4.0 ASSESSMENT OF POTENTIAL IMPACTS

4.1 Groundwater Assessment

Modelling of long term groundwater quality impacts for new or expanding landfill sites is required under O. Reg. 232/98 (MOE, 1998a). Typically, the modelling is conducted to demonstrate that the proposed design will meet the requirements of MOECC Guideline B-7 (MOE, 1994a).

A comprehensive description of the contaminant transport modelling that was carried out in consideration of the CRRRC landfill, including the groundwater protection features described herein (e.g., a low permeability natural clay liner, a geosynthetic clay liner (perimeter hydraulic barrier), and a leachate collection system), is provided in the Geology, Hydrogeology & Geotechnical Report(Volume III).

The conceptual contaminant transport movement at the Site is downward towards the silty layer. Shallow groundwater in the surficial silty sand layer potentially impacted by the landfill will be cut off by a geosynthetic clay liner (GCL) barrier around the landfill perimeter footprint and keyed into the upper silty clay. It was considered conservative to model concentrations in the silty layer.

The results of the hydrogeologic/contaminant transport modelling are described in the Geology, Hydrogeology & Geotechnical Report (Volume III). All parameter results in the silty layer were negligible (i.e., the impact of the landfill is not measurable in the silty layer) and, considering Site characteristics and the proposed design and operation of the other components of the CRRRC, the overall Site performance is predicted to meet the Reasonable Use Performance Objective (RUPO) (MOE, 1994a).

4.2 Surface Water Assessment

The surface water assessment considered surface water quantity and surface water quality as described in Appendix A, Stormwater Management System Design Report.

The post-development model results were compared to the pre-development results, with consideration of proposed mitigation systems, to determine the “net effects” of the proposed project on surface water.

The objectives of the stormwater management design are to:

1) Control post-development stormwater discharges from the Site to the three Municipal Drains (that are the receivers of both existing and proposed surface water runoff) at or below pre-development rates, for the 1 in 2 year to 1 in 100 year design storm events;

2) Minimize sediment loading in runoff leaving the Site during and post-construction, to adhere to the MOECC Guidelines for Enhanced Level of treatment (80% Total Suspended Solids (TSS) removal) or greater (MOE, 2003); and,

3) Maintain Site runoff water quality at or above Site water quality standards.

The stormwater management design criteria for the Site to meet the objectives outlined above are set out in the following:

- The City of Ottawa, Stormwater Control Quantity and Surface Water Quality Policies (City of Ottawa, 2009);
- Ontario Reg. 232/98 for Landfilling Sites (MOE, 1998a); and,
- The MOECC stormwater management pond sizing guidelines for impervious area percentages to achieve TSS removal objectives (MOE, 2003).

The surface water assessment concluded as follows:

- The total Site drainage area is not expected to change, although the drainage area boundaries within each of the three on-Site sub-catchments will be shifted to provide stormwater management for the proposed Site development. The sub-catchment area contributing to the Regimbald Municipal Drain will increase somewhat, as will that contributing to the Simpson Drain, while that associated with the Wilson-Johnston Drain will decrease;
- Under the post-development scenario, the increase in respective impervious land use and average slopes for the sub-catchment areas are expected to generate increased runoff conditions;
- Due to the proposed changes in land use, the overall Site is expected to see a decrease in annual infiltration and a corresponding increase in annual runoff;
- The proposed stormwater management ponds are sized to meet storage volume requirements to manage peak flows without flooding, and the detention and controlled release will mitigate the shifting of post-development on-Site sub-catchment areas; and,
- The proposed works are predicted to result in water quality conditions that are comparable to existing conditions and meet MOECC Provincial Water Quality Objectives (PWQO) (MOE, 1994c). Post-closure, the ponds will continue to operate to ensure surface water quality downstream of the Site remains protected.

4.3 Noise Assessment

The noise assessment addressed the noise effects of the proposed operations at the CRRRC on the neighbouring sensitive points of reception (PORs). The noise study was prepared in accordance with the MOECC publications Noise Guidelines for Landfill Sites (MOE, 1998d) and Environmental Noise Guideline NPC-300 (MOE, 2013a). The results of the noise assessment are provided in Appendix B, Acoustic Assessment Report and TSD #2.

4.3.1 Criteria and Guidelines

The noise assessment methodology used in this study was based on the guidelines stipulated by the Landfill Standards publication issued by MOECC (MOE, 1998b). The Landfill Standards outline the sound level limit criteria for evaluating on-Site stationary noise sources. The Landfill Standards also outline the protocol for evaluating ancillary facilities and off-Site haul road truck traffic.

All existing receptor locations identified in this study are located in a Class 1 area, as per MOECC Publication NPC-300 (MOE, 2013a). A Class 1 area means an area with an acoustical environment typical of a major population centre, where the background sound level is dominated by the activities of people, usually road traffic, often referred to as “urban hum”.

NPC-300 (MOE, 2013a) defines the establishment of sound level limits as either the applicable exclusion limit, or the minimum background sound level that occurs or is likely to occur during the time period corresponding to the operation of the stationary source under impact assessment.

These studies have addressed noise associated with the landfill operations and ancillary equipment. Calculations of the noise levels at receptor locations have been done in accordance with the relevant international standards; namely, International Organization for Standardization (ISO) 9613-2 (ISO, 1996) on sound propagation outdoors.

4.3.2 Receptor Summary Locations

Ten receptor locations have been identified as being the most sensitive receptors in the vicinity of the CRRRC Project. Three vacant lots (VLs) zoned to allow possible future noise sensitive land use have also been identified. The table below provides a summary of the PORs and VLs used in the assessment. The table also includes the UTM coordinates and indicates which baseline noise monitoring location was used to establish the existing noise level at each POR or VL.

Table 2: Description of Receptor Locations

Receptor	UTM Coordinates	Representative Noise Monitoring Location
POR01	465558, 5020774	Measurement Location #2
POR02	465319, 5020015	Measurement Location #3
POR03	465888, 5019611	Measurement Location #3
POR04	465421, 5020818	Measurement Location #2
POR05	465428, 5021084	Measurement Location #2
POR06	465323, 5021149	Measurement Location #2
POR07	465319, 5021197	Measurement Location #2
POR08	465306, 5021229	Measurement Location #2
POR09	465318, 5021389	Measurement Location #2
POR10	464934, 5021613	Measurement Location #1
VL01	465916, 5020949[1]	Measurement Location #2
VL02	466206, 5020603[1]	Measurement Location #3
VL03	466808, 5021378[1, 2]	N/A[3]
	467094, 5020583[1, 4]	N/A[5]

Notes: Locations are shown on Figure 2 and 3 of Appendix B.
1 UTM coordinates are for the assumed location of the future developments.
2 Assumed location representative of worst-case noise impact for ancillary noise sources.
3 Noise monitoring was not carried out at this location. The minimum background sound level due to road traffic was calculated using STAMSON v5.04 (see Table 5, TSD #2).
4 Assumed location representative of worst-case noise impact for landfill noise sources.
5 MOECC exclusionary sound level limits for Class 1 areas have been used.

4.3.3 Compliance

Measurable changes to existing noise levels were predicted at some locations, however, the noise levels were evaluated and it has been concluded that they are in compliance with MOECC guidelines.

Follow-up monitoring as described in Section 7.4 is recommended to confirm that the mitigation measures considered integral to the CRRRC are being incorporated as planned, and are effective. Follow-up monitoring shall take place annually during the initial period of operations at the CRRRC; modifications would be determined in consultation with the MOECC.

4.4 Air Quality and Odour Assessment

The air quality and odour assessment for the proposed CRRRC consisted of the following steps:

- Calculating representative air and odour (where applicable) emission rates for each source at the proposed CRRRC during operations;
- Dispersion modelling to predict resulting concentrations of indicator compounds; and,
- Comparison of resulting concentrations to MOECC standards and guidelines.

Under Section 9 of the EPA, an ECA for Air and Noise must be obtained from the MOECC for operation of the proposed facility. As part of this approval, operations at the proposed facility are required to demonstrate compliance with O.Reg 419/05 (MOE, 2013c). Sections 19 and 20 of O.Reg 419/05 outline the standards to which facilities must comply. The section that a facility must comply with is dependent on the North American Industrial Classification System (NAICS) (Statistics Canada, 2012) code for the facility, the date that operations commence, and the type of activities that occur on-Site.

The NAICS codes (Statistics Canada, 2012) that best describe the CRRRC's primary operations are 562920 (Materials Recovery Facilities) and 562210 (Waste Treatment and Disposal), the second of which is listed in Schedule 5 of O.Reg 419/05 (MOE, 2013c). As a result, the CRRRC must demonstrate compliance with Section 20 of O.Reg. 419/05.

In addition to the air quality standards provided in O.Reg. 419/05 (MOE, 2013C), the MOECC has air quality guideline values that are also used to assess air quality. Relevant to the operation of the CRRRC is the MOECC's odour guideline of 1 odour unit (OU)/m^3. This value is aimed at preventing odour impacts at sensitive receptors (e.g., residences, schools).

The air quality and odour assessment of the proposed CRRRC is focused on concentrations of the following compounds, 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.

As part of the ECA (Air and Noise) application for the proposed CRRRC, an Emission Summary and Dispersion Modelling (ESDM) report has been prepared for the facility to demonstrate compliance with Section 20 of O.Reg. 419/05 (MOE, 2013C), as well as the MOECC's odour guideline. The ESDM report is provided in Appendix C.

The ESDM report for the CRRRC assesses all sources and contaminants which, as defined by the MOECC within O.Reg 419/05 (MOE, 2013C) and O.Reg 524/98 (MOE, 1998c), require ECA (Air and Noise) permitting. Table 3 outlines the emission sources at the proposed CRRRC.

Table 3: Summary of Sources Assessed as part of the Compliance Assessment

Source Information		Significant (Yes or No)?	Modelled (Yes or No)?	Rationale
General Location	**Source**			
Flare and/or Electrical Generation Plant	Enclosed LFG and biogas flare and/or engines	Yes	Yes	—
Construction and Demolition Facility	Dust collector	Yes	Yes	—
Material Recovery Facility	Dust collector	Yes	Yes	—
Organics Processing Facility	Biofilter	Yes	Yes	—
	Organics processing operations (material handling)	Yes	Yes	—
	Organics processing operations (tailpipe emissions)	Yes	Yes	—
Composting	Composting, curing, and post processing (material handling)	Yes	Yes	—
	Composting, curing, and post processing (tailpipe emissions)	Yes	Yes	—
PHC Impacted Soil Treatment Area	Biofilter	Yes	Yes	—
	PHC soil treatment operations (material handling)	Yes	Yes	—
	PHC soil treatment operations (tailpipe emissions)	Yes	Yes	—
Landfill	Landfill Cap	Yes	Yes	—
	Landfill operations (material handling)	Yes	Yes	—
	Landfill operations (tailpipe emissions)	Yes	Yes	—
Leachate Pre-treatment	Leachate pre-treatment	Yes	Yes	—
	Leachate ponds	Yes	Yes	—
Paved Roads	Vehicle exhaust and fugitive road dust	Yes	Yes	-
Unpaved Roads	Vehicle exhaust and fugitive road dust	Yes	Yes	—
Emergency Generator	Diesel emergency power generator used to provide electricity during power outages.	Yes	No	The emergency power equipment only operates periodically (rather than continuously) and therefore produces emissions that are negligible relative to the overall emissions from the CRRRC. Additionally, the emergency power generator will not be operating at the same time as any other equipment and therefore is not a part of the worst-case scenario.
Support Activities	Operational support activities, such as maintenance activities (including welding, compressor, diesel fire pump, lights)	No	No	These activities are considered to be negligible in comparison to the other activities occurring on site.
	Stationary fuel combustion	Yes	Yes	Emissions from these sources occur seasonally (i.e., do not occur at all times during a year) and are very small compared to mobile combustion sources. For this assessment, only nitrogen oxide emissions were modelled.

The ESDM report was compiled in accordance with Section 26 of O.Reg 419/05 (MOE, 2013C) and the MOECC's Procedure for Preparing an Emission Summary and Dispersion Modelling Report (MOE, 2009), as appropriate.

When assessing compliance with Section 20 of O.Reg. 419/05 (MOE, 2013C), it was conservatively assumed that all of the sources are operating simultaneously, at their maximum capacities. Estimated emissions from these sources were input to the US EPA AERMOD atmospheric dispersion model, to predict the maximum off-property point of impingement concentrations for each contaminant.

The following were also input to the AERMOD model for the Site:

- Digital elevation model (DEM) terrain data provided by the MOECC;
- Surface and upper air meteorological data for the Ottawa area, provided by the MOECC as the regional dataset for the Site;
- An off-property receptor grid that corresponds with the requirements under Section 14 of O.Reg. 419/05 (MOE, 2013C);
- A fenceline receptor grid that corresponds with the requirements under Section 14 of O.Reg. 419/05 (MOE, 2013C);
- Sensitive receptors in the Site vicinity; and,
- Model source parameters derived in accordance with the MOECC's Air Dispersion Modelling Guideline for Ontario (MOE, 2009).

Table 4 presents the concentrations of the indicators at the applicable point-of-impingement. The assessment indicates that the proposed facility will be in compliance with O. Reg. 419/05, even with mobile equipment and fugitive emissions from roadways and storage piles considered. The results of the modelling are documented in the ESDM report.

Table 4: Predicted Compliance Air Quality Concentrations at POI

Indicator	Averaging Period	Air Quality Criteria ($\mu g/m^3$)	Maximum Concentration at POI ($\mu g/m^3$) (1)	Percentage of Limit (%)
SPM (24-hr)	24-hour	120	98.23	82%
PM_{10} (24-hr)	24-hour	50	23.30	47%
$PM_{2.5}$ (24-hr)	24-hour	25	20.16	81%
NO_X (1-hr)	1-hour	400	68.90	17%
NO_X (24-hr)	24-hour	200	37.15	19%
NO_2 (1-hr)(2)	1-hour	400	68.90	17%
NO_2 (24-hr)(2)	24-hour	200	37.15	19%
SO_2 (1-hr)	1-hour	690	15.91	2%
SO_2 (24-hr)	24-hour	275	8.54	3%
CO (1/2-hr)	½-hour	6000	860.01	14%
H_2S (24-hr)	24-hour	7	0.26	4%
H_2S (10-min)	10-min	13	0.79	6%
C_2H_3Cl (24-hr)	24-hour	1	0.021	2%
Odour (10-min) (3)	10-min	1(3)	0.58	58%

Notes:
(1) Represents the maximum predicted concentrations at POI locations within the Site vicinity.
(2) A conservative concentration conversion value of 100% of NO_x was applied to NO_2.
(3) The 99.5th percentile predicted concentration at discrete receptors

The results of the modelling are documented in the ESDM report, provided in Appendix C, and show that the proposed CRRRC is capable of operating in compliance with Section 20 of O.Reg 419/05 (MOE, 2013C) as well as pertinent MOECC air quality guidelines (e.g., odour guideline of 1 OU/m³).

A Site-specific "best management practice" dust and odour management plan will be implemented to mitigate against potential dust emissions (SPM and PM_{10}) and odour.

4.5 Lateral Gas Migration Assessment

At landfill sites, the potential for lateral migration of gases off-Site and the explosion hazard of methane should it migrate and collect in confined spaces at a concentration of between 5 and 15 percent in air, is commonly assessed. Methane gas is lighter than air and migrates under both concentration and pressure gradients.

Based on the physical Site setting of the CRRRC landfill, potential lateral migration of LFG through the subsurface is expected to be very limited. The surficial silty sand layer and silty clay soils and high water table conditions are the natural limiting factors for potential lateral migration of LFG between the waste disposal area and the property boundaries.

As indicated in the Geology, Hydrogeology & Geotechnical Report, the groundwater table is located on average 0.4 m below ground surface. In the Guideline for Assessing Methane Hazards from Landfill Sites (MOE, 1987) it is stated that "a commonly applied rule of thumb is that significant methane migration may extend for a distance equal to 10 times the depth of landfill, between the ground surface and the water table", i.e., 10 times the effective thickness of refuse, H. Moreover, this Guideline goes on to say that "any proposed development may be approved if it can be shown that it is at a distance in excess of D in the relationship D = 10H."

If the depth to the groundwater table is conservatively taken as 2 m (the deepest water level recorded in 2013 at the Site was >1.5 m when monitoring well 13-21-2 was dry), "D" would equal 20 m. As discussed in Section 5.2, the on-Site buffer zones that will be provided meet or exceed these conservative approximations of "D" by five to six times.

It is noted that a GCL barrier will surround the landfill perimeter and be keyed into the upper silty clay. The GCL will add an additional barrier to LFG migration. As well, there is a minimum 100 metre wide buffer between the landfill footprint and the Site property boundaries; and there are ditches and drains that would interrupt the movement of any LFG in the unlikely event that it had migrated away from the landfill through the thin unsaturated zone.

In light of the physical Site setting, the engineered perimeter cut-off around the landfill and the proposed active LFG collection system that will impose negative gas pressures in the waste mound, the potential for lateral migration at this Site is negligible. No subsurface LFG monitoring is proposed at the property boundaries.

4.6 Biological Assessment

Complete details of the biological impact assessment are provided in TSD #4 for the EASR. The report states that with the recommended mitigation measures, potential direct and indirect effects of the CRRRC are not expected to adversely affect the biology in the Site-vicinity. A monitoring program was recommended as discussed in Section 7.3.