# AMBIENT AIR QUALITY MONITORING PLAN

DURHAM YORK RESIDUAL WASTE STUDY

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May 8, 2012

Project No.: 160930024

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# 1 INTRODUCTION

## 1.1 Monitoring Objectives

The Regional Municipalities of Durham and York are proposing to construct and operate the Durham York Energy Centre (DYEC) which will be 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.

This monitoring plan was developed based on the Regional Council mandate to provide ambient monitoring in the area of the DYEC for a three year period. An ambient 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 (MOE, 2010). The purposes of the ambient monitoring program will be 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, 2009a);
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.

## 1.2 Monitoring Period

The monitoring program will commence one (1) year prior to DYEC commissioning (approximately July 1, 2013) to monitor baseline air quality in the absence of emissions from the DYEC (as per Condition 11 of the Ministry of Environment (MOE) Notice of Approval). During commissioning (starting approximately July 1, 2014) continuous monitoring parameters only will be collected. When the EFW Facility is fully operational, monitoring of all contaminants will again be conducted continuously until notification from the MOE Regional Director that the monitoring is no longer required is received. Based on the Regional Council mandate, operational monitoring will be conducted for a minimum 3 year period. The need for further monitoring beyond this time frame will be determined based on the results of the monitoring program in consultation with the Ontario Ministry of Environment (MOE) and the Durham Region Medical Officer of Health (MOH).

## 1.3 Project Description

The proposed DYEC will process about 140,000 tonnes of municipal solid waste annually. There will be two completely independent waste processing trains at the DYEC. Each train will consist of a feed chute, stoker, integrated furnace/boiler, acid gas scrubber, a fabric filter baghouse and associated ash and residue collection systems. Steam produced in the boilers will drive a turbine-generator to produce electricity for delivery to the grid, for in-plant use and potentially to provide district heating to the neighbouring Courtice Water Pollution Control Plant and Clarington Energy Park. A site plan showing the layout of the DYEC is presented in Figure 1-1.

The following emissions sources were identified based on the preliminary design:

- A conventional stack associated with air pollution control equipment on the waste processing trains which is defined by location, base elevation, stack height, stack diameter, gas exit velocity, gas exit temperature, and contaminant emission rates (the stack typically operates on a continuous basis with relatively constant emission rates);
- One 250 kW emergency diesel generator;
- Two 224 kW emergency diesel fire pumps;
- Diesel tanks for the emergency generator and fire pumps;
- Onsite vehicle traffic;
- Comfort heating of the administration and support buildings;
- A welding station in the storage and maintenance shop; and,
- Fugitive emissions associated with refuse, fly ash and bottom ash transport and handling.

## 1.4 EFW Site Characteristics

The DYEC will be located on undeveloped land owned by Durham Region, located south of Highway 401 in the Municipality of Clarington (the Site). The Site is on the west side of Osborne Road north of a CN Rail corridor. There are commercial properties north of the Site. The lands east and west of the site are undeveloped commercial land, which are currently used for agricultural purposes. The Courtice Water Pollution Control Plant is south and the Darlington Nuclear Generating Station is located approximately 1.8 km to the east of the Site. The nearest major intersection is Highway 401 and Courtice Road, which is approximately 1.7 km from the Site. The location of the DYEC relative to the local area is shown in Figure 1-2.

The DYEC will be located about 750 m north of Lake Ontario. The Lake is at an elevation of approximately 70 m above mean sea level and along the shoreline there is an escarpment which is approximately 20 m above the Lake's water level. North of the lake shore, the local topography is relatively flat with terrain elevations varying from 90 m to 100 m above mean sea level within the immediate vicinity of the Site.

A total of 391 discrete sensitive receptors in the study area were examined in the Environmental Assessment of the DYEC. These receptors included industrial areas, residences/residential areas, hospitals, schools, day cares, nursing homes, recreational areas and water bodies. A plot of the special receptors in proximity to the DYEC is shown in Figure 1-3. A listing of all special receptors can be found in Table 3-9 of the AQTSR (Jacques Whitford, 2009a). The properties adjacent to the site in all directions are current or future industrial. There are two farms each located about 500-m to the east and west of the site. The nearest residential areas to the site are located about 1.5-km to the north-west (Solinas and Baseline Roads) and about 1.5-km to the north-east (Baseline and Trulls Roads).

## 1.5 Report Contents

The MOE's Operations Manual for Air Quality Monitoring in Ontario (MOE, 2008) (Operations Manual) requires a monitoring plan to include the following sections:

- Purpose or objectives of the monitoring program – Section 1.1
- Expected duration of the monitoring program – Section 1.1
- Identified and suspected air emission source(s) – Sections 1.2, 1.3
- Identified and suspected receptors – Sections 1.3, 2.2
- Number and location of monitoring sites (including meteorological sites) – Section 4.2
- Air quality parameters to be monitored and the monitoring frequency – Sections 4.1, 5.1, 5.2
- Monitoring methods/instruments to be used – Section 5
- Analytical methods/procedures – Sections 5, 6
- Laboratory services support to be used – Section 6
- Dispersion model to be used (if applicable) – N/A
- Quality Assurance and Quality Control (QA/QC) plan – Section 7
- Data reporting procedures – Section 8.

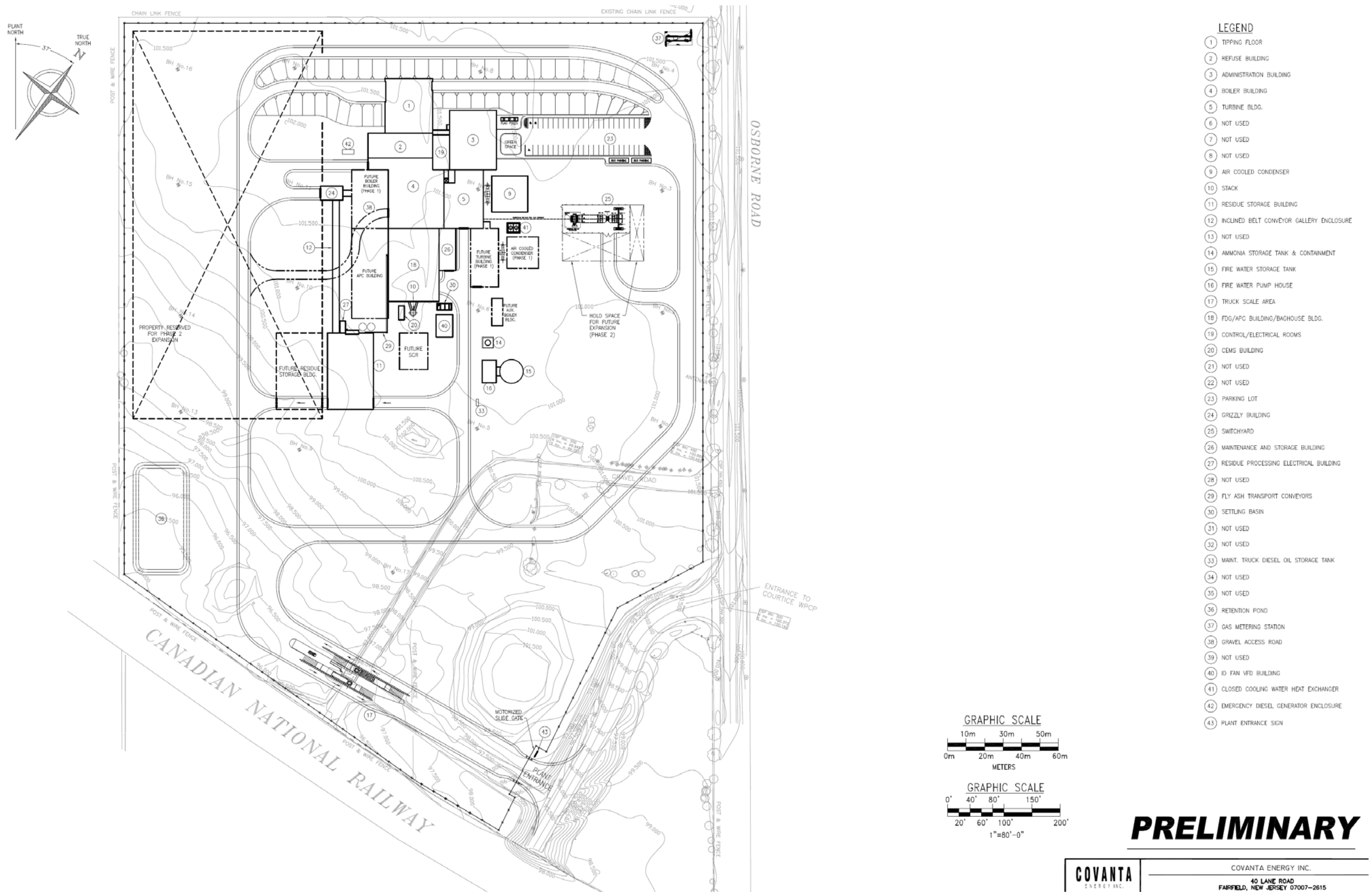
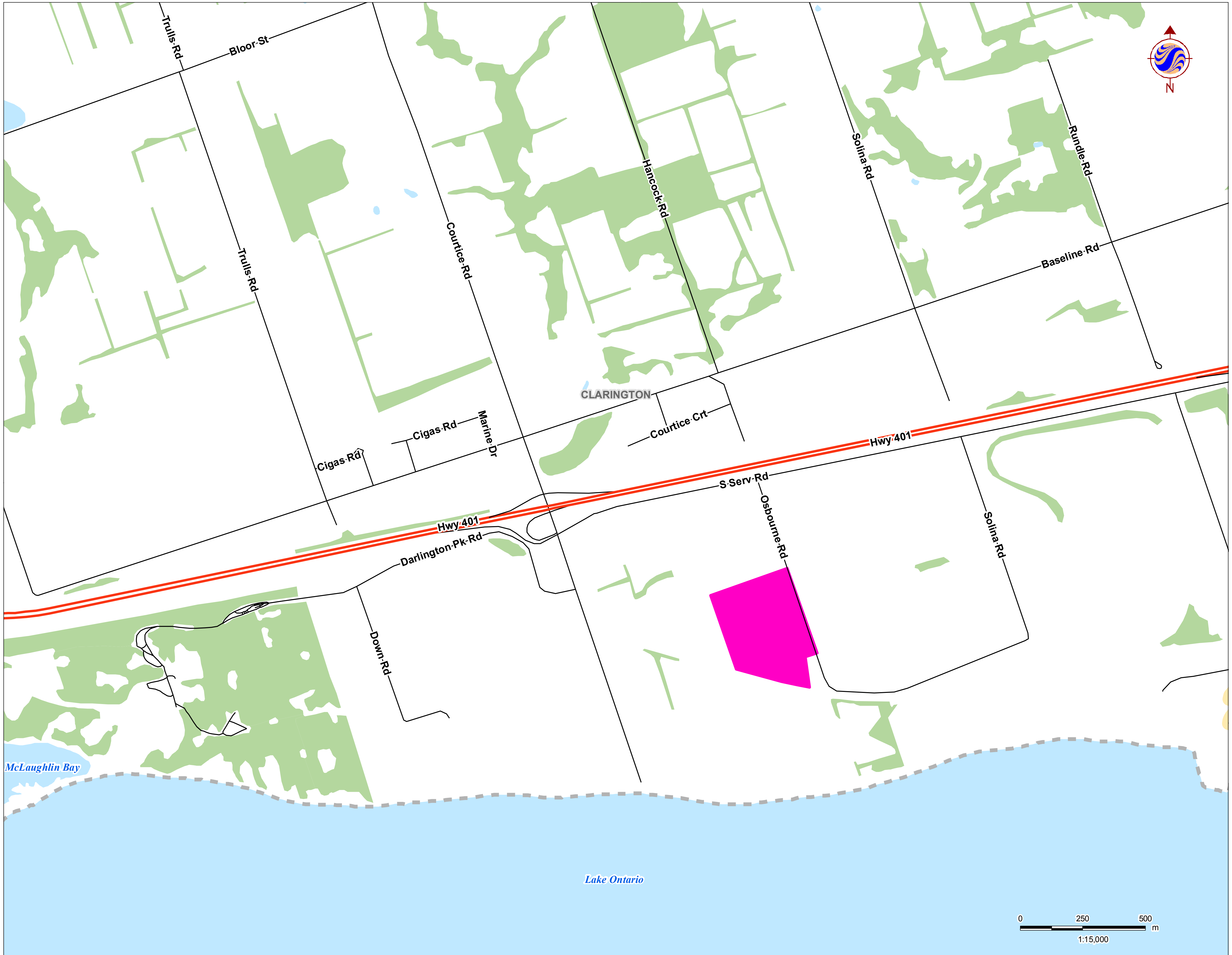



**Figure 1-1 Proposed 140,000 tonnes/yr Facility Site Plan**

DATE: 8/30/2011
PROJECT: 160930024




## Legend

- Road
- Highway
- Proposed EFW Facility Site
- Waterbody
- Wooded Area

## Notes

1. Coordinate System: UTM NAD 83 - Zone 17 (N).
2. Data provided by Ontario Ministry of Natural Resources. Copyright 2004 Queen's Printer Ontario

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January 2011
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Figure No.

1-2

Title

**Location of EFW Facility and Surrounding Area**

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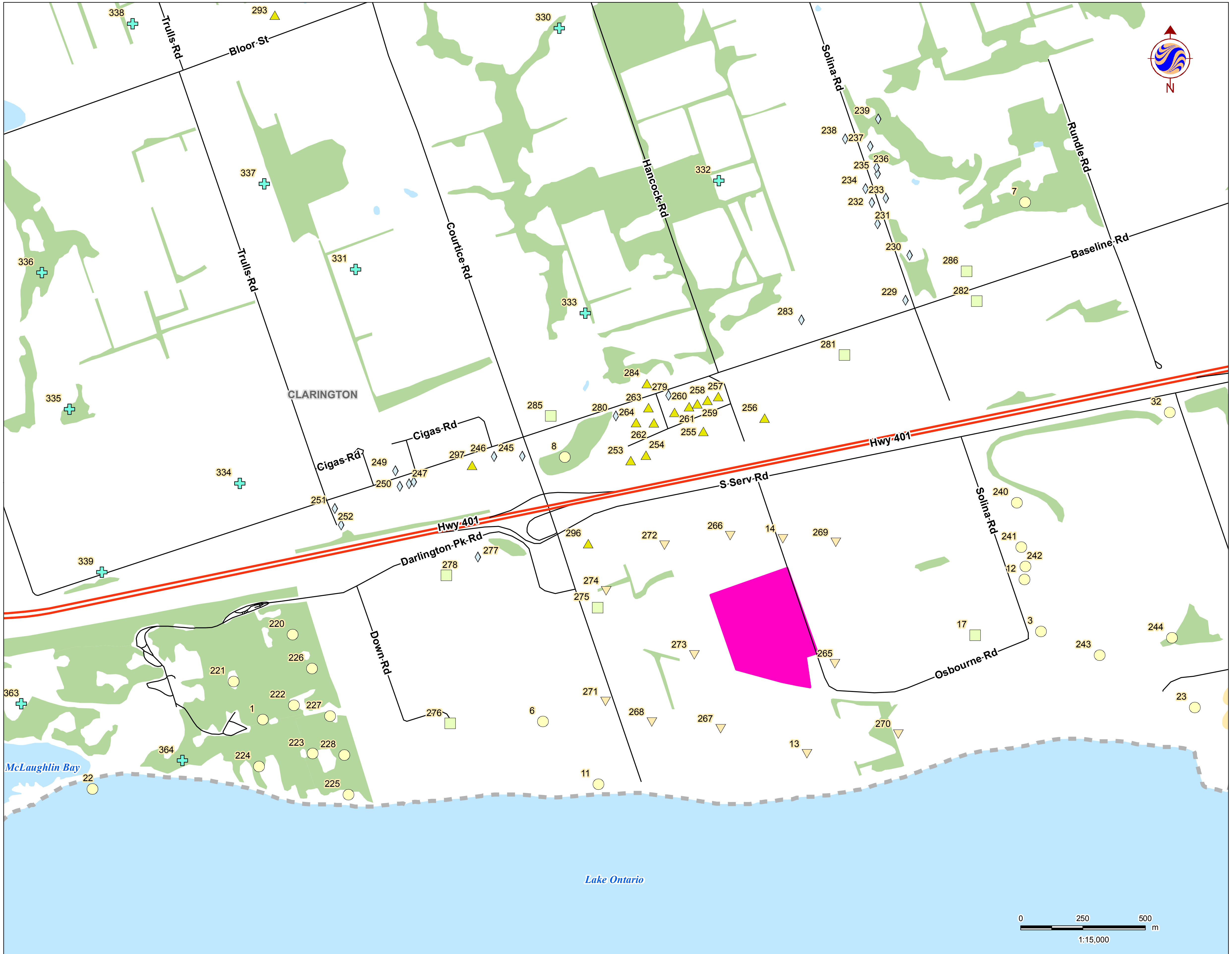
Revised on: January 7, 2011 By: sallen




## Legend

- Road
- Highway
- Proposed EFW Facility Site
- Waterbody
- Wooded Area

**Receptor Category**

- Farm
- Commercial/Industrial
- Future Commercial/Industrial
- Natural/Recreational
- Residence
- Watershed

## Notes

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Figure No.
1-3

Title
**Locations of Sensitive Receptors**

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Revised on: May 27, 2011 By: bcowper

# 2 SUMMARY OF DISPERSION MODELLING PREDICTIONS

Dispersion model predictions are an aide in the siting of monitoring stations recommended by the United States Environmental Protection Agency (40 CFR, Part 58) (US EPA). A dispersion modelling study of emissions from the DYEC was completed as part of the approved environmental assessment (EA) for this project (Jacques Whitford, 2009a). This study examined emissions of about 90 different contaminants of potential concern including criteria air contaminants, metals, PAHs, and dioxins/furans. The maximum off-property ground-level concentrations due to emissions from the DYEC were estimated using the CALPUFF dispersion model.

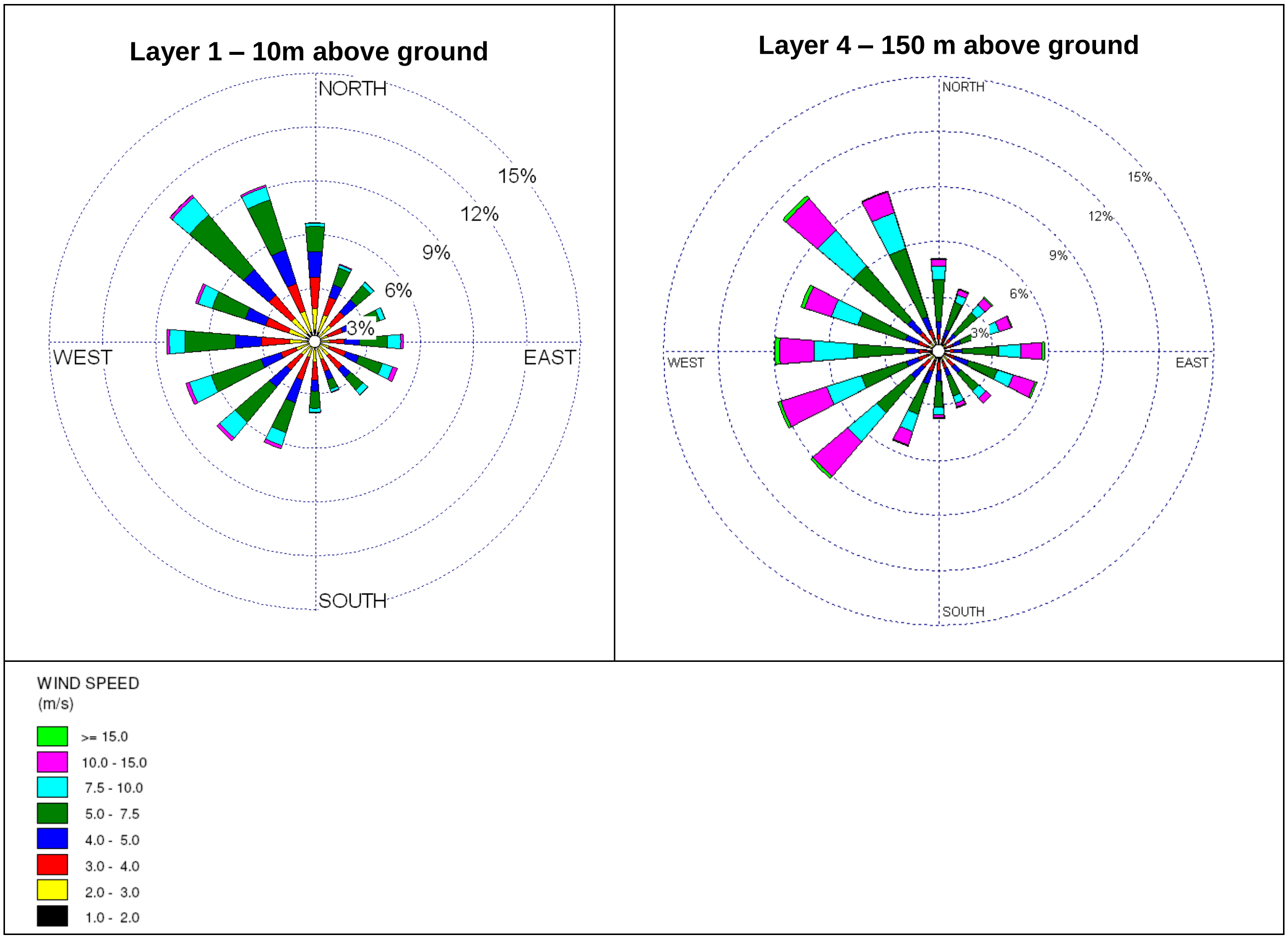
This section presents a brief overview of the dispersion modelling methodology and results relevant to the siting of the ambient monitors. Additional details can be found in the Air Quality Technical Study Report prepared for the EA (Jacques Whitford, 2009a).

## 2.1 Meteorological Modelling

As part of the dispersion modelling study, data from Environment Canada regional surface meteorological stations, in conjunction with modelled wind data from the Weather Research and Forecasting (WRF) model were used as inputs into the CALPUFF meteorological model. The CALMET meteorological model was run over a five year period to depict a wide range of meteorological conditions and associated dispersion conditions per the MOE's Air Dispersion Modelling Guideline for Ontario (MOE, 2009). The five years of meteorological data produced by the CALMET model were used to initialize the CALPUFF dispersion model.

Wind rose diagrams are an efficient and convenient way of summarizing wind speed and directional data. The length of the radial barbs gives the total percent frequency of winds from the indicated direction, while the portions of the barbs of different widths indicate the frequency of associated wind speed categories. Figure 2-1 below summarizes the hourly CALMET-output winds at the model grid cell nearest to the DYEC Site location. The wind data presented has been extracted from CALMET model levels 1 and 4 (which correspond to 10-m and 150-m above ground) and spans all hours in the five-year modelling period.

**Figure 2-1 Summary of Winds at the Site Location**




The wind rose diagrams show winds occur most frequently from the southwest and northwest directions, and occur least frequently from the south and northeast directions. During the winter months, winds occur more frequently from the west and northwest, while during the summer, the prevailing wind direction tends to be from the southwest.

## 2.2 Dispersion Modelling

The dispersion modelling assessment was conducted to predict the downwind concentrations of air contaminants emitted by the DYEC.

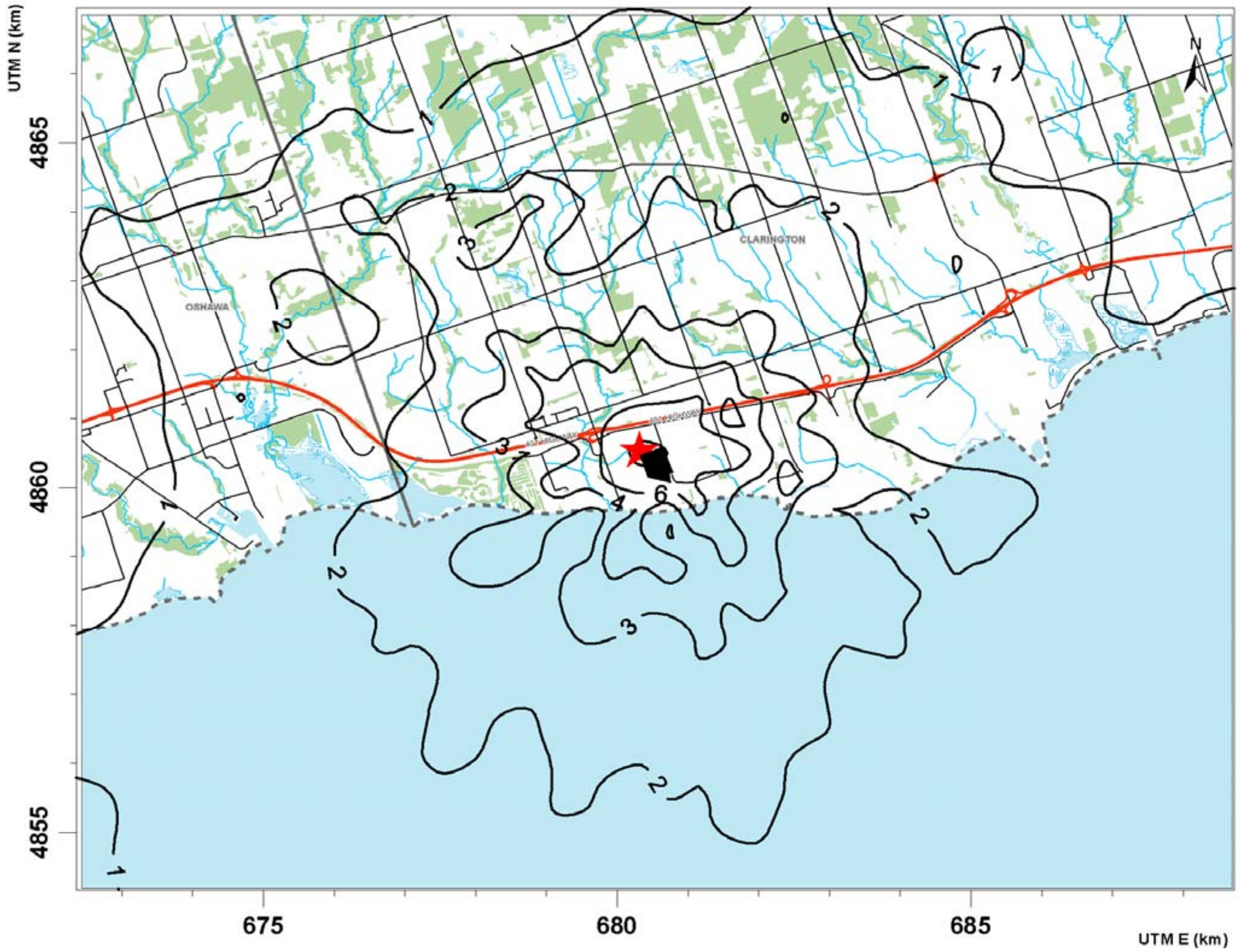
The primary emissions source in the DYEC is the 87.6 metre tall main stack. The waste processing operations in the DYEC (including the truck tipping bay and storage pit) are all enclosed and kept under negative pressure, with the air from these areas being used in the combustion process and vented to the main stack. Therefore, no low level emissions will occur from the DYEC operations with the exception of emergency diesel generator testing, road dust from vehicles on paved roads and the occasional filling of carbon/lime storage silos (which are equipped with fabric filters to minimize emissions). Therefore, the main stack is the only source of emissions of concern from the waste processing facility. The minor emissions from low level emissions sources were modeled in the EA (and ECA application) and demonstrated to be in compliance with MOE air quality criteria. As the low level emissions are of common contaminants that occur from many industrial/commercial facilities, their consideration for ambient monitoring is not required.

Contour plots showing the maximum predicted ground level concentrations for a unit emission rate (facility-wide emission rate of 1 g/s) from the DYEC stack over the five year modeling period are presented in Figures 2-2 through 2-4 for hourly, 24-hour and annual averaging periods, respectively. In all cases, the figures show results for emissions released under maximum normal Facility operation (100% capacity).

Figures 2-2 and 2-3 show that the areas with the highest predicted short-term concentrations occur to the north-west of the DYEC, within 500m of the property line. Moving beyond this 500 m radius, the predicted concentrations become gradually lower with increasing distance from the DYEC. It should be noted that the maximum predicted short-term events occur infrequently and represents a modelled worst-case hourly or daily average prediction over a five-year period.

The areas with the highest annual averaging concentrations are shown in Figure 2-4. This contour plot shows that the predicted maximum annual average concentration occurs approximately 1.5 km to the northeast of the DYEC, with another area of almost as high annual concentrations occurring  about 1.5 km to the west-northwest of the DYEC.

Dispersion modelling of maximum total annual contaminant depositions was conducted to predict particulate and gaseous depositions at the special receptors considered in the air quality assessment. Plots of total annual particulate and gaseous dry depositions for a unit emission rate (1 g/s) from the facility are presented in Figures 2-5 and 2-6 for the special receptors in close proximity to the DYEC. For both particulate and gaseous, these plots show that depositions are lower in close proximity to the facility than for receptors further away. This is attributable to the high stack height (87.6-m) resulting in plume impingement more frequently occurring at distances further away from the facility than at the property line.




Legend

Maximum GLC

Facility

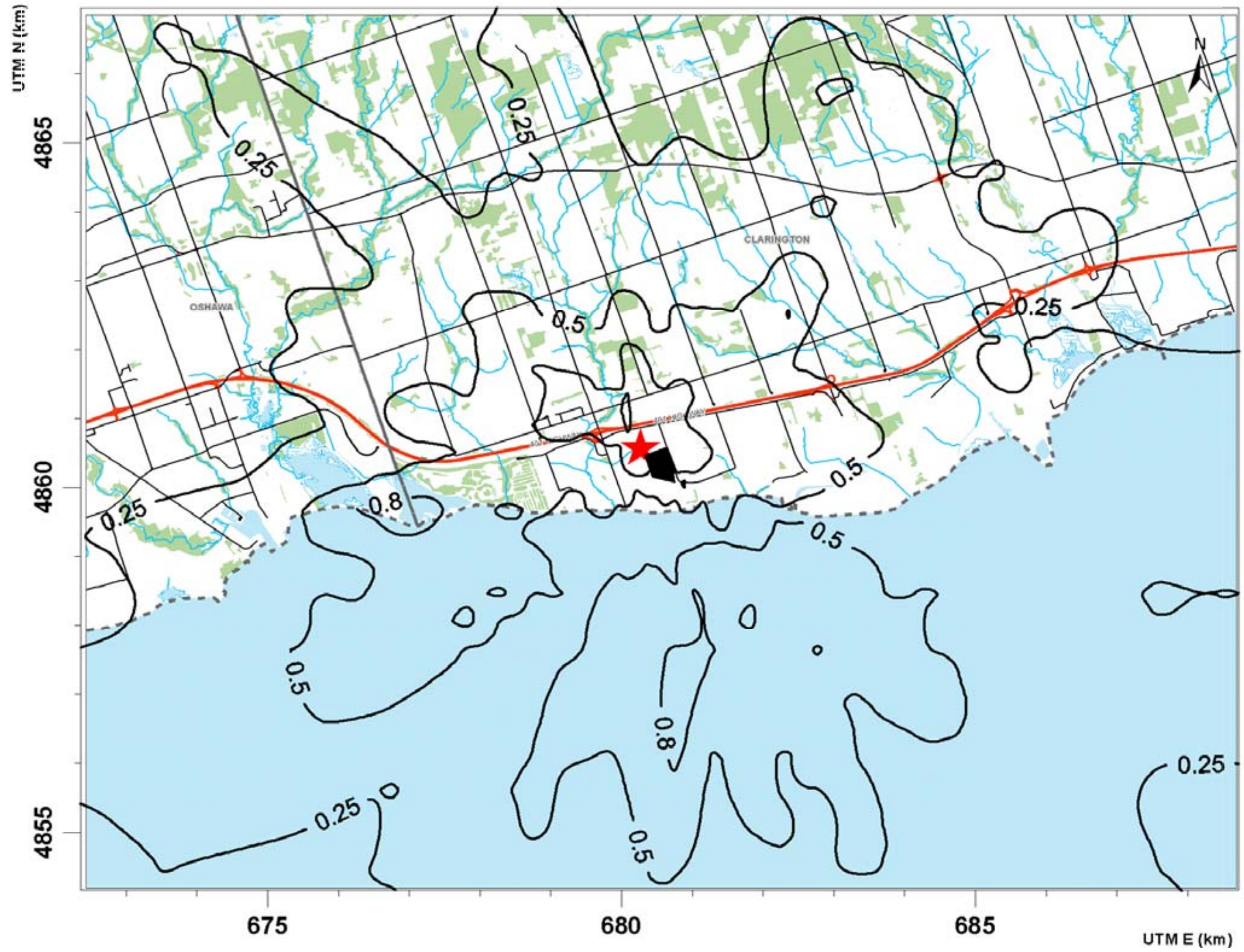
**FIGURE 2-2**

**Plot of Maximum Predicted Hourly-Average Ground Level Concentrations for Normalized Facility-Wide Emission Rate**

**Scenario 1A (MCR, 140,000 tonnes/yr Facility)**

**Predicted Statistical Maximum GLC = 8.78 (μg/m$^3$)/(g/s)**

Map Parameters
Projection: UTM
Datum: NAD 83
Zone: 17
Map Units: m
DATE: 8/30/2011
PROJECT: 160930024




Legend

Maximum GLC

Facility

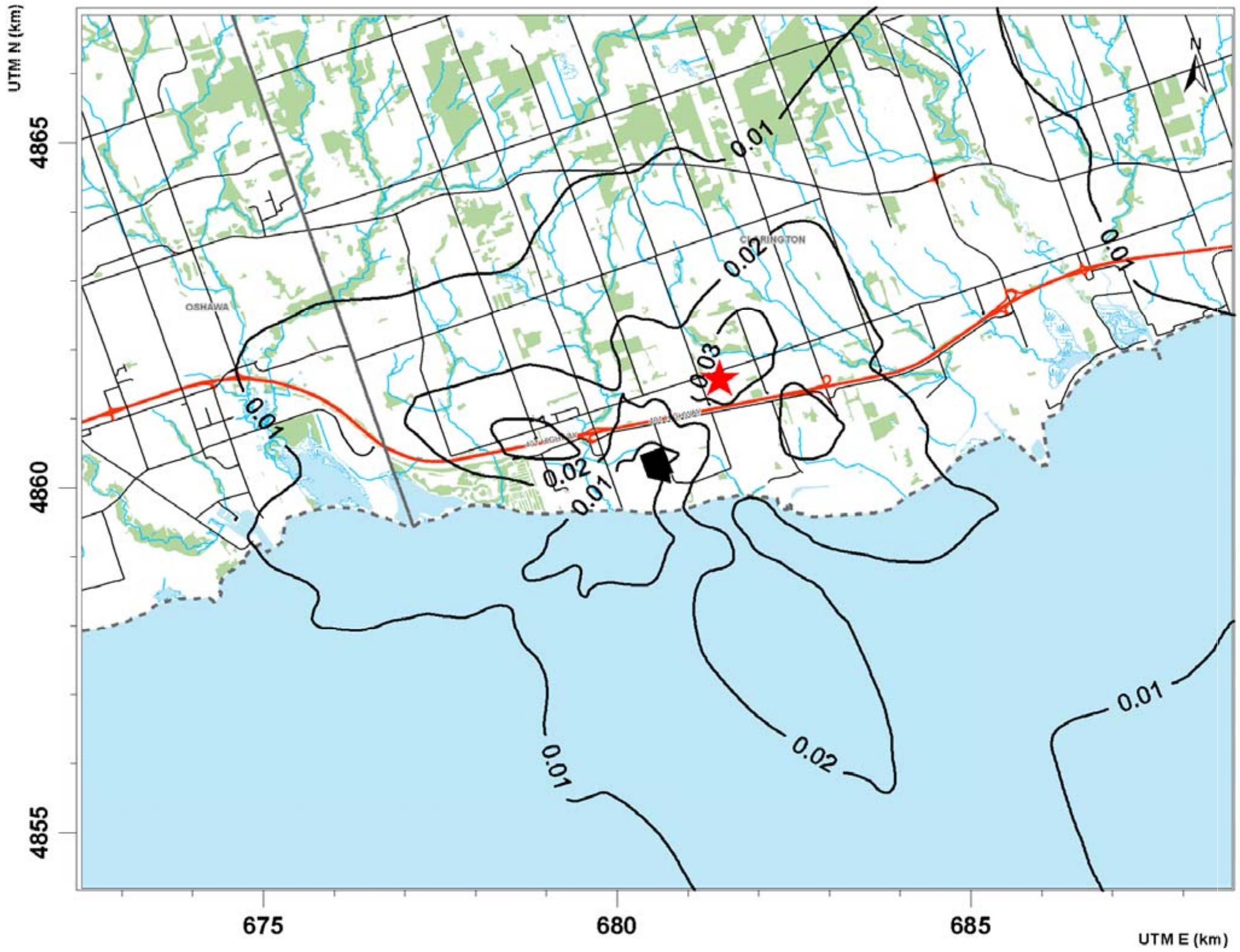
**FIGURE 2-3**

**Plot of Maximum Predicted 24-Hour-Average Ground Level Concentrations for Normalized Facility-Wide Emission Rate**

**Scenario 1A (MCR, 140,000 tonnes/yr Facility)**

**Predicted Statistical Maximum GLC = 1.21 (μg/m$^3$)/(g/s)**

Map Parameters
Projection: UTM
Datum: NAD 83
Zone: 17
Map Units: m
DATE: 8/30/2011
PROJECT: 160930024




Legend

Maximum GLC

Facility

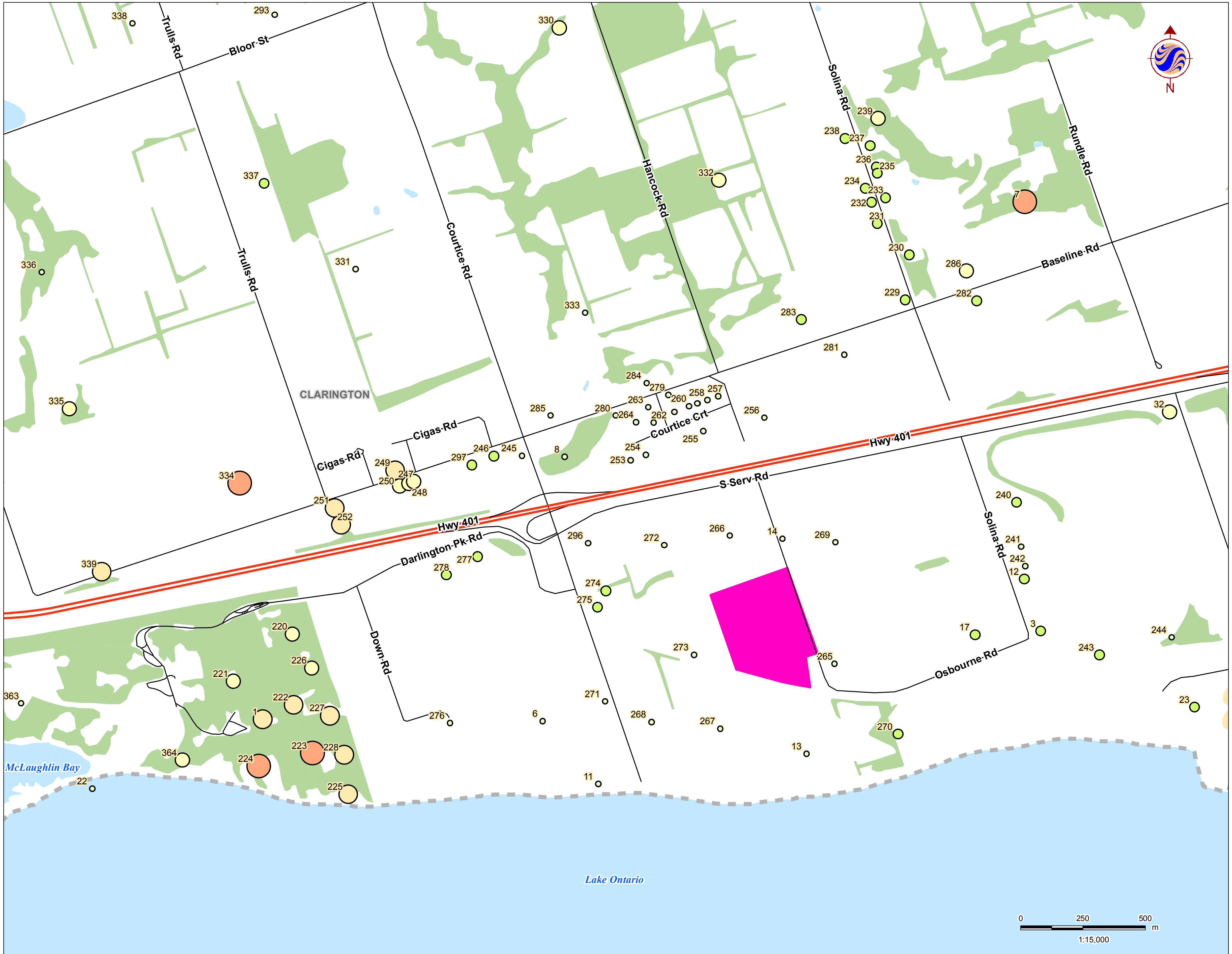
**FIGURE 2-4**

**Plot of Maximum Predicted Annual-Average Ground Level Concentrations for Normalized Facility-Wide Emission Rate**

Map Parameters
Projection: UTM
Datum: NAD 83
Zone: 17
Map Units: m
DATE: 8/30/2011
PROJECT: 160930024

**Scenario 1A (MCR, 140,000 tonnes/yr Facility)**

**Predicted Statistical Maximum GLC = 0.035 (μg/m$^3$)/(g/s)**




## Legend

- Road
- Highway
- Proposed EFW Facility Site
- Waterbody
- Wooded Area

**Deposition Particulates**

ug/m2/yr/(g/s)

- 65 - 500
- 501 - 1000
- 1001 - 2500
- 2501 - 5000
- 5001 - 6150

## Notes

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2-5

Title

**Plot of Total Annual Particulate Dry Deposition for a Normalized Facility-Wide Emission Rate**

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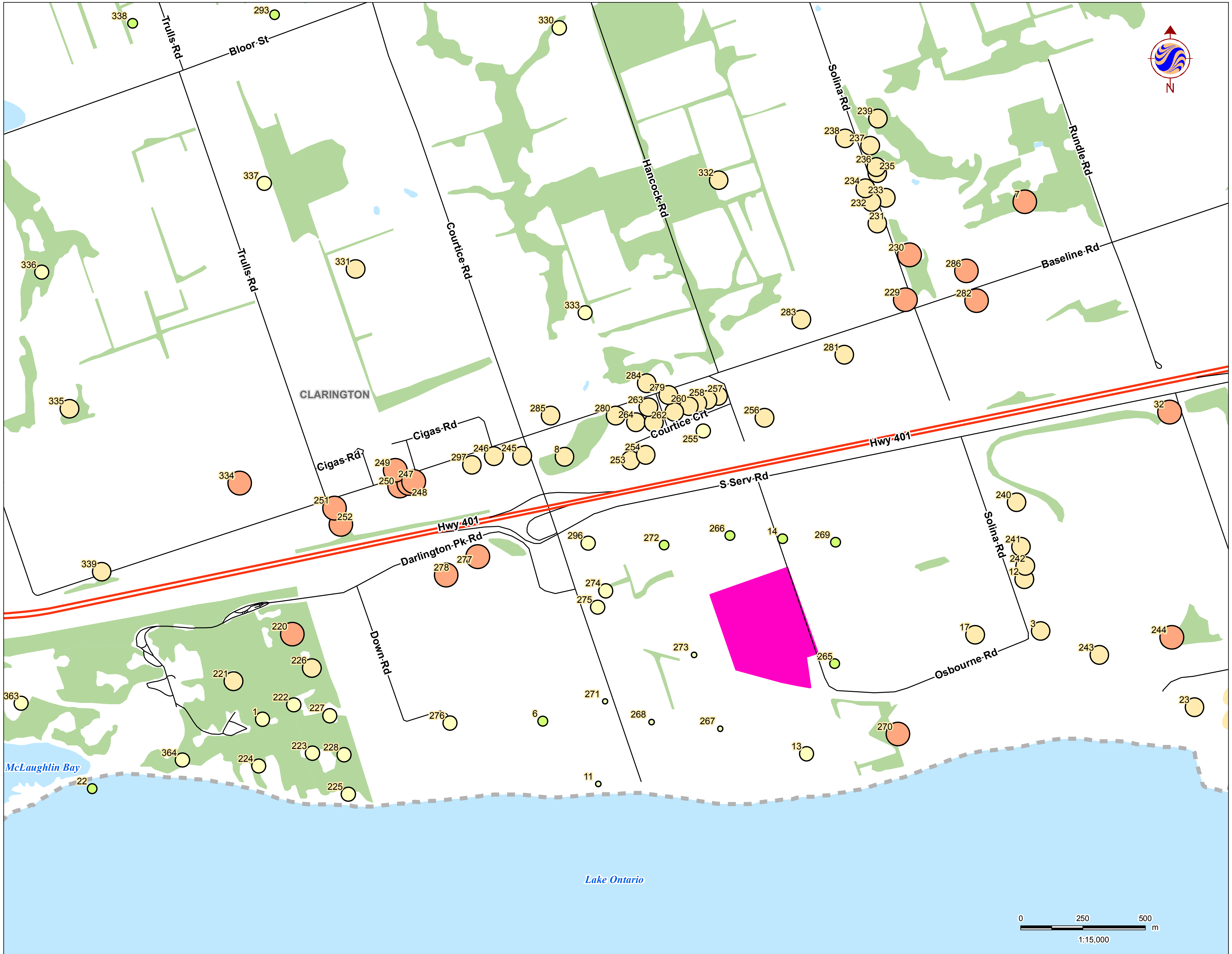
Revised on: May 30, 2011 By: bcowper




## Legend

- Road
- Highway
- Proposed EFW Facility Site
- Waterbody
- Wooded Area

**Deposition Vapour**

ug/m2/yr/(g/s)

- 1053 - 1500
- 1501 - 2000
- 2001 - 3000
- 3001 - 4000
- 4001 - 5503

## Notes

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Figure No.

2-6

Title

**Plot of Total Annual Gaseous Dry Deposition for a Normalized Facility-Wide Emission Rate**

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Revised on: May 30, 2011 By: bcowper

# 3 GENERAL SITING CONSIDERATIONS

## 3.1 Scale of Representativeness

Proper siting of monitoring stations requires a precise specification of the monitoring objective, which usually includes a desired spatial scale of representativeness. The spatial scale of representativeness is described in terms of the physical dimensions of the air parcel nearest to a monitoring station through which the pollutant concentration is reasonably uniform. The goal in siting monitoring stations is to correctly match the spatial scale represented by the sample of monitored air with the monitoring objective of the station. The scales of representativeness of most interest for local air monitoring are:

- Microscale – defines concentrations in air volumes associated with area dimensions ranging from several metres up to about 100 m.
- Middle Scale – defines the concentration typical of areas ranging in size from about 100 m to 0.5 km.
- Neighbourhood Scale – defines concentrations within extended areas with relatively uniform land use with dimensions of 0.5 to 4.0 km.
- Urban Scale – defines overall city-wide conditions with dimensions on the order of 4 to 50 km.

US Consolidated Federal Regulations, Section 40, Part 58 (40CFR Part 58), (US EPA, 2010) provide guidelines on the scales of representativeness required for specific monitoring objectives. The objective of monitoring source impact is associated with micro, middle and neighbourhood scales. Monitoring for background concentrations requires neighbourhood or regional scales of representativeness.

This monitoring plan has been developed to meet the following objectives:

1. to quantify the ground level concentration resulting from emissions from the DYEC on local air quality, including validating the predicted concentrations;
2. to monitor concentration levels in nearby residential areas; and,
3. to quantify background ambient levels in the area.

Based on the objectives listed above, the monitor should be situated to capture middle to neighbourhood scales of representativeness (hundreds of metres to 4 km). The dispersion modeling results summarized in Section 3 show the maximum predicted concentrations occur within this range for both short-term and long-term averaging periods.

## 3.2 Siting Requirements

The following table provides a summary of siting requirements listed in the MOE's Operations Manual (MOE, 2008) that will be followed as closely as possible for the siting of the monitor, however the final location of the station will be constrained to sites with adequate security (within a secured, fenced area), vehicle access, set-back from roadways, and access to power.

**Table 3-1 Summary of Siting Criteria for Ambient Monitors**

| Contaminant | MOE Recommended Criteria |
|---|---|
| Sulphur Dioxide ($SO_2$) | 3 - 15 m above ground |
| | > 1 m vertical and horizontal distance from supporting structure |
| | > 20 m from trees |
| | Distance from sampler to any air flow obstacle must be >2x height of obstacle above the sampler |
| | Unrestricted air flow in 3 of the 4 wind quadrants |
| | No nearby furnace or incineration flues |
| | Probe material - Pyrex glass or FEP Teflon |
| Nitrogen Dioxide ($NO_2$) | 3 - 15 m above ground |
| | > 1 m vertical and horizontal distances from supporting structure |
| | > 20 m from trees |
| | Distance from sampler to any air flow obstacle must be >2x height of obstacle above the sampler |
| | Unrestricted air flow in 3 of the 4 wind quadrants |
| | Spacing from roadways varies with road traffic |
| | No nearby furnace or incineration flues |
| Total Suspended Particulate (TSP): General | 2 - 15 m above ground |
| | > 1 m vertical and > 2 m horizontal distance from supporting structure |
| | > 20 m from trees |
| | Distance from sampler to any air flow obstacle must be >2x height of obstacle above the sampler |
| | Unrestricted air flow in 3 of the 4 wind quadrants |
| | No nearby furnace or incineration flues |
| | Distance from sampler to roadway should be > 20-25 m for sampler inlet heights of 2-5 m |

**Table 3-1 Summary of Siting Criteria for Ambient Monitors**

| Contaminant | MOE Recommended Criteria |
|---|---|
| Particulate Matter less than 2.5 Microns in Diameter ($PM_{2.5}$): General | 2 - 15 m above ground |
| | > 1 m vertical and > 2 m horizontal distance from supporting structure |
| | > 20 m from trees |
| | Distance from sampler to any air flow obstacle must be >2x height of obstacle above the sampler |
| | Unrestricted air flow in 3 of the 4 wind quadrants |
| | > 5 m from chimneys with natural gas combustion emissions |
| | > 20 - 25 m from major roadways |
| PAHs and Dioxins/Furans | 3 - 15 m above ground |
| | > 1 m vertical and > 2 m horizontal distance from supporting structure |
| | No nearby sources of PAHs, dioxins and furans which could interfere with sample results |
| Wind speed and Direction | => 10 m height above ground |
| | > 1 building height (H) upwind of a building obstruction |
| | > 1.5 H above building roof for rooftop installation |
| | > 5-10 H downwind of building |
| | > 10 m above dense vegetative canopy |
| | > 2 tower side widths (D) for boom installations |
| Air Temperature | > 2 m height above ground |
| | Temperature sensor > 4 obstruction heights and > 30 m from large paved areas |
| | > 1 D for tower mast installations |

## 3.3 Number of Monitors

US Consolidated Federal Regulations, Section 40, Part 58 (40CFR Part 58), Appendix D (US EPA, 2010) provides criteria for the basic air monitoring requirements including the total number of monitoring sites that will serve specific data needs. EPA notes that the optimum size of a particular network involves trade-offs among data needs and available resources. The numbers of monitoring sites recommended in Appendix D are based on population levels and contaminant being monitored. The relevant study area for the DYEC would cover the Municipality of Clarington, which has a population of 77,820 (2006 census data). The contaminants considered in 40CFR Part 58, App D relevant to the DYEC are $NO_2$ and $PM_{2.5}$. For $NO_2$ one monitoring station is recommended for areas with less than 1 million people, while for $PM_{2.5}$, 40CFR Part 58, App D recommends one monitoring station in areas with populations between 50,000 to 500,000.

Thus, based on the guideline data available from US EPA, a minimum of one monitoring station would be required. Discussions with the MOE have indicated that they will require that an upwind station and a property line monitor (for a 1-year period) are also included in the monitoring network.

Other considerations in setting the number of monitoring stations would be the presence of potentially health sensitive receptors within the scales of representativeness identified in Section 3.1 (100's of metres to 4–km). The nearest hospital to the DYEC is located about 4.8 km to the east-northeast, in a predominantly upwind direction and outside the siting area of consideration. The nearest daycare centre identified in the EA is located about 3.9 km to the north-northeast, also in a predominantly upwind direction and at the edge of the siting area of interest. The nearest primary and secondary schools are located about 4.0 and 4.7 km from the site in east-northeasterly and northeasterly directions respectively. The schools are both located in predominantly upwind directions and near the edge or outside of the siting area of interest. As all of these receptors are either outside the siting area of consideration or located considerable distances from the DYEC in predominantly upwind directions (where predicted concentration levels are considerably lower than in closer proximity to the DYEC), monitoring at these locations would not be expected to provide useful information.

Another objective of the monitoring program will be to validate the dispersion model predictions conducted in the EA. The CALPUFF model used in the air quality assessment was extensively validated against multiple ambient measurement data sets (for different emissions sources and in different terrain) prior to the model being accepted as a regulatory model by the US EPA. To adequately validate the dispersion modelling for the DYEC therefore only requires measurements upwind and downwind of the DYEC to quantify background and source contributions to ambient air quality for comparison to the model predictions. As a number of contaminant emission rates will be continuously monitored at the stack as well as at the two monitoring stations, this provides an extensive data base of measurements with which to validate the model (8760 hours of measurement/model prediction points each year).

Further discussion on the number of monitoring stations is provided in Section 4.3.

Based on the on-going results of the ambient monitoring program, the need for additional monitoring stations will be assessed and the network adjusted accordingly. If the ambient monitoring data do not agree well with the dispersion model predictions, the need for additional monitoring stations (or re-location of the existing stations) will be reviewed and assessed with the MOE.

# 4 CONTAMINANTS AND LOCATIONS FOR MONITORING

The proposed contaminants to be monitored were determined based on the results of the Site-Specific Human Health and Ecological Risk Assessment (HHERA) (Stantec, December 2009), conducted in support of the EA for the DYEC as well as the ambient monitoring program completed for the undertaking. The proposed locations for monitoring were determined based on the results of the Air Quality Assessment, prevailing wind direction, locations of nearby residences, and the general siting requirements outlined in Section 3.

## 4.1 Contaminants to be Monitored

The HHERA was prepared in support of the approved Durham and York Region's Residual Waste Planning EA.

The HHERA examined the potential for emissions from the DYEC to pose an unacceptable risk to human and ecological receptors in the short-term and long-term (i.e., after 30 years of operating the DYEC). The HHERA evaluated the potential risk from the DYEC operating at its permitted capacity of 140,000 tonnes/year (tpy). The Local Risk Assessment Study Area (LRASA) encompassed a 10 km radius from the proposed DYEC and included the evaluation of 309 receptor locations and all of the watershed areas within.

A total of 87 contaminants of potential concern (COPCs) were evaluated in the inhalation assessment and 57 of these were evaluated in a multiple pathway assessment for human and ecological receptors. The first scenario involved the evaluation of baseline conditions of COPCs in air, soil, vegetation, water and biota. Baseline Case acute (1-hr or 24-hr) and chronic (annual) risk estimates for inhalation exposure to COPCs did not exceed their regulatory benchmark, which have been developed to be protective of human health and the environment. Therefore no adverse health risk was expected from exposure to baseline air concentrations of chemicals.

The results of the multi-pathway assessment predicted that exposure to DYEC-related air emissions would have no undue carcinogenic or non-carcinogenic risk to human receptors living or visiting the LRASA while the DYEC is operating at 140,000 tpy. All hazard quotients and incremental lifetime cancer risks were below their respective government benchmarks for all chemicals and exposure scenarios. The ecological risk assessment did not predict any undue ecological risks from DYEC emissions when operating at 140,000 tpy.

Therefore, based on the results of the risk assessment, there were no COPCs that warrant any special attention or inclusion in the air monitoring program to be undertaken. However, given it is a requirement in the Minister's Notice of Approval, detailed in Condition 11 (MOE, 2010), a list of chemicals was developed based on:

- Their emission rate from the DYEC;
- Those chemicals that were already present in the ambient air at appreciable concentrations; and,
- Those that are considered to be of greatest concern to public or environmental health.

Based on these criteria, the following contaminants were chosen to be included in this monitoring program:

- Nitrogen oxides ($NO_X$);
- Sulphur dioxide ($SO_2$);
- Particulate matter less than 2.5 microns in diameter ($PM_{2.5}$);
- Metals in total suspended particulate matter (TSP);
- Polycyclic Aromatic Hydrocarbons (PAHs); and,
- Dioxins and Furans.

A full listing of speciated metals and PAHs to be analyzed is provided in Section 5 of this monitoring plan.

The maximum predicted ground level speciated PAH, dioxins and furans, and metals concentrations due to DYEC emissions are either close to or less than their method detection limits. Therefore it is not expected that appreciable changes in ambient levels of these contaminants will be detected, however they are included in the monitoring due to their potential for human health effects and because they are contaminants of concern to the public.

The contaminant list to be monitored will act as a surrogate for the greater list of chemicals that are expected to be emitted from the DYEC.

## 4.2 Contaminants not Monitored

The following CoPCs were not chosen to be sampled:

- Speciated VOCs;
- Hydrogen Fluoride;
- Hydrogen Chloride; and,
- Ammonia.

VOCs were not chosen to be sampled, as emissions of these contaminants are expected to occur in trace amounts and predicted ambient levels of speciated VOCs are all well below typical laboratory method detection limits for VOC CoPCs included a standard US EPA TO-15 analysis (see Table 4-1). As can be seen in this table, the maximum predicted VOC concentrations are all much less than their respective laboratory detection limits, so no detectable changes in ambient concentrations would be expected to be measured.

**Table 4-1 Comparison of Maximum Predicted Speciated VOC Concentrations to Laboratory MDLs`**

| Contaminant | Laboratory MDL ($\mu g/m^3$) | Maximum Predicted Concentration ($\mu g/m^3$) |
|---|---|---|
| 1,1,1-Trichloroethane | 1.6 | 7.15E-05 |
| 1,2,4-Trichlorobenzene | 14.8 | 2.58E-06 |
| 1,2-Dichlorobenzene | 2.4 | 1.02E-04 |
| Benzene | 0.6 | 1.55E-03 |
| Bromodichloromethane | 1.3 | 1.26E-02 |
| Bromoform | 2.1 | 3.46E-03 |
| Bromomethane | 0.7 | 1.80E-03 |
| Carbon Tetrachloride | 1.9 | 2.16E-05 |
| Chloroform | 0.7 | 2.55E-05 |
| Dichlorodifluoromethane (FREON 12) | 1.0 | 4.36E-03 |
| Ethylbenzene | 0.9 | 5.19E-05 |
| Ethylene Dibromide | 1.3 | 2.03E-05 |
| m / p-Xylene | 1.6 | 3.02E-02 |
| Methylene Chloride(Dichloromethane) | 1.0 | 8.81E-03 |
| o-Xylene | 0.9 | 3.02E-02 |
| Toluene | 0.8 | 2.52E-03 |
| Trichlorofluoromethane (FREON 11) | 1.1 | 8.62E-03 |
| Vinyl Chloride | 0.5 | 2.18E-03 |

Similarly to VOCs, hydrogen fluoride (HF) was not chosen to be monitored as the maximum predicted 24-hour average concentration of 0.05 $\mu g/m^3$ was about two orders of magnitude less than the best available method detection limit. HF will be continuously monitored at the stack and therefore HF emissions to the environment will be well quantified.

Hydrogen chloride was not chosen to be monitored as the maximum predicted 24-hour average concentration of 0.45 $\mu g/m^3$ was about an order of magnitude less than the best available method detection limit. Also HCl will be continuously monitored at the stack and therefore HCL emissions to the environment will be well quantified.

Ammonia was also not included in the monitoring as the maximum predicted $NH_3$ concentration of 0.27 µg/m$^3$ is more than an order of magnitude less than the available method detection limit.

## 4.3 Monitoring Locations

Based on the results of the air quality modelling, the locations of nearby sensitive receptors, and the general siting criteria discussed in the previous sections, three monitoring stations (one downwind, one property line, and one upwind) are proposed for the ambient monitoring program. The selected downwind location takes into account the following specific considerations:

- The dominant wind direction which could result in plume transport to nearby residential receptors is southwesterly;
- The dispersion modelling predicted the highest concentrations over longer-term periods would occur within a 1 to 2 km radius measured from the Site location, with the highest predicted area of influence located to the northeast;
- The land use immediately adjacent to the site is current or future industrial;
- The majority of residential areas are located north of the Site;
- Highway 401 is located approximately 500 m north of the Site;
- There are no residential receptors located between the Site and Highway 401 in the predominant wind direction (winds blowing from southwesterly directions towards the northeast);
- As seen in Figures 2-5 and 2-6, predicted particulate and gaseous deposition is larger at receptors further away from the site as opposed to the receptors immediately adjacent to the site; and,
- The monitor(s) should be situated to capture middle to neighbourhood scales of representativeness (hundreds of metres to 4 km).

Based on these considerations, the proposed downwind ambient monitoring program will monitor the contaminants listed above at a downwind monitoring station sited northeast of the DYEC (in the area with the highest predicted annual-average concentrations). Two alternative sites in the same general area have been identified as being viable alternatives for the monitoring station, shown in Figure 4-1 as Downwind #1 (D-1) and Downwind #2 (D-2). One of these two locations will be used for the downwind monitoring site dependent on successful negotiations with the property owners. The monitoring station will measure all the air contaminants listed in Section 4.1. As can be seen in Figure 1-3, the two proposed alternatives for the downwind monitoring location are in the vicinity of the first grouping of residential receptors downwind of the DYEC in this direction. Both of these locations fall in the area where maximum annual concentrations are predicted to occur (in Figure 2-4 this is taken to be the 0.03 µg/m$^3$/(g/s) contour line). The highest predicted annual concentration was

0.035 µg/$m^3$/(g/s) so anywhere within the 0.03 contour is greater than or equal to 86% of the maximum predicted level.

Location D-1 falls on the edge of this area (on the 0.03 contour line) and would measure about 86% of the max predicted concentration, while Location D-2 falls within the 0.03 contour so would be measuring >86% of the maximum predicted level.

The receptors identified in the EA between these monitoring locations and the DYEC are either industrial (adjacent to the DYEC property) or farmland. These proposed downwind locations are also in the vicinity of elevated deposition predictions for both gaseous and particulate contaminants relative to locations closer the DYEC (see Figures 3-5 and 3-6).

MOE provided feedback on the draft ambient monitoring plan (March 2011) that they would recommend a second downwind ambient monitoring station be included in closer proximity to the site. This recommendation was premised on there being sensitive residential receptors located between locations D-1/D-2 and the Site (south of Highway 401) and that depositions would be higher closer to the Site than at locations D-1/D-2. As noted above, depositions are predicted to be greater further away from the Site than close to the property line (attributable to the very tall stack) and there are no residential receptors between the Site and Highway 401 to the north-west.

MOE has requested (Nov 30th 2011) that a second downwind monitoring station be installed in the vicinity of the plant property line (for a minimum of one year) and measure TSP and metals concentrations after construction is complete. The approximate location of this station, which will be located within the perimeter fence along the north east portion of the DYEC property (near the gas metering station) is presented in Figure 4-1.

One location for the upwind monitoring site requested by the MOE has also been identified. Based on MOE feedback, the siting of the upwind station was requested to be to the west or southwest of the DYEC in order to measure background air quality in the predominantly upwind direction. The proposed location is presented in Figure 4-1 as Upwind #1 (U-1). This location is the same site used for background monitoring during the EA from September 2007 to December of 2008. The monitoring station will continuously measure $SO_2$, $NO_X$, and $PM_{2.5}$ as well as wind speed/direction, temperature, and relative humidity. TSP and metals will also be measured at this station. Monitoring these contaminants is expected to provide sufficient data to determine the DYEC's incremental contribution to local air quality (in an upwind/downwind analysis for facility contribution) as they will act as surrogates for all other potential contaminants. Trees which provided partial obstruction on the site during the EA sampling will be removed for the proposed sampling program.

A comparison of how these proposed locations for the monitoring stations compare to the MOE probe siting criteria for ambient monitors is presented in Table 4-1. All of the proposed locations for the stations meet the criteria. Photos of the alternative locations are shown in Figures 4-2 to 4-4 below.

In the design of the program, monitoring at a nearby soccer field east of the proposed DYEC and west of the Darlington Nuclear Power Plant was considered, due to its proximity to the DYEC Site. As the soccer field may be removed as part of a planned expansion at the Darlington Nuclear Plant, inclusion of monitoring at this location was not considered warranted due to the limited exposure time for participants at this location, and the uncertainty of its use in the near future.

**Table 4-2 Comparison of Proposed Monitoring Locations to Probe Siting Criteria**

| Contaminant | MOE Recommended Criteria | Proposed Downwind Monitoring Station Location[1] | | | Proposed Upwind Monitoring Station Location (U-1) |
|---|---|---|---|---|---|
| | | Alternate Location 1 (D-1) | Alternate Location 2 (D-2) | Property Line | |
| $SO_2$ | 3 - 15 m height above ground | > 3 m | > 3 m | NA | > 3 m |
| | > 1 m vertical and horizontal distance from supporting structure | Yes | Yes | NA | Yes |
| | > 20 m from trees | > 20 m [2] | > 20 m | NA | > 20 m [5] |
| | Distance from sampler to any air flow obstacle must be > 2x height of obstacle above the sampler | Yes | Yes [3] | NA | Yes |
| | Unrestricted air flow in 3 of the 4 wind quadrants | Yes | Yes | NA | Yes |
| | No nearby furnace or incineration flues | N/A | N/A | NA | N/A |
| | Probe material - Pyrex glass or FEP Teflon | Yes | Yes | NA | Yes |
| $NO_2$ | 3 - 15 m height above ground | > 3 m | > 3 m | NA | > 3 m |
| | > 1 m vertical and horizontal distance from supporting structure | Yes | Yes | NA | Yes |
| | > 20 m from trees | > 20 m [2] | > 20 m | NA | > 20 m [5] |
| | Distance from sampler to any air flow obstacle must be > 2x height of obstacle above the sampler | Yes | Yes [3] | NA | Yes |
| | Unrestricted air flow in 3 of the 4 wind quadrants | Yes | Yes | NA | Yes |
| | Spacing from roadways varies with road traffic | Meets criteria [4] | Meets criteria [4] | NA | Meets criteria [4] |

**Table 4-2 Comparison of Proposed Monitoring Locations to Probe Siting Criteria**

| Contaminant | MOE Recommended Criteria | Proposed Downwind Monitoring Station Location[1] | | | Proposed Upwind Monitoring Station Location (U-1) |
|---|---|---|---|---|---|
| | | Alternate Location 1 (D-1) | Alternate Location 2 (D-2) | Property Line | |
| | No nearby furnace or incineration flues | N/A | N/A | NA | N/A |
| Metals/TSP (general) | 2 - 15 m height above ground | > 2 m | > 2 m | > 2 m | > 2 m |
| | > 1 m vertical and > 2 m horizontal distance from supporting structure | Yes | Yes | Yes | Yes |
| | > 20 m from trees | > 20 m [2] | > 20 m | > 20 m | > 20 m |
| | Distance from sampler to any air flow obstacle must be > 2x height of obstacle above the sampler | Yes | Yes [3] | Yes [3] | Yes [3] |
| | Unrestricted air flow in 3 of the 4 wind quadrants | Yes | Yes | Yes | Yes |
| | No nearby furnace or incineration flues | N/A | N/A | N/A | N/A |
| | Distance from sampler to roadway should be > 20-25 m for sampler inlet heights of 2-5 m | > 20 m from side road, > 500 m from Hwy. 401 | > 20 m from side road, > 500 m from Hwy. 401 | > 20 m from Osborne Road, >400-m from Hwy. 401 | > 20 m from side road, > 500 m from Hwy. 401 |
| $PM_{2.5}$ (general) | 2 - 15 m height above ground | > 2 m | > 2 m | NA | > 2 m |
| | > 1 m vertical and > 2 m horizontal distance from supporting structure | Yes | Yes | NA | Yes |
| | > 20 m from trees | > 20 m [2] | > 20 m | NA | > 20 m [5] |
| | Distance from sampler to any air flow obstacle must be > 2x height of obstacle above the sampler | Yes | Yes [3] | NA | Yes |
| | Unrestricted air flow in 3 of the 4 wind quadrants | Yes | Yes | NA | Yes |
| | > 5 m from chimneys with natural gas combustion emissions | N/A | N/A | NA | NA |
| | > 20- 25 m from major roadways | > 20 m from side road, > 500 m from Hwy. 401 | > 20 m from side road, > 500 m from Hwy. 401 | NA | > 20 m from side road, > 500 m from Hwy. 401 |

**Table 4-2 Comparison of Proposed Monitoring Locations to Probe Siting Criteria**

| Contaminant | MOE Recommended Criteria | Proposed Downwind Monitoring Station Location[1] | | | Proposed Upwind Monitoring Station Location (U-1) |
|---|---|---|---|---|---|
| | | Alternate Location 1 (D-1) | Alternate Location 2 (D-2) | Property Line | |
| PAHs and Dioxins/ Furans | 3 - 15 m height above ground | > 3 m | > 3 m | NA | NA |
| | > 1 m vertical and > 2 m horizontal distance from supporting structure | Yes | Yes | NA | NA |
| | No nearby sources of PAHs, dioxins which could interfere with sample results | Yes | Yes | NA | NA |
| Wind speed and Direction | => 10 m height above ground | > 10 m | > 10 m | NA | >10 m |
| | > 1 building height (H) upwind of a building obstruction | Yes | Yes | NA | Yes |
| | > 1.5 H above building roof for rooftop installation | Yes | Yes | NA | Yes |
| | > 5-10 H downwind of building | Yes | Yes [3] | NA | Yes [6] |
| | > 10 m above dense vegetative canopy | N/A | N/A | NA | N/A |
| | > 2 tower side widths (D) for boom installations | N/A | N/A | NA | N/A |
| Air Temperature | > 2 m height above ground | > 2 m | > 2 m | NA | > 2 m |
| | Temperature sensor > 4 obstruction heights and > 30 m from large paved areas | Yes | Yes | NA | Yes |
| | > 1 D for tower mast installations | Yes | Yes | NA | Yes |

Note:

1 – Final sampler locations on the potential sites are still to be determined.

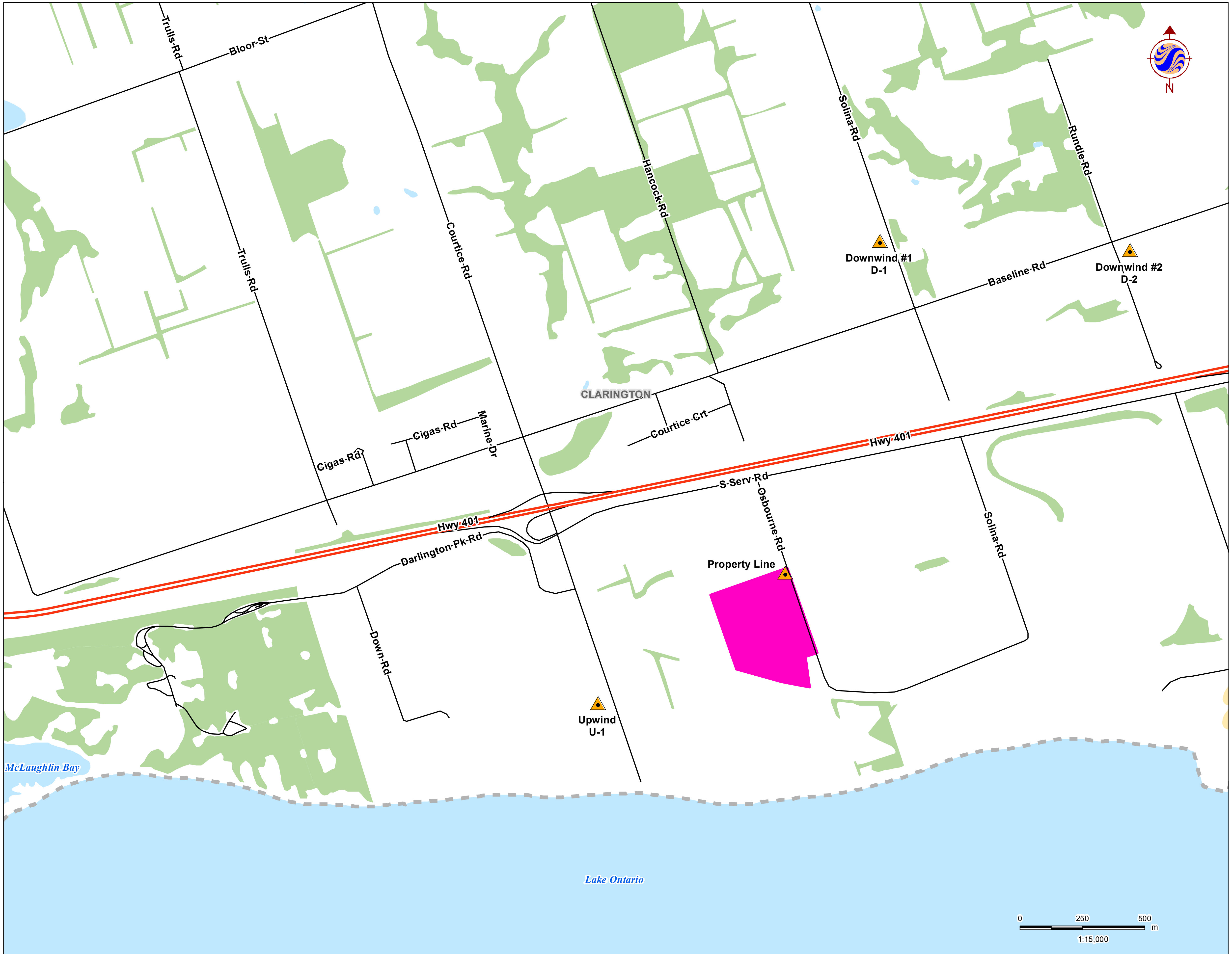
2 – Alternate Location #1 has some trees located to the north of the potential sampling location, as shown in Figure 4-2. It is anticipated that a sampling location can be chosen on the potential site to meet the MOE recommended separation distance of at least 20 m.

3 – Alternate Location #2 has a one-story structure located on the site, as shown in Figure 4-3. It is anticipated that a sampling location can be chosen on the potential site to meet the MOE recommended separation distance.

4 – Both sites meet the recommended separation distances between sampler locations and roadways of different capacities as listed in the MOE document “Operations Manual for Air Quality Monitoring in Ontario”.

5 – With removal of two trees, the 20-m spacing criteria can be met.

6 – The monitor will be located in a predominantly upwind location about 4H from the nearest building. Station not downwind of this building for the predominant wind direction.




## Legend

- Station Location
- Road
- Highway
- Proposed EFW Facility Site
- Waterbody
- Wooded Area

## Notes

1. Coordinate System: UTM NAD 83 - Zone 17 (N).
2. Data provided by Ontario Ministry of Natural Resources. Copyright 2004 Queen's Printer Ontario
3. One of D-1 or D-2 to be chosen for downwind station location.

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RESIDUAL WASTE STUDY

Figure No.
4-1

Title

**Location of Proposed Monitoring Locations**

Projection text in notes (2nd note should still reflect the base features copyright):
Coordinate System: NAD 1983 UTM Zone 17N

**Figure 4-2 Proposed Location for the Downwind Monitoring Station – Alternative D-1**

**Figure 4-3 Proposed Location for the Downwind Monitoring Station – Alternative D-2**

**Figure 4-4 Proposed Location for the Upwind Monitoring Station – U-1**

Note – photograph shows the ambient monitoring station for the EA 2008 measurements on the site.

**Table 4-3 UTM Coordinates of Proposed Monitoring Locations**

| Location | UTM Northing (m) | UTM Easting (m) |
|---|---|---|
| Downwind D-1 | 4861915 | 680995 |
| Downwind D-2 | 4861877 | 681997 |
| Property Line [1] | ~ 4860586 | ~ 680616 |
| Upwind U-1 | 4860067 | 679899 |

1 – Location approximate. Exact location will be finalized in consultation with the MOE prior to installation.

# 5 INSTRUMENTATION AND DATA ACQUSITION

The measurement program at the monitoring site will include 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 ($SO_2$) will be conducted on a continuous basis over the duration of the ambient air monitoring program. Monitoring for metals in total suspended particulates (TSP), polycyclic aromatic hydrocarbons (PAHs) and dioxins and furans will be conducted at the downwind monitoring station with non-continuous monitors, per the methodology and analysis recommended by the MOE Operations Manual (MOE, 2008).

A 10-m meteorological tower will be installed at each station to continuously monitor wind speed, wind direction, atmospheric temperature and relative humidity. Barometric pressure will be measured at one station.

The following sections detail the continuous and non-continuous monitors proposed for this sampling program.

## 5.1 Continuous Ambient Monitors

### 5.1.1 Respirable Particulate Matter ($PM_{2.5}$)

The $PM_{2.5}$ sampler will consist of a Thermo Sharp 5030 Synchronized Hybrid Ambient Real-time Particulate Monitor (or equivalent). The sampler operates using a synchronized hybrid approach combining light scattering photometry and beta radiation attenuation for continuous $PM_{2.5}$ measurement.

| | |
|---|---|
| Principle of Operation: | Light Scattering Photometry/Beta Attenuation |
| Range: | 0-10 mg/m$^3$ |
| Time interval: | 1 minute |

### 5.1.2 Nitrogen Oxides ($NO_X$)

The $NO_X$ sampler will consist of an API Model 200E Chemiluminescence Analyzer (or equivalent) to measure continuous concentrations of nitric oxide (NO), nitrogen dioxide ($NO_2$) and nitrogen oxides ($NO_X$). The sampler operates based on the principle of chemiluminescence, where the amount of light given off during a chemical reaction is measured. Nitric oxide (NO) reacts with ozone ($O_3$) to produce nitrogen dioxide ($NO_2$), 10 %

electronically excited nitrogen dioxide ($NO_2$*) and oxygen. Following the NO-O3 reaction, the $NO_2$* molecules immediately revert to $NO_2$. This process creates a light emission directly proportional to the NO concentration in the sample. The intensity of the resulting light emission is then measured by a photomultiplier tube and associated electronics. An $NO_2$ to NO converter will be used to measure the amount of $NO_X$ (NO + $NO_2$) in the sample.

| | |
|---|---|
| Principle of Operation: | Chemiluminescence |
| Range: | 0-1000 ppb |
| Time interval: | 1 second |

### 5.1.3 Sulphur Dioxide ($SO_2$)

The $SO_2$ sampler will consist of a Teledyne Monitor Labs Sulphur Dioxide Analyzer (or equivalent). The sampler operates using the principle of "Pulsed Fluorescence". Sulphur dioxide molecules absorb fluorescent energy, producing electronically excited $SO_2$ molecule with a known spectral decay rate to the ground state. The fluorescence emitted by the reaction is detected by a photo multiplier tube and the signal is converted proportionally to an electronic output signal which is then captured by a data logger.

| | |
|---|---|
| Principle of Operation: | Pulsed Florescence |
| Range: | 0-1000 ppb |
| Time interval: | 1 second |

## 5.2 Non-Continuous Ambient Monitors

### 5.2.1 Metals in Total Suspended Particulate (TSP)

Total suspended particulate matter (TSP) and metals will be collected onto pre-weighed, conditioned Teflon coated glass fibre filters for a 24-hour period using a Tisch Environmental TE-5170 volumetric-flow high volume sampler (or equivalent) measuring TSP. This monitor operates by continuously drawing a sample of ambient air through a filter onto which particulate matter is deposited. The filters will be subsequently weighed for particulate loading and analysed using the Atomic Emission Spectroscopy/Inductively Coupled Plasma (AES/ICP) technique to determine metals content. Analysis of the TSP/metals samples will be conducted by a Canadian Assurance for Laboratory Accreditation (CALA) accredited laboratory following MOE guidance. The sampling schedule will correspond with the MOE's province-wide ambient sampling schedule (one sample taken every six days).

The list of metals to be analysed is:

- Aluminum (Al)
- Antimony (Sb)
- Boron (B)
- Thallium (Tl)
- Arsenic (As)
- Barium (Ba)
- Beryllium (Be)
- Cadmium (Cd)
- Chromium (Cr) (Total)
- Cobalt (Co)
- Lead (Pb)
- Mercury (Hg)
- Manganese (Mn)
- Nickel (Ni)
- Phosphorus (Ph)
- Selenium (Se)
- Silver (Ag)
- Tin (Sn)
- Vanadium (V)
- Zinc (Zn)

Additionally, although not expected to be emitted from the DYEC in appreciable quantities (based on the literature review of EFW emissions conducted as part of the EA), to address comments received from the Ambient Air Monitoring and Reporting Working Group (AAMRWG), the following additional metals will be monitored:

- Bismuth (Bi)
- Magnesium (Mg)
- Strontium (Sr)
- Thallium (Tl)
- Uranium (U)
- Zirconium (Zr)
- Copper (Cu)
- Iron (Fe)
- Molybdenum (Mo)
- Titanium (Ti)

### 5.2.2 Polycyclic Aromatic Hydrocarbons (PAHs) and Dioxins and Furans

PAHs and dioxins and furans will be collected with Tisch Environmental TE-1000 mass-flow high volume air samplers (or equivalent). The samplers will be located on the roof of the instrumentation shelter to meet the required MOE siting characteristics. Each sampler is equipped with a dual chambered sampling module to contain a Teflon-coated glass fibre filter and a Poly-Urethane Foam (PUF) cartridge. PAHs will be collected for a 24-hour period at 12-day intervals and dioxins and furans will be collected, also for a 24-hour period, at 24-day intervals.

The list of PAHs to be analyzed is:

- 1-Methylnaphthalene
- 2-Methylnaphthalene
- Acenaphthene
- Acenaphthylene
- Anthracene
- Benzo(a)anthracene
- Benzo(a)fluorene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(b)fluorene
- Benzo(e)pyrene
- Benzo(g,h,i)perylene
- Benzo(k)fluoranthene
- Chrysene
- Dibenz(a,h)anthracene
- Dibenz(a,c)anthracene
- Fluoranthene
- Indeno(1,2,3-cd)pyrene
- Naphthalene
- Biphenol
- Perylene
- Phenanthrene
- Pyrene
- Tetralin
- o-Terphenyl
- Total PAHs

The samples will be submitted to a CAL accredited laboratory. PAHs and dioxins/furans will be analyzed using Gas Chromatography/Mass Spectrometry (GC/MS) as per the protocols defined by US EPA Compendium Method TO-13A (for PAHs) and Compendium Method TO 9A (for dioxins and furans).

## 5.3 Data Acquisition System

In addition to instrument resident data logging registers, a rack mounted digital data acquisition system (DAS) will be installed. Although the exact DAS model has not been determined, a typical model, such as a Campbell Scientific CRX1000 station data acquisition system (or equivalent) will be used to collect ambient instrument data and status codes from the ambient air monitors. Typically, continuous station data will be maintained in the data loggers, and data will be viewed locally using a laptop and the relevant DAS software applications. The logger will typically store approximately 21 days of five minute averages and 3 months of one hour averages. If possible, the DAS will acquire data and control the ambient analyzers via serial communication. Remote data transmission will be accomplished by the periodic transmission of collected station air quality data via phone line.

## 5.4 Meteorological Tower

Horizontal wind speed, wind direction, ambient temperature, relative humidity, barometric pressure, and rainfall will be collected. The meteorological sensors will be mounted on an external telescoping 10 m aluminum tower. Meteorological sensor measurement data will be logged using the DAS mentioned above. The proposed meteorological equipment will be:

- Wind Speed/Wind Direction: Met One Instruments Inc. Model 034B (or equivalent)
- Temperature: Campbell Scientific Model 107 (or equivalent)
- Relative Humidity: Campbell Scientific Model HMP60 (or equivalent)
- Atmospheric Pressure: Campbell Scientific Model CS106 (or equivalent)
- Rainfall: Texas Electronic TE525M (or equivalent)

## 5.5 Equipment Enclosure and Sampling Manifold

A custom instrumentation shelter will be used to store the monitoring equipment. The shelter will have a steel frame structure covered in a weatherproof exterior. A rooftop guardrail and accompanying ladder will be installed to provide access to the hi-volume samplers. Wall mounted HVAC units will be installed to provide adequate heating and cooling to the shelter during different weather conditions, which will ensure correct temperature readings during the sampling.

A shelter temperature of 20-25°C will be maintained to within +/- 1°C by an automatic heat/cool thermostat with adjustable hysteresis. The shelter temperature will be measured and collected along with the pollutant and meteorological data, and alarmed with limits. Out-of-limit shelter temperature conditions will be immediately flagged and communicated to maintenance technicians via phone line/cellular call out.

Ambient air will be drawn into the station using an insulated 6” Teflon lined stainless steel sampling cane and, 4 port manifold (or equivalent). The manifold flow rate will be approximately 60 cubic feet per meter (cfm) to ensure an adequate ambient air exchange rate. The temperature control on the manifold will be automatically adjusted to ensure that the manifold temperature is at least 10°C above the ambient dew point to prevent the formation of condensation or water droplets.

# 6 LABORATORY ANALYTICAL PROCEDURES

All samples will be obtained and analysed following US EPA reference or equivalent methods, as per the MOE Operations Manual (MOE, 2008). A summary of the contaminants to be assessed by laboratory analytical procedures during this monitoring program and their laboratory reference methods is provided below.

**Table 6-1 Summary of Laboratory Reference Methods**

| Contaminant | Laboratory Reference Method |
|---|---|
| Total Suspended Particulate (TSP) and Metals | US EPA Manual Reference Method: 40 CFR Part 50, Appendix B<br>Compendium Method IO-3 with Atomic Emission Spectroscopy/Inductively Coupled Plasma (AES/ICP) |
| Polycyclic Aromatic Hydrocarbons (PAHs) | Gas Chromatography/Mass Spectrometry (GC/MS) following US EPA Method TO-13A |
| Dioxins and Furans | Gas Chromatography/Mass Spectrometry (GC/MS) following US EPA Method TO-9A |

A summary of the method detection limits to be used in the analysis versus their applicable air quality criteria is presented in Tables 6-2 to 6-4. As required by the MOE, the MDLs for all contaminants are at least a factor of ten less than their applicable criteria (with the exception of the dioxin and furan MDL for which a single value for the MDL cannot be presented, as explained below).

**Table 6-2 Method Detection Limits for Metals**

| Contaminant | MOE 24-Hour Criteria (µg/m$^3$) | MDL (µg/m$^3$) [1] | Ratio of MDL to Criteria |
|---|---|---|---|
| Aluminum | 4.8 | 1.18E-02 | 408 |
| Antimony | 25 | 5.88E-03 | 4250 |
| Arsenic | 0.3 | 3.53E-03 | 85 |
| Barium | 10 | 5.88E-04 | 17000 |
| Beryllium | 0.01 | 5.88E-04 | 17 |
| Boron | 120 | 3.53E-03 | 34000 |
| Cadmium | 0.025 | 1.18E-03 | 21 |
| Total Chromium (and compounds) | 0.5 | 1.18E-03 | 425 |
| Cobalt | 0.1 | 1.18E-03 | 85 |
| Lead | 0.5 | 1.76E-03 | 283 |

**Table 6-2 Method Detection Limits for Metals**

| Contaminant | MOE 24-Hour Criteria ($\mu g/m^3$) | MDL ($\mu g/m^3$) [1] | Ratio of MDL to Criteria |
|---|---|---|---|
| Nickel | 0.2 | 1.76E-03 | 113 |
| Phosphorus | 0.35 | 1.47E-02 | 24 |
| Silver | 1 | 5.88E-04 | 1700 |
| Selenium | 10 | 5.88E-03 | 1700 |
| Tin | 10 | 5.88E-03 | 1700 |
| Vanadium | 2 | 1.18E-03 | 1700 |
| Zinc | 120 | 2.94E-03 | 40800 |
| Bismuth | no criteria | 3.53E-03 | NA |
| Copper | 50 | 1.18E-03 | 42500 |
| Iron | 4 | 2.94E-03 | 1360 |
| Magnesium (JSL List) | 0.2 | 5.88E-03 | 34 |
| Molybdenum | 120 | 1.76E-03 | 68000 |
| Strontium | 120 | 5.88E-04 | 204000 |
| Thallium (JSL List) | 0.24 | 5.88E-03 | 40.8 |
| Titanium | 120 | 5.88E-04 | 204000 |
| Uranium | 0.3 | 1.76E-02 | 17 |
| Zirconium (JSL List) | 20 | 5.88E-04 | 34000 |

**Note:** 1 - Based on a hi-vol sample volume of 1700 $m^3$ in a 24-hour period (typical value from EA ambient monitoring program).

**Table 6-3 Method Detection Limits for PAHs**

| Contaminant | MOE 24-Hour Criteria ($\mu g/m^3$) | MDL ($\mu g/m^3$) [1] | Ratio of MDL to Criteria |
|---|---|---|---|
| Acenaphthylene | 3.5 | 9.42E-05 | 37170 |
| Acenaphthene | no criteria | 9.42E-05 | NA |
| Anthracene | 0.2 | 9.42E-05 | 2124 |
| Benzo(a)anthracene | no criteria | 9.42E-05 | NA |
| Benzo(b)fluoranthene | no criteria | 9.42E-05 | NA |
| Benzo(k)fluoranthene | no criteria | 9.42E-05 | NA |
| Benzo(a)fluorene | no criteria | 1.88E-04 | NA |
| Benzo(b)fluorene | no criteria | 1.88E-04 | NA |
| Benzo(ghi)perylene | 1.2 | 9.42E-05 | 12744 |

**Table 6-3 Method Detection Limits for PAHs**

| Contaminant | MOE 24-Hour Criteria ($\mu g/m^3$) | MDL ($\mu g/m^3$) [1] | Ratio of MDL to Criteria |
|---|---|---|---|
| Benzo(a)pyrene [2] | 5.0E-05 | 5.6E-08 | 885 |
| Benzo(e)pyrene | no criteria | 1.88E-04 | NA |
| Biphenyl | no criteria | 1.88E-04 | NA |
| Chrysene | no criteria | 9.42E-05 | NA |
| Dibenzo(a,h)anthracene | no criteria | 9.42E-05 | NA |
| Fluoranthene | 140 | 9.42E-05 | 1486800 |
| Indeno(1,2,3-cd)pyrene | no criteria | 9.42E-05 | NA |
| 1-methylnaphthalene | 12 | 1.88E-04 | 63720 |
| 2-methylnaphthalene | 10 | 1.88E-04 | 53100 |
| Naphthalene | 22.5 | 1.36E-04 | 165938 |
| Perylene | no criteria | 1.88E-04 | NA |
| Phenanthrene | no criteria | 9.42E-05 | NA |
| Pyrene | 0.2 | 9.42E-05 | 2124 |
| Tetralin | 1200 | 1.88E-04 | 6372000 |
| O-terphenyl | no criteria | 1.88E-04 | NA |

**Note:** 1 - Based on a hi-vol sample volume of 531 $m^3$ in a 24-hour period (typical value from EA ambient monitoring program).
2 – Using High Resolution Mass Spectrometry (HRMS)

**Table 6-4 Method Detection Limits for Dioxins and Furans**

| Contaminant | MOE 24-Hour Criteria ($\mu g/m^3$) | MDL ($\mu g/m^3$) [1] | Ratio of MDL to Criteria |
|---|---|---|---|
| Dioxins and Furans (TEQ) | 1.00E-07 | 6.3E-09 to 2.4E-08 | 16 to 4 |

**Note:** 1 - Based on a hi-vol sample volume of 531 $m^3$ in a 24-hour period and maximum and minimum TEQ DL values from the EA ambient monitoring program.

For dioxins and furans, a TEQ MDL range is presented in Table 6-4. The TEQ MDL will vary depending on the estimated detection limit of each dioxin and furan cogener included in the TEQ calculation and therefore cannot be accurately represented by a single value. To gauge the relative range of the expected dioxin and furan TEQ MDLs, the maximum and minimum sample specific DLs measured during the EA ambient monitoring program were examined. The ratio of laboratory TEQ DLs to the MOE dioxin and furan AAQC varied from 16 to 4. The factor of 16 meets the MOE criteria for the MDL to be 10 times lower than the AAQC. At the other end of the range, the ratio of 4 would not meet the MOE requirement, but would meet the US EPA requirement for dioxin and furan ambient monitoring presented in 40 CFR Part 136, Appendix B (DL to be less than 1/3 of the regulatory compliance level).

# 7 QUALITY ASSURANCE PROCEDURES

## 7.1 Operator Requirements

The proposed monitoring program will be operated by a third-party consultant hired by the Regions. The consultant will be responsible for all data analysis and for preparing both quarterly and annual reports summarizing the monitoring to date.

The consultant will be required to provide the Regions with a quality plan for operating and maintaining the monitoring program, which will include the following general provisions:

- All field activities will be recorded in standardized field notes. Hi-vol data sheets will include initial and final flow measurements for each sample;
- Chain of custody forms will be completed and submitted along with exposed samples to the CALA laboratory used for analysis;
- All original containers will be used when submitting filters for analysis to avoid cross-contamination of samples, which will be recorded in the chain of custody forms; and,
- Maintaining training records for all personnel involved in the project.

## 7.2 Instrumentation Calibration

Samplers will be bench-tested and calibrated prior to their installation in the field. If required, the samplers will be re-calibrated once installed before their first use. On-going calibration of the samplers will follow the recommended calibration schedule listed in the MOE Operations Manual (MOE, 2008), but will be done on a quarterly basis at a minimum.

MOE will conduct periodic audits of the equipment including prior to commencement of the monitoring program.

## 7.3 Accuracy Checks of Analysis Techniques

Travel and field blank samples will be submitted to the CALA accredited laboratory to ensure the accuracy of the analytical techniques used. Blank samples will account for ten percent (10%) of total submitted samples.

## 7.4 Sample Collection and Transportation

Samples will be properly handled to ensure that there is no contamination. For filters this entails the use of surgical gloves and tweezers to avoid contamination. All samples will be carefully removed from the monitoring device by a trained operator, and placed in sealed, non-reactive containers. All samples will be placed in protective cases for protection from breakage, contamination or loss during transportation.

Quality records for sample collection will be maintained. The quality record will include at least the following parameters:

- Station ID;
- Station name/location;
- Filter/canister ID;
- Sample start date/time;
- Sample end date/time or elapsed time;
- Date/time sample collected;
- Technician name;
- Meteorological conditions during sampling; and,
- Comments on visual inspection of filters/canisters prior to and after sampling.

## 7.5 Data Review and Validation

Data collected from the continuous monitors will be screened for any suspicious data including outliers, instrumentation drift and missing data following MOE protocols given in the document Operations Manual (MOE, 2008). In general, the Operations Manual states that at a minimum, the required rate of recovery of valid data for both continuous and non-continuous monitors is 75% (both seasonally and annually). In addition, for $NO_X$ and $SO_2$ sampling, zero drifts beyond 5 parts per billion (ppb) require an off-set adjustment.

A final data screening of all measurement data will be performed at the end of the monitoring program to examine overall trends and to identify and correct any suspect data following MOE protocols (MOE, 2008).

# 8 REPORTING REQUIREMENTS

Both quarterly and annual reports will be generated that include the results of the ambient monitoring program. The quarterly reports will follow a standardized format to be agreed upon by the Regions, and will include the following statistical information as required by the MOE (MOE, 2008):

For Continuous Monitors:

- Period Arithmetic Mean;
- Monthly Arithmetic Mean;
- Maximum for any averaging period used for comparison to statutory or regulatory limits;
- Maximum 24-hour; and,
- Percentage of valid hours.

For Non-Continuous Monitors:

- No. of valid samples;
- Percentage of valid data;
- Period arithmetic mean;
- Period geometric mean (TSP only);
- Maximum 24-hour value; and,
- Maximum monthly value.

In addition, should a validated exceedance of O.Reg.419/05 criteria occur, it will be reported. For quarterly report submissions, continuous and non-continuous data will be submitted electronically (Excel format) along with the report. Edit logs for all continuous and non-continuous monitors will be provided in the quarterly reports.

Annual reports will follow a similar format to the quarterly reports, and will include both a summary and analysis of the ambient monitoring program of the previous year. In addition to the required sections as detailed for the quarterly report, the annual report will include the following:

- A map showing the location of emitting sources, property boundaries, and monitoring stations, including scaling and north arrow;
- A summary of overall operations, e.g., summary of parameters monitored and equipment/model numbers, frequency of site visits and calibrations, confirmation of data backups and/or archiving, list of problems that resulted in significant losses of data along with remedial actions;

- A summary of audits and audit outcomes;
- Summary statistics, including:
  - Annual Arithmetic Mean;
  - Annual Geometric Mean (TSP only);
  - Maximum 1-hour (continuous data only);
  - Maximum 24-hour;
  - Number of valid hours or sampling periods;
  - Percent of valid data;
- A summary of any exceedences of O.Reg.419/05 or other applicable criteria for each applicable averaging period and the number of times exceedances occurred; and,
- A comparison to historical data collected at the monitoring station.

Further requirements for both the quarterly and annual reports can be found in the MOE Operations Manual (MOE, 2008).

The quarterly and annual reports and data collected from the monitoring program will be made available to the Ontario Ministry of Environment per the requirements of the MOE Operations Manual (MOE, 2008). The Regions will make this information available to other parties per the requirements of the Minister's Notice of Approval for the EA.

# 9 DATA REVIEW AND TRIGGERS FOR PROGRAM ALTERATION

## 9.1 Data Review and Corrective Actions

Bi-weekly screening of the analytical data will be conducted to ensure that short-term 1 hour and 24 hour objectives are met. These are acute exposure timeframes that should be monitored to ensure that health and the environment are protected in between the timeframe of preparing quarterly and annual reports. This process will be conducted for the first year of monitoring during DYEC operation and the need for continued review will be re-visited based on the results of the first year. The results of the bi-weekly review will be summarized in a letter report to the Regions only (the MOE will be notified of exceedances, as described below).

Two sets of standards will be used for comparison to the air quality data during the screening process. The first set of standards will be the limits reported in O.Reg.419/05 (Schedules 3 and 6). These are compliance based standards used through the province of Ontario. However, not all chemicals have O.Reg.419/05 criteria, or in some instances updated health-based standards were used in the human health risk assessment (HHRA) conducted in support of the Environmental Assessment. These health-based values, which are 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, 2009b) will be used as the second set of standards.

If at any time at the monitoring locations the 1 hour and 24 hour criteria are exceeded for one or more contaminants, then the Regions, the MOE and the Medical Officer of Health (MOH) for Durham Region will be immediately notified and an investigation into the root cause will be undertaken, as there may be several potential explanations for an exceedance other than the DYEC emissions (e.g. other emissions sources, instrument malfunction, field handling/laboratory analysis errors, etc). The notification of exceedances of applicable air standards for ambient air quality criteria will be reported to the MOE District Manager within 7 days of the exceedance(s) being identified. It is noted that minor exceedances of the health-based standards may not necessarily be cause for concern. These benchmarks have a number of safety factors built in and the toxicological endpoint is usually an irritant effect for the 1 hour values, such that it would be highly unlikely of anyone experiencing an actual health effect. A qualified toxicologist will evaluate the magnitude of the exceedance and the potential for health effects.

If it is determined that the DYEC was the likely cause, for example through review of facility operations and stack emissions data during that period, then the MOE will be formally notified as per the requirements of Section 28 of O. Reg. 419/05. Appropriate corrective actions will be undertaken in consultation with the Region, MOE and MOH and following the requirements of Section 28 of O. Reg. 419/05.

## 9.2 Monitoring Program Review

### 9.2.1 Placement and Location of Ambient Monitoring Stations

Selection of the two monitoring stations – upwind and downwind – was based on sound science and engineering practices and professional experience of the air quality engineers. The MOE has also requested that a property line station be installed. If ongoing review of the monitoring data suggests that any of the monitoring stations are not providing relevant information to the program objectives, then in consultation with the MOE, consideration will be given to altering their location(s).

If unexpected results (e.g., measured exceedances of contaminants attributable to DYEC emissions or measured concentrations are significantly higher than those predicted in the EA for the DYEC emissions) then consideration will be given to installation of additional monitoring locations and/or relocation of the existing stations.

Neither of these decisions would be made without detailed review of the data in consultation with the MOE, Regions and the MOH.

### 9.2.2 Environmental Assessment Model Validation

One of the objectives of the air monitoring program will be to assess the accuracy of the dispersion modeling exercise undertaken during the Environmental Assessment and used to evaluate the potential risk to health and the environment.

Once an appropriate amount of air quality data has been collected at both monitoring locations (a minimum of one-year of measurements (with a 75% data completeness in each quarter) during DYEC operation or to the satisfaction of the Regional Director), it will be used to validate the predictions made in the EA. Model validation procedures will include comparison of maximum measured concentrations at each stations (for each contaminant) to the EA predictions and development of Q-Q plots or measured and modeled concentrations at each location.

If the air quality model predictions used in the EA/HHRA are shown to be either reflective of actual measurements or higher than those measured during facility operation, then no further action would be required. This would mean that the values used in the risk assessment were accurate / conservative and that predictions of potential risk to human and ecological receptors would remain valid.

If air quality modeled predictions underestimated actual ground level concentrations measured during DYEC operation, then the results of the HHERA would need to be revisited using the actual measured data. This would be required for only those chemicals that have higher ground level concentrations that could be attributed to the facility. It is important to note that if higher concentrations are measured at ground level during operation it does not necessarily mean that there would be an unacceptable health or ecological risk. For the majority of chemicals and exposure timeframes (i.e., 1 hour, 24 hour, and annual) the concentration ratios (CR) and incremental lifetime cancer risks (ILCRs) that were used to benchmark potential health risks were often several orders of magnitude below those of concern.

In the event that measured ground level concentrations during DYEC operations are above the health thresholds, then immediate notification of the MOE, Regions and MOH would be required and appropriate corrective actions undertaken in consultation with the Region, MOE and MOH.

### 9.2.3 Revisions to the Ambient Monitoring Plan

As noted in Section 11.6 of the Provincial Minister's Notice of Approval to Proceed with the Undertaking, the Regional Director may require changes be made (or approve requested changes) to this ambient monitoring and reporting plan. The Region shall revise the plan and implement it in accordance with the required/requested changes.

# 10 CLOSURE

This Ambient Monitoring Plan (Report) has been prepared by Stantec Consulting Limited (Stantec) for the use of the Regions of Durham and York. The assessment represents the conditions of the proposed DYEC and other identified locations only at the time of the assessment, and is based on the information referenced and contained in this Report. The conclusions presented herein respecting current conditions and potential future conditions at the DYEC and other identified locations represent the best judgment of the assessor based on current environmental standards and information. Stantec attests that to the best of our knowledge, the information presented in this Report is accurate. The use of this Report for other projects or matters without the written permission of Durham Region, York Region and Stantec is solely at the user's own risk.

Respectfully Submitted,

**STANTEC CONSULTING LTD.**

***Original Signed by G. Crooks***

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