APPENDIX C

Emission Summary and Dispersion Modelling Report

December 2014

APPENDIX C

Emission Summary and Dispersion Modelling Report
Volume IV Design and Operations Report
Capital Region Resource Recovery Centre

REPORT

Report Number: 12-1125-0045/4500/vol IV

Golder Associates

Executive Summary

This Emission Summary and Dispersion Modelling (ESDM) Report was prepared in support of the Design and Operation (D&O) Report for the proposed Capital Region Resource Recovery Centre (CRRRC) facility located in Ottawa, Ontario (the Facility) as proposed by Taggart Miller Environmental Services (Taggart Miller). In preparing this ESDM, Guidance in the Ontario Ministry of the Environment and Climate Change (MOECC) publication "*Guideline A-10: Procedure for Preparing an Emission Summary and Dispersion Modelling (ESDM) Report, Version 3.0"*, dated March 2009 (ESDM Procedure Document) PIBS 3614e03 was followed, as appropriate.

The CRRRC is proposed to provide facilities and capacity for the recovery of resources and diversion of materials from disposal for wastes that are generated by the Industrial, Commercial and Institutional (IC&I) and Construction and Demolition (C&D) sectors in Ottawa and eastern Ontario. It would also provide landfill disposal capacity for post-diversion residuals and materials that are not diverted. The Facility is expected to emit products of combustion, suspended particulate matter, as well as other emission by-products from waste processing and management. The North American Industry Classification System (NAICS) codes that apply to the Facility are 562920 (Material Recovery Facilities) and 562210 (Waste Treatment and Disposal), the second of which is listed in Schedule 5 of *Ontario Regulation* (O. Reg.) 419.05. The modelled emission inventory includes process sources as well as fugitive sources.

The maximum emission rates for each significant contaminant emitted from the significant sources were calculated in accordance with s.11 of O. Reg. 419/05 and the data quality assessment follows the classification system outlined in the ESDM Procedure Document.

The Facility is subject to s.20 of O. Reg. 419/05, therefore the modelled impact of contaminant emissions were assessed against the Schedule 3 standards using the AERMOD model, which is an approved dispersion model under O. Reg. 419/05. The modelling scenario, for the relevant averaging period, assumed operating conditions for the Facility that result in the highest concentration of each significant contaminant at a point of impingement (POI). The results are presented in the following Emission Summary Table.

The POI concentrations listed in the Emission Summary Table were compared against published MOECC POI Limits as described in the ESDM Procedure Document.

This ESDM Report demonstrates that the Facility can operate in compliance with s.20 of O. Reg. 419/05.

Table I: Emission Summary Table

Contaminant	CAS No.	Total Facility Emission Rate [g/s]	Air Dispersion Model Used	Maximum POI Concentration [µg/m³]	Averaging Period [hours]	MOECC POI Limit [µg/m³]	Regulation Schedule No.	Percentage of MOECC Limit [%]
Sulphur Dioxide	7446-09-5	0.102	AERMOD	8.54	24	275	Schedule 3	3.1%
Sulphur Dioxide	7446-09-5	0.102	AERMOD	15.91	1	690	Schedule 3	2.3%
Hydrogen Sulfide	7783-06-4	0.0077	AERMOD	0.26	24	7	Schedule 3	3.7%
Hydrogen Sulfide	7783-06-4	0.0077	AERMOD	0.79	10-min	13	Schedule 3	6.1%
Nitrogen Oxides	10102-44-0	3.24	AERMOD	37.15	24	200	Schedule 3	18.6%
Nitrogen Oxides	10102-44-0	3.24	AERMOD	68.90	1	400	Schedule 3	17.2%
Carbon Monoxide	630-08-0	6.17	AERMOD	872.4	½	6000	Schedule 3	14.5%
Vinyl chloride	75-01-4	0.0006	AERMOD	0.021	24	1	Schedule 3	2.1%
Suspended particulate matter (< 44 µm Diameter)	N/A	1.38	AERMOD	98.23	24	120	Schedule 3	81.9%
PM_{10}	N/A	0.64	AERMOD	23.30	24	50	AAQC	46.6%
$PM_{2.5}$	N/A	0.46	AERMOD	20.16	24	25	AAQC	80.6%
Odour	N/A	21732	AERMOD	0.58	10-min	1	Guideline	57.8%

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EMISSION SUMMARY AND DISPERSION MODELLING REPORT CHECKLIST

Company Name:	Taggart Miller Environmental Services
Company Address:	c/o 225 Metcalfe Street, Suite 708, Ottawa, Ontario, K2P 1P9
Location Facility	Boundary Road and Devine Road, Ottawa, Ontario

The attached Emission Summary and Dispersion Modelling Report was prepared in accordance with s.26 of O. Reg. 419/05 and the guidance in the MOECC document "Procedure for Preparing an Emission Summary and Dispersion Modelling Report" dated March 2009 and "Air Dispersion Modelling Guideline for Ontario" dated March 2009 and the minimum required information identified in the check-list on the reverse of this sheet has been submitted.

Company Contact:	Taggart Miller Environmental Services
Name:	Derek Cathcart
Title:	General Manager of Engineering
Phone Number:	905-415-7317
Signature:	
Date:	

Technical Contact:	
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Date:	

EMISSION SUMMARY AND DISPERSION MODELLING REPORT CHECKLIST

	Required Information			
			Submitted	**Explanation/Reference**
	Executive Summary and Emission Summary Table			
	1.1	Overview of ESDM Report	☒ Yes	Executive Summary
	1.2	Emission Summary Table	☒ Yes	Table I
1.0	**Introduction and Facility Description**			
	1.1	Purpose and Scope of ESDM Report (when report only represents a portion of facility)	☒ Yes	Section 1.1
	1.2	Description of Processes and NAICS code(s)	☒ Yes	Section 1.2
	1.3	Description of Products and Raw Materials	☒ Yes	Section 1.2.1
	1.4	Process Flow Diagram	☒ Yes	Figures 2A and 2B
	1.5	Operating Schedule	☒ Yes	Section 1.3
2.0	**Initial Identification of Sources and Contaminants**			
	2.1	Sources and Contaminants Identification Table	☒ Yes	Table 1
3.0	**Assessment of the Significance of Contaminants and Sources**		☒ Yes	
	3.1	Identification of Negligible Contaminants and Sources	☒ Yes	Section 3.0
	3.2	Rationale for Assessment	☒ Yes	Section 3.0
4.0	**Operating Conditions, Emission Estimating and Data Quality**			
	4.1	Description of operating conditions, for each significant contaminant that results in the maximum POI concentration for that contaminant	☒ Yes	Section 4.1
	4.2	Explanation of Method used to calculate the emission rate for each contaminant	☒ Yes	Section 4.2
	4.3	Sample calculation for each method	☒ Yes	Section 4.3
	4.4	Assessment of Data Quality for each emission rate	☒ Yes	Section 4.4
5.0	**Source Summary Table and Property Plan**			
	5.1	Source Summary Table	☒ Yes	Table 2
	5.2	Site Plan (scalable)	☒ Yes	Figure 1
6.0	**Dispersion Modelling**			
	6.1	Dispersion Modelling Input Summary Table	☒ Yes	Table 3
	6.2	Land Use Zoning Designation Plan	☒ Yes	Figure 4
	6.3	Dispersion Modelling Input and Output Files	☒ Yes	Section 6.9
7.0	**Emission Summary Table and Conclusions**			
	7.1	Emission Summary Table	☒ Yes	Table 5
	7.2	Assessment of Contaminants with no MOECC POI Limits	☒ Yes	Section 7.2
	7.3	Conclusions	☒ Yes	Section 8.0
	Attachments (Provide supporting information or details such as...)			
	Attachment A – Emission Rate Calculations		☒ Yes	Attachment A

1.0 INTRODUCTION AND FACILITY DESCRIPTION

1.1 Purpose and Scope of ESDM Report

Taggart Miller Environmental Services (Taggart Miller) is proposing the construction and operation of the Capital Region Resource Recovery Centre (CRRRC) facility to be located in Ottawa, Ontario (the Facility). The location of the Facility is presented in Figure 1 – Site Location Plan.

This Emission Summary and Dispersion Modelling (ESDM) Report was prepared to support the Design and Operation (D&O) Report for the facility in accordance with s.26 of O. Reg. 419/05. In addition, guidance in the Ontario Ministry of the Environment and Climate Change (MOECC) publication "*Guideline A-10: Procedure for Preparing an Emission Summary and Dispersion Modelling (ESDM) Report, Version 3.0"*, dated March 2009 (ESDM Procedure Document) PIBS 3614e03 was followed, as appropriate.

1.2 Description of Processes and NAICS Code(s)

1.2.1 Description of Processes (including Raw Materials and Products)

The CRRRC is proposed to provide facilities and capacity for the recovery of resources and the diversion of materials from disposal for wastes that are generated by the Industrial, Commercial and Institutional (IC&I) and Construction and Demolition (C&D) sectors in Ottawa and eastern Ontario. It would also provide landfill disposal capacity for post-diversion residuals and materials that are not diverted. The following diversion facilities/operations are proposed for the CRRRC:

- LFG & Biogas Flare;
- Electrical Generation Plant;
- Material Recovery Facility (MRF);
- C&D Recycling;
- Organics Processing;
- Leaf and yard waste composting;
- Petroleum hydrocarbon impacted soil treatment;
- Landfill for residual wastes; and,
- Leachate pre-treatment.

The Facility also includes ancillary operations such as an emergency generator, maintenance welding equipment, a compressor, a diesel fire pump, and emergency lights. The C&D, MRF, and organics processing facilities are proposed to be heated using heat recovered from the flare or electrical generation plant, and therefore emissions associated with heating of these facilities are accounted for in the flare and electrical generator plant emission estimates.

Proposed throughputs and process information are provided in detail in Attachment A – Emission Rate Calculations. Table 1 – Sources and Contaminants Identification Table provides a summary of the individual sources of emissions at the Facility.

A process flow diagram is provided in Figures 2A and 2B – Simplified Process Flow Diagram.

1.2.2 Description of NAICS Code(s)

The North American Industry Classification System (NAICS) codes that apply to the Facility are 562920 (Material Recovery Facilities) and 562210 (Waste Treatment and Disposal).

1.3 Operating Schedule

The Facility is proposed to operate as follows:

Facility	Activity	Daily Operating Hours (hours/day)	Annual Operating Period (days/year)
MRF and C&D Processing Facilities	Dust collectors	12	312
Organics Processing Facility	Organics processing operations biofilter	24	365
	Material handling at organics processing facility	12	312
PHC impacted soil treatment facility	PHC impacted soil treatment facility biofilter	24	365
	Material handling at PHC impacted soil treatment facility	12	312
Leaf and yard waste composting	Composting/Curing pad operations	12	312
	Material handling at composting/curing pad	12	312
Flare and Energy Processing Facility	LFG and biogas combustion	24	365
Leachate Pre-treatment	Ventilation from leachate pre-treatment operations	24	365
	Leachate ponds	24	365
Landfill	Landfill gas fugitive losses through the cover soils	24	365
	Material handling at the landfill	12	312

The proposed operating hours for waste receiving and processing (ancillary facilities) and landfill operations are from 0600 to 1900 hours Monday to Saturday. Essential equipment associated with bio-gas, leachate and power generation is required to operate 24 hours per day 365 days of the year.

1.4 Facility Throughput

The Facility throughput will vary; however, the maximum operating capacities of the Facility is to receive approximately 450,000 tonnes of waste and soils per year, with a maximum daily rate of 3,000 tonnes/day.

2.0 INITIAL IDENTIFICATION OF SOURCES AND CONTAMINANTS

2.1 Sources and Contaminants Identification Table

Table 1 – Sources and Contaminants Identification Table includes all the emission sources at the Facility, O. Reg. 419/05. Each of the identified sources has been assigned a source reference number.

There may be general ventilation in some portions of the CRRRC (i.e., the administration building and maintenance garage) that only discharges uncontaminated air from the workspaces or air from the workspace that may include contaminants that come from commercial office supplies, building maintenance products or supplies and activities; these types of ventilation sources are considered to be negligible and were not identified as sources at the Facility.

Although as per O. Reg. 524/98-S.13 the emissions from on-Site vehicles and fugitive emissions from on-Site roadways and storage piles are exempt from O. Reg. 419 compliance assessment, they have conservatively been included in the O. Reg. 419/05 compliance assessment for the CRRRC.

The types of contaminants potentially emitted from each source are also identified in Table 1; however this assessment focuses on concentrations of the following indicator contaminants, which could be emitted from the proposed CRRRC, and for which air quality criteria exist:

- Particulate matter, including suspended particulate matter (SPM), particles nominally smaller than 10 µm in diameter (PM_{10}), and particles nominally smaller than 2.5 µm in diameter ($PM_{2.5}$);
- Oxides of nitrogen (NO_X);
- Sulphur dioxide (SO_2);
- Carbon monoxide (CO);
- Hydrogen sulphide (H_2S);
- Vinyl chloride (C_2H_3Cl); and,
- Odour.

3.0 ASSESSMENT OF THE SIGNIFICANCE OF CONTAMINANTS AND SOURCES

Contaminants and sources at the Facility were assessed for significance following the guidance outlined in the ESDM Procedure Document. Contaminants that are discharged from the Facility in negligible amounts and/or sources that discharge a contaminant in a negligible amount were excluded from further analysis. The rationale for these exclusions is provided below.

Of the sources listed in Table 1 – Sources and Contaminants Identification Table, two (2) sources have been identified as negligible; operational Support activities (such as maintenance activities, including welding, compressor, diesel fire pump, lights), and tailpipe exhaust from maintenance vehicles.

4.0 OPERATING CONDITIONS, EMISSION ESTIMATING AND DATA QUALITY

4.1 Description of Operating Conditions

Section 10 of O. Reg. 419/05 states that an acceptable operating condition is a scenario in which operating conditions for the Facility would result, for the relevant contaminant, in the highest concentration of the contaminant possible at the point of impingement (POI). The operating condition described in this ESDM Report meets this requirement.

The operating scenario presented includes the emissions of all the CRRRC components, with all equipment operating at the maximum rated capacity for the entire period.

The averaging time for the operating condition is dependent on the averaging time for the MOECC POI Limit. The individual maximum rates of production for each significant source of emissions correspond to the maximum emission rate for the averaging time. Details of the maximum operating rates are provided in Attachment A – Emission Rate Calculations.

4.2 Explanation of the Methods Used to Calculate Emission Rates

The maximum emission rates for each significant contaminant emitted from the significant sources were estimated in accordance with requirements of the ESDM Procedure Document. These rates and methods are summarized in Table 2 – Source Summary Table.

4.3 Sample Calculations

Sample calculations are presented in Attachment A – Emission Rate Calculations. All of the emission estimation methods are acceptable methods as outlined in the ESDM Procedure Document.

4.4 Assessment of Data Quality

The data quality for each contaminant emission rate is documented in Table 2 – Source Summary Table and Attachment A – Emission Rate Calculations.

4.5 Conservatism of Emission Estimates and Operating Condition

The following assumptions were included in the development of the emission estimates and operating condition for the Facility:

- The operating scenario presented includes the emissions of all the CRRRC components, with all equipment operating at the maximum rated capacity for the entire period.
- Road dust and vehicle exhaust were conservatively included in the emission estimates and modelling.

Based on the conservative assumptions summarized above and detailed in Attachment A – Emission Rate Calculations, the emission rates listed in Table 2 are not likely to be an underestimate of the actual emission rates.

5.0 SOURCE SUMMARY TABLE AND SITE PLAN

5.1 Source Summary Table

The emission rates for each source of significant contaminants are documented in Table 2 – Source Summary Table in accordance with requirements of sub paragraph 8 of s.26(1) of O. Reg. 419/05.

5.2 Site Plan

A scaled Site plan is provided in Figure 3 – Dispersion Modelling Plan. This includes:

- The property boundary;
- The co-ordinates for sufficient points on the property boundary to accurately describe the boundary;
- Each significant source of significant contaminants; and,
- The currently proposed location, dimensions and height of every proposed structure on the property.

Where reasonable, the location and heights of only those on-Site structures that may affect the dispersion of emissions from significant sources are included.

For ease of reference, each of the sources is labelled with the source reference number in Table 2 – Source Summary Table.

6.0 DISPERSION MODELLING

The dispersion modelling was conducted in accordance with the MOECC publication *"Guideline A-11: Air Dispersion Modelling Guideline for Ontario, Version, 2.0"*, dated March 2009 (ADMGO) PIBS 5165e02.

The Facility was has not yet been constructed and therefore, s.20 of O. Reg. 419/05 currently applies to the Facility.

The use of a more refined model, such as AERMOD, is necessary when assessing air quality against Schedule 3 Standards. It is applicable to rural and urban areas, flat and complex terrain, surface and elevated releases, and multiple sources (including point, area, and volume sources).

The AERMOD modelling system is made up of the AERMOD dispersion model, the AERMET meteorological pre-processor and the AERMAP terrain pre-processor. The following approved dispersion model and pre-processors were used in the assessment:

- AERMOD dispersion model (v. 13350);
- AERMAP surface pre-processor (v. 11103); and,
- BPIP building downwash pre-processor (v.42104).

AERMET was not used in this assessment, as a pre-processed MOECC meteorological dataset was used. The dataset for Eastern Ontario, which is comprised of hourly surface meteorological data from Ottawa Airport (Station ID 610600) and upper air data from Maniwaki (Station ID 7034480) for the period 1996-2000 were used. The land use surrounding the facility is characterized as rural, and therefore MOECC's "CROPS" meteorological dataset is used.

There are no sensitive receptors (e.g., child care facility, health care facility, senior's residence, long-term care facility or an educational facility) located at the Facility. Therefore, same structure contamination was not considered.

6.1 Dispersion Modelling Input Summary Table

A description of the way in which the approved dispersion modelling was performed is included as Table 3 – Dispersion Modelling Input Summary Table. This table meets both the requirements of s.26(1)11 and sections 8-17 of O. Reg. 419/05 and follows the format provided in the ESDM Procedure Document.

The source data required for each source was determined according to the procedures provided in ADMGO and presented in Figure 3 – Dispersion Modelling Plan. Furthermore, the dispersion modelling input parameters are summarized in Table 4 – Dispersion Modelling Source Summary Table.

6.2 Coordinate System

The Universal Transverse Mercator (UTM) coordinate system, as per Section 5.2.2 of the ADMGO, was used to specify model object sources, buildings and receptors. All coordinates were defined in the North American Datum of 1983 (NAD83).

6.3 Meteorology and Land Use Data

Sub paragraph 10 of s.26(1) of O. Reg.419/05 requires a description of the local land use conditions if meteorological data, as described in paragraph 2 of s.13(l) of O. Reg. 419/05, was used. In this assessment, the AERMOD model was run using a MOECC pre-processed five year dispersion meteorological dataset (i.e., surface and profile files), last updated in 2007, in accordance with paragraph 1 of s.13(1) of O. Reg. 419/05. The dataset for Eastern Ontario, which is comprised of hourly surface meteorological data from Ottawa Airport (Station ID 610600) and upper air data from Maniwaki (Station ID 7034480) for the period 1996-2000 were used in the assessment. The land use surrounding the facility is characterized as rural, as illustrated in Figure 4 – Land Use Zoning Designation Plan and Figure 5 – 3 km Satellite Image. As a result, MOECC's "CROPS" meteorological dataset was used.

6.4 Terrain

Terrain data used in this assessment was obtained from MOECC (7.5 minute format) and is illustrated in Figure 6. DEM files used in this assessment are:

- 1424_1.DEM
- 1424_2.DEM
- 1425_1.DEM
- 1425_2.DEM
- 1426_1.DEM
- 1426_2.DEM

6.5 Receptors

Receptors were chosen based on recommendations provided in Section 7.1 of the ADMGO, which is in accordance with s.14 of O. Reg. 419/05. Specifically, a nested receptor grid, centered around the outer edges of all the sources, was placed as follows:

a) 20 m spacing, within an area of 200 m by 200 m;

b) 50 m spacing, within an area surrounding the area described in (a) with a boundary at 300 m by 300 m outside the boundary of the area described in (a);

c) 100 m spacing, within an area surrounding the area described in (b) with a boundary at 800 m by 800 m outside the boundary of the area described in (a);

d) 200 m spacing, within an area surrounding the area described in (c) with a boundary at 1,800 m by 1,800 m outside the boundary of the area described in (a); and,

e) 500 m spacing, within an area surrounding the area described in (d) with a boundary at 4,800 m by 4,800 m outside the boundary of the area described in (a).

In addition to using the nested receptor grid, receptors were also placed every 10 m along the property line. The area of modeling coverage is illustrated on Figure 7 – Dispersion Modelling Receptors. In addition to the modelling receptor grid, discrete receptors representing the location of the closest nearby residences were included for the odour modelling assessment, as shown in Figure 7.

There is no child care facility, health care facility, senior's residence, long-term care facility or an educational facility located at the Facility. As such, same structure contamination was not considered. The nearest residence is located within approximately 500 m from the Facility's property line.

6.6 Building Downwash

Building wake effects were considered in this assessment using the U.S. EPAs Building Profile Input Program (BPIP-PRIME), another pre-processor to AERMOD. The inputs into this pre-processor include the coordinates and heights of the buildings and stacks. The output data from BPIP is used in the AERMOD building wake effect calculations.

The PRIME plume rise algorithms include vertical wind shear calculations [important for buoyant releases from short stacks (i.e. stacks at release heights within the recirculation zones of buildings)]. The PRIME algorithm also allows for the wind speed deficit induced by the building to change with respect to the distance from the building. These factors improve the accuracy of predicted concentrations within building wake zones that form in the lee of buildings.

6.7 Averaging Time and Conversions

Schedule 3 standards of O. Reg. 419/05 apply to this Facility. Many of these standards are based on 1-hour and 24-hour averaging times, which are averaging times easily provided by AERMOD. In cases where a standard has an averaging period that AERMOD is not designed to predict (e.g., 10-min), a conversion to the appropriate averaging period was completed using the MOECC recommended conversion factors, as documented in the ADMGO.

An example is given below for converting from a 1-hour averaging period to a 10-minute averaging period:

$$F = \left(\frac{t_1}{t_0}\right)^n$$

$$= \left(\frac{60}{10}\right)^{0.28}$$

$$= 1.65$$

Where:

F = the factor to convert from the averaging period t_1 output from the model (MOECC assumes AERMOD predicts true 60 minute averages) to the desired averaging period t_0 (assumed to be 10-minutes in the example above), and,

n = the exponent variable; in this case the MOECC value of n = 0.28 is used for conversion.

For averaging periods greater than 1-hour, the AERMOD output was used directly.

Modelling of odour based compounds (whole odour and H_2S) was completed in accordance with the MOE Technical Bulletin titled *Methodology for Modelling Assessments of Contaminants with 10-minute Average Standards and Guidelines* (MOE, 2008).

6.8 Dispersion Modelling Options

The options used in the AERMOD dispersion model are summarized in the table below.

Options used in AERMOD

Modelling Parameter	Description	Used in the Assessment?
DFAULT	Specifies that regulatory default options will be used	No
CONC	Specifies that concentration values will be calculated	Yes
DDPLETE	Specifies that dry deposition will be calculated	No
WDPLETE	Specifies that wet deposition will be calculated	No
FLAT	Specifies that the non-default option of assuming flat terrain will be used	No, the model used elevated terrain data files as detailed in the AERMAP output.
NOSTD	Specifies that the non-default option of no stack-tip downwash will be used	No
AVERTIME	Time averaging periods calculated	1-hr, 24-hr
URBANOPT	Allows the model to incorporate the effects of increased surface heating from an urban area on pollutant dispersion under stable atmospheric conditions	No
URBANROUGHNESS	Specifies the urban roughness length (m)	No, Site specific urban roughness values were incorporated into the AERMET processing.
FLAGPOLE	Specifies that receptor heights above local ground level are allowed on the receptors	No

6.9 Modelling Files

6.9.1 Contaminant Specific Modelling

Individual model runs were conducted for the following contaminants:

- Particulate matter, including suspended particulate matter (SPM), particles nominally smaller than 10 µm in diameter (PM_{10}), and particles nominally smaller than 2.5 µm in diameter ($PM_{2.5}$);
- Oxides of nitrogen (NO_X);
- Sulphur dioxide (SO_2);
- Carbon monoxide (CO);
- Hydrogen sulphide (H_2S);
- Vinyl chloride (C_2H_3Cl); and,
- Odour.

Each contaminant was modelled individually using the calculated emission rate.

7.0 EMISSION SUMMARY TABLE

7.1 Emission Summary Table

A POI concentration for each significant contaminant emitted from the Facility was determined based on the emission rates listed in Table 2 – Source Summary Table. The results are presented in Table 5 – Emission Summary Table.

As per the guidance document, the eight (8) highest concentrations in the model outputs for 1-hour averaging periods were removed, while the single highest concentration was removed for 24-hour averaging periods. This is to account for meteorological anomalies. The POI concentrations listed in Table 5 were compared against the MOECC POI Limits. At 81.9%, SPM has the highest concentration relative to the corresponding MOECC POI Limit of 120 µg/m^3 over 24-hrs. The maximum is predicted to occur at 465963.00, 5021033.2 (UTM Zone 18), as shown in Figure 7.

7.2 Assessment of Contaminants with no MOECC POI Limits

All nine (9) indicator contaminants assessed have MOECC POI limits.

7.3 Summary of Assessment

In order to simplify the presentation of the results and to focus the report on the assessment of compliance, the contaminants have been categorized, as follows:

Contaminant Category	Number of Contaminants in this ESDM
Significant Contaminants	
Number of Compounds Assessed	9
Compounds without MOECC POI Limits greater than the Jurisdictional Screening Level (JSL)	0
Compounds without MOECC POI Limits greater than the *de minimus* limit	0
Number of Compounds with Upper Risk Thresholds	0

8.0 CONCLUSIONS

This ESDM Report was prepared in accordance with s.26 of O. Reg. 419/05. In addition, guidance in the ESDM Procedure Document was followed, as appropriate.

The Facility is subject to s.20 of O. Reg. 419/05; contaminant emissions are assessed for their appropriate averaging periods using the AERMOD dispersion model.

All the emission rates listed in Table 2 – Source Summary Table correspond to the operating scenario that results in the maximum POI concentration from the Site. Therefore, the emission rates listed in Table 2 – Source Summary Table are not likely to be an underestimate of the actual emission rates.

A POI concentration for each significant contaminant emitted from the Facility was determined based on the calculated emission rates and the output from AERMOD; the results are presented in Table 5 – Emission Summary Table and were compared against the respective MOECC POI Limits.

For the nine (9) contaminants assessed with MOECC POI Limits, all the predicted POI concentrations are below the corresponding limits. At 81.9%, SPM has the highest predicted concentration relative to the corresponding MOECC POI Limit of 120 µg/m^3 over 24-hrs.

It is assumed that the conservative emission rates, when combined with the conservative assumed operating conditions and conservative dispersion modelling assumptions, are not likely to under predict the concentrations at a POI. Therefore, this assessment demonstrates that the Facility can operate in compliance with s.20 of O. Reg. 419/05.

9.0 CLOSURE

We trust that this report meets your current needs. If you have any questions, or if we may be of further assistance, please contact the undersigned.

GOLDER ASSOCIATES LTD.

Camille Taylor, P.Eng., Eng.
Air Quality Specialist

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Principal

CT/AVW/AC/ca/sg
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TABLES

Table 1

Sources and Contaminants Identification Table

Source Information				Significant (Yes or No)?	Modelled (Yes or No)?	Rationale
Source ID	General Location	Sources	Expected Compounds			
1	Flare	Enclosed LFG and Biogas Flare	Landfill gas & biogas combustion by-products	Yes	Yes	—
2	Electrical Generation Plant	LFG and Biogas to Energy Engine	Landfill gas & biogas combustion by-products	Yes	Yes	—
3	Construction and Demolition Facility	Dust Collector	Particulate matter	Yes	Yes	—
4	Material Recovery Facility	Dust Collector	Particulate matter	Yes	Yes	—
5	Organics Processing Facility	Biofilter	Odour	Yes	Yes	—
6		Composting Operations (Material Handling)	Particulate matter	Yes	Yes	—
		Organics Processing Operations (Tailpipe Emissions)	Combustion by-products	Yes	Yes	Although as per O. Reg. 524/98-S.13 the emissions from on-Site vehicles are exempt from Ontario Reg. 419 compliance assessment, they have conservatively been included in the O.Reg. 419/05 compliance assessment for the CRRRC.
7	Composting	Composting, Curing, and Post Processing (Material Handling)	Particulate matter	Yes	Yes	—
		Composting, Curing, and Post Processing (Tailpipe Emissions)	Combustion by-products	Yes	Yes	Although as per O. Reg. 524/98-S.13 the emissions from on-Site vehicles are exempt from Ontario Reg. 419 compliance assessment, they have conservatively been included in the O.Reg. 419/05 compliance assessment for the CRRRC.
8	PHC Impacted Soil Treatment Area	Biofilter	Odour	Yes	Yes	—
9		PHC Impacted Soil Treatment Operations (Material Handling)	Particulate matter	Yes	Yes	—
		PHC Impacted Soil Treatment Operations (Tailpipe Emissions)	Combustion by-products	Yes	Yes	Although as per O. Reg. 524/98-S.13 the emissions from on-Site vehicles are exempt from Ontario Reg. 419 compliance assessment, they have conservatively been included in the O.Reg. 419/05 compliance assessment for the CRRRC.
10	Landfill	Landfill Cap	Products of decomposition of landfill gas	Yes	Yes	—
		Landfill Operations (Material Handling)	Particulate matter	Yes	Yes	—
		Landfill Operations (Tailpipe Emissions)	Combustion by-products	Yes	Yes	Although as per O. Reg. 524/98-S.13 the emissions from on-Site vehicles are exempt from Ontario Reg. 419 compliance assessment, they have conservatively been included in the O.Reg. 419/05 compliance assessment for the CRRRC.
11	Leachate Pre-treatment	Leachate Pre-treatment	Odour	Yes	Yes	—
24		Leachate Holding Pond	Odour	Yes	Yes	Potential odour emissions from the leachate holding pond and the treated effluent pond will be mitigated through aeration and use of a misting system. The leachate holding pond is intended to be used for overflow prior to pre-treatment.
25		Leachate Equalization Pond	Odour	Yes	Yes	
12	Paved Roads	Vehicle Exhaust and Fugitive Road Dust	Particulate matter and Combustion by-products	Yes	Yes	Although as per O. Reg. 524/98-S.13 the emissions from on-Site vehicles and fugitive emissions from on-Site roadways and storage piles are exempt from Ontario Reg. 419 compliance assessment, they have conservatively been included in the O.Reg. 419/05 compliance assessment for the CRRRC.
13	Unpaved Roads	Vehicle Exhaust and Fugitive Road Dust				
14	Support Activities	Stationary Fuel Combustion (MRF)	Combustion by-products	Yes	Yes	—
15		Stationary Fuel Combustion (C&D)				
16		Stationary Fuel Combustion (PHC Impacted Soil Treatment Area)				
17		Stationary Fuel Combustion (Organics Processing Facility)				
18		Stationary Fuel Combustion (Administrative Building)				
19		Stationary Fuel Combustion (Maintenance Garage)				
20		Stationary Fuel Combustion (Leachate Treatment Facility)				
21		Diesel Emergency Power Generator (used to provide electricity during power outages)	Combustion by-products	N/A	N/A	The emergency power generator will be registered under the Environmental Activity and Sector Registry (EASR).
22		Operational Support Activities (such as maintenance activities, including welding, compressor, diesel fire pump, lights)	N/A	No	No	These activities are considered to be negligible in comparison to the other activities occurring on site.
23		Tailpipe Exhaust from Maintenance Vehicles	Combustion by-products	No	No	These activities are considered to be negligible in comparison to the other activities occurring on site.

Table 2
Source Summary Table

Source Identifier	Source Description	Source			Emission Data							
		Stack Height Above Roof [m]	X Coordinate [m]	Y Coordinate [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	Max. Emission Rate per source (or m^2)	Averaging Period [hours]	Emission Estimating Technique	Emissions Data Quality	Percentage of Overall Emissions [%]
1	Flare	N/A	466687.1	5021298.5	Hydrogen Sulfide	7783-06-4	0.00013	0.0001309	1	EF	Above-Average	2%
					Vinyl chloride	75-01-4	0.00007	0.0000710	1	EF	Above-Average	10%
					Carbon Monoxide	630-08-0	0.40571	0.406	1	EF	Above-Average	6%
					Nitrogen Oxides	10102-44-0	0.34709	0.347	1	EF	Above-Average	10%
					Suspended particulate matter (< 44 µm Diameter)	N/A	0.13091	0.131	1	EF	Above-Average	9%
					PM10	N/A	0.13091	0.131	1	EF	Above-Average	17%
					PM2.5	N/A	0.13091	0.131	1	EF	Above-Average	22%
					Sulphur Dioxide	7446-09-5	0.10182	0.102	1	EF	Average	50%
2	Electrical Generation Plant	6.5	466688.8	5021351	Hydrogen Sulfide	7783-06-4	0.00305	0.00044	1	EF	Above-Average	39%
		6.5	466690.8	5021347	Vinyl chloride	75-01-4	0.00025	0.00004	1	EF	Above-Average	36%
		6.5	466692.3	5021342	Carbon Monoxide	630-08-0	4.65650	0.665	1	EF	Above-Average	71%
		6.5	466694.1	5021337	Nitrogen Oxides	10102-44-0	0.44044	0.063	1	EF	Above-Average	12%
		6.5	466696.1	5021333	Suspended particulate matter (< 44 µm Diameter)	N/A	0.12761	0.0182	1	EF	Marginal	8%
		6.5	466697.6	5021328	PM10	N/A	0.12761	0.018	1	EF	Marginal	17%
		6.5	466699.5	5021323	PM2.5	N/A	0.12761	0.018	1	EF	Marginal	22%
					Sulphur Dioxide	7446-09-5	0.10183	0.015	1	EF	Average	50%
3	Construction and Demolition Facility	2	466349.70	5021470.00	Suspended particulate matter (< 44 µm Diameter)	N/A	0.07079	0.071	1	EC	Average	5%
					PM10	N/A	0.07079	0.071	1	EC	Average	9%
					PM2.5	N/A	0.07079	0.071	1	EC	Average	12%
4	Material Recovery Facility	2	466688.80	5021351.40	Suspended particulate matter (< 44 µm Diameter)	N/A	0.07079	0.071	1	EC	Average	5%
					PM10	N/A	0.07079	0.071	1	EC	Average	9%
					PM2.5	N/A	0.07079	0.071	1	EC	Average	12%
5	Organics Processing Facility	2.5	466485.8	5021210.5	Odour	N/A	10000.00000	10000.000	10-min	EC	Above Average	46%
8	PHC Impacted Soil Treatment Area	N/A	466355.3	5020948.9	Odour	N/A	2083.33333	2083.333	10-min	EC	Above Average	10%
11	Leachate Pre-Treatment	2.5	466483.6	5021034.7	Odour	N/A	6944.44444	6944.444	10-min	EC	Above Average	32%
AREA SOURCES		Area [m^2]	X Coordinate [m]	Y Coordinate [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	Max. Emission Rate per source (or m^2)	Averaging Period [hours]	Emission Estimating Technique	Emissions Data Quality	Percentage of Overall Emissions [%]
6, 7, 9	Organics processing facility, composting, PHC soil treatment facility	99596	Various	Various	Suspended particulate matter (< 44 µm Diameter)	N/A	1.05E-01	1.06E-06	1	EF	Above Average	7%
					PM10	N/A	9.78E-02	9.82E-07	1	EF	Above Average	13%
					PM2.5	N/A	9.00E-02	9.04E-07	1	EF	Above Average	15%
					Nitrogen Oxides	10102-44-0	1.65E+00	1.65E-05	1	EF	Marginal	46%
					Sulphur Dioxide	7446-09-5	2.78E-05	2.79E-10	1	EF	Marginal	<1%
					Carbon Monoxide	630-08-0	1.51E+00	1.51E-05	1	EF	Marginal	23%
7	Composting	22739	Various	Various	Odour	N/A	3.09E+02	1.36E-02	1	EF	Marginal	1%
10	Landfill	839408	Various	Various	Carbon monoxide	630-08-0	2.92E-03	3.48E-09	1	EF	Average	<1%
					Hydrogen Sulfide	7783-06-4	4.66E-03	5.56E-09	1	EF	Above-Average	59%
					Vinyl chloride	75-01-4	3.80E-04	4.52E-10	1	EF	Above-Average	54%
					Odour	N/A	2.39E+03	2.85E-03	1	EC	Marginal	11%
					Suspended particulate matter (< 44 µm Diameter)	N/A	7.79E-02	9.28E-08	1	EF	Average	5%
					PM10	N/A	6.94E-02	8.27E-08	1	EF	Average	9%
					PM2.5	N/A	6.30E-02	7.50E-08	1	EF	Average	11%
					Nitrogen Oxides	10102-44-0	1.08E+00	1.29E-06				30%
24	Leachate Holding Pond	6629	Various	Various	Odour	N/A	9.25E-01	1.40E-04	10-min	EF	Marginal	<1%
25	Leachate Equalization Pond	19688	Various	Various	Odour	N/A	9.25E-01	4.70E-05	10-min	EF	Marginal	<1%
VOLUME SOURCES		Initial Vertical Dimension of Volume [m]	X Coordinate [m]	Y Coordinate [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	Max. Emission Rate per source (or m^2)	Averaging Period [hours]	Emission Estimating Technique	Emissions Data Quality	Percentage of Overall Emissions [%]
12	Paved Roads	1.63	Various	Various	Suspended particulate matter (< 44 µm Diameter)	N/A	6.35E-01	N/A	1	EF	Marginal	42%
					PM10	N/A	1.23E-01	N/A	1	EF	Marginal	16%
					PM2.5	N/A	3.05E-02	N/A	1	EF	Marginal	5%
					Nitrogen Oxides	10102-44-0	3.15E-02	N/A	1	EF	Marginal	<1%
					Sulphur Dioxide	7446-09-5	8.79E-05	N/A	1	EF	Marginal	<1%
					Carbon Monoxide	630-08-0	7.26E-03	N/A	1	EF	Marginal	<1%
13	Unpaved Roads	1.63	Various	Various	Suspended particulate matter (< 44 µm Diameter)	N/A	2.88E-01	N/A	1	EF	Marginal	19%
					PM10	N/A	7.79E-02	N/A	1	EF	Marginal	10%
					PM2.5	N/A	7.86E-03	N/A	1	EF	Marginal	1%
					Nitrogen Oxides	10102-44-0	2.51E-03	N/A	1	EF	Marginal	<1%
					Sulphur Dioxide	7446-09-5	7.00E-06	N/A	1	EF	Marginal	<1%
					Carbon Monoxide	630-08-0	5.78E-04	N/A	1	EF	Marginal	<1%
14	Stationary Fuel Combustion (MRF)	6.3	466340.4	5021465.9	Nitrogen Oxides	10102-44-0	6.05E-03	N/A	1	EF	Marginal	<1%
15	Stationary Fuel Combustion (C&D)	6.4	466140.2	5021380	Nitrogen Oxides	10102-44-0	6.05E-03	N/A	1	EF	Marginal	<1%
16	Stationary Fuel Combustion (PHC Impacted Soil Treatment Area)	4.2	466360.8	5020952	Nitrogen Oxides	10102-44-0	3.46E-03	N/A	1	EF	Marginal	<1%
17	Stationary Fuel Combustion (Organics Processing Facility)	7.2	466486.4	5021208.2	Nitrogen Oxides	10102-44-0	5.18E-03	N/A	1	EF	Marginal	<1%
18	Stationary Fuel Combustion (Administrative Building)	3.5	465945.7	5021095.2	Nitrogen Oxides	10102-44-0	3.74E-04	N/A	1	EF	Marginal	<1%
19	Stationary Fuel Combustion (Maintenance Garage)	3.7	466535.2	5021494.6	Nitrogen Oxides	10102-44-0	2.30E-03	N/A	1	EF	Marginal	<1%
20	Stationary Fuel Combustion (Leachate Treatment Facility)	7.2	466480.1	5021031.8	Nitrogen Oxides	10102-44-0	1.53E-02	N/A	1	EF	Marginal	<1%
21	Diesel Emergency Power Generator (used to provide electricity during power outages)	N/A	N/A	N/A	Nitrogen Oxides (EPG)	10102-44-0	1.45E-01	N/A	1	EF	Marginal	100%

Notes:
1- The emergency generator was not included in the model as it will be registered under the MOE Environmental Activity and Sector Registry (EASR), as described in Table 1.
"V-ST" - Validated Source Test, "ST" - Source Test, "EF" - Emission Factor, "MB" Mass Balance, "EC" - Engineering Calculation
Data Quality Categories: "Highest"; "Above-Average"; "Average"; and "Marginal"

Table 3
Dispersion Modelling Input Summary Table

Relevant Section of the Regulation	Section Title	Summary of How the Approved Dispersion Model Was Used	Location of Supporting Documentation in ESDM Report
Section 8	Negligible Sources of Contaminants	Sources and contaminants that were considered negligible were explicitly identified, and therefore were not modelled in accordance with s.8 of O.Reg.419/05.	Section 3.0, Table 1
Section 9	Same Structure Contamination	Not applicable as the Facility is the only tenant occupying the property, and does not have a child care facility, health care facility, senior's residence, long-term care facility or an education facility located at the on-site.	N/A
Section 10	Operating Conditions	The operating scenario presented includes the emissions of all the CRRRC components, all equipment operating at the maximum rated capacity for the entire period.	Section 4.0, Table 4
Section 11	Source of Contaminant Emission Rates	The emission rate for each significant contaminant emitted from a significant source was estimated, the methodology for the calculation is documented in Table 2 - Source Summary Table.	Section 4.0, Table 2
Section 12	Combined Effect of Assumptions for Operating Conditions and Emission Rates	The Operating Conditions were estimated in accordance with s.10(1) 1 and s.11(1) 1 of O.Reg.419/05 and are therefore considered to result in the highest POI concentration that the Facility is capable of for each contaminant emitted.	Section 4.0
Section 13	Meteorological Conditions	AERMOD model was run using a MOE pre-processed five year dispersion meteorological dataset (i.e., surface and profile files), last updated in 2007, in accordance with paragraph 1 of s.13(1) of O. Reg. 419/05. The rural land-use meteorological dataset for the Ottawa area was used.	Section 6.3
Section 14	Area of Modelling Coverage (receptor locations)	A nested grid of receptors, centered around the outer edges of all of the sources was chosen based on recommendations provided in Section 7.1 of the ADMGO, which is in accordance with s.14 of O. Reg. 419/05.	Section 6.5, Figure 7
Section 15	Stack Height for Certain New Sources of Contaminant	Not applicable as s.15 of O.Reg.419/05 does not apply to the Facility.	N/A
Section 16	Terrain Data	Terrain data used in this assessment was obtained from MOE (7.5 minute format).	Section 6.4, Figure 6
Section 17	Averaging Periods	The Schedule 3 standards for many of the contaminants emitted from the site are based on a 1-hour or 24-hour averaging time, which is easily provided by AERMOD. Some of the contaminants have 10-min and 1/2-hour MOE POI Limits. These MOE POI concentrations were estimated using the conversion factors provided in Section 4.4 of the ADMGO.	Section 6.7

Table 4
Dispersion Modelling Source Summary Table

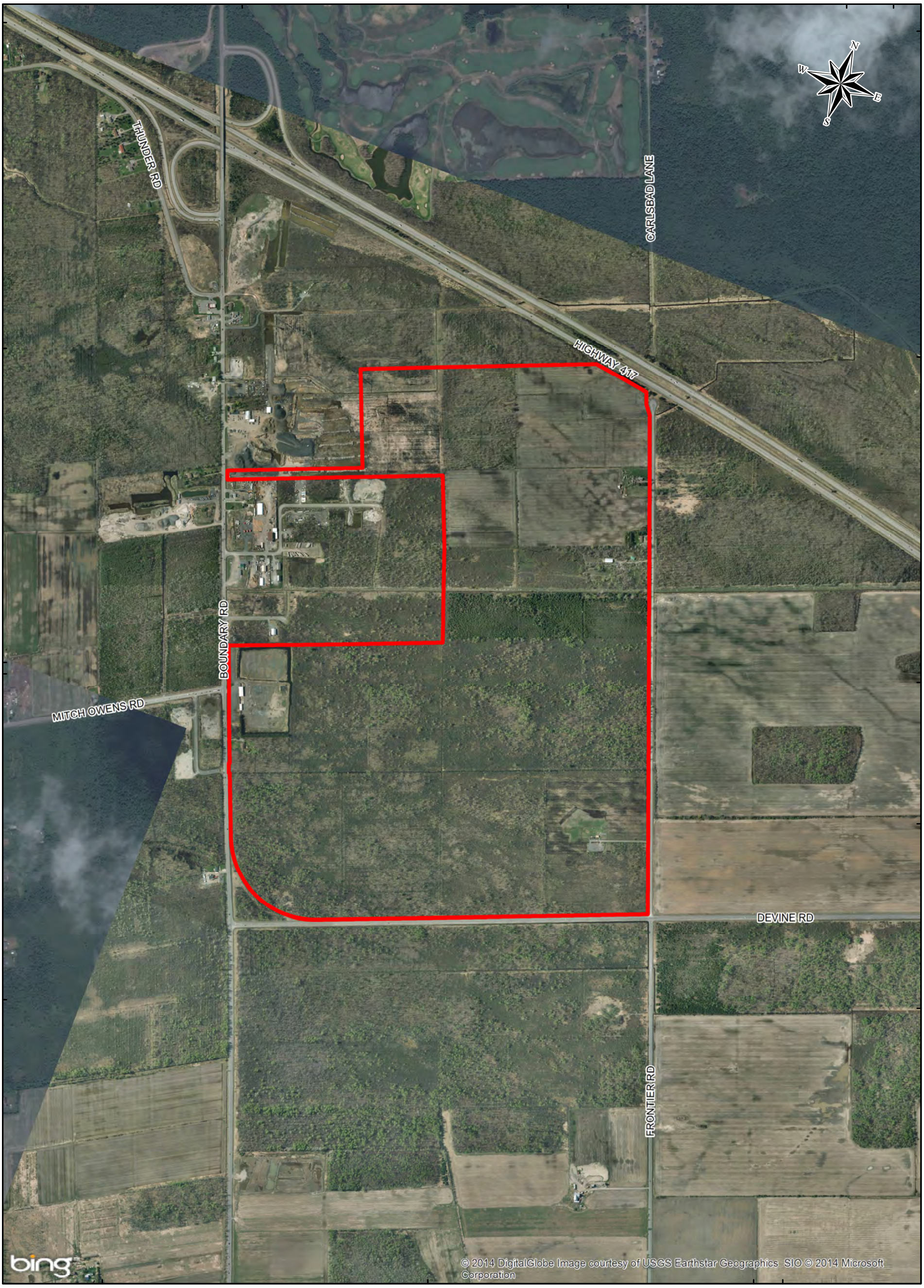
Modelling ID	Source ID(s)	Source Type	Modelling Source Data						Emissions Data		
			Stack Height Above	Stack Gas Exit Velocity [m/s]	Stack Gas Exit Temperature [°C]	Stack Inner Diameter	X Coordinate [m]	Y Coordinate [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]
1	FLARE	Point	12.2	16.6	1,528	3.0	466687.1	5021298.5	Hydrogen Sulfide	7783-06-4	1.31E-04
									Vinyl chloride	75-01-4	7.10E-05
									Carbon Monoxide	630-08-0	4.06E-01
									Nitrogen Oxides	10102-44-0	3.47E-01
									Suspended particulate matter (< 44 µm Diameter)	N/A	1.31E-01
									PM10	N/A	1.31E-01
									PM2.5	N/A	1.31E-01
									Sulphur Dioxide	7446-09-5	1.02E-01
2	ENG1	Point	12.5	17.8	509	0.3	466688.8	5021351.0	Hydrogen Sulfide	7783-06-4	3.05E-03
	ENG2		12.5	17.8	509	0.3	466690.8	5021347.0	Vinyl chloride	75-01-4	2.49E-04
	ENG3		12.5	17.8	509	0.3	466692.3	5021342.0	Carbon Monoxide	630-08-0	4.66E+00
	ENG4		12.5	17.8	509	0.3	466694.1	5021337.0	Nitrogen Oxides	10102-44-0	4.40E-01
	ENG5		12.5	17.8	509	0.3	466696.1	5021333.0	Suspended particulate matter (< 44 µm Diameter)	N/A	1.28E-01
	ENG6		12.5	17.8	509	0.3	466697.6	5021328.0	PM10	N/A	1.28E-01
	ENG7		12.5	17.8	509	0.3	466699.5	5021323.0	PM2.5	N/A	1.28E-01
									Sulphur Dioxide	7446-09-5	1.02E-01
3	CnD_DC	Point	15.75	9.0	20	1.0	466349.7	5021470.0	Suspended particulate matter (< 44 µm Diameter)	N/A	7.08E-02
									PM10	N/A	7.08E-02
									PM2.5	N/A	7.08E-02
4	MRF_DC	Point	15.5	9.0	20	1.0	466688.80	5021351.40	Suspended particulate matter (< 44 µm Diameter)	N/A	7.08E-02
									PM10	N/A	7.08E-02
									PM2.5	N/A	7.08E-02
5	Org_BioF	Point	5.0	17.7	25	1.2	466485.8	5021210.5	Odour	N/A	1.00E+04
8	HC_BioF	Point	4.0	8.3	25	0.8	466355.3	5020948.9	Odour	N/A	2.08E+03
11	LEACHATE	Point	18.0	8.8	25	1	466483.6	5021034.7	Odour	N/A	6.94E+03
AREA SOURCES				Release Height [m]	Initial Vertical Dimension (Optional) [m]	Area [m2]	X Coordinate [m]	Y Coordinate [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]
6, 7, 9	AREA	Area		4	1.9	99,595.9	Various	Various	Suspended particulate matter (< 44 µm Diameter)	N/A	1.05E-01
									PM10	N/A	9.78E-02
									PM2.5	N/A	9.00E-02
									Nitrogen Oxides	10102-44-0	1.65E+00
									Sulphur Dioxide	7446-09-5	2.78E-05
									Carbon Monoxide	630-08-0	1.51E+00
7	COMP_OPS	Area		4	0.0	22739.17	Various	Various	Odour	N/A	3.09E+02
10	Landfill	Area		45.8	0	839407.5	Various	Various	Hydrogen Sulfide	7783-06-4	4.66E-03
									Vinyl chloride	75-01-4	3.80E-04
									Odour	N/A	2.39E+03
									Suspended particulate matter (< 44 µm Diameter)	N/A	7.79E-02
									PM10	N/A	6.94E-02
									PM2.5	N/A	6.30E-02
									Nitrogen Oxides	10102-44-0	1.08E+00
24	POND	Area		0.6	0	6629	Various	Various	Odour	N/A	9.25E-01
25	EQ_POND	Area		0.6	0	19688	Various	Various	Odour	N/A	9.25E-01
VOLUME SOURCES				Release Height [m]	Initial Lateral Dimension of Volume [m]	Initial Vertical Dimension of Volume [m]	X Coordinate [m]	Y Coordinate [m]	**Contaminant**	**CAS No.**	**Maximum Emission Rate [g/s]**
12	PAVED	Volume		3.50	3.14	1.63	Various	Various	Suspended particulate matter (< 44 µm Diameter)	N/A	6.35E-01
									PM10	N/A	1.23E-01
									PM2.5	N/A	3.05E-02
									Nitrogen Oxides	10102-44-0	3.15E-02
									Sulphur Dioxide	7446-09-5	8.79E-05
									Carbon Monoxide	630-08-0	7.26E-03
13	UNPAVED	Volume		3.50	4.01	1.63	Various	Various	Suspended particulate matter (< 44 µm Diameter)	N/A	2.88E-01
									PM10	N/A	7.79E-02
									PM2.5	N/A	7.86E-03
									Nitrogen Oxides	10102-44-0	2.51E-03
									Sulphur Dioxide	7446-09-5	7.00E-06
									Carbon Monoxide	630-08-0	5.78E-04
14	MRF_NOx	Volume		13.5	50.2	6.28	466340.4	5021465.9	Nitrogen Oxides	10102-44-0	6.05E-03
15	CnD_NOx	Volume		13.75	60.5	6.4	466140.2	5021380	Nitrogen Oxides	10102-44-0	6.05E-03
16	HCS_NOx	Volume		9	23.5	4.19	466360.8	5020952	Nitrogen Oxides	10102-44-0	3.46E-03
17	Org_NOx	Volume		15.5	40.8	7.2	466486.4	5021208.2	Nitrogen Oxides	10102-44-0	5.18E-03
18	Admin_NOx	Volume		7.5	20.7	3.48	465945.7	5021095.2	Nitrogen Oxides	10102-44-0	3.74E-04
19	Maint_NOx	Volume		8	23.8	3.72	466535.2	5021494.6	Nitrogen Oxides	10102-44-0	2.30E-03
20	Leachate_NOx	Volume		15.5	38.3	7.2	466480.1	5021031.8	Nitrogen Oxides	10102-44-0	1.53E-02
21	EPG	Volume		N/A	N/A	N/A	N/A	N/A	Nitrogen Oxides (EPG)	10102-44-0	1.45E-01

Note:
1- The emergency generator was not included in the model as it will be registered under the MOE Environmental Activity and Sector Registry (EASR), as described in Table 1.

Table 5
Emission Summary Table

Contaminant	CAS No.	Total Facility Emission Rate [g/s]	Air Dispersion Model Used	Maximum POI Concentration [µg/m³]	Averaging Period [hours]	MOE POI Limit [µg/m³]	Limiting Effect	Regulation Schedule No.	Percentage of MOE Limit [%]
Sulphur Dioxide	7446-09-5	0.102	AERMOD	8.54	24	275	Health & Vegetation	Schedule 3	3.1%
Sulphur Dioxide	7446-09-5	0.102	AERMOD	15.91	1	690	Health & Vegetation	Schedule 3	2.3%
Hydrogen Sulfide	7783-06-4	0.0077	AERMOD	0.26	24	7	Health	Schedule 3	3.7%
Hydrogen Sulfide	7783-06-4	0.0077	AERMOD	0.79	10-min	13	Odour	Schedule 3	6.1%
Nitrogen Oxides	10102-44-0	3.241	AERMOD	37.15	24	200	Health	Schedule 3	18.6%
Nitrogen Oxides	10102-44-0	3.241	AERMOD	68.90	1	400	Health	Schedule 3	17.2%
Carbon Monoxide	630-08-0	6.173	AERMOD	872.44	½	6000	Health	Schedule 3	14.5%
Vinyl chloride	75-01-4	0.0006	AERMOD	0.021	24	1	Health	Schedule 3	2.1%
Suspended particulate matter (< 44 µm Diameter)	N/A	0.00	AERMOD	98.23	24	120	Visibility	Schedule 3	81.9%
PM10	N/A	0.637	AERMOD	23.30	24	50	—	AAQC	46.6%
PM2.5	N/A	0.461	AERMOD	20.16	24	25	—	AAQC	80.6%
Odour	N/A	21732.183	AERMOD	0.58	10-min	1	Odour	Guideline	57.8%

FIGURES



LEGEND

PROPERTY BOUNDARY

400 200 0 400

SCALE 1:12,000 METRES

NOTE

THIS FIGURE IS TO BE READ IN CONJUCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT.

REFERENCE

BACKGROUND IMAGERY - BING MAPS AERIAL (C) 2010 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.
AERIAL PHOTOGRAPHS PURCHASED FROM THE CITY OF OTTAWA.
LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2012.
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18

PROJECT
EMISSION SUMMARY AND DISPERSION MODELLING REPORT FOR CAPITAL REGION RESOURCE RECOVERY CENTRE

TITLE
SITE LOCATION PLAN

Golder Associates
Ottawa, Ontario

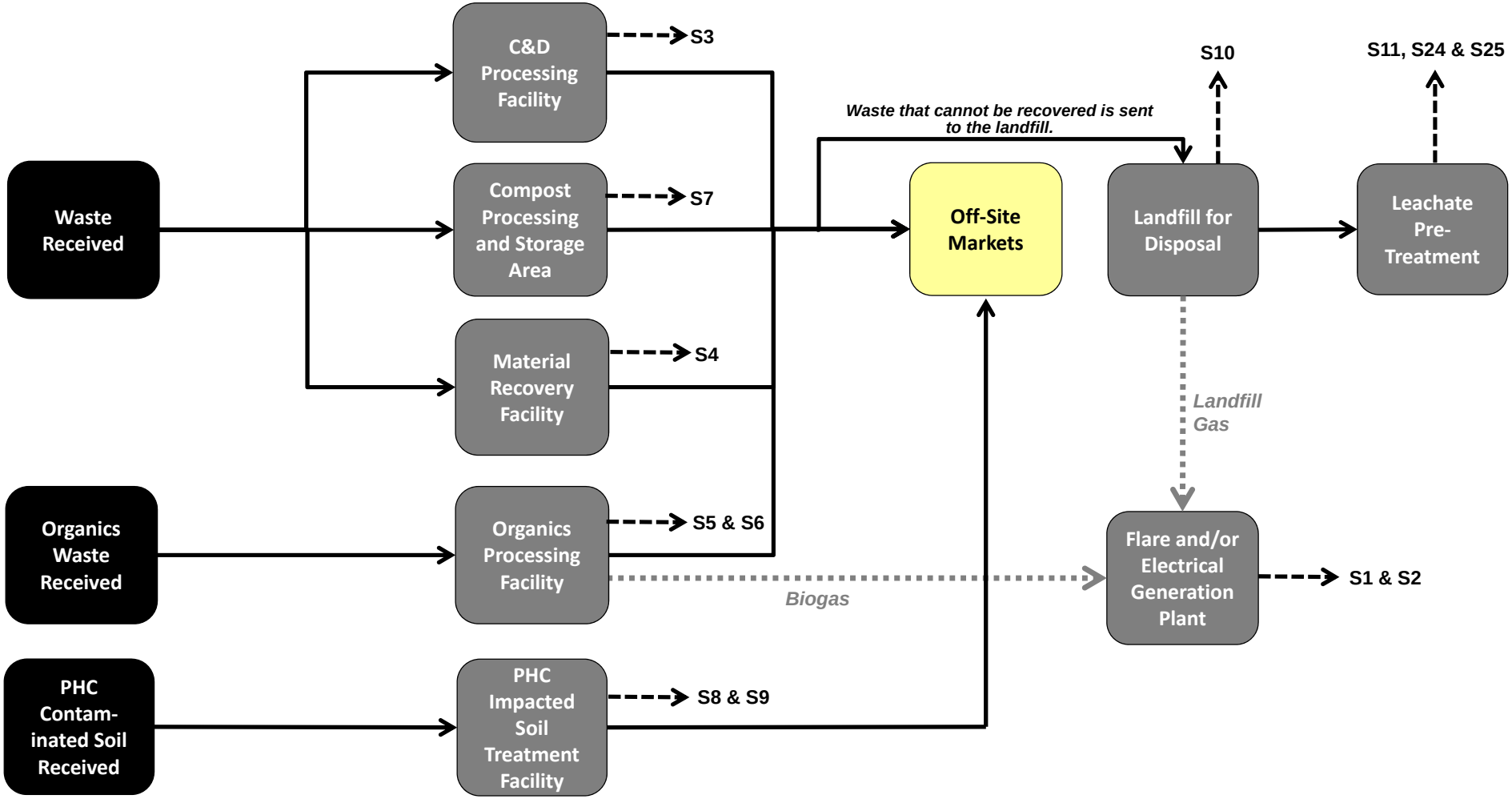
PROJECT No. 12-1125-0045			SCALE AS SHOWN	REV. 0.0
DESIGN	AVW	MAR. 2014	FIGURE 1	
GIS	BR/PM	MAR. 2014		
CHECK	PLE	AUG. 2014		
REVIEW	PAS	AUG. 2014		

Path: N:\Active\Spatial_IM\Miller_Paving_Ltd\CRRRC\GIS\MXDs\12-1125-0045\Reporting\Phase2000\Task_110_Air\1211250045-2000-0110-01_SiteLocationPlan.mxd

Date: November 2013
Project: 12-1125-0045
Golder Associates

SIMPLIFIED PROCESS FLOW DIAGRAM
Capital Region Resource Recovery Centre
Ottawa, Ontario

FIGURE 2A



LEGEND

- PROCESS FLOW
- EMISSIONS TO ATMOSPHERE
- SOURCE IDENTIFIER

Made By: AVW
Checked By: CST

NOTES:

1. This schematic represents the major processes taking place at the Facility. Simple processes such as maintenance, QA/QC procedures, backup operational procedures, and parts-washing have not been represented.
2. Vehicle exhaust and fugitive road dust (S12 & S13) are not shown.

N:\Active\20121125 - Environmental and Civil Engineering\12-1125-0045 CRRRC EA Eastern ON\Phase 4000_EA_Documentation\Vol 4 - D&O\ESDM Report\Figures

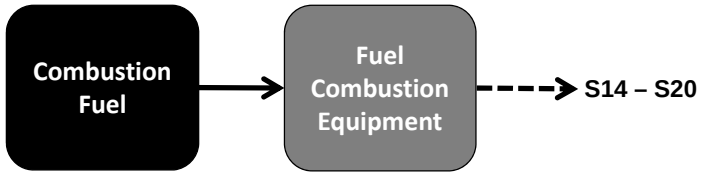
Date: November 2013

Project: 12-1125-0045

Golder Associates

SIMPLIFIED PROCESS FLOW DIAGRAM
Capital Region Resource Recovery Centre
Ottawa, Ontario

FIGURE 2B



LEGEND

- **PROCESS FLOW**
- **EMISSIONS TO ATMOSPHERE**
- **SOURCE IDENTIFIER**

Made By: AVW

Checked By: CST

NOTES:

1. **This schematic represents the major processes taking place at the Facility. Simple processes such as maintenance, QA/QC procedures, backup operational procedures, and parts-washing have not been represented.**

N:\Active\2012\1125 - Environmental and Civil Engineering\12-1125-0045 CRRRC EA Eastern ON\Phase 4000_EA_Documentation\Vol 4 - D&O\ESDM Report\Figures

466000

5021000

HIGHWAY 417

BOUNDARY RD

FRONTIER RD

DEVINE RD

5020000

467000

INSET MAP

SEE INSET MAP

1:1,000

PROPERTY BOUNDARY CORNER CO-ORDINATES		
ID	X	Y
1	465475.45	5020877.03
2	465887.24	5021036.01
3	465770.77	5021337.24
4	466489.24	5021616.32
5	466673.67	5021585.12
6	466687.52	5021547.04
7	466712.81	5021510.80
8	467261.83	5019983.45
9	466218.84	5019586.71
10	466040.66	5019602.46
11	465895.98	5019754.74
12	465675.04	5020342.05
13	466328.83	5020589.22
14	466142.17	5021102.27
15	465485.80	5020848.88

LEGEND

- POINT SOURCES
- PROPERTY BOUNDARY CORNER CO-ORDINATES
- VOLUME SOURCE
- PROPERTY BOUNDARY
- AREA SOURCES
- BUILDINGS

BUILDING HEIGHTS
BUILDING 1 - 7.50 m
BUILDING 2 - 9.00 m
BUILDING 3 - 15.50 m
BUILDING 4 - 15.50 m
BUILDING 5 - 10.75 m
BUILDING 6 - 6.50 m
BUILDING 7 - 8.00 m
BUILDING 8 - 13.75 m
BUILDING 9 - 6.00 m
BUILDING 10 - 13.50 m

Point Sources		
Source ID	X Coordinate	Y Coordinate
S1	466687.1	5021298.5
S2	Various	Various
S3	466145.7	5021382.2
S4	466349.7	5021470
S5	466485.8	5021210.5
S8	466355.3	5020948.9
S11	466483.6	5021034.7

Area Sources
Source ID
S6
S7
S9
S10
S21
S22

Volume Sources
Source ID
S14
S15
S16
S17
S18
S19
S20

NOTE

THIS FIGURE IS TO BE READ IN CONJUCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT.

REFERENCE

BACKGROUND IMAGERY - BING MAPS AERIAL (C) 2010 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.
AERIAL PHOTOGRAPHS PURCHASED FROM THE CITY OF OTTAWA.
LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2012.
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18

200 100 0 200

SCALE 1:6,000 METRES

PROJECT
EMISSION SUMMARY AND DISPERSION MODELLING REPORT FOR CAPITAL REGION RESOURCE RECOVERY CENTRE

TITLE
DISPERSION MODELLING PLAN

Golder Associates
Ottawa, Ontario

PROJECT No. 12-1125-0045			SCALE AS SHOWN	REV. 0.0
DESIGN	AVW	MAR. 2014	FIGURE 3	
GIS	BR/PM	MAR. 2014		
CHECK	PLE	AUG. 2014		
REVIEW	PAS	AUG. 2014		

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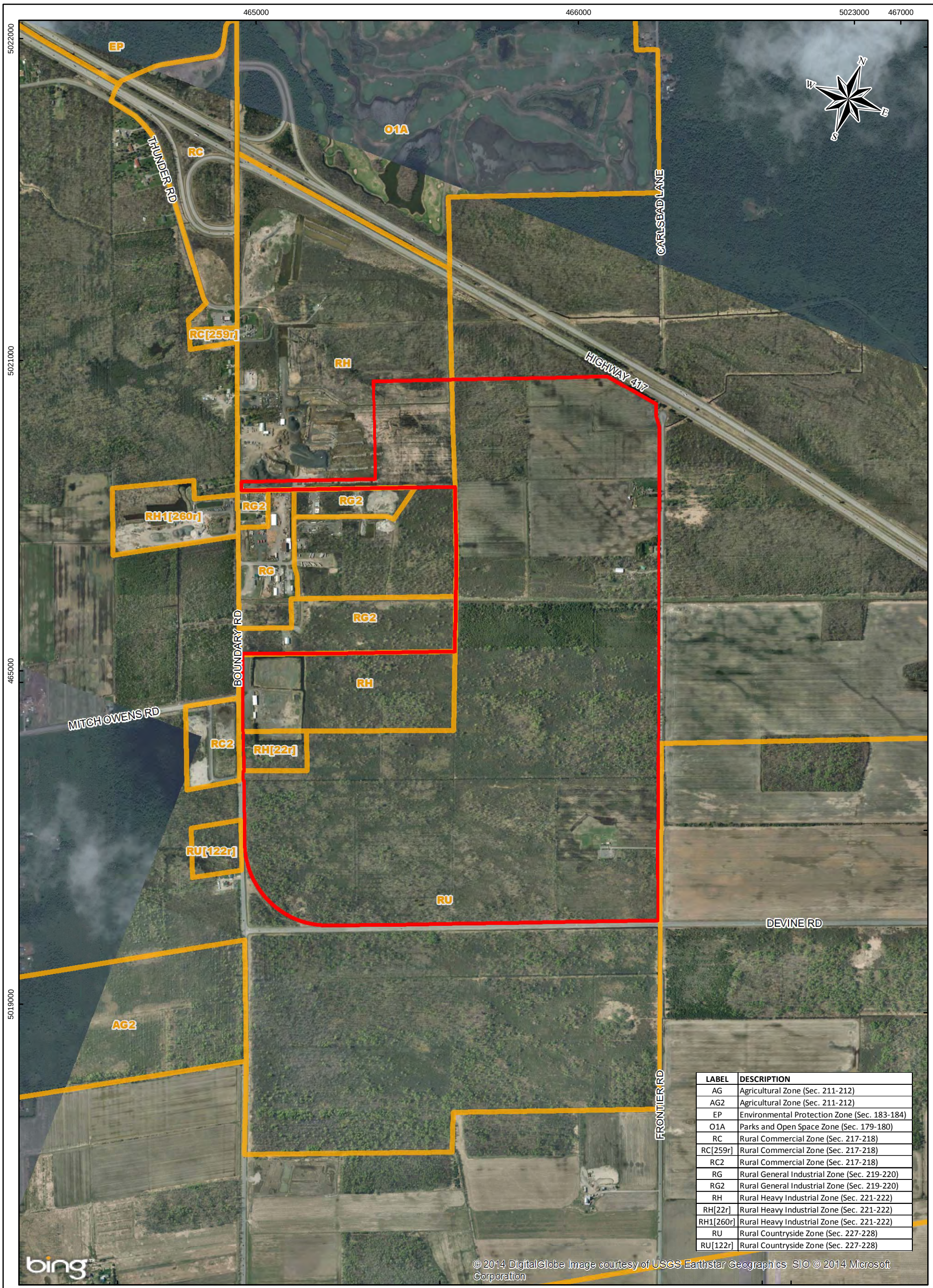

LABEL	DESCRIPTION
AG	Agricultural Zone (Sec. 211-212)
AG2	Agricultural Zone (Sec. 211-212)
EP	Environmental Protection Zone (Sec. 183-184)
O1A	Parks and Open Space Zone (Sec. 179-180)
RC	Rural Commercial Zone (Sec. 217-218)
RC[259r]	Rural Commercial Zone (Sec. 217-218)
RC2	Rural Commercial Zone (Sec. 217-218)
RG	Rural General Industrial Zone (Sec. 219-220)
RG2	Rural General Industrial Zone (Sec. 219-220)
RH	Rural Heavy Industrial Zone (Sec. 221-222)
RH[22r]	Rural Heavy Industrial Zone (Sec. 221-222)
RH1[260r]	Rural Heavy Industrial Zone (Sec. 221-222)
RU	Rural Countryside Zone (Sec. 227-228)
RU[122r]	Rural Countryside Zone (Sec. 227-228)

LEGEND

PROPERTY BOUNDARY

CITY OF OTTAWA ZONING BOUNDARY

400 200 0 400

SCALE 1:12,000 METRES

NOTE

THIS FIGURE IS TO BE READ IN CONJUCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT.

REFERENCE

ZONING BOUNDARIES DIGITIZED FROM GEOOTTAWA, CITY OF OTTAWA MAPPING WEBSITE, HTTP://MAPS.OTTAWA.CA/GEOOTTAWA.
BACKGROUND IMAGERY - BING MAPS AERIAL (C) 2010 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.
AERIAL PHOTOGRAPHS PURCHASED FROM THE CITY OF OTTAWA.
LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2012.
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18

PROJECT

EMISSION SUMMARY AND DISPERSION MODELLING REPORT FOR CAPITAL REGION RESOURCE RECOVERY CENTRE

TITLE

LAND USE ZONING DESIGNATION PLAN

Golder Associates
Ottawa, Ontario

PROJECT No. 12-1125-0045			SCALE AS SHOWN	REV. 0.0
DESIGN	AVW	MAR. 2014	FIGURE 4	
GIS	BR/PM	MAR. 2014		
CHECK	PLE	AUG. 2014		
REVIEW	PAS	AUG. 2014		

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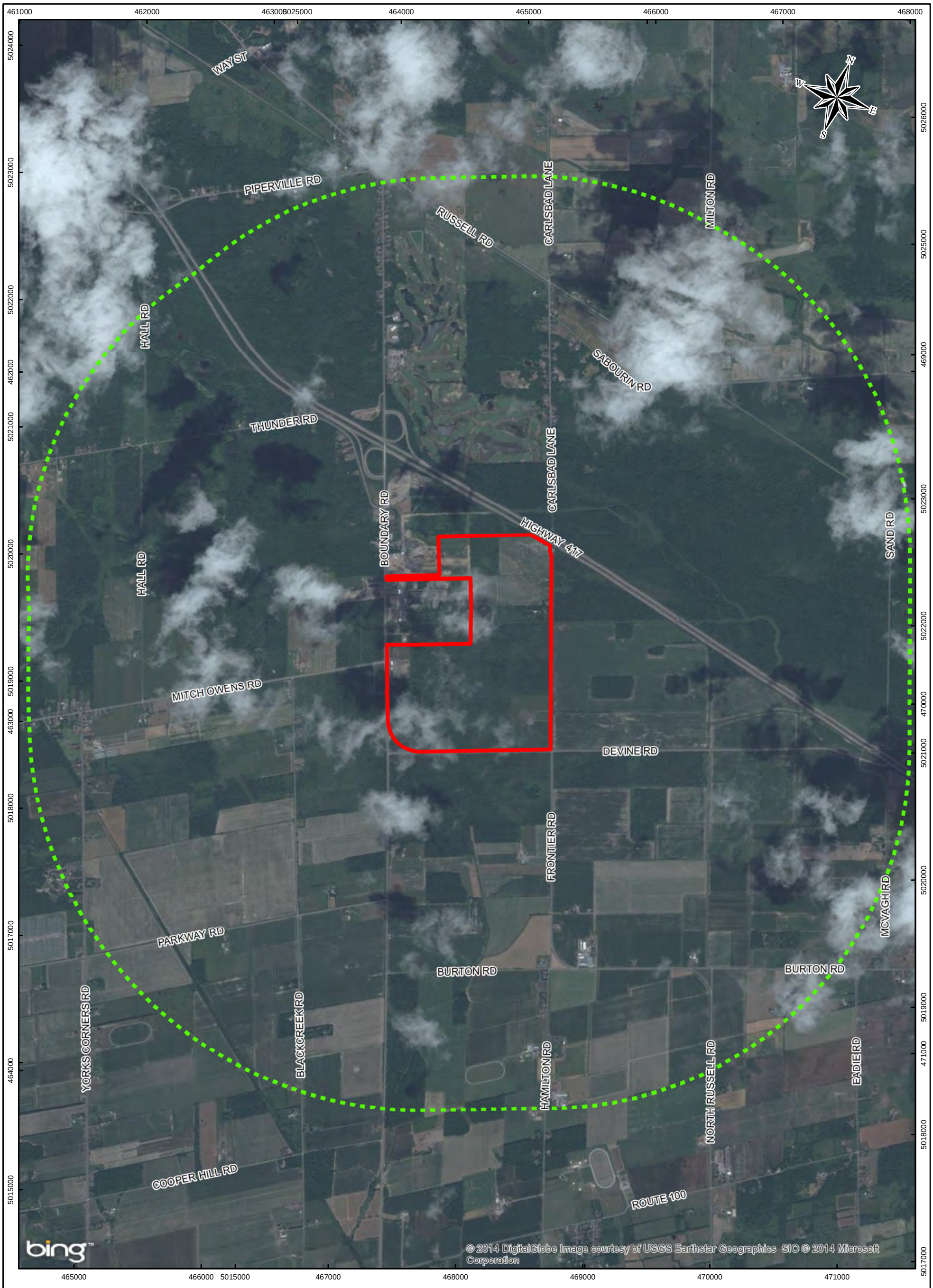

LEGEND

PROPERTY BOUNDARY

3 km BUFFER FROM PROPERTY BOUNDARY

1,000 500 0 1,000

SCALE 1:30,000 METRES

NOTE

THIS FIGURE IS TO BE READ IN CONJUCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT.

REFERENCE

BACKGROUND IMAGERY - BING MAPS AERIAL (C) 2010 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.
LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2012.
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18

PROJECT
EMISSION SUMMARY AND DISPERSION MODELLING REPORT FOR CAPITAL REGION RESOURCE RECOVERY CENTRE

TITLE
3 km SATELLITE IMAGE

Golder Associates
Ottawa, Ontario

PROJECT No. 12-1125-0045			SCALE AS SHOWN	REV. 0.0
DESIGN	AVW	MAR. 2014	FIGURE 5	
GIS	BR/PM	MAR. 2014		
CHECK	PLE	AUG. 2014		
REVIEW	PAS	AUG. 2014		

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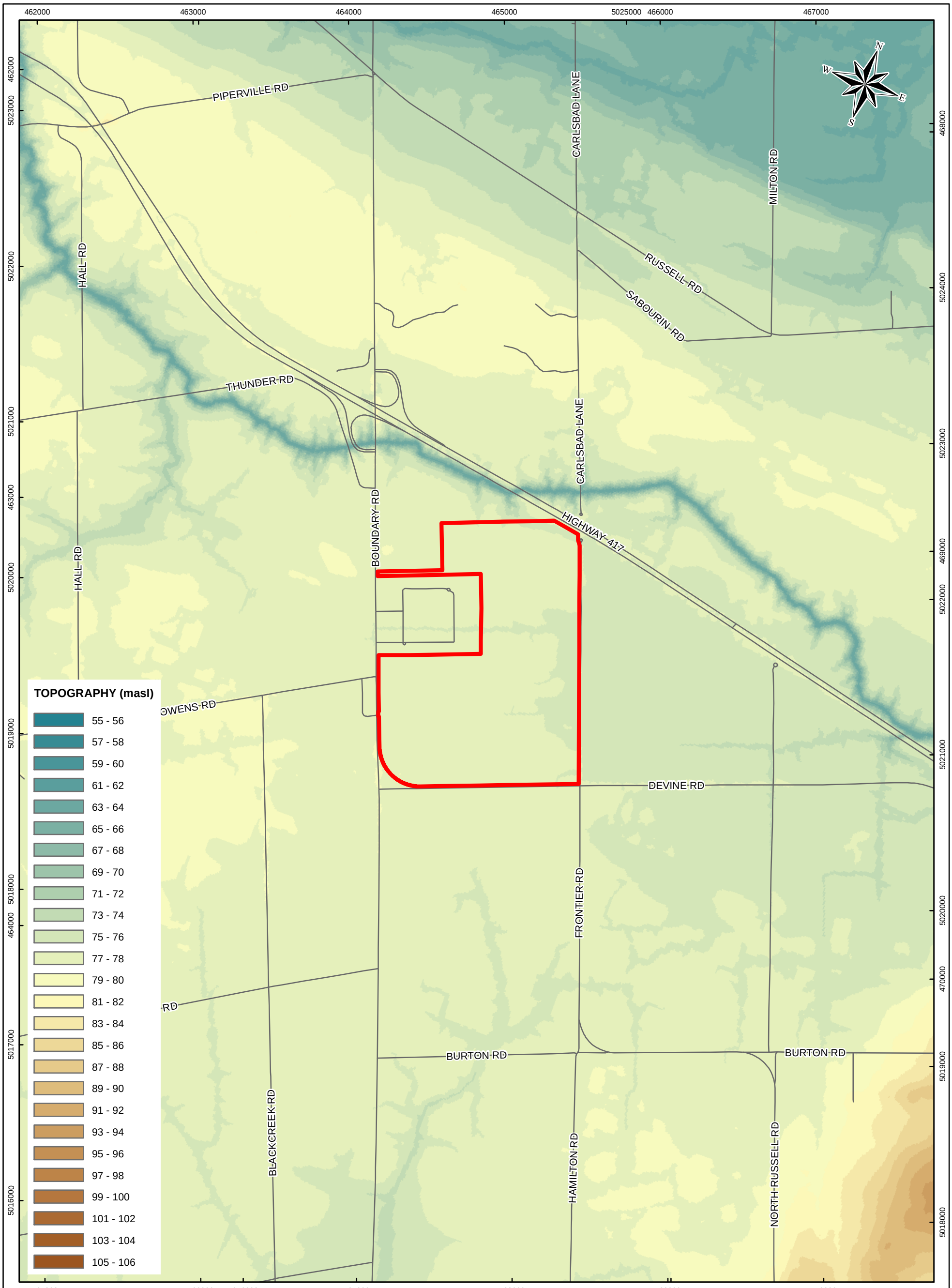


LEGEND

PROPERTY BOUNDARY

500 250 0 500 1,000

SCALE 1:25,000 METRES

NOTE

THIS FIGURE IS TO BE READ IN CONJUCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT.

REFERENCE

LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2012.
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18

PROJECT
EMISSION SUMMARY AND DISPERSION MODELLING REPORT FOR CAPITAL REGION RESOURCE RECOVERY CENTRE

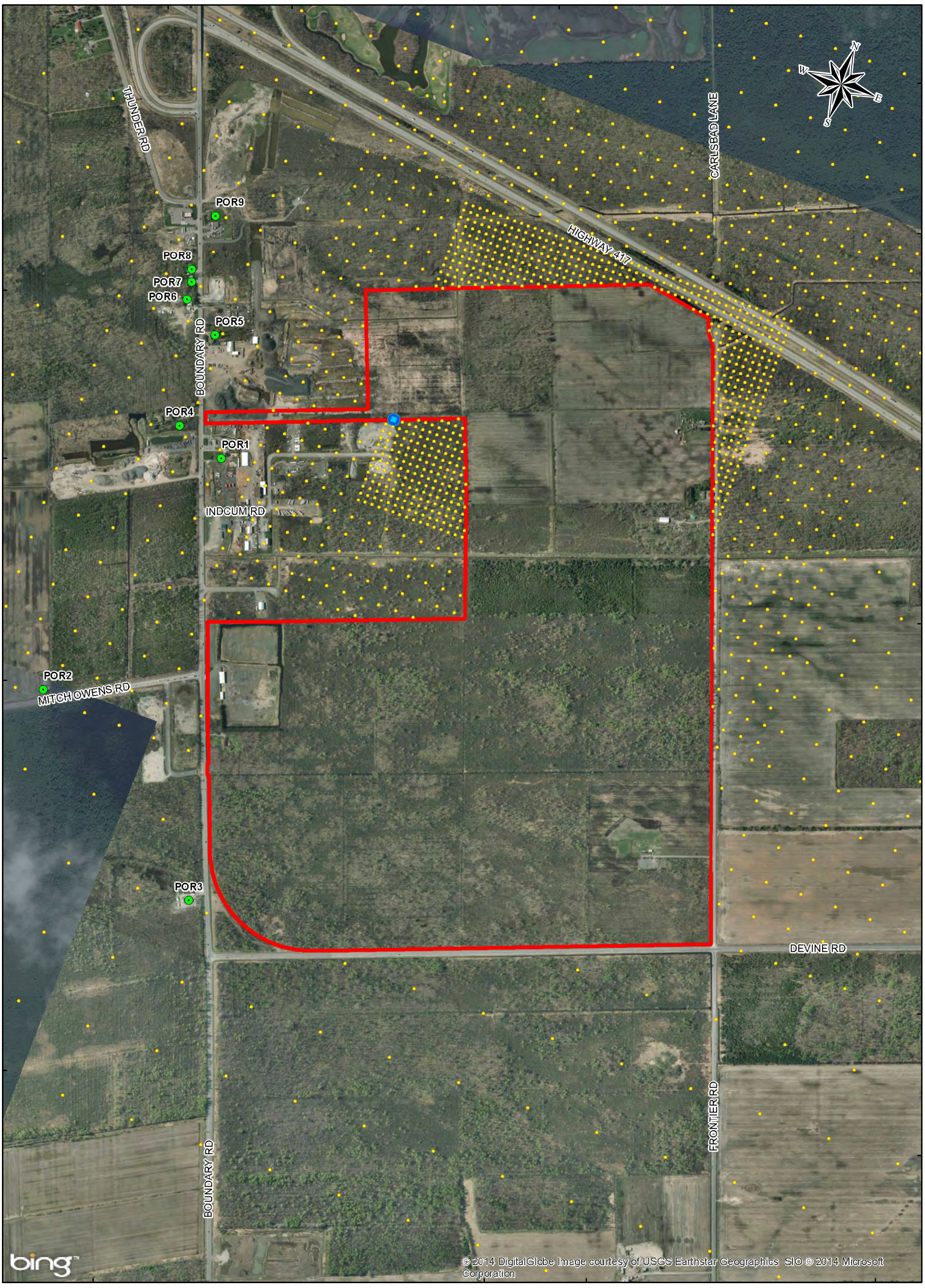
TITLE
DIGITAL TERRAIN DATA

Golder Associates
Ottawa, Ontario

PROJECT No. 12-1125-0045			SCALE AS SHOWN	REV. 0.0
DESIGN	AVW	MAR. 2014		
GIS	BR	MAR. 2014		
CHECK	PLE	AUG. 2014		
REVIEW	PAS	AUG. 2014		

FIGURE 6

Path: N:\Active\Spatial_IM\Miller_Paving_Ltd\CRRRC\GIS\MXDs\12-1125-0045\Reporting\Phase2000\Task_110_Air\1211250045-2000-0110-06_DigitalTerrainData.mxd



LEGEND

- POINT OF IMPINGEMENT
- DISPERSION MODELLING RECEPTORS
- DISCRETE RECEPTORS
- PROPERTY BOUNDARY (INCLUDING RECEPTORS LOCATED ALONG THE PROPERTY BOUNDARY AT A SPACING OF 10 m)

NOTE

THIS FIGURE IS TO BE READ IN CONJUCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT.

REFERENCE

BACKGROUND IMAGERY - BING MAPS AERIAL (C) 2010 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.
LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2012.
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18

200 100 0 200
SCALE 1:10,000 METRES

PROJECT
EMISSION SUMMARY AND DISPERSION MODELLING REPORT FOR CAPITAL REGION RESOURCE RECOVERY CENTRE

TITLE
DISPERSION MODELLING RECEPTORS

Golder Associates
Ottawa, Ontario

PROJECT No. 12-1125-0045			SCALE AS SHOWN	REV. 0.0
DESIGN	AVW	MAR. 2014	FIGURE 7	
GIS	BR/PM	MAR. 2014		
CHECK	PLE	AUG. 2014		
REVIEW	PAS	AUG. 2014		

Path: N:\Active\Spatial_IM\Miller_Paving_Ltd\CRRRC\GIS\MXDs\12-1125-0045\Reporting\Phase2000\Task_110_Air\1211250045-2000-0110-07_DispersionModellingReceptors.mxd

ATTACHMENT A

Emission Rate Calculations

December 2014

ESDM REPORT

ATTACHMENT A

Emission Rate Calculations

Report Number: 12-1125-0045/4500/vol IV

Golder Associates

ACRONYMS AND GLOSSARY OF TERMS

Acronym	Definition
C&D	Construction and Demolition
CO	Carbon monoxide
CRRRC	Capital Region Resource Recovery Centre
EA	Environmental Assessment
EPA	Environmental Protection Agency
ER	Emission rate
ESDM	Emissions Summary and Dispersion Modelling
FR	Flow Rate
GHG	Greenhouse Gas
HC	Hydrocarbon
IPCC	International Panel on Climate Change
LFG	Landfill gas
MOE	Ontario Ministry of the Environment
MRF	Material Recycling Facility
MSW	Municipal Solid Waste
NO	Nitrogen oxide
NO_2	Nitrogen dioxide
NO_X	Oxides of nitrogen
O. Reg.	Ontario Regulation
O_3	Ozone
PM_{10}	Particles nominally smaller than 10 µm in aerodynamic diameter
$PM_{2.5}$	Particles nominally smaller than 2.5 µm in aerodynamic diameter
POI	Point-of-Impingement
S	Sulphur
SO_2	Sulphur dioxide
SPM	Suspended particulate matter (also Total Suspended Particulate or TSP)
TSD	Technical Supporting Document
US EPA	United States Environmental Protection Agency
VKT	Vehicle kilometres travelled
VMT	Vehicle mile travelled

UNITS

Unit	Definition
acfm	Actual cubic feet per minute
g/s	Grams per second
g/m^3	Grams per cubic metres
kg/mg	Kilograms per milligrams
km	Kilometres
kPa	Kilopascals
m	Metres
m/s	Metres per second
m^3/s	Cubic metres per second
m^3/yr	Cubic metres per year
mg/m^3	Milligrams per cubic metre
mt/hr	Metric tonne per hour
$\mu g/m^3$	Micrograms per cubic metre
µm	Micrometres (also microns), one-millionth of a metre
OU	Odour Units
OU/m^3	Odour Units per cubic metre
ppb	Parts per billion
ppm	Parts per million
VKT/hr	Vehicle kilometres travelled per hour

Table of Contents

1.0 INTRODUCTION

This Attachment provides sample calculations to demonstrate how the emission estimates were developed for the proposed CRRRC. The emission rates were determined as per guidance in the Ontario Ministry of the Environment (MOE) document *"Procedure for Preparing an Emission Summary and Dispersion Modelling Report"* Version 3.0 (March 2009) (ESDM Procedure Document). The results are all in units of grams per seconds (g/s), which are required for the dispersion models.

2.0 SAMPLE CALCULATIONS

2.1 Flare

The landfill gas (LFG) collection system will collect approximately 75% of the LFG produced by the landfill, (U.S. EPA, 2008). This collected gas is either combusted using an enclosed flare or sent to electrical generation plant, which converts the LFG (along with biogas from the organics processing area) to electricity. Based on design specifications, the flare has capacity for LFG and biogas with 56.2% methane and the flow rate of LFG and biogas to the flare will be 0.98 m^3/s, made up of 36% LFG and 64% biogas. LFG constituents and their estimated respective concentrations in the LFG were obtained from the U.S. EPA AP 42 Chapter 2.4 (Table 2.4-1). As worst-case estimates, the biogas was assumed to have the same constituents and concentration as the LFG.

The following is a sample calculation for the emission rate of the LFG constituents (in this case, vinyl chloride) from the flare:

$$\text{ER} = \text{Landfill Gas flow rate } \frac{\text{m}^3}{\text{s}} \times \text{conc.} \frac{\mu\text{g}}{\text{m}^3} \times \frac{1\text{ g}}{1{,}000{,}000\ \mu\text{g}} \times (1 - \text{ destruction efficiency } (\%))$$

Where:

ER	=	emission rate (g/s),
Landfill Gas Flow rate	=	flow rate of landfill and organics gas to the flare (m^3/s),
conc.	=	concentration of the contaminant in the landfill gas ($\mu g/m^3$) obtained from US EPA AP 42 Chapter 2.4, and
destruction efficiency	=	amount of the contaminant that is destroyed during combustion (%) obtained from US EPA AP 42 Chapter 2.4.

$$\text{ER} = 0.983\ \frac{\text{m}^3}{\text{s}} \times 3627.21 \frac{\mu g}{\text{m}^3} \times \frac{1\text{ g}}{1{,}000{,}000\ \mu\text{g}} \times (1 - 98\ \%)$$

$$\text{ER} = 0.0000713\ \frac{\text{g}}{\text{s}}$$

The emission rate for reduced sulphur compounds was calculated based on expected LFG composition. The concentration of sulphur in the LFG was estimated by summing the concentration of compounds containing sulphur (based on US EPA AP 42 Chapter 2.4) multiplied by the number of moles of sulphur in each compound. The concentration of reduced compounds was determined to be 39.64 m^3 of sulphur per 1,000,000 m^3 of LFG.

$$\text{ER} = \text{conc. of sulphur in the LFG } \frac{\text{m3 S}}{\text{m3 LFG}} \times \text{flow rate } \frac{\text{m3LFG}}{\text{sec}} \times \frac{1 \text{ mol. K}}{8.3145 \text{ m3 S. PA}} \times \frac{101325 \text{ Pa}}{298.15 \text{ K}} \times \frac{32.1 \text{ gS}}{\text{mol}}$$

$$\text{ER} = 39.64 \frac{\text{m}^3\text{S}}{1{,}000{,}000 \text{ m}^3 \text{ LFG}} \times 0.983 \frac{\text{m3 LFG}}{\text{sec}} \times \frac{1 \text{ mol. K}}{8.3145 \text{ m3 S. PA}} \times \frac{101325 \text{ Pa}}{298.15 \text{ K}} \times \frac{32.1 \ g_s}{\text{mol}}$$

$$\text{ER} = 0.0511 \frac{g_s}{\text{s}}$$

The sulphur dioxide emission rate from the flare was calculated as follows[1]:

$$\text{ER} = \text{reduced sulphur compounds emission rate } \times {}^{MW_{SO2}}/_{MW_S}$$

$$\text{ER} = 0.0511 \frac{g_s}{s} \times \frac{64.0}{32.1}$$

$$\text{ER} = 0.102 \frac{\text{g}}{\text{s}}$$

The following is a sample calculation for the emission rate of combustion by-products (in this case nitrogen oxides) from the flare:

$$\text{ER} = \text{flow rate dscm} \times \text{percent of methane in LFG(\%)} \times \text{NOx emission factor} \times \text{conversion factors}$$

$$\text{ER} = 0.983 \frac{\text{m}^3}{\text{s}} \times 56.2 \text{ \% CH4} \times 631 \frac{\text{kg}}{1{,}000{,}000 \text{dscm of CH4}} \times 1000 \frac{\text{g}}{\text{kg}}$$

$$\text{ER} = 0.348 \frac{\text{g}}{\text{s}}$$

The emission rates for all LFG and biogas constituents were calculated as presented above.

[1] S= sulphur

2.2 Electrical Generation Plant

If built, the electrical generation plant would receive collected LFG and biogas from the organics processing facility. The combined gas would be used to fuel internal combustion engines that will be coupled to electrical generators. Electricity produced by the plant would be exported to the local electrical distribution system and/or used to power on-Site electrical demand. It is anticipated that 7 Jenbacher 1.06 MW engines (each with an electrical generator) would be required to combust this gas. LFG constituents and their estimated respective concentrations in the LFG were obtained from the U.S. EPA AP 42 Chapter 2.4 (Table 2.4-1).

The emission rates for the proposed electrical generation plant were calculated in the same manner as for the flare (refer to Section 2.1).

2.3 Dust Collectors

The Construction and Demolition (C&D) Recycling Facility and the Material Recovery Facility (MRF) will both have dust collectors to control particulate emissions from these facilities. An outlet loading emission factor of 10 mg/m^3 for SPM was used to calculate particulate emissions from these dust collectors. This emission factor is based on guidance provided in the MOE *Procedure for Preparing an Emission Summary and Dispersion Modelling Report* (MOE, March 2009) for small dust collectors. An expected dust collector flow rate of 15,000 acfm was also assumed.

The following is a sample calculation for the emission rate of SPM from the dust collectors proposed at the MRF:

$$\text{ER} = \text{outlet loading}\ \frac{\text{mg}}{\text{m}^3} \times \text{flow rate} \times \frac{\text{ft}^3}{\text{min}} \times \frac{1\ \text{m}^3}{35.32\ \text{ft}^3} \times \frac{1\ \text{min}}{60\ \text{s}} \times \frac{1\ \text{g}}{1000\ \text{mg}}$$

$$\text{ER} = \frac{10\ \text{mg}}{\text{m}^3} \times \frac{15{,}000\ \text{ft3}}{\text{min}} \times \frac{1\ \text{m}^3}{35.32\ \text{ft}^3} \times \frac{1\ \text{min}}{60\ \text{s}} \times \frac{1\ \text{g}}{1{,}000\ \text{mg}}$$

$$\text{ER} = 0.0708\ \text{g/s}$$

Emission rates of PM_{10} and $PM_{2.5}$ were assumed to be 100% of the SPM emission rate.

2.4 Biofilters

Air from the PHC impacted soil treatment and the organics processing areas will be collected and treated through biofilters. There is proposed to be one biofilter for the PHC impacted soil treatment area and one biofilter for the organics processing area.

For the PHC impacted soil treatment area, the flow rate of the biofilter was estimated to be 15,000 m^3/hr based on Information provided by Taggart Miller.

For the organics processing facility, the maximum airflow for the biofilter was assumed to be 72,000m^3/hr based on the maximum design airflow provided by Taggart Miller.

Based on testing completed at similar facilities by BIOREM, maximum odour levels leaving the biofilters were estimated to be 500 OU/m^3.

The following is a sample calculation for the emission rate of odour from the PHC impacted soil treatment area:

$$\text{ER} = \text{biofilter exit odour concentration}\ \frac{\text{OU}}{\text{m}^3} \times \text{flow rate}\ \frac{\text{m}^3}{\text{hr}}\ \times \frac{1\ \text{hr}}{3600\ \text{s}}$$

$$\text{ER} = 500\ \frac{\text{OU}}{\text{m}^3} \times 15{,}000\ \frac{\text{m}^3}{\text{hr}}\ \times \frac{1\ \text{hr}}{3600\ \text{s}}$$

$$\text{ER} = 2{,}083\ \text{OU/s}$$

2.5 Material Transfer Fugitive Dust

The U.S. EPA AP-42 emission factors from Chapter 13.2.4 – Aggregate Handling and Storage Piles (November 2006) were used to calculate the fugitive dust emissions associated with material transfer activities that will occur at the landfill, the composting area, the organics processing facility, and the hydrocarbon (HC) impacted soil treatment area. The following predictive emissions equation was used in determining the emission factors for material handling:

$$\text{EF} = \text{k} \times 0.0016\ \times \frac{\left(\frac{\text{U}}{2.2}\right)^{1.3}}{\left(\frac{\text{M}}{2}\right)^{1.4}}$$

Where:
EF = particulate emission factor (kg/Mg),
k = particle size multiplier for particle size range (see Table A 2-1),
U = mean wind speed (m/s), and
M = moisture content of material (percent) (%).

Table A 2-1: Particle Size Assumptions Material Transfer

Size Range	k
$PM_{2.5}$	0.053
PM_{10}	0.35
SPM	0.74

The following is a sample calculation for the SPM emission factor for material handling that will occur at the PHC impacted soil treatment area. A mean wind speed of 3.5 m/s obtained from the MOE pre-processed meteorological data (1996-2000) used for the dispersion modelling assessment. A moisture content of 12% for municipal solid waste landfill cover soil was used, which was obtained from Table 13.2.4.1 of the U.S. EPA AP-42.

$$\mathrm{EF} = 0.74 \times 0.0016 \times \frac{\left(\frac{3.5\ \mathrm{m/s}}{2.2}\right)^{1.3}}{\left(\frac{12\%}{2}\right)^{1.4}}$$

$$\mathrm{EF} = 0.000176\ \mathrm{kg/Mg}$$

The following is a sample calculation for the SPM emission rate per drop for a handling rate of 106 tonnes/hr.

$$\mathrm{ER} = \frac{0.000176\ \mathrm{kg}}{\mathrm{tonnes}} \times \frac{106\ \mathrm{tonnes}}{\mathrm{hr}} \times \frac{1\ \mathrm{hr}}{3{,}600\ \mathrm{s}} \times \frac{1{,}000\ \mathrm{g}}{1\ \mathrm{kg}}$$

$$\mathrm{ER} = 0.00518\ \frac{\mathrm{g}}{\mathrm{s}}\ \text{per drop}$$

It was assumed that there will be two loaders in the PHC impacted soil treatment area that can be moving material simultaneously, at the same time that each biopile can be turned, thus a maximum of 2 drop points occurring at the same time during operations at the PHC impacted soil treatment area was assumed. The emission rate is as follows:

$$\mathrm{ER} = \mathrm{ER\ per\ drop} \times \#\ \mathrm{of\ drops}$$

$$\mathrm{ER} = 0.00518 \frac{\mathrm{g}}{\mathrm{s}} \mathrm{per\ drop} \times 2$$

$$\mathrm{ER} = 0.0104\ \mathrm{g/s}$$

The emission rates of PM_{10} and $PM_{2.5}$ were calculated as presented above.

2.6 Composting/Curing Pad

Leaf and yard, wood waste, and digested product will be composted or cured on-Site. Emission factors used to calculate the odour emissions associated with the proposed composting/curing pad activities were obtained from a study completed for GORE (Barth & Bitter GmbH, 2006). The annual throughput of compost/curing pad activities is anticipated to be 50,000 tonnes/yr, 60% of which will be digested product, and 40% of which will be yard waste. Approximately 32,300 tonnes of the final product may be produced annually.

The following is a sample calculation for the emission rate of the composting/curing pad pile:

$$\text{ER} = \text{emission factor}\ \frac{\text{OU}}{\text{m}^2 - s} \times \text{area}\ (\text{m}^2)$$

$$\text{ER} = 0.56\ \frac{\text{OU}}{\text{m}^2 - s} \times 447(\text{m}^2)$$

$$\text{ER} = 250\ \text{OU/s}$$

The average emission rate for all composting/curing pad activities was calculated.

2.7 Landfill Cap

LFG not collected and distributed to the flare or the electrical generation plant may result in fugitive LFG emissions from the landfill cap. These fugitive emissions were estimated, including odour emissions. LFG constituents and their estimated respective concentrations in the LFG were obtained from the U.S. EPA AP 42 Chapter 2.4 (Table 2.4-1). Average LFG emissions per year were estimated using results from the LandGEM model based on a 75% capture efficiency.

The following is a sample calculation for the emission rate of vinyl chloride from the landfill cap:

$$\text{ER} = \text{conc.}\frac{\mu\text{g}}{\text{m}^3} \times \text{LGF}\ \frac{\text{m}^3}{\text{yr}} \times \frac{1\ \text{yr}}{365\ \text{days}} \times \frac{1\ \text{day}}{24\ \text{hrs}} \times \frac{1\ \text{hr}}{3{,}600\ \text{s}} \times \frac{1\ \text{g}}{1{,}000{,}000\ \mu\text{g}} \times (1 - \text{collection efficiency}\ (\%))$$

Where:
ER = emission rate (m^3/s),
conc. = concentration of the contaminant in the landfill gas (g/m^3) obtained from US EPA AP 42 Chapter 2.4
LFG = average landfill gas emissions per yr (m^3/yr) (obtained from LandGEM), and
collection efficiency = collection efficiency of landfill gas.

$$\text{ER} = 3627.21\ \frac{\mu\text{g}}{\text{m}^3} \times 13{,}199{,}538.3\frac{\text{m}^3}{\text{yr}} \times \frac{1\ \text{yr}}{365\ \text{days}} \times \frac{1\ \text{day}}{24\ \text{hrs}} \times \frac{1\ \text{hr}}{3{,}600\ \text{s}} \times \frac{1\ \text{g}}{1{,}000{,}000\ \mu\text{g}} \times (1 - 75\%)$$

$$\text{ER} = 0.0003795\frac{\text{g}}{\text{s}}$$

Emissions of the remaining LFG constituents were calculated in the same manner presented above.

To calculate the odour emissions, the flow rate of the landfill cap is needed. The following is a sample calculation to determine the flow rate from the landfill cap:

$$\text{FR} = \text{LFG}\ \frac{\text{m}^3}{\text{yr}} \times \frac{1\ \text{yr}}{365\ \text{days}} \times \frac{1\ \text{day}}{24\ \text{hrs}} \times \frac{1\ \text{hr}}{3{,}600\ \text{s}} \times (1 - 75\%)$$

Where:
FR = flow Rate (m^3/s),
LFG = average landfill gas emissions per year (m^3/yr) (obtained from LandGEM), and
75% = collection efficiency of landfill gas.

$$\text{FR} = 13{,}199{,}538.3\ \frac{\text{m}^3}{\text{yr}} \times \frac{1\ \text{yr}}{365\ \text{days}} \times \frac{1\ \text{day}}{24\ \text{hrs}} \times \frac{1\ \text{hr}}{3{,}600\ \text{s}} \times (1 - 75\%)$$

$$\text{FR} = 0.105\ \frac{\text{m}^3}{\text{s}}$$

The following is a sample calculation for the emission rate of odour from the landfill cap. The odour concentration of the LFG was estimated to be 10,000 OU/m^3 based on the upper range from the MOE's *Interim Guide to Estimate and Assessing Landfill Air Impacts* (MOE, 1992).

$$\text{ER} = \text{odour concentration}\ \frac{\text{OU}}{\text{m}^3} \times \text{flow rate}\ \frac{\text{m}^3}{\text{s}}$$

$$\text{ER} = 10{,}000\ \frac{\text{OU}}{\text{m}^3} \times 0.105\ \frac{\text{m}^3}{\text{s}}$$

$$\text{ER} = 1{,}050\ \text{OU/s}$$

2.8 Leachate Pre-treatment

Leachate odour emissions were estimated based on information obtained from BIOREM as well as the proposed flow rate of the scrubber system and odour emissions at other similar leachate pre-treatment operations. These were used as worst-case emissions from the proposed leachate treatment building. The design includes the use of a scrubber.

The following is a sample calculation for the emission rate of odour from the leachate facilities:

$$\text{ER} = \text{odour concentration}\ \frac{\text{OU}}{\text{m}^3} \times \text{flow rate}\ \frac{\text{m}^3}{s}$$

$$\text{ER} = 1{,}000\ \frac{\text{OU}}{\text{m}^3} \times 6.94\ \frac{\text{m}^3}{\text{s}}$$

$$\text{ER} = 6940\ \text{OU/s}$$

2.9 Leachate Ponds

Emissions from the leachate ponds were estimated based on information obtained from the design team. Additionally a detection threshold (i.e. emission factor) of 100 OU for a final clarifier was obtained from a paper titled 'Odor Threshold Emission Factors for Common WWTP Processes' (St. Croix Sensory Inc., 2008). The volume throughput used is based on the maximum design capacity of the pond.

The following is a sample calculation for the emission rate of odour from the leachate holding pond:

$$\text{ER} = \text{odour detection limit}\ \frac{\text{OU}}{\text{m}^3} \times\ \text{volumetric throughput}\frac{\text{m}^3}{s}$$

$$\text{ER} = 100\ \frac{\text{OU}}{\text{m}^3} \times 0.0093\frac{\text{m}^3}{\text{s}}$$

$$\text{ER} = 0.93\ \text{OU/s}$$

2.10 Stationary Fuel Combustion

The proposed CRRRC buildings may be heated using fuel oil. Anticipated fuel oil usage rates for stationary fuel combustion were provided by Taggart Miller. U.S. EPA AP-42 emission factors from Chapter 1.3 – Fuel Oil Combustion (US EPA1999) were used to calculate emissions from combustion.

The following is a sample calculation for the MRF building for the emission rate of NOx:

$$\text{ER} = \text{diesel usage}\frac{10^3\ \text{gal}}{\text{yr}}\ \times\ \text{emission factor NOx}\frac{\text{lb}}{10^3\ \text{gal}} \times \frac{1\ \text{yr}}{365\ \text{days}} \times \frac{1\ \text{day}}{24\ \text{hrs}} \times \frac{1\ \text{hr}}{3600\ \text{s}}$$

$$\text{ER} = 21\frac{10^3\ \text{gal}}{\text{yr}}\ \times 20\frac{\text{lb}}{10^3\ \text{gal}} \times \frac{1\ \text{yr}}{365\ \text{days}} \times \frac{1\ \text{day}}{24\ \text{hrs}} \times \frac{1\ \text{hr}}{3600\ \text{s}} \times \frac{453.6\ \text{g}}{1\ \text{lb}}$$

$$\text{ER} = 0.006\frac{\text{tonnes}}{\text{yr}}$$

2.11 Non-Road Vehicles – Exhaust Emissions

Crank case emission factors and load factors for non-road Engine Modelling (Compression Ignition) – U.S. EPA 009d (July, 2010) were used to calculate the exhaust emissions from on-Site vehicles. It was assumed that all on-Site vehicles comply with Tier 3 emission standards.

The following predictive emissions equation was used to determine the combustion emission rates for on-Site vehicles:

$$\text{ER} = \text{EF}\ \times \text{engine horsepower rating}\ \times \text{load factor}\ \times \frac{1\ \text{hr}}{3{,}600\ \text{s}}$$

Where:
ER = emission rate (g/s), and
EF = emission factor (g/hp-hr).

The following is a sample calculation for the NO_x emissions for the Caterpillar 430 backhoe to be located at the landfill:

$$\text{ER} = \frac{2.62\ \text{g}}{\text{hp} - \text{hr}} \times 500\ \text{hp} \times 0.21 \times \frac{1\ \text{hr}}{3{,}600\ \text{s}}$$

$$\text{ER} = 0.0764\ \text{g/s}$$

The emission rates for non-road vehicles were calculated for each of the areas of the Site where non-road vehicles are anticipated to be present (the landfill, composting pad area, petroleum hydrocarbon impacted soil treatment area, and the organics treatment area) by summing the emission rates from each of the vehicles at the respective areas. The emissions rates for suspended particulate matter (SPM), PM_{10} and $PM_{2.5}$, SO_2, and CO were calculated using the same equation.

2.12 On-Road Vehicles – Exhaust Emissions

Emission factors for the on-Site vehicle exhaust for on-road vehicles were obtained using the U.S. EPA MOBILE6 emission model.

The emission factors developed for the fleet trucks are provided in Table A 2-2.

Table A 2-2: Emission Factors for Fleet Trucks Calculated Using MOBILE6

Compound	Emission Factor (g/VKT)[1]
SPM	1.02E-01
PM_{10}	1.02E-01
$PM_{2.5}$	8.49E-02
NO_X	2.43E+00
SO_2	6.80E-03
CO	5.60E-01

Notes: (1) VKT =vehicle kilometres travelled

The following equation was used to determine the vehicle kilometres travelled per hour (VKT/hr):

$$\frac{VKT}{hr} = \frac{\#\ of\ Trucks}{Hour}\ X\ Road\ Length\ Travelled\ (km)$$

The following is a sample calculation for VKT/hr on one segment (P1) of the paved roads:

$$\frac{VKT}{hr} = \frac{45\ Trucks}{Hour}\ X\ \ 0.7\ km$$

VKT/hr = 31.6

Each of the road segments P1 to P11 was calculated using the equation above. The road segments are presented in Figure A.1. The value of 46.7 VKT/hr represents total vehicle kilometres travelled per hour on all paved road segments. This value is used in the sample calculation for NO_x below.

The following predictive emissions equation was used to determine the tailpipe emission rates for on-Site vehicles travelling on paved roads:

$$\text{ER} = \text{EF} \times \text{vehicle kilometres travelled per hour} \times \frac{1\ \text{hr}}{3{,}600\ \text{s}}$$

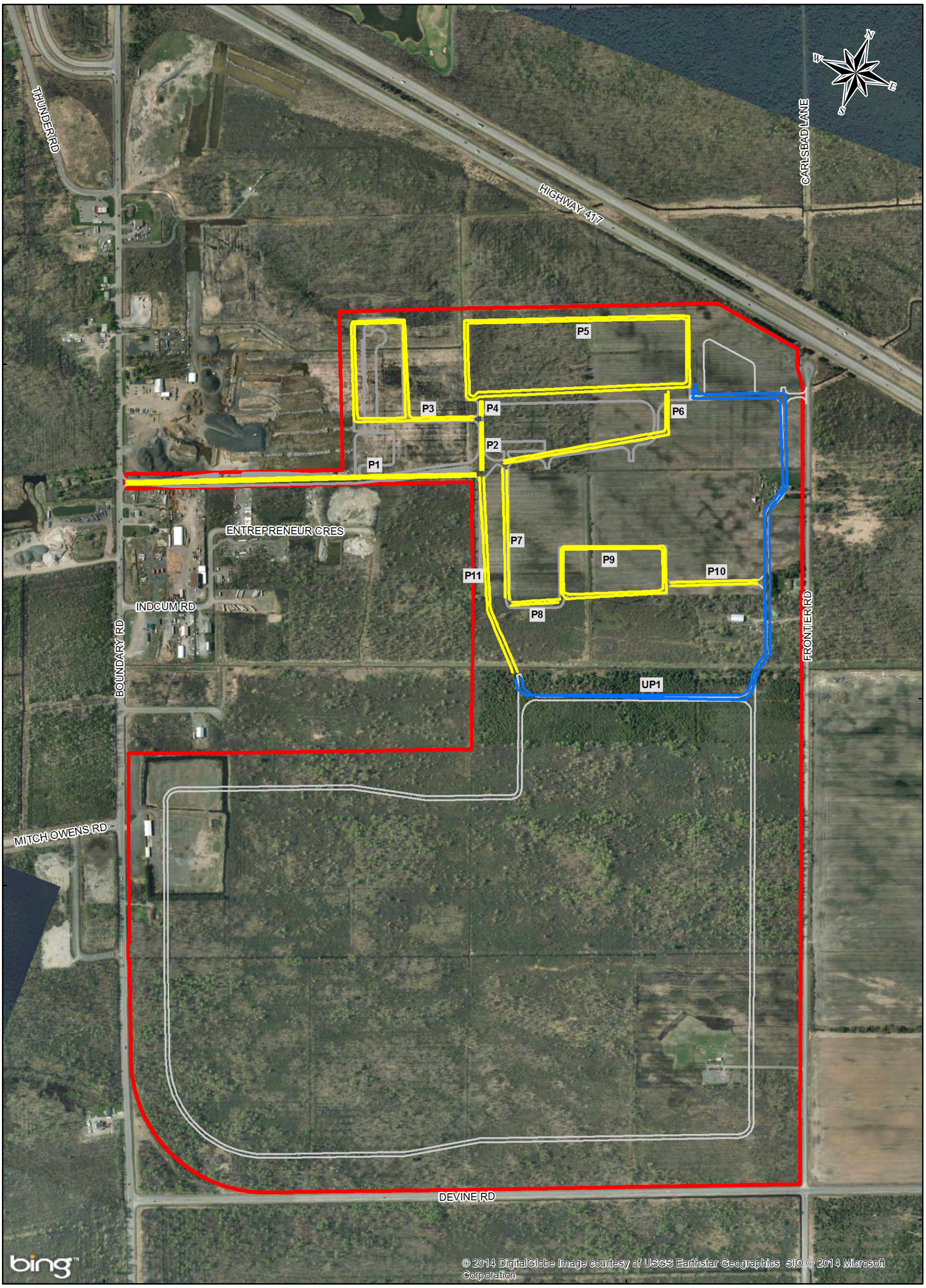
Where:
ER = emission rate (g/s),
EF = emission factor (g/VKT), and
VKT = 46.7 VKT (calculated VKT for all paved road segments.)

The following is a sample calculation for NO_x emissions for on-Site vehicles tailpipe emissions on paved road segments.

$$ER = \frac{2.43\ \text{g}}{\text{VKT}} \times \frac{46.7\ \text{VKT}}{\text{hr}} \times \frac{1\ \text{hr}}{3{,}600\ \text{s}}$$

$$\text{ER} = 0.0315\ \text{g/s}$$

Additionally, SPM, PM_{10} and $PM_{2.5}$, SO_2, and CO were calculated using the same equation. The emission rates for unpaved road segments were calculated using the same emissions factor and the same approach to determine the vehicle kilometres travelled as shown in Section 4.1.3 and 4.1.4.



LEGEND

- PROPERTY BOUNDARY
- UNPAVED ROADS
- PAVED ROADS
- MODELLED PAVED ROADS
- MODELLED UNPAVED ROADS

NOTE

THIS FIGURE IS TO BE READ IN CONJUCTION WITH THE ACCOMPANYING REPORT.

REFERENCE

BACKGROUND IMAGERY - BING MAPS AERIAL (C) 2010 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.
LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2012.
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18

150 75 0 150
SCALE 1:7,500 METRES

PROJECT
ENVIRONMENTAL ASSESSMENT OF THE CAPITAL REGION RESOURCE RECOVERY CENTRE

TITLE
EMISSION SUMMARY AND DISPERSION MODELLING REPORT FOR CAPITAL REGION RESOURCE RECOVERY CENTRE

Golder Associates
Ottawa, Ontario

PROJECT No. 12-1125-0045			SCALE AS SHOWN	REV. 0.0
DESIGN	AVW	DEC. 2013	FIGURE A.1	
GIS	PJM	DEC. 2013		
CHECK	PLE	AUG. 2014		
REVIEW	PAS	AUG. 2014		

Path: N:\Active\Spatial_IM\Miller_Paving_Ltd\CRRRC\GIS\MXDs\12-1125-0045\Working\Phase2000\Task110-Atmosphere\Air Quality & Odour Assessment\1211250045-2000-0110-B06_EmissionDispersion.mxd

2.13 Vehicles – Unpaved Road Dust

The predictive equation in U.S. EPA AP-42 Chapter 13.2.2 – Unpaved Roads (November 2006) was used to calculate the fugitive dust emissions from paved roadways. The equation accounts for the application of dust suppressant control efficiency. The equation is as follows:

$$\mathrm{EF} = \left(\mathrm{k}\left(\frac{\mathrm{s}}{12}\right)^{\mathrm{a}} \times \left(\frac{\mathrm{W}}{3}\right)^{\mathrm{b}} \times 281.9\right)(1 - \text{control efficiency})$$

Where:
EF = particulate emission factor (g/VKT),
k = empirical constant for particle size range (pounds (lbs) per vehicle mile travelled (VMT)) (see Table A 2-3),
s = road surface silt content (%) assumed to be 6.4% (as per US EPA AP-42 Section 13.2.2 for MSW landfills),
W = average weight (tons) of the vehicles traveling the road,
a = empirical constant for particle size range (dimensionless) (see Table A 2-3),
b = empirical constant for particle size range (dimensionless) (see Table A 2-3),
281.9 = conversion from pounds per vehicle miles travelled to grams per vehicle kilometres travelled, and
control efficiency = reduction of fugitive dust emissions due to dust suppressant use.

Table A 2-3: Particle Size Assumptions for Unpaved Road Dust

Size Range	k (lb/VMT)	a	b
$PM_{2.5}$	0.15	0.9	0.45
PM_{10}	1.5	0.9	0.45
SPM	4.9	0.7	0.45

The following is a sample calculation for SPM for the emission factor for vehicles that will travel along the north side of the landfill. It was estimated that the fleet vehicles will have an average weight of 15.43 tons. A control efficiency of 85% was selected to represent the use of dust suppressants.

$$\mathrm{EF} = \left(4.9\left(\frac{6.4}{12}\right)^{0.7} \times \left(\frac{15.43}{3}\right)^{0.45} \times 281.9\right)(1 - 85\%)$$

$$\mathrm{EF} = 278.8\ \mathrm{g/VKT}$$

The following is a sample calculation for the SPM emission rate for vehicles travelling along the same unpaved road segment:

$$\mathrm{ER} = \frac{278.8\ \mathrm{g}}{\mathrm{VKT}} \times \frac{3.72\ \mathrm{VKT}}{\mathrm{hr}} \times \frac{1\ \mathrm{hr}}{3600\ \mathrm{s}}$$

$$\mathrm{ER} = 0.288\ \mathrm{g/s}$$

The emission rates of PM_{10} and $PM_{2.5}$ were calculated as presented above.

2.14 Vehicles – Paved Road Dust

The U.S. EPA AP-42 emission factors from Chapter 13.2.1 – Paved Roads (January 2011) were used to calculate the fugitive dust emissions from paved roadways. The following predictive emissions equation was used to determine the fugitive dust emission factor for paved roads:

$$\mathrm{EF} = (\mathrm{k}(\mathrm{sL})^{0.91} \times (\mathrm{W})^{1.02})\ (1 - \text{control efficiency})$$

Where:
EF = particulate emission factor (having units matching the units of k),
k = particle size multiplier for particle size range and units of interest (see Table A 2-4),
sL = road surface silt loading (g/m^2) assumed to be 7.4 (as per US EPA AP-42 Section 13.2.1-3, silt loading for MSW landfills),
W = average weight (tons) of the vehicles traveling the road, and
control efficiency = reduction of fugitive dust emissions due to dust suppression activities.

Table A 2-4: Particle Size Assumptions for Paved Road Dust

Size Range	k (g/VKT)
$PM_{2.5}$	0.15
PM_{10}	0.62
SPM	3.23

The following is a sample calculation for SPM for the predictive emission factor for vehicles that will travel along the entrance road segment to/from Boundary Road. It was estimated that the fleet vehicles will have an average weight of 15.43 tons. The number of precipitation days was estimated to be 163 as per Environment Canada Climate Normals records. A control efficiency of 85% was selected to represent the dust suppression activities that will occur based on best management practices expected control efficiency.

$$\mathrm{EF} = (3.23\ \times (7.4)^{0.91} \times (15.43)^{1.02})(1 - 85\%)$$

$$\mathrm{EF} = 48.80\ \mathrm{g/VKT}$$

The following is a sample calculation for the SPM emission rate for vehicles travelling along the same paved road segment:

$$\mathrm{ER} = \frac{48.80\ \mathrm{g}}{\mathrm{VKT}} \times \frac{31.62\ \mathrm{VKT}}{\mathrm{hr}} \times \frac{1\ \mathrm{hr}}{3600\ \mathrm{s}}$$

$$\mathrm{ER} = 0.429\ \mathrm{g/s}$$

The emission rates of PM_{10} and $PM_{2.5}$ were calculated as presented above.

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ATTACHMENT 1

Activity	Assumption			
	Parameter	Value	Unit	Notes
Flare (S1)	Flow rate to flare	0.98	am^3/s	Based on 1000 cfm of biogas (received from Taggart Miller) and 1,770 cfm of landfill gas (obtained from LandGEM model). Converted to m3/s and assumed actual.
Engines (S2)	Flow rate to engines	0.98	am^3/s	Flow rate for each of the 7 engines. Based on the engine specs. Assumed actual.
C&D and MRF (S3 and S4)	Flow rate of dust collectors	15,000	acfm	Provided by Taggart Miller. Stack assumed to be in the centre of the building. Assumed actual.
	Outlet loading	10	mg/m^3	Manufacturer guarantee and MOE recommendation for small dust collectors.
Organics and HC Soil Biofilters (S5 and S8)	Odour concentration	500	OU/m^3	Estimated by BIOREM as a maximum concentration output for a similar facility.
	Stack volumetric flow rate for organics processing facility	72,000	Am^3/hr	Estimated. Assumed to be actual.
	Stack volumetric flow rate for HC soil facility	15,000	Am^3/hr	Estimated. Assumed to be actual.
Leachate building stack (S11)	Odour concentration	1,000	OU/m3	Estimated and assumes the exhaust is equipped with a scrubber.
	Stack volumetric flow rate	25,000	Am3/hr	Estimated. Assumed to be actual.
Organics Processing (S6)	Number of drop points for organics process	4	drop pts	Based on information provided by Taggart Miller (equipment list and maximum number of drop points).
	Number of drop points for transfer of organic waste for off-site treatment	2	drop pts	Based on information provided by Taggart Miller (equipment list and maximum number of drop points).
	Food waste handling rate	50,000	tonnes/yr	Provided by Taggart Miller.
	Non-food organic waste handling rate	16,000	tonnes/yr	Provided by Taggart Miller.
	Bulking agent handling rate	7,000	tonnes/yr	Provided by Taggart Miller.
PHC Impacted Soil Material Handling (S9)	Number of drop points	2	drop pts	Assumed that there are 2 loaders in the HC soil area that can be moving material simultaneously, at the same time that each biopile can be turned.

Activity	Assumption			
	Parameter	Value	Unit	Notes
	Handling rate	106	tonnes/hr	Based on information provided by Taggart Miller.
Compost Material Handling (S7)	Number of drop points	7	drop pts	Based on information provided by Taggart Miller. Based on 7 pieces of equipment.
	Leaf and yard waste material handling	20000	tonnes/yr	Provided by Taggart Miller.
	Digestate compost material handling	30000	tonnes/yr	Provided by Taggart Miller.
Landfill Operations (S10)	Landfill area	839,408	m^2	From the site plans designed by Golder.
	LFG Emissions	13,199,538	m^3/yr	Annual average of LFG emissions calculated using the LandGEM model.
	Collection efficiency	75%	%	Typical range of operation. Based on recommendation from MOE.
	Odour concentration	10,000	OU/m^3	Based on the 'upper range' estimate of odour concentration from the MOE's Interim Guide to Estimate and Assess Landfill Air Impacts.
Composting (S7)	Annual throughput	50,000	tonnes/yr	Provided by Taggart Miller.
	Proportion that is organic waste	60%	%	Provided by Taggart Miller.
	Proportion that is yard waste	40%	%	Provided by Taggart Miller.
	Amount of finished product	32,300	tonnes/yr	Calculated based on information provided by Taggart Miller (annual throughput of compost produced, and breakdown percentages).
	Pile height	4	m	Estimated pile size.
	Pile base size	8	m	Estimated pile size.
Stationary Fuel Combustion (S14-S20)	Fuel oil usage	134,412	gal/yr	Provided by Taggart Miller.

Note: — denotes not applicable

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