg		41.5	2.1		N/A	N/A		56.6	2.2	
2,3,7,8-Tetra CDF **	pg		<2.1	2.1	0.1	N/A	N/A	0.1	<4.7 (1)	4.7	0.1
1,2,3,7,8-Penta CDF	pg		<2.1	2.1	0.03	N/A	N/A	0.03	<2.2	2.2	0.03
2,3,4,7,8-Penta CDF	pg		<2.1	2.1	0.3	N/A	N/A	0.3	<2.2	2.2	0.3
1,2,3,4,7,8-Hexa CDF	pg		<2.1	2.1	0.1	N/A	N/A	0.1	5.3	1.9	0.1
1,2,3,6,7,8-Hexa CDF	pg		<2.0	2.0	0.1	N/A	N/A	0.1	2.0	1.8	0.1
2,3,4,6,7,8-Hexa CDF	pg		<2.3	2.3	0.1	N/A	N/A	0.1	<1.9	1.9	0.1
1,2,3,7,8,9-Hexa CDF	pg		<2.4	2.4	0.1	N/A	N/A	0.1	<2.1	2.1	0.1
1,2,3,4,6,7,8-Hepta CDF	pg		5.9	1.9	0.01	N/A	N/A	0.01	10.9	1.6	0.01
1,2,3,4,7,8,9-Hepta CDF	pg		<2.3	2.3	0.01	N/A	N/A	0.01	2.6	1.9	0.01
Octa CDF	pg		8.4	2.1	0.0003	N/A	N/A	0.0003	16.7	3.5	0.0003
Total Tetra CDF	pg		<2.1	2.1		N/A	N/A		7.0	2.0	
Total Penta CDF	pg		<2.1	2.1		N/A	N/A		9.4	2.2	
Total Hexa CDF	pg		<2.9 (1)	2.9		N/A	N/A		12.2	1.9	
Total Hepta CDF	pg		8.3	2.1		N/A	N/A		21.0	1.7	
Toxic Equivalency	pg										

Calculated Concentrations	Annual			Courtice	Courtice	Courtice
				4	5	6
	Units	Maximum	Minimum	26/11/2015	08/12/2015	20/12/2015
2,3,7,8-Tetra CDD *	pg/m^3	0.004	0.003	0.003	-	0.003
1,2,3,7,8-Penta CDD	pg/m^3	0.003	0.003	0.003	-	0.003
1,2,3,4,7,8-Hexa CDD	pg/m^3	0.008	0.002	0.003	-	0.002
1,2,3,6,7,8-Hexa CDD	pg/m^3	0.017	0.003	0.003	-	0.007
1,2,3,7,8,9-Hexa CDD	pg/m^3	0.033	0.003	0.003	-	0.013
1,2,3,4,6,7,8-Hepta CDD	pg/m^3	0.227	0.054	0.054	-	0.075
Octa CDD	pg/m^3	0.844	0.179	0.186	-	0.214
Total Tetra CDD	pg/m^3	0.004	0.003	0.003	-	0.003
Total Penta CDD	pg/m^3	0.008	0.003	0.003	-	0.003
Total Hexa CDD	pg/m^3	0.174	0.029	0.033	-	0.057
Total Hepta CDD	pg/m^3	0.480	0.117	0.117	-	0.159
2,3,7,8-Tetra CDF **	pg/m^3	0.008	0.003	0.003	-	0.007
1,2,3,7,8-Penta CDF	pg/m^3	0.003	0.003	0.003	-	0.003
2,3,4,7,8-Penta CDF	pg/m^3	0.003	0.003	0.003	-	0.003
1,2,3,4,7,8-Hexa CDF	pg/m^3	0.015	0.003	0.003	-	0.015
1,2,3,6,7,8-Hexa CDF	pg/m^3	0.006	0.003	0.003	-	0.006
2,3,4,6,7,8-Hexa CDF	pg/m^3	0.003	0.003	0.003	-	0.003
1,2,3,7,8,9-Hexa CDF	pg/m^3	0.003	0.003	0.003	-	0.003
1,2,3,4,6,7,8-Hepta CDF	pg/m^3	0.031	0.009	0.017	-	0.031
1,2,3,4,7,8,9-Hepta CDF	pg/m^3	0.007	0.002	0.003	-	0.007
Octa CDF	pg/m^3	0.047	0.012	0.024	-	0.047
Total Tetra CDF	pg/m^3	0.020	0.003	0.003	-	0.020
Total Penta CDF	pg/m^3	0.026	0.003	0.003	-	0.026
Total Hexa CDF	pg/m^3	0.034	0.003	0.004	-	0.034
Total Hepta CDF	pg/m^3	0.059	0.015	0.023	-	0.059
Toxic Equivalency	pg/m^3					
TOTAL TOXIC EQUIVALENCY	pg TEQ/m^3	0.017	0.010	0.010	-	0.013
Calculated TEQ Concentrations	**Units**			**Courtice**	**Courtice**	**Courtice**
				26/11/2015	**08/12/2015**	**20/12/2015**
2,3,7,8-Tetra CDD *	pg TEQ/m^3			0.003	-	0.003
1,2,3,7,8-Penta CDD	pg TEQ/m^3			0.003	-	0.003
1,2,3,4,7,8-Hexa CDD	pg TEQ/m^3			0.0003	-	0.0002
1,2,3,6,7,8-Hexa CDD	pg TEQ/m^3			0.0003	-	0.0007
1,2,3,7,8,9-Hexa CDD	pg TEQ/m^3			0.0003	-	0.0013
1,2,3,4,6,7,8-Hepta CDD	pg TEQ/m^3			0.0005	-	0.0008
Octa CDD	pg TEQ/m^3			0.00006	-	0.00006
Total Tetra CDD	pg TEQ/m^3					
Total Penta CDD	pg TEQ/m^3					
Total Hexa CDD	pg TEQ/m^3					
Total Hepta CDD	pg TEQ/m^3					
2,3,7,8-Tetra CDF **	pg TEQ/m^3			0.0003	-	0.0007
1,2,3,7,8-Penta CDF	pg TEQ/m^3			0.0001	-	0.0001
2,3,4,7,8-Penta CDF	pg TEQ/m^3			0.001	-	0.001
1,2,3,4,7,8-Hexa CDF	pg TEQ/m^3			0.0003	-	0.0015
1,2,3,6,7,8-Hexa CDF	pg TEQ/m^3			0.0003	-	0.0006
2,3,4,6,7,8-Hexa CDF	pg TEQ/m^3			0.0003	-	0.0003
1,2,3,7,8,9-Hexa CDF	pg TEQ/m^3			0.0003	-	0.0003
1,2,3,4,6,7,8-Hepta CDF	pg TEQ/m^3			0.00017	-	0.00031
1,2,3,4,7,8,9-Hepta CDF	pg TEQ/m^3			0.00003	-	0.00007
Octa CDF	pg TEQ/m^3			0.000007	-	0.000014
Total Tetra CDF	pg TEQ/m^3					
Total Penta CDF	pg TEQ/m^3					
Total Hexa CDF	pg TEQ/m^3					
Total Hepta CDF	pg TEQ/m^3					
TOTAL TOXIC EQUIVALENCY	pg TEQ/m^3			0.010	0.000	0.013

Notes:
EDL = Estimated Detection Limit
* CDD = Chloro Dibenzo-p-Dioxin, ** CDF = Chloro Dibenzo-p-Furan
TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient

WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds
a) Sample not collected due to a power outage and timer malfunction.
b) Sample was not analyzed due to monitor power failure.

Dioxins and Furans	Rundle Road Station	2015								
Location		Rundle			Rundle			Rundle		
Date	dd/mm/yyyy	23/10/2015			2/11/2015			14/11/2015		
Start Time	hh:mm	12:00			0:00			0:00		
Sample Duration	minutes	23.57			24.15			23.89		
Technician		TH			TH			TH		
Filter Number		BEB891-01			BFN680-01			BFN873-01		
Maxaam ID		(note a)								
Analytical Report #										
Total Volumetric Flow	Am^3/sample	342.03			371.78			333.52		
Analytical Results	Units	Value	EDL	WHO_{2005} TEF	Value	EDL	WHO_{2005} TEF	Value	EDL	WHO_{2005} TEF
2,3,7,8-Tetra CDD *	pg	<2	1.7	1	<2.2	2.2	1	<2.1	2.1	1
1,2,3,7,8-Penta CDD	pg	<3	2.5	1	<2.3	2.3	1	<2.1	2.1	1
1,2,3,4,7,8-Hexa CDD	pg	<3	2.6	0.1	<1.9	1.9	0.1	3.7	2.1	0.1
1,2,3,6,7,8-Hexa CDD	pg	<3	2.8	0.1	<2.1	2.1	0.1	7.2	2.3	0.1
1,2,3,7,8,9-Hexa CDD	pg	<2	2.4	0.1	<1.8	1.8	0.1	14.7	2.0	0.1
1,2,3,4,6,7,8-Hepta CDD	pg	7	1.6	0.01	11.1	1.6	0.01	118	2.2	0.01
Octa CDD	pg	29	1.6	0.0003	35.2	1.5	0.0003	412	2.2	0.0003
Total Tetra CDD	pg	<2	1.7		<2.2	2.2		<2.5	2.5	
Total Penta CDD	pg	<3	2.5		<2.3	2.3		<2.1	2.1	
Total Hexa CDD	pg	<3	2.6		6.7	1.9		78.1	2.1	
Total Hepta CDD	pg	16	1.6		24.4	1.6		252	2.2	
2,3,7,8-Tetra CDF **	pg	<2	2.0	0.1	<2.5	2.5	0.1	2.8	2.2	0.1
1,2,3,7,8-Penta CDF	pg	<2	1.7	0.03	<2.6	2.6	0.03	<2.2	2.2	0.03
2,3,4,7,8-Penta CDF	pg	<2	1.7	0.3	<2.6	2.6	0.3	<2.2	2.2	0.3
1,2,3,4,7,8-Hexa CDF	pg	<2	1.8	0.1	<1.9	1.9	0.1	<2.1	2.1	0.1
1,2,3,6,7,8-Hexa CDF	pg	<2	1.8	0.1	<1.8	1.8	0.1	<2.0	2.0	0.1
2,3,4,6,7,8-Hexa CDF	pg	<2	2.0	0.1	<2.0	2.0	0.1	<2.1	2.1	0.1
1,2,3,7,8,9-Hexa CDF	pg	<2	2.1	0.1	<2.1	2.1	0.1	<2.3	2.3	0.1
1,2,3,4,6,7,8-Hepta CDF	pg	<2	1.9	0.01	2.5	1.8	0.01	<4.2	4.2	0.01
1,2,3,4,7,8,9-Hepta CDF	pg	<2	2.2	0.01	<2.2	2.2	0.01	<2.3	2.3	0.01
Octa CDF	pg	<2	2.2	0.0003	<1.8	1.8	0.0003	7.0	2.2	0.0003
Total Tetra CDF	pg	<2	2.0		2.5	1.8		2.8	2.2	
Total Penta CDF	pg	<2	1.7		<2.6	2.6		<2.2	2.2	
Total Hexa CDF	pg	<2	1.9		2.2	1.9		<2.1	2.1	
Total Hepta CDF	pg	<2	2.0		2.5	2.0		4.7	2.1	
Toxic Equivalency	pg									

Calculated Concentrations	Annual			Rundle	Rundle	Rundle
				1	2	3
	Units	Maximum	Minimum	23/10/2015	2/11/2015	14/11/2015
2,3,7,8-Tetra CDD *	pg/m3	0.003	0.002	2.49E-03	2.96E-03	3.15E-03
1,2,3,7,8-Penta CDD	pg/m3	0.004	0.003	3.65E-03	3.09E-03	3.15E-03
1,2,3,4,7,8-Hexa CDD	pg/m3	0.011	0.003	3.80E-03	2.56E-03	1.11E-02
1,2,3,6,7,8-Hexa CDD	pg/m3	0.022	0.003	4.09E-03	2.82E-03	2.16E-02
1,2,3,7,8,9-Hexa CDD	pg/m3	0.044	0.002	3.51E-03	2.42E-03	4.41E-02
1,2,3,4,6,7,8-Hepta CDD	pg/m3	0.354	0.020	2.05E-02	2.99E-02	3.54E-01
Octa CDD	pg/m3	1.235	0.085	8.48E-02	9.47E-02	1.24E+00
Total Tetra CDD	pg/m3	0.004	0.002	2.49E-03	2.96E-03	3.75E-03
Total Penta CDD	pg/m3	0.004	0.003	3.65E-03	3.09E-03	3.15E-03
Total Hexa CDD	pg/m3	0.234	0.004	3.80E-03	1.80E-02	2.34E-01
Total Hepta CDD	pg/m3	0.756	0.047	4.68E-02	6.56E-02	7.56E-01
2,3,7,8-Tetra CDF **	pg/m3	0.008	0.003	2.92E-03	3.36E-03	8.40E-03
1,2,3,7,8-Penta CDF	pg/m3	0.003	0.002	2.49E-03	3.50E-03	3.30E-03
2,3,4,7,8-Penta CDF	pg/m3	0.003	0.002	2.49E-03	3.50E-03	3.30E-03
1,2,3,4,7,8-Hexa CDF	pg/m3	0.012	0.003	2.63E-03	2.56E-03	3.15E-03
1,2,3,6,7,8-Hexa CDF	pg/m3	0.004	0.002	2.63E-03	2.42E-03	3.00E-03
2,3,4,6,7,8-Hexa CDF	pg/m3	0.004	0.003	2.92E-03	2.69E-03	3.15E-03
1,2,3,7,8,9-Hexa CDF	pg/m3	0.004	0.003	3.07E-03	2.82E-03	3.45E-03
1,2,3,4,6,7,8-Hepta CDF	pg/m3	0.023	0.003	2.78E-03	6.72E-03	6.30E-03
1,2,3,4,7,8,9-Hepta CDF	pg/m3	0.006	0.003	3.22E-03	2.96E-03	3.45E-03
Octa CDF	pg/m3	0.032	0.002	3.22E-03	2.42E-03	2.10E-02
Total Tetra CDF	pg/m3	0.036	0.003	2.92E-03	6.72E-03	8.40E-03
Total Penta CDF	pg/m3	0.014	0.002	2.49E-03	3.50E-03	3.30E-03
Total Hexa CDF	pg/m3	0.023	0.003	2.78E-03	5.92E-03	3.15E-03
Total Hepta CDF	pg/m3	0.044	0.003	2.92E-03	6.72E-03	1.41E-02
Toxic Equivalency	pg/m3					
TOTAL TOXIC EQUIVALENCY	pg TEQ/m^3	0.021	0.010	0.010	0.010	0.021

Calculated TEQ Concentrations	Units	Rundle	Rundle	Rundle
		23/10/2015	2/11/2015	14/11/2015
2,3,7,8-Tetra CDD *	pg TEQ/m^3	2.49E-03	2.96E-03	3.15E-03
1,2,3,7,8-Penta CDD	pg TEQ/m^3	3.65E-03	3.09E-03	3.15E-03
1,2,3,4,7,8-Hexa CDD	pg TEQ/m^3	3.80E-04	2.56E-04	1.11E-03
1,2,3,6,7,8-Hexa CDD	pg TEQ/m^3	4.09E-04	2.82E-04	2.16E-03
1,2,3,7,8,9-Hexa CDD	pg TEQ/m^3	3.51E-04	2.42E-04	4.41E-03
1,2,3,4,6,7,8-Hepta CDD	pg TEQ/m^3	2.05E-04	2.99E-04	3.54E-03
Octa CDD	pg TEQ/m^3	2.54E-05	2.84E-05	3.71E-04
Total Tetra CDD	pg TEQ/m^3			
Total Penta CDD	pg TEQ/m^3			
Total Hexa CDD	pg TEQ/m^3			
Total Hepta CDD	pg TEQ/m^3			
2,3,7,8-Tetra CDF **	pg TEQ/m^3	2.92E-04	3.36E-04	8.40E-04
1,2,3,7,8-Penta CDF	pg TEQ/m^3	7.46E-05	1.05E-04	9.89E-05
2,3,4,7,8-Penta CDF	pg TEQ/m^3	7.46E-04	1.05E-03	9.89E-04
1,2,3,4,7,8-Hexa CDF	pg TEQ/m^3	2.63E-04	2.56E-04	3.15E-04
1,2,3,6,7,8-Hexa CDF	pg TEQ/m^3	2.63E-04	2.42E-04	3.00E-04
2,3,4,6,7,8-Hexa CDF	pg TEQ/m^3	2.92E-04	2.69E-04	3.15E-04
1,2,3,7,8,9-Hexa CDF	pg TEQ/m^3	3.07E-04	2.82E-04	3.45E-04
1,2,3,4,6,7,8-Hepta CDF	pg TEQ/m^3	2.78E-05	6.72E-05	6.30E-05
1,2,3,4,7,8,9-Hepta CDF	pg TEQ/m^3	3.22E-05	2.96E-05	3.45E-05
Octa CDF	pg TEQ/m^3	9.65E-07	7.26E-07	6.30E-06
Total Tetra CDF	pg TEQ/m^3			
Total Penta CDF	pg TEQ/m^3			
Total Hexa CDF	pg TEQ/m^3			
Total Hepta CDF	pg TEQ/m^3			
TOTAL TOXIC EQUIVALENCY	pg TEQ/m^3	0.010	0.010	0.021

Notes:
RDL = Reportable Detection Limit
* CDD = Chloro Dibenzo-p-Dioxin, ** CDF = Chloro Dibenzo-p-Furan
TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient
WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds
a) Timer set-up error. Sample was collected on Oct 23 after correcting issue.

Dioxins and Furans	Rundle Road Station			2015							
Location				Rundle			Rundle			Rundle	
Date	dd/mm/yyyy			26/11/2015			08/12/2015			20/12/2015	
Start Time	hh:mm			0:00			0:00			0:00	
Sample Duration	minutes			24.01			23.31			23.94	
Technician				TH/ AW			TH			TH	
Filter Number				BFS953-01			BLF185-01			BNI173-01	
Maxaam ID											
Analytical Report #											
Total Volumetric Flow	Am^3/sample			373.96			324.47			342.50	
Analytical Results	Units			Value	EDL	WHO_{2005} TEF	Value	EDL	WHO_{2005} TEF	Value	EDL	WHO_{2005} TEF
2,3,7,8-Tetra CDD *	pg			<2.3	2.3	1	<2.2	2.2	1	<1.8	1.8	1
1,2,3,7,8-Penta CDD	pg			<2.2	2.2	1	<2.7	2.7	1	<2.0	2.0	1
1,2,3,4,7,8-Hexa CDD	pg			<2.0	2.0	0.1	<2.2	2.2	0.1	<2.1	2.1	0.1
1,2,3,6,7,8-Hexa CDD	pg			<2.2	2.2	0.1	4.1	2.4	0.1	<2.2	2.2	0.1
1,2,3,7,8,9-Hexa CDD	pg			<1.9	1.9	0.1	9.0	2.1	0.1	4.0	2.0	0.1
1,2,3,4,6,7,8-Hepta CDD	pg			19.7	2.2	0.01	51.2	2.2	0.01	24.5	1.5	0.01
Octa CDD	pg			66.1	2.1	0.0003	159	2.2	0.0003	73.0	2.0	0.0003
Total Tetra CDD	pg			<2.3	2.3		<2.2	2.2		<1.8	1.8	
Total Penta CDD	pg			<2.2	2.2		<2.7	2.7		<2.0	2.0	
Total Hexa CDD	pg			12.2	2.0		37.6	2.2		16.3	2.1	
Total Hepta CDD	pg			43.0	2.2		106	2.2		51.2	1.5	
2,3,7,8-Tetra CDF **	pg			<2.0	2.0	0.1	<3.1 (2)	3.1	0.1	<4.1 (1)	4.1	0.1
1,2,3,7,8-Penta CDF	pg			<2.1	2.1	0.03	<2.2	2.2	0.03	<2.3	2.3	0.03
2,3,4,7,8-Penta CDF	pg			<2.1	2.1	0.3	<2.2	2.2	0.3	<2.3	2.3	0.3
1,2,3,4,7,8-Hexa CDF	pg			<1.9	1.9	0.1	<3.2 (1)	3.2	0.1	4.1	2.1	0.1
1,2,3,6,7,8-Hexa CDF	pg			<1.9	1.9	0.1	<2.3	2.3	0.1	<2.0	2.0	0.1
2,3,4,6,7,8-Hexa CDF	pg			<2.1	2.1	0.1	<2.5	2.5	0.1	<2.1	2.1	0.1
1,2,3,7,8,9-Hexa CDF	pg			<2.2	2.2	0.1	<2.7	2.7	0.1	<2.3	2.3	0.1
1,2,3,4,6,7,8-Hepta CDF	pg			6.5	1.9	0.01	7.5	2.0	0.01	7.9	1.4	0.01
1,2,3,4,7,8,9-Hepta CDF	pg			<2.2	2.2	0.01	<2.4	2.4	0.01	2.1	1.7	0.01
Octa CDF	pg			7.9	2.0	0.0003	7.1	2.0	0.0003	10.8	2.0	0.0003
Total Tetra CDF	pg			<2.0	2.0		<3.1 (1)	3.1		12.4	2.0	
Total Penta CDF	pg			<2.1	2.1		<4.6 (1)	4.6		4.8	2.3	
Total Hexa CDF	pg			3.1	2.0		4.6	2.5		7.8	2.1	
Total Hepta CDF	pg			8.9	2.1		11.0	2.2		15.0	1.5	
Toxic Equivalency	pg											

Calculated Concentrations	Annual			Rundle			Rundle			Rundle		
				4			5			6		
	Units	Maximum	Minimum	26/11/2015			08/12/2015			20/12/2015		
2,3,7,8-Tetra CDD *	pg/m3	0.003	0.002	3.08E-03			3.39E-03			2.63E-03		
1,2,3,7,8-Penta CDD	pg/m3	0.004	0.003	2.94E-03			4.16E-03			2.92E-03		
1,2,3,4,7,8-Hexa CDD	pg/m3	0.011	0.003	2.67E-03			3.39E-03			3.07E-03		
1,2,3,6,7,8-Hexa CDD	pg/m3	0.022	0.003	2.94E-03			1.26E-02			3.21E-03		
1,2,3,7,8,9-Hexa CDD	pg/m3	0.044	0.002	2.54E-03			2.77E-02			1.17E-02		
1,2,3,4,6,7,8-Hepta CDD	pg/m3	0.354	0.020	5.27E-02			1.58E-01			7.15E-02		
Octa CDD	pg/m3	1.235	0.085	1.77E-01			4.90E-01			2.13E-01		
Total Tetra CDD	pg/m3	0.004	0.002	3.08E-03			3.39E-03			2.63E-03		
Total Penta CDD	pg/m3	0.004	0.003	2.94E-03			4.16E-03			2.92E-03		
Total Hexa CDD	pg/m3	0.234	0.004	3.26E-02			1.16E-01			4.76E-02		
Total Hepta CDD	pg/m3	0.756	0.047	1.15E-01			3.27E-01			1.49E-01		
2,3,7,8-Tetra CDF **	pg/m3	0.008	0.003	2.67E-03			4.78E-03			5.99E-03		
1,2,3,7,8-Penta CDF	pg/m3	0.003	0.002	2.81E-03			3.39E-03			3.36E-03		
2,3,4,7,8-Penta CDF	pg/m3	0.003	0.002	2.81E-03			3.39E-03			3.36E-03		
1,2,3,4,7,8-Hexa CDF	pg/m3	0.012	0.003	2.54E-03			4.93E-03			1.20E-02		
1,2,3,6,7,8-Hexa CDF	pg/m3	0.004	0.002	2.54E-03			3.54E-03			2.92E-03		
2,3,4,6,7,8-Hexa CDF	pg/m3	0.004	0.003	2.81E-03			3.85E-03			3.07E-03		
1,2,3,7,8,9-Hexa CDF	pg/m3	0.004	0.003	2.94E-03			4.16E-03			3.36E-03		
1,2,3,4,6,7,8-Hepta CDF	pg/m3	0.023	0.003	1.74E-02			2.31E-02			2.31E-02		
1,2,3,4,7,8,9-Hepta CDF	pg/m3	0.006	0.003	2.94E-03			3.70E-03			6.13E-03		
Octa CDF	pg/m3	0.032	0.002	2.11E-02			2.19E-02			3.15E-02		
Total Tetra CDF	pg/m3	0.036	0.003	2.67E-03			4.78E-03			3.62E-02		
Total Penta CDF	pg/m3	0.014	0.002	2.81E-03			7.09E-03			1.40E-02		
Total Hexa CDF	pg/m3	0.023	0.003	8.29E-03			1.42E-02			2.28E-02		
Total Hepta CDF	pg/m3	0.044	0.003	2.38E-02			3.39E-02			4.38E-02		
Toxic Equivalency	pg/m3											
TOTAL TOXIC EQUIVALENCY	pg TEQ/m^3	0.021	0.010	0.010			0.017			0.012		

Calculated TEQ Concentrations	Units			Rundle			Rundle			Rundle		
				26/11/2015			08/12/2015			20/12/2015		
2,3,7,8-Tetra CDD *	pg TEQ/m^3			3.08E-03			3.39E-03			2.63E-03		
1,2,3,7,8-Penta CDD	pg TEQ/m^3			2.94E-03			4.16E-03			2.92E-03		
1,2,3,4,7,8-Hexa CDD	pg TEQ/m^3			2.67E-04			3.39E-04			3.07E-04		
1,2,3,6,7,8-Hexa CDD	pg TEQ/m^3			2.94E-04			1.26E-03			3.21E-04		
1,2,3,7,8,9-Hexa CDD	pg TEQ/m^3			2.54E-04			2.77E-03			1.17E-03		
1,2,3,4,6,7,8-Hepta CDD	pg TEQ/m^3			5.27E-04			1.58E-03			7.15E-04		
Octa CDD	pg TEQ/m^3			5.30E-05			1.47E-04			6.39E-05		
Total Tetra CDD	pg TEQ/m^3											
Total Penta CDD	pg TEQ/m^3											
Total Hexa CDD	pg TEQ/m^3											
Total Hepta CDD	pg TEQ/m^3											
2,3,7,8-Tetra CDF **	pg TEQ/m^3			2.67E-04			4.78E-04			5.99E-04		
1,2,3,7,8-Penta CDF	pg TEQ/m^3			8.42E-05			1.02E-04			1.01E-04		
2,3,4,7,8-Penta CDF	pg TEQ/m^3			8.42E-04			1.02E-03			1.01E-03		
1,2,3,4,7,8-Hexa CDF	pg TEQ/m^3			2.54E-04			4.93E-04			1.20E-03		
1,2,3,6,7,8-Hexa CDF	pg TEQ/m^3			2.54E-04			3.54E-04			2.92E-04		
2,3,4,6,7,8-Hexa CDF	pg TEQ/m^3			2.81E-04			3.85E-04			3.07E-04		
1,2,3,7,8,9-Hexa CDF	pg TEQ/m^3			2.94E-04			4.16E-04			3.36E-04		
1,2,3,4,6,7,8-Hepta CDF	pg TEQ/m^3			1.74E-04			2.31E-04			2.31E-04		
1,2,3,4,7,8,9-Hepta CDF	pg TEQ/m^3			2.94E-05			3.70E-05			6.13E-05		
Octa CDF	pg TEQ/m^3			6.34E-06			6.56E-06			9.46E-06		
Total Tetra CDF	pg TEQ/m^3											
Total Penta CDF	pg TEQ/m^3											
Total Hexa CDF	pg TEQ/m^3											
Total Hepta CDF	pg TEQ/m^3											
TOTAL TOXIC EQUIVALENCY	pg TEQ/m^3			0.010			0.017			0.012		

Notes:
RDL = Reportable Detection Limit
* CDD = Chloro Dibenzo-p-Dioxin, ** CDF = Chloro Dibenzo-p-Furan
TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient
WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equival
a) Timer set-up error. Sample was collected on Oct 23 after correcting issue.