Waste Management of Canada Corporation

Environmental Assessment for a New Landfill Footprint at the West Carleton Environmental Centre

ATMOSPHERIC – ODOUR DETAILED IMPACT ASSESSMENT

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1. Introduction

This report documents the odour impact assessment of the Preferred Alternative Landfill Footprint for the Environmental Assessment (EA) for a new landfill footprint at Waste Management of Canada Corporation's (WM) West Carleton Environmental Centre (WCEC). In the preceding Alternative Methods phase of the EA, net effects analyses as well as a comparative evaluation of the four alternative landfill footprint options were carried out in order to identify a Preferred Alternative Landfill Footprint. The Preferred Alternative Landfill Footprint was determined to be Option #2 – the North Footprint Option. The potential environmental effects, mitigation or compensation measures to address the potential adverse environmental effects and the remaining net effects following the application of the mitigation or compensation measures were identified for the Preferred Alternative Landfill Footprint.

The Preferred Alternative Landfill Footprint was refined based on stakeholder comments received and to further avoid or mitigate potential adverse environmental effects, and is illustrated in **Figure 1**.

A Facilities Characteristics Report (FCR) as well as a description of the ancillary facilities associated with the WCEC has been prepared so that potential environmental effects and mitigation or compensation measures identified for the Preferred Alternative Landfill Footprint during the Alternative Methods phase of the EA could be more accurately defined, along with enhancement opportunities and approval requirements.

The discipline-specific work plans developed during the Terms of Reference (ToR) outlined how impacts associated with the Preferred Alternative Landfill Footprint would be assessed. The results of these assessments have been documented in the following 10 standalone Detailed Impact Assessment Reports:

- Atmospheric (Air Quality, Noise, Odour and Landfill Gas (LFG))
- Geology and Hydrogeology
- Surface Water
- Biology
- Archaeology
- Cultural Heritage
- Transportation
- Land Use
- Agriculture
- Socio-Economic (including Visual)

Despite being standalone documents, there are; however, interrelationships between some of the reports, where the information discussed overlaps between similar disciplines. Examples of this include the following:

- Geology and Hydrogeology, Surface Water, and Biology (Aquatic Environment); and
- Land Use, Agricultural, and Socio-Economic.

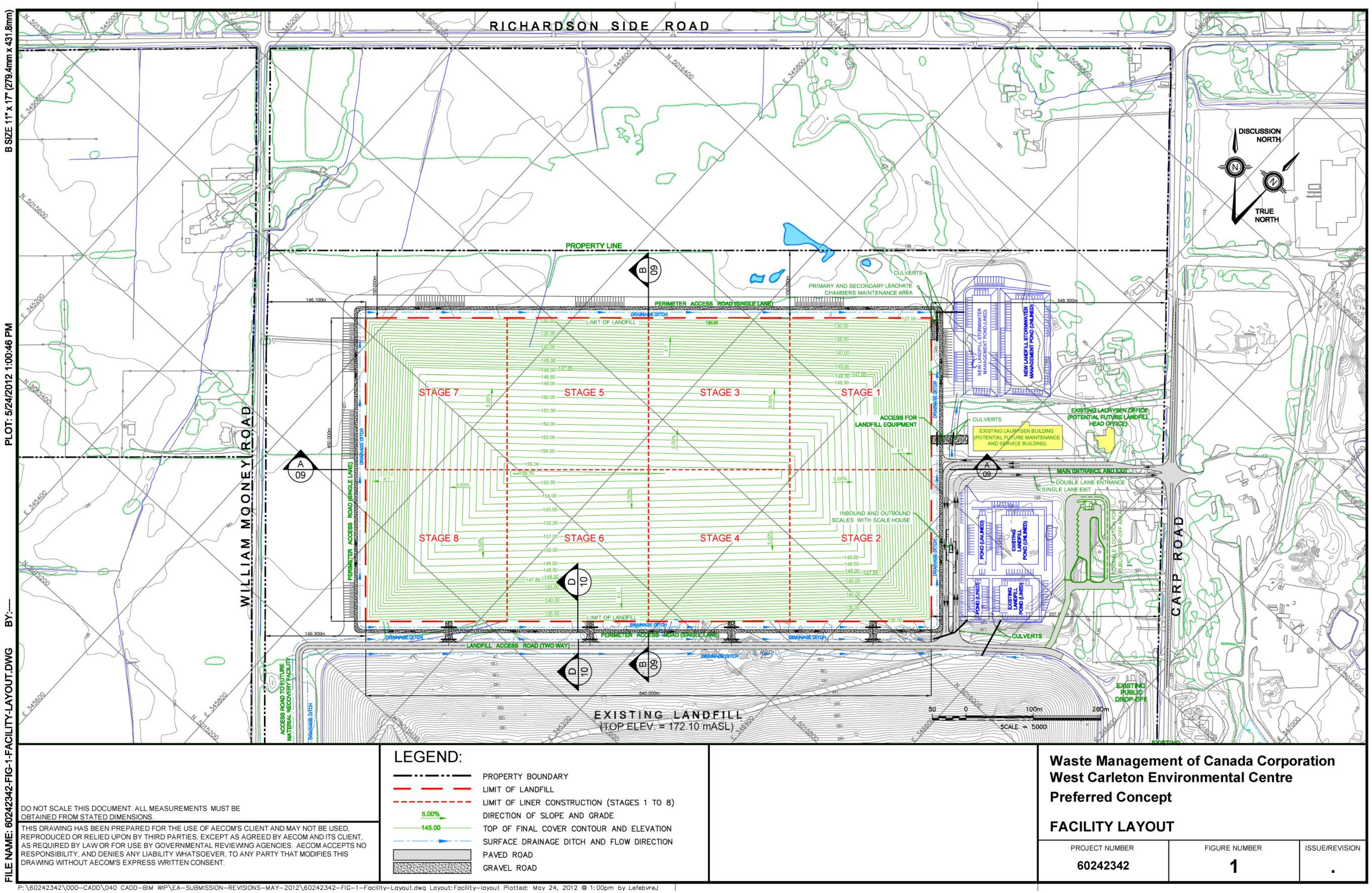

Figure 1. Preferred Alternative Landfill Footprint

1.1 Description of the Preferred Alternative Landfill Footprint

The southern half of the Preferred Alternative Landfill Footprint is located on WM owned lands and the northern half is located on lands that WM has options to purchase. A 100 m buffer is maintained between the north limit of the Preferred Footprint and the private lands to the north (e.g., lands which front onto Richardson Side Road) in accordance with Ontario Regulation (O. Reg.) 232/98, and an approximate 350 m buffer is maintained between the east limit of the footprint and Carp Road. A light industrial building (e.g., the Laurysen building) is situated in the eastern portion of WM optioned lands, which WM anticipates using for equipment storage/maintenance or waste diversion activities in the future. An approximate 45 to 50 m buffer is maintained between the toe of slope of the existing and new landfill footprints, thus allowing sufficient area for a new landfill waste haul road to the new footprint, and for maintenance and monitoring access. The location of the west limit of the Preferred Alternative Landfill Footprint was determined by maintaining the noted buffers and providing the required 6,500,000 m^3 of disposal capacity, while maintaining landfill elevation below 158 metres above sea level (mASL) (as reported in the Conceptual Design Report (CDR)) and maintaining side slopes required by O. Reg. 232/98 (e.g., varying from 4H to 1V to 5%). This results in an approximate 146 m buffer between the west limit of the Preferred Footprint and William Mooney Road. This buffer preserves a portion of the existing woodlot within the west part of the WM-owned lands.

The final contours of the landfill are shown in **Figure 1** and reflect a rectangular landform with a maximum elevation (top of final cover) of 155.7 mASL. This elevation is approximately 30.7 m above the surrounding existing grade. By comparison, the maximum elevation of the existing Ottawa WM landfill is approximately 172 mASL or approximately 47 m above the surrounding existing grade. The contours reflect maximum side slopes of 4H to 1V, and a minimum slope of 5%. The total footprint area of the new landfill is 37.8 ha.

1.2 Facilities Characteristics Report

The FCR presents preliminary design and operations information for the Preferred Alternative Landfill Footprint (Option #2) and provides information on all main aspects of landfill design and operations including:

- Site layout design;
- Surface water management;
- Leachate management;
- Gas management; and,
- Landfill development sequence and daily operations.

The FCR also provides estimates of parameters relevant to the Detailed Impact Assessment including estimates of leachate generation, contaminant flux through the liner system, LFG generation, LFG collection and traffic levels associated with waste and construction materials haulage.

1.3 Other WCEC Facilities

In addition to the new landfill footprint, the WCEC will also include other new facilities not subject to EA approval. These include:

- A material recycling facility
- A construction and demolition material recycling facility
- An organics processing facility
- Residential diversion facility
- Community lands for parks and recreation
- A landfill-gas-to-energy (LGTE) facility
- Greenhouses

Some of the proposed WCEC facilities, such as the material and recycling facility, the residential diversion facility, and the organic processing facility have the potential to generate odour emissions. The proposed facilities are at the initial stages of conception and no design details, including operation (i.e. waste volumes handled) or building details, exist at present. These facilities do not require EA approval and were not included in the Odour Detailed Impact Assessment.

The other facilities proposed as part of the WCEC but not subject to EA approval will be designed with the intent of minimizing odour emissions discharged to the atmosphere. An assessment of their emissions, including odour emissions, will be completed to ensure compliance with applicable requirements prior to construction as part of the MOE's Environmental Compliance Approval (ECA) process or any other applicable environmental approvals processes.

1.4 Atmospheric – Air Quality Study Team

The atmospheric study team consists of RWDI AIR Inc. staff. The actual individuals and their specific roles are provided as follows:

- **John DeYoe**, B.A., d.E.T., Project Director, John.DeYoe@rwdi.com
- **Brad Bergeron**, A.Sc.T.,d.E.T., Senior Project Manager, Brad.Bergeron@rwdi.com

- **Sarah Pellatt**, B.Sc., Senior Scientist, Sarah.Pellatt@rwdi.com
- **Claire Finoro**, B.Sc. (Eng), E.I.T., Project Co-ordinator, Claire.Finoro@rwdi.com

1.5 Contaminants of Interest

An odour is deemed as a nuisance if it is detected and considered to be unpleasant. When odour levels are elevated and occur frequently, they can be construed as having an adverse effect.

The cumulative odours from the landfill sources and non-landfill sources were assessed as a contaminant of interest. The odours from the landfill are based on a mixture of compounds contained within the LFG and surface emissions (e.g., working face odour). The odours from the non-landfill sources are based on a mixture of compounds contained in the SBR system exhausts and the leachate evaporator exhausts. Although these landfill and non-landfill odours are distinct from one another, they have been treated as cumulative odours for the purpose of this Odour Detailed Impact Assessment.

1.6 Applicable Guidelines

Regulation 419/05 (Reg. 419) provides air quality standards for use in Ontario. However, Reg. 419 does not include a standard for "odour" as a mixture of compounds. According to Section 14 of the Ontario *Environmental Protection Act*, an odour is deemed a nuisance if it is detected and considered unpleasant. The MOE does provide some guidance regarding the assessment of odour impacts in their document "Methodology for Modelling Assessments of Contaminants with 10-Minute Average Standards and Guidelines under O. Reg. 419/05", April 2008. This guidance document indicates that odour concentrations need only be assessed at odour-sensitive receptor locations, such as residences, commercial buildings, and outdoor parks and recreation areas. Odour impacts that are greater than 1 odour unit (OU) per cubic metre (m^3) are acceptable at sensitive receptor locations, as long as the frequency of exceedance is less than 0.5% of the time.

An odour unit is defined as the quantity of odourous substance that, when dispersed in 1 m^3 of odour free air, becomes just detectable by a "normal" human observer whose sensitivity to the odorant represents the mean of the population. The average odour detection threshold is 1 OU/m^3, although odours at this level are not necessarily a nuisance. Odour concentrations that may cause a complaint due to their ability to annoy typically range from 3 to 5 OU/m^3. Through RWDI's experience with other landfills in Southern Ontario, the objectionable level for odour was considered to be generally in the range of 3 to 5 OU/m^3. These levels are more closely related to public complaints. For the purposes of this assessment, the site-wide odours from the WCEC operations were compared to both the 1 OU/m³ detection threshold and the 3 OU/m³ annoyance threshold.

Although certain contaminants known to be present in the LFG, such as hydrogen sulphide, have odour-based standards under O. Reg. 419, these standards are not applicable to the overall mixture of compounds that form the LFG odours. Comparisons of the impacts from individual contaminants to their odour-based O. Reg. 419 Standards are provided in the companion study – Atmospheric Landfill Gas Detailed Impact Assessment.

1.7 Emission Sources

Under normal operating conditions, solid waste landfills have the potential to produce odours from several areas, including:

- LFG and garbage odours from the landfill and waste acceptance activities: working face, interim cover areas, final cover areas, public waste drop off areas, installation of LFG wells, trenching activities, and cracks/fissures in the landfill cover;
- Leachate odours from the leachate management system;
- Hydrocarbon odours from the use of contaminated soils as cover materials; and,
- Compost odours from the spreading of compost on the landfill mound to encourage vegetation growth.

These landfill and non-landfill related sources are typically known to produce odours. Although exposure to odours does not necessarily relate to a health risk to individuals residing adjacent to a landfill, the odours can be a considerable nuisance. Site-wide odours from the WCEC operation, including both landfill and non-landfill related odours, have been evaluated due to their potential for nuisance impacts on the environment surrounding the landfill. Although these landfill and non-landfill odours are distinct from one another, as a conservative approach they have been treated as cumulative odours for the purpose of this Odour Detailed Impact Assessment.

The current ECA includes approval for the operation of the soil bioremediation biopile process and an exhaust of a gas stripper in the Blower building. After receiving approval for the operation of the soil bioremediation biopile process, WM decided not to move forward with this process in the future. The exhaust for the gas stripper in the Blower building was inspected during site visits and no odour was noted from this source. For the reasons stated above, the soil bioremediation biopile process and the exhaust from the gas stripper in the Blower building were not assessed as part of this Odour Detailed Impact Assessment.

A source summary table including each source of emission is provided in the Table Section for review. The Source Summary Table provides a summary of each source, the type of modelled source and the overall emission rate per source of emission. Each of these sources is discussed in the following sections.

1.7.1 Existing Landfill Mound under Final Cover

The existing landfill mound under final cover is the portion of the WCEC where waste is no longer being deposited. This area is characterized by the presence of a landfill cap and LFG collection system. The existing landfill is closed and the entire landfill mound is under final cover. The top portion of the landfill has also been fitted with a heavy polymer membrane cap (beanie). The total landfill final cover area is estimated to be approximately 355,000 m^2 with a final peak height of 47 metres above grade. However, the existing landfill mound was modelled at a height of zero metres above grade for a conservative estimate, as referred to in the Odour Baseline Conditions Report.

Odour from the existing landfill mound under final cover results from the fugitive emissions of LFG released through the surface of the landfill. The LFG collection system in the final cover area of the landfill serves to extract the LFG from the mound, thus reducing the amount of LFG available to escape through the surface of the mound. In addition, the cover material filters and limits the ability of the LFG to be released through the surface of the landfill. However, even with the LFG collection system and cap in place, some LFG is released through the atmosphere through the final cover.

Between the years 2004 and 2010, the efficiency of the LFG collection system has increased due to the progressive increase in the portion of the existing landfill with final cover in place and the increase in the total number of LFG extraction wells installed in the landfill mound. These factors have resulted in an increase in the overall LFG collection efficiency from 23% in 2004 to 85% in 2010.

1.7.2 Preferred Alternative Landfill Mound

The preferred alternative landfill area is the portion of the landfill where accepted waste will be deposited at an estimated rate of 400,000 tonnes per year over a ten year period, equating to a total waste tonnage of 4,000,000 tonnes. As stated in the FCR, the material accepted will consist primarily of institutional, commercial and industrial waste, as well as residential waste and ‘special’ waste. ‘Special’ waste consists primarily of impacted soils that may be used for daily or interim covers. The composition of the waste stream is expected to vary based on actual waste sources.

The total landfill final cover area is estimated to be approximately 378,000 m^2 with a final peak height of 31 metres above grade. However, the proposed landfill mound was modelled at a height of zero metres above grade for a conservative estimate, as done for the existing landfill mound. Please refer to the Landfill Gas Baseline Conditions Report for full details.

It was assumed that the construction of the preferred alternative landfill would begin in the year 2013. The preferred alternative landfill will be filled in eight stages, each stage having an approximate surface area of 47,250 m^2. The waste placement will generally occur in two phases. Phase 1 reflects filling sequentially from Stages 1 to 8, from East to West, to an elevation of approximately 141.5 mASL. Phase 2 reflects filling sequentially from Stages 1 to 8, from East to West, to the final design contours. Two worst case scenarios were assessed as part of the Odour Detailed Impact Assessment: an intermediate operation scenario (Year 2018) and a final operation scenario (Year 2023) scenario.

For the intermediate operation scenario (Year 2018), it was assumed that Phase 1 was completed and therefore half of the total waste, approximately 2,000,000 tonnes, had been deposited in all eight stages of the landfill. This area is characterized by the presence of a LFG collection system with a collection efficiency of 85%. Phase 2 was also assumed to have commenced, and approximately 250,000 tonnes of waste was deposited in Stage 1 during the year 2018. As a conservative approach, it was assumed that the entire surface area (47,250 m^2) of Stage 1 was considered the "active stage". The active stage is the area where waste has been deposited within the modelled year. The active stage is characterized by an interim cover, and includes a 900 m^2 working face where landfilling is actively occurring. The active stage does not have a completely installed LFG collection system, therefore only collecting the LFG with a collection efficiency of 50%.

For the final operation scenario (Year 2023), it was assumed that approximately 3,720,000 tonnes had been deposited in Phase 1 and Stages 1 through 7 of Phase 2 of the landfill. The entire landfill area, with the exception of Stage 8 of Phase 2, is characterized by the presence of a final cover and a LFG collection system with a collection efficiency of 85%. Phase 2 was assumed to have been complete with the last 250,000 tonnes of waste deposited in Stage 8 during the year 2023. As a conservative approach, it was assumed that the entire surface area (47,250 m^2) of Stage 8 was considered the active stage area. As previously described, the active stage area is characterized by an interim cover, which includes a working face, where waste has been deposited within the modelled year. The active stage does not have a completely installed LFG collection system, therefore only collecting the LFG with a collection efficiency of 50%.

Although LFG generation is at a maximum during the first year post-closure of a landfill, an assessment of the post-closure year was not completed in this detailed odour impact assessment. It is more conservative to assess the last year of operations approaching closure, as this scenario included a full Stage of the landfill without final cover and a working face with reduced LFG collection efficiency (50% efficiency). A LFG source with reduced collection efficiency (50% efficiency) will result in higher overall LFG emissions from the landfill mound in comparison to the LFG emission from the landfill mound under final cover and equipped with a full gas collection system during its first year post closure of the landfill.

1.7.3 Public Waste Drop Off

The Ottawa Landfill has a public waste drop off area is to be located to the northern corner of the site, adjacent to Carp Road.

The public waste drop off area has traditionally had very little odour impact. The majority of waste typically received in this area consists of yard waste and construction waste, which have a very low odour potential. However, from time to time odourous waste may find its way into the drop off bins, causing the containers to generate odours. This situation represents upset conditions and as such was not considered in the Odour Detailed Impact Assessment.

1.7.4 Installation of Landfill Gas Wells

The operations at the WCEC preferred alternative landfill include progressive installation of the LFG collection system as the landfill is formed. Horizontal LFG collection piping will be installed as landfill filling progresses. Vertical wells will be installed once a sufficient fill thickness is achieved.

The installation of a new vertical LFG collection well involves drilling into the landfill mound, installing the well casing, backfilling material around the casing, and connecting the well to the LFG collection system.

At the existing WCEC landfill, current operating practices limit the number of wells drilled to two per day. Backfilling is performed as soon as possible once the casing has been installed. The well is capped with a Bentonite seal. The well casing is loosely covered overnight and then capped and connected to the LFG collection system the next day.

The process of drilling into the mound causes odours from two sources – the exposure of partially decomposed waste and the release of LFG from the mound. Since the LFG wells are being installed in areas where landfilling has been completed, a significant amount of LFG is expected to be in these areas. Drilling into the landfill opens a conduit for this LFG to escape directly into the atmosphere.

The installation of LFG wells represents upset conditions and as such was not considered in the Odour Detailed Impact Assessment.

1.7.5 Trenching Activities

The process of trenching involves digging a shallow trench into the side of the landfill to install gas system header lines. Once the installation is complete, the trench is backfilled with the removed waste and the cover material is replaced.

As with well installation, the process of trenching produces odours from two sources – the exposure of partially decomposed waste and the release of LFG from the mound. Trenching through the landfill cover, especially the final clay cover, opens a conduit for this LFG to escape directly into the atmosphere. Trenching through the landfill cover represents upset conditions and as such was not considered in the Odour Detailed Impact Assessment.

1.7.6 Cracks/Fissures in Landfill Cap

The final cover of the landfill includes a clay cap, which limits the migration of LFG through the surface of the landfill. However, cracks and fissures can form in this clay layer, allowing LFG to pass through unchecked. These cracks and fissures can form for a variety of reasons, including the effect of freeze/thaw cycles, erosion due to surface water runoff, and heavy equipment operating on the capped area. These cracks and fissures in the landfill cap represent upset conditions and, as such, were not considered in the Odour Detailed Impact Assessment.

1.7.7 Leachate Management System

Leachate produces a strong, unpleasant odour that is distinct from the LFG odours. Leachate odours can arise from several sources on-site. These sources are described individually in the following section. Although these sources are described individually, their effects will be cumulative. That is, any detectable leachate odours are likely a result of a combination of these sources.

WM has proposed two methods to treat the leachate generated at the WCEC: the preferred leachate treatment method and a contingency leachate treatment method. Both of the methods are described in this section.

For both methods, the leachate collection mains are placed under negative pressure so that no odours escape from the manholes or other open points in the leachate management system.

1.7.7.1 Preferred Leachate Management System

As referred to in the FCR, the Preferred Leachate Management System consists of disposal of leachate through pre-treatment and discharge to the City of Ottawa sanitary system, in tandem with disposal through irrigation of trees. The leachate will be pre-treated on-site using a Sequencing Batch Reactor (SBR) system, similar to the one proposed for the existing landfill with a pending Environmental Compliance Approval.

The leachate pre-treatment system will have a single train. The tanks associated with the SBR system operation include the raw leachate equalization tank, the SBR tank, the effluent equalization tank, and the sludge tank. Raw leachate from the leachate collection wells will be pumped to an equalization tank for storage. From the equalization tank, raw leachate will be pumped using leachate transfer pumps to the SBR tank. There will be two duty and one standby raw leachate transfer pumps.

The SBR operates on a batch cycle which includes the following steps:

- Fill cycle – in the fill cycle the raw leachate is pumped into the SBR tank to fill the tank to a preset level;
- React cycle – in the react cycle the SBR tank contents are aerated and the biological decomposition of the leachate occurs;
- Settle phase – after the reaction phase, the aeration and mixing of the SBR is stopped and the mixed liquor suspended solids are allowed to settle;
- Decant phase – in the decant phase the clarified effluent is decanted from the top of the SBR tank to the treated leachate effluent tank; and,
- On a periodic basis, waste activated sludge is pumped from the SBR tank to the sludge storage tank.

The effluent from the equalization tank is pumped to the leachate discharge force main to the Ottawa sanitary sewage collection system.

The SBR system consists of the following sources, included in the dispersion model with the following parameters:

- One (1) raw leachate equalization tank, which is an outdoor above-ground storage tank, exhausting through a passive vent with a diameter of 0.2 metres, located 0.6 metres above the roof of the tank, which is equivalent to 6.6 metres above grade;
- One (1) SBR tank, which is an outdoor above-ground storage tank, exhausting through a passive vent with a diameter of 0.2 metres, located 0.6 metres above the roof of the tank, which is equivalent to 6.6 metres above grade;

- One (1) effluent equalization tank, which is an outdoor above-ground storage tank, exhausting through a passive vent with a diameter of 0.2 metres, located 0.6 metres above the roof of the tank, which is equivalent to 6.6 metres above grade; and
- One (1) sludge holding tank, which is an outdoor above-ground storage tank, exhausting through a passive vent with a diameter of 0.2 metres, located 0.6 metres above the roof of the tank, which is equivalent to 6.6 metres above grade.

The exhausts for the SBR system sources contain the following contaminants:

- 1,2 Dichloroethane
- 1,3,5 Trimethylbenzene
- 1,4 Dichlorobenzene (-p)
- Ammonia
- Benzene
- Chlorobenzene
- Chloroethylene (vinyl chloride)
- Chloromethane (methylchloride)
- cis-1,2 Dichloroethylene
- Ethylbenzene
- Methylene Chloride (dichloromethane)
- Naphthalene
- Phenanthrene
- Phenol
- Tetrachloroethene
- Toluene
- Trichloroethylene
- Xylene

Some of these contaminants have the potential to be odourous and therefore the SBR system was included in the Odour Detailed Impact Assessment.

1.7.7.2 Contingency Leachate Management System

The contingency method of leachate disposal would also involve pre-treatment of the leachate using the SBR system with the addition of a leachate evaporator system. For the leachate evaporator, the current technology selected to be evaluated in the Detailed Impact Assessment is the E-Vap® Leachate Evaporator System, which has the capacity to treat 20,000 gallons of leachate per day.

The evaporator system will use LFG as the primary fuel for the combustion process. The hot combustion gases are injected into the leachate reservoir generating water vapour. Prior to being discharged, the water vapour is sent through spin vane separators (mist eliminators) in line with the exhausts and then discharged to the atmosphere. The mist is returned to the leachate equalization tanks.

Fresh leachate is fed into the evaporator continuously and residual is drawn off and sent to a clarifier tank for further concentration. The concentrate is collected and used at other locations within the facility or shipped off-site. For the 20,000 gallons per day operation, LFG is fed into the burner at a rate of 333 standard cubic feet per minute (scfm). The feed rate of the leachate would be approximately 14 gallons per minute. The leachate evaporator stack was modelled with the following parameters:

- One (1) leachate evaporator system, used to evaporate leachate collected by the leachate collection system, exhausting to the atmosphere at a maximum combined flow rate 13.3 standard cubic meters per second through two stacks modelled as one stack, having an equivalent exit diameter of 0.9 metre and extending 22 metres above grade.

The exhausts for the leachate evaporator contain contaminants such as volatile organic compounds and ammonia, which have the potential to be odourous and therefore the leachate evaporator was included in the Odour Detailed Impact Assessment.

1.7.8 Leachate Cleanout Manholes

Leachate cleanout manholes are used for removing and cleaning debris that may accumulate inside the leachate collection system. Two leachate cleanout manholes are currently located at the WCEC site, one located at the northern portion of the existing landfill and one located at the southern portion of the existing landfill. The preferred alternative landfill may require additional leachate manholes to be installed. All manholes were assumed to be sealed and the leachate collection system was assumed to be under negative pressure with collected gases diverted to the flare. The leachate cleanout manholes were therefore excluded from the Odour Detailed Impact Assessment.

1.7.9 Leachate Seepage

Leachate seepage occurs when leachate “breaks through” the cover of the landfill and pools on the surface. Leachate seepage can occur due to poor drainage, cracks and fissures in the landfill cap, or blockage of the leachate collection system. Leachate seepage represents an upset condition and as such was not considered in the odour Detailed Impact Assessment.

1.7.10 Contaminated Soil Stockpiles

The FCR states that the WCEC receives contaminated soil or 'special' waste from off-site locations for use as daily cover. The majority of this soil is petroleum fuel-contaminated and contains fuel-related VOCs such as benzene and other light aromatics. The contaminated soil is stockpiled near the haul routes for daily access. It was assumed that the contaminated soil stockpile has a surface area of 4,000 m^2. In comparing the surface area of the contaminated soil stockpile, 4,000 m^2, to the combined surface area of the existing landfill mound and the preferred alternative landfill mound, 733,000 m^2, the contaminated soil stockpile represents approximately 0.5% of the surface area with potential to release odours. The significant difference between the contaminated soil stockpiles and the landfill mound surface areas results in a lower emission rate for the contaminated soil pile in comparison to that of the landfill mounds. Therefore, odours arising from contaminated soil stockpiles are assumed to be insignificant and were not assessed in the Odour Detailed Impact Assessment.

1.7.11 Compost Spreading

Compost is occasionally spread on top of the clay cover to facilitate vegetative growth on the landfill mound. This activity is intermittent in nature and produces odours similar to the background odour from agriculture farming in the area; therefore it was not included in the Detailed Impact Assessment.

1.7.12 Off-Site Sources

The odours produced by the landfill are distinctive. No other facilities in the vicinity are expected to emit odours in common with the WCEC. Therefore, only the odours from the WCEC operations were included in the Detailed Impact Assessment.

1.7.13 Summary of Sources Assessed

The Detailed Impact Assessment considered odour sources from the WCEC operations under typical operating conditions. The site-wide WCEC odour sources in the Detailed Impact Assessment include the following:

- Existing Landfill Mound Under Final Cover
- Preferred Alternative Landfill Mound;
- Preferred Alternative active face - interim cover area;
- Preferred Alternative active face – working face area; and,
- Leachate Management System (SBR system and leachate evaporator).

The locations of these sources are illustrated in **Figure 3**.

2. Landfill Footprint Study Areas

The specific On-Site, Site-Vicinity, and Regional study areas for the Preferred Alternative Landfill Footprint at the WCEC are listed below:

- **On-Site** .... the lands owned or optioned by WM and required for the Preferred Alternative Landfill Footprint. The Site is bounded by Highway 417, Carp Road and Richardson Side Road;
- **Site-Vicinity**..... the lands in the vicinity of the site including the Preferred Alternative Landfill Footprint, extending about 500 m in all directions; and,
- **Regional** .... the lands within approximately 3 to 5 kilometres (km) of the Site and the Preferred Alternative Landfill Footprint for those disciplines that require a larger analysis area (i.e., socio-economic, odour, etc.).

The evaluation considered the potential impacts from the WCEC odour sources including the preferred alternative landfill footprint at 24 discrete receptor locations (see **Figure 2**), representing receptors of interest in the Site-Vicinity and the Regional study areas. The discrete receptor locations considered in the dispersion model include nearby residences, schools, businesses, and other sensitive receptor locations. These sensitive receptors are considered to be representative of any current or future developments in the area. For all cases, humans were assumed to be present at these receptors for 24 hours per day.

It should be noted that there are other receptors within the On-Site, Site-Vicinity and Regional study areas. However, for the purposes of evaluation, the closest/worst-case receptors in each direction were analyzed to determine potential effects. It is assumed that mitigation applicable to the closest/worst-case receptors would also apply to all other receptors as well.

In addition, the modelling was performed using a receptor grid covering the Site-Vicinity and Regional study areas to produce isopleths of predicted concentrations. The receptor grid covers the lands within approximately 3 to 5 km of the WCEC sources. The results for all other areas are visually outlined for the three contaminants of particular interest within the isopleths provided in **Figures 4 to 7**.

It should be noted that since the Draft EA was issued in March 2012, WM obtained an agreement to purchase a parcel of land located south of Richardson Side Road, east of William Mooney Road, west of Carp Road in July 2012. Given this recent property acquisition, receptor R1 no longer applies to this impact assessment. A supporting memo has been attached to this Detailed Impact Assessment outlining the changes (see **Appendix D**).

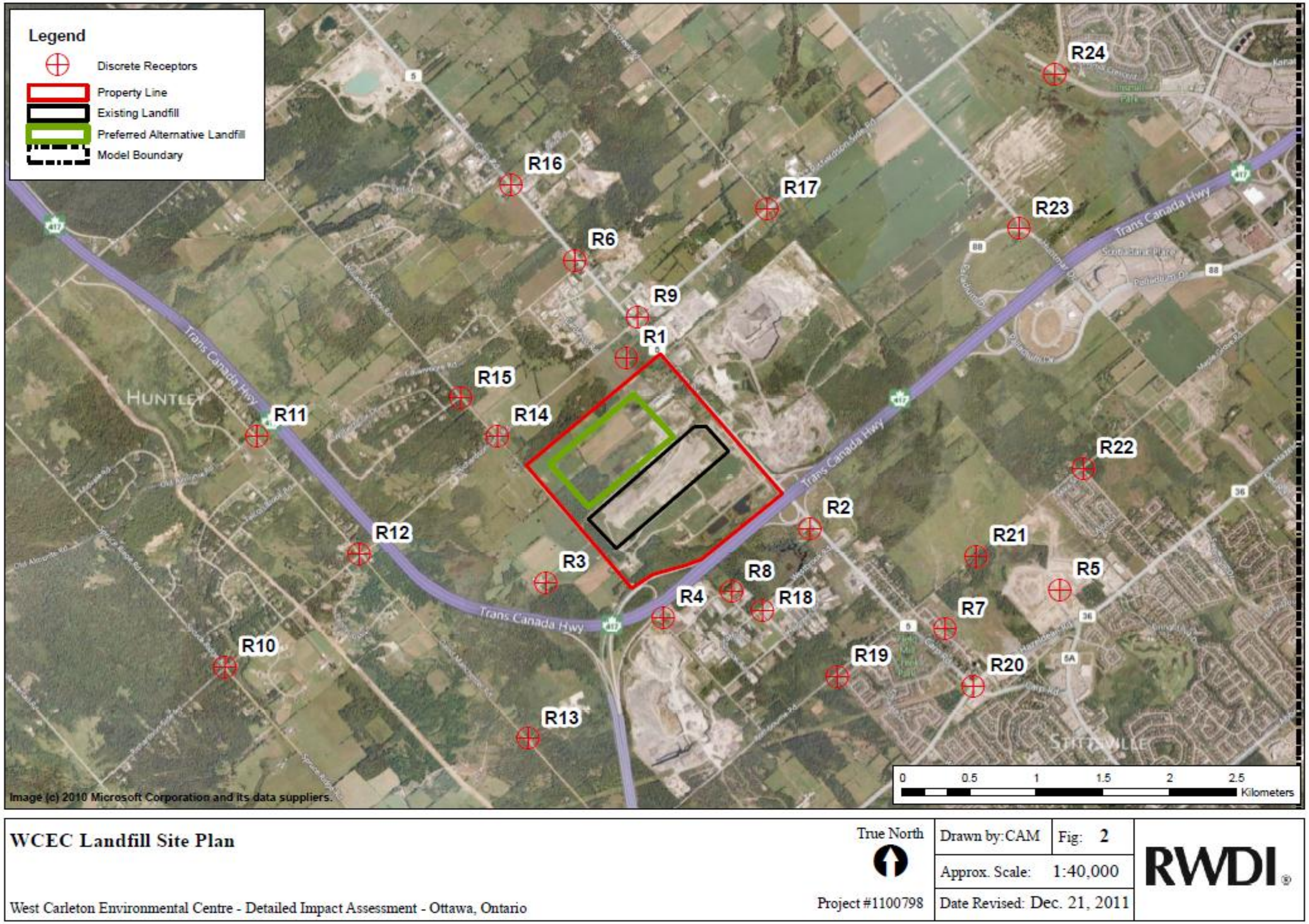

Figure 2. WCEC Landfill Site Plan

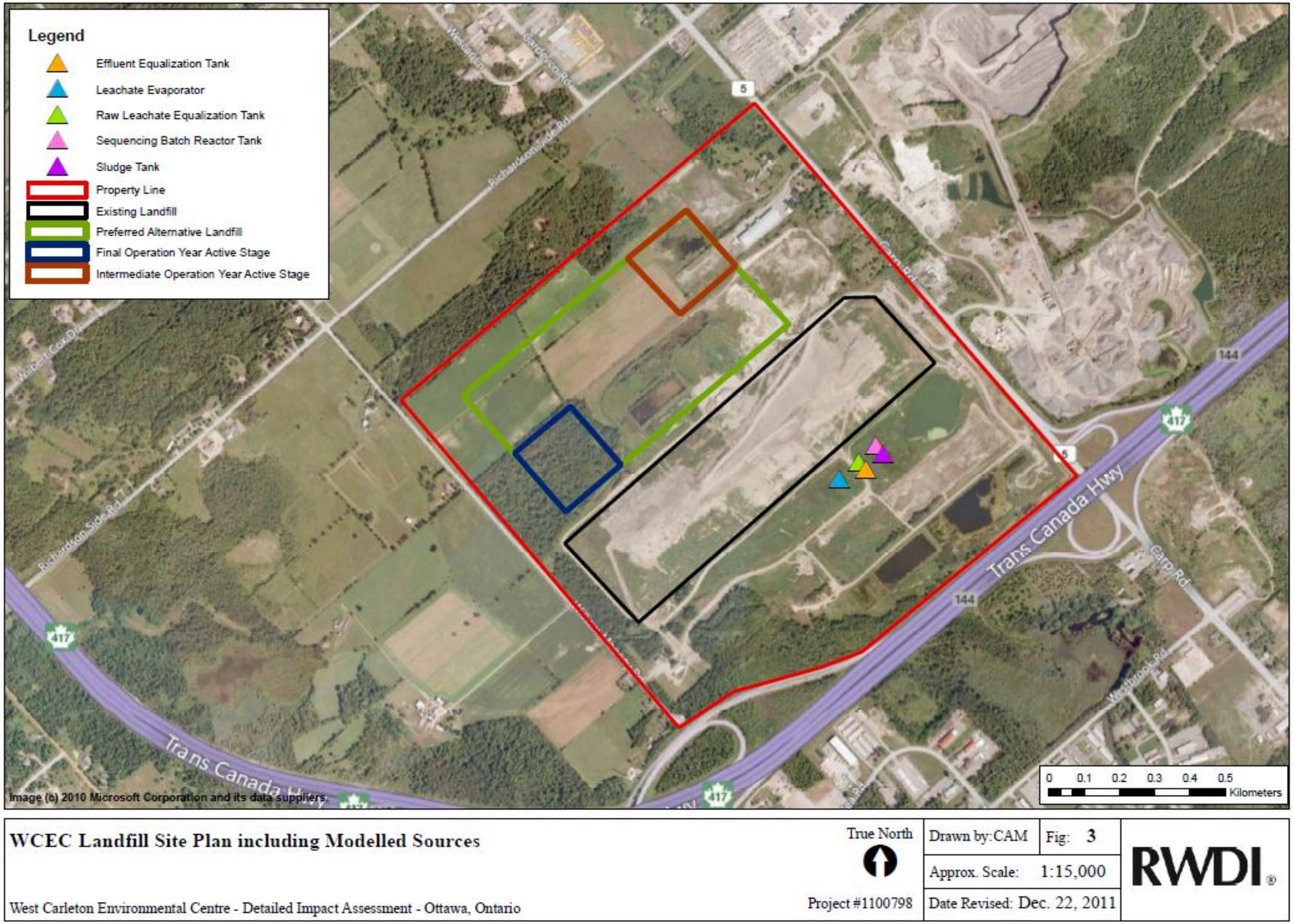

Figure 3. WCEC Landfill Site Plan including Modelled Sources

3. Methodology

The assessment of impacts associated with the Preferred Alternative Landfill Footprint was undertaken through a series of steps that were based, in part, on two previously prepared reports (Atmospheric Existing Conditions Report – Odour Baseline Assessment and Atmospheric Environment Comparative Evaluation). The net effects associated with the four Alternative Landfill Footprint Options identified during the Alternative Methods phase of the EA were based on Conceptual Designs. These effects were reviewed within the context of the preliminary design plans developed for the Preferred Alternative Landfill Footprint. Additional investigations were then carried out, where necessary, in order to augment the previous work undertaken.

With these additional investigations in mind, the potential impact on the atmospheric environment of the Preferred Alternative Landfill Footprint was documented.

With a more detailed understanding of the atmospheric environment developed, the previously identified potential effects and recommended mitigation or compensation measures associated with the Preferred Alternative Landfill Footprint (documented in the Atmospheric Environment Comparative Evaluation Technical Report, September 2011) were reviewed to ensure their accuracy in the context of the preliminary design. Based on this review, the potential effects, mitigation or compensation measures, and net effects associated with the Preferred Alternative Landfill Footprint were confirmed and documented. In addition to identifying mitigation or compensation measures, potential enhancement opportunities associated with the preliminary design for the Preferred Alternative Landfill Footprint were also identified, where possible.

Following this confirmatory exercise, the requirement for monitoring in relation to net effects was identified, where appropriate. Finally, any atmospheric approvals required as part of the implementation of the Preferred Alternative Landfill Footprint were identified.

3.1 Assessment Scenarios

The potential odour impacts that would result from the construction and operation of the proposed preferred alternative landfill were assessed at the worst case future build stages and phases of development. The future build scenarios were assessed by determining odour associated with the significant emission sources in each scenario and determining the potential off-site impacts through dispersion modelling. The scenarios assessed include the intermediate operation scenario (Year 2018) and final operation scenario (Year 2023), as described in Section 1.7.2.

In addition to the two operation scenarios, two proposed leachate management methods used to treat the leachate, as described in Section 1.7.7 were assessed: the preferred method (SBR system only) and the contingency method (SBR system with leachate evaporator).

An overview of the modelling scenarios assessed in this study is presented in **Table 1**.

Table 1. Summary of Emission Sources Included in Each Odour Modelling Scenario

Leachate Management System	Future Build Scenario Assessed	Sources Modelled											
		Existing Landfill Mound	Proposed Preferred Alternative Landfill Mound – Phase 1	Proposed Preferred Alternative Landfill Mound – Phase 2	Active Stage of Preferred Alternative Landfill Mound (Stage 1)	Working Face of the Active Stage (Stage 1)	Active Stage of Preferred Alternative Landfill Mound (Stage 8)	Working Face of the Active Stage (Stage 8)	Raw Leachate Equalization Tank	Sequencing Batch Reactor	Effluent Equalization Tank	Sludge Tank	Evaporator Leachate Stack
Preferred Leachate Treatment Method	*Intermediate Operation (Year 2018)*	X	X		X	X			X	X	X	X	
	Final Operation (Year 2023)	X	X	X			X	X	X	X	X	X	
Contingency Leachate Treatment Method	*Intermediate Operation (Year 2018)*	X	X		X	X			X	X	X	X	X
	Final Operation (Year 2023)	X	X	X			X	X	X	X	X	X	X

Note: X – Indicated source included in modelling scenario

3.2 Emission Rate Development

The emission rate development methodology for each source considered in the assessment is presented in the following sections. Please refer to the Appendix Section for additional details and sample calculations.

3.2.1 Existing Landfill Gas Emission Rate Calculations

The odour emission rates for fugitive emissions of LFG from the final cover area of the landfill mound were based on the quantity of LFG released by the closed existing landfill and the odour concentration in this gas.

The odour emission rates were estimated through the use of emission factors based on LFG generation rates and the Ministry of Environment recommended odour concentration of 10,000 OU/m^3 of LFG, outlined in the MOE's "Interim Guide to Estimate and Assess Landfill Air Impacts", 1992.

To calculate the LFG generation rate, the same approach used in the LFG Detailed Impact Assessment was used. The LANDGEM model was used to calculate LFG generation for the WCEC landfill for the 2010 calendar year; however, when compared to the metered LFG consumption 2010 data from the LGTE facility and the LFG flares, the amount of gas combusted exceeded the amount predicted by LANDGEM. The reason for this discrepancy is likely attributed to the unknown and estimated historical waste acceptance rate at the existing landfill. Therefore, the metered consumption data was used in combination with the estimated collection efficiency of the LFG collection system to back calculate the amount of LFG generated by the landfill in 2010 and determine a correction factor that can be applied to determine future year LFG generation from the existing landfill.

The LANDGEM model and correction factor was used to calculate LFG generation for the existing WCEC landfill for the 2018 and 2023 calendar year. For the existing landfill, the assumed percentage of the landfill with the gas collection system in place (100%), and the estimated efficiency of the LFG collection system (85%) made for the baseline assessment went unchanged for the detailed impact assessment.

Please refer to **Appendix A1** for full details on the existing landfill odour emission rate sample calculations.

3.2.2 Preferred Alternative Landfill Gas Emission Rate Calculations

The odour emission rates were estimated through the use of emission factors based on LFG generation rates and the Ministry of Environment recommended odour concentration of 10,000 OU/m^3 of LFG, outlined in the MOE's "Interim Guide to Estimate and Assess Landfill Air Impacts", 1992.

The LANDGEM model was used to calculate LFG generation for the Preferred Alternative Landfill Footprint for the 2018 and 2023 calendar year.

The key inputs in the LANDGEM program are the methane generation rate (k) and the methane generation capacity (L_0). The LFG generation of 0.72 m^3/s was based on the recommended k and L_0 values for Ontario landfills from Environment Canada's GHG Quantification Guidance - Emission Factors from Canada's GHG Inventory – Waste obtained in May 2011 ($k=0.045$, $L_0=83$). These values were selected as they represent the most recent guidance for landfills in Ontario.

The range of LFG generation of 0.85 to 1.7 m^3/s stated in the FCR were based on LANDGEM default values (k=0.04, L_0=100) and United States Clean Air Act (CAA) recommended values (k=0.05, L_0=170). Neither of these sets of k and L_0 values are specific to landfills in Ontario. The FCR states that the CAA values had been found to over-estimate the LFG generation for landfills in Ontario. However, these numbers have been used as an upper limit for the WCEC site. The CAA values were used as a maximum engineering design specification for the LFG collection system, and are not necessarily to be used for assessment of off-site impacts.

The LFG collection system will be designed to accommodate the greater gas generation rate to facilitate a safety margin for good engineering design. As a consequence this will further enhance the gas collection efficiency in providing an additional measure of conservatism in our emission estimates.

A correction factor was not applied in determining the LFG generated from the Preferred Alternative Landfill Footprint. A correction factor was not applied due to WM plans to execute diversion efforts and accept less organic material at the WCEC landfill, resulting in lower LFG generation rates. Also, the waste acceptance at the preferred alternative landfill will be well documented. For these reasons, it is thought that the LFG generation estimated using the LANDGEM model will be more accurate and little discrepancy will occur when compared to the future metered consumption data.

The assumed percentage of the Preferred Alternative Landfill Footprint with the gas collection system in place is dependent on the scenario assessed, as described in Section 1.7.2. The estimated gas collection efficiency of the LFG collection system varies between the portions of the landfill with final cover (85% collection) and the active stage of the landfill (50% collection).

Please refer to **Appendix A2 and A3** for full details on the preferred alternative landfill and interim cover area odour emission rate sample calculations.

3.2.3 Working Face of the Active Stage

Odour emission rates from the working face area were determined through flux chamber measurements taken at various representative landfill sites in Ontario such as Ridge Landfill, Britannia Road Sanitary Landfill, Trail Road Landfill and Walker Landfill. Flux chamber measurements are used to directly measure the odour emission rate originating from the surface of interest.

The odour emission samples were collected using a stainless flux chamber. The flux chamber was placed on the surface of the working face and the bottom edge of the chamber was forced a short depth down into the surface to create a seal. The flux chamber was operated under a slight positive pressure to further prevent outside air from entering underneath the walls and into the chamber.

Samples were collected and submitted for analysis by an odour panel, a representative group of the population that smell and characterize diluted odour samples to quantitatively determine the strength of the odour source in odour units. The 90th percentile concentration from the samples collected on each source was used in determining the emission rate for the source.

Please refer to **Appendix A4** for full details on the working face odour emission rate sample calculations.

3.2.4 Leachate Management System Emission Rate Calculations

3.2.4.1 Sequencing Batch Reactor (SBR) System

Since the leachate treatment facility is currently in the proposal stage, it is not possible to conduct source testing measurements to quantify the odour emission rate from the various sources from the proposed WCEC Landfill SBR system. No representative facilities in Ontario were identified as having similar leachate treatment processes as the initial proposed design for the SBR system treating leachate collected from the existing landfill; therefore, odour emissions were approximated based published odour thresholds from the American Industrial Hygiene Association (AIHA) and emission rates previously developed for the SBR system. In anticipation of the increased leachate generation due to the construction and filling of the preferred alternative landfill, the SBR system is assumed to double in capacity and therefore as a conservative approach the initial estimated emission rates for the raw leachate equalization tank, the effluent equalization tank, and the sludge holding tank were also doubled.

The emissions from the SBR tank were not doubled, since the SBR is a batch process and maximum emissions would not occur from both SBR tanks at the same time. During the beginning of the proposed expansion, the leachate volumes generated will not exceed the current capacity of the SBR system. For the purposes of this Detailed Odour Impact Assessment and to obtain the most conservative emissions release estimate, the following was assumed:

1. the SBR system is operating at its maximum flow rate;
2. the leachate inlet concentration for each parameter identified is at its highest;
3. the leachate generated from the preferred alternative landfill and the existing landfill are similar in quality; and
4. the SBR tank, although a batch process, is discharging emission continuously, 24 hours per day, 7 days a week.

Therefore, having one SBR system operating 24-hours per day at the worst-case conditions is an overly conservative assumption intended to address any potential additional capacity that may be required in the future. In the unlikely event that any additions to the SBR system are required, an assessment of associated emission changes will be required as part of the ECA process. At that time, with the SBR system constructed and running, the SBR emissions can be derived by performing validated source testing.

Odour emission rates from each of the four identified leachate sources associated with the SBR system were calculated based on the parts per million (ppm) thresholds from the AIHA document "Odour Thresholds for Chemicals with Established Occupational Health Standards" for the various volatile contaminants contained in the leachate. For each contaminant, the minimum odour detection threshold value was selected from the "Range of Acceptable Values" provided in the AIHA document. For those contaminants that did not have a "Range of Acceptable Values", the minimum value was selected from the "Range of All Referenced Values" provided in the document. The minimum values were chosen to help account for the potential odour contribution from those chemicals that were not included in the leachate chemical list as well as for potential synergistic effects that may be occurring due to the combination of the various odourous compounds.

The in-stack concentration of each leachate compound was calculated and used to determine the odour emission rate from each chemical for each source. An overall odour emission rate from each leachate source was developed by taking the sum of the odour emission rates for each individual contaminant.

Estimating odour impacts based on summing odour threshold values for individual chemical species is generally a conservative approach. Typically, specific compounds tend to dominate the odour emissions, which serves to mask the other compounds; therefore, the odours tend to not be additive. However, it cannot be stated as a certainty that the compounds will not have a synergistic effect. The SBR system has yet to be installed, and there are no similar systems at representative facilities in Ontario. Therefore, this approach represents the best available approach to determine the odour emission rates associated with the SBR system.

Please refer to **Appendix B** for full details on the SBR system odour emission rate sample calculations.

3.2.4.2 Leachate Evaporator System

An odour emission sampling program was conducted on the exhaust system serving the leachate evaporator system currently installed and operating at WM's Glenn's Landfill site located in Maple City, Michigan. The leachate evaporator was processing approximately 20,000 gallons of leachate per day. This is equivalent to the amount that would be processed at the WCEC facility if this contingency leachate treatment method is selected; therefore the odour emission results from WM's Glenn's Landfill leachate evaporator were applied directly to the proposed WCEC evaporator.

Please refer to **Appendix C** for full details on the leachate evaporator source testing and results.

3.2.4.3 Ammonia Emissions

The odours associated with the leachate evaporator emissions are estimated by use of an odour sampling plan on an exhaust system currently serving operations with no pre-treatment plan (i.e., no SBR system). As the proposed contingency leachate management system includes the pre-treatment of the leachate through the SBR system, the odours associated with the ammonia emissions emitted from the SBR system would be eliminated from the leachate evaporator system before being emitted to the atmosphere. To maintain a conservative approach, the full ammonia emissions were evaluated as being emitted from both the SBR system and the leachate evaporator system, which in reality will not be the case.

3.3 Dispersion Modelling

The odour impacts from the WCEC operations were determined using a dispersion model and reasonable worst-case emission rates. Dispersion modelling was performed using the U.S. EPA's AERMOD dispersion model (AERMOD) to predict concentrations of odour emitted from the WCEC preferred alternative landfill operations at various receptors in the vicinity. The AERMOD model is an advanced dispersion model that has been approved for use in Ontario by the MOE. AERMOD is a steady-state Gaussian model that is capable of handling multiple emission sources. Within the model, receptor grids as well as discrete receptor locations of interest can be considered. The modelling assessment was conducted in accordance with MOE's Guideline A11: "Air Dispersion Modelling Guideline for Ontario", March 2009 and the MOE's Technical Bulletin "Methodology for Modelling Assessments of Contaminants with 10-Minute Average Standards and Guidelines under O. Reg. 419/05", April 2008.

The odour emission rates were applied in a dispersion model to predict the off-site odour concentrations. The frequency of time that the predicted concentration exceeded the 1 OU/m³ detection threshold and the 3 OU/m³ annoyance threshold was also calculated from the dispersion modelling results.

Additional elements of the dispersion modelling assessment are discussed in the following sections.

Electronic copies input and output modelling files are provided**.**

3.3.1 Sources Modelled

The sources included in the dispersion model were the existing capped landfill mound and the preferred alternative landfill mound, including areas of final cover and an active stage, which contains an interim cover area and a working face area. In addition, the sources associated with the leachate management system, as described in Section 1.7 were also included in the dispersion model. All modelled sources were assumed to emit maximum odour emissions concurrently throughout the entire modelled period.

Although the SBR is a batch system, the sources were conservatively assumed to be emitting continuously. For the purposes of the assessment, three of the leachate treatment tanks (the raw leachate equalization tank, the effluent equalization tank, and the sludge holding tank) were assumed to be emitting contaminants simultaneously and at maximum capacity, based on doubled capacity. The SBR tank was also assumed to be emitting contaminants simultaneously, based on one batch operation (single capacity) operating continuously at maximum emission rates.

The locations of all modelled sources are shown in **Figure 3**.

3.3.2 Meteorological Data

Five years of local meteorological data (2006-2010) were used in the AERMOD dispersion model. The meteorological data set for the WCEC was developed by the MOE's Environmental Monitoring and Reporting Branch (EMRB). This dataset, however, was based on the MOE's regional meteorological data for Eastern Ontario, which considers surface data from the Ottawa International Airport. The Ottawa Airport, which is located approximately 25 km away from the landfill, is the nearest weather station providing the desired meteorological parameters on an hourly basis. The EMRB adjusted the regional meteorological dataset to account for local land uses surrounding the WCEC facility. The data set provided by the EMBR was used directly in the dispersion model, with no changes or alterations conducted by RWDI.

Consultation on the meteorological dataset was conducted with Jinliang (John) Liu from the EMRB. As the meteorological dataset provided by the EMRB, is still based on the regional data, rather than local data, a Section 13(1) request is not required.

3.3.3 Area of Modelling

Typically, when modelling odours, impacts are assessed only at odour sensitive receptor locations, not at the property line. In the MOE Technical Standard Methodology for Modelling Assessments of Contaminants with 10-Minute Average Standards and Guidelines, April 2008, odour sensitive receptors are defined as "any locations where and when human activities regularly occur". A total of 24 receptor locations were considered in the modelling as odour sensitive receptors, including nearby residences, schools, businesses, and other sensitive receptor locations. For all cases, humans were assumed to be present at these receptors for 24-hours per day. These discrete receptors were modelled at flagpole heights of 1.5 m above grade. The locations of these discrete receptors are shown on **Figure 2**. These discrete receptors were used to assess compliance with the MOE's odour objectives.

In addition, the modelling was performed using a receptor grid covering the Site-Vicinity and Regional study areas to produce isopleths of predicted concentrations. The receptor grid covers the lands within approximately 3 to 5 km of the Site sources. The results for the areas covered by this receptor grid are visually outlined within the isopleths provided in **Figures 4 to 7**. These results were only used for visual representation of the predicted odour impacts; the grid results were not used for comparison to the odour guidelines.

3.3.4 Terrain Data

Terrain information for the area surrounding the existing WCEC Landfill was obtained from the MOE Ontario Digital Elevation Model Data web site. The terrain data are based on the North American Datum 1983 (NAD83) horizontal reference datum. These data were run through the AERMAP terrain pre-processor to estimate base elevations for receptors and to help the model account for changes in elevation of the surrounding terrain.

3.3.5 Building Information

The Building Profile Input Program (BPIP) is used to calculate the effects of building downwash on point sources, such as stacks. The proposed leachate evaporator enclosure, the LGTE building and the flare building were included in the modelling, as these structures have the potential to affect emissions from the leachate evaporator, engines and flares. The SBR system tanks were also included in the modelling as buildings, as the tanks have the potential to affect the emissions from the tank vent sources. The BPIP model was run prior to running the AERMOD model in order to incorporate the potential building downwash effects.

The potential building downwash effects were only evaluated for the point sources within the dispersion model. Although the existing and proposed preferred alternative landfill mounds may be considered "structures", dispersion modelling tests were completed including these landfill mound "structures" and it was found that the effects of mound downwash have insignificant impacts on the maximum off-site concentrations. The effects of the mound downwash are insignificant as the sloping features of the mound do not act as a solid block building.

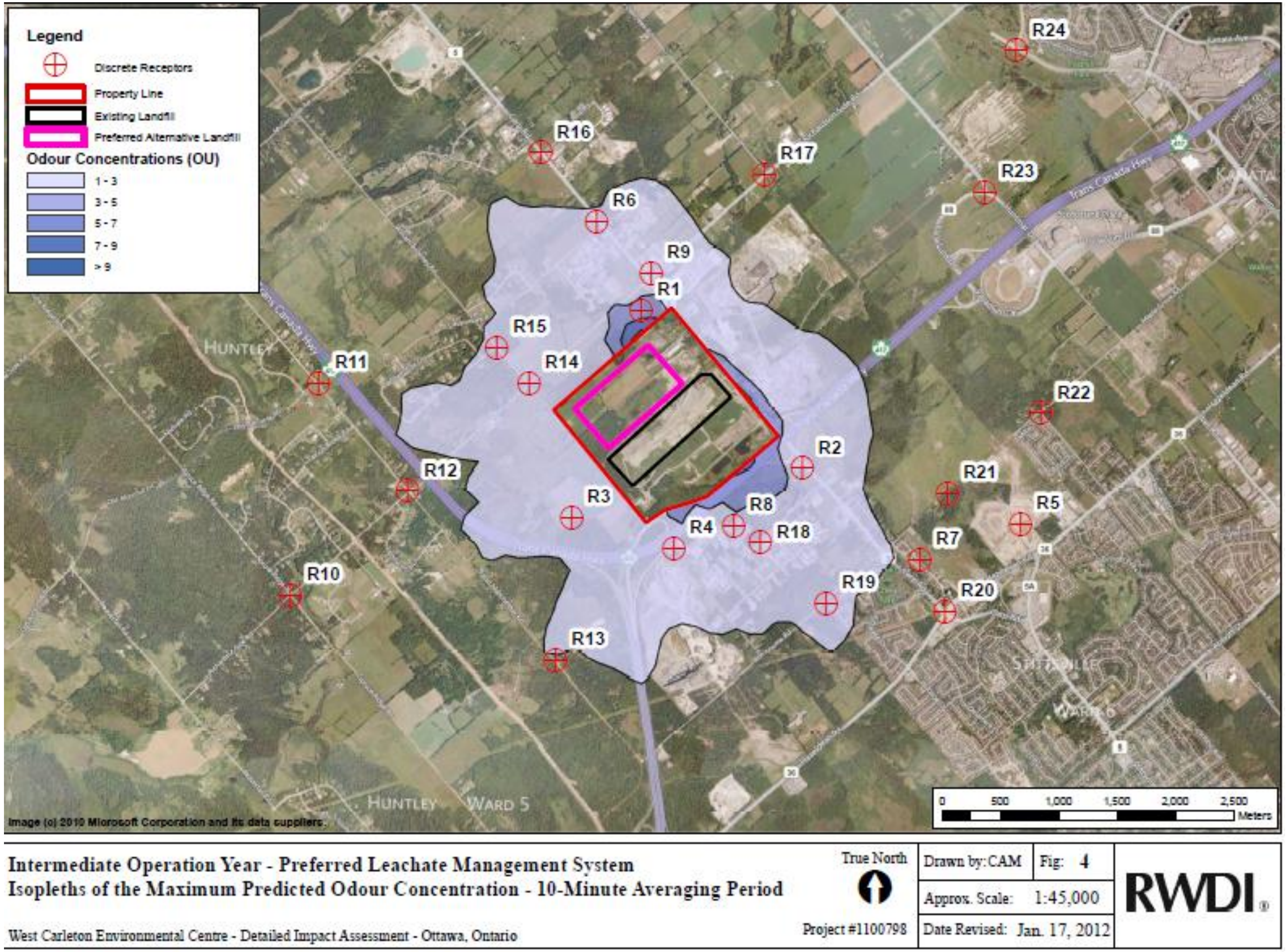

Figure 4. Intermediate Operation Year – Preferred Leachate Management System Isopleths of the Maximum Predicted Odour Concentration – 10-Minute Average Period

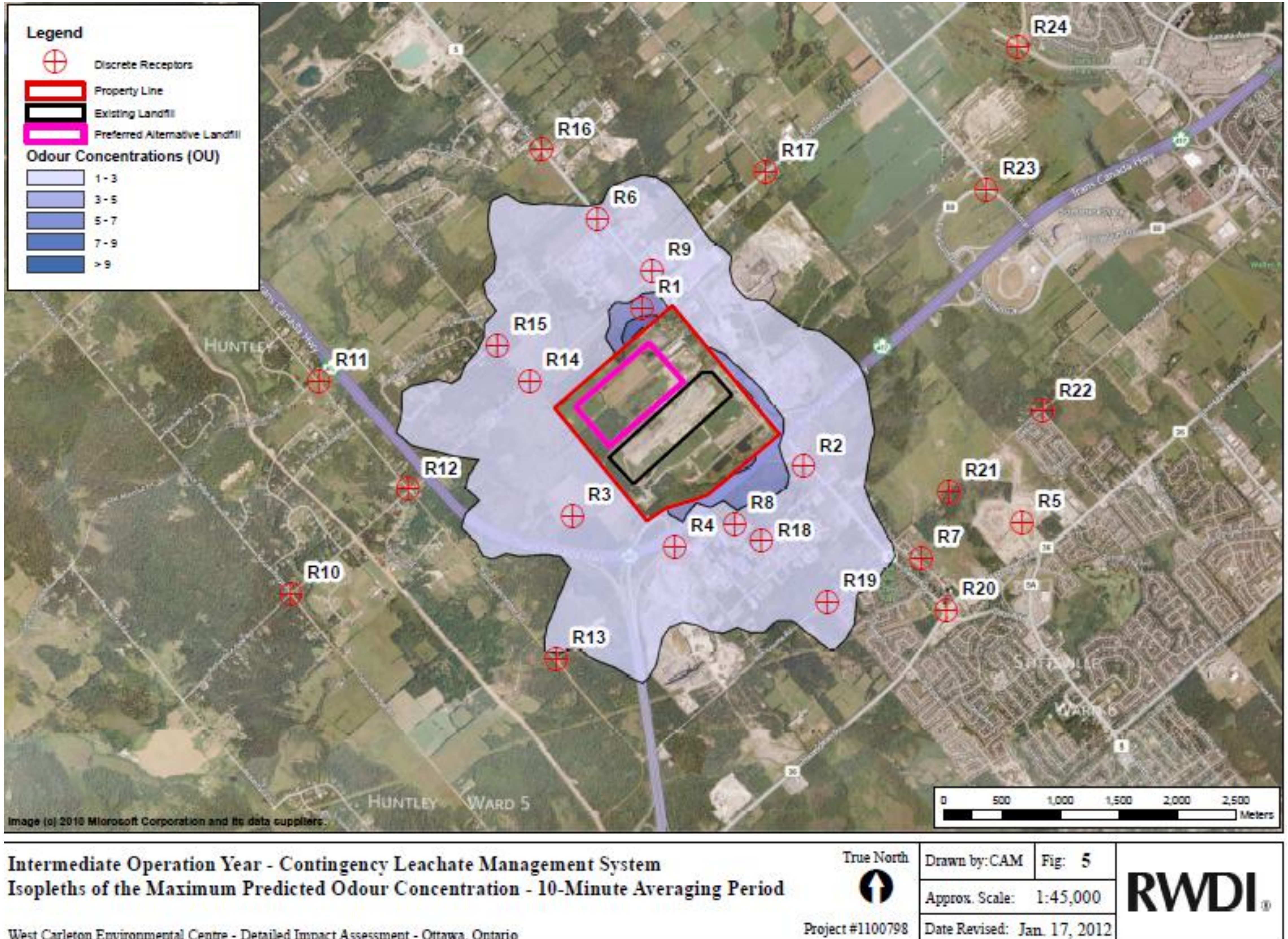

Figure 5. Intermediate Operation Year – Contingency Leachate Management System Isopleths of the Maximum Predicted Odour Concentration – 10-Minute Average Period

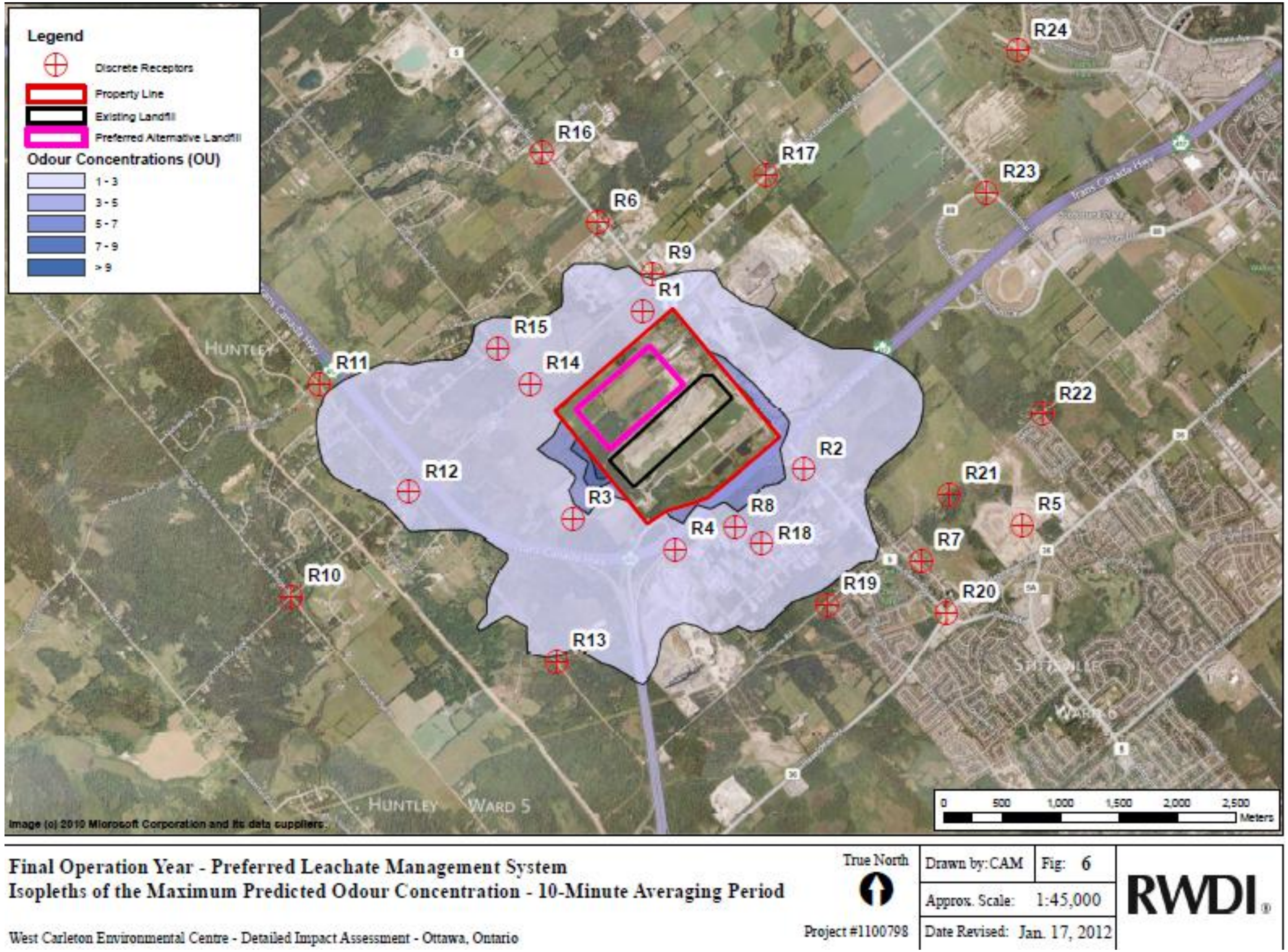

Figure 6. Final Operation Year – Preferred Leachate Management System Isopleths of the Maximum Predicted Odour Concentration – 10-Minute Average Period

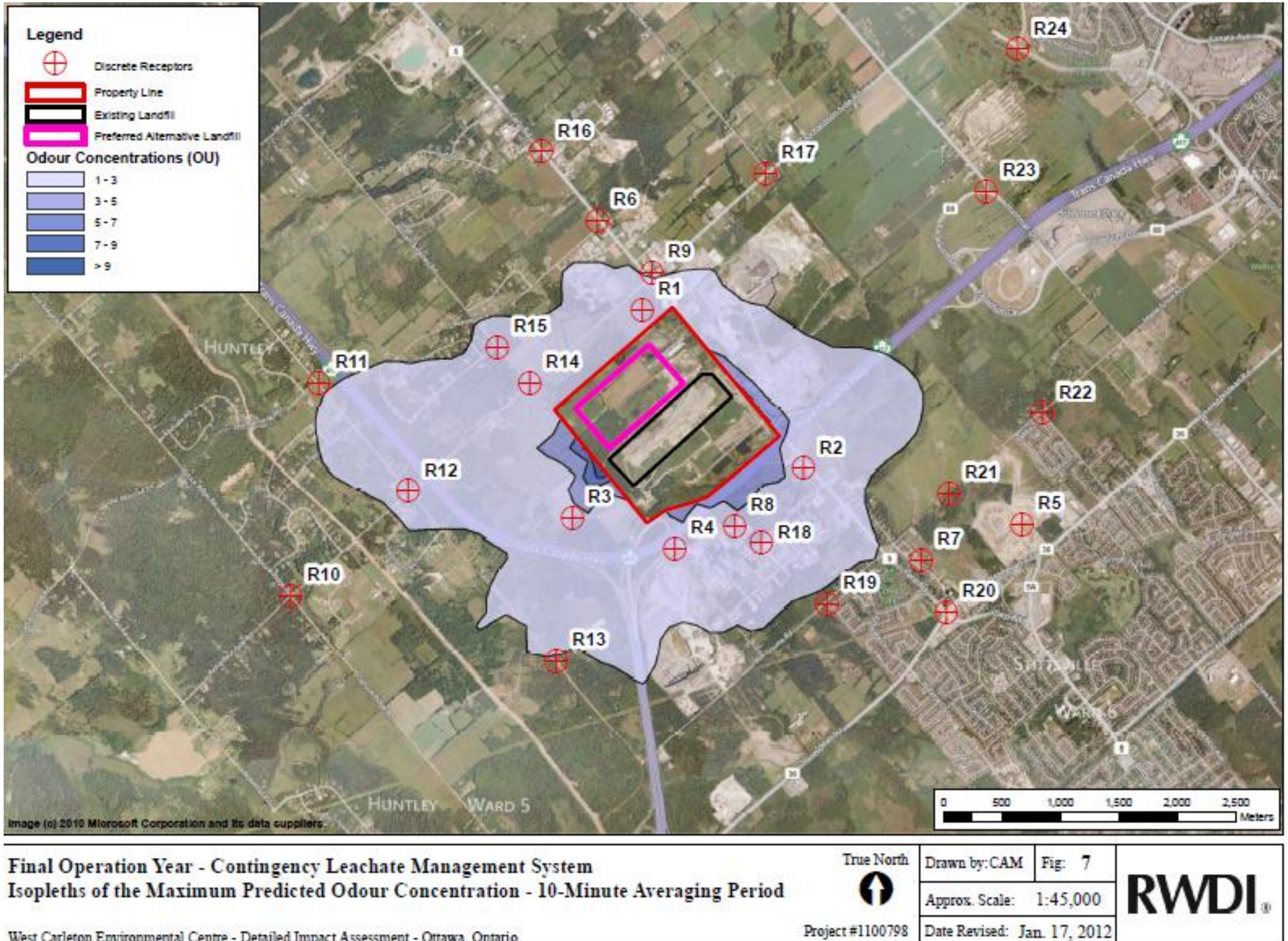

Figure 7. Final Operation Year – Contingency Leachate Management System Isopleths of the Maximum Predicted Odour Concentration – 10-Minute Average Period

3.3.6 Averaging Periods Used

The results from the dispersion model, which represent a 1-hour averaging period, were converted to a 10-minute averaging period for comparison with the applicable odour guidelines. A conversion factor of 1.65 was used to convert 1-hour results to 10-minute averages, based on guidance provided in the MOE's "Procedure for Preparing an Emission Summary and Dispersion Modelling Report", March 2009.

4. Additional Investigations

Since the WCEC is the only source of landfill-related odours in the area, no additional investigations of off-site odour sources were required.

5. Detailed Description of the Environment Potentially Affected

This section describes the predicted odour impacts that would result from the construction and operation of the proposed preferred alternative landfill with the preferred and contingency leachate management system. To determine the effect of the additional waste on the air quality conditions surrounding the site, a modelling assessment was completed for each of the future build stages, as previously described.

5.1.1 On-Site and in the Vicinity

The maximum modelled odour concentration predicted at the property line of the WCEC site for combined odours from all WCEC operations are summarized in **Table 2**. The maximum odour concentrations associated with each landfill and non-landfill source are summarized in **Table 3**.

Table 2. Maximum Predicted 10-Minute Average Odour Concentrations at the Property Line

Future Build Scenario	Maximum Predicted 10-Minute Average Concentration (OU/m^3)	
	Preferred Leachate Management System	Contingency Leachate Management System
Year 2018	10	10
Year 2023	12	12

The combined odour impact of all the landfill and non-landfill sources, listed in **Table 2**, assesses the all the sources emitting simultaneously at the overall worst case grid receptor.

The combined odour impact from the site-wide WCEC operations was predicted to exceed the recommended annoyance guideline of 3 OU/m³. For all scenarios, the exceedances were predicted to occur near the facility property line. The maximum 10-minute averaged concentration at any modelled receptor for 2018 conditions was predicted to be 10.0 OU/m³. The maximum 10-minute averaged concentration at any modelled receptor for 2023 conditions was predicted to be 12.2 OU/m³. Contour plots showing the 10-minute average concentrations for odour for each scenario are presented in **Figure 4** through **Figure 7**. The contour plots also illustrate the off-site area where odour impacts from the WCEC operations may exceed the 1 OU/m³ detection threshold and the 3 OU/m³ annoyance threshold from time to time.

Table 3. Maximum Predicted 10-Minute Average Odour Concentrations at the Property Line by Source

Odour Type	Odour Source	Maximum Predicted 10-Minute Average Concentration (OU/m³)	
		2018	2023
Landfill	Existing Landfill Mound	1.6	1.3
	Preferred Alternative Landfill Mound	0.4	0.7
	Interim Face	2.1	2.2
	Working Face	8.9	9.9
Leachate Management System	SBR System	5.1	5.1
	Leachate Evaporator	0.8	0.8

In **Table 3**, the maximum predicted concentration associated with the landfill and non-landfill sources are listed. These represent the odour impacts of each source assessed independently at the worst-case grid receptor. The location of the worst-case receptor may vary by source due to the location of each individual source. These results cannot be summed to obtain the cumulative odour impacts, but are a good indicator of the maximum contribution from each individual source.

The maximum predicted odour concentration occurring from the landfill sources are influenced by the close proximity of these sources to the property line. The working face was generally the most dominant landfill source in causing off-site impacts. The working face represents the landfill source with the highest emission flux rate (odour emissions per square meter), due to the deposit and handling of fresh waste, reduced gas collection efficiency, and a lack of cover material in this area. The predicted impacts from the existing landfill mound are predicted to decrease in 2023, relative to 2018, due to the reduction in LFG produced from the existing landfill in future years. The predicted impacts from the preferred alternative landfill increased in 2023, relative to 2018, as a result of increased waste present in the preferred alternative landfill in future years, which results in increased LFG generation, and thus increased odour emissions, from this source.

The maximum predicted odour concentrations for all future build scenarios are influenced by emissions from the SBR, the pretreatment process of the preferred Leachate Management System. No other odour sources are associated with the Preferred Leachate Management System. The SBR pretreatment system is comprised of several tanks, which have vent exhausts with low exit velocities and little momentum, resulting in poor dispersion from these sources. The poor dispersion results in high concentrations at the property line. Potential odours associated with the Contingency Leachate Management System may result from the leachate evaporator stack exhaust. No pretreatment is anticipated and consequently will not be an additional odour source. The leachate evaporator stack exhaust has a tall stack, high exit velocity, and high momentum, resulting in good dispersion. For these reasons, the leachate evaporator has little impact on the maximum predicted odour concentration at the property line, as the maximum predicted concentrations between the Preferred Leachate Management System and the Contingency Leachate Management System are relatively unchanged.

Although the maximum predicted odour concentrations at the property line are predicted to exceed the 3 OU/m³ annoyance threshold from time to time, the MOE guidance document indicates that odour concentrations need only be assessed at odour-sensitive receptor locations, such as residences, commercial buildings, and outdoor parks and recreation areas. Therefore, the assessment of odour impacts from the WCEC operations at the odour-sensitive discrete receptor locations is discussed in the following section.

5.1.2 Discrete Receptors

The following section outlines the results from the all the landfill related odours at the 24 odour-sensitive discrete receptors near the WCEC.

Table 4 presents the maximum predicted 10-minute odour concentrations at each of the 24 sensitive receptor locations, based on the Preferred Leachate Management System for the intermediate operation year (2018) scenario and in the approaching closure operation year (2023) scenario.

Table 4. Summary of Maximum Predicted 10-Minute Results at Discrete Receptors for Each Future Build Scenario – Preferred Leachate Management System

Receptor No.	2018			2023		
	Maximum 10-Minute Average Concentration (OU/m³)	Frequency >1 OU	Frequency >3 OU	Maximum 10-Minute Average Concentration (OU/m³)	Frequency >1 OU	Frequency >3 OU
1	**4.2**	**1.15%**	**0.15%**	1.4	0.10%	--
2	2.5	0.35%	--	2.5	0.33%	--
3	1.4	0.10%	--	**2.7**	**0.18%**	**--**
4	2.5	0.15%	--	2.4	0.18%	--
5	0.5	--	--	0.5	--	--
6	1.0	0.01%	--	0.8	--	--
7	0.8	--	--	0.6	--	--
8	2.6	0.15%	--	2.6	0.12%	--
9	2.1	0.48%	--	1.0	--	--
10	0.5	--	--	0.7	--	--
11	0.7	--	--	1.0	--	--
12	0.8	--	--	1.3	0.02%	--
13	1.0	--	--	1.0	--	--
14	1.5	0.08%	--	1.6	0.35%	--
15	1.1	0.01%	--	1.1	0.04%	--
16	0.8	--	--	0.6	--	--
17	0.6	--	--	0.5	--	--
18	1.9	0.13%	--	1.8	0.09%	--
19	1.1	0.02%	--	0.9	--	--
20	0.7	--	--	0.5	--	--
21	0.6	--	--	0.7	--	--
22	0.4	--	--	0.6	--	--
23	0.4	--	--	0.5	--	--
24	0.3	--	--	0.3	--	--

In the intermediate operation year, the maximum odour concentration resulting from the WCEC operations was predicted to occur at Receptor R1, with a value of 4.2 OU/m³. The predicted odour impacts at Receptor R1 are predicted to exceed the odour detection threshold of 1 OU 1.15% of the time, based on worst-case operations with the working face of the landfill in the worst-case location relative to the R1 location. Under this worst-case scenario, the predicted odour impacts at R1 were predicted to exceed the odour annoyance threshold of 3 OU only 0.15% of the time. However, the working face of the landfill, which was shown to be a main source of odour impacts at R1, would only be in this worst-case location for only a portion of the year. Therefore, it is expected that the actual frequency of odour impacts above the detection threshold to be less than the 1.15% of the time predicted by the model.

Based on the analysis, 74% of the predicted levels above 1 OU occur between the hours of 8:00 pm to 6:00 am. The working face would have a daily cover applied during this time period, which will reduce the odour emission for this source by at least a factor of 2. It was conservatively assumed that the maximum working face odours would be emitted 24-hours per day. Therefore, in reality the odour occurrences would be less frequent than the analysis predicts.

In the final operating year, the maximum odour concentration resulting from the WCEC operations was predicted to occur at Receptor R3, with a value of 2.7 OU/m³. The odour concentration at Receptor R3 was predicted to exceed the 1 OU/m³ detection threshold less than 0.5% of the time and was not predicted to exceed the 3 OU/m³ annoyance threshold. The predicted concentrations for all other sensitive receptors were predicted to exceed the 1 OU/m³ detection threshold less than 0.5% of the time.

Therefore, for the Preferred Leachate Management System, all sensitive receptor locations are predicted to comply with the MOE's current guidelines for odour, with the exception of R1 during the intermediate operation year.

Table 5 presents the maximum predicted 10-minute odour concentrations at each of the 24 sensitive receptor locations, based on the Contingency Leachate Management System for the intermediate operation year (2018) scenario and in the approaching closure operation year (2023) scenario.

Table 5. Summary of Maximum Predicted 10-Minute Results at Discrete Receptors for Each Future Build Scenario – Contingency Leachate Management System

Receptor No.	2018			2023		
	Maximum 10-Minute Average Concentration (OU/m³)	Frequency >1 OU	Frequency >3 OU	Maximum 10-Minute Average Concentration (OU/m³)	Frequency >1 OU	Frequency >3 OU
1	**4.2**	**1.15%**	**0.15%**	1.4	0.10%	--
2	2.5	0.36%	--	2.5	0.33%	--
3	1.4	0.10%	--	**2.7**	**0.18%**	**--**
4	2.5	0.16%	--	2.4	0.19%	--
5	0.5	--	--	0.5	--	--
6	1.0	0.01%	--	0.8	--	--
7	0.8	--	--	0.6	--	--
8	2.6	0.15%	--	2.6	0.13%	--
9	2.1	0.48%	--	1.0	--	--
10	0.5	--	--	0.7	--	--
11	0.7	--	--	1.0	--	--
12	0.8	--	--	1.3	0.02%	--
13	1.0	--	--	1.0	--	--
14	1.5	0.08%	--	1.6	0.35%	--
15	1.1	0.01%	--	1.1	0.04%	--
16	0.8	--	--	0.6	--	--
17	0.6	--	--	0.5	--	--
18	1.9	0.14%	--	1.8	0.09%	--
19	1.1	0.02%	--	0.9	--	--
20	0.7	--	--	0.5	--	--
21	0.6	--	--	0.7	--	--
22	0.4	--	--	0.6	--	--
23	0.4	--	--	0.5	--	--
24	0.3	--	--	0.3	--	--

The results for the Contingency Leachate Management System are similar to the results for the Preferred Leachate Management System. This is consistent with the finding that the leachate evaporator is not a main contributor to off-site odour impacts. Overall, the maximum predicted odour concentrations for the Contingency Leachate Management System are the same as those predicted for the Preferred Leachate Management System, while the predicted frequencies of exceedance of the 1 OU/m³ detection threshold increased slightly at some sensitive receptor locations.

Therefore, for the Contingency Leachate Management System, all sensitive receptor locations are predicted to comply with the MOE's current guidelines for odour, with the exception of R1 during the intermediate operation year.

6. Environmental Air Quality Net Effects

As mentioned, the previously identified potential effects and recommended mitigation or compensation measures associated with the Preferred Alternative Landfill Footprint were reviewed to ensure their accuracy in the context of the preliminary design, based on the more detailed understanding of the atmospheric environment developed through the additional investigations. With this in mind, the confirmed potential effects, mitigation or compensation measures, and net effects are summarized in **Table 7** and described in further detail in the sections below.

6.1 Potential Effects on Atmospheric Environment

Through comparison of the modelling results from the conditions presented due to the preferred alternative landfill it is possible to determine the net effect of the proposed landfill expansion on the community based discrete receptors. The impact of the expansion is evaluated based on the maximum predicted concentration and frequency of time that the predicted concentration exceeds the odour detection threshold of 1 OU/m³ and the odour annoyance threshold of 3 OU/m³. When the mitigation measures discussed Section 6.2 are incorporated, the predicted odours at all of the discrete receptors are in compliance with the MOE's current guidelines in terms of both predicted concentrations and frequency of predicted impacts, with the exception of Receptor 1. Predicted impacts at Receptor 1 exceed the 1 OU/m³ detection threshold 1.15% of the time and exceed the 3 OU/m³ annoyance threshold 0.15% of the time. These predicted impacts are slightly above the MOE guideline, which allows for predicted exceedances of the 1 OU/m³ detection threshold 0.5% percent of the time. Consequently, the impact of the expansion is considered low at all discrete receptors for all future build scenarios, with the exception of Receptor 1, where it is considered medium.

These results assume that the worst-case operations are occurring in the same locations for a five-year period. In reality, the working face, which has been shown to be a dominant contributor to off-site impacts, particularly at R1, will move to various locations within each landfill Stage over the modelled period. The impact from the working face at a particular receptor will be lessened as the distance between this source and the receptor increases. Therefore, the frequencies of exceedance of the 1 OU/m³ and 3 OU/m³ thresholds at Receptor 1 may be reduced relative to what was predicted by the dispersion modelling.

6.2 Additional Mitigation and/or Compensation Measures

The odour assessment considered several mitigation measures that are part of the design of the preferred landfill alternative. These mitigation measures include the following:

- Development of an Odour Best Management Practices (BMP) Plan;
- Progressive installation of the LFG collection system for the preferred alternative landfill;
- Flaring or otherwise combusting all collected LFG;
- Ensure emergency measures are in place should a power failure or lightning strike occur that disrupts the flare (including notification to staff or alarm system);
- Increase in stack height of the leachate evaporator to a minimum of 22 m above grade;
- Maintaining the leachate collection system under negative pressure and sending the collected gas to the LFG collection system;
- Minimizing the size of the working face; and,
- Daily covering of the working face.

These mitigation measures were considered in the assessment and, as such, the predicted impacts presented in Section 6.1 incorporate the effect of these measures. In addition to these mitigation measures that were considered in the modelling, WM will be developing an Odour BMP Plan that will include potential additional mitigation measures and operational practices that will be undertaken to further reduce odour impacts. The Odour BMP Plan will be prepared as part of the ECA process.

6.3 Potential Impacts on the Environment with Additional Mitigation Measures

Additional mitigation measures will be applied, if necessary, to further reduce the odour impacts. These additional mitigation measures will be outlined in the Odour BMP Plan. The effect of additional mitigation measures have not been quantified at this time.

6.4 Net Effects

Through comparison of the modelling results from the baseline scenario (please refer to the Odour Baseline Conditions Report) and the expansion scenarios (Section 3.1) it is possible to determine the net effect of the proposed landfill expansion on the community based discrete receptors. The overall maximum predicted impact at each receptor, based on the single maximum predicted concentration and frequency of exceedance over both operating years and both leachate treatment scenarios, were compared to the results of the baseline assessment.

The impact of the expansion is evaluated based on both the maximum predicted concentration as well as the frequency of exceedance of the detection and annoyance thresholds for odour. The maximum predicted impacts show increased odour levels relative to the baseline condition. However, the only odour source included in the baseline scenario was the existing landfill under final cover with full gas collection at an efficiency of 85%. The comparison indicates that the proposed landfill expansion will result in increased detection of odours at the discrete receptors, relative to baseline conditions; however, the detection frequencies are relatively low and are within MOE guidelines for all receptors with the exception of Receptor R1.

Table 6. Comparison of Maximum Predicted Impacts with the Baseline Condition

Receptor No.	Baseline			Maximum Predicted Impact (Contingency Leachate Management, 2018 or 2023)		
	Maximum 10-Minute Average Concentration (OU/m³)	Frequency >1 OU	Frequency >3 OU	Maximum 10-Minute Average Concentration (OU/m³)	Frequency >1 OU	Frequency >3 OU
1	0.3	--	--	**4.2**	**1.15%**	**0.15%**
2	0.3	--	--	2.5	0.36%	--
3	**0.9**	**--**	**--**	2.7	0.18%	--
4	0.4	--	--	2.5	0.19%	--
5	0.2	--	--	0.5	--	--
6	0.2	--	--	1.0	0.01%	--
7	0.2	--	--	0.8	--	--
8	0.3	--	--	2.6	0.15%	--
9	0.3	--	--	2.1	0.48%	--
10	0.3	--	--	0.7	--	--
11	0.2	--	--	1.0	--	--
12	0.3	--	--	1.3	0.02%	--

Table 6. Comparison of Maximum Predicted Impacts with the Baseline Condition

Receptor No.	Baseline			Maximum Predicted Impact (Contingency Leachate Management, 2018 or 2023)		
	Maximum 10-Minute Average Concentration (OU/m³)	Frequency >1 OU	Frequency >3 OU	Maximum 10-Minute Average Concentration (OU/m³)	Frequency >1 OU	Frequency >3 OU
13	0.6	--	--	1.0	--	--
14	0.4	--	--	1.6	0.35%	--
15	0.3	--	--	1.1	0.04%	--
16	0.1	--	--	0.8	--	--
17	0.3	--	--	0.6	--	--
18	0.3	--	--	1.9	0.14%	--
19	0.2	--	--	1.1	0.02%	--
20	0.2	--	--	0.7	--	--
21	0.2	--	--	0.7	--	--
22	0.2	--	--	0.6	--	--
23	0.3	--	--	0.5	--	--
24	0.2	--	--	0.3	--	--

Table 7. Potential Effects, Proposed Mitigation and Compensation Measures, and Resulting Net Effects

ID #	Potential Effect	Mitigation/ Compensation	Net Effect
1.	Detection threshold exceeded from time to time; annoyance threshold exceeded from time to time; does not meet MOE guidelines	• Development of an Odour Best Management Practices Plan – including additional mitigation measures as required; • Progressive installation of the LFG collection system for the preferred alternative landfill; • Flaring or otherwise combusting all collected LFG; • Increase in stack height of the leachate evaporator to a minimum of 22 m above grade; • Maintaining the leachate collection system under negative pressure and sending the collected gas to the LFG collection system; • Minimizing the size of the working face; and, • Daily covering of the working face.	Further reduced odour impacts
2.	Detection threshold exceeded from time to time; annoyance threshold not exceeded; meets MOE guidelines		Further reduced odour impacts
3.	Detection threshold exceeded from time to time; annoyance threshold not exceeded; meets MOE guidelines		Further reduced odour impacts
4.	Detection threshold exceeded from time to time; annoyance threshold not exceeded; meets MOE guidelines		Further reduced odour impacts
5.	Detection and annoyance thresholds not exceeded; meets MOE guidelines		Further reduced odour impacts
6.	Detection threshold exceeded from time to time; annoyance threshold not exceeded; meets MOE guidelines		Further reduced odour impacts
7.	Detection and annoyance thresholds not exceeded; meets MOE guidelines		Further reduced odour impacts
8.	Detection threshold exceeded from time to time; annoyance threshold not exceeded; meets MOE guidelines		Further reduced odour impacts
9.	Detection threshold exceeded from time to time; annoyance threshold not exceeded; meets MOE guidelines		Further reduced odour impacts
10.	Detection and annoyance thresholds not exceeded; meets MOE guidelines		Further reduced odour impacts
11.	Detection and annoyance thresholds not exceeded; meets MOE guidelines		Further reduced odour impacts

Table 7. Potential Effects, Proposed Mitigation and Compensation Measures, and Resulting Net Effects

ID #	Potential Effect	Mitigation/ Compensation	Net Effect
12.	Detection threshold exceeded from time to time; annoyance threshold not exceeded; meets MOE guidelines		Further reduced odour impacts
13.	Detection and annoyance thresholds not exceeded; meets MOE guidelines		Further reduced odour impacts
14.	Detection threshold exceeded from time to time; annoyance threshold not exceeded; meets MOE guidelines		Further reduced odour impacts
15.	Detection threshold exceeded from time to time; annoyance threshold not exceeded; meets MOE guidelines		Further reduced odour impacts
16.	Detection and annoyance thresholds not exceeded; meets MOE guidelines		Further reduced odour impacts
17.	Detection and annoyance thresholds not exceeded; meets MOE guidelines		Further reduced odour impacts
18.	Detection threshold exceeded from time to time; annoyance threshold not exceeded; meets MOE guidelines		Further reduced odour impacts
19.	Detection threshold exceeded from time to time; annoyance threshold not exceeded; meets MOE guidelines		Further reduced odour impacts
20.	Detection and annoyance thresholds not exceeded; meets MOE guidelines		Further reduced odour impacts
21.	Detection and annoyance thresholds not exceeded; meets MOE guidelines		Further reduced odour impacts
22.	Detection and annoyance thresholds not exceeded; meets MOE guidelines		Further reduced odour impacts
23.	Detection and annoyance thresholds not exceeded; meets MOE guidelines		Further reduced odour impacts
24.	Detection and annoyance thresholds not exceeded; meets MOE guidelines		Further reduced odour impacts

7. Impact Analysis of Other WCEC Facilities

Some of the proposed WCEC facilities which are in the conceptual stage of planning, such as the material and recycling facility, the residential diversion facility and the organic processing facility have the potential to emit odourous emissions associated with the activities that the facilities house. As they are proposed facilities, design details including operation (i.e. waste volumes handled) and building details do not yet exist and, therefore, these facilities were not included in the Odour Detailed Impact Assessment. These proposed facilities will be designed with the intent of minimizing odour emissions discharged to the atmosphere and an assessment of their emissions, including odour emissions, will be included during the ECA process.

The other WCEC facilities, such as the construction and demolition material recycling facility, the residential diversion facility, the community lands for parks and recreation, the LGTE facility, and the greenhouses, do not have odours associated with the activities that they house. These activities do not significantly contribute to the potential odour impacts of the construction and operation of the preferred alternative landfill; therefore, an impact analysis of the other WCEC facilities was not performed in this Odour Detailed Impact Assessment.

8. Monitoring and Commitments for the Undertaking

To ensure that the mitigation measures identified in **Section 6** are implemented as envisioned, a strategy and schedule was developed for monitoring environmental effects. With these mitigation or compensation measures and monitoring requirements in mind, commitments have also been proposed for ensuring that they are carried out as part of the construction, operation, and maintenance of the landfill.

8.1 Monitoring Strategy and Schedule

As mentioned, a monitoring strategy and schedule was developed based on the Atmospheric Impact Assessment carried out for the Preferred Alternative Landfill Footprint to ensure that (1) predicted net negative effects are not exceeded, (2) unexpected negative effects are addressed, and (3) the predicted benefits are realized.

8.1.1 Environmental Effects Monitoring

Monitoring will aid in identifying and correcting problems before they cause off-site impacts. The following monitoring measures are recommended for the WCEC facility:

- Total hydrocarbon or hydrogen sulphide surface surveys of both the existing and proposed alternative landfill mounds, as well as leachate collection manholes, to identify any cracks, fissures, or other hot-spots for escaping LFG;
- Continuous monitoring for temperature and flow on the LFG flares and the LGTE engine-generator sets to ensure proper operation;
- Volatile organic compound and hydrogen sulphide ambient air quality monitoring programs to continue to track annual emissions and identify increases in emissions over time;

- Source testing of the SBR and leachate evaporator for odour source validation;
- Confirmatory measurement of on-site odour sources; and,
- Tracking of any strong odours noted on site.

8.1.2 Development of an Environmental Management Plan

An Environmental Management Plan (EMP) or Plans (i.e., Odour BMP Plan) will be developed following approval of the undertaking by the Minister of the Environment and prior to construction. The EMP will be prepared as part of the ECA process and will include a description of the proposed monitoring, mitigation measures, and commitments.

When developing the Odour BMP Plan, WM will identify and assess the most applicable mitigation measures before committing to their implementation at the WCEC. Included below is a list of typical best odour management mitigation measures that may be incorporated in the Odour BMP Plan for the WCEC.

- Conduct regular maintenance of the landfill cap and interim cover areas to reduce the cracks and fissures due to erosion and settling;
- Conduct regular maintenance of landfill gas collection and control system to prevent leaks in the system and ensure proper function of the system;
- Progressive installation of gas extraction wells in the proposed preferred alternative landfill footprint to improve LFG collection efficiency;
- Record meteorological conditions (i.e., wind) on a continuous basis and consider the conditions before undertaking highly odourous activities to minimize off-site odour impacts (i.e., excavation of previously filled areas);
- Minimize area of the landfill working face to reduce LFG and odourous releases to the atmosphere;
- Cover landfill working face daily with appropriate cover materials (soil) to filter odour. Odour suppressant chemicals may be used in addition, if necessary;
- Apply final or interim cover to completed waste cells as quickly as possible to reduce LFG and odourous releases to the atmosphere; and,
- Document, address and investigate all odour complaints to determine odour source and prevent or minimize future off-site odour impacts.

8.2 Commitments

The following commitments have been proposed for ensuring that the identified mitigation or compensation measures and monitoring requirements are carried out as part of the construction, operation, and maintenance of the undertaking:

a) Increase stack height of leachate evaporator stack to a minimum of 22 metres above grade, should the contingency leachate management system be installed;
b) Progressive installation of the LFG collection system; and,
c) Placing the leachate collection system under negative pressure and sending the leachate gases to the LFG collection system.

9. Environmental Air Quality Approvals Required for the Undertaking

WM currently has ECA approvals #7816-7C9JMR and #7025-7F4PN5 in place, covering the operation of their flares, the current configuration of the landfill gas-fired engines, and an emergency diesel generator. WM also has additional ECAs under review by the MOE to cover the SBR leachate treatment process as well as amendments to the landfill gas-fired engines. WM may need to seek additional approvals or amend or consolidate their existing ECAs to incorporate future changes at the facility, which may include:

- Changes to the SBR leachate treatment;
- Proposed landfill expansion operations;
- Installation of the leachate evaporator; and,
- Development of any of the other on-site diversion facilities.

Some sources, such as the emergency diesel generators, may need to be registered under the MOE's Environmental Activities and Sector Registry.

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Tables

WCEC Source Summary Table: Odour - Intermediate Operation Year (2018) RWDI Project #1100798

Source ID	Source Type	Source Description	Source Data						LFG		Emission Data				
			Stack Volumetric Flow Rate (Am³/s)	Stack Exit Gas Temp. (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate (OU/s)	Averaging Period (hours)	% of Overall Emissions [1] (%)
LM_EX	Area	Existing Landfill Mound	n/a	n/a	n/a	21.6	n/a	n/a	423470	5014385	Odour	n/a	1938	1	7%
LM_PP	Area	Proposed Landfill Mound	n/a	n/a	n/a	n/a	n/a	n/a	423148	5014878	Odour	n/a	602	1	2%
WF	Area	Working Face of Proposed Landfill Mound	n/a	n/a	n/a	n/a	n/a	n/a	423438	5014540	Odour	n/a	808	1	3%
INTERIM	Area	Interim Cover Area of Proposed Landfill Mound	n/a	n/a	n/a	n/a	n/a	n/a	423419	5014563	Odour	n/a	29	1	<1%
EVAP [1]	Point	Leachate Evaporator Stack	13.3	84	0.9	19.1	22	5	424216	5014634	Odour	n/a	18395	1	71%
RAWLEACH	Point	Raw Leachate Equalization Tank	0.0001	25	0.2	0.003	6.6	0.6	424269	5014684	Odour	n/a	20	1	<1%
SBR	Point	Sequencing Batch Reactor Tank	0.0001	32	0.2	0.003	6.6	0.6	424317	5014732	Odour	n/a	3473	1	13%
EFFLUENT	Point	Effluent Equalization Tank	0.0001	25	0.2	0.003	6.6	0.6	424290	5014662	Odour	n/a	6	1	<1%
SLUDGE	Point	Sludge Tank	0.0001	25	0.2	0.003	6.6	0.6	424340	5014708	Odour	n/a	809	1	3%
Total - Preferred	- -	Total of all Listed Sources - Preferred Leachate Scenario	- -	- -	- -	- -	- -	- -	- -	- -	Odour	n/a	7685	- -	n/a
Total - Contingency	- -	Total of all Listed Sources - Contingency Leachate Scenario	- -	- -	- -	- -	- -	- -	- -	- -	Odour	n/a	26080	- -	100%

Notes:
[1] For the preferred leachate management method, the emissions associated with the leachate evaporator were not included in the modelling.
[2] The Percentage of Overall Emissions are based on the total emissions for the Contingency Leachate Scenario

WCEC Source Summary Table: Odour - Final Operation Year (2023)

RWDI Project #1100798

Source ID	Source Type	Source Description	Source Data						LFG		Emission Data				
			Stack Volumetric Flow Rate (Am^3/s)	Stack Exit Gas Temp. (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate (OU/s)	Averaging Period (hours)	% of Overall Emissions [1] (%)
LM_EX	Area	Existing Landfill Mound	n/a	n/a	n/a	21.6	n/a	n/a	423470	5014385	Odour	n/a	1548	1	6%
LM_PP	Area	Proposed Landfill Mound	n/a	n/a	n/a	n/a	n/a	n/a	423148	5014878	Odour	n/a	1082	1	4%
WF	Area	Working Face of Proposed Landfill Mound	n/a	n/a	n/a	n/a	n/a	n/a	423438	5014540	Odour	n/a	808	1	3%
INTERIM	Area	Interim Cover Area of Proposed Landfill Mound	n/a	n/a	n/a	n/a	n/a	n/a	423419	5014563	Odour	n/a	29	1	<1%
EVAP [1]	Point	Leachate Evaporator Stack	13.3	84	0.9	19.1	22	5	424216	5014634	Odour	n/a	18395	1	70%
RAWLEACH	Point	Raw Leachate Equalization Tank	0.0001	25	0.2	0.003	6.6	0.6	424269	5014684	Odour	n/a	20	1	<1%
SBR	Point	Sequencing Batch Reactor Tank	0.0001	32	0.2	0.003	6.6	0.6	424317	5014732	Odour	n/a	3473	1	13%
EFFLUENT	Point	Effluent Equalization Tank	0.0001	25	0.2	0.003	6.6	0.6	424290	5014662	Odour	n/a	6	1	<1%
SLUDGE	Point	Sludge Tank	0.0001	25	0.2	0.003	6.6	0.6	424340	5014708	Odour	n/a	809	1	3%
Total - Preferred	- -	Total of all Listed Sources - Preferred Leachate Scenario	- -	- -	- -	- -	- -	- -	- -	- -	Odour	n/a	7775	- -	n/a
Total - Contingency	- -	Total of all Listed Sources - Contingency Leachate Scenario	- -	- -	- -	- -	- -	- -	- -	- -	Odour	n/a	26170	- -	100%

Notes:

[1] For the preferred leachate management method, the emissions associated with the leachate evaporator were not included in the modelling.

[2] The Percentage of Overall Emissions are based on the total emissions for the Contingency Leachate Scenario

Appendix A

Appendix A1

Existing Landfill Mound Odour Emission Rates – Based on Scaling 2010 Flow Data

Appendix A1 - Existing Landfill Mound Odour Emission Rates - Based on Scaling 2010 Flow Data

Odour Concentration of Landfil Gas	10,000 OU/m³	"upper range" estimate of odour concentrationfrom the MOE's Interim Guide to Estimate and Assess Landfill Air Impacts

Landfill Gas Consumed (2010)	48,911,689	m³/year (from flowmeter data as provided in 2010 NPRI Info)
% of LM_EX with Gas Collection System in Place	100%	
Estimated Efficiency of LFG Collection System	85%	
Overall Gas Collection	85%	
Total Landfill Gas Generated	57,543,164	m³/year (based on gas consumed & overall gas collection)
Total Landfill Gas Released	8,631,475	m³/year (based on gas generated & overall gas collection)
Continuous Emission Rate	0.27	m³/s

Emission Flux Rate from Landfill

Landfill Area	355,013	m² (actual area)
Landfill Area	365,726	m² (modelled area)

Notes:

[1] Using flowmeter data provided in 2010 NPRI Info and Landgem LFG Output, a ratio was calculated and applied to other years to predict actual LFG generation rates

Ratio Gas Generated/LANDGEM Prediction = 1.64

Year	LANDGEM Emissions (m^3/year)	Total Landfill Gas Generated (m^3/year)	Collection Efficiencies	Total Landfill Gas Released (m^3/year)	Continuous Emission Rate (m^3/s)	Odour Emission Rate (OU/s)	Odour Emission Flux Rate (OU/m^2/s)
Intermediate Operation Year (2018)	24,834,505	40,751,168	0.85	6,112,675	0.194	1938.317	5.30E-03
Final Operation Year (2023)	19,830,755	32,540,469	0.85	4,881,070	0.155	1547.777	4.23E-03

Appendix A2

Preferred Alternative Landfill Mound Odour Emission Rates – Based on LANDGEM

Appendix A2 - Preferred Alternative Landfill Mound Odour Emission Rates - Based on LANDGEM

Odour Concentration of Landfil Gas	10,000 OU/m³	"upper range" estimate of odour concentrationfrom the MOE's Interim Guide to Estimate and Assess Landfill Air Impacts

Year	Modelled Preferred Alternative Landfill Area (m^2)
Intermediate Operation Year (2018)	326490
Final Operation Year (2023)	326428.5

Notes: No actual change in landfill area, change is due to change of the active stage placement and therefore slight adjustments made to the preferred alternatice landfill mound polygon source in the modelling

Proposed Landfill

Year	LANDGEM Emissions (m^3/year)	Collection Efficiencies	Total Landfill Gas Released	Continuous Emission Rate (m^3/s)	Odour Emission Rate (OU/s)	Odour Emission Flux Rate (OU/m^2/s)
Intermediate Operation Year (2018)	12,649,667	0.85	1,897,450	0.060	601.677	1.84E-03
Final Operation Year (2023)	22,750,632	0.85	3,412,595	0.108	1082.127	3.32E-03

Appendix A3

Preferred Alternative Landfill Interim Cover Area Odour Emission Rates – Based on LANDGEM

Appendix A3 - Preferred Alternative Landfill Interim Cover Area Odour Emission Rates - Based on LANDGEM

Year	Modelled Interim Cover Area (m2)
Intermediate Operation Year (2018)	45666.3
Final Operation Year (2023)	45999.5

Notes: No actual change in landfill area, change is due to change of the working face placement and therefore slight adjustments made to the interim face polygon source

Interim Face

Year	Collection Efficiencies	Odour Emission Rate (OU/s)	Odour Emission Flux Rate ($OU/m^2/s$)
Intermediate Operation Year (2018)	0%	1141.658	0.025
Final Operation Year (2023)	0%	1149.988	0.025

Notes:

LANDGEM Emission is based on the placement of 250,000 Mg of waste, with no historic cumulation

This is the maximum amount of gas that would be emitted from that waste (i.e. 1 year after its placement)

Appendix A4

Working Face Odour Emission Rates Based on Representative Facilities in Ontario

Appendix A4: Working Face Odour Emission Rates based on Representative Facilities in Ontario

Sample ID	Odour Concentration (OU/m^3)	Odour Emission Flux Rate Concentration (OU/m^2/s)	Source
WF1-O26	512	0.37	Trail Road
WF2-O26	868	0.62	Trail Road
WF1-LT	163	0.12	Trail Road
WF2-LT	161	0.12	Trail Road
WF3-LT	178	0.13	Trail Road
WF1-J21	793	0.58	Trail Road
WF2-J21	841	0.61	Trail Road
Aug23-F3	742	0.54	Trail Road
Aug23-F4	917	0.67	Trail Road
Aug23-F5	1149	0.83	Trail Road
Aug23-F6	1149	0.83	Trail Road
BFC-5	2272	1.63	Britannia Road
BFC-6	1262	0.91	Britannia Road
BFC-7	1035	0.74	Britannia Road
BFC-8	1230	0.88	Britannia Road
BFC-9	985	0.71	Britannia Road
BFC-10	861	0.62	Britannia Road
Working Face	4350	1.1	BFI Ridge/Eastview CJB Report
Working Face	1100	0.0124	Britannia Road 1992
Working Face	1100	0.0105	Britannia Road 1992
Working Face	1100	0.01027	Britannia Road 1992
Working Face	1100	0.0379	Britannia Road 1992
T1	390	0.280	Walker 2005
T2	302	0.217	Walker 2005
T3	329	0.236	Walker 2005

90th Percentile **0.898**

Year	Working Face Surface Area (m^2)	Odour Emission Flux Rate (OU/m^2/s)
Intermediate Operation Year (2018)	900	0.898
Final Operation Year (2023)	900	0.898

Appendix B

Appendix B1

SBR System Odour Emission Rate – AIHA Odour Thresholds

Appendix B1: SBR System Odour Emission Rate - AIHA Odour Thresholds

Contaminant Name	CAS Number	Molecular Weight	Odour Threshold (ppm)	Odour Threshold (mg/m^3)	Odour Threshold Reference
1,1 Dichloroethene (vinylidene chloride)	75-35-4	96.94	n/a	n/a	- -
1,2 Dichloroethane	107-06-2	98.96	6.00	24.28	[1]
1,3,5 Trimethylbenzene	108-67-8	120.19	0.037	0.18	[2]
1,4 Dichlorobenzene (-p)	106-46-7	147.01	15	90.19	[2]
Ammonia	7664-41-7	17.03	0.043	0.03	[2]
Benzene	71-43-2	78.11	34	108.62	[1]
Bis(2-Ethylhexyl)Phthalate	117-81-7		n/a	n/a	- -
Chlorobenzene	108-90-7	112.56	0.087	0.40	[2]
Chloroethane (ethyl chloride)	75-00-3		n/a	n/a	- -
Chloroethylene (vinyl chloride)	75-01-4	62.50	10	25.56	[2]
Chloromethane (methylchloride)	74-87-3	50.49	10	20.65	[2]
Chromium (total)	7440-47-3		n/a	n/a	- -
cis-1,2 Dichloroethylene	156-59-2	96.95	n/a	n/a	- -
Ethylbenzene	100-41-4	106.16	0.092	0.40	[2]
Mercury	7439-97-6		n/a	n/a	- -
Methane	74-82-8		n/a	n/a	- -
Methylene Chloride (dichloromethane)	75-09-2	84.94	1.2	4.17	[2]
Naphthalene	91-20-3	128.16	0.0095	0.05	[2]
Phenanthrene	85-01-8		n/a	n/a	- -
Phenol	108-95-2	94.11	0.0045	0.02	[2]
Tetrachloroethene	127-18-4	165.84	2	13.57	[2]
Toluene	108-88-3	92.13	0.16	0.60	[1]
Trichloroethylene	79-01-6	131.40	0.50	2.69	[2]
Xylene	1330-20-7	106.16	0.081	0.35	[2]

Conversion from ppm to mg/m^3

ppm)

24.45

These formulas can be used when measurements are taken at 25°C and the air pressure is 760 torr (= 1

Notes:

[1] Minimum odour threshold value from range of "Acceptable Values" from AIHA, 1989. Odour Thresholds for Chemicals with Established Occupational Health Standards. Akron, Ohio.

[2] Minimum odour threshold value from range of "All Referenced Values" from AIHA, 1989. Odour Thresholds for Chemicals with Established Occupational Health Standards. Akron, Ohio.

Appendix B2

SBR System Odour Emission Rates

Appendix B2: SBR System Odour Emission Rates

Source ID [1]	Source Type [1]	Source Description	Source Data LFG: Stack Volumetric Flow Rate (Am^3/s)	Stack Exit Gas Temp. (ºC)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Emission Data: Contaminant	CAS Number	Maximum Emission Rate (g/s)	In-Stack Concentration (mg/m^3)	Odour Threshold (mg/m^3)	In-Stack Odour Concentration (OU/m^3)	Maximum Odour Emission Rate (OU/s)	Total Odour Emission Rate [1] (OU/s)
RAWLEACH	Point	Raw Leachate Equalization Tank	0.0001	25	0.2	0.003	6.6	0.6	424269	5014683.8	1,2 Dichloroethane	107-06-2	1.64E-05	1.64E+02	2.43E+01	6.75E+00	6.75E-04	**20**
											1,3,5 Trimethylbenzene	108-67-8	1.27E-05	1.27E+02	1.82E-01	6.99E+02	6.99E-02	
											1,4 Dichlorobenzene (-p)	106-46-7	2.62E-05	2.62E+02	9.02E+01	2.90E+00	2.90E-04	
											Ammonia	7664-41-7	3.06E-04	3.06E+03	3.00E-02	1.02E+05	1.02E+01	
											Benzene	71-43-2	5.48E-05	5.48E+02	1.09E+02	5.05E+00	5.05E-04	
											Chlorobenzene	108-90-7	9.90E-06	9.90E+01	4.01E-01	2.47E+02	2.47E-02	
											Chloroethylene (vinyl chloride)	75-01-4	1.25E-04	1.25E+03	2.56E+01	4.88E+01	4.88E-03	
											Chloromethane (methylchloride)	74-87-3	7.92E-05	7.92E+02	2.07E+01	3.84E+01	3.84E-03	
											Ethylbenzene	100-41-4	4.46E-04	4.46E+03	3.99E-01	1.12E+04	1.12E+00	
											Methylene Chloride (dichloromethane)	75-09-2	2.76E-03	2.76E+04	4.17E+00	6.62E+03	6.62E-01	
											Naphthalene	91-20-3	2.04E-05	2.04E+02	4.98E-02	4.10E+03	4.10E-01	
											Phenol	108-95-2	9.44E-07	9.44E+00	1.73E-02	5.45E+02	5.45E-02	
											Tetrachloroethene	127-18-4	1.04E-04	1.04E+03	1.36E+01	7.70E+01	7.70E-03	
											Toluene	108-88-3	1.74E-03	1.74E+04	6.03E-01	2.88E+04	2.88E+00	
											Trichloroethylene	79-01-6	2.04E-04	2.04E+03	2.69E+00	7.59E+02	7.59E-02	
											Xylene	1330-20-7	1.59E-03	1.59E+04	3.52E-01	4.53E+04	4.53E+00	
SBR	Point	Sequencing Batch Reactor Tank	0.0001	32	0.2	0.003	6.6	0.6	424317	5014732.1	1,2 Dichloroethane	107-06-2	3.63E-05	3.63E+02	2.43E+01	1.49E+01	1.49E-03	**3473**
											1,3,5 Trimethylbenzene	108-67-8	9.07E-06	9.07E+01	1.82E-01	4.99E+02	4.99E-02	
											1,4 Dichlorobenzene (-p)	106-46-7	3.36E-05	3.36E+02	9.02E+01	3.73E+00	3.73E-04	
											Ammonia	7664-41-7	0.103	1030000	0.030	34,388,044.78	3439	
											Benzene	71-43-2	1.45E-04	1.45E+03	1.09E+02	1.33E+01	1.33E-03	
											Chlorobenzene	108-90-7	2.53E-06	2.53E+01	4.01E-01	6.32E+01	6.32E-03	
											Chloroethylene (vinyl chloride)	75-01-4	1.12E-03	1.12E+04	2.56E+01	4.38E+02	4.38E-02	
											Chloromethane (methylchloride)	74-87-3	3.91E-04	3.91E+03	2.07E+01	1.89E+02	1.89E-02	
											Ethylbenzene	100-41-4	1.27E-03	1.27E+04	3.99E-01	3.18E+04	3.18E+00	
											Methylene Chloride (dichloromethane)	75-09-2	3.78E-02	3.78E+05	4.17E+00	9.07E+04	9.07E+00	
											Naphthalene	91-20-3	5.15E-05	5.15E+02	4.98E-02	1.03E+04	1.03E+00	
											Phenol	108-95-2	6.52E-08	6.52E-01	1.73E-02	3.76E+01	3.76E-03	
											Tetrachloroethene	127-18-4	5.31E-04	5.31E+03	1.36E+01	3.91E+02	3.91E-02	
											Toluene	108-88-3	5.09E-03	5.09E+04	6.03E-01	8.44E+04	8.44E+00	
											Trichloroethylene	79-01-6	9.65E-04	9.65E+03	2.69E+00	3.59E+03	3.59E-01	
											Xylene	1330-20-7	4.29E-03	4.29E+04	3.52E-01	1.22E+05	1.22E+01	

Appendix B2: SBR System Odour Emission Rates

Source ID [1]	Source Type [1]	Source Description	Source Data						LFG		Emission Data							
			Stack Volumetric Flow Rate (Am³/s)	Stack Exit Gas Temp. (ºC)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate (g/s)	In-Stack Concentration (mg/m³)	Odour Threshold (mg/m³)	In-Stack Odour Concentration (OU/m³)	Maximum Odour Emission Rate (OU/s)	Total Odour Emission Rate [1] (OU/s)
EFFLUENT	Point	Effluent Equalization Tank	0.0001	25	0.2	0.003	6.6	0.6	424290	5014661.7	1,2 Dichloroethane	107-06-2	8.50E-06	8.50E+01	2.43E+01	3.50E+00	3.50E-04	**6**
											1,3,5 Trimethylbenzene	108-67-8	7.52E-06	7.52E+01	1.82E-01	4.13E+02	4.13E-02	
											1,4 Dichlorobenzene (-p)	106-46-7	1.44E-05	1.44E+02	9.02E+01	1.60E+00	1.60E-04	
											Ammonia	7664-41-7	5.08E-06	5.08E+01	3.00E-02	1.70E+03	1.70E-01	
											Benzene	71-43-2	3.12E-05	3.12E+02	1.09E+02	2.87E+00	2.87E-04	
											Chlorobenzene	108-90-7	5.58E-06	5.58E+01	4.01E-01	1.39E+02	1.39E-02	
											Chloroethylene (vinyl chloride)	75-01-4	8.24E-05	8.24E+02	2.56E+01	3.22E+01	3.22E-03	
											Chloromethane (methylchloride)	74-87-3	4.76E-05	4.76E+02	2.07E+01	2.31E+01	2.31E-03	
											Ethylbenzene	100-41-4	2.64E-04	2.64E+03	3.99E-01	6.61E+03	6.61E-01	
											Methylene Chloride (dichloromethane)	75-09-2	1.62E-03	1.62E+04	4.17E+00	3.88E+03	3.88E-01	
											Naphthalene	91-20-3	1.05E-05	1.05E+02	4.98E-02	2.11E+03	2.11E-01	
											Phenol	108-95-2	4.48E-07	4.48E+00	1.73E-02	2.59E+02	2.59E-02	
											Tetrachloroethene	127-18-4	6.62E-05	6.62E+02	1.36E+01	4.88E+01	4.88E-03	
											Toluene	108-88-3	1.03E-03	1.03E+04	6.03E-01	1.72E+04	1.72E+00	
											Trichloroethylene	79-01-6	1.22E-04	1.22E+03	2.69E+00	4.56E+02	4.56E-02	
											Xylene	1330-20-7	9.50E-04	9.50E+03	3.52E-01	2.70E+04	2.70E+00	
SLUDGE	Point	Sludge Tank	0.0001	25	0.2	0.003	6.6	0.6	424340	5014707.5	1,2 Dichloroethane	107-06-2	1.23E-03	1.23E+04	2.43E+01	5.05E+02	5.05E-02	**809**
											1,3,5 Trimethylbenzene	108-67-8	2.38E-04	2.38E+03	1.82E-01	1.31E+04	1.31E+00	
											1,4 Dichlorobenzene (-p)	106-46-7	8.96E-04	8.96E+03	9.02E+01	9.93E+01	9.93E-03	
											Ammonia	7664-41-7	1.64E-03	1.64E+04	3.00E-02	5.48E+05	54.75378004	
											Benzene	71-43-2	3.18E-03	3.18E+04	1.09E+02	2.93E+02	2.93E-02	
											Chlorobenzene	108-90-7	3.96E-04	3.96E+03	4.01E-01	9.89E+03	9.89E-01	
											Chloroethylene (vinyl chloride)	75-01-4	4.62E-03	4.62E+04	2.56E+01	1.81E+03	1.81E-01	
											Chloromethane (methylchloride)	74-87-3	4.06E-03	4.06E+04	2.07E+01	1.97E+03	1.97E-01	
											Ethylbenzene	100-41-4	2.50E-02	2.50E+05	3.99E-01	6.26E+05	6.26E+01	
											Methylene Chloride (dichloromethane)	75-09-2	4.42E-01	4.42E+06	4.17E+00	1.06E+06	1.06E+02	
											Naphthalene	91-20-3	7.44E-04	7.44E+03	4.98E-02	1.49E+05	1.49E+01	
											Phenol	108-95-2	3.22E-05	3.22E+02	1.73E-02	1.86E+04	1.86E+00	
											Tetrachloroethene	127-18-4	3.82E-03	3.82E+04	1.36E+01	2.82E+03	2.82E-01	
											Toluene	108-88-3	1.48E-01	1.48E+06	6.03E-01	2.45E+06	2.45E+02	
											Trichloroethylene	79-01-6	1.01E-02	1.01E+05	2.69E+00	3.77E+04	3.77E+00	
											Xylene	1330-20-7	1.12E-01	1.12E+06	3.52E-01	3.17E+06	3.17E+02	

Notes:
[1] Source ID, Source Type: should provide information on the modelling source type (e.g., Point, Area or Volume Source); the process source or sources within the modelling source (e.g., Process Line #1); and the stack or stacks within each process source.
[2] Emission Estimating Technique Short-Forms are V-ST (Validated Source Test), "ST" (Source Test), EF (Emission Factor), MB (Mass Balance), and EC (Engineering Calculation).
[3] Data Quality Categories: Highest; Above-Average; Average; and Marginal.

Appendix C

Leachate Evaporator Odour Emission Rate – Based on Source Testing Results

Appendix C: Leachate Evaporator Odour Emission Rate - Based on Source Testing Results

Sample Location	Sample ID	Lab Results [1] (ou)	Odour Concentration (ou/m^3)	Average Odour Concentration (ou/m^3)	Wet Reference Flow Rate [2] (m^3/s)	Odour Emission Rate (ou/s)
Leachate Evaporator Stack NW	Odour Baseline #1 / 21:1	85	1785	2,765	6.7	18,395
	Odour Baseline #2 / 21:1	110	2310			
	Odour Baseline #3 / 21:1	200	4200			

Notes:

[1] Detection Threshold Values reported

[2] Flow rate, average wet flow rate from TPM and SVOC sampling

Information Source: I:\1102113\Reports\Appendix G -Odour

Appendix D

Memorandum – Addendum to WCEC Environmental Assessment

CONSULTING ENGINEERS
& SCIENTISTS

Memorandum

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RWDI AIR Inc.
650 Woodlawn Road West
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Email: solutions@rwdi.com

Date: August 28, 2012 **RWDI Reference #:** 1100798

To: Mr. Tim Murphy **E-Mail:** Tmurphy3@wm.com

From: Brad Bergeron **E-Mail:** Brad.Bergeron@rwdi.com

Re: **Addendum to Environmental Assessment for a New Landfill Footprint at the West Carleton Environmental Centre**
Waste Management of Canada Corporation
Ottawa Landfill Site – Acquisition of 2485 Carp Road North
Ottawa, Ontario

Throughout the Environmental assessment the Receptor R1 (NR1 in the noise evaluation) has been the most problematic with regard to several disciplines. Receptor R1 is identified as a 1-storey home at 2485 Carp Road North. Waste Management (WM) has optioned this property in July of 2012, which will affect the receptor based evaluations (Noise and Odour). The purpose of this document is to detail any changes to the results or mitigation requirements caused by the acquisition.

ODOUR

There will be no changes to any odour impact evaluations, excepting that R1 will no longer need to be evaluated. There are no changes with regard to any proposed odour mitigation measures.

NOISE

With NR1 removed, the next closest noise-sensitive receptors are three residential homes located immediately north of the Richardson Side Road, between Carp Road and William Mooney Road. These are 1-storey residential homes which have been represented by a single receptor, labelled NR1alt, as shown in **Figure 1**. Receptor NR1 was previously the limiting receptor located to the north. This addendum shows the impact at several receptors listed below to demonstrate the impact at the closest receptors to the north, now that NR1 was removed. It should be noted that the original analysis shows the impact at these locations with contour plots but not individual results as detailed herein.

NOISE ASSESSMENT CRITERIA

The relevant criterion for receptor NR1alt is the MOE Landfill guideline for landfilling activities. The Landfill guideline sets the One Hour Energy Equivalent Sound Level (Leq(1-hr)) limit for noise from a landfill site are outlined as follows:

- The higher of 55 dBA or background noise, during the daytime hours (7:00 am to 7:00 pm);
- The higher of 45 dBA or background noise, during the evening hours (7:00 pm to 11:00 pm); and
- The higher of 45 dBA or background noise, during the night-time hours (11:00 pm to 7:00 am).

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The MOE Landfill guideline uses the background sound level as the applicable sound level limit, where the background sound level is above the default values. If the actual background sound level is below the default limit, then the default limit can be used.

Background sound levels based only on traffic volumes were examined for receptor NR1alt. Road traffic noise was modelled for NR1alt using methods outlined in the MOE Publications NPC-206 and the Ontario Road Noise Analysis Method for Environment and Transportation (ORNAMENT) algorithms. Traffic analysis of background sound levels is provided in **Attachments 1 and 2** to this memo. Background noise levels related to traffic were estimated based on the south façade since it is exposed to both Richardson Side Road and the worst-case exposure to the landfill noise emissions.

Minimum background sound levels due to traffic demonstrate that background sound levels are higher than the MOE Landfill guideline minima. The minimum hourly sound levels, and resulting guideline limits for receptor NR1alt are therefore 61 dBA, 57 dBA and 45 dBA for the daytime, evening and night-time hours, respectively. Since landfilling activities occur only during the daytime, only the daytime limit has been used in the assessment and summarized in **Table 1**.

This addendum considers only the following affected receptors within the 500 m to the north of the landfill (see **Table 1**). All other receptors in the EA and results at those receptors remain unchanged.

Table 1: Resulting Daytime Landfill Guideline Limits

Point of Reception ID	Point of Reception (PoR) Description	MOE Landfill Guideline Limit [1] (dBA)	Verified by Acoustic Audit [2]	Performance Limit [3] (dBA)	Performance Limit Source [4] (dBA)	Resulting Landfill Guideline Limit [5] (dBA)
PR4	2-storey home on Richardson Side Road NNW	55	No	52	C	55
NR1alt	1-storey home on Richardson Side Road	55	No	61	C	61
NR9	2-storey Sensitive Business Operation	55	No	64	C	64
RR14	2-storey at 607 William Mooney Road	55	No	61	C	61
RR15	2-storey Wilbert Cox Drive	55	No	50	D	55

Notes to Table 1:

1. MOE Noise Guidelines for Landfill Sites.
2. Has an acoustic audit (as defined in Publication NPC-233) been conducted with source in place and operating?
3. Applicable worst-case NPC-205 / NPC-232 / ORNAMENT road traffic modelling sound level limit.
4. Performance limit (aka guideline limit) based on following:
   C = Calculated based on road traffic volumes in compliance with NPC-206 requirements.
   M = Measured based on monitoring for a minimum 48 hour period, in accordance with NPC-233 requirements.
   D = Default guideline minima per NPC-205 / NPC-232, as applicable (e.g., 50 dBA daytime for NPC-205).
5. The higher of MOE Landfill guideline limit or performance limit.

NOISE RESULTS

The assessment was completed through modelling of the predictable worst-case landfilling scenario. All WCEC sources considered occur concurrently for this assessment. The combined unmitigated $L_{EQ,\ 1\text{-hr}}$ dBA values were calculated using the sound emissions from the individual sources and are shown in **Figure 1** and **Table 2**. The modelling showed that the applicable sound level limit for landfill steady-state sources may be exceeded in the daytime at one location, receptor PR4.

Table 2: Acoustic Assessment Summary - Unmitigated

Point of Reception ID	Point of Reception (PoR) Description	Total Sound Level at PoR [1] (dBA)	Verified by Acoustic Audit [2]	Resulting Landfill Guideline Limit [3] (dBA)	Performance Limit Source [4] (dBA)	Compliance with Performance Limit [5] (dBA)
PR4	2-storey home on Richardson Side Road NNW	56	No	55	C	**No**
NR1alt	1-storey home on Richardson Side Road	57	No	61	C	Yes
NR9	2-storey Sensitive Business Operation	53	No	64	C	Yes
RR14	2-storey at 607 William Mooney Road	59	No	61	C	Yes
RR15	2-storey Wilbert Cox Drive	55	No	55	D	Yes

Notes to Table 2:

1. Worst-case cumulative sound level from all applicable steady-state sources operating.
2. Has an acoustic audit (as defined in Publication NPC-233) been conducted with source in place and operating?
3. The higher of MOE Landfill guideline limit or performance limit.
4. Performance limit (aka guideline limit) based on following:
   C = Calculated based on road traffic volumes in compliance with NPC-206 requirements.
   M = Measured based on monitoring for a minimum 48 hour period, in accordance with NPC-233 requirements.
   D = Default guideline minima per NPC-205 / NPC-232, as applicable (e.g., 50 dBA daytime for NPC-205).

Potential Mitigation Measures

Previous mitigation recommended temporary berms be placed at both the construction and landfilling working faces to sufficiently control noise levels (see Section 6.2 of the EA). The temporary berms were required mostly to address sound levels at receptor NR1. Given that NR1 will be removed as a noise-sensitive receptor, temporary berms are no longer required at the active working faces.

However, a berm located near the outer perimeter of Cell 7 would sufficiently control noise levels at the receptors based on predictable worst-case sound levels. At a minimum, the berm should block line of sight and be 0.5 m above the top height of the tallest equipment. This berm is mainly required for construction of the base liners occurring at grade in Cell 7. The location of the perimeter berm is illustrated in **Figure 2**.

Mitigation measures for pest control devices remain the same as outlined in the EA.

With the proposed controls in place, sound levels from the WCEC expansion project are predicted to meet the applicable daytime sound level limit. With the berm providing compliance, residual effects from the EA would remain unchanged The predicted sound levels are summarized in **Figure 2** and **Table 3**.

Table 3: Acoustic Assessment Summary - Mitigated

Point of Reception ID	Point of Reception (PoR) Description	Total Sound Level at PoR [1] (dBA)	Verified by Acoustic Audit [2]	Resulting Landfill Guideline Limit [3] (dBA)	Performance Limit Source [4] (dBA)	Compliance with Performance Limit [5] (dBA)
PR4	2-storey home on Richardson Side Road NNW	54	No	55	C	Yes
NR1alt	1-storey home on Richardson Side Road	56	No	61	C	Yes
NR9	2-storey Sensitive Business Operation	53	No	64	C	Yes
RR14	2-storey at 607 William Mooney Road	56	No	61	C	Yes
RR15	2-storey Wilbert Cox Drive	52	No	55	D	Yes

Notes to Table 3:

5. Worst-case cumulative sound level from all applicable steady-state sources operating.
6. Has an acoustic audit (as defined in Publication NPC-233) been conducted with source in place and operating?
7. The higher of MOE Landfill guideline limit or performance limit.
8. Performance limit (aka guideline limit) based on following:
   C = Calculated based on road traffic volumes in compliance with NPC-206 requirements.
   M = Measured based on monitoring for a minimum 48 hour period, in accordance with NPC-233 requirements.
   D = Default guideline minima per NPC-205 / NPC-232, as applicable (e.g., 50 dBA daytime for NPC-205).

NOISE CONCLUSION

Given the option obtained by WM in July of 2012 on the parcel of land on which NR1 is located, this updated addendum has been developed for the EA for a New Landfill Footprint at the WCEC previously submitted. The updated analysis shows that the temporary landfill berm requirements previously recommended no longer apply. With the berm at the outer perimeter of Cell 7, as described in this addendum, the predicted sound levels from the new landfill comply with the applicable sound level limits and residual impact would be unchanged.

Changes to Mitigation

1) Temporary Berming around working face no longer required.
2) Berm around outer perimeter of Cell 7 required during construction.

We would be pleased to respond should you have any questions.

Kind regards,

Brad Bergeron, A.Sc.T., d.E.T.
Senior Project Manager/Principal

BCB/klm